

A & B

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COMPUTING

FOR USERS OF THE BBC MICRO AND ELECTRON

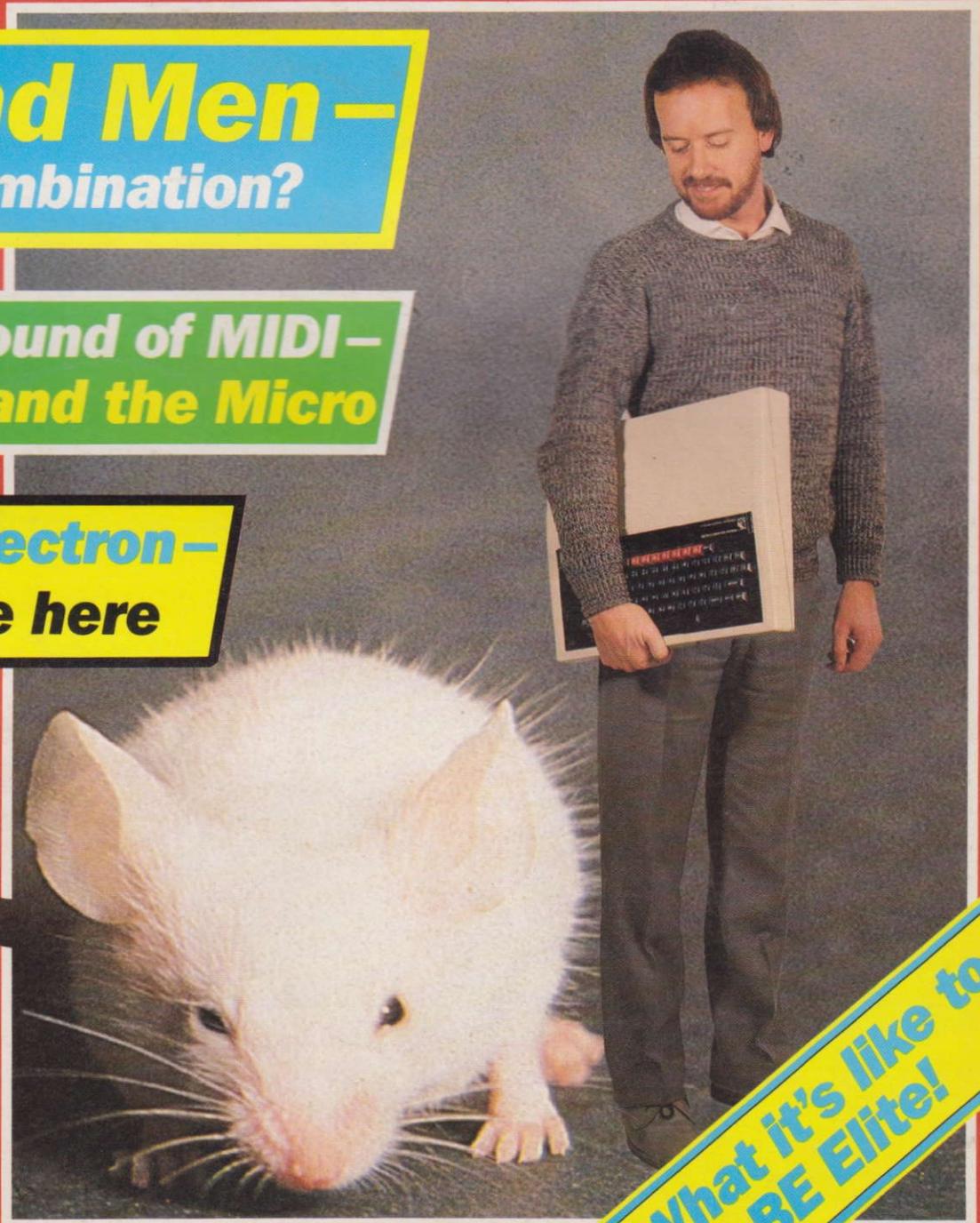
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Mixing Music and the Micro**

**Expand the Electron –
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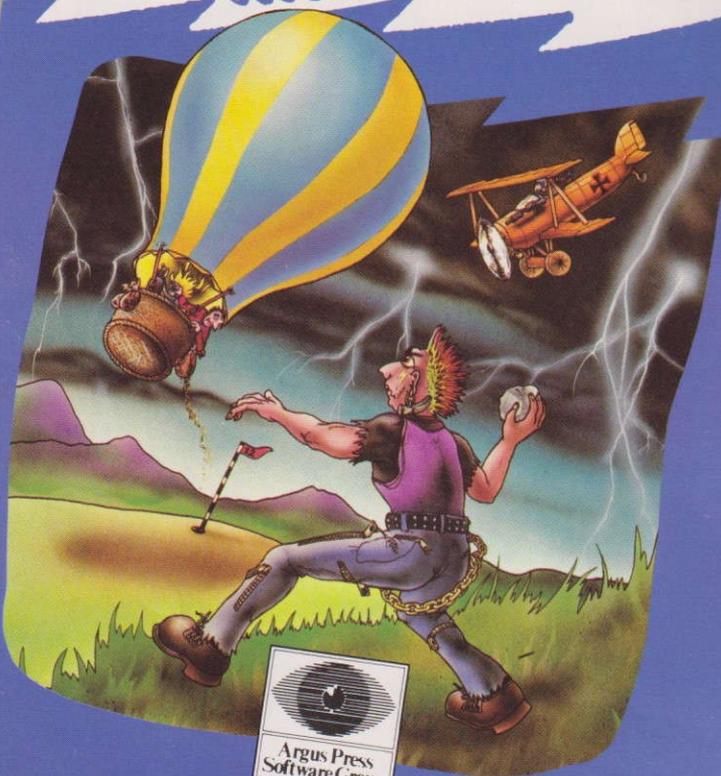
**A Nightingale
sings and
travelling beyond
the bounds of
BBC BASIC –
Extension ROM**



**What it's like to
BE Elite!**

STARCADE

UP UP AND AWAY...



©1984

How do you fancy getting away from it all with a trip in our hot air balloon?

Sounds tempting doesn't it. But it takes skill and fast reactions to avoid all the hazards.

Are you up to it?

Could you manoeuvre the balloon over the tree tops and mountain peaks, while still keeping an eye on your ballast and your fuel, because when it starts to run low you'll have to descend, and not being distracted by people throwing stones at you, land carefully on the fuel pods. You'll be lucky to rise back up again. But look out!!

Watch that kite doesn't become entangled with you and don't worry about the noise, its only the aeroplanes that come diving and swooping at you. You'll need to rise higher to avoid the turbulence from the windmill blades but as you do you're likely to run into storm clouds and bolts of lightning. Also, the higher you climb in the stratosphere the more difficult the balloon becomes to handle.

By now you'll start to panic!! and wonder how on earth you're going to make it, but then again that's all the fun of the air.

COMMODORE, ATARI, BBC/ELECTRON (£8.95 each)

On disc for

COMMODORE, ATARI, BBC/ELECTRON (£10.95 each)

From Boots and all leading retailers

STARCADE



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Volume Two 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 5 1/4", 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.

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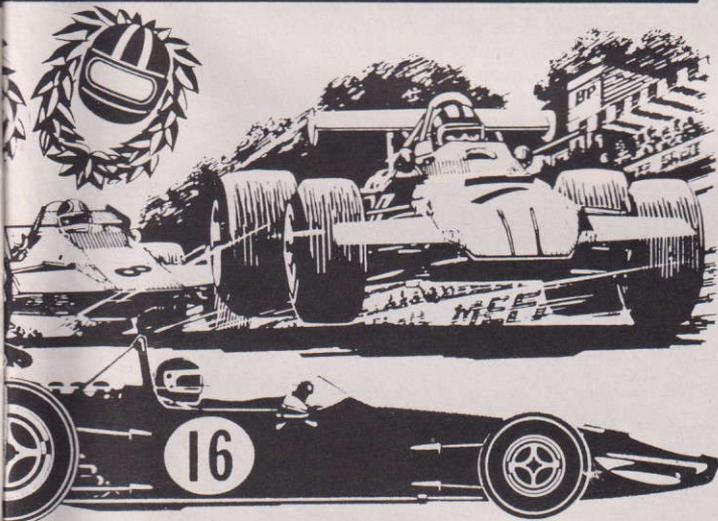
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Two February 1984

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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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Meet Spiderman looking for the Garden of Eden in a Maze down at Arendarvon Castle - software sector.

The Electron gets a section all to itself.

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News Me

ACORN AVALANCHE

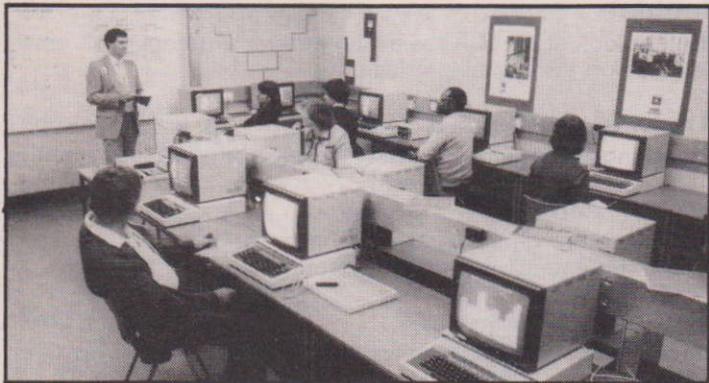
Acorn burst dramatically onto the Christmas stage with their packed stand at Compec '84. November 13th saw the launch of eight new products, hardware and software, and previews of much more.

BBC and Electron owners benefit fairly equally from the deluge.

The 32016 second processor finally made it to the shelves! It's been "under development" for a long time now but, for those prepared to pay the £899, is probably worth the wait.

The high speed crunching and 256 Kbytes of RAM are designed to tempt professional, scientific, engineering and educational users.

The operating system, PANOS, has been specially developed and supports BASIC, C, Fortran 77, Cambridge Lisp and Pascal. All this software comes bundled with the processor.



HIGHER LEVELS

The similarly long awaited Winchester disc system made an appearance. £1,499 for 10 Mbytes and £2,299 for 30 Mbytes will especially tempt users of Econet.

Average seek time is 85ms and transfer rate up to one Mbit per second. A level 3 file server (£200) builds on present Econet systems and is only available with the Acorn Winchester. It comprises a 6502 second processor, NET software and a bundled Viewdate system. Level 3 can accommodate 60 users instantaneously.

A new Econet start-up kit (£99) supplies networks with a new high performance clock, two unpowered terminators (reducing necessary power sources from three to one) and three double socket boxes (no soldering needed). This improved Econet runs at 200Kbits/sec and is not affected by the length of cable.

Previewed at Compec and available now is the Econet bridge, a 6502 processor controlling data transfer across two networks.

Three bridged networks have been on field trial at Manchester Polytechnic for the last six months. Two networks, each comprising 18 micros, are used primarily for lecturing and project purposes. The third network is for staff use only. Plans include extending this latter system into each staff room, with a micro in each room capable of functioning as a free-standing micro, an Econet work-station or an intelligent terminal to the Polytechnic's mainframe.

On each student net there are two file servers (one attached to an Acorn Winchester, the other to a floppy disc drive). Peter Hutt, Microtech Centre Manager, explains "Winchesters increase capacity and speed data transfer. Bridges optimise the transfer and sectionalise the system — one net failure would leave the rest of the system generally operational."

Econet (Plus 2) will also be available for the Electron in the new year when it will, like the BBC, be able to take advantage of Level 3. Electrons and Winchesters side by side in a net sounds very cost effective. Schools take note!

ELECTRON GETS SERIOUS

The 100,000 plus Electron users in the UK can look forward to an interesting new year and plenty of incentive to upgrade their machines to take advantage of "serious" software applications.

The Plus 3 disc interface and 3.5 inch single sided drive takes advantage of Acorn's Advanced Filing System. It's a double density filing system and the Plus 3 thus provides 300 Kbytes on its super thin Sony diskettes, formatted to 80 tracks. BBC disc users may have every reason to start feeling jealous. Despite the bulky appearance of the Plus 3 (the drive is relatively small), there wasn't enough room for filing system software.

This comes on disc and includes some very nice utilities, including EFORM and fast COMPAC. There's also very straightforward copying of single or multiple directories. The main problem is the £229 but that's an all-in price. The Plus 3 is the next logical step. At Compec, Acornsoft's Database (with View integration) was running acceptably fast on the Electron Plus 3.

Also new for the Electron is a specially designed data recorder.

The RS423 interface was also previewed but perhaps the most glorious sight for Electron users was their machine working alongside BBCs in the Level 3 network. A Tube interface plugs into the Plus One cartridge port to enable the Electron to make use of any Acorn second processor — even the 32016 if you want! The Electron turns into an I/O processor and the second processor (6502 running at 4MHz) transforms the usual sluggish display. Is Acorn undercutting the BBC with its own machine?



MORE MUSIC

For the BBC yet another musical add-on is Acorn's own Music 500. The £199 matching unit plugs into the 1MHz bus at one end and into amplification/recording equipment at the other.

Emphasis is on quality output with a 750KHz sampling rate and ultra fine frequency resolution. Sounds are produced from user-defined waveforms. Music 500 provides sixteen sound channels organised as eight musical voices which can be spread over seven stereo positions. Each channel is tuneable and can be mixed with frequency and ring modulation. The synthesiser can also handle wave form synchronisation.

MS NEWS

To control all this musical power is some new software called **AMPLE**. It allows, among other features, interpreted and compiled modes of operation and multi-tasking (keyboard control while music program is running). **AMPLE** does not use conventional notation but is apparently easy to use with music, sound and programming keywords. Music 500 sounds like a powerful competitor, alongside **MIDI**, for the amateur/professional musician's cash. A separate keyboard is available.



DEFINITIVE LANGUAGES

Acornsoft and Logo experts like Richard Noss (Editor of the British Logo Users Group magazine), Professor Celia Jones (London University Institute of Education) and the MEP have been working on Logo throughout 1984 and the results are comprehensive: two 16K ROMs, utility cassette and disc, introduction, reference manual and card.

The 32K interpreter implements full list processing facilities and all existing BBC Micro commands (in total 220). An Electron version was up and working at Compec.

Logo is designed to allow young children to control a turtle (screen cursor or robot) with simple commands. Logical and appropriate terminology and low reading-level error messages have been built in.

Also included are sound facilities, a "nib", multiple, independently controlled turtles and commands like **DOFOREVER**, **HATCH** and **DEBUG**.

From the programmers of the future to the present with Acornsoft ISO Pascal. The ROM version has been passed Class B and the disc second processor version Class A, validation at the British Standards Institution Level One.

This means that the disc version is a faultless implementation of ISO Pascal and the ROM version has only minor errors. The BSI use a Pascal Validation Suite of 734 programs to test the budding compiler!

BBC and Electron owners benefit from full documentation and a version of Acorn's text editor (as used on the 6502 Development System). Acornsoft Pascal has extensions into the machines' sound and graphics facilities.

Once again an Electron cartridge version of ISO Pascal was on view at Compec. Both Logo and ISO Pascal are available from £69.00.

Acorn Computers are at Fulbourn Road, Cherry Hinton, Cambridge CB1 4JN. Tel: 0223 245200. Mail order from Vector Marketing, Denington Industrial Estate, Wellingborough, Northants NN8 2RL.

TURBO POWER

If you're a first time user of Pascal you might be interested in a manual called **Turbo Tutor** from Altor Computer. It gives step by step instructions on how to use the Turbo Pascal development environment and costs £29.95.

Altor are also interested in expanding their users' group for Turbo Pascal users of the BBC.

Please contact them at 801 Govan Road, Glasgow G51 3DJ if you are interested in swapping ideas and problems.

ELECTRON PHLOOPY

The Phloopy, reviewed in this issue, is now available for the Electron. It has been designed to interface with the machine through the Plus One cartridge slot or plug directly to the Databus. On the Databus version a centronics type printer port is also available as an optional extra.

The Phloopy has been reduced in price and now costs £85 for both the BBC and Electron. Add to this the price of the interface — £15 for the BBC, £29 for the Electron via Plus 1 and £38 via Databus.

launched by Geophysical Systems Computers Ltd. Over the last two years GSCL have been developing their SchoolNet system which comprises six modified BBCs, a 10.5MB formatted Winchester, two 100K floppy disc drives and a printer and 64K printer buffer.

SchoolNet will accept most existing BBC software and will also run programs designed for Acorn's Econet and Amcom's E-Net.

The network system will allow a school's existing BBCs to be interfaced to a greater number of workstations or to upgrade all their monitors to colour. More floppy discs can be added and the Winchester advanced to up to 280MB. For laboratories and workshops the user can add analogue to digital conversion and signal analysers. Add-ons planned for the future include interface capability with other makes of micro, fibre optic communications, Prestel and Viewdata interfaces, access to electronic libraries of educational software and Z80 and C/PM compatibility.

With the SchoolNet system a single teacher can control and demonstrate to up to five groups of students working on the same or different tasks. The work-



SCHOOL SYSTEM

A new network system for educational establishments has been

stations may send to or receive from the central control station, allowing the teacher to supervise and guide each group separately

CONTINUED OVER

and permitting each group to proceed at its own speed.

To protect work undertaken on the SchoolNet system GSCL are offering a tape streamer backup for the Winchester or, if required, a regular visit from their engineers to transfer data from floppy disc to tape without committing the school to the expense of its own tape storage system.

GSCL are selling the package complete with installation into one or two rooms for £5595. For further information contact them at West Portway, Andover, Hants SP10 3SG.

FIX IT QUICK

If your BBC is out of warranty and needs repairing at any time, a new British company, Computer-fix Ltd, are asking you to check out their prices first.

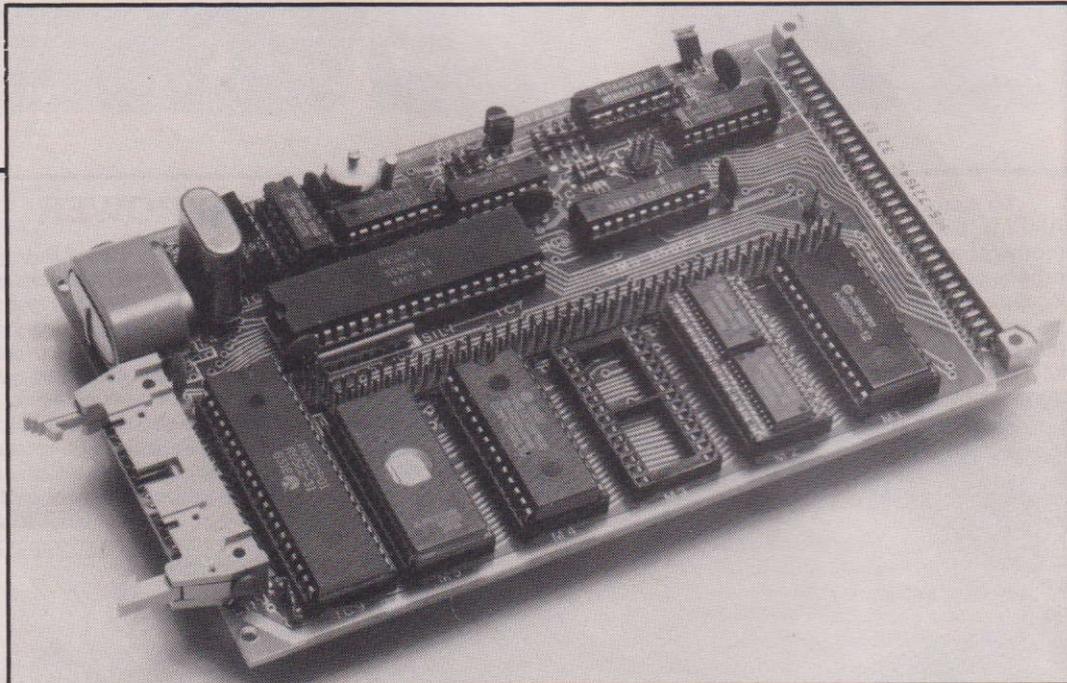
The company has set up a national network of initially 500 dealers offering guaranteed repairs in 48 hours plus postage time from the dealer to their Camberley headquarters. The BBC repair price, including labour, spares, postage, insurance and VAT is £40.25.

You can find your nearest Computer-fix dealer in the Yellow Pages or else contact them at Albany Park Estate, Frimley Road, Camberley GU15 2PL.

TUBE CONNECTIONS

Cambridge Microprocessor Systems have recently released a 6502 second processor with full bus expansion capability. An on-board 64-way bus connector allows direct access to a range of interface cards including analogue cards, eprom programmers and an IEEE controller. Connecting to the BBC via the tube interface, the processor is able to run BBC Basic, Forth, Pascal and other language ROMs.

The board is arranged as a single eurocard and can operate as either a second processor or stand alone computer. The manufacturers see its main attraction as being that even relatively



inexperienced programmers are given the ability to write, develop and test application programs in Basic before disconnecting the board from the micro, plugging it into the application to prove the program, and then transferring it to Eprom.

CMS have produced a selection of hardware interfaces which can be used with the second processor. The user then has the basis of a programmable controller giving, for example, over 100 I/O lines, Real Time clock and a serial and centronics printer port. Also available are an IEEE talker listener controller, 12-bit ADC interface, EPROM programmer, high resolution colour graphics and an eight-inch industrial racking system.

The company offer technical support and after-sales backup. For further information contact CMS, 44A Hobson Street, Cambridge CB1 1NL.

PLAN AHEAD

Do you enjoy playing adventure games? Do you "die" at the same place every game thinking "Didn't I do that wrong last time?" If so then help is at hand in the form of Print 'n' Plotter Products' Adventure Planner.

You need no longer try and remember all your moves or jot them down on scruffy bits of paper — Adventure Planner is a 50 page planning pad giving the facility for planning, pre-planning

and keeping a permanent record of your game to avoid repetition, mistakes etc.

Each page in the pad contains a mapping system with over 150 locations and comes complete with examples, hints and tips on how to use the Adventure Planner system.

The Planner costs £3.95 from retailers or £4.50 mail order from Print 'n' Plotter Products Ltd, 19 Borough High Street, London SE1 9SE.

ACORNS IN THE CHILTERN

Those of you in the Chesham and Amersham areas of Buckinghamshire who would like to get together with other Acorn computer users will be interested in the Chiltern BBC Micro-computer User Group.

The purpose of the group is to enable members to improve their knowledge of Acorn micros and their programming skills.

For further information contact Colin Mills, 70 Chestnut Lane, Amersham on the Hill, Bucks HP6 6EH.

WRITE AND WIPE

Title your programs clearly and simply using Warnes Wipers wipe clean computer labelling kit and re-titling becomes easy. You wipe the label clean with a damp

tissue and start again.

The kits, priced at £1.49, include 12 labels, the Wipers pen and a set of mini labels for indexing and permanent information. They come in two types — for disc or cassette — and are available from major computer stores or mail order direct from Warnes Wipers, 23 Werter Road, London SW15 2LL.

SIX FORM ROBOT

A computing package designed to teach simple robotics concepts and control theory has been manufactured by Fischertechnik. The package contains all the components needed to build any of six robot forms.

The six forms comprise; a telescopic "teach in" robot arm, a graphics board for music making and drawing, a simple sorting machine, a lifting and sorting robot, a plotter which utilises polar co-ordinates and a tracking mechanism for keeping a solar cell in the correct alignment with the path of the sun.

The kit itself contains motors, potentiometers, micro-switches, an electro-magnet and the other necessary electrical components as well as the relevant building parts. It can also be used in conjunction with other Fischertechnik kits and is controllable from the BBC with an interface. The package retails at £64.95.

Artur Fischer (UK) Ltd,
Fisher House, 25 Newtown
Road, Marlow, Bucks SL7 1JY.

PRICE DRIVE

A new "budget-price" 5¼ inch disc drive has been launched by Opus Supplies. The 100K drive comes with a two-year guarantee, user manual and utilities on disc.

Priced at £119.95, it is available from larger branches of Boots.

FINGERTIP FACTS

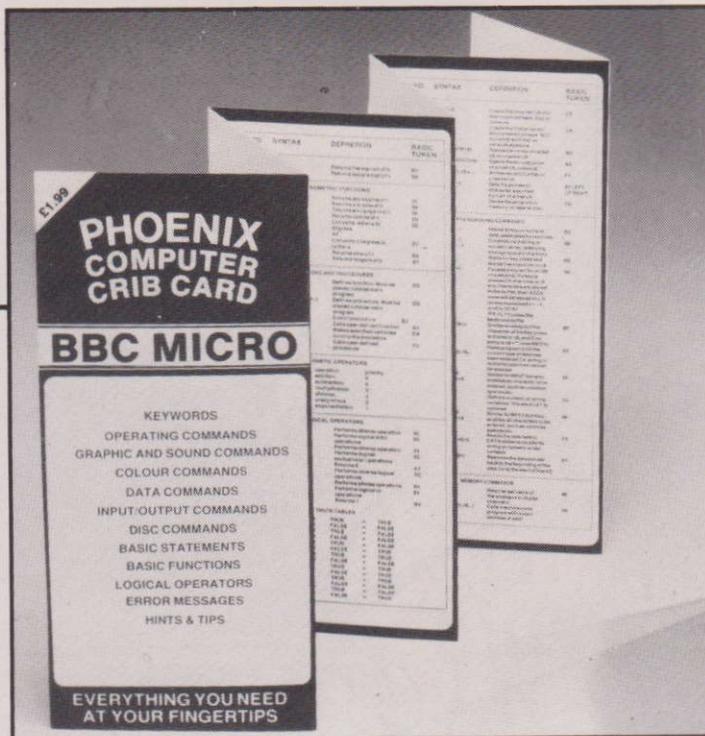
If you're fed up with searching through your User Guide every time you need to check a programming operation then the Phoenix Computer Crib Cards could be just what you're looking for.

These cards, for both the BBC and Electron, give easy access to all the main facts that you need while you are programming. They're made of sturdy card and are free standing to provide information at a glance.

The cards are available from the larger branches of Boots, bookshops and computer stores and cost £1.99.

SLOW MOTION

An add-on you probably haven't considered for your Beeb yet is



one to slow it down. Slomo, from Nidd Valley Micro Products, offers you the opportunity to play all your computer games much more slowly so that you can gain high scores easily.

The manufacturers see many serious applications for Slomo, for example; as an aid to the disabled allowing them to play games; as a software development aid because graphics can be viewed pixel by pixel and sound heard note by note; educational programs can be controlled to suit a particular age group with screens frozen for discussion and the freeze frame control also makes photographic copies of the screen possible.

Slomo fits to the BBC's tube output and an adaptor is available for second processor connections. It retails at £14.95 from Cambridge Computing Research Ltd, 61 Ditton Walk, Cambridge CB5 8QD.

CCS COMPETITION

We only received ten correct answers to the Strategy game competition from our November issue. The lucky winners of a selection of games from Cases Computer Simulations are: C J Wilkes from Mitcham; Simon Watson from Harlow; F G Jones from Whyteleafe; Dawn Walker from Wellington; Richard Williams from Fareham; C L Serbutt from London SW17; Colin Box from Worcester; Mike Jones from Hinckley; B Durrant from East Grinstead and Stuart Lambert from Turriff.

DOMESDAY DISCS SPEARHEAD INTERACTIVE VIDEO

The British Broadcasting Association has embarked on one of the most ambitious cultural and technical projects of all time with its Domesday Discs project. And guess what's at the heart of the whole set-up and vital to its success — the BBC Micro.

By now, schools all over Britain have been circulated with details of the kind and amount of help they will be asked to provide for the project. Each school will make use of its own (or borrowed) BBC Micro to enter up to 20 pages of information about its

local history, geography and way of life.

The BBC will provide free software to schools to help data input and will support the project through schools radio and a regular series of television programmes fronted by that great popularising presenter Michael Woods.

The end product will be one of two interactive video discs, the Domesday discs (celebrating the 900th anniversary of the original book). The project will come to fruition in 1986.

The BBC Micro will also be the key component in the interactive system which will play back the discs (and many like them). The BBC has leant its prestigious initials once again to a piece of revolutionary hardware, the yet to be designed laser disc player from Phillips, a future development of their current hardware, the LaserVision system.

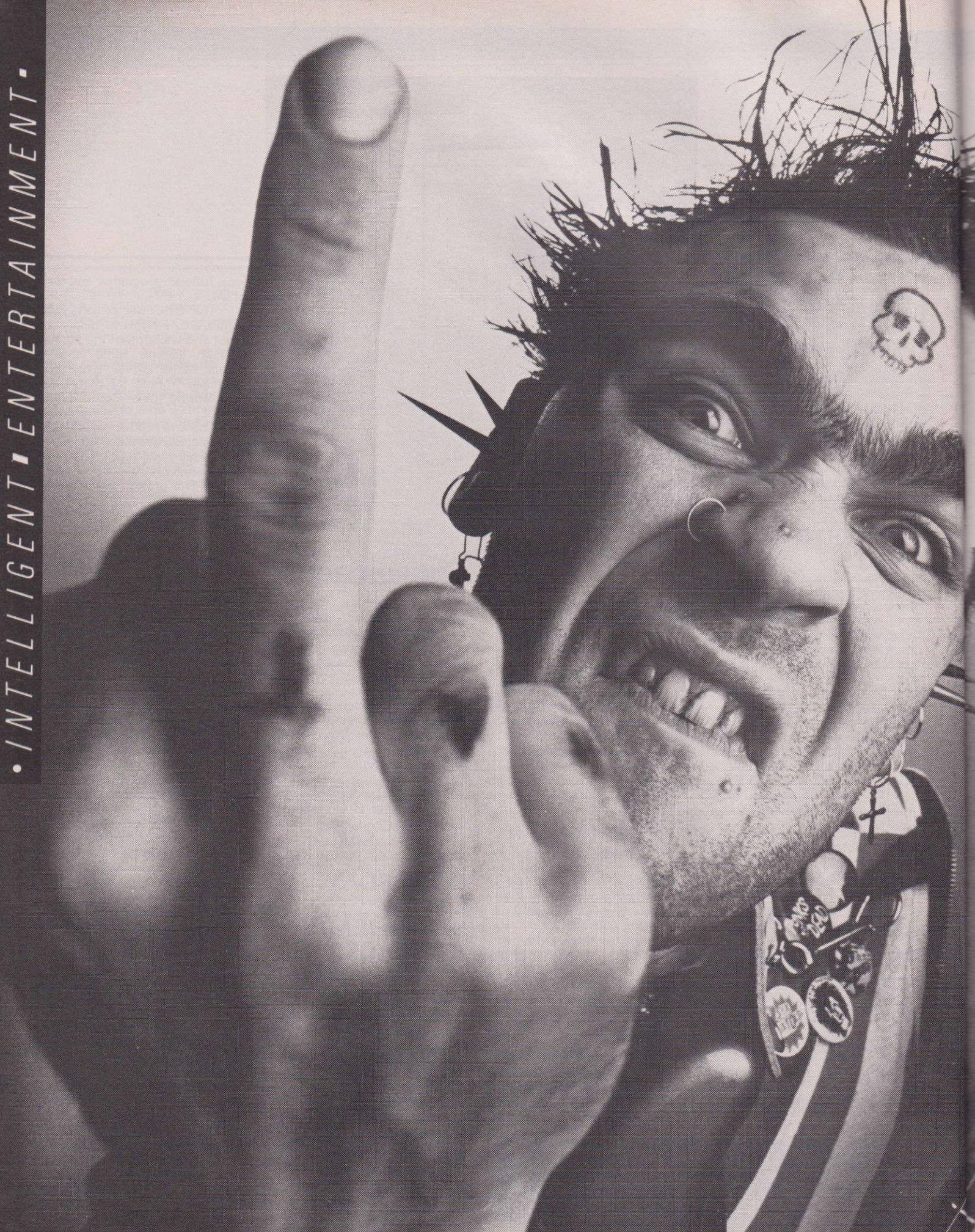
The new player will interface with the BBC Micro (plugging into the 1 MHz bus) thus forging a powerful union for the display of interactive material on disc. The interface represents the extent of Acorn's involvement. The system will be a full level three application with all kinds of text, still photography, film, video and computer graphics on the disc, as well as the computer programs to provide instant access to individual frames, interaction with the user and other computer based facilities.

Despite the computer link, storage on the video disc will be of the analogue type. The second of the two discs will be made up of more technical information about Britain in the 1980s culled from national and academic archives.

Enthusiasm for the project abounds throughout the industry despite teachers' qualms about the role they will be expected to play and the rewards involved. The end product may, after all, be beyond the resources of individual schools taking part in the project. A&B will look at the project in more detail next month and bring you the reaction to it from those who will be doing the groundwork — the teachers and children.



• INTELLIGENT • ENTERTAINMENT •

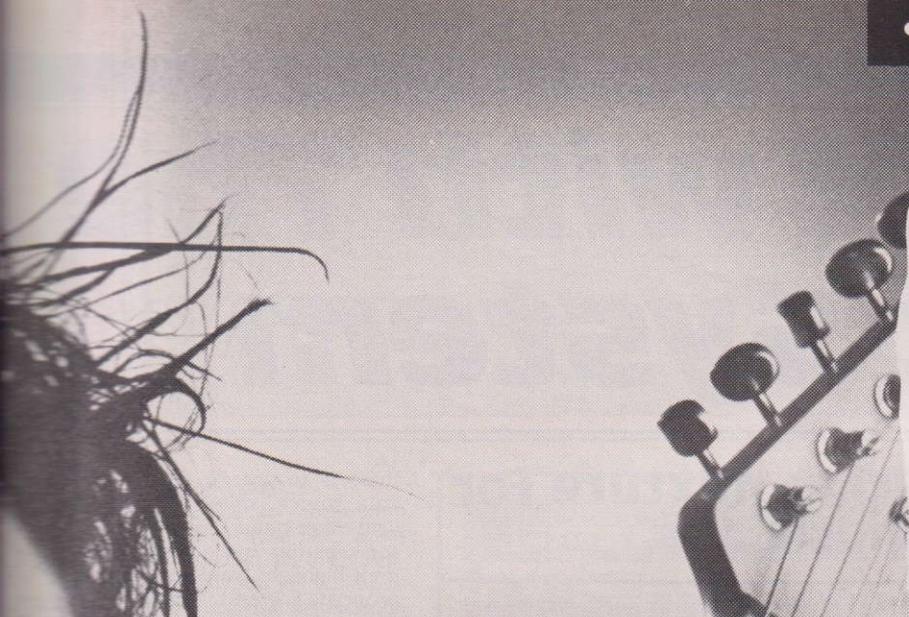


AVAILABLE ON



&





One finger and half a brain are all you need to make music on the new Music System.



You're looking at a composer.
It's hard to believe, I know. But
with the aid of The Music System
program, he has just written a
whole 'song' completely by himself.
Clever boy.

"Toxteth Dawn" is the name of
the 'song'.

It's a love song.

Without any knowledge of
music he bought the music system
program, went home,
booted it up on his dad's
BBC B and started to
create.

He used the synthesiser
part of the program
to make a few noises.

Added a pinch of an old song from
the Song and Sound Library.

Laid down some percussion.
And put a hint of bassoon and
strings over the top.

And hey presto.

The musical answer to zits.
"Toxteth Dawn."

Because his dad's computer
had a printer as well, the program
even printed out the composition
in full musical-manuscript form.

So he could show it to the rest
of the band. And they could say,
'WOSSAT?'

Isn't it time you
became a composer
too?

The brand new
Music System from
Island Logic.



DISK PACK £24.95 INC VAT. CASSETTE 1 (SYNTHESISER, KEYBOARD, SONG AND SOUND LIBRARY) £12.95 INC VAT. CASSETTE 2 (EDITOR, PRINT-OUT, SONG AND SOUND LIBRARY) £12.95 INC VAT. PLEASE ADD £1.25 P & P PER ORDER AND SEND A CHEQUE/PO, ACCESS OR VISA CARD NO. WITH ORDER TO: SYSTEM, 12 COLLEGIATE CRES., SHEFFIELD S10 2BA. (CREDIT CARD HOTLINE 0742 682321).

**THIS PROGRAM IS RECORDED ON THE HIGHEST POSSIBLE
QUALITY DISKS, AS SUPPLIED BY MEMOREX**



Mixing it with The Music System

Mark Webb

Software sells hardware. This statement is not a controversial one within the world of business computing. It might seem so at the home computing level but more and more the software available is used as a selling point for a particular computer.

The Music System, a joint venture between System Software and the nascent Island Logic, is the sort of software which, on its own, could persuade someone interested in this microcomputer application to buy BBC. If you already own a BBC (especially if music is one of your interest areas) then you are one step ahead of the field and very lucky that such a program has been created for your machine.

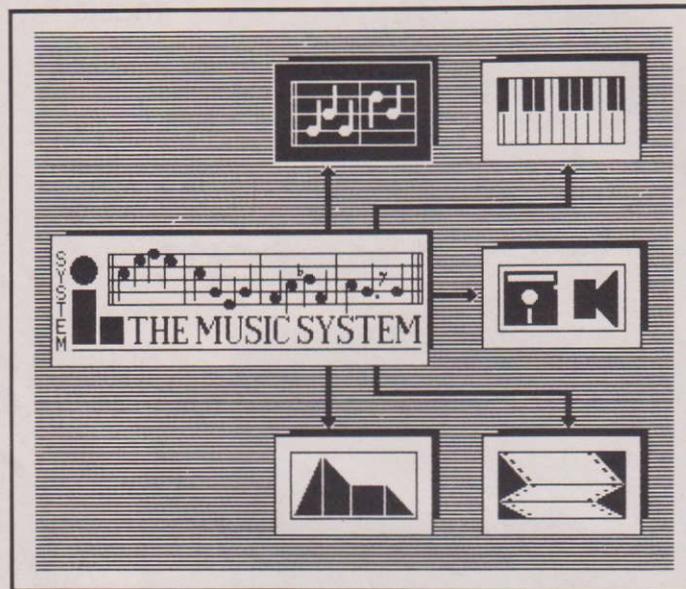
HISTORY LESSON

The System Software Music Editor, upon which this package is based, was originated by Phil Black at Sheffield University in April 1983. It was launched commercially by System in June of that year and is the only music editor to allow music to be written onto staves on screen. Geoffrey Ellis of Manchester University meanwhile had written the Envelope Generator, sold separately but adapted for the Editor by System from August 1983.

Since November 1983, after an approach from Adrian Boot of Island, a combined team has been working on what is a fully machine coded program (using System's A.D.E.). The specification already included the Editor, Synthesiser (Envelope Generator), Keyboard, Linker and Printout. The Envelope Generator even found its way onto Black Uhuru's Island release, Anthem.

Actual coding began in February of 1984 and involved developing the modules separately, including the totally new keyboard/multitrack recorder emulation and the pop-up/icon graphics. Then followed the integration and debugging, and the combination of the whole caboodle under the Control pro-

An inspiring mixture for musicians.



Control Screen

gram. Field testing has been going on since July 1984.

ICON SELECT

The result of all this effort on behalf of the designers and programmers is probably the most ambitious and effective program yet for the standard BBC. The cassette version is inferior to that on disc but nevertheless offers most of the options, and all of the important ones. The disc system user, which is where Island should score heavily with sales to educational establishments, gets a very sophisticated program whose use is considerably enhanced by the speed of disc access to the various modules. Software sells disc drives could also prove to be a true assertion.

Apple's considerable efforts in providing friendly software for its business clients, helped by the use of easily recognisable graphic symbols, icons, has certainly inspired imitators throughout the industry.

The Acorn ABCs, at the top of the range, will benefit from an icon driven Desk Top Manager.

This is made possible by Digital Research hitting back with software to implement icon graphics on rival systems. Lisa and Macintosh haven't gone unnoticed in home computing either. The Music System deliberately and successfully apes the screen design of these superstars of the micro world.

When you !BOOT up into TMS (as we shall call it), the control screen offers five options, symbolically linked to a window of scrolling notes representing the complete system. From the outset it is obvious that it is impossible to move between modules directly but that each option is selected from the control screen. Each module is in fact entered via its own status screen. Spacebar moves around the icons, Return selects.

Let's try the Editor. We can get some music going from there.

STATUS SYMBOLS

Here we are at our first status screen, that of the Editor. First

thing is to specify the required data source, drives 0 to 3. As with other status screens, the cursor keys (up and down) move a dark highlight band over the appropriate line and the cursor keys (left and right) change the value. Default is drive 0. Since we haven't loaded either a music file or an envelope file (always treated separately) the screen currently displays the default values, Key signature C, Time signature 4, Tempo 4/4, Tempo 100 beats/min. The number of notes and bars currently in each voice defaults to 0 and 1. All values can be edited in the same way as the data source described above.

The function keys are sensibly used to initiate file handling and f6 in this case will prompt "Load music file (Y/N)". These pop ups are a feature of the graphics and appear during work at the status screens, to help you on your way or to explain that an error has occurred.

If you wish to catalogue your data source then f0 does the trick. Loading and Saving are on f7 and f8. TMS makes good use of the DFS directories to distinguish between types of file. Everything is checked for out of range input and error messages are explicitly helpful. The rest of the filing system is utilised with Rename file, Delete file, Copy envelope and Swap envelope.

Pop up messages are especially useful when learning such a complex piece of software. They become part of a routine set of keypresses which guide you to the desired function. The fact that the manual has six full pages devoted to key combinations (very good graphics make things clear throughout the documentation) suggests that the odd friendly message can do no harm as you plough through the myriad combinations.

At this juncture it is appropriate to wholesomely praise the manual. The front cover should say "Read this before anything". Of course you won't be able to keep your hands off TMS so I suggest that you head for the Editor, load and play some example tunes from the Sound and Song library and sit



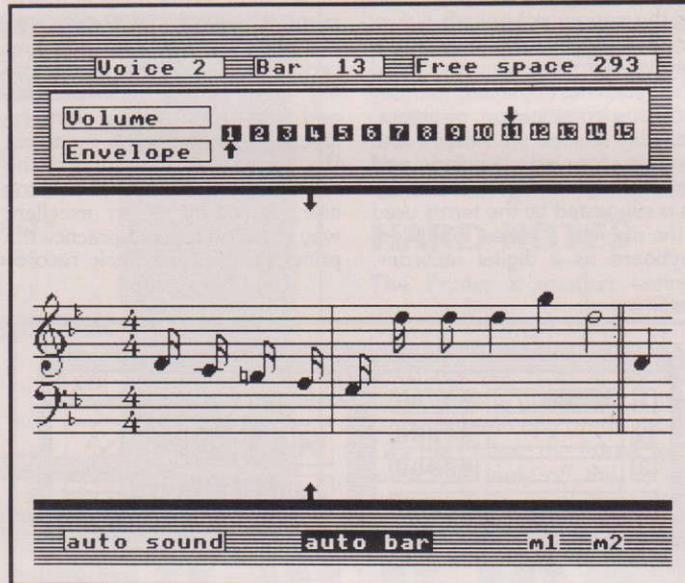
back for a good read.

The novice to computing need not fear because TMS lays a striped sheen over all the workings of the software. All you have to do is follow the instructions and press the right buttons. Even if you are new to music, the notation or the technical language, then the manual will clear things up. The design and content of the manual are of the highest standard, with lots of screen visuals, graphics of appropriate keys and above all, a structured approach to the problem of describing the program. This leads to some repetition of basic points but does mean that you can come back to the manual for the detail.

MAKING MUSIC

The Editor status screen is the portal to the four voice screens. The cassette version does not have the fourth, percussive, voice. Function keys one to four get you there, or Return for voice one.

The music for each voice is entered onto the bass or treble staff for each voice. The duration, pitch, instrument (envelope) sound and volume are all instantly variable from the keyboard, up and down. Time signature has been set from the status screen so



Editor

if autobar is one, each bar will be drawn as required. Each note can be sounded on entry (or not) or tried out beforehand. Return enters a note, but don't worry, editing is just as straightforward.

Accidentals can be added to any note, and the note at the cursor is switched to a reset by hitting Space Bar. Notes of the same pitch can be tied and combinations of notes changed into triplet

form. There are lots of nice touches which allow you to arrive at the voice screen in the desired position, for playing back from the start or from a marker and for changing time signature and automatically resetting bar lines. Repeat bars are also catered for.

As would be expected, the editing facilities are excellent, with insert, delete, move to start and end of voice and set and move marker as well as the normal left and right scrolling throughout the voice. There are also "macros" which deal with changing volume or pitch for the whole tune (from the status screen) or voice (all or part). A combination of CTRL and SHIFT function keys accomplishes these tasks. The most interesting is the ability to transpose tune or voice a whole octave. This does not work with voice four.

Voice four is a percussion voice only and as such is useful for providing backing tracks to your own compositions. There are some interesting examples on the sound library disc. There are 15 predefined effects available and the cursor keys (up and down) choose between them as you enter note values along the staff.

The best way to see all the Editor functions in action is to

practice on an actual piece of music. The shortest route is to load one of the example files, enter the editor for each voice and see what's going on. Then you can experiment, distort a disco track or refine some Bach!

SOOTHING SOUND SYNTHESIS

Editor lets you play composer, Synthesiser takes you into the studio. Anyone who has dabbled in the art of combining 19 parameters into an acceptable sound envelope for the BBC, will know how time consuming it can be and how frustrating even with a traditional Envelope definer. The Synthesiser takes the strain out of this creative process.

The graphics are probably used to better effect in this module than in any other. The envelope is depicted graphically within the Parameter screen but there is also a Graph screen which displays frequency and amplitude graphs. Each active frequency pattern is shown in alternate shading patterns (type of shading is selectable). Similarly displayed is the amplitude pattern. Both graphs are matched according to their timescales. The graphs rescale themselves to take into account the length of each note.

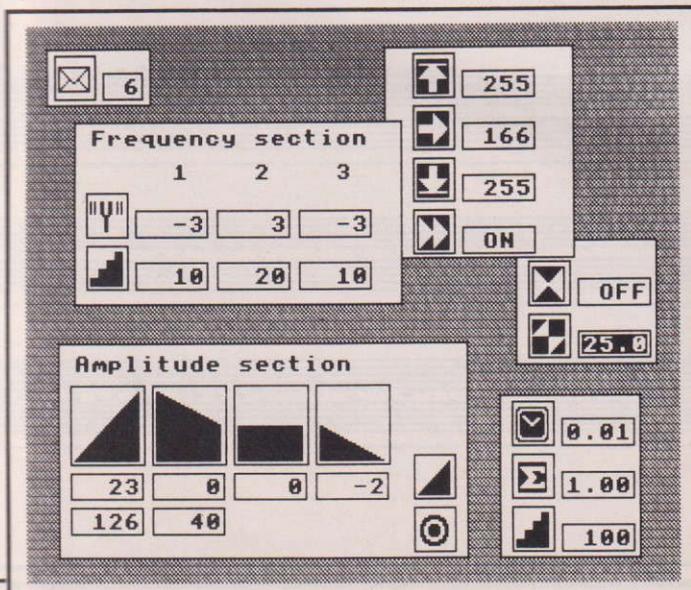
You can still edit parameters from this screen by using a convenient window into which you can scroll the desired element. The graph screen can be studied whole if required.

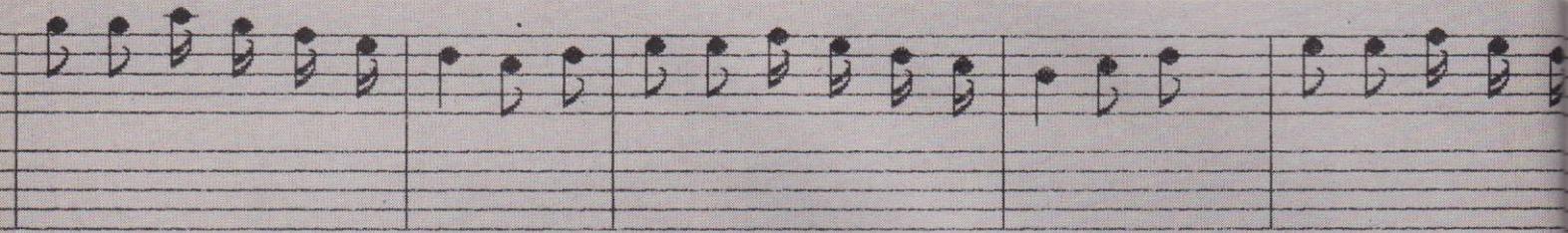
Up to 30 envelopes can be held in memory at any one time, 15 from file one and 15 from file two. Files can be saved in either music or BBC format. Music format envelopes can be loaded back into the TMS, BBC format envelopes cannot. BBC format envelopes can be included in other BASIC or machine code programs. This is the only link with the ordinary BBC world outside TMS in the whole system.

There are useful filing system commands to swap and copy envelopes around and pop

CONTINUED OVER

Synthesiser





ups do a wonderful job clarifying the situation during these operations.

Actually on the parameter screen we find the various elements which go to make up each envelope clearly labelled with graphics for steps, time units, attack, decay, sustain, release and so on. The manual brings the units of measurement and the lines of the graphs together to help explain what you can hear and see, something which may be travelling beyond your control if you experiment with parameters without knowing what they mean.

Free editing around the parameter screen and instant switching around the 30 envelopes, as well as handy facilities like on/off for repeat of frequency sections, makes the Synthesiser indispensable. It is an impressive advance on anything yet designed to help out the musician intent on getting that sound in his/her head to come loud and clear from the speaker.

FINGER CONTROL

If you are thinking that TMS seems like a bit of a slog through a multitude of parameters, keypresses and status screens then the antidote is the Keyboard module. The keyboard sets up the Qwerty keys to play notes. The current keyboard is restricted to the second line of black keys and the number on the top line representing black keyboard (musical) keys. It sounds confusing but appears obvious on screen, a tribute to the screen design.

The actual playable notes represent half the possible keyboard. Octave shifts up and down (left and right on the graphic) access the rest of the piano keyboard and this may put people off. It is possible to form your own methods of successfully getting a tune from Qwerty but there are, for the serious musician, the

compensating advantages of having the computer beneath.

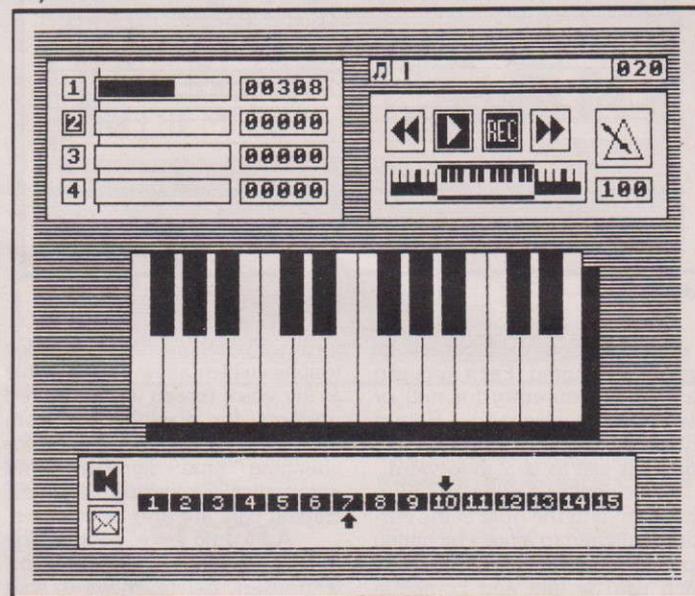
The Keyboard allows you to play in all four voices, to record what you have played, to play back any combination of voices, and play in time with them, and to fast forward, rewind and play back your digital recording. As is suggested by the terms used in the manual, it is best to think of Keyboard as a digital recorder,

rather than a true musical instrument. There is a metronome ticking away in voice four (until you produce or load your own backing track) to help maintain time and the four voices can be layered together track by track. We are back in the world of the recording studio and if nothing else, Keyboard is an excellent way to introduce and practice the principles of four track record-

ing.

There are by now familiar comprehensive editing aids for deleting voices, selecting envelopes, changing volume and moving around the "tape". "Tape" travel for each voice is indicated by moving sector displays in the top left hand corner of the screen, and the amount of memory used in the top right. The selected envelope and volume are indicated with the familiar pointers below the piano keyboard graphic.

Keyboard



Printout

Music File: a:BOH001
 Envelope File: a:Boh00
 Beats/min: 4512511168
 Key signature: R C MAJOR

Send to: The Music System's
 Song and Sound Library
 Output from The Printer

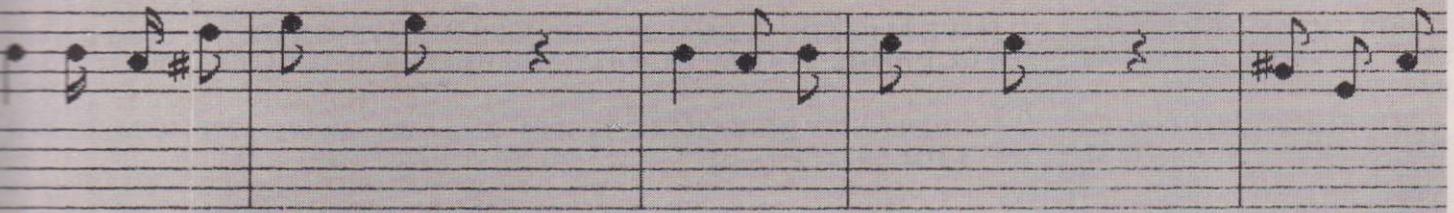
THE MUSIC SYSTEM
 TRADE LOGIC - AUSTRIA

Voice 1
 Voice 2
 Voice 3

IN PERFORMANCE

For those who wish to use TMS software for performance rather than practice, learning or composition then the very near future should see a MIDI interface (possibly the Siel to be reviewed next month) allowing TMS compositions to be played back via professional electronic instruments equipped with this standard serial connection. By the time you have come up with your first TMS production, you may well be able to play it back via your own instruments.

For those who wish to use TMS in the back bedroom or the classroom rather than on stage



Data source drive 1	
<a>	m.sonata
	m.puff
<c>	m.scale2
<d>	m.baby3e
<e>	m.menu6
<f>	m.puff1
<g>	m.bouree
<h>	m.
<i>	m.
<j>	m.
Free space 2132	

Linker

then the usual add-on speaker or amplifier connection can be made from PL15 or PL16. TMS does allow the musician to make very good use of volume, even down to the individual note, and this can be better appreciated if the sound chip output is amplified.

Both the Editor and the Keyboard are limited by the amount of memory available to each composition. They both

start with 860 free notes and each entry, in any voice, eats up one of these. TMS has the answer, and a very good one it is. The Linker allows up to 16 music files (not keyboard files) to be loaded into it, edited into the required sequence and saved as a Linker file or played back in sequence. Each file can be used as many times as you wish.

Linker means that you can string together enough modules,

with repeat sections if required, to last for many minutes, if not hours! Experimenting with simple verse, chorus and middle eight combinations soon makes the composer appreciate the Linker section and it is an essential feature for the more ambitious musician.

HARD NOTES

The Printer is another entirely new addition to the original System Editor and is a marvellous option to have. Whatever the level of achievement, anyone using TMS is likely to want hard copy of the results. Like the Linker, the Printer grabs music files only off the backing storage. It has only one screen, similar to the status screens of other modules and simply gives you the choice of file, data source and choice of voices to be printed in high or low resolution.

Low res is quicker but high res is much nicer! Typical of TMS, you have the choice. Enter your three line title in the window supplied and hit COPY. The manuscript will now be printed on Epson compatible printers. Epson FX80, RX80 and Star Delta 10 can be selected direct from the screen. The final print-out option depends on whether you wish to have all the bars lined up. Once again speed is sacrific-

ed if you do.

In situations where a number of people will use the system just once a week (at school or club) then hard copy can be taken away for further study and to show the family! Of course you can link TMS to a tape recorder and listen to your potential chart entry on your walkman or ghetto blaster if you really want transportability! Hard copy is however important for anyone learning the conventions of musical notation and for making compositions available to the school orchestra or local pop group.

IS TMS FOR YOU?

It is if you have already dabbled in making music on your Micro, have bought software and been disappointed or have written your own and found the task beyond your resources. System Software and Island Logic have those resources and TMS is the result of collaboration between musicians and programmers and feedback from the field trials.

The different modules which go to make up TMS are not entirely integrated but allow the transfer of envelopes and music files to all necessary functions. The Keyboard is out on its own within TMS but is a revolutionary and important addition to the Editor based modules. Within the constraints of the computer itself it is difficult to imagine a more comprehensive musical program. In addition the designers have come up with some of the most attractive and easy to use software available for the BBC.

Beneath the icons and graphics there is a very substantial program requiring a long period of learning. The documentation and easy interaction through use of global keys for file handling and moving between screens makes this learning process much less daunting. In other words, musicians who have no familiarity with computer conventions as well as computer buffs who have a musical leaning can equally enjoy and profit from TMS.



HAVE YOU ALREADY GOT DISK DRIVE(S) FOR YOUR BBC COMPUTER?

SOLIDISK HAS SOMETHING TO OFFER.

— FOR THOSE OF YOU WHO DO HAVE ALREADY, A DUAL FDC DISK FILING SYSTEM (DFDC, using the old 8271 and adding the new WD1770 FDC), ADDS DOUBLE DENSITY AND KEEPS TOTAL COMPATIBILITY (See opposite page).

— FOR THOSE WHO HAVEN'T, A DUAL DENSITY DISK FILING SYSTEM (using the new WD 1770) WILL PROVE MUCH FASTER AND CHEAPER THAN THE 8271.

THE DISK DRIVE:

The disk drive (see pictures) comes from the new series VLSI ultra quiet, auto spin-up, 5.25" half height, solenoid head load, 40/80 track, single and double density MITSUBISHI M4853. It is fast, quiet and consumes far less power than any previous models. 2 new 64 pin surface mounted microcontrollers (from Motorola and Mitsubishi), largely reduce the area occupied by the drive electronics (see pictures), leaving so much more room for the diskette, with very low noise level and reduced friction of the media and the jacket.

SOLIDISK DUAL DENSITY DISK FILING SYSTEM.

Basic characteristics include very high operating speed, Acorn compatibility, automatic 40/80 track switching, auto-density, resident disk formatter and 100% compatibility with Solidisk Sideways RAM.

It is also the simplest ever Disk Upgrade for the BBC computer: with only 4 components: 1 ROM, 2 buffers and the FDC. (See picture 3).

Solidisk software engineers have built in to the 8192 bytes of the 1.40 ROM more facilities than any other DDFS manufacturer has managed before.

The result is a substantial cost reduction, which is passed on to you.

Solidisk engineers won't stop there.

But let's first answer some more immediate questions.

1 — SINGLE OR DOUBLE DENSITY?

You get 60% more storage in double density mode than in single density mode at no extra cost.

In single density — the usual Acorn disk format — you get 10 sectors or 2.5 k bytes of storage per track. That is what the Acorn DFS and many others can do.

In other words, you get 100k with a 40 track single sided disk drive (such as the TEAC 55A), 400k with a double sided 80 tracks disk drive (such as the one in this offer).

In double density, you get 16 sectors or 4k bytes per tracks, an increase of 60%.

With the same TEAC 55A disk drive, you get 160k instead of 100k or with the disk drive in this offer, you get 640k bytes instead of 400k.

The majority of software tested also runs FASTER in double density mode than in single density mode, especially Wordwise, View, Masterfile and Scribe and 95%+ of games are also compatible with double density.

2 — INSTALLATION:

As the STL DFS consists of only 4 ICs, to be plugged into existing sockets on the BBC computer board, installation is quite simple and should not take more than a few minutes even if you are a novice. Simply instal the 4 ICs into their sockets and connect the disk drive (see picture 4).

3 — BASIC DISK SYSTEM COMMANDS AND UTILITIES:

- *ACCESS <afsp> (optional L)
- *BACKUP (!source drive) <dest. drive>
- *COMPACT (optional <drive>)
- *COPY <source drive> <dest. drive> <afsp>
- *DELETE <fsp>
- *DIR (<dir>)
- *DRIVE (optional <drive>)
- *ENABLE
- *F40 (optional <drive>)
- *F80 (optional <drive>)
- *INFO <afsp>
- *LIB (optional <dir>)
- *LOAD <fsp> (optional <load address>)
- *RENAME <old name> <new name>
- *SAVE <fsp> <start> <end> <exec>
- *TITLE <title>
- *VERIFY (<optional <drive>)
- *WIPE <afsp>
- *BUILD <fsp>
- *DISC
- *DUMP <fsp>
- *LIST <fsp>
- *TYPE <fsp>
- *DDFS

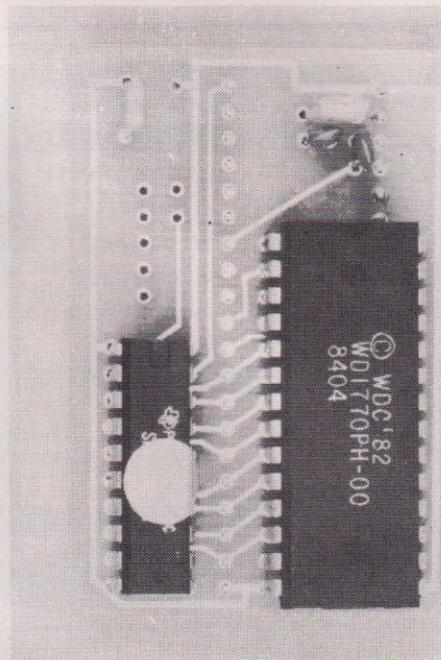
THE SPECIAL PACKAGE DEAL:

A COMPLETE 640K DISK OUTFIT AT ONLY £209.95 INCLUSIVE:

- ONE 80 TRACK DOUBLE SIDED DISK DRIVE.
- ONE DOUBLE DENSITY DISK INTERFACE.
- ALL LEADS AND MANUAL.
- WORD PROCESSOR.
- ELECTRONIC SPREADSHEET.
- SPELLING CHECKER.
- DATABASE.
- STOCK CONTROL.
- MACRO BASIC.
- FULL ONE YEAR NO QUIBBLE WARRANTY.

Optional extra:

- DFDC instead of DDFS: £10.00.



Other OS commands include LOAD, SAVE, BPUT, BGET, OSFILE, BLOCK GET, BLOCK PUT OSARGS, OSFIND, PTR, OSWORD 7F, 7D, 7E etc.

Care is taken in the disk directory presentation, showing the disk size and other useful information. Whenever a diskette is being spun, its number of tracks and density are identified. This information helps the DFS to skip alternate tracks if a 40 track disk is in use in an 80 track drive and also switch the FDC to single or double density.

The net result is exceptional response and user-friendliness.

Outstanding speed too.

As shown in the benchmark test on the opposite page.

CUT THE COST OF RUNNING YOUR MACHINE

Solidisk DDFS comes with free bundled software: (see picture 5).

- Solidisk Database — a fast, efficient and flexible disk based random access database. Ideal for prescription records, club membership etc.
- Solidisk wordprocessor.
- Solicalc electronic spreadsheet.
- Stock Control — very useful for small commerce. Features include menu driven, easy to follow operating instructions, stock items can be grouped by categories, by suppliers, by frequency of movements etc. Stock valuation report (inventory), sale price list, reorder forms can be printed automatically as requested.
- Sillexicon — the most successful spelling checker with English, French and German dictionary. Self dictionary generating capability.
- Macro Basic — a BASIC program generator capable of using bits of old programs to create new programs. Simply ingenious!
- Benchmark for disk drive and disk utilities.

4 — OUTSTANDING PERFORMANCE:

The table below shows the benchmark timing for STL DDFS 1.4. The benchmark consists of disk operations such as save and load a disk program, open and close files, BPUT, BGET strings and numbers, format and verify a disk etc., and is available upon request, otherwise listed in Solidisk DDFS User Manual.

The benchmark tests B1 to B9 are the same as used by many reviewers. The time is expressed in seconds and parts of 100th of a second. The disk drives are twin 40/80 track double sided MITSUBISHI M4853, the diskettes are Verbatim Datalife MD 557 series, 96 TPI double density, double sided, pre-verified to ensure that the media is free of all error and mechanical defects and containing solely the benchmark program. The test is loaded into memory, the drive motors are allowed to stop completely 2 seconds between tests. 10 timing samples are taken and the mean time is calculated automatically.

For example:

100 DEFFN B1:REM Save a 16k program.

110 T% = TIME

120 *SAVE A 8000 + 4000

130 = TIME - T%

Full listings are included in the User Manual.

This FN is called 10 times with 3 sec. interval, the mean result is printed as 'B1'.

BENCHMARK DESCRIPTION	S/D TIME	D/D TIME	
B1 Save 16k	2.62	1.43	
B2 Load 16k	2.45	1.23	
B3 Openin and close 100 times	20.70	20.16	*See note 1
B4 Openout and print 1000 numbers (255)	5.84	4.66	
B5 Openin and input 1000 numbers (255)	4.72	4.14	
B6 Openout and print 100 80 bytes strings	6.18	4.91	
B7 Openin and input 100 80 bytes strings	4.90	4.31	
B8 BPUT 100 bytes (255)	3.01	2.06	
B9 BGET 1000 bytes (255)	1.88	1.52	

Note 1: Whenever a file is to be opened, STL DDFS automatically refreshes the disk directory, thus preventing erroneous disk change. Many other DFS's do not take the same care, although yielding a much shorter time, and this could accidentally stop the program.

With Wordwise:

Load 2000 words (17811 bytes) 16.80 sec. (41.40 sec. with AC.

With Scribe:

Count 2000 words (17811 bytes) 4.20 sec. (9.80 sec. with AC .90 DFS)

With Beebug's Masterfile:

Sort records 1 to 20 in PEOPLE sample database, the database is presorted on field 2 then the program is asked to sort on field 1, the time is then taken: 56.23 sec. (127.86 sec. with AC.90 DFS).

These timings are improved even further in double density mode.

The figures speak for themselves.

STL DDFS dramatically increases the operating speed of your software, including wordprocessors like Wordwise, View, Scribe, databases like Masterfile, Starbase etc.

Solidisk engineers won't stop there.

ONE ROM TO RULE THEM ALL

Already a super mini floppy (2.4 MB) and controller for under £400, a 10MB integrated Winchester hard disk for under £600 AND AN EVEN MORE POWERFUL 16K ROM (2.0 UPGRADE) with outlined specifications below are planned for Christmas.

- Unlimited number of entries into the disk directory.
- File size and disk size can be as big as 16MB.
- Immediate recovery of accidental file deletion.
- Built-in wordprocessor in place of the classical *BUILD.
- Disk sector editor, disk search and replace, tape to disk, disk to memory below PAGE, disk duplication.
- Instant data encryption and decryption using 256 byte single key (expandable).
- Quadruple FDC drivers (8271, 8272, WD 1770, WD 2793).
- RAM Disk facilities for Solidisk Sideways RAM.

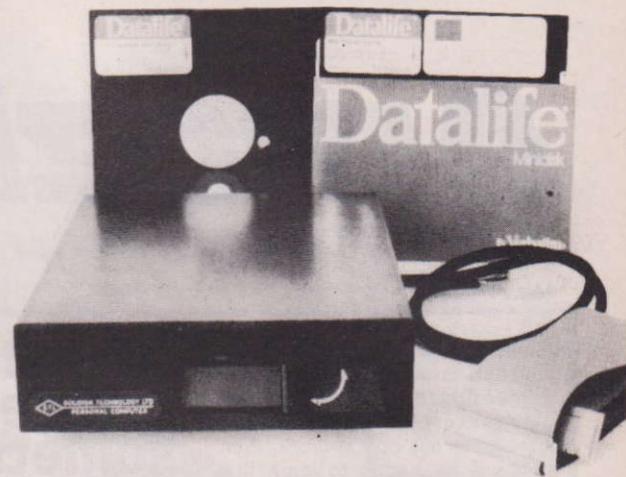
6 — SOLIDISK DFDC:

THE ONLY SYSTEM TO ADD DOUBLE DENSITY AND KEEP COMPATIBILITY.

If your BBC is already fitted with Acorn Single Density DFS, you can ADD double density to your system and KEEP the existing DFS with Solidisk DUAL FDC Filing System (DFDC).

Solidisk DFDC system overcomes the problems caused by around 5% of the games 'specially those produced by Acornsoft newest releases such as Elite). These programs (directly) controls the 8271 thus requiring its presence.

Solidisk DFDC ROM controls BOTH FDC at a flick of a switch, you can choose the new FDC for speed or the old 8271 for Acornsoft game disks.



OPERATIONS	S/D TIME	D/D TIME
FORMAT 40 TRACKS:	17.74	17.74
FORMAT 80 TRACKS:	33.22	33.22
VERIFY 40 TRACKS:	9.30	9.30
VERIFY 80 TRACKS:	17.84	17.84
BACKUP 01 80 TRACKS:	37.69	37.69
BACKUP 02 80 TRACKS:	39.46	39.46
COMPACT 100K-10 FILES	22.42	18.82

7 — PRICES (including P and P and VAT)

STL DDFS (disk chip upgrade for BBC B)	£39.95
STL DFDC for those who have Acorn DFS	£49.95
640k DISK OUTFIT (complete package)	£209.95
1.3MB DISK OUTFIT (with twin drives)	£359.95
2.0 ROM Upgrade (available soon)	£10.00

To order, you can use the coupon. Access and Barclaycard holders can ring direct:

HOW TO ORDER?

You can order any item using the coupon. Prices are inclusive of VAT, post and packing. Access and Barclay card holders can place their order by phone.

Educational authorities, Acorn dealers and OEMs can obtain quantity discounts.

Name:

Address:

.....

Credit Card Account:

Callers are requested to ring first for appointment.

Total: !

SOLIDISK TECHNOLOGY LIMITED
17 SWEYNE AVE
SOUTHEND-ON-SEA
ESSEX SS2 6JQ

SOLIDISK'S NEW TELEPHONE NUMBER: SOUTHEND (0702) 354674 (10 lines)

Amazing Mouse

Mark Webb

Amazing Mouse! If you have ever watched in awe as someone has demonstrated a mouse on a Mac or Apricot or if you are lucky enough to use one at work, then you will be happy to learn that AMS has come up with a rodent for the BBC which rivals the best.

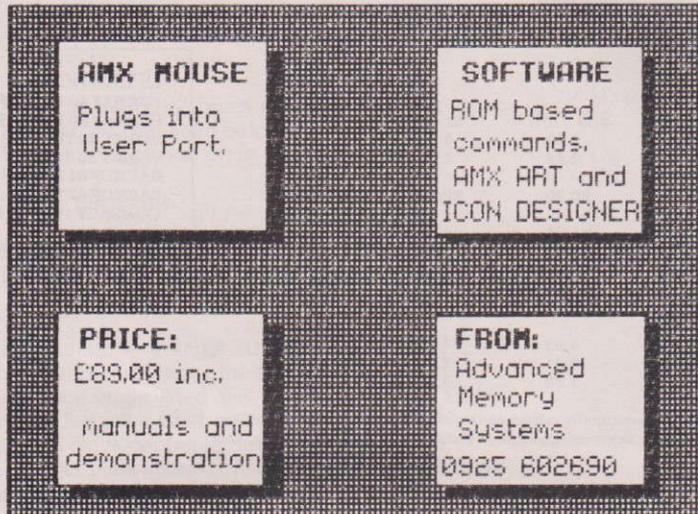
For those who know only of Jerry or Danger Mouse, let me explain that a mouse is a control device which sits on a flat surface like a desk top and is connected via a cable or by infra red to the microcomputer. The AMX mouse plugs into the user port of the BBC. The mouse is moved around by resting the palm of one hand upon it and manoeuvring it with movements from the elbow and wrist. The three middle fingers of the hand rest upon three buttons on the front of the mouse, facing away from the user.

The idea of the mouse, which was invented by Apple to make using their Lisa software easy for businessmen, is closely connected with icon graphics. These graphics symbols appear on screen and represent branches within the application program. Meaningful icons can make recognition of the required task much quicker than with conventional test menus and you don't have to learn all the key presses of a command controlled program.

The mouse plays an important role, moving the pointer to the chosen icon, selecting, executing and cancelling with the three keys. Use of the keyboard is kept to an absolute minimum in a program like AMX ART.

You might think that the joystick or just the plain old cursor keys could do the same job but this is not so. The AMS mouse itself is designed so well that the

The AMX mouse ingeniously provides something for everyone.



user develops a "feel" for moving the pointer around the screen. The brain, it seems, finds it easy to make the connection between the mouse and hand and the eye and screen pointer. Reaction times improve and the learning curve for carrying out combinations of selections is very short.

TOTAL PACKAGE

There is certainly no spare room going in the polystyrene box which contains the mouse. AMS have packed it with goodies. The Mouse software is on EPROM, ready go to into one of your sideways ROM sockets. There is a very comprehensive Mouse manual. An icon designer utility comes on disc or cassette as ap-

propriate and the first piece of full blown icon graphics software, AMX ART, comes bundled, also with its own manual.

The heart of the system is the EPROM containing the Mouse commands. It is recommended that you fit this in the first priority socket on your BBC board, ie the far right socket. This will be socket 15 on a standard ROM expansion board but not on ATPL's, on which 15 is reserved. The manual states that this is for efficiency's sake. The software has been tested with a lot of other ROM software and AMS have talked to other companies about use of memory locations. I have come across no interference problems yet.

The Mouse software, written by David Elliot of Swoop fame, registers upon the screen at start up with "AMX Mouse off". Commands available are listed in table one. Of special interest is the fact that the commands are easily accessible from BASIC or Assembler. The technical guide lends a hand to those wishing to write their own software around the Mouse or to convert existing software to work with it.

The ROM software checks

the position of the mouse and the state of the buttons. This entails using two vectors, the event vector and the keyboard vector. The mouse continually generates interrupts. The mouse makes use of bits two and five to eight of the user port as well as lines CB1 and CB2.

OSWORD (&FFF1) is called with the accumulator set to 64. The coordinates of the mouse (in graphics and text form) are returned, together with the state of the three mouse buttons, into seven bytes pointed to by the X and Y registers. The manual details the contents of this seven byte block and provides simple BASIC and assembly programs to plot points as the mouse moves around.

MOUSE COMMANDS

The results of the OSWORD 64 call control the on-screen pointer. For fine control of the pointer, there is a *SENSITIVITY command. *Mcursor ON/OFF controls the use of the mouse within application software like View or Wordwise. The command actually gets the mouse to emulate the cursor keys. Using *BUTTONS, you can define the mouse buttons to get codes equivalent of oft used keypresses (DELETE, COPY, RETURN for instance).

*WINDOW, *ICON, i,x,y, and *DEFINE commands are available to aid the design and coding of icon based software. Windows are drawn with special borders and icons accessed by icon number(i) and planted at TAB(x,y).

This software is especially easy to use from BASIC. *DESK is the equivalent of CLS to grey background — one of the trademarks of icon software, witness Acornsoft Database (Electron), The Music System, Acorn Desk Top Manager and Apple predecessors.

The icons themselves are split into two types, those defined in the ROM (32 to 96) and those which have to be user defined (0 to 31). There are example sets in the bundled software. The ICON

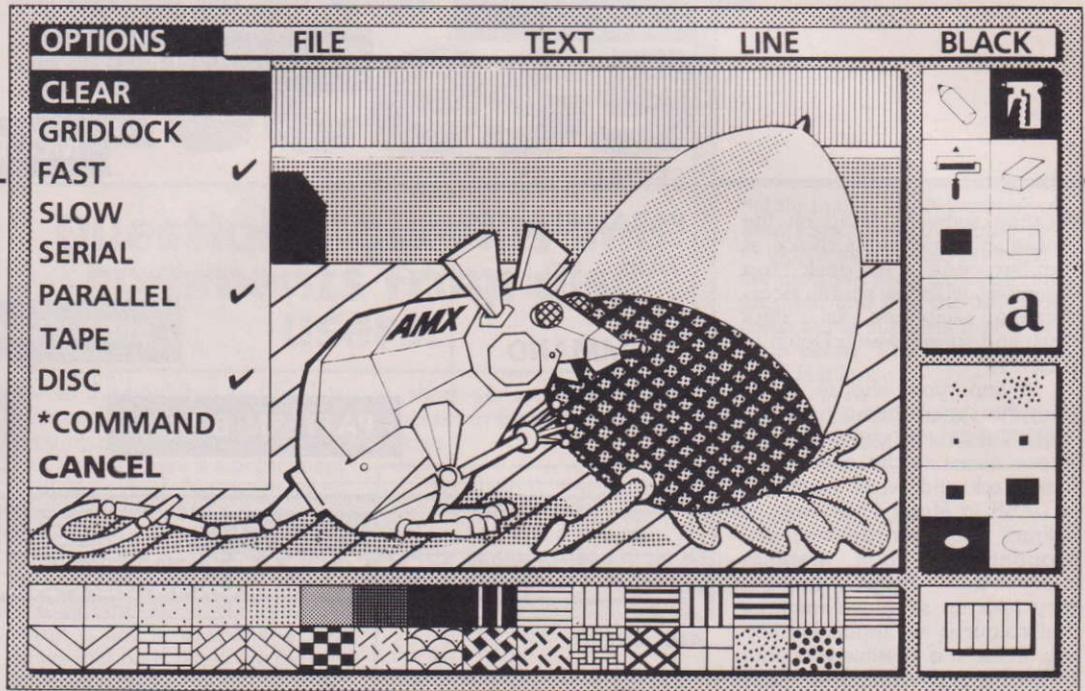
Mouse commands

*BREAK	*MOVEPOINTER
*BUTTONS n/OFF	*POINTER i1 [,i2]
*DEFINE filename	*POINTER ON/OFF
*DESK	*SENSITIVITY sx [,sy]
*HIDEPOINTER	*SHOWPOINTER
*ICON i [,x,y]	*UPDATE
*Mcursor ON/OFF	*WINDOW lx,by,rx,ty
*MOUSE ON/OFF	[, title]

DESIGNER is used to build and file icon libraries and DEFINE to specify which set you wish to use. The manual describes the file structure used to store icons so they can be easily incorporated into software not designed to access the ROM commands.

The BASIC designer itself will be familiar to anyone who has used a character or "sprite" designer. The 32 byte icon is built up from individual squares on a larger grid, while the actual size icon appears beside it. New icons are assigned a place in the current library. Icon files can be loaded and saved and individual icons dumped in the bin or amended on the oversize grid.

Perhaps the most important family of commands are those associated with the pointer. Unlike the other, before they can be used, a * POINTER ON command must be issued and the Break key pressed. This reserves 256 bytes and PAGE moves up to &1A00. This is not necessary if a second processor is being



Nibbling at an Acom!

employed. To simulate Break within a program a *BREAK command is available.

Once the pointer routines are initialised *POINTER icon1 icon2, sets the icon number (and its mask) which will be used as a

pointer. If icon2 is not specified then the program assumes the mask to be icon1 + 1. ROM held icons 80 to 91 are designed for use with this command and consist of icon and mask pairs. *POINTER 80 sets the arrow

icon as pointer.

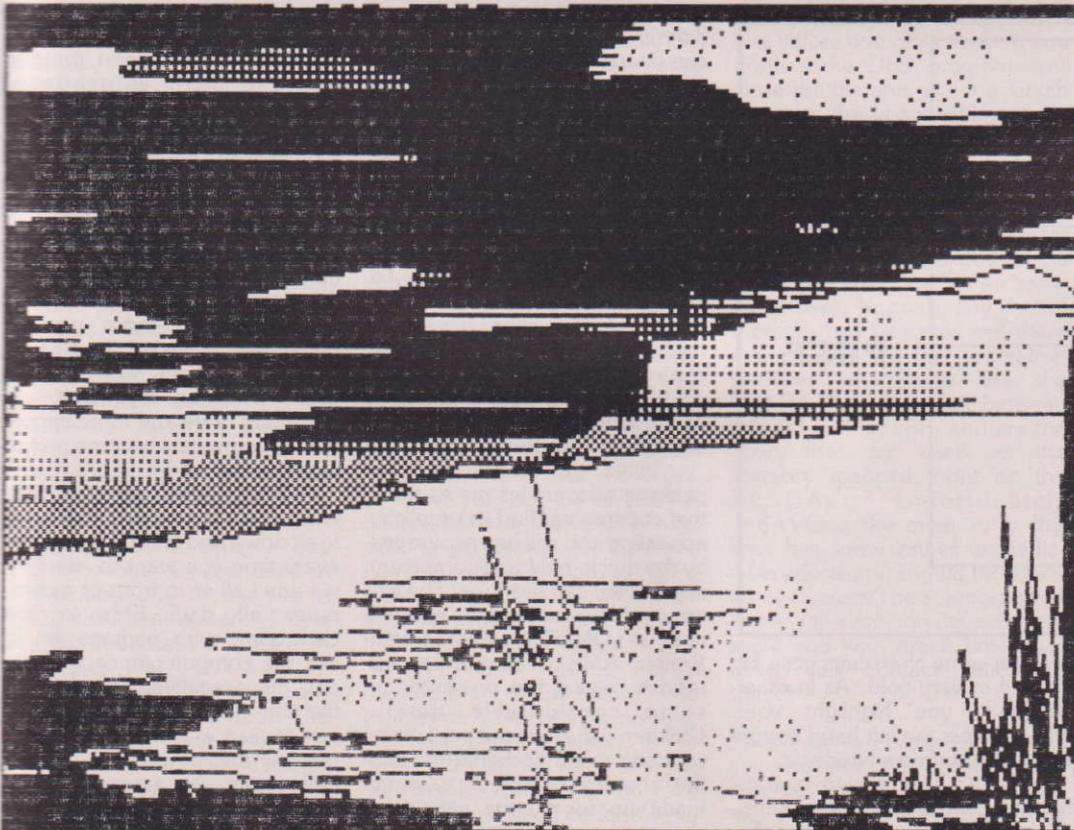
*SHOWPOINTER displays the pointer at the current mouse position. HIDEPOINTER removes the pointer. For smooth movement *MOVEPOINTER combines the two, with a *FX19 thrown in to wait for screen refresh.

*UPDATE uses OSWORD 64 to move the text cursor to the current position of the mouse. As well as using 256 bytes workspace, these routines also make use of zero page locations &70 to &8F.

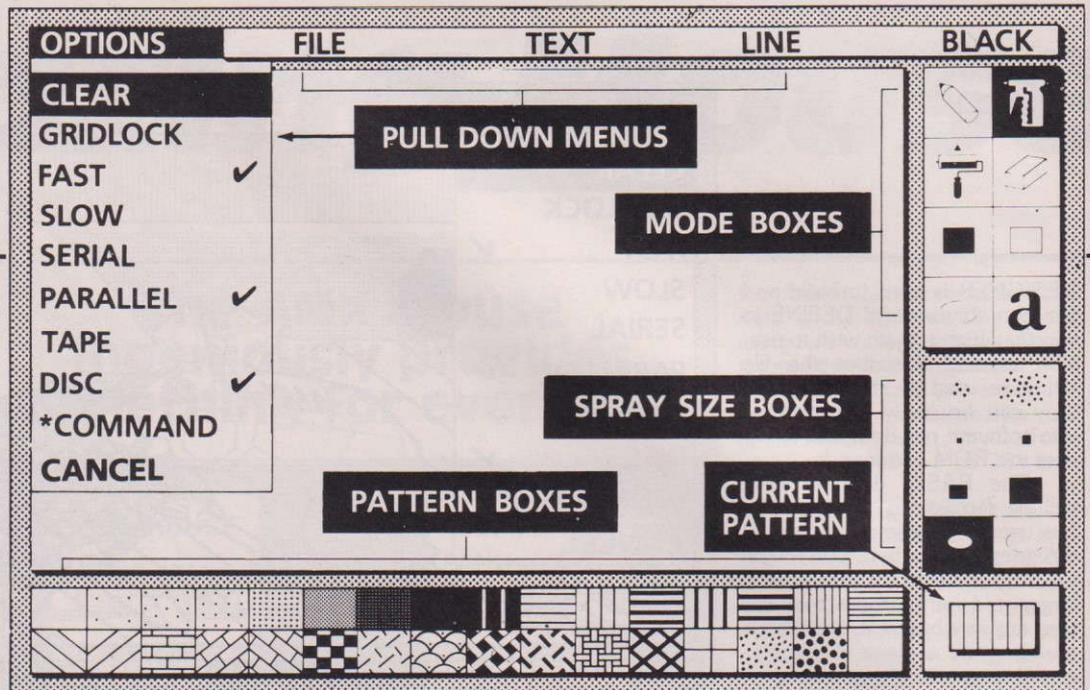
I think it is plain from this brief look at what the commands do that making use of the mouse software should not prove a problem to BASIC programmers. The commands can also encourage beginners to try their hand since results are speedy and impressive. The manual provides a technical run-down of each command and is devoted to opening doors for the would-be mouse programmer.

BRINGING OUT THE ARTIST

No longer ARTWORK because of some obscure American software company having got there first, AMX ART is the first ap-



CONTINUED OVER



AMX ART

plication software based on the mouse. It's an obvious choice as number one. A desk top organiser will follow shortly incorporating telephone list, desk diary and so on (watch Down to Business).

When you choose AMX from the system menu (you can *RUN it direct if you wish), the screen clears to the grey (alternate black and white pixels) of *DESK in Mode 4. Sober grey colours are now deemed appropriate for icon graphics everywhere — mainly because they take up so much memory that colour is an impossible luxury. In fact it is possible with your own icon programming to make use of colour by redefinition.

Everything is on screen. If you point to any of the choices on the top line then "pull down" menus enlarge upon your options.

"File" opens up for loading and saving pictures — shame that you can't catalogue a disc from here. Saving means typing in a

me for its Clear command but is full of miscellaneous options for control over printout, cassette/disc filing, grid lock, access to *commands and fast/slow sensitivity. Options are highlighted by moving the mouse and executed with the left hand button.

"Text" can be plain, italic, bold or very bold, and certain combinations of italic and bold. In

window but also displayed at all times in the top right hand corner of the screen.

AMX ART lacks some of the "goodies" of a MacDraw but provides for drawing with lines, airbrush and roller (fill). Airbrush is especially easy to master and results can be impressive. Different types, sizes and shades can be employed. The artist can switch around between sixteen different patterns — the Designer can be used to create new types. Circles and rectangles can be situated, moved and drawn by pointing at the right box and making use of the left and middle mouse buttons.

The current action can always be cancelled by pressing the righthand button. Indeed with the fill, your last try can be cancelled out even after execution. Other corrections have to be made with the "rubber", a mouse controlled cursor which clears to white background. The mouse is so sensitive that it is not difficult to tidy up pictures to fine detail.

Initial experience with the package encourages me to think that children will find its simplicity appealing and will be encouraged by the quick, bold and competent results they can produce. The examples I have seen in the manual and at UMIST, where David Brader, AMS's technical director resides, reveal the possibility of some considerable detail. Children will enjoy the availability of ready made backgrounds and the absence of colour is partly made up for by the variety of shading.

SUMMARY

The AMX mouse has won over everyone who has used it. The hardware is ingenious, works alongside all the other sideways ROMs I could find and works with a second processor. The commands in ROM are not designed for the professional programmer but for everyone and are fully documented with examples and demonstrations. The software displays great promise for use with educational packages, providing symbolic representation on screen and extremely easy access for children to computing power.

AMX ART is a worthy package in its own right. Once again simplicity of operation, a difficult thing to achieve, makes it a joy to work with especially for youngsters and those new to computing. It pushes the BBC to its limits without worrying the user. "Software ergonomics" is becoming more and more important as computers become part of everyone's lives.

The mouse and icon software means that you don't have to sit down and learn the software every time you want to use it — we don't all sit in front of a computer all day! Kids in the classroom, who perhaps get to use the computer once a week, and the executives who haven't the time to take up a new hobby just to use a computer will appreciate the mouse as well as us enthusiasts. An amazing mouse indeed!

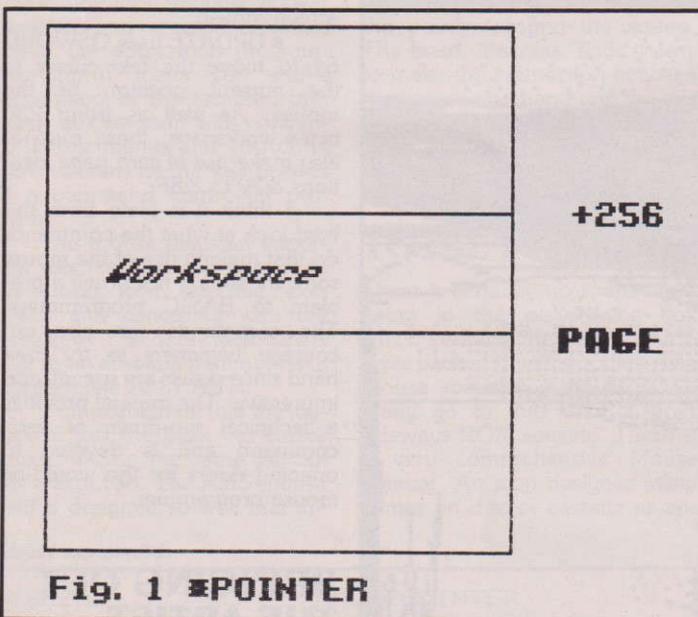


Fig. 1 *POINTER

filename, hitting Return and then confirming the choice. The right hand mouse button cancels at any time but there is also a cancel option on screen.

"Options" was most used by

practice some characters get a bit stunted in very bold. As in other windows, you highlight your choice, press the left hand button and a tick appears besides it.

"Line" has plotting options for black, white and dotted lines. Current selection is ticked in the

Random Access

Dave Carlos

N J Reed of Somerset provides the first query this month, he has an 80 track drive and is having difficulty with 40 track disc.

Unfortunately the letter didn't say whether the drives concerned are switchable from 40 to 80 tracks or not. If they aren't then there is very little that anyone can do about this problem in the short term. The problem is that using an eighty track drive means that the steps that the head makes to find each track are smaller than on the forty track version. They are precisely half of the distance in fact and this is likely to be the problem. The remedies are far from simple I'm afraid. You could copy the disc from forty to eighty track format but this involves getting the help of someone with both types of drive, perhaps your local dealer might help if the material isn't copyright. You might try returning the disc if it is copyright and request a copy on eighty track, but expect there to be some kind of charge for this service. Finally you might like to consider fitting a modification to make the drive switchable from forty to eighty tracks and back again. These were offered by PACE and ALGOTEK some time ago and although not promoted heavily I do know people who use them successfully.

If the drives are switchable and you have tried the disc with the drives on the forty setting then the problem is likely to be elsewhere. Some people don't like to write discs for forty track drives using an eighty track drive. The argument usually centres around the assertion that the tracks laid down are too thin. I haven't found this to be the case but these discs are certainly very prone to slight misalignment errors. These occur when a disc written on one drive is used in another and one of the two is slightly out of adjustment. This is the exact equivalent of those program tapes that won't load on your machine but load quite happily on the bloke's next door. The remedy is in two parts, firstly, you should have the alignment of your own drive checked by a dealer. If this is found to be accurate then you should return the

Questions, queries and comments from disc users.

disc to the publisher and explain your problem requesting another copy by return.

Finally, there is a point about formatting discs that needs to be born in mind. Most formatting discs have a program to format 40 tracks and another to format 80 tracks. N J Reed says that he is using the 80 track formatter which is fine if, and only if, the drives that he is using are indeed 80 track drives. If they are forty track drives there is little point in using the eighty track formatter as it won't increase the number of tracks on the disc. It only cause the drives to hit its end stop after formatting the first forty tracks and wait there until told to write the directory to track zero. When this is done the disc believes that it has eighty tracks, this information is held on the second sector of the disc, but it really only has forty. It is likely to work quite happily until you try to write to the last track or try to backup the disc. The golden rule is to always use the formatting program for the type of drive that you are going to use even though another might appear to work.

Random access filing is the subject of the next query and setting up the files has been a problem for Mr E Allchin of Bridgewater.

He has been using the *SAVE method of opening out the files that he intends to put his data into. This seems to work very well indeed with short files, ie those of up to &FE00 in length, but over that length things start to go wrong. He uses the KENDA double density filing system so it is possible that there are two problems here, not just the one. If we examine the *SAVE first, this is not a method that I would recommend to anyone when setting up their files. A better method is to OPENOUT the file using the normal BASIC command and then use a short piece of code to write "dummy" information to the file.

A short yet perfectly adequate program to perform this reads as follows:

```
10 INPUT "Program name" file$
20 INPUT "How many kilobytes to save" kilobytes
30 file% = OPENOUT file$
40 FOR length = 0 TO kilobytes * 4
50 PRINT # file% ,STRING$(254," ")
60 NEXT
70 CLOSE #0
80 END
```

After running this program you should have a file of approximately the correct length into which you can now write your data. (Using the value 254 on line 50 means that each string written to the disc takes exactly 256 bytes, ie just one sector.) Here is a short tip about using files like this, you should always try to put the pointer at the end of files before you close them. If you don't some DFS programs will close the file and give it a length equal to the last position of the pointer. Remembering to move the pointer to the very end of a file ensures that this won't happen.

The reason that Mr. Allchin is having problems is due to the area of memory that he is choosing to save. Normally any area of memory can be saved but there are a few bytes that are rather sensitive when you use the KENDA DFS. These are between &FE80 and &FE8F, and are the bytes that are used as the memory mapped input on the KENDA. Unfortunately *SAVEing the memory in this area has some rather unpredictable effects and should be avoided at all costs. The solution given above will avoid this difficulty and leave you with much tidier files which just contain strings of spaces.

Finally just a couple of raps on the knuckles this month, from observant readers.

David Greenwood of Luxembourg points out, quite

rightly that in my November column I said that you would have to type a new PAGE setting in at the machine each time you ran a program and that this isn't quite correct. He suggests that a program called "FRED" could have as its first line

```
0 IF PAGE < >&6500 THEN
PAGE = &6500:CHAIN "FRED"
```

This is a technique that I am familiar with and I don't know why I didn't mention it at the time. I even used it in the DISC MENU program that was in last month's magazine. My apologies to those who were confused, the above technique is perfectly acceptable as long as you remember not to change the file name of the program.

The other rap comes from B V McGrath amongst others who points out that the original disc menu program (March/April) issue won't work on Amcom DFS. I have to admit that I knew this and the reason is that AMCOM and a number of other DFS programs write their file data to different locations in memory. This means that the program is trying to "peek" the wrong area and it puts rubbish on the screen. That is one of the reasons that Acorn warn us not to use indirection operators to do things like this. The correct way of finding all the file information is to use a OSGBPB call and I intend to try to publish a new routine, to add to the bones of the old program, as soon as I get the time to test it properly. Then, if all the DFS chip writers have obeyed Acorn's ruling on the matter, it should work on a much greater range of DFS programs.

If you have any questions about Discs, Drives, DFS or their use, please let me know at the editorial address. Others may learn just as much as you from any answer that I can give. I look forward to hearing from you!

Elitism

Tony Self

Commander Glew pilots his ship on a voyage into the unknown that becomes much more than just a game.

In our December issue we reviewed Elite, Acornsoft's space trading simulation (I personally think it's an insult to call this a game), which has already sold over 50,000 copies and become their best seller to date. Since we reviewed the program we have tracked down one of the few traders who has managed to obtain ELITE status and also become one of the first trading millionaires.

David Glew of West Wickham, Kent has been an avid games player since he bought his BBC Model B over two years ago. His collection of games software for the Beeb is second to none and you would be hard pressed to find a game that he hasn't tried his hand at. You will regularly find him on a Friday night at Orpington Computer Club showing off his latest software purchase.

Last year David, who works for an Australian insurance company in Croydon, had clocked up four weeks' holiday which he had to take. He didn't have any plans on how to spend the time apart from visiting the PCW show during his first week. Little did he know at the outset how busy he would be.

A&B What was your first impression of Elite?

GLEW As soon as I saw Elite being demonstrated on the Acorn stand at the Show I knew it was no ordinary game. Despite the cost of the package you get a lot for your money and a truly sensational game. The graphics are out of this world and the actual game is highly addictive with a lot to offer both arcade and trader games players.

A&B Once you had bought your disc version of Elite how did you get started?

GLEW When I first opened the package I went straight for the 64 page Space Trader's Flight Training Manual. My initial reaction was that of horror — so much knowledge seemed to be required to play the game.

Usually I plunge straight into the games I buy with little attention to the instructions, and learn my lessons the hard way. However, it was obvious that this method would be foolhardy with Elite. After reading about 20 pages of the manual I began to realise that although there are extensive and important details to be understood and remembered,

there is also a huge amount of padding intended to set the scene and stimulate the player's imagination. By skipping over most of the irrelevant details, the actual amount to understand shrinks considerably. Many details regarding various weapons, types of planets and their status can be learned or looked up when needed during the game, especially as there is a "Game Freeze" facility which I used extensively at first.

A&B The manual suggests that you practise docking with the Coriolis space station orbiting Lave before proceeding any further. Is this good advice?

GLEW Yes, it is essential for the player to master this very difficult manoeuvre at least a couple of times, because unless you can dock you won't get anywhere.

A&B Did you use keyboard or joystick to control your Cobra MkIII?

GLEW I decided to use a joystick. This was an unusual decision for me as I usually prefer to use keys because I am more at home with them and the response is usually better. Elite's joystick response seemed to be



very fast and accurate. I certainly found it easier to match the rotation of the space stations with the joystick.

A&B What tactics did you use at the beginning of the game?

GLEW Initially I wanted to raise enough credits to improve my ship's equipment. I already appreciated the necessity for purchasing a Docking Computer as soon as possible. I decided to stock up with goods and textiles which were cheap and were being sold on Lave well below the average price. I then sought a planet that was predominantly industrial, as food and textiles would sell there hopefully at a higher than average price and I would make an early profit. On industrial planets I tried to buy commodities like minerals if the price was low enough and occasionally a computer.

One thing I did find very helpful during this very early stage of the game was to write out details of various planets buying and selling prices. This was useful as it helped me to get acquainted with the market prices I could expect to find on different categories of planets.

A&B Did you find that you were building up your credits quickly?

GLEW At the beginning of the game I didn't make much progress and docking was tediously slow — oh for that docking computer. I decided to take a few risks and purchase narcotics that were being sold for well under 10

credits per tonne. This type of cargo can be very profitable because many planets such as rich agriculturalists often pay around 90 credits per tonne. With a full cargo and one successful trading I managed to make a profit of 1760 credits. Enough to buy that docking computer.

Actually getting the narcotics to the desired planet however was not easy for, on buying them, my legal status became that of offender. This meant that pirates and police vipers took a particular interest and, as I had only recently started the game, I had little protection and fire power for dealing with sustained attacks. However I did find that if I only purchased the narcotics when my status was clean I was very seldom attacked, provided I did not attack any spaceships myself. The one disadvantage of this ploy was that when I came out of Hyperdrive I was not usually able to Skip as close to the planet as usual because of the proximity of interested ships. Not daring to attack them I had to wait on many occasions for 10+ minutes before I was finally able to dock.

A&B Now that you were building up your credits through illegal trading, what equipment purchases did you make?

GLEW I initially bought a docking computer and a large cargo bay. This enabled me to speed up my trading between planets con-

siderably and with the larger cargo bay I was able to increase my profits more quickly. During this period I was forced to take on and destroy various enemy ships that fired at me. Because my Cobra was weak on fire power and I was inexperienced at destroying enemy ships I was blown to pieces many times and forced to reload my last saved position.

A&B I presume you had improved your rating by now?

GLEW Yes, my rating changed first to MOSTLY HARMLESS and then to POOR. My trading habits also changed, I could now afford to buy full cargoes of computers at rich or mainly industrial planets for approximately 63 credits each and sell them to rich or mainly agricultural planets for 90-100 credits, a profit of just over 1,000 credits each trip. I would return with furs, liquors and wines — cheap on agricultural planets but highly valued by rich industrialists. I found two close planets of these types and travelled back and forwards between them, still at this

stage not looking for too many fights as credit building to buy armaments was now the order of the day.

A&B Profits were soon rolling in then?

GLEW Yes, I had soon gained about 5,000 credits this way and picked up an E.C.M. and an Energy Unit which proved to be vital when I turned my attention to fighting, because it replenished my ship's energy and shields twice as fast as before.

A&B How long was it before you reached COMPETENT status?

GLEW After about seven days of playing for eight to ten hours a day.

A&B How did your tactics change during this period?

GLEW After my credits rose to 5,000 I started to increase my armaments by purchasing Energy bombs. These destroy all ships in the surrounding area, but they are rather expensive at 900 credits each. Although I continued to trade in computers and furs I visited feudal and anarchic planets where there were many pirates and occasionally

Thargoids just itching for a fight. I soon became quite proficient at destroying their ships and my rating increased to first AVERAGE and then ABOVE AVERAGE with my credits increasing to about 12,000.

I then realised I was wasting my credits on Energy bombs to get out of critical situations caused mostly by the relative ineffectiveness of my pulse lasers. So I purchased a more powerful Beam laser to replace my front pulse laser, which I moved to the rear of the ship. Whilst the Beam laser was a big improvement, I found it almost impossible to get used to the rear laser, because lining up my laser sights on an enemy ship required joystick movements to be exactly opposite those needed for the front laser.

It was very shortly after this that I decided to do my final front laser upgrade and purchase the very expensive Military Laser (6,000 credits). This however very quickly paid for itself as I was not only able to increase my kill ratio in between each planetary docking, but I also got through more often with valuable illegal cargoes such as firearms and narcotics.

Once I had built up my credits to a comfortable 50,000 I felt it was time to go on full attack and concentrate on improving my rating. I sought out a cluster of closely grouped planets with a concentration of anarchic and feudal governments where I would find plenty of pickings. I started to get kills much faster but I also got wiped out myself on many occasions and had to reload my last saved position. Also on occasions I had various pieces of equipment or cargo destroyed. If the loss was too great, such as a docking computer or several items of equipment in one go, I usually decided to reload rather than pay out again for replacements. By doing this I did have to accept the loss of all my kills since I had left the last planet.

A&B How did you feel on reaching COMPETENT status?

GLEW It almost took me by surprise as I was beginning to think I would never reach it. My delight

in attaining the rating kept me very happy for a couple of days.

A&B What happened then?

GLEW Well I had been playing over 25 hours without any rating improvement and I was beginning to realise the magnitude of my mission, after all I still had to get to DANGEROUS and DEADLY before I could even begin to consider ELITE. I was getting fed up and despondent and even thinking of giving up when suddenly, after docking for the nth time, my screen reported "INCOMING MESSAGE..."

A&B This must have related to one of the missions that are only available on the disc version?

GLEW That's right. The message was from the GalCop and they told me of a brand new craft they had developed, with extra armour and a new type of military laser, which had been stolen. They asked me if I would accept the mission of destroying it. They also advised me where it was last sighted and showed me what it looked like.

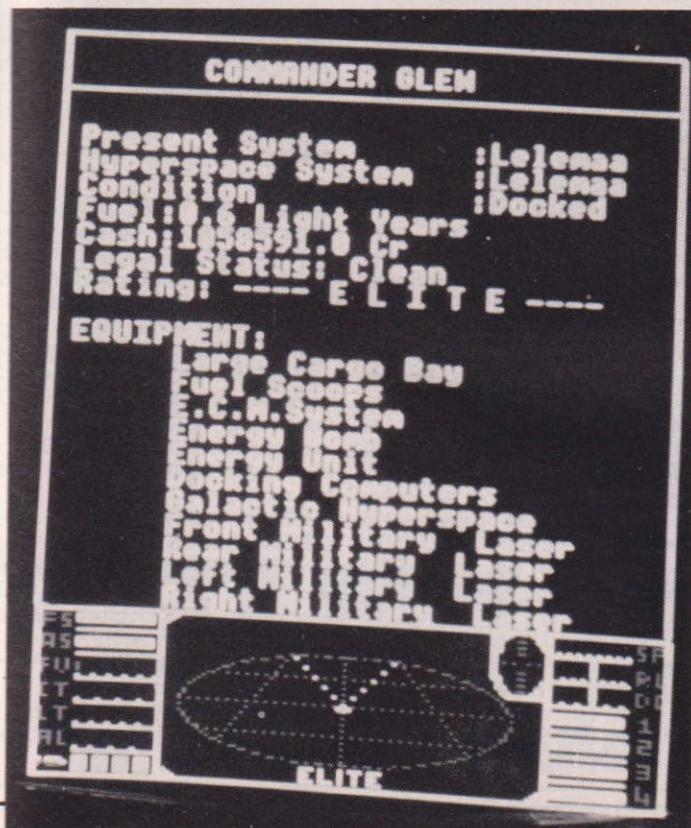
I decided to seek this strange new craft and used the FIND button to locate the planet they mentioned. It turned out I could not reach it in one go so I was forced to dock at a planet in between to refuel. On docking at this planet I was informed that the craft had just left using its Galactic Hyperdrive. I took the hint and promptly purchased a hyperdrive. Thank goodness I had previously built up my credits as this cost me 5,000 credits.

As soon as I had launched from the docking station I operated the Galactic Hyperdrive and quickly found myself in the second Galaxy. I headed for a planet close by where I expected to get further details of the stolen vessel.

Upon docking I was distressed to find no message waiting for me — I couldn't believe it. Here I was in the next Galaxy not knowing where to go and I had lost my quarry.

With a strong feeling of being cheated I decided to take up my previous tactics of destroying every ship I came across. This continued for about half-an-hour,

CONTINUED OVER



during which I docked at several planets.

Eventually, I received a further message telling me that the stolen ship had been sighted once again. I raced there immediately and found it. The ship turned on me and promptly blew me to pieces so I had to reload again. The second time I kept hitting it with my powerful Military lasers, but to no avail — it just would not destruct and like before it turned on me and I was destroyed. This happened three more times and I was wondering just what to do with it.

GalCop had told me it had an E.C.M. so using my missiles was pointless, and my most powerful weapon seemed to make no impact. On my sixth attempt I caught the ship and fired off a blistering salvo which would have destroyed any other space vessel twice over, but not this one. It fired on me yet again and wiped out my front shields as it raced past me. This time I gambled and slowed dramatically as this enabled me to do a 180 degree turn much faster than if my speed was flat out. It worked. I found myself facing the back of the fast disappearing ship. I increased my speed to flat out and fired my lasers and still it wouldn't die. It tried to lose me but I followed it like a limpet firing all the time. My lasers kept overheating but I hung on doggedly.

An explosion occurred. I had finally succeeded in destroying the ship. I was elated. A message came on the screen "RIGHT ON COMMANDER". I looked at my current rating to see whether the destruction of the ship was the magic formula to attain DANGEROUS — horror, I was still only competent — what do I have to do, I wondered.

On docking at the nearby planet I received another message from the GalCop thanking me for my help and advising that my assistance would be remembered and they would probably contact me again in the near future.

Then my current status appeared which happens after



every docking. But this time a further change had occurred — I was now classified DANGEROUS. I was in seventh heaven, it was now three o'clock am and three days of intensive fighting since I achieved my COMPETENT rating. I went to bed a very happy person with my interest and keenness rejuvenated — nothing is more fulfilling than success in this game.

A&B Were you contacted again?

GLEW Yes, it was after five days prolonged fighting and with battle fatigue setting in fast. I had already moved into Galaxy 4 and pushed up my credits to 186,000. This time I was told to report to a particular planet for further instructions. The planet turned out to be in the current Galaxy but at the opposite end to where I was, and I took some time reaching it. Upon my arrival I was told by the GalCop that they had found the dreaded Thargoids home planet and they wanted me to take the plans to one of the GalCop headquarters. This just happened to be at the other end of the Galaxy, in fact only a short distance from where I was when I received the message to report to this planet — how infuriating.

After much battling I reached my destination expecting to be praised and upgraded. Instead I was given an Energy Unit — big deal I thought. I looked at my rating. It was still DANGEROUS. Surely, I thought, I don't have to take on two missions this time?

I didn't have to, after another 10 hours of zapping pirates and trading, my credits rose to around 200,000 and my rating changed quietly and without warning to DEADLY.

A&B How long had you been playing to get to this stage?

GLEW I had now been playing for about 17 days, almost non stop from morning to night. Thank goodness I was on leave from my office for four weeks, otherwise it would have taken months instead of weeks to get this far.

A&B Are there any more hints or tips that helped you through the last part of your ordeal?

GLEW Rather belatedly I discovered that I could carry more than 35 tonnes of cargo, provided it was in gold, platinum or gem stones, as these were allowed to be carried in my ship's cabin. One thing you do have to be careful about is not to store up too much of these items because they can cause the bottom to fall out of the market and instead of selling platinum for around 75 credits you would only get eight.

It also dawned on me how to increase my kill ratio many times over each hour. Up until now I had added to my kills in between each docking by going to dangerous and unstable worlds.

Many times however, I only came across a couple of enemy ships before docking and the docking procedure is very time consuming. The trick I used was to Hyperdrive to a new planet as usual but, after having killed all pirates found in the vicinity instead of entering the planet's Safe zone and docking, I turned the ship around in the opposite direction and used the skip button to speed away from the planet until I approached another ship looking for a fight. By skipping to and from the planet in this manner (only choosing to drift in space when I needed a little time for damaged shields to be restored) I was able to increase my kill ratio to 25-35 kills in between each docking. It was by using this tactic I managed to achieve the ELITE rating in about the same time it took me to get from DANGEROUS to DEADLY, about five days.

A&B What was it like to actually attain ELITE?

GLEW Ecstasy, and what a relief. I never believed I could get such exhilaration from a game, but after 22 days of playing it had become an obsession. I had stopped thinking of ELITE as a mere game but a real adventure with me, Commander Glew, in charge of a ruthless fighting machine.

A&B Did you then sit back and rest?

GLEW No. I had decided to enter Acornsoft's October competition and as it was only 7th October I thought I would try and boost my credits as this was obviously going to be the deciding factor. I set myself the target of 1,000,000. This meant I would have to average about 36,000 credits per day if I was going to increase my current 235,000 to the magical million by the end of the month.

A&B Did you make it?

GLEW Somehow after many long nights I did. I finally ended up with a little over 1,058,000 credits by 26th October with a couple of days to spare.

We have had a word with Acornsoft and they tell us that David did not win. There were over 400 entries for the competition in October. Of these only 50 attained Elite and just nine with more than a million credits. Bad luck Dave.

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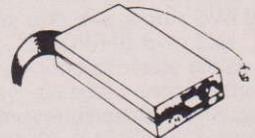
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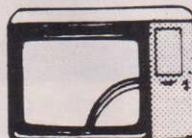
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Beebword

Eddie James

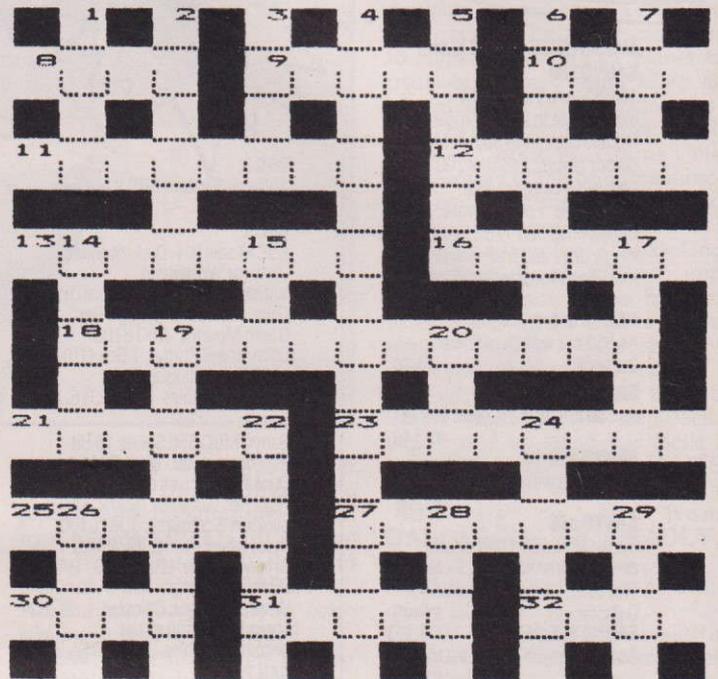
CLUES ACROSS

- 8 Comments about girl (4)
- 9 No yob, this dealer (5)
- 10 No longer the thing to quit the program? (4)
- 11 Analogue gravity device releasing oxygen essential to programmers (8)
- 12 Stored keywords — alright in 10's? (6)
- 13 Chain store product (8)
- 16 Established procedure but messy time change (6)
- 18 Add-on provides electricians with energy on island (National Trust) and the Queen with plane! (4,9)
- 21 Time-wasting loops? (6)
- 23 Princess's kettle left out storage (8)
- 25 Newspaper feature set by TAB(X) (6)
- 27 Grasp ROM, replace software (8)
- 30 Adjacent delimiting statement (4)
- 31 Stop the project: **A&B** gets circle right (5)
- 32 Puts software through its paces? (4)

CLUES DOWN

- 1 Game could be worth a million (4)
- 2 A call — best go out (6)
- 3 Records only partly loaded at address (4)
- 4 Data expert to let — unusual piece of hardware! (8,7)
- 5 America, off and on? (6)
- 6 Printer I/O shakes badly (8)
- 7 Write your name "X"? (4)
- 14 Single? English? Get married! (5)
- 15 The result of $\pi + s$ (3)
- 17 Earth outlet the programmer may choose to ignore (5)
- 19 In BBC Basic only the first half calls for a calculation (8)
- 20 Mnemonic reverses truncated string (3)
- 22 Error produces nasty turn before ten (6)
- 24 No room too big, for example (6)
- 26 Reserve a channel for sporting event (4)

- 28 Decides it's time to interrupt the operations (4)
- 29 User-friendly device for people at university (4)



32 RUNS
23 DISKETTE 25 COLUMN 27 PROGRAMS 30 NEXT 31 ABORT
8 REMS 9 AGENT 10 EXIT 11 LANGUAGE 12 TOKENS
13 MULTIPLE 16 SYSTEM 18 IEEE INTERFACE 21 DELAYS

SOLUTIONS ACROSS

28 OPTS 29 MENU
6 SEIKOSHA 7 SIGN 14 UNITE 15 PSI 17 EVENT
19 EVALUATE 20 RTS 22 SYNTAX 24 ERRORS 26 OPEN
1 MEGA 2 OSBGET 3 DATA 4 TELETEXT ADAPTOR 5 STATES

SOLUTIONS DOWN

BASIC Extension ROM

Dave Carlos

No matter how much of an improvement you may feel that BBC BASIC was over any of its predecessors, you have to admit that there are a number of useful programming structures left out of the final version which would have been useful to most advocates of full structured programming.

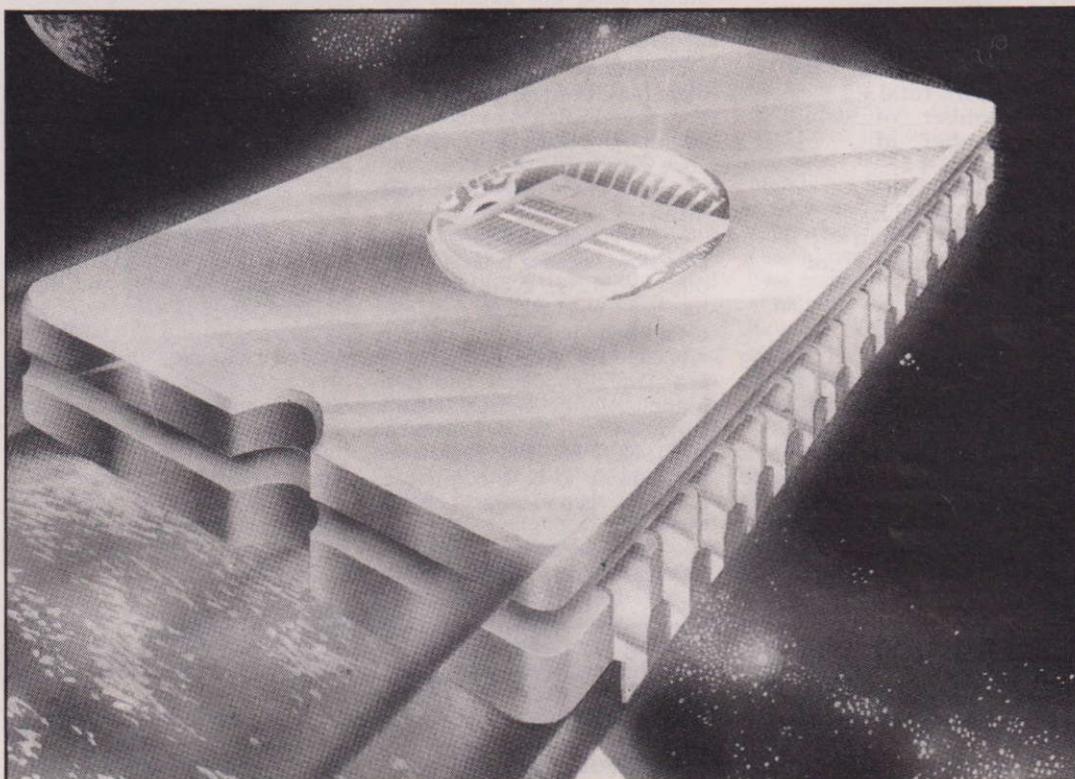
The two that are most needed are the While/Wend loop structure and the Case structure which are available in other languages but not yet in most BASICs. This ROM adds these and a number of other features to BBC BASIC and makes the use of good programming structure that much more simple.

This addition of structures isn't the only feature of the ROM however for there are also a number of new BASIC words, most of which replace the rather difficult VDU statements and a whole series of utility routines provided too. In fact it is difficult knowing where to start to examine its features.

The ROM comes with a very well written manual of some 44 pages. This is well laid out with the explanation of a new word on the right hand page and the example programs, to illustrate the use of the word, on the facing page. Despite the spelling mistakes, the explanations are full enough for the first time user, without being at a banal level for those who have some idea of the subject in the first place.

It is important to note that this ROM has been written to fully integrate with whichever BASIC chip you are using in your machine. It will detect the type and react accordingly, it cannot even be fooled by having two BASICs in the machine and switching between them. It takes a single 265 byte page as its exclusive workspace which means that Page is moved from its usual level upwards by one page (cassette becomes &F00, disc &1A00). This is rather a bind if you are using long programs or high resolution graphics but I am informed that the release version of the chip (I am using a late development version) will have the facility to define this workspace to any available page. This

Micro Power's big plus for BBC BASIC.



is a good idea for disc users who can assign this to be the cassette workspace without taking any extra memory. Once installed, it initialises on pressing Break and a line is added to the sign on messages to show its presence.

Another little niggle is that the manual says it doesn't initialise if BASIC is not the current language, I found this to be incorrect and when using Wordwise to write this review I lost that extra page.

USING THE HOOKS

By using the "hooks" left by the Acornsoft programmers when they wrote BASIC, this ROM integrates fully into the language. It tokenises all its words just as BASIC does, meaning that program text is as compressed as possible. It also has its own series of error messages and a different error handling routine. If you make an error with this chip in-

stalled, the line with the error is displayed and a marker placed underneath the line showing where the error is thought to be. Then using the cursor and copy keys you can re-input the line and try again.

The tokenisation mentioned above is the source of my major criticism of this chip. Tokenisation means that there are a number of possible abbreviations which can be used instead of typing the full word into your program lines. Most of you will use such abbreviations as a matter of course especially such things as "LO" instead of LOAD and "O" instead of OLD. With this ROM installed there are a number of changes to be considered. "LO" becomes the abbreviation for LOOP, one of the new words within the ROM, and "O" the abbreviation for Otherwise.

This is a real pain, and causes much frustration if you are a believer in minimum effort. Unfortunately this is unlikely to be changed as it would mean a

major re-write of the code. Whilst I have described it as frustrating and as the major criticism, it shouldn't be taken too seriously when weighing up the value of this ROM. As we are about to see, the rest of the ROM is very good indeed and therefore this can only really be seen as a minor criticism of the whole project.

If we start with the extra structures there are four new types available. The first is the While/Wend loop which is provided with the words "WHILE" and "ENDWHILE". This provides a loop structure which isn't always executed once, as the test of the condition is found at the beginning of the loop, not at the end. It makes branching out of input loops very simple by using negative "terminating" values, for example. Here is a short program, adapted from the manual, which will find the mean of a range of values when you input a negative value as a terminator..

CONTINUED OVER

```

10 total = 0
20 number_of_
   values = 0
30 INPUT value
40 WHILE value >= 0
50 total = total + 1
60 number_of_values =
   number_of_
   values + 1
70 INPUT value
80 ENDWHILE
90 PRINT "Mean =";
   total/number_of_
   values
100 End
    
```

With the possibility of nesting such loops to a level of 31 this is a powerful addition to the loops that we have available in BASIC.

The next new structure is CASE and allows branching to any number of procedures dependent upon the value of a particular variable. This can be simulated with the ON/GOTO structure which is already in BASIC but is not as flexible as the new CASE structure, where any type of code can follow the condition tested and where the whole of the code is held in one part of the program without needing to jump around like a yo-yo. An extract from one of the demonstration programs shows its use:

```

50 INPUT Z"Your choice
   ";c%
60 CASE c%
70 WHEN 1
80 add
90 WHEN 2
100 amend
110 WHEN 3
120 delete
130 WHEN 4
140 finish
150 OTHERWISE GOTO 50
160 ENDCASE
    
```

The lines between the WHEN statements are those executed if the particular case applies and, in this case, each calls a procedure. Notice that when you use this statement the word PROC becomes optional and is assumed, each of the lines between the WHENs would normally read PROCadd etc. This short piece of code should show how

easy it is to develop menu programs using this structure and how readable and easy to debug such a program really is. The OTHERWISE is only executed if there have been no TRUE conditions found when execution passed through the WHEN lines. This code can be a series of lines, but must end in the ENDCASE statement.

Expect this structure to be a little slow because it tests all the other WHENs, even after one has been evaluated as TRUE. It would have been much faster to branch to the ENDCASE after the first TRUE condition had been found. All the normal BASIC conditions can be used including AND, NOT and OR. Once again this is likely to be a boon to all those who like to write in a structured manner.

Another looping structure is provided using the words LOOP and ENDLOOP. These words, used alone, will continue to be executed indefinitely for they don't have any conditional content. The words EXITIF and ENDEXIT are used to stop the loop. The execution follows from the LOOP to the ENDLOOP and back again unless an EXITIF line is evaluated to have a TRUE condition. This causes execution to pass to the line after the ENDLOOP when the ENDEXIT statement is found. This allows you to have a whole string of code executed as you exit from the loop. A simple example may make things clearer:

```

10 LOOP
20 PRINT "Press the
   SPACE BAR"
30 EXITIF INKEY (10) = 32
40 PRINT "Well done!"
50 ENDEXIT
60 PRINT "Hurry up I'm
   getting tired"
70 ENDLOOP
80 PRINT "The rest of the
   program can go here"
90 END
    
```

This loop will continue PRINTing "Press the Space Bar" and then "Hurry up. . ." etc until the space bar is pressed. When this is the case, the message "Well done" will be output and execution will pass to the end of the loop i.e.

line 80. From this admittedly silly example, I hope you can see how this can be used to set up a loop with an exit at almost any position during the loop, which will not leave any nasty values on the stack, unlike branching out of FOR/NEXT and REPEAT/UNTIL loops.

Finally, there is the multiple line IF/THEY/ELSE structure which is simply an extension of the facility already in BASIC. The IF is replaced by FIF and this is followed by any number of program lines all of which will be executed if the condition is TRUE. If this is not TRUE and you want to execute another set of code it can be done using the ELSEIF statement. The ENDIF causes execution to return to the following line and must be used to mark where the FIF lines end. As in normal BASIC the THEN is optional and assumed.

RUN TIME COMPATIBILITY

That completes the survey of all the new structures provided and a number of you must by now be wondering what use they are going to be, as not everyone has the chip and so they will not be able to use programs that incorporate these new words. I have to admit that this has always been a problem in the past — if you write programs using a graphics chip, for example, they are only of any use to you or another with that chip. This doesn't apply here as there is a special "Run Time" code available, which will allow you to run the program even without the chip present in the machine. At a cost of less than two pounds, I can see this being a great boom to schools and others in multi-machine situations.

Whilst we are considering schools, it is they who will benefit most from this new set of structures. Many schools use BBC machines and this means that a large number are used for O Level and A Level examination studies. The A Level syllabus, in my area at least, specifies that students should have experience of WHILE/WEND and CASE structures. I can see teachers rub-

bing their hands with glee at the thought of being able to do this on the BBC and in BASIC.

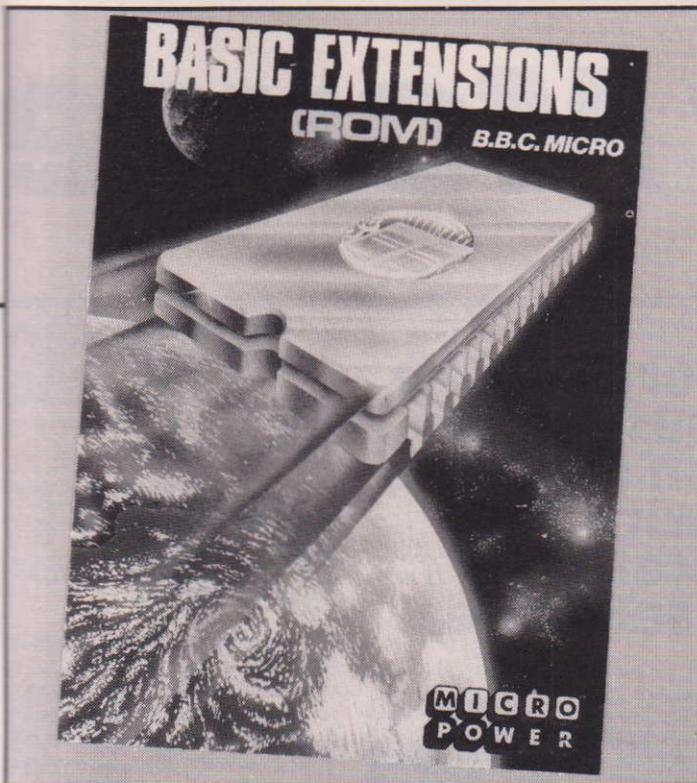
For the rest of us there is still plenty in this ROM and I shall quickly list these features. KILL is an important command which removes all the BASIC extensions from the machine. It doesn't reset PAGE to its normal value, however, you have to do that by hand. There are two commands that affect the stack, FPOP and GPOP, which will allow you to leave FOR/NEXT loops and GOSUB returns without corruption. These aren't here to forgive your poor programming though, they are used with another command CONT which allows you to restart a program after a minor error to see if there are any more errors still to be found. This is a useful feature for debugging and can be of great value.

There is one command that is likely to be of special use to those with second processors, MEMSHIFT. This is only fully implemented on the second processor where it can be used to take data, actually memory contents, and then place it in the other processor's memory. On the basic machine configuration it can be used to shift files or data within memory, at will.

The next four words are all new ways of performing VDU commands. Far from being superfluous, they are very useful in terms of program readability where it is much simpler to understand the actions taken. Each command is followed by the same parameters as usual but with commas as separators.

ORIGIN performs a VDU 29 command. SETTEXT enables you to set a text window without using VDU 28. SETCOLOUR is a way of changing the actual colour that is printed for each logical colour, i.e. VDU 19. The last of these commands is SETGRAPHIC which sets up a graphic window like VDU 24. Nothing new here but they look so much more logical that you might prefer to use them.

One of the first of the new words that I used was LPRINT, a word in Microsoft BASIC which sends its output only to the



BASIC EXTENSIONS

Program Statements

```
WHILE <cond>
ENDWHILE
CASE <var>
WHEN <cond> {<cond>}
OTHERWISE
ENDCASE
FIF <cond> (THEN)
ELSEIF
ENDIF
LOOP
EXITIF <cond> (THEN)
ENDEXIT
ENDLOOP
FPOP
GPOP
KILL
LPRINT (,) (:) <string> <expr>
MEMSHIFT <start expr>, <end expr> TO
<dest expr> (<processor>)
SETCOLOUR <log col> TO <act col>
(<expr>,<expr>,<expr>)
SETTEXT <left>,<bottom>,<right>,<top>
SETGRAPHIC <left X>,<bottom Y>,
<ht X>,<top Y>
ORIGIN <X expr>,<Y expr>
```

Direct Mode Commands

```
FIND <target>
CHANGE <target> <CR> <result>
REPLACE <target> <CR> <result>
COMPACT
SHIFT <start>,<end>,<dest>,<inc>
DUMP (%) (< )
CONT
DTOB <expr>
BTOD <bin num>
STATUS
SECURE
WILDCARD <char>
MERGE (<filename>)
JOIN (<filename>)
VERIFY (<filename> <start address>)
VIEW (<filename>)
LISTO 8 Indents WHILE - ENDWHILE loops.
LISTO 16 Indents LOOP - ENDLOOP loops.
LISTO 32 Indents CASE - ENDCASE structure.
LISTO 64 Indents FIF - THEN - ELSEIF - ENDIF
structure.
LISTO 128 Prints one space after reserved words +
one space before functions.
```

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printer and performs all the switching on and off of the printer stream automatically. I used it as I had a new printer to test whose manual was written to Microsoft standard. I typed in the demonstration programs and hey presto they worked like a treat. This command is ideal for that type of situation and can be used with program examples from the Epson series of printers by typing them straight from the manual, without the need for a conversion chart.

The final new word in this series is actually rather an old word, RUN. Because RUN causes an initialisation of the various BASIC stacks and this chip has a whole series of extra structures there are a number of new stacks to be initialised. This means that a new token must be issued for RUN that will have the

action of initialising these. Unfortunately this means that if you type the word RUN with the chip enabled it has a different token value to the normal RUN and if you then load the program onto a machine without the chip it will give a syntax error. The ways round this are to i) disable the chip and then type RUN, ii) use the Run Time module, iii) edit the line with the error and then resave the program. This is another of those little niggles that could have been avoided if the tokenisation was differently implemented but it isn't too fatal.

NOT SHORT ON PROGRAMMING HELP

This brings us to the programmer's utility words and a number

of these are familiar favourites that are also included on other chips but do no harm being repeated here. The difference between those in this chip and the others is that there is no need for the "*" prefix to them. You simply type them in at the keyboard and then watch them do their thing. COMPACT is a useful command as it reduces programs to their shortest running length by removing all REMs, assembler comments and spurious spaces.

CONT has already been mentioned elsewhere. It restarts a program at the statement after the last reported error. If it was in the middle of a loop or a subroutine you will need to FPOP or GPOP before the program will restart properly.

For programmers who want to rename variables or to check the progress of a particular word or variable through a program, there are three words to help. All three have a wildcard facility using "?" but the actual wild card value can be changed using the WILDCARD command. FIND has the action of displaying any lines containing the search string, which may include tokenised words as well as ordinary strings. CHANGE is a global search and replace command that can have undesirable effects if you use wildcards but is fine otherwise. REPLACE is the selective version of the Change command with you having the opportunity to select which occurrences are replaced and which are not.

Dynamic variable dumping, i.e. a listing of those variables defined by your program, is provided with a DUMP command. This can be followed by a "%" sign for a printout of the resident integer variable values. This can be set to list in hexadecimal by prefacing it with the usual "~" (tilde) sign.

You can move parts of a program from one location to another using SHIFT, although this doesn't remove the old lines, just copies them to their new location. STATUS is a memory usage utility and gives you program length, variable space, memory free and maximum free memory readout. Conversions

between number bases are provided by the DTOB and BTOD words. SECURE locks up your machine using a password and cannot be unlocked without you retyping the same password exactly, even a CTRL/BREAK won't shift this one.

The final series of commands are to help with the filing system and its use. VERIFY is supported by this chip and is very easy to use. It provides a byte by byte comparison of the program in memory with the program you have just saved to file. A verify error is given if there are any discrepancies. VIEW is a very interesting and useful facility for it takes a program on a tape or disc and LISTs it on screen, in the usual manner, but without affecting memory in any way at all. I have used this to check which version of a program is the one that I want before actually loading it and rubbing out the current project. MERGE is provided as a simpler way to join programs than the *SPOOL command but acts in the same way, i.e. it overwrites original line numbers if there is any clash. Finally there is JOIN which adds the new program to the end of the current one in memory.

As you can see from this very detailed discussion of the ROM, there is a great deal in it that is likely to be of use to most programmers. There are a couple of further details that should be mentioned. Firstly, although this version won't work on the 6502 second processor there is a version that will work on this system and which will interact with Hi-BASIC. This will be supplied on disc, as will a version for those who use RAM boards or Solidisks. This seems a very good idea for those with the facilities and, as the "Run Time" system will be provided free on the same disc, is very good value for money. The price of the version on EPROM is just £19.95, undercutting the other utility and additional command ROMs by at least £5 and probably nearer £10. I cannot conclude other than to say that this really is an excellent product even with the niggles and it is provided at a super price too.

Project Mouse

Harm-Jan Wessels

MODIFICATION AND INSTALLATION

The plug of the Radio Shack mouse can't be used in combination with the BBC computer because the mouse has to be connected to the joystick port. Therefore I've put a 15 pin D connector on the cable. After I had cut off the plug, there appeared to be five wires:

1. orange : earth
2. green : voltage for both potentiometers
3. yellow : connection to the 'FIREBUTTON'
4. brown : X potentiometer
5. red : Y potentiometer

Installation of the D connector:

1. orange : is connected to GND pen 8
2. green : is connected to VREF pen 14
3. yellow: is connected to PBO pen 13
4. brown : is connected to CH0 pen 15
5. red : is connected to CH1 pen 7

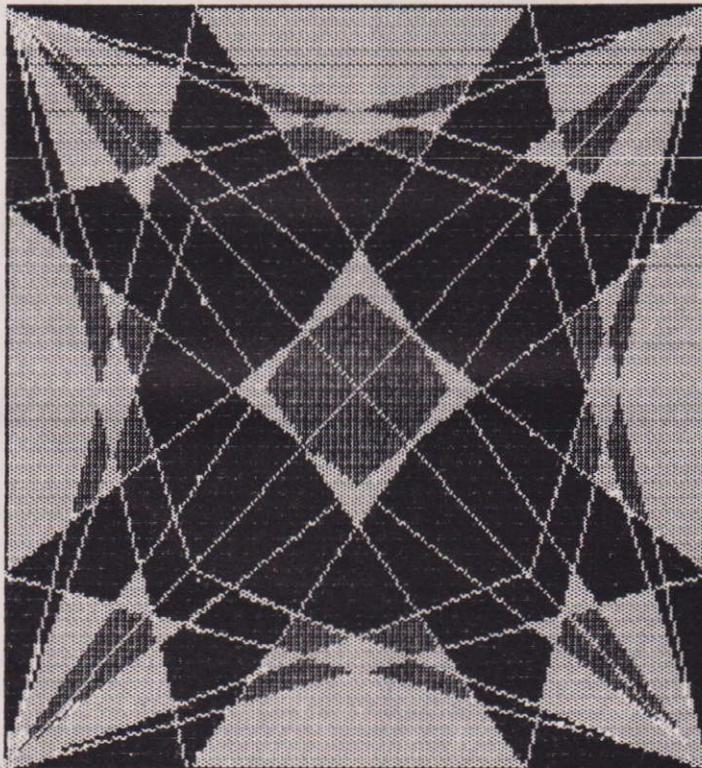
See also the diagram for this installation.

When this has been done the mouse is ready for use. However, the only disadvantage is that the X and Y values, delivered by the potentiometers, are quite the opposite of the normal ones. (Fig. 1).

If we want to solve this problem we have to open the mouse and exchange the connections of both potentiometers. The middle contacts must not be changed. The potentiometer, which is most accessible, gives the Y value. This potentiometer must be changed so that the black wire is connected to the lowest soldering pin and the red wire to the highest. The same must be done with the other potentiometer.

After this has been done the mouse is completely compatible with an Acorn paddle. For instance, the mouse can be used when playing Aviator. The program can be divided into two parts:

A unique opportunity to add a Pet Mouse to the BBC or Electron Plus One, together with our sophisticated Mousedraw software.



1. a colour selection program
2. a main program which contains the plotting routines

HOW TO USE THE FIRST PROGRAM

To start type CHAIN"MOUSE" (followed by RETURN). A screen will be set up with, on the left side, sixteen colour bars. The selection procedure can now be started. The first colour is selected by moving the cursor to

tion by putting the cursor in one of two rectangles "yes" or "no". If yes, the work screen will be set up and the main program will be loaded. If not, the selection procedure is started again.

HOW TO USE THE MAIN PROGRAM

The plotting routines in the main program are ready for use as soon as the cursor appears on the screen. When you look at the left column you can see that this column is divided into 11 squares, representing four colours and seven drawing routines. The asterisk in the fourth square means that this colour is currently selected. Changing the ink colour is done by putting the cursor in one of the other three squares and then pressing the firebutton. The asterisk will move to this square.

The remaining seven squares represent the plotting routines:

1. freehand drawing of thick lines
2. freehand drawing of thin lines
3. drawing lines between points
4. drawing rectangles
5. drawing circles
6. filling areas with colour
7. writing text

Items 3, 4 and 5 use rubberband technique.

To use one of these routines just put the cursor in the square representing the routine you want to use. There will appear an asterisk in this square meaning that this routine is ready for use. While using one of the routines the ink colour can be changed in the same way as described above. If you want to choose another plotting routine, then

the desired colour bar. The same must be done for the other three colours. After this you are asked whether the selection is good or not. You can answer this ques-

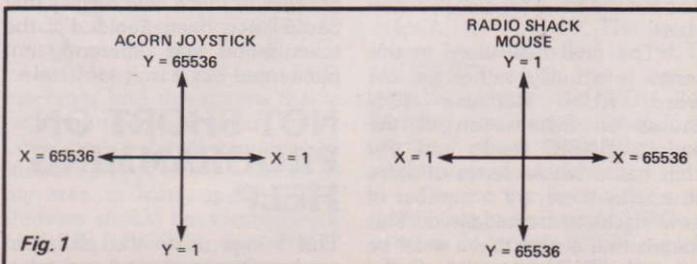


Fig. 1

move the cursor to one of the other squares and press the firebutton twice.

A SHORT DESCRIPTION OF THE ROUTINES

1. After the selection of this routine you can move the cursor up to the place on the screen where you want to start drawing. When pressing the firebutton now, three asterisks appear in the square indicating that when you move the cursor a thick line will be drawn. To stop drawing just press the firebutton.

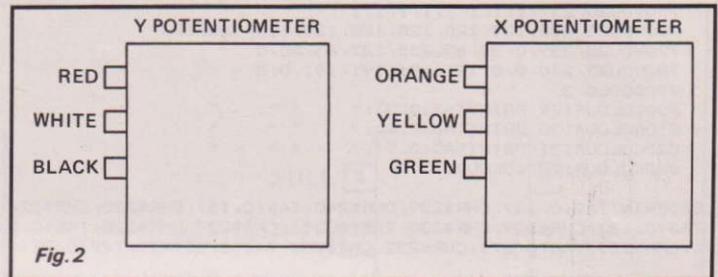
2. This routine is exactly the same as routine 1 apart from the fact that thin lines are drawn instead of thick lines.

3. After the selection of the line routine the starting point of the line is determined by pressing the firebutton. The end of this line is currently determined by moving the cursor around the screen. The line is drawn when the firebutton is pressed again.

4. This routine works in the same way as routine 3. First you determine one of the angular points and then the diagonally opposite.

5. This routine, too, works in almost the same way as the line drawing routine. First the centre is fixed by pressing the firebutton. After this the radius can be varied by moving your mouse in the X direction. To draw the circle just press the firebutton for a while and then release it.

6. The filling routine is activated by moving the cursor to the area that is to be filled and pressing the firebutton. Then this area will be



filled with the currently selected ink colour. You can continue drawing or filling as soon as the cursor appears again.

7. After selection of the text routine just move the cursor to the place where you want to have the text. Then press the firebutton and type your text. After keying in just press return.

Wiping out lines, text, circles etc can be done by drawing in the background colour using either the thick or thin line drawing

routines. To clear the whole screen just press 'C' for a while and then release it.

Though the easiest way of making pictures is using the mouse, a joystick can do the job too, as the mouse is completely compatible with a joystick. Using a joystick will give you a good impression of the unlimited possibilities and might persuade you to spend some £30 on a BBC adapted mouse.

The Radio Shack mouse is available from most Tandy stores.

PROGRAM LISTING

```

10REM*****
20REM*****MOUSE APPLICATION1*****
30REM***** BY *****
40REM***** Harm-Jan Wessels *****
50REM*****
60ON ERROR RUN
70MODE2
80PROCSELECT
90MODE1
100PROCVDU
110PROCINIT
120PAGE=&1200
130CHAIN"MOUSE2"
140END
150:
160DEF PROCSELECT
170DIM K(3)
180REPEAT
190CLS
200PRINTTAB(6,1)"Select your"TAB(6,3)"* colours *"
210FOR N=0 TO 15
220COLOUR128+N
230PRINTTAB(0,N*2); " " " ";
240NEXT N
250GOTO, 7
260MOVE0, 0
270DRAW0, 1023
280DRAW320, 1023
290DRAW320, 0
300DRAW0, 0
310COLOUR 128: COLOUR 7
320FOR N=0 TO 3
330REPEAT
340COLOUR128
350PRINTTAB(6, 6+N*3); "colour"; N; "=";
360PROCCOOR
370UNTIL XCO<320
380K(N)=POINT(XCO, YCO)

```

```

390COLOUR128+K(N)
400PRINTTAB(15, 6+N*3); " ";
410NEXT N
420COLOUR128
430PRINTTAB(6, 19)"Are these the "TAB(6, 21)"four
you want?"
440FOR N=400 TO 900 STEP 500
450GOTO, 1: MOVE N, 192
460PLOT 1, 192, 0
470PLOT 1, 0, -128
480PLOT 1, -192, 0
490PLOT 1, 0, 128
500NEXT N
510PRINTTAB(6, 24)"Yes"; TAB(15, 24)"No"
520REPEAT
530PROCCOOR
540UNTIL ((XCO>400 AND XCO<592) OR (XCO>900 AND
XCO<1092))|(AND YCO>64 AND YCO<192
550IF XCO<592 THEN ENDPROC
560UNTIL FALSE
570ENDPROC
580DEF PROCVDU
590FORN=0TO3: VDU19, N, K(N), 0, 0, 0: NEXT N
600ENDPROC
610:
620DEFPROCINIT
630VDU23, 225, 3, 15, 63, 224, 63, 15, 3, 0
640VDU23, 226, 131, 231, 239, 47, 239, 231, 131, 0
650VDU23, 227, 255, 255, 192, 192, 192, 192, 255, 255
660VDU23, 228, 255, 255, 3, 3, 3, 3, 255, 255
670VDU23, 229, 0, 0, 0, 0, 3, 14, 56, 224
680VDU23, 230, 3, 14, 56, 224, 128, 0, 0, 0
690VDU23, 231, 24, 102, 64, 129, 129, 64, 102, 24
700VDU23, 232, 0, 3, 11, 127, 63, 16, 8, 7
710VDU23, 233, 6, 15, 159, 255, 255, 2, 6, 240
720VDU23, 234, 255, 255, 255, 255, 255, 255, 255, 255
730VDU23, 235, 255, 255, 127, 63, 31, 15, 7, 3
740VDU23, 236, 255, 255, 254, 252, 248, 240, 224, 192

```

CONTINUED OVER

```

750VDU23, 237, 1, 1, 1, 1, 1, 1, 1, 1
760VDU23, 238, 128, 128, 128, 128, 128, 128, 128, 128
770VDU23, 239, 0, 30, 63, 255, 127, 63, 30, 0
780VDU23, 240, 0, 0, 191, 191, 191, 191, 0, 0
790GCOLOR, 3
800COLOUR129: PRINTTAB(0, 3); " " " "
810COLOUR130: PRINTTAB(0, 6); " " " "
820COLOUR131: PRINTTAB(0, 9); " " " "
830COLOUR128: COLOUR3

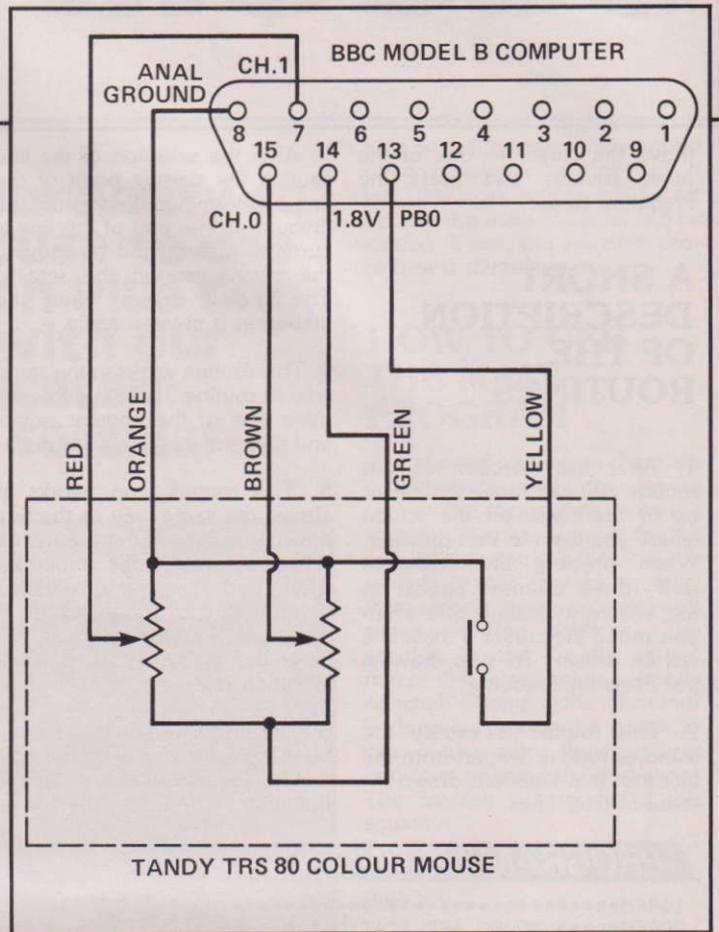
840PRINTTAB(0, 12); CHR$239; CHR$240; TAB(0, 15); CHR$225; CHR$226;
TAB(0, 18); CHR$229; CHR$230; TAB(0, 21); CHR$227; CHR$228; TAB(0, 24
); CHR$231; TAB(0, 27); CHR$232; CHR$233; TAB(0, 30)"T"; TAB(0, 31); "
"
850COLOUR0: COLOUR131
860PRINTTAB(2, 8); "*"
870COLOUR128
880MOVE128, 0: DRAW128, 1024
890FORN=112TO1026STEP96
900MOVE0, N: DRAW128, N
910NEXT
920ENDPROC
930:
940DEFPROC CURSOR
950PLOT2, -32, 16
960PLOT2, 0, -32
970PLOT2, 64, 32
980PLOT2, 0, -32
990PLOT2, -32, 16
1000ENDPROC
1010:
1020DEFPROC WACHT
1030REPEAT UNTIL FNKNOP=0
1040ENDPROC
1050:
1060DEF FNKNOP
1070=(ADVAL(0)AND3)
1080:
1090DEFPROC COOR
1100LOCAL X, Y
1110REPEAT
1120X=INT((65536-ADVAL(1))/51.2)
1130Y=INT(ADVAL(2)/64)
1140MOVE X, Y
1150PROC CURSOR: PROC CURSOR
1160UNTIL FNKNOP=1
1170PROC WACHT
1180XC=X: YC=Y
1190ENDPROC
    
```

PROGRAM LISTING

```

10REM*****
20REM*****MOUSE APPLICATION*****
30REM***** BY *****
40REM***** Harm-Jan Wessels *****
50REM*****
60PROC INIT
70REPEAT
80PROC COOR
90IF XCO%>128 UNTIL FALSE
100IFYCO%<112 PROCTEXT: UNTIL FALSE
110IFYCO%<208 PROCFILL: UNTIL FALSE
120IFYCO%<304 PROCCIRCLE: UNTIL FALSE
130IFYCO%<400 PROCRUBBER: UNTIL FALSE
140IFYCO%<496 PROCRUBBERLN: UNTIL FALSE
150IFYCO%<592 PROCPEN: UNTIL FALSE
160IFYCO%<688 PROCWIP: UNTIL FALSE
170PROCCOL(XCO%, YCO%)
180UNTIL FALSE
190DEFPROC INIT
200COL=3: BGCOL=128: BG=0: DIM cos(60), sin(60), L(15)

210FORA%=1TO60: cos(A%)=COS(A%*PI/30): sin(A%)=SIN(A%*PI/30): N
EXT
220VDU23: 8202, 0, 0, 0;
230ENDPROC
    
```

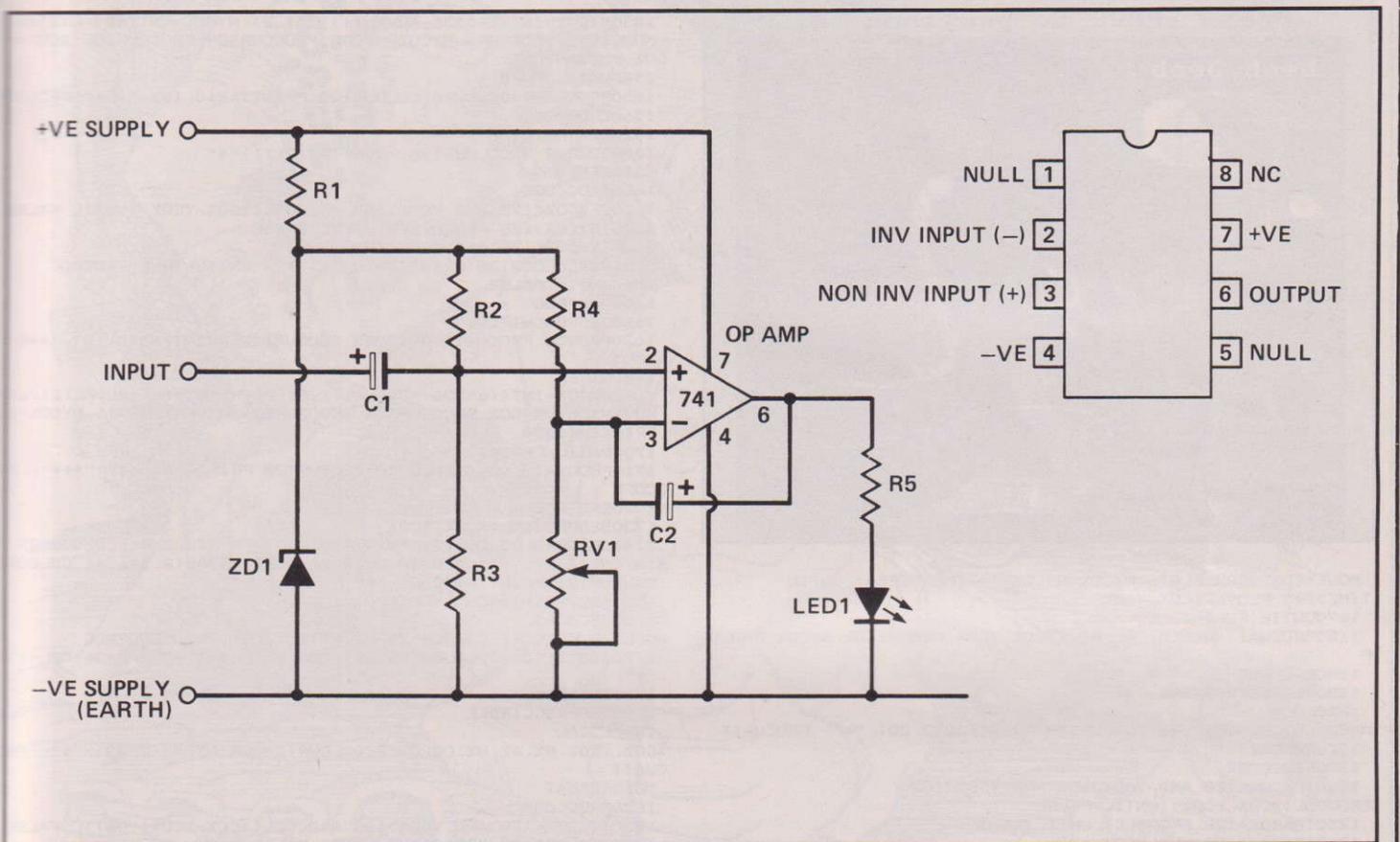


```

240DEFPROC ON
250VDU24, 133; 0; 1279; 1023;
260ENDPROC
270DEFPROC OFF
280VDU24, 0; 0; 1279; 1023;
290ENDPROC
300DEFPROC CURSOR

310PLOT2, -16, 16: PLOT2, 0, -32: PLOT2, 32, 32: PLOT2, 0, -32: PLOT2, -1
6, 16
320ENDPROC
330DEFPROC WAIT
340REPEAT UNTIL FNPB=0
350ENDPROC
360DEF FNPB
370=(ADVAL(0)AND3)
380DEFPROC COOR
390REPEAT

400XC=X: YC=Y: YCO%=INT(ADVAL(2)/64): MOV
EXCO%, YCO%: PROC CURSOR: PROC CURSOR
410IF INKEY(-83) THEN PROC ON: GCOLOR, 128+COL: CLG: PROCOFF
420UNTIL FNPB=1
430PROC WAIT
440ENDPROC
450DEFPROC FILL
460COLOUR3: COLOUR128: PRINTTAB(2, 26); "*" : PROC WAIT
470REPEAT
480PROC COOR
490IF XCO%<128 AND YCO%>688 AND YCO%<1024
PROCCOL(XCO%, YCO%): UNTIL FALSE
500IF XCO%>128
PROCON: KL=POINT(XCO%, YCO%): BGCOL=128+KL: GCOLOR, BGCOL: PROCFILL
2(XCO%, YCO%, BGCOL): PROCOFF: UNTIL FALSE
510IF XCO%<128 AND YCO%<688
COLOUR0: COLOUR128: PRINTTAB(2, 26); "*" : UNTIL TRUE: ENDPROC
520UNTIL FALSE: ENDPROC
530DEFPROC FILL2(X, Y, V)
540IF V=128=COL: ENDPROC
    
```



```

550DIM PARAM 7
560V=V AND 15
570LOCAL M
580A%=135: M=((USR(&FFF4)DIV&10000)AND15)-1
590IFM=7ORM=3ORM=6ENDPROC
600W=2^(M MOD3+1)
610Z=2*W
620PROCUD(X, Y, 4): PROCUD(X, Y, -4)
630ENDPROC
640DEFPROCUD(X, Y, S)
650LOCALF%, B%, C%, D%, E%
660PLOT76, X, Y
670B%=FNC(4)
680C%=FNC(0)
690PLOT77, X, Y
700Y=Y+S
710D%=FNC(4)
720E%=FNC(0)
730IFE%-C%<Z THEN780
740F%=C%
750F%=F%+W
760IFPOINT(F%, Y-S)=V PROCUD(F%, Y-S, S)
770IFF%<E%THEN750
780IFB%-D%<Z THEN830
790F%=D%
800F%=F%+W
810IFPOINT(F%, Y-S)=V PROCUD(F%, Y-S, S)
820IFF%<B%THEN800
830IFC%-E%<Z THEN880
840F%=E%
850F%=F%+W
860IFPOINT(F%, Y-2*S)=V PROCUD(F%, Y-2*S, -S)
870IFF%<C%THEN850
880IFD%-B%<Z THEN930
890F%=B%

```

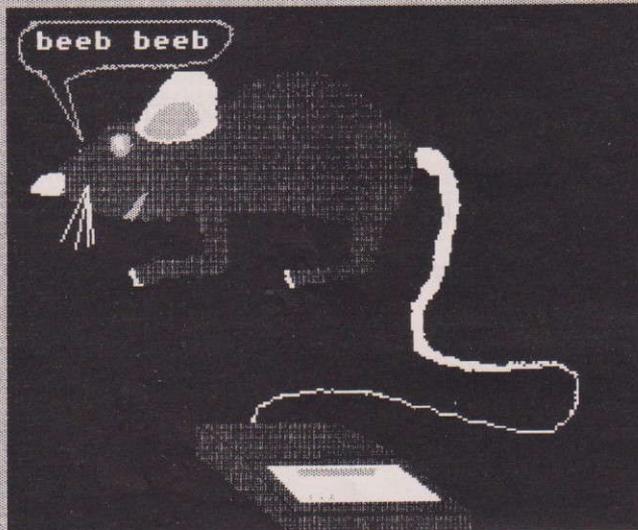
```

900F%=F%+W
910IFPOINT(F%, Y-2*S)=V PROCUD(F%, Y-2*S, -S)
920IFF%<D%THEN900
930B%=D%
940C%=E%
950IFPOINT(X, Y)<>V THEN960ELSE690
960IFPOINT(X, Y)=-1ENDPROC
970F%=E%
980REPEAT
990F%=F%+W
1000UNTILF%>D%ORPOINT(F%, Y)=V
1010IFF%>D%ENDPROC
1020X=F%
1030GOTO690
1040DEFNFC(0): AX=13: X%=PARAM MOD256: Y%=PARAM
DIV256: CALL&FFF1: =(PARAM!0)AND&FFFF
1050DEFPROCUBBERLN
1060LOCAL
NXCO%, NYCO%: COLOUR3: COLOUR128: PRINTTAB(2, 17); "*":: PROCWAIT
1070REPEAT
1080PROCCOOR
1090IFXCO%<128 AND YCO%>688 AND YCO%<1024
PROCCDL(XCO%, YCO%): UNTIL FALSE
1100IFXCO%>128 PROCLINE: UNTIL FALSE
1110IFXCO%<128 AND YCO%<688
COLOUR0: COLOUR128: PRINTTAB(2, 17); "*":: UNTIL TRUE: ENDPROC
1120UNTIL FALSE: ENDPROC
1130DEF PROCLINE
1140PROCDN
1150REPEAT
1160NXCO%=INT((65536-ADVAL(1))/51.2): NYCO%=INT(ADVAL(2)/64)

```

CONTINUED OVER

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```

: MOVEXCO%, YCO%: PLOT6, NXCO%, NYCO%: T=TIME: REPEAT UNTIL
TIME>T+5: PLOT6, XCO%, YCO%
1170UNTIL FNPB=1
1180PROCWAIT: GCULO, COL: MOVEXCO%, YCO%: DRAWNXCO%, NYCO%: PROCOFF
F
1190ENDPROC
1200DEFPROCUBERR
1210LOCAL
NXCO%, NYCO%: COLOUR3: COLOUR128: PRINTTAB(2, 20); "*" : PROCWAIT
1220REPEAT
1230PROCCOOR
1240IFXCO%<128 AND YCO%>688 AND YCO%<1024
PROCCOL(XCO%, YCO%): UNTIL FALSE
1250IFXCO%>128 PROCCRECT: UNTIL FALSE
1260IFXCO%<128 AND YCO%<688
COLOUR0: COLOUR128: PRINTTAB(2, 20); "*" : UNTIL TRUE: ENDPROC
1270UNTIL FALSE
1280ENDPROC
1290DEFPROCPL(X, Y, NX, NY)
1300MOVEX, Y: PLOT6, NX, Y: PLOT6, NX, NY: PLOT6, X, NY: PLOT6, X, Y
1310ENDPROC
1320DEFPROCRECT
1330PROCON
1340REPEAT
1350NXCO%=INT((65536-ADVAL(1))/51.2): NYCO%=INT(ADVAL(2)/64)
: PROCCPL(XCO%, YCO%, NXCO%, NYCO%): PROCCPL(XCO%, YCO%, NXCO%, NYCO%)
1360UNTIL FNPB=1
1370PROCWAIT: GCULO, COL: MOVEXCO%, YCO%: DRAWNXCO%, YCO%: DRAWNXCO%,
NYCO%: DRAWXCO%, NYCO%: DRAWXCO%, YCO%: PROCOFF
1380ENDPROC
1390DEFPROCPEN
1400LOCAL
NXCO%, NYCO%: COLOUR3: COLOUR128: PRINTTAB(2, 14); "*" : PROCWAIT
1410REPEAT
1420PROCCOOR
1430IFXCO%<128 AND YCO%>688 AND YCO%<1024
PROCCOL(XCO%, YCO%): UNTIL FALSE
1440IFXCO%>128 PROCPEN2: UNTIL FALSE
1450IFXCO%<128 AND YCO%<688
COLOUR0: COLOUR128: PRINTTAB(2, 14); "*" : UNTIL TRUE: ENDPROC
1460UNTIL FALSE
1470ENDPROC
1480 :
1490DEFPROCPEN2
1500PROCON
1510COLDUR3: COLOUR128: PRINTTAB(0, 15); "****";
1520REPEAT

```

```

1530NXCO%=INT((65536-ADVAL(1))/51.2): NYCO%=INT(ADVAL(2)/64)
: MOVEXCO%, YCO%: DRAWNXCO%, NYCO%: PROCCURSOR: PROCCURSOR: XCO%=NXCO%
: YCO%=NYCO%
1540UNTIL FNPB=1
1550PROCWAIT: COLOUR0: COLOUR128: PRINTTAB(0, 15); "****": PROCOFF
1560ENDPROC
1570DEFPROCWIPE
1580COLOUR 3: COLOUR128: PRINTTAB(2, 11)"*"
1590REPEAT
1600PROCCOOR
1610IFXCO%<128 AND YCO%>688 PROCCOL(XCO%, YCO%): UNTIL FALSE
1620IFXCO%>128 PROCCWIPE2: UNTIL FALSE
1630IFXCO%<128 AND YCO%<688
COLOUR0: COLOUR128: PRINTTAB(2, 11)"*" : UNTIL TRUE: ENDPROC
1640UNTIL FALSE
1650ENDPROC
1660DEFPROCWIPE2
1670PROCON: PROCWAIT: COLOUR3: COLOUR128: PRINTTAB(0, 12); "****";
: VDU5
1680REPEAT
1690NXCO%=INT((65536-ADVAL(1))/51.2): NYCO%=INT(ADVAL(2)/64)
: MOVEXCO%, NYCO%: PROCCURSOR: PROCCURSOR: MOVEXCO%-16, NYCO%+16
: PRINTCHR$234
1700UNTIL FNPB=1
1710PROCWAIT: VDU4: COLOUR0: COLOUR128: PRINTTAB(0, 12)"****": PR
COFF
1720ENDPROC
1730DEFPROCCOL(XCO%, YCO%)
1740COLOUR0: COLOUR128: PRINTTAB(2, 0); "*" : COLOUR1: COLOUR129: P
RINTTAB(2, 2); "*" : COLOUR2: COLOUR130: PRINTTAB(2, 5); "*" : COLOUR3
: COLOUR131: PRINTTAB(2, 8); "*"
1750COL=POINT(XCO%, YCO%)
1760IFCOL=0
GCULO, 0: COLOUR1: COLOUR128: PRINTTAB(2, 0); "*" : ENDPROC
1770GCULO, COL: COLOUR0: COLOUR128+COL: PRINTTAB(2, 2+3*(COL-1))
; "*"
1780ENDPROC
1790DEFPROCCIRCLE
1800LOCAL
XCO%, YCO%, R%, A%, N%: COLOUR3: COLOUR128: PRINTTAB(2, 23); "*" : PRO
CWAIT
1810REPEAT
1820PROCCOOR
1830IFXCO%<128 AND YCO%>688 PROCCOL(XCO%, YCO%): UNTIL FALSE
1840IFXCO%>128 PROCCIRKT: UNTIL FALSE
1850IFXCO%<128 AND YCO%<688
COLOUR0: COLOUR128: PRINTTAB(2, 23); "*" : UNTIL TRUE: ENDPROC
1860UNTIL FALSE
1870ENDPROC
1880DEFPROCCIRKT
1890PROCON
1900REPEAT
1910NXCO%=INT((65536-ADVAL(1))/51.2): R%=ABS(NXCO%-XCO%)
1920FORN%=1TO2
1930MOVE
ABS(NXCO%-XCO%)+XCO%, YCO%: FORA%=1TO60STEP3: PLOT6, XCO%+R%*cos
(A%), YCO%+R%*sin(A%): NEXT
1940NEXT
1950UNTIL FNPB=1
1960PROCWAIT: MOVE
ABS(NXCO%-XCO%)+XCO%, YCO%: FORA%=1TO60: DRAWXCO%+R%*cos(A%), YC
O%+R%*sin(A%): NEXT: PROCOFF
1970ENDPROC
1980DEFPROCTEXT
1990COLOUR3: COLOUR128: PRINTTAB(2, 29); "*" : COLOUR
COL: PROCWAIT
2000REPEAT
2010PROCCOOR
2020IFXCO%<128 AND YCO%>688 PROCCOL(XCO%, YCO%): UNTIL FALSE
2030IFXCO%>128 PROCT: UNTIL FALSE
2040IFXCO%<128 AND YCO%<688
COLOUR0: COLOUR128: PRINTTAB(2, 29); "*" : UNTIL TRUE: ENDPROC
2050UNTIL FALSE
2060ENDPROC
2070DEFPROCT
2080*FX15, 0
2090PROCON: VDU5: MOVEXCO%-14, YCO%+13
2100REPEAT: A=GET: IFA=13 UNTIL TRUE ELSE VDU A: UNTIL FALSE
2110VDU4: PROCOFF
2120ENDPROC

```



REWRITE THE HIGH SCORE TABLES

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Firm Control

This ROM represents an interesting specialist application of the BBC's firmware facilities. Essentially it lets you read from or write to the whole machine memory as if it were a filing system, called *IO, with the main intention of simplifying the use of the ports and the 1 MHz bus in control applications. The use of a filing system is an imaginative move as it makes the facilities available from any language and full 6502 second processor compatibility is readily assured. The I/O memory is always the one addressed.

When the ROM is installed the machine powers up in its normal filing system but the filing system in the ROM, although not activated, reserves three pages of work space for itself, so you will find that in a tape machine PAGE=&1200 and with discs &1C00. If you do not want to use the ROM you have to type *NOIO and hard reset to get the three pages back for your own use. This is, I think, a rather unfortunate way round to have chosen to set up the ROM. I think it is generally better to have to positively activate a ROM that pinches valuable memory rather than have to disable it, particularly if, as in this case, it is a ROM that you are not likely to use on every occasion.

ACTIVATION

To actually activate the I/O filing system you type *IO and your DFS or tape filing system disappears until re-activated by *DISC or *TAPE. You can quite happily switch between the I/O and normal filing systems as required with open files in either system being preserved pending your return.

To use the ROM to write to memory you must write a sequence such as :

```
10 screen% = OPENOUT
   T"MEM"
20 PTR # screen% = &7C00
30 BPUT # screen
   % ,ASC"W"
```

MEM being a pre-defined channel to the I/O processor memory. A large number of other such channels are provided,



An evaluation of the SJ Research Control ROM.

ed, many with the value of PTR# pre-set and fixed. The most useful are those which refer to the user port. The following sequence will write the value &FF to the port and then read and display the port status.

```
10 portout% = OPENOUT
   "USERPORT"
20 portin% = OPENIN
   "USERPORT"
```

```
30 BPUT # portout% ,&FF
40 PRINT BGET # portin%
USERPORT is a pre-defined channel with its pointer set permanently to &FE62. Notice that there is also no need to set up the data direction register for the port, the firmware automatically configures the port correctly as an input or output depending on whether you are reading it or writing to it.
```

Even more useful are channels that will read or write individual bits of the port. The example below shows how you might switch a light on and off connected to a switch controlled by bit 0 of the port:

```
10 light% = OPENOUT"
   BIT0"
20 on% = 1:off% = 0
30 BPUT # light,on%:REM
   Switch on
40 BPUT # light,
   OFF%:REM Switch off
```

All the other port bits, including bit 8, which is the CB2 control

line, can be accessed in the same way.

It should be fairly clear from these examples that programming the user port with this ROM is very easy and moreover automatically produces very readable code, but if this was your only reason for wanting the ROM I think that you would regard the £45-00 that is costs as expensive and determine to buckle down and learn about bitwise logic and masking, but there is much more available.

A generalised and more flexible form of the channels that let you write to the individual bits of the user port is provided so that you can take complete control over each bit in a particular byte. You have to set up a format, such as:

```
port% = OPENOUT"USER-
PORT 1-0-T."
```

This would mean that, whenever a byte was written to the port, bits 0, 4 and 6 of the port would be unaffected, bit 1 would always be held set and bit 2 reset. Also any write would toggle bit 3 and map bit 1 of the byte written into the port at bit 7 and bit 0 of the byte into the port at bit 5. Imagine trying to program that lot from scratch! There are also options to latch write only locations which ensure that a copy of the location is kept in RAM and available for reading between writes without risking

disaster.

This is all getting a bit complicated now, but what I am really trying to do is to impress on you the immense power of the ROM. It is certainly not to be regarded as a beginner's easy introduction to port control but is very much, in my view, a tool to assist the serious programmer who wants to write compact and readable BASIC code for control applications. Regarded in this manner the ROM is an excellent tool.

The manual is densely packed reading and needs careful study but it is generally clear and accurate.

Before summing up I should mention some of the other facilities available. The type of thing that I have illustrated with the user port can be done with the 1 MHz bus through a channel "BUS" which operates in the same way as "MEM" but accepts a 24 bit address as its pointer. Dedicated channels for all the 6522 VIA functions are also available, including access to the interrupt control registers and all the event timers. Also provided in the ROM are some unrelated routines which seem a bit out of place but may be gratefully received.

*TERMINALBBC converts your machine into a dumb terminal using the serial port. You have to set up the baud rates etc on the port with FX calls before calling the ROM. The terminal software worked well on the I/O and 6502 second processors and although it is not very sophisticated, any second processor compatible communications firmware is to be welcomed at present.

*ROMFILL allows you to transfer code from &3000 to any specified ROM socket, provided it contains RAM, of course. This also worked satisfactorily, but only from I/O processor memory of course.

In conclusion I would certainly think that this ROM is to be seriously considered by anyone with control applications in mind for their Beeb, but I cannot help feeling that, given the prevailing price of firmware from other sources, it is perhaps a little over priced at £45-00.

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(any OS, BASIC I/II)

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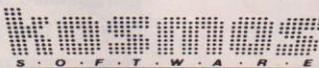


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AMX ART

AMX MOUSE

The AMX MOUSE is an advanced opto-mechanical device which brings to the B.B.C. micro facilities hitherto only available on more expensive machines. It enables you to use advanced features such as ICONS, WINDOWS, and POINTERS in your own programs.

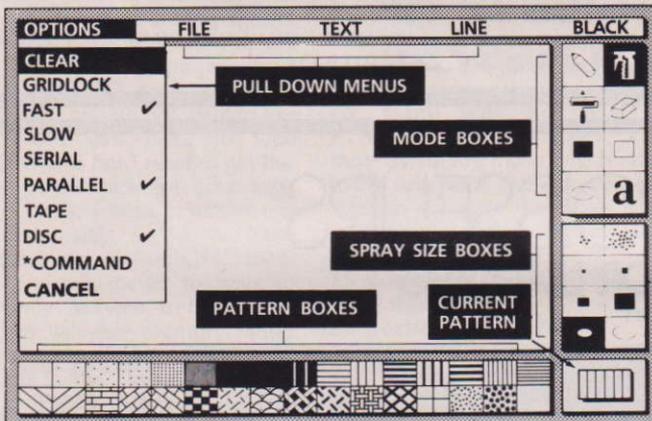
The AMX MOUSE can be used with ordinary programs to replace the cursor keys and with the AMX software it turns the B.B.C. micro into a far more user-friendly device, enabling beginners to quickly learn to use the computer for a wide range of purposes, including COMPUTER AIDED DESIGN, Word Processing, and a host of business uses – to say nothing of its inclusion in games software.

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THE AMX MOUSE PACKAGE

The AMX MOUSE – an advanced three buttoned mouse which simply plugs into the B.B.C. user port drawing its power from the computer.

AMX ART GRAPHICS PROGRAM



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Please send No. _____ **AMX MOUSE** package/s (including **AMX ART** and EPROM) at **£89.95** inc. VAT and P&P. I enclose a cheque/PO for £ _____ or debit my credit card.

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To: Advanced Memory Systems Ltd., Woodside Technology Centre, Green Lane, Appleton, Warrington, WA4 5NG, England.

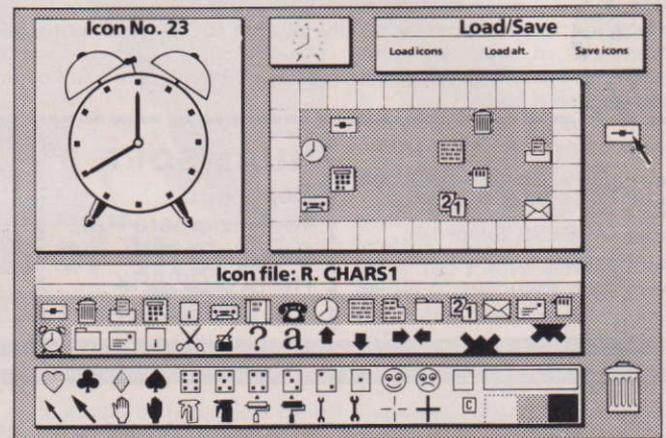
If not available from one of our main dealers, fill in the coupon and we will send you an AMX MOUSE with AMX ART with our full no quibble money back guarantee. OR phone 0925 602690/62907 for instant Access or Visa orders.

A MANUAL describes how to operate the MOUSE and the ROM routines which are available in both basic and machine code programs.

AMX ART – a superb computer aided drawing program on both tape cassette and a 5 1/4" floppy disc with its own manual. It is suitable for a wide range of uses including preparation of illustrations, architectural and engineering detail drawings, teachers' worksheets, and just creating your own pictures. It soon becomes addictive.

AMX ART includes full use of on screen menu boxes, icons, and pull down menus so that beginners find it very easy to learn and gain confidence in the use of the B.B.C. Micro.

An ICON DESIGNER program which enables you to create and store icons for use in your own programs.



TECHNICAL REQUIREMENTS

The AMX MOUSE can be used with any B.B.C. Model B computer fitted with the Operation System 1.2 and is compatible with the second processor and disc or tape filing systems.

The AMX MOUSE is adjustable for sensitivity via software control and three buttons can be programmed to simulate 24 different key codes.

The AMX MOUSE may be disabled by a simple software command and will then not interfere with normal operation of the computer.

The AMX ART programme enables users to print out screen displays using any Epsom compatible dot-matrix printer. Owners of non-standard printers may use their own screen dump routines.

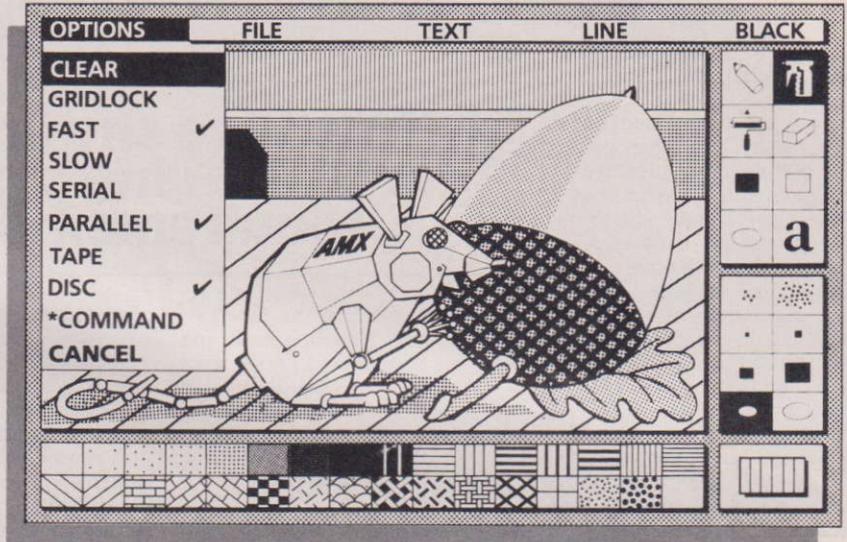


'View' is a word processing program by Acornsoft Ltd.
'Wordwise' is a wordprocessing program by Computer Concepts.

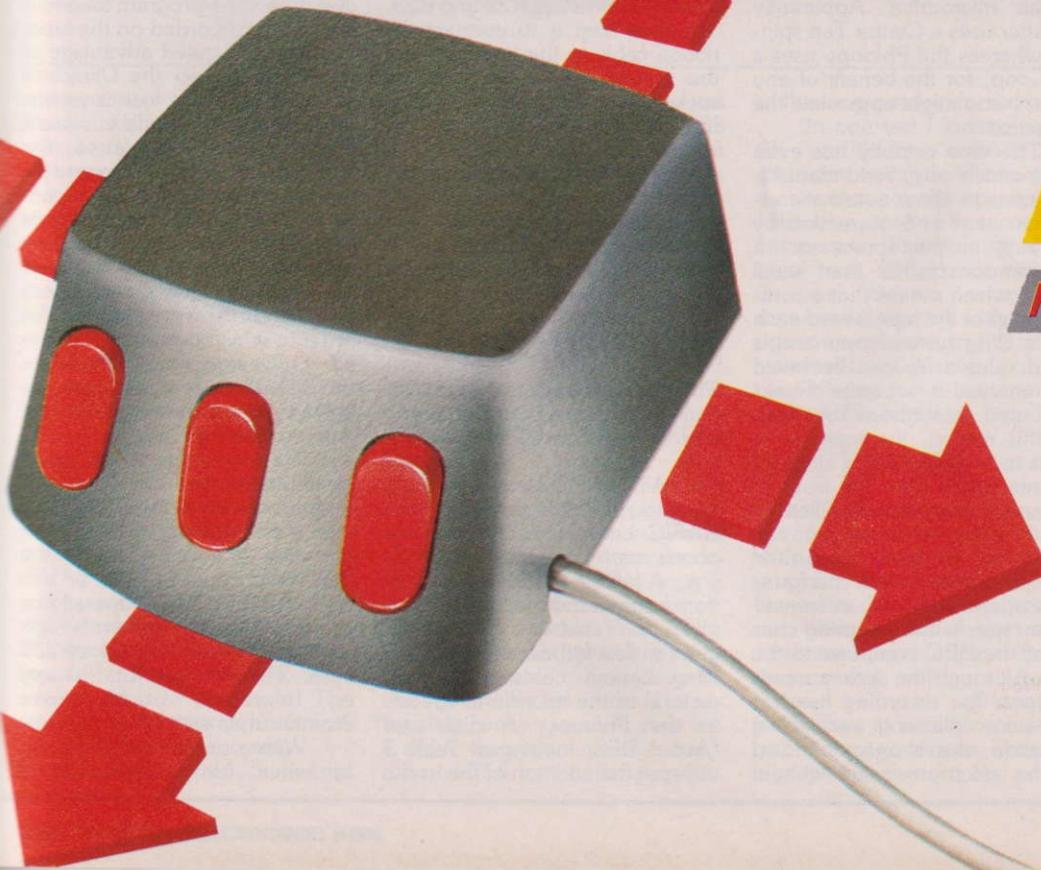
AMX MOUSE

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MODEL B**



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Phloopy

Jonathan Evans

If you are fed up with loading files from cassette the chances are either that you are frustrated by its slowness and suspect reliability or that you require serious file handling which is impractical on the tape system (or both).

If you are hesitating to buy a disc drive it may be the price that is putting you off, or the sheer confusion. Do you need standard size or mini-discs, 40 track or 80 track? Do you need a dual disc drive, or perhaps a double sided single drive? And what is going to happen now that the single density chip controller used by the standard Acorn DFS has gone out of production? The observant may have noticed that Acorn's Electron disc upgrade, new ABC computer and Level 2 Econet all involve a new double density chip. Makes you wonder doesn't it?

If price is the problem and you don't already have a disc drive interface fitted to your machine, you might consider a fast tape system as an alternative solution. There are two systems on the market that I am aware of. One is the Ikon Ultradrive (upgraded Hobbit) which I reviewed in the October issue of A & B Computing. The other is the Phloopy, distributed by Phi Mag Systems (Trenoggie Industrial Estate, Falmouth, Cornwall TR11 4RY). There is a considerable price difference, with the Ultradrive retailing at a totally inclusive price of £79.95 and the Phloopy at £147.75 (notwithstanding the misleading £99 at the top of their advertisements, which does not include VAT, interface, carriage etc).

The Phloopy's claim for superiority over the Ultradrive is faster file access due to a much faster data transfer rate, on-board microprocessor and 16K (rather than 8K) filing system ROM which avoids the need for a utility tape. However, as we shall see later, the practical file access time on the Phloopy is incredibly variable, according to how it is used. Its main claim over disc is price, though at around £150 it is not much cheaper than the cheapest 100K systems (with interface) that are now being advertised. The only other advantage I

Is fast tape the answer for your filing system requirements?

can think of is that the tape cartridges are far more robust and easy to handle than floppy discs — a useful point if young children are involved in the use of the computer.

HARDWARE

Anyone who has opened a computer magazine in the last few months will have seen a full colour Phloopy ad explaining its "byte wide" head, ie eight track recording, which has enabled them to achieve the astonishing data transfer rate of 10K per second, which is comparable to disc.

Unlike the Ultradrive (which is reel to reel), the Phloopy uses a continuous tape loop, but one which they assure me is superior in design to the much criticised Sinclair microdrive. Apparently the latter uses a Centre Tap spindle, whereas the Phloopy uses a Bin Loop, for the benefit of any readers who might appreciate the distinction.

The tape actually has extra tracks which carry redundant information to allow automatic error detection and correction by the built in microprocessor. It uses random rather than serial access, which means that a complete map of the tape is read each time a filing system command is issued, and a file can be saved and retrieved in separate chunks distributed throughout the tape. For this reason, the tape never needs to be compacted, since all the free space from the front of the tape is automatically filled.

A nice feature of the Phloopy is the on-board microprocessor which performs some operations, such as formatting a tape, while returning control of the BBC computer to the user. Although the system needs to return the recording head to the splice following each filing operation, this is again handled by the microprocessor without

occupying the computer's time once the save or load has been completed.

The Phloopy connects to the disc port and requires the fitting of an interface. I didn't have to do this myself since I was loaned a suitably equipped micro for the review, so I can only pass on a summary of the very clear and detailed instructions in the manual (the documentation is generally very good).

Two 14 pin connectors are inserted in the IC79 and IC80 sockets and a much larger controller board into the IC78 socket — the text suggests that lining up the pins might be a bit tricky here. There is, of course, a filing system ROM to be fitted into one of the sideways ROM sockets, and a bit that will frighten some readers — a need to cut the wires leading to resistors R22 and R23. The final step is to connect the ribbon cable to the disc port and the power supply cable to the socket provided on the BBC machine. Although the instructions are clear, with diagrams, some people will inevitably lack the confidence to do it themselves (or be worried about warranty), in which case a dealer's fee must be added to the cost of the system.

OPERATION

The Phloopy loads and saves files in a completely automatic fashion and responds to all the usual filing system commands (*CAT, *SPOOL etc) in addition to permitting use of the BASIC commands for random access such as PTR# and EXT#. A full list of Phloopy's additional commands (all in ROM) is given in Table 1. The manual gives a detailed description of all filing system commands, both general to the micro and specific to the Phloopy. A disc user (Acorn DFS) looking at Table 1 will spot the addition of the useful

*VERIFY and note, in particular, the absence of *COMPACT and *BACKUP. The former, as I have explained, is not needed but the latter would have been useful especially because *COPY can only handle one file at a time with no wildcards etc.

We now consider the critical question of the speed of the system which, at the price asked, one would expect to improve considerably on the Ultradrive and approach that of a disc. First impressions are that this is indeed so, until one investigates a little more carefully.

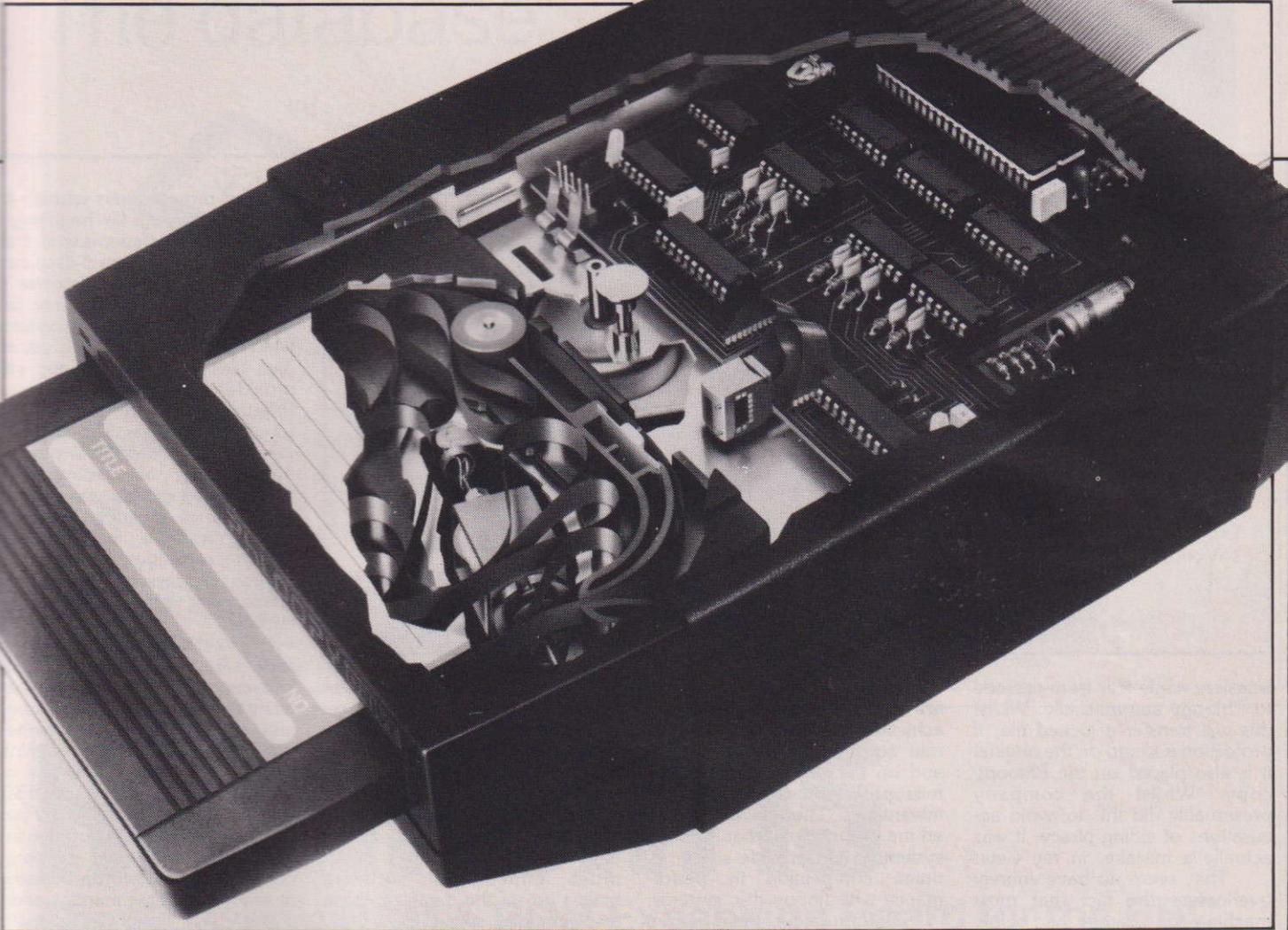
A standard 100K Phloopy cartridge takes 13 seconds to go around the loop, so this is the maximum time that it can take to load a single program. By comparison the Ultradrive can take up to 45 seconds when formatted with two catalogues on each side of the (120K+) tape, and it can take up to 45 seconds to change catalogues if you start at the wrong one. Hence, the Phloopy shows a big advantage over the Ultradrive but some inferiority to disc unless the program loaded is the first file recorded on the tape.

The big speed advantage of the Phloopy over the Ultradrive may, however, be lost or reversed if a program loads in several parts. This is because the Phloopy can only pick up one file on one spin of the loop, and cannot chain a series of programs recorded in correct sequence at one pass. This does, at least, have the advantage that one does not need to worry about the order in which programs are saved. However, we can begin to see why there is much more involved in file access time than data transfer rate.

We now come to the major weakness of the Phloopy, which is the way in which it handles data files. All filing systems load and save data files slower on the BBC micro than LOAD, SAVE, *LOAD or *SAVE operations, because the filing system is switched off between blocks of 256 bytes. The effect on the Phloopy is, however, much more dramatic than with other systems.

With a single data file open, as when using Wordwise, it

Phloopy with on-board processor.



manages to pick up (or lay down) about 1.5K and then must do a complete loop before it can do any more. To test the effects of this I loaded the identical smallish (6.3K) Wordwise file on several different filing systems. A Teac 80 track disc drive took a surprisingly long 14 seconds, while domestic cassette loaded the file in 140 seconds.

The Phloopy took 70 seconds and lost comfortably to the Ultradrive which loaded in 50 seconds (all figures approximate!).

Phi Mag have responded to the Wordwise problem in two ways. One is that they have produced shorter loops for development work. The same file loaded in 32 seconds and 20 seconds on a 50K and 25K loop respectively. The snag is that these short tapes come very expensive for the amount of data they hold. The standard 100K cartridges are fairly pricey in my opinion — £18.11 for 5 or £4.25 bought

singly. Both 25K and 50K tapes will sell at £16.95 for 5 or £4.03 individually. The company also tells me that they are developing their own wordprocessor for the Phloopy which they plan to supply free of charge on cartridge when the whole system is bought. I have, of course, no idea how good this program will be, but I understand that it will overcome the slow save/load problem. At my suggestion, the company are now testing View for its suitability of use with the Phloopy.

Wordwise is not the only user of data files of course, which may be used for saves in games programs and also in users' own BASIC programs for data logging etc. This is where I have to give the really bad news. The Phloopy, like disc and Ultradrive, claims to be able to handle up to five open files at once. Unfortunately, once a second data file is open, the system can only handle one 256 byte buffer per spin

of the loop on any open data file.

In one test I loaded a small 3K data file from a BASIC program first with one file open and then with a second opened. The Ultradrive took 28 seconds in either case. The Phloopy (100K tape) took 32 seconds with one file open, but an horrendous 2 minutes 41 seconds with two files open. I am forced to the conclusion that for all practical purposes the Phloopy is a non-starter as a multiple file handler.

SOFTWARE

Once you upgrade your filing system you will run into problems with commercial software. Some programs are available on disc, but many, especially games, are not. Despite the claims of the advertisements it appears that no commercial software houses have as yet committed themselves to supplying software on Phloopy cartridges. Transferring tape programs to disc runs in-

to two problems, program protection (if present) and use of memory, since the disc system sets page up from &E00 to &1900.

Similar problems arise with the Phloopy since it normally sets PAGE to &1600. The problem is a little easier than with disc since a program can be loaded direct to &E00 if it does not then attempt to load or save another file, and to &F00 allowing chaining of other programs etc. However, any program which loads below &E00 will need to be "downloaded", ie loaded in higher in memory and then shifted down in software before running.

Phi Mag have provided supplementary documentation to their customers on how to download machine code, as well as BASIC programs. They have also provided a command in their ROM, *TRANSFER, which

CONTINUED OVER



transfers single files from cassette to Phloopy automatically. Whilst this will transfer a locked file, if protection is found on the original it is also placed on the Phloopy copy. Whilst the company presumably did this to avoid accusations of aiding piracy, it was actually a mistake, in my view.

They seem to have entirely overlooked the fact that most machine code games load below &E00 and thus cannot run on Phloopy without downloading. Since a protected Phloopy file can only be *RUN, their (presumably) frustrated customers have no means of *LOADing the copied file in order to download it. There is also a bug in the *TRANSFER routine, which sometimes puts protection on to harmless BASIC programs which then refuse to CHAIN. Such programs can of course be transferred by *TAPE, LOAD, *PHLOOPY, SAVE etc, but the utility provided is more convenient and should work as documented.

CONCLUSIONS

How good a buy is the Phloopy? The sensible comparisons seem to be with the Ultradrive, which is much cheaper, and a disc drive which is significantly more expensive (at least one of a quality

worth buying). Firstly, Phi Mag are to be congratulated on achieving a superb data transfer rate equalling or bettering disc, and on the use of an on-board microprocessor which has many advantages. They have convinced me, in principle, that fast tape systems could provide some genuine competition in performance with floppy disc systems.

Unfortunately, their current software design does not seem to me to permit the hardware to realise its potential. When programs chain in sections or when one data file is open (as in Wordwise) the system's performance is way below that of discs and, if anything, inferior to the Ultradrive, unless one is prepared to work with the very short and expensive tape loops. Worse still, in multiple file handling operations in which the disc system excels and the Ultradrive is workable, the Phloopy is effectively useless.

How many people need multiple-file handling, the manufacturers will retort. Well, it is needed in serious database manipulation, for example, to keep index files to speed up the computation of access into large masterfiles. True, commercial software written to use such facilities is aimed at disc users, but what of programmers who wish to do such operations themselves? I would imagine that secondary school usage in both

teaching computer science and laboratory applications will require this facility, so the Phloopy must concede this potentially lucrative market entirely to discs. The Phloopy might appeal to primary schools because of its relatively fast program access time and robust cartridges. Whilst much educational software makes use of the datafiles, these are generally single file operations because the software is written to work with ordinary cassettes.

What of home owners? If they are primarily Wordwise

users or programmers wishing to do extensive data file handling, I would have to recommend that they upgrade to discs if they can afford it, or to the Ultradrive if they cannot. If their prime interest is in writing programs which do not make much use of data files then the Phloopy will provide very good performance. Whether the system is a good buy for games players is debatable: (a) it's a lot of money to pay for the privilege of loading your games more quickly, (b) there is no guarantee as yet that commercial games will be sold on Phloopy cartridges, (c) a fair proportion of cassette based programs will prove difficult to transfer.

One thing is for sure, no one should buy the Phloopy without knowing what kind of use they want to make out of the micro, and checking carefully whether the system will be suitable. I think this is unfortunate since one of the big advantages of the BBC micro is its flexibility. Thus owners might initially buy one for games or educational software, but later get into wordprocessing or serious database management. If they have bought a relatively expensive filing system they are entitled to expect it to cope with the range of filing activities provided by the machine without drastic loss of efficiency.

Table 1

* Commands in Phloopy ROM

* COPY	Copies a single file to another tape either on the same drive or a different drive
* DELETE	Deletes specified file
* DRIVE	Selects drive
* FORMAT	Formats a blank tape
* HELP PHLOOPY	Lists commands
* INFO	Provides parameters of specified file (load address, length etc)
* LOCK	Locks files to prevent accidental overwriting or deletion (equivalent to * ACCESS on disc system)
* PHLOOPY	Selects Phloopy filing system
* RENAME	Renames specified file
* TITLE	Gives a title to a tape (optional)
* TRANSFER	Transfers a file from domestic cassette recorder
* UNLOCK	Reverses * LOCK
* VERIFY	Verifies saved file with contents of memory

STARdataBASE . . .

The database



for the BBC



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- ★ Address label printing – (up to 8 across the page).
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RAMROM 15

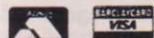
The Sideways RAM & ROM Expansion Board for the BBC

The GCC RAMROM 15 board adds to the BBC Micro another eleven sideways ROM sockets plus the necessary hardware for sideways RAM.

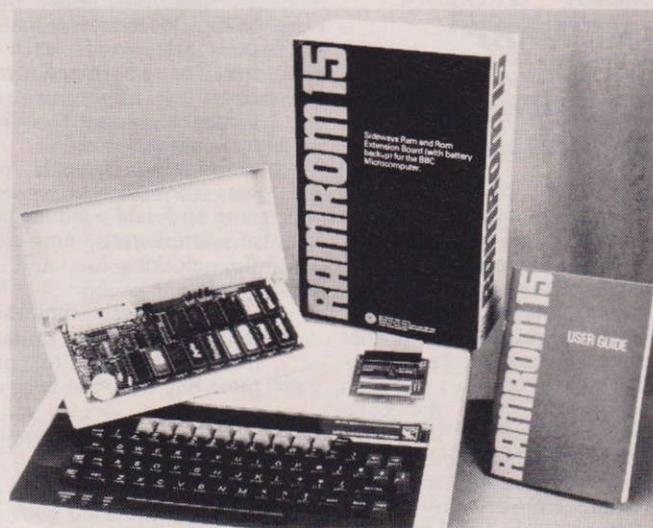
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- ★ Fully buffered board.
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Down to Business

Jon Vogler

Most business computer programs try to reduce the executive's dependence on specialists: the word processor can replace an expensive secretary with a copy typist; the spread sheet and the accounting program can partially take over from the accountant and the database does away with the filing clerk. The only problem is, they all demand one thing the executive is short of — time!

The "small-business man" differs from a "self-employed worker" in that he is more concerned with saving time than money. The worker will gladly deliver a local letter by hand to save the stamp or will resharpen a long-loved saw or chisel. He only becomes a "businessman" when he discovers that it is more profitable to employ the post office, or buy a new tool and use the time saved to do more business. So businessmen and women will spend freely on anything that genuinely saves time (or achieves better, time-saving, organization).

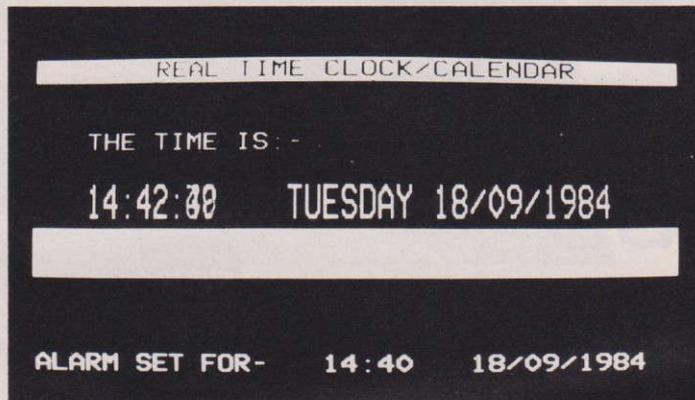
The executive's equivalent of Kipling's "Three honest serving men" are his diary, his watch and his telephone. All are used constantly and are a challenging target for the computer engineer.

TIMEWARP CLOCK/ CALENDAR BY TECHNOMATIC

Timewarp is a small box, about the size of a cigarette packet, which plugs into the "user port" underneath the front of the computer, and maintains an accurate time and date, even when the computer is switched off. It does this by means of a nickel-cadmium battery, which recharges whenever the computer is switched on. Although it is advertised as "supplied with extensive applications software", the unit comes with a tape cassette containing just three programs:

- one to set an alarm for a given time and date,
- one to continuously display the time and date at the top

A&B's own busy executive investigates digital desk-top devices.



TIMEWARP's alarm in operation.

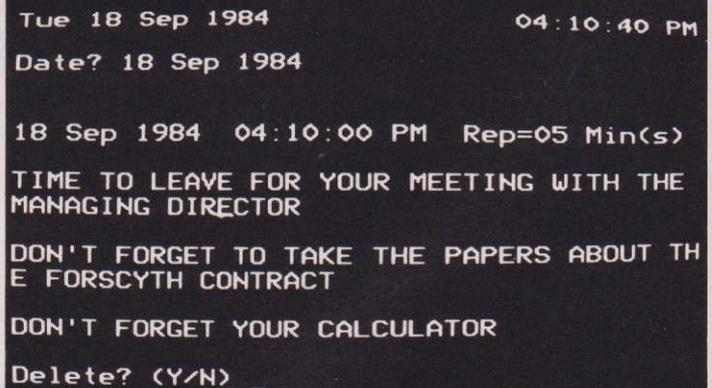
- of your computer screen,
- one to reset time and date should this be necessary.

The makers urge that the user should write programs to use the device as, for example:

- an electronic diary, with automatic alarm, to give reminders of appointments,
- an automatic label date-stamp, for incoming mail or perishable goods such as fruit or pharmaceuticals,
- dating of cheques, documents and correspondence,
- industrial or scientific process control where precise time and date need logging,
- an employer's time-clock (for clocking on and off work)
- with a speech synthesiser (a device that imitates human voices) to progressively bully the busy executive:
 - * "You should leave your appointment in half an our Sir"
 - * "Ten minutes to go Sir"
 - * "Time to leave now Sir"
 - * "You're late, You're late, You're late!"

The handbook is no more than a number of duplicated sheets in extremely small print which is dif-

ficult both to read and understand. As soon as they started talking about machine code and memory addresses I gave up but no doubt enthusiasts would delight in it.



ACACIA's diary in operation: it faithfully repeated the reminder every five minutes until I deleted it and left.

At £33.35, the price is modest — Technomatic tell me that a real time clock for the Apple costs \$150-\$300. However only those executives who are computer enthusiasts will spare the time and effort to write programs that fully exploit this device. For them, and for many scientists and process engineers as well as hobbyists, it could offer a low-cost solution to many tasks.

ACACIA DIARY AND RAM

Leave the lid off your spare can of petrol and you soon learn what "volatile" means; running out of fuel late at night on a lonely road, to the accompaniment of a slight smell! Your spare petrol has "flown away". A computer's memory is similarly volatile — switch off and everything evaporates. Tedious sequences are necessary, from discs or tapes or even the laborious keyboard. For a diary, whose information must be instantaneously available, it is useless.

Unless you buy Acacia's ingenious RAM that is. Acacia uses a long-life battery that will maintain power for five years, after three years the ingenious diary itself reminds you to change it! The device can contain not only the time and date, but also 30,000 characters of memory, all non-volatile. Switch off, take a fortnight's holiday, switch on and it is all waiting for you!

The simple but elegantly efficient diary is the most obvious application, and we fell in love at first sight. I staggered, weary-eyed, into my office this morning, trying to remember what the day held in store. I switched on, to be greeted with a polite reminder to sit down and write this article, keep an appointment with a client mid-morning, deal with an invoice that must be paid today to claim prompt payment discount

27 Sep 1984 10:00:00 PM Rep=05 Min(s)
MEETING WITH M.D. ABOUT FORSYTH CONTRACT
ASK HIM ABOUT SUB-CONTRACTING THE CIVIL WORK

DON'T FORGET CALCULATOR!

Delete? (Y/N) N

24 Oct 1984 12:13:00 PM Rep=None
MEETING WITH FORSYTH CLIENTS

Delete? (Y/N) N

27 Oct 1984 09:30:00 PM Rep=30 Min(s)
SITE MEETING AT FORSYTH
TAKE COPY OF CONTRACT

Delete? (Y/N) N

05 Nov 1984 04:17:00 PM Rep=01 Day(s)
SEND OUT INVITATIONS FOR TENDERS ON FORSYTH LIGHTING AND HEATING INSTALLATIONS

Delete? (Y/N) N

ACACIA's diary: to my great joy worked perfectly with my second processor but I could not turn it off in mid-task.

and, less welcome, finish off at the dentist. I sat down to the article and became oblivious but, an hour later, a repeated bleep interrupted me. A few keystrokes and the screen announced

"TIME TO LEAVE; TAKE CONTRACT FILE, PROJECT DOCUMENTS AND CALCULATOR"

I cancelled the reminder and had just finished the article when, exactly five minutes later, the reminder was repeated. I cannot recall a day when I was so punctual for appointments yet managed to cram in so much useful work while ignoring my watch.

It is the simplicity which most appeals: the only commonly used commands are:

- Enter an appointment
- Look at (or print) all appointments on a specified date
- Read, and turn off if you wish, a reminder that has set off the alarm
- Display (or print) all reminders that contain a given "keyword"

This last is an elegant facility for example if you are engaged in a number of contracts. Just before meeting your client on the "Forsyth" contract you invoke this command, switch on the printer and, within seconds, have a list of all diary entries that include the keyword "Forsyth". To reschedule the timetable, you can call them up and advance dates in seconds, if the contract is cancelled you can delete the entries just as quickly.

Choosing the best diary size is always a problem. Only a large desk diary has enough page

space for minutes of meetings, yet is far too large to carry around. Besides, the secretary needs it to enter appointments and answer queries while the boss is out. Acacia solves this. Before a trip rapidly print (on one sheet of paper) all relevant appointments, and carry it while your secretary keeps your diary up to date. With help from a suitable telephone modem she can even display it to you, sitting in your client's computerised office — see January's Down to Business.

The extra memory is available for far more than the diary — a rapid response filing system. Type:

* RAM

and any file or program can be stored or retrieved, as from disc or tape, only much quicker and more quietly. Particular uses would be

- sequences for loading other programs
- defining user keys, switching on the printer and changing the screen colours
- document layout headings (which must otherwise be held on each word-processor disc)
- petty cash account
- commonly used 'phone numbers and codes

There is no limit to its potential but for those dull souls unable to fill the memory there is a smaller 4,000 character version for half the price. Acacia tell me that most customers buy this model and find they have quite enough memory for the most extensive diary, because the soft-

ware uses memory very efficiently.

If an appointment reminder is repeated it reuses the same chunk of memory. Clever!

This excellent product will become a useful feature of daily working practice for many business men. It is simple to fit, does not interfere with the computer's other functions and, to my delight, works perfectly with a second processor. However there are some criticisms:

- The large memory version at £300 is expensive: three quarters the price of a complete BBC computer for about a tenth as much product and even the small version at £149 will stretch many pockets. Business men have a sense of value-for-money. Effective and useful as it is, they may feel this price is excessive and wait for competitive products.
- It looks cheap: a box of shiny plastic and thin metal, of inconvenient size and ugly. The two cables are generously long but emerge untidily and no trouble has been taken to paint it in BBC cream finish.
- Those who use professional software such as CP/M may find they cannot shut off the alarm without interrupting current work. A moment ago it sounded, while I was polishing this eloquent text. I had two choices:

- * to save the text, exit from the program, quieten the diary, reload the program and reload the file, praying not to see:

DISC ERROR

because I had not taken

even longer and saved a "back-up" or

- * sit and work on with that damn noise bleeping!

Both are unacceptable. Acacia should urgently add a "time delay button" that will mute the alarm for five minutes. With ROM based programs, like VIEW, WORDWISE or COMMSTAR, the user has immediate access to the operating system (ie can use a * command) at any time, without interrupting work, and there is no such problem.

- The Hand-book is awful! Although a convenient size, with card covers:

- * there is no index
- * the explanations are confusing
- * black "reversed-out" characters begin admirably by referring to individual keys such as ESCAPE, BREAK or RETURN but later encompass keyboard commands like SPOOL or *LOAD KEYS
- * Some instructions are incorrect. The beginner who obeys the first:

LOAD "RWRAM" RETURN

receives a discouraging "NO SUCH FILE". In fact the file has been renamed "RWRAM30" but no hint is given

- * The grammar is appalling!

Despite these criticisms, Acacia have pioneered an imaginative product which, if they develop it further and charge a realistic price, I would expect to see in most executive's offices in the future.

MEMO TO ALL EXECUTIVES

If you need a simple calendar/time (but only if you can write your own application program) buy TIMEWARP: low in cost and good value for money.

To ensure you are never again late or ill-prepared for an appointment. ACACIA's diary is most efficient. It is pricey, so buy the small-memory version unless you want extra computer memory as well.

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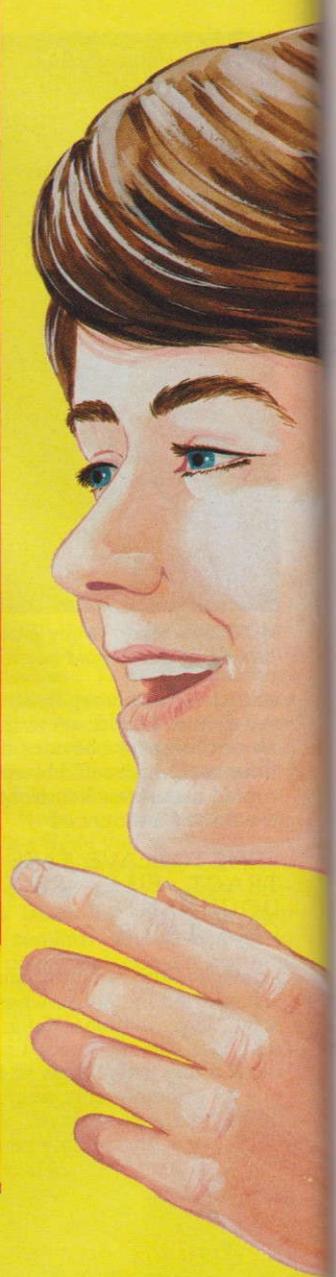
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Bouncer

Margaret Stanger

The story so far: Assuming you have been busy at the keyboard you will have the scenery in place, and the sprites all ready for action!

THE GLIDE

This month we'll examine the routines for the smooth gliding movement of the animals and the missiles. The missiles will move twice as fast as the animals, to avoid the game becoming too easy.

The apples are thrown horizontally, and move from right to left, two pixels per frame, eight pixels (or two PRINT TAB spaces) in one complete move.

To move two pixels left, the old sprite is erased, 16 subtracted from the screen location, and the new sprite POKEd as illustrated in the diagram.

The apple cores are dropped from the top branch on to the unsuspecting kangaroo, four pixels at a time, two spaces in one complete move, as illustrated in the second diagram.

The four frames per move are implemented as follows:

The first and third frames are identical and take place in the following manner:

Erase old sprite,
POKE top half of new sprite in bottom half of old space,
POKE bottom half of new sprite in top half of new space.

Similarly the second and fourth moves are identical and are executed as follows:

Erase top half of last sprite,
Erase bottom half of last sprite,
POKE new sprite in new position, four pixels below the last sprite position.

The animal movements are similar to those previously described, but they only move one space for four frames. The horizontal movements are one pixel per frame, an adjustment of eight to the screen location. For the vertical movement, instead of moving two pixels on every frame, the sprites move four pixels on alternate frames. This looks reasonably smooth on the

Part three of the game with Bounce!

screen and avoids extra arithmetic. Two routines are necessary for diagonal upward movement, up/left and up/right.

The animals are larger than the missiles, and as both halves of the sprite have to be moved, the movement routines for them are necessarily more complex.

As these sprites have been defined facing in different directions, it is necessary to define both the current sprite and the previous sprite for each animal, since the sprite being blanked will not necessarily be the same as the new sprite about to be printed (if the animal has just changed direction, for example).

Some zero page workspace has been reserved for a block of information needed for the movement routines. The locations used are as follows:

&7F	move flag
&80	screen location low byte
&81	screen location high byte
&82	flag2
&83	current position on tree lb
&84	current position on tree hb
&85	current sprite base lb
&86	current sprite base hb
&87	previous sprite base lb
&88	previous sprite base hb
&89	previous position on tree lb
&8A	previous position on tree hb

The other zero page locations are used as temporary workspace by the various routines as below.

&70 and &71	Temporary base for sprite.
&73 and &74	Temporary store for scenery item.
&7D	Temporary move flag for kangaroo.
&7E	Temporary storage.
&8B to &8F	Used in delay routine.

So that the same movement routine can be used for each animal, they all have a block of information that can be copied to zero page, used, updated, and copied back. For convenience there is also a copy of the data for each animal in its initial position for setting up the scene.

The Keys are:
DELETE left
COPY right
A up
Z down
SPACE punch

Current Block	Initial Block	Beast
&D08-&D13	&D98-&DA3	KANGAROO
&D44-&D1F	&DA4-&DAF	JOE
&D20-&D2B	&DB0-&DBB	MONKEY 1
&D2C-&D37	&DBC-&DC7	MONKEY 2
&D38-&D43	&DC8-&DD3	MONKEY 3
&D44-&D4F	&DD4-&DDF	MONKEY 4

There is a similar current block of information for each fruit, but in this case only the first eight bytes are needed as the previous sprite and tree location are not needed.

&DE0-&DE7 APPLE CORE
&DE8-&DEF APPLE 1
&DF0-&DF7 APPLE 2
Other locations on page &0D00 are used thus:
D50-D6F Patrol Information
&D8E Level Number
&D70 Joystick/Key Flag
&D71 Frame Number

The remaining page &0D00 locations are set to zero at the start of the game, and most of them are used in the scoring which will be covered in the final section next month.

THE KEY TO THE KANGAROO MOVEMENT

The kangaroo can be controlled by the keys or joystick. The following OSBYTE routines respond to whichever is chosen.

OSBYTE 129 reads a key with a time limit. If called with register Y=&FF and a negative

You could define your own keys at this stage if you wish. OSBYTE 128 reads the ADC status for the Joystick. On entry if register X=0, then on exit, bits 0 and 1 indicate the status of the fire buttons.

If X is 1 to 4 on entry, then on exiting the routine X and Y contain the 16 bit value (X low, Y high) read from the channel specified by X. This joystick routine is based on the standard BBC sticks and allows for a little dead space in the centre.

After the GO routine the eight bits of zero page location &7D contain the following flags:

Bit	Flag
1	punch
5	down
6	up
7	right
8	left

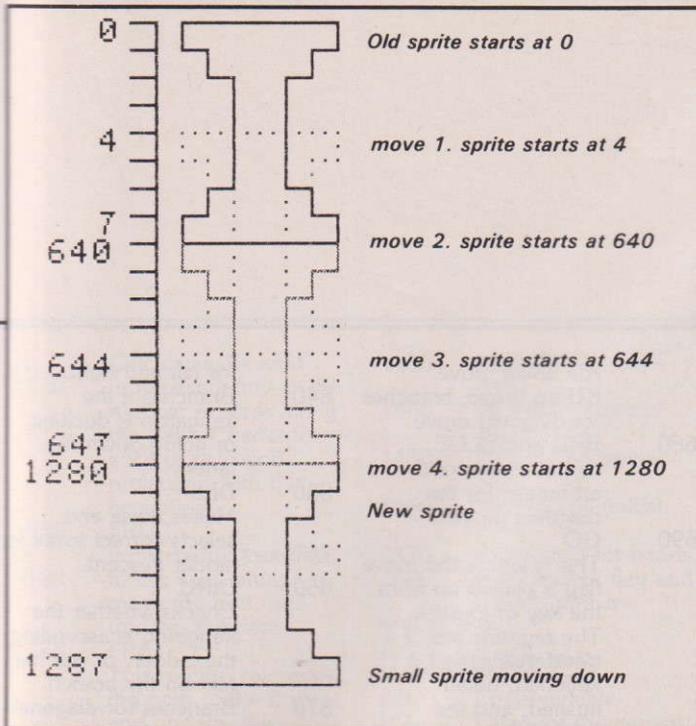
and if the Kangaroo can move in the direction indicated by the flags without bumping into the tree, this information is copied to location &7F to indicate her direction.

The GO routine also acknowledges any pressing of the escape key. There is also an option to pause (press S) and continue (press G) in case the user wants to answer the telephone or just give his fingers a rest.

GOING APE

The monkeys move in set paths or patrols. MONKEY1 runs backwards and forwards along the top branch next to the jail. The other three monkeys climb down the tree until they reach their own branch, where they stay.

The four possible actions for any one monkey are represented



as a two bit code in the following way:

- 3 move left
- 2 move right
- 1 stay put
- 0 move down

This information is stored as steps along a predetermined track. e.g. a five step path consisting of left, right, left, down and stay, could be represented by 3,2,3,0 and 1 in successive bytes of memory. Instead of a separate patrol for each monkey, all the information can be stored in one byte as follows.

- Bits 1 and 2 MONKEY 1
- Bits 3 and 4 MONKEY 2
- Bits 5 and 6 MONKEY 3
- Bits 7 and 8 MONKEY 4

as 32 steps in locations &D50 to &D6F. The animals go from step 1 to step 32 and then repeat from step 22 to 32 until a death or a rescue occurs. You will find an extra code in the unused bits 3 and 4 of the movement flag to identify the monkey.

- 0 MONKEY 1 and Joe
- 4 MONKEY 2
- 8 MONKEY 3
- 12 MONKEY 4

This technique could be used for longer patrols, and works well as long as the animals positions, at the two ends (in this case steps 22 and 32) coincide.

Flag2 is not needed by the user driven kangaroo, so it is used as a death flag.

set if the fruit is active, and clear otherwise.

The program checks whether to activate a fruit, by setting the flag in bit1 of the first byte, setting the step number to maximum, and POKEing the fruit on the screen next to the monkey concerned. For each step of its path the step number is decreased and the missile moved (apples left, cores down).

APPLE1 is always thrown by MONKEY3 on the middle branch. APPLE2 can be thrown by MONKEY2 or MONKEY4 depending on the whereabouts of the kangaroo. These two apples are arranged to be slightly out of phase. The apple is thrown higher above the branch to catch the kangaroo on the higher screens or levels.

WHAT TO DO NEXT

The source program SOURCE3 is typed in with PAGE = &4000 to allow space for the assembled machine code.

To avoid running out of space, the program borrows a few pages of memory that would normally be free as long as the program is running.

and &18FF, with a small gap for the user defined characters from Part One of this series. This inconveniently overwrites part of the disc filing system workspace, so that it cannot be saved on disc in this form. The machine code has to be moved to &3000 to &3FFF in order to save it, and must be downloaded before running.

So all you have to do is:

Set PAGE = &4000
Type NEW
Type in SOURCE3
SAVE "SOURCE3" in case part of the program is overwritten by mistake during the run.

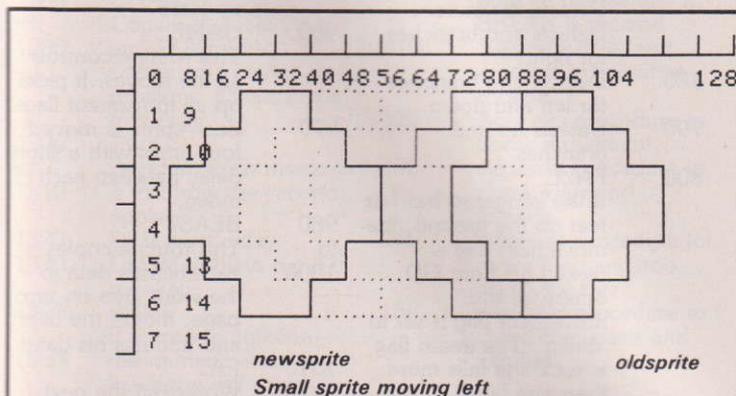
RUN SOURCE3, remembering that it will need to LOAD "VDU" from the first part of the series.

Press CTRL and BREAK

* SAVE "MC3" 3000 3FFF 801F to save the machine code. N.B. It is still possible to retrieve the program by typing PAGE = &4000 OLD

When you have saved your final version of SOURCE3 and MC3:

Set Page = &1900
Type NEW
Type in TEST3
SAVE "TEST3" (just in case!)



Movement Diagrams

- old sprite starts at loc. 64
- move 1. sprite starts at 88
- move 2. sprite at 32
- move 3. sprite at 16
- move 4. (newsprite) at 0

The current step of the path is stored as the fourth byte of the information block, designated as flag 2.

Joe has to move frantically backwards and forwards in his jail, and uses the MONKEY1 path slightly of out phase (ie. he starts on a different step number from MONKEY1).

All this information is stored

FRUIT THROWING

The movement of the fruit is rather simpler. The information on each fruit is stored in blocks of eight bytes as described above. Flag2 is the step number.

The movement flag has bit1

&0900 to &09FF
&0A00 to &0AFF
&0B00 to &0BFF
&0C00 to &0C6F

&0D00 to &18FF

Cassette Output Buffer
Cassette Input Buffer
Soft Key Buffer
User Defined Characters space not used by program
Disc Filing System workspace

The machine code is assembled in two parts, the first part between &0900 and &C6F, the second part between &0D00

RUN TEST3, which will LOAD MC1 and MC2 from the

CONTINUED OVER

first and second parts of this series.

MC3 will then be LOADED and downloaded into the right location.

The program can be RUN to check the machine code routines. If the machine code is in place, the LOADING routine can be skipped.

To resave the program:

Press CTRL and BREAK

Set PAGE = &1900

Type OLD

Type SAVE "TEST3"

The machine code may be overwritten at this stage, so if you wish to run it again, you will probably have to repeat the loading routine.

SOURCE3 PROGRAM

Line		210
20	Accesses initialisation procedure. Loads in "VDU" ready to be incorporated into "MC3".	220
30	Assembles machine code.	270
40	Clears page &0D00 ready for data.	280
50	Reads information for animals.	330
60	Reads patrol data.	340
70	Moves machine code and data so that it can be saved.	350

PROCEDURES

90	PROCIN	460
	Defines lables for use in machine code assembly, including the SPIC and LPIC routines, and the sounds from last month's MC2.	480
110	PROCAS	490
120	Sets assembly options.	520
130	FLEET	580
	Moves small sprite to left.	590
140	SPRTOP	650
to	POKEs top half of sprite in bottom half of space.	660
170	SPRFEET	670
180	to	
	POKEs bottom half	

of sprite in top half of space.
FDOWN
Moves small sprite four pixels down.

BLEFT
Moves large sprite to the left.

Note that the beast is in second position on frames 2 and 3, and the old sprite is erased and updated on frame 2.

PREV Puts old sprite base into &70 and &71.

CUR Puts current sprite into &70 and 71.

TRA Updates old sprite to current.

BRIGHT
Moves beast to the right.

BDOWN
Moves beast four pixels down.

The old sprite is erased and updated on frame 3, and poked in.

Second position. No move on frames 2 and 4.

KIB ("Kangaroo in bits")

POKEs half of beast using

SPRTOP and SPRFEET.

SIB ("Sprite in bits")

POKEs complete beast using KIB.

BUP
Moves beast four pixels up.

DUCK
Puts kangaroo in ducking position each frame.

BUL
Combines up and left movements.

BUR
Combines up and right movements.

BMV ("Beastmove")
Branches depending on movement flag.

KL left move.

KR right move.

KD down move.
KU up move, branches for diagonal move.

BRU and BLUE contain some of the arithmetic for the diagonal moves.

GO
This is where the move flag is picked up from the key or joystick.

The registers are transferred, the keyboard buffer flushed, and the ESCAPE key detected.

Scans for "S", if detected pauses until "G" is pressed.

Branches for key or joystick.

KEY
detects space bar, goes to PUNCH routine.

Scans for, and branches on, up, left and right.

Scans for down and branches.

Acknowledges ESCAPE.

Sets flag for right and left.

Sets flag for up and down. Punch routine.

JOY
Detects fire button.

Detects and branches for right.

Detects and branches for left and down.

Detects up and branches.

FALL
If the kangaroo has her feet on the ground, the movement flag is picked up from GO, otherwise the movement flag is set to 'down'. The death flag is set if she falls more than one level.

GROUND
Finds the code for the part of the scenery immediately below the kangaroo's feet.

DIR
This routine points the kangaroo in the correct direction. Branches for up, down, left and right.

Puts the correct sprites

for left and right.

Branches if the kangaroo is ducking, or going down the ladder.

DES
Makes noise and selects correct sprite for ladder descent.

DIRU
Checks whether the kangaroo is ascending the ladder, or has her feet on the branch.

Branches for diagonal move.

Makes noise and selects correct sprite for ladder descent.

Makes noise and selects correct sprite for left, right, up, down and diagonal moves. Calculates new tree position.

MOK
Checks that the kangaroo can move in the chosen direction. If not, the movement flag is cleared (except for the punch) and the tree position remains the same.

If she can move, her position on the tree is updated.

GAME
This routine controls all the moves. It picks up all movement flags. Each sprite is moved four times with a short delay between each move.

BEAST
This routine copies each beast's data to the work area on zero page, moves the beast and updates his data.

PAT
Works out the next movements for each beast, and updates movement flags.

Selects correct sprite for Joe.

Selects correct sprite for monkeys.

UPD
Updates the tree position for Joe and the monkeys.

PATH

to
1120 Calculates the next move according to the number of steps along the path. Checks for each of path and replaces it with the beginning.

1130 FRUIT
to
1160 transfers the fruit data to the work area, move the fruit, and updates the data.

1170 FPAT
This routine calculates the path of the fruit, and updates the movement flag. If there is no apple core, starts a new one.

1180 Starts a new apple if necessary.

1190 Erases fruit at the end of the path and clears the flag, otherwise decreases the steps remaining.

1200 Updates tree position of the fruit.

1210 Starts second apple if necessary.

1220 Calculates how high above the branch the missile should be.

1230 Starts apple core.

1240 Starts apple 1.

1250 Starts apple 2.

1260 CHARS
to
1290 Copies all initial data, and POKEs all characters in initial positions. Clears active fruit flags.

1300 TWIG
to
1310 Decides which monkey is to throw the second apple.

1320 DEL short delay.

1330 DEDM displays dead monkey.

1340 BUMP
to
1360 If there is a collision the monkey and kangaroo self destruct.

1370 DPIC POKEs a double sprite.

1380 KDED displays a dead kangaroo.

1390 HALO Checks for a bump or a fall.

DATA

1410 Kangaroo (initial data)
1420 Joe (initial data)

1430 MONKEY1 (initial data)
1440 MONKEY2 (initial data)
1450 MONKEY3 (initial data)
1460 MONKEY4 (initial data)
1470 Patrol data for beasts
1480 Key/joystick flag and frame number

TEST3 VARIABLES

A% Loop variable
B% Label for movement routine under test
I% Loop variable
X% Loop variable
ROW Row of sprite
COL Column of sprite

MAIN PROGRAM

Line
20-50 Envelopes.
60 This can be used to bypass the next four lines if the machine code is already present.
70-90 Loads assembled machine code.
100 Downloads MC3 into the correct position. This machine code may be overwritten if BREAK is pressed.
110 Sets MODE 2, and accesses initialisation routine.
120 Accesses procedure to check movement.
130 Accesses procedure to check keys and joystick.
140 Accesses procedure to move the kangaroo about the tree.
150 Accesses procedure to check the beasts and missiles.

PROCEDURES

170 PROCPIX
180 Redefines palette and prints scenery for level 1.
190 Reads the address of each fruit movement routine.
200 POKEs apple at row 10, column 10.
210 Moves the apple one

220 frame at a time with a key press between each frame.
Reads address of the seven beast movement routines.
230 POKEs the kangaroo at row 20, column 9.
240 Moves the kangaroo one frame at a time, with a key press between each frame.
260 PROCKEY
This routine tests joystick, then key routines for a minute each.
270 Sets times to zero.
280 Calls GO, and prints any non zero movement flag.
290 Checks for end of time interval (adjustable).
310 PROCKAN
320 Sets scene and POKEs kangaroo.
330 Sets initial values for kangaroo (extreme left of lowest branch).
340 Calls GO if she is not falling.
350 Calls DIR, and checks if the move is OK. Moves kangaroo for four frames with a very short delay in between. The routine finishes when the kangaroo dies.
370 PROCBEAST
380 Sets scenery, POKEs animals on screen in initial positions.
390 Sets delay (medium) and calls GAME. All beasts and missiles should move.
400 Calls HALO to check for death.
410 Until the kangaroo dies.
430 PROCIN defines labels.
480 FN(ROW,COL) works out the screen location of the row and column.

DATA

500 contains the addresses of the movement routines
&900 FLEFT
&991 FDOWN

&A09 BLEFT
&ABB BRIGHT
&B7B BDOWN
&C00 BUP
&E00 BUL
&EAC BUR
&C4E DUCK

HINTS ON TESTING

PROCPIX tests each movement routine slowly to make sure that they are all correct before using them in PROCKAN and PROCBEAST.

PROCKEY is for testing GO to make quite sure the correct value is put in the movement flag.

PROCKAN links GO with the kangaroo's movement and still displays the movement flag. If you find that the kangaroo climbs invisible ladders and bumps into non existent branches, check first the values in line 330, then the whole of DIR and MOK, where the tree position is updated.

To proceed to the next routine, make the kangaroo fall off the ladders.

PROCBEAST This procedure could be slowed down with a keypress at line 395 if desired.

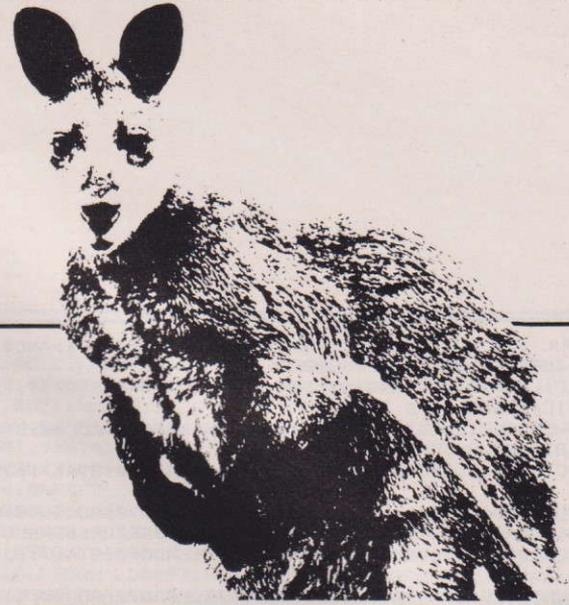
If the creatures do not appear, check CHARS and the initial date.

Joe and MONKEY 1 should run along the top branch, and the other monkeys climb down the tree to their own branch. If they go completely haywire check the initial data, the patrol data, PAT and the routine to copy the data to the work area.

The top monkey should drop apple cores, the middle monkey throw one apple, and the monkey nearest the kangaroo throw the other apple. If this does not occur check FPAT, the copying routine and the routines to start the fruit.

Now check the collision routine. If the kangaroo occupies the same space as one of the monkeys, the monkey dies first followed by the kangaroo. You can start the procedure again by typing:

CONTINUED OVER



PROGRAM LISTING

```

TS
1150.FD JSRFDOWN:RTS:.FL JSRFLLEFT:RTS
1160.FW LDY#8:.FW1 LDA&DDF,X:STA&7E,Y:DEX:DEY:TYA:BNE
FW1:RTS:.WF LDY#8:.WF1 LDA&7E,Y:STA&DDF,X:DEX:DEY:TYA:B
NE WF1:RTS
1170.FPAT LDX#8:JSR FW:LDA&7F:AND#1:BNE FPAT3:JSR CORE
:LDX#8:JSR FW
1180.FPAT3 JSR FPAT1:LDX#8:JSR WF:LDX#16:JSRWF:LDA&7F:
AND#1:BNE FPAT4:LDA&DF0:BEQ FPAT4:JSR APPLE1:LDX#16:JSR
FW
1190.FPAT1 DEC&82:BNEUPDF:LDA#0:STA&7F:LDA&85:STA&70:L
DA&86:STA&71:JSRSPIC:RTS
1200.UPDF LDA&85:CMF#&A0:BEQ DTREEF:JSRLTREE:JSRLTREE:
RTS:.DTREEF JSRDTREE:JSRDTREE:RTS
1210.FPAT4 JSR FPAT1:LDX#16:JSR WF:LDX#24:JSRWF:LDA&7F
:AND#1:BNE FPAT5:JSR APPLE2:LDX#24:JSRWF:.FPAT5 JSRFPAT
1:LDX#24:JSRWF:RTS
1220.FRLEVEL LDA&D8E:AND#3:TAX:BEQFRLEVEL2:.FRLEVEL3 D
EX:TXA:BEQFRLEVEL1:SEC:LDA&80:SBC#128:STA&80:LDA&81:SBC
#2:STA&81:SEC:LDA&83:SBC#20:STA&83:LDA&84:SBC#0:STA&84:
JMPFRLEVEL3:.FRLEVEL1 RTS:.FRLEVEL2 LDX#4:JMPFRLEVEL3
1230.CORE LDA#17:STA&7F:LDA#&2E:STA&86:STA&71:LDA#&A0:
STA&85:STA&70:LDA#12:STA&82:LDA&D21:STA&80:LDA&D22:STA&
81:LDA&D2A:STA&83:LDA&D2B:STA&84:LDX#8:JSRWF:JSRSPIC:RT
S
1240.APPLE1 LDA#129:STA&7F:LDA#&2E:STA&86:STA&71:LDA#&
80:STA&85:STA&70:LDA#9:STA&82:LDA&D39:STA&80:LDA&D3A:ST
A&81:LDA&D42:STA&83:LDA&D43:STA&84:JSRFRLEVEL:LDX#16:JS
RWF:JSRSPIC:RTS
1250.APPLE2 LDA#129:STA&7F:LDA#&2E:STA&86:STA&71:LDA#&
80:STA&85:STA&70:LDA#9:STA&82:JSRTWIG:JSRFRLEVEL:LDX#24
:JSRWF:JSRSPIC:RTS
1260.CHARS LDX#72:.CH1 LDA&D97,X:STA&D07,X:DEX:BNECH1
1270JSRKW:JSRCHPIC:JSRJW:JSRCHPIC:JSRMW:JSRCHPIC:JSRM2
W:JSRCHPIC:JSRM3W:JSRCHPIC:JSRM4W:JSRCHPIC
1280LDA#0:STA&DE0:STA&DE8:STA&DF0:RTS
1290.CHFIC LDA&85:STA&70:LDA&86:STA&71:JSRLPIC:RTS
1300.TWIG LDA#129:STA&7F:LDA&D0D:CMF#&25:BNETWIG1:LDA&
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500DATA&900,&991,&A09,&ABB,&B7B,&C00,&E00,&EAC,&C4E
    
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Software Reviews

Reviewers this issue: Dave Carlos, Jonathan Evans, Jon Revis, Peter Rochford, Shingo Sugiura, Alan Supple, B. Timmins.

Title Polar Perils
Publisher Squirrel Software
Machine Model B/
 Electron
Price £7.95

"Brr!! — Adrift on the Arctic Sea, with a ravenous POLAR BEAR about to leap on to your tiny ice floe!" reads the first line of the instruction sheet that comes with Polar Perils. It carries on in no less a dramatic fashion to warn you of the other terrible dangers that await you on your trip across the frozen wastes.

Unfortunately however playing the game comes as a bit of a let down after the rather impressive build up. The polar bears look far from menacing, in fact, they look nothing like polar bears whilst the Arctic scenery is none too convincing either.

The idea of the game is to guide your eskimo across the icy wilderness of the Arctic trying to achieve certain tasks whilst avoiding the bears and other nasty hazards. Scene one finds you jumping your man from one drifting ice floe to another to reach the safety of the far shore of the sea. On the way, you must avoid the polar bear who is also leaping his way around the ice floes in an effort to flatten you. You can land on one of the islands in the sea to grab a spear and then kill the bear when he gets close to you.

Although this all sounds quite exciting, in practice it's real yawn-a-minute stuff as the drifting ice floes just keep on drifting and drifting and drifting... This means you have to wait patiently until your ice floe drifts near enough to be able to leap onto another and makes it all very tedious.

Later screens which feature tasks such as kayaking between icebergs and plotting your way across the thin ice of a frozen lake are no more challenging or interesting than the first.

The graphics in Polar Perils are just about passable but show little flair, imagination or originality. Use of sound is reasonably good but nowhere near outstanding either. The only thing I could find commendable about

this game is that it features good facilities such as freeze game, abort game, sound on/off, user-definable keys, joystick option and a high score table.

Sorry Squirrel Soft, but you'll have to do better than this these days, especially at the price you're asking when games of the calibre of Frak! are available for a similar amount of money. **P.R.**

Ratings Table:

SOUNDS	40%
GRAPHICS	35%
DOCUMENTATION	70%
VALUE FOR MONEY	25%
OVERALL	35%

Title Swag
Publisher Micro Power
Machine Model B/
 Electron
Price £6.95

You may have seen in the advertisements that Swag is a two player game, and indeed it is, but don't let that put you off if you are the only Electron fan in town. There is also a "practise mode" for one player to hone his skills. This also acts as a one player version of the game with a computer controlled opponent.

The aim of the game is to get \$250,000 in the kitty. You can collect diamonds and gold and deposit them in the bank. Spare ammo can be got at the store. As well as your gun toting opponent, you have to deal with the droids,



Henrys and Percys. One lot go after you, the other lot go after your arch enemy. If you manage to shoot them, they swop personalities and chase the opposition. You can reverse all droids and send your opponent back home (from which both duellists emerge) by moving over objects on screen.

Police cars present a further danger (as you can imagine the screen is pretty cluttered). If you shoot them then they chase you. You need to drink Herbert brew before shooting them again to stop them. Police cars don't seem to take offence in "practise mode".

The sound effects for the guns going off are frighteningly lifelike and noisy. They can be turned on and off with the first two function keys. Other options include unlimited bullets and the ability to give either player a head start.

When a player does finally battle through to \$250,000 then the game comes to an end, the winner is announced and a fanfare heralds our hero as he walks out to applause. A fitting end for a grandiose and highly complicated shoot-out game. Probably the best two player game on the market. The Electron version runs at very acceptable speeds and features all the same touches as the Model B version. **M.W.**

Ratings Table:

SOUNDS	80%
GRAPHICS	80%
DOCUMENTATION	85%
VALUE FOR MONEY	80%
OVERALL	80%

Title BMX On the Moon
Publisher Superior Software
Machine Model B
Price £7.95

You control a moon cycle which you must use to patrol the surface of the moon. There are many rocks on the ground. You must accelerate and try to jump over. To make them easier to jump



over, you can blast them with your moon-gun. If you fire into the ground, a crater will be created. Sounds familiar? Well, "BMX on the moon" is a version of the arcade game "Moon Patrol" where the moon buggy has been replaced by a BMX bike!

For those of you too young to remember this game, here's the plot. You control your vehicle over a barren landscape which scrolls past you in Scramble fashion and take pot shots at the various rocks which come towards you. From time to time, an alien will fly overhead and bomb you or the ground to make things more difficult. In this particular version, you do exactly the same except you control a BMX bike.

The graphics are well executed. The scrolling is smooth and the characters have been well defined. I especially like the way in which your bike hugs the ground. The presentation is well up to the usual Superior Software standard with all the extra features such as sound on/off, freeze, quit and hall of fame. Admittedly, although the game is incredibly unoriginal, it is good fun to play. **S.S.**

Ratings Table:

SOUNDS	70%
GRAPHICS	60%
DOCUMENTATION	60%
VALUE FOR MONEY	75%
OVERALL	67%

Title Know your own Psi-Q
Publisher Mirrorsoft/
 Ivan Berg
Machine Model B/
 Electron
Price £9.95 cassette,
 £12.95 disc

This program is rather different because it aims to take you and your micro from this world into the world of the Supernatural! The Psi in the title stands for Psychic phenomena and the program gives you the tools to investigate those of extra sensory perception (ESP) and mind-over-matter or psychokinesis (PK).

Taking itself rather seriously, there is a program that tries to ascertain just how sympathetic you are to this kind of happening and it does so by asking you 108 questions in three sections each with three possible answers. Based on the work of Eysenk and Sargent (who wrote the manual) it gives you a rating and suggests what sort of response you might have on the game. I rated "sceptical" which seems about right.

The second, and probably more interesting, section is the game program which includes four varieties of activity. The first type is the card games and the two options are guessing the suit or guessing the colour. There are two options in the grid games too, you might test your clairvoyance by guessing where the targets are after their positions have been selected or precognition by selecting a position before the computer has decided their locations.

You can play "Psi-Psubs" in which you try to shoot the submarines hidden in the grid by moving your sight, using joystick or cursor keys to do so. The fourth game is really a non-violent variation of the Psubs game but with faces instead of submarines.

The final parts of the program are the filing system on which you can store your scores over a period and then chart your progress over time and the relaxation routine which, the instructions tell me, will relax you before your Psi session.

I'm sure that there are those

who will find this package fascinating and will regard it as the best thing since Space Invaders. It is certainly comprehensive and well thought out and can be good fun in a crowd — you should have seen them at the Computer Club! Me? Well, I'm still sceptical both of the value of a program like this and of its underlying theme. But you should have known that if you had any Psychic power at all!

D.C.

Ratings Table:

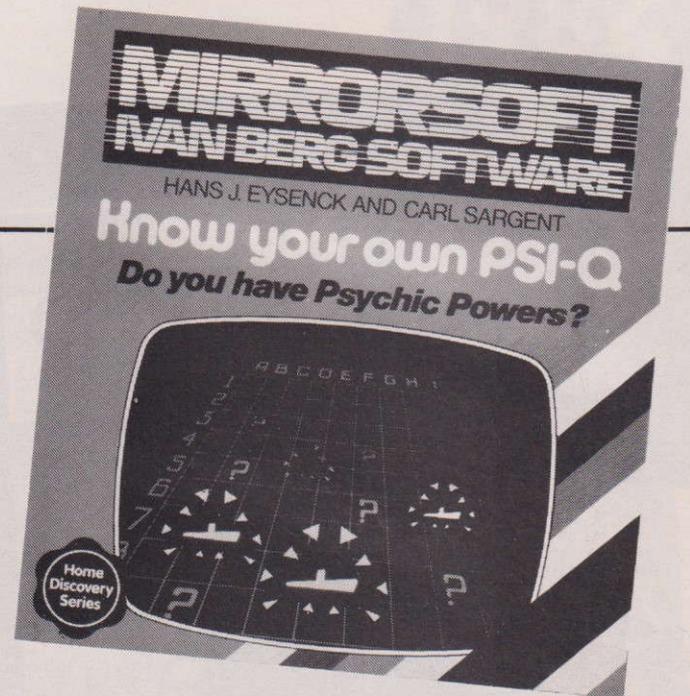
SOUNDS	70%
GRAPHICS	70%
DOCUMENTATION	80%
VALUE FOR MONEY	70%
OVERALL	75%

Title MA3
Publisher Micro Arts
Machine Model B
Price £3.00

Micro Arts is a new magazine launched last autumn. It covers the wide area of graphic art created upon microcomputers (and in some cases by micros). As well as producing the magazine, there is a range of software for the Spectrum and the BBC.

Martin Rootes has written the BASIC routines which generate the "art" on MA3. Textures, mixes, seas of colour, solids, filling and washing over the screen canvas make this an interesting program. The probability of certain types of overlay occurring change throughout. There are circles and rectangles, hatching and random use of the BBC's ability to "combine" colours logically.

Vortex produces mathematical shapes in four colours. You can choose which ones. Limited but pretty. Mondrian is animated graphics, coloured squares outlined in black being spun into position, colours swapped, and shapes switched. Mondrian reminds me of some of the caption graphics being used on the television. It's all in BASIC and very impressive from a performance point of view. Whether it is art is up to you.



Pic-Swap is based on card graphics used at the Moscow Olympics. An Assembler routine holds two screens in memory and swaps them over in sections. Runner is based on a photo sequence in the style of Marcel Duchamp's "Nude Descending a Staircase". It won't run on disc systems without being down-

loaded! A very promising start from Micro Arts. Graphics are one of the key areas in home computing and they can be quite inspiring on the BBC. Try this package for

size. Can the computer produce great works of art? Is it just a tool for the human artist? All worth thinking about and testing for yourself. MA3 helped to remind me that the BBC is fun as well as very useful. Contact Micro Arts at PO Box 587 London SW4 9PH.

M.W.

Ratings Table:

GRAPHICS	100%
DOCUMENTATION	40%
VALUE FOR MONEY	80%
OVERALL	75%

Title The Horse Lord
Publisher Century Software
Machine Model B
Price £12.95

This is a "bookware" pack. The book, by Peter Morwood, is a fantasy novel which is just about readable — at least your conscientious reviewer read it — but scarcely in the Tolkein class. The published price of the book is £2.50 which means that they are charging over £10 for the accompanying program. At that price, with a fantasy book, you'd expect a pretty fantastic adventure game, right? Wrong, what you get is a mediocre arcade game. Apart from being rotten value for money, I don't see how even the best of arcade games can sensibly be packed with a book, because they have so little meaning. There wasn't even any text or instruction included in the program to indicate the relation between the book and the game, and my review copy had no documentation with it.

The game involves riding around a spiral path and then zooming into a close-up screen when an obstacle is encountered. These are remarkably similar, involving the crossing of streams and combat with an opponent — apparently on horseback — but the graphics are vague. The same weapon seems to serve as both sword and crossbow. The controls for rotation, movement and weapon yielding are not described since there is no instruction program. Having discovered them empirically, I found both keys and joystick version to be virtually unmanageable.

CONTINUED OVER

CENTURY SOFTWARE

THE HORSE LORD

NOVEL BY PETER MORWOOD
COMPUTER GAME BY JONATHAN GRIFFITHS



This is possibly the worst value for money package I have ever seen. Anyone who has been conned into expecting a high quality adventure game and parted with their money should demand a refund from the publisher. **J.E.**

Ratings Table:

SOUNDS	45%
GRAPHICS	35%
VALUE FOR MONEY	10%
OVERALL	20%

Title	Stock Car
Publisher	Micro Power
Machine	Electron
Price	£6.95

Stock Car is another of the new cheaper, better packaged Electron games from the Leeds based software emporium. The professional look of Micro Power games is further extended in this package by some very nice screen graphics for the Stock Car logo and the enforced use of Mode 6 for the instructions page, much neater than BBC Mode 7.

The game is two player, a market uniquely tapped by Micro Power, with a practise mode for

the lone racer. The computer is a mean opponent and you may well prefer a human, and therefore fallible, competitor. There is no joystick option for the Plan One or First Byte interfaces and keyboard controls are the usual ones for left, right, gears up and down. There are symmetrical sets for both sides of the keyboard.

There is a choice of six different and imaginative circuits, variable skid (0% to 99%) and selectable number of laps (1 to 40). There are also oil patch hazards. The computer controls two yellow cars even in the two player game, taking over the third if you are on your own. Escape resets all game options.

After the finish, if you are fast enough, you enter your name against your lap time in the high score table.

The game has been tweaked to make it run acceptably fast on the Electron (and it does). If anyone wants to run it on a BBC then the first two gears are enough to be going on with!

Graphics are simple but effective and sound is well exploited. If you bought your Electron to have fun then this is just the software to achieve that goal and best played with a friend.

M.W.

Ratings Table:

SOUNDS	85%
GRAPHICS	75%
DOCUMENTATION	75%
VALUE FOR MONEY	75%
OVERALL	80%

Title	Flying Scotsman
Publisher	Dee-Kay Systems
Machine	Model B
Price	£7.95

In Flying Scotsman we have the complete opposite of the slick arcade games of the Micro Powers and Acornsofts. Dee-Kay have come up with an highly enjoyable simulation of a train journey between London Kings Cross and Newcastle, non-stop. More enjoyable than the real thing in some cases!



The simulation is not as you might think, graphical, but rather a series of pieces of information about the journey, seen from the driver's point of view. As such it is of limited appeal but enthusiasts will lap it up and I recommend that you try and take a look at a copy to see whether this is your cup of tea.

At Kings Cross roster notices are posted to inform the driver of any particular problems on the route. You get a report on your train (I chose the 125) which will go something like this: "Motive Power dept. report your train in ex-works condition." You are now placed on board with two minutes to go before departure.

There are over 8,000 lines of BASIC supplying the information on your Mode 7 screen all the way along the route. The clock ticks away, your speed is registered along with your controller status (1-5), brakes and other status details, for instance: "engine idling".

You don't have to take the high speed (when they are moving!) trains. You could choose to drive a Deltic or a Class 47. The documentation reveals enthusiasts at play. There's lots of good sensible information about the program itself and revealing information about the journey, including a schedule and a gradient profile.

As well as controlling the train and trying to keep up with the clock, you get to sound your horn — very realistic. Places you know (if you have done the journey) appear in the mind's eye and the program gives them names — Gasworks tunnel and Copenhagen tunnel. There's Arlesley, Maxley, Little Barford (though I don't think they mention the power station which you can't miss), Essendine, Little Bytham and Corby Glenn. Later we come across Botany Bay and Piper's Wood, very romantic.

Throughout the journey we are kept up to date with how far out from the last stop we are — so many miles from Kings Cross, so many from Stevenage and so on. The main skill in driving the trains is in getting used to the controls, the performance of the train you have chosen and ad-

justing for the various gradients and speed limits you will encounter along the line.

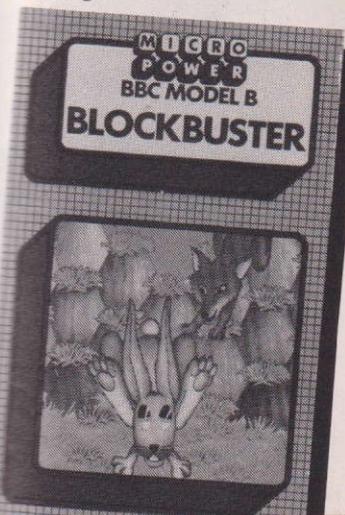
This is not the next piece of hit software headed for the Christmas, or post Christmas charts but for anyone remotely interested in the noble train and for anyone who would like a complete change in the sort of software they are loading into their BBC, Flying Scotsman is worth a look. It would be nice if Dee-Kay could write the program to incorporate historical versions of this famous train and its run up and down the East Coast Line to prolong the interest and value of the program. As it stands, it is an interesting, if not brilliantly realised, piece of software. **M.W.**

Ratings Table:

SOUNDS	70%
DOCUMENTATION	90%
VALUE FOR MONEY	75%
OVERALL	80%

Title	Blockbuster
Publisher	Micro Power
Machine	BBC Model B / Electron
Price	£7.95

This is another version of the arcade game "Q * BERT". The game involves two pyramids of multicoloured blocks. The player controls a rabbit which must jump onto each block in the pyramid, to change its colour.



Unfortunately, life is made difficult for our little friend — balls bouncing down the pyramid get in his way, and the black ball will change onto a sly fox when it reaches the bottom of the screen. This fox can be destroyed by jumping into a "teleport" disc, which moves you to the top of the pyramid, and causes the fox to jump off the edge. It is also important to keep a lookout for the bird which will kill you with its "toxic guano" (!), and another small monster who puts dirty footprints all over the blocks which have to be cleared up and their colour changed before proceeding to the next level.

You are given three men and these can be lost in a variety of ways; by colliding with a ball,

Title	1984
Publisher	Incentive Software
Machine	Model B
Price	£6.95

In 1984 you play the role of Prime Minister running the British economy. You must negotiate pay settlements, fix annual government budgets, interest rates, taxes and so on. Your success on a variety of economic indicators (inflation, unemployment, trade balance etc) is indicated annually, together with public opinion poll ratings. The object is to survive in office as long as possible. Incompetent government may lead to premature resignation or failure to get re-elected.

Few computer games are original and this strategy game is remarkably similar in conception to the earlier "Great Britain Limited" by Simon Hessel. Whilst 1984 is more complex and has noticeably better screen displays — the use of Mode 7 graphics for bar charts is particularly impressive — I would not recommend purchase if you already own the Hessel game. Having said that, the game is well presented, has excellent documentation and is good value for money.

The game is rather difficult — as a good strategy game should be. I tended to rush for growth, pumping money into industry and the economy generally. Unfortunately, my short term gains in falling unemployment soon turned into disastrous inflation and uncontrolled public expenditure. Was Nigel Lawson an advisor on the program, I wonder? There is a serious point here, of course. A program like this appears to be educational, but you have to take on trust the quality of the simulation. After all, economists cannot seem to agree about the correct way to model our economy and any program for a 32K micro must be highly simplified. Like a flight simulator one should enjoy this type of program without taking it too seriously. **J.E.**

Ratings Table:

SOUNDS	70%
GRAPHICS	80%
DOCUMENTATION	90%
VALUE FOR MONEY	80%
OVERALL	80%

being eaten by a fox, dying from guano poisoning, or accidentally jumping off the edge of the pyramid!

The graphics are colourful and reasonably smooth, although I have seen better. Sound effects are slightly above average. The instructions (on the cassette insert) are concise but adequate. This is a good version of an arcade favourite and good value for money. **A.S.**

Ratings Table:

SOUNDS	70%
GRAPHICS	80%
DOCUMENTATION	75%
VALUE FOR MONEY	75%
OVERALL	75%



Title	Game Core
Publisher	BBC Publications
Machine	Model B
Price	£10.95

Up until now the only game generation programs that I had encountered were of the arcade game variety. The user merely specifying the type of game, the background and the aliens. Game Core should in no way be confused with this type of game generator. Game Core has been specifically designed with the aim of producing strategic board games of the Reversi, Draughts variety.

Game Core is supplied in cassette format but can be transferred to disc quite easily. BBC Soft has even supplied a !BOOT file for the benefit of disc users.

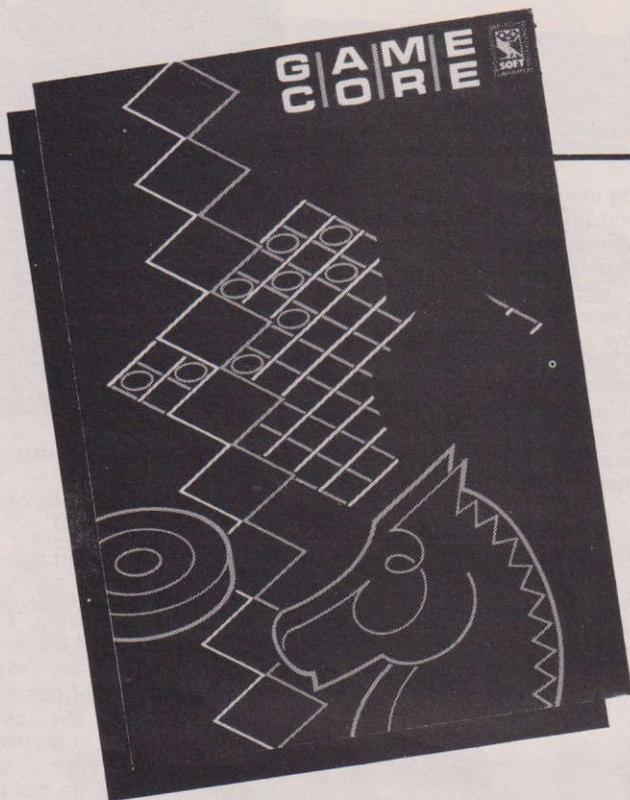
A game produced with the aid of Game Core consists of two separate parts. The first being Game Core itself — this part of the program contains the algorithms which allow the computer to determine which of the moves possible would be its most favourable. The second half of the program must be supplied by the user. This section must:

- 1) Draw the board,
- 2) Check the legality of the moves,
- 3) Evaluate board positions.

One look at the manual should warn a prospective buyer that this package is not for the casual user who is hoping to buy a program that will supply a means of producing a whole variety of board games quickly and simply.

On the subject of producing the game board, the user is informed that an 8x8 board is represented by 64 bytes of

CONTINUED OVER



memory. Whether a square is occupied, the type of piece occupying the square and whether the piece is yours or the computers must all be determined by peeking and poking those 64 bytes of memory. And that is merely the manipulation of the board.

In an effort to help the user through the barrage of extremely heavy going text, several example programs have been supplied. Of these programs "Reversi" and "Don't be Greedy" are both described in some detail. The tasks of the Functions and Procedures are explained and a complete variable list is also provided.

Should a user with only limited programming experience

purchase this program then he would probably never progress further than playing the demonstration programs. The package is aimed at the person who has both a logical way of thinking and a great deal of spare time. Unless you are willing to devote several hours to the process of analysing the rules and tactics of a board game, then programming it to run on your BBC will be an impossibility. **J.R.**

Ratings Table:

GRAPHICS	90%
DOCUMENTATION	90%
VALUE FOR MONEY	80%
OVERALL	85%

Title	Mastermind
Publisher	Mirrorsoft/Ivan Berg
Machine	Model B/Electron
Price	£9.95 (Quizmaster £5.95)

There is no doubt that this type of game has been a success on other computer systems and at last it has been transferred to what you might call its natural home, the BBC. The game is a faithful reproduction of the television series, complete with the signature tune and all the phrases that have made Magnus Magnusson a household name. Unfortunately you don't receive one of those chairs through the post by filling in a little card in the pack!

If you are the sort of person who likes to pit your wits against another then this might interest you, but be warned that the type of

game you can enjoy depends entirely on the databases that you have had developed for you. I say "for you" because it will need a little planning to design a game from scratch — you need to get people to develop questions on the specialist subjects as well as the general knowledge questions and there are only two sets of each enclosed with the package. The specialist subjects included on the tape or disc are Films and TV and Sports and Games. This means that unless you can make a team of people who all wish to specialise in these subjects you have a fair amount of work ahead.

Once you have your databases, for which you need a special program to create them called Quizmaster, you can start the game. First you are asked your name and occupation, then your specialist subject and at this point you must have the file of questions ready. Once this has loaded you have two minutes to answer as many questions as possible or to pass. Answers have to be typed and accuracy of spelling and typing is vitally important or you tend to lose points without need. Passing involves a simple press of the RETURN key. The next contestant follows and if the same subject is requested the program doesn't need to reload the database — a nice touch. As there are 60 questions per database you can use the same subjects for all the contestants without any overlap, it being unlikely that anyone will use all 15 questions. Scores are kept and passed questions are displayed with their answers.

The next round is general knowledge and follows the same pattern as before, and exactly as in the TV show. Then a winner is found and hailed in a suitable manner. Overall I cannot help but feel that this is one of those games that will be used once and then ignored, particularly in view of the amount of effort needed to get the questions organised. Rather like Dungeons and Dragons it all revolves around one person being prepared to put in the effort to get the game going. I also feel that it is rather a cheat to make you pay extra for the question making program. Great for a laugh but not a serious program due to its limitations. **D.C.**

Ratings Table:

SOUNDS	60%
GRAPHICS	40%
DOCUMENTATION	80%
VALUE FOR MONEY	70%
OVERALL	65%

Title	Acid Drops
Publisher	Firebird
Machine	Model B
Price	£2.50

This game from Firebird, a division of British Telecom, is a galaxians style game with a scramble type sideways scroll routine thrown in for good measure.

Your task is to destroy the moths, pods and spinners as they home in on your space craft dropping bombs and missiles. Above you, a tank of acid slowly drips its contents down onto you and provides a further hazard to your task of staying alive and shooting down the attackers.

Whilst you battle away, a gate at the side of the screen



slowly drifts apart and when fully open, your space ship flies upwards and through it. From now on, you have to guide your craft through a sideways scrolling maze to reach the next screen for another round of alien bashing.

Sounds exciting doesn't it? Well in fact it's downright boring! There are nine screens to shoot your way through in Acid Drops and it's a good job they're numbered — they all look identical! It's the same shoot-em-up routine followed by a quick dash through the maze and then more alien thrashing.

No, I haven't overlooked the fact that the game only costs £2.50, but even though it is cheap, there is no getting away from the fact it is rather dull and repetitive which will mean it will not hold interest for long.

My advice if you haven't got a game of this type already in your collection is to shell out the extra money for something like Aardvark's Zalaga or Acornsoft's Galaxians. True they're three times the price, but I'll guarantee they will provide more fun and lasting interest than Acid Drops will.

P.R.

Ratings Table:

SOUNDS	50%
GRAPHICS	40%
DOCUMENTATION	60%
VALUE FOR MONEY	35%
OVERALL	35%

Title	McVid
Publisher	pica software
Machine	Models A&B/ Electron
Price	£14.95 cassette, £15.95 disc

There have been numerous times, when writing a program in BASIC involving graphics, that I have wished I possessed a better knowledge of machine code, so I could speed things up.

Line and circle drawing along with plotting and filling shapes have always caused me headaches, but at last someone has come up with some ready-made routines that will do all of these and a lot more besides.

This package from McVid

consists of a 45 page manual along with either a cassette or disc containing the routines and some sample programs.

The manual starts off quite rightly by warning you that a reasonable amount of knowledge of machine code is needed to take advantage of the routines at all. Furthermore, a good knowledge of machine code is required to be able to understand how they work. This is very true, so don't get the idea that the package will enable you to write dazzling arcade games with little or no previous knowledge of assembler, because it won't.

What it sets out to do, and does quite admirably, is provide routines which students of machine code can analyse and play around with to increase their knowledge. They can then modify and incorporate the routines into their own programs.

The way this is achieved is by the provision of listings of the source code of all the programs on the disc, which are fully documented line by line with further explanations in the text of the manual. The text explains very thoroughly how you can go about modifying and using these routines in your own programs.

The manual takes you through the processes of line drawing, sprite drawing, screen scrolling and circle drawing and

filling. These are dealt with for all graphics modes and there is a sample routine on the disc for each one.

Also on the disc or cassette is a sprite definer and line definer which I found really excellent, enabling the writing of some pretty impressive graphics even when used only from BASIC.

In the main, I found this whole package very useful and easy to follow though I would warn you to look carefully through the manual if you are considering purchasing. I think it will definitely appeal to the student of machine code who is looking for an insight into some of the more complex tasks using assembler.

P.R.

Ratings Table:

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

Title	Super-7
Publisher	Tape
Machine	D.A.C.C.
Price	£8.95

This is one of the many bumper collections of mini arcade games on the market at the moment. As the title implies, there are seven



games in the pack, all partly machine code. They are all arcade type, but of course not up to the standard of normal computer versions of arcade games.

The first of the games, Space Rescue, has two parts; in the first the player must destroy the "plasmoid bolts" approaching his ship from all directions. In the second part you have arrived at an alien planet, and must rescue your captured men from the planet's surface.

In Creatures of the Deep you are cast as a fisherman who must haul in the heaviest catch possible in the time allocated. However, there are obstacles, such as jellyfish and crabs.

Bouncer is a version of Breakout with a difference, the ball speeds up as the game goes on!



In Chopper Chase the player is a helicopter pilot bombing tanks in the desert. However you must keep an eye out for the jet fighter.

Space Pilot Test is a sort of futuristic shooting gallery. The player must shoot columns of moving targets on the left and right of the screen whilst preventing the flying saucer from reaching the bottom of the screen, and avoiding the space mines.

CONTINUED OVER



As a Fire Chief your job is to fight fires in tower blocks, at the same time making sure that you do not run out of fuel of water.

The final game is The Guns of Navarone, in which you defend your cliff-top bunker from the onslaught of enemy helicopters and destroyers. You are armed with two guns.

Most of these games are fun for the first two or three playings, but after this they tend to become boring. Although the cassette represents good value, I would prefer to buy a similarly priced full feature arcade type game, which has more lasting appeal. **A.S.**

Ratings Table:

SOUNDS	50%
GRAPHICS	45%
DOCUMENTATION	50%
VALUE FOR MONEY	70%
OVERALL	55%

Title	Winged Warlords
Publisher	Superior Software
Machine	Model B
Price	£7.95

In Winged Warlords, each player rides an ostrich. The aim is to knock the enemy off by colliding with them. In a collision, the rider with the highest jousting pole will be victorious. If you are successful, the enemy will revert to its original form, an egg. This egg must be collected at some stage to prevent it from rehatching. Avoid the lava at the bottom of the screen.

With a story line like this, what can you say? It's obviously a version of the arcade game "Joust" by William Electronics which proved very popular last year.

Winged Warlords is in fact the first implementation of this game on the Beeb and as such, it is rather disappointing. Although the characters are very nicely defined and very detailed (in Mode 1 rather than Mode 2) the movement leaves a lot to be desired. The characters are con-

stantly flickering and the movement is generally jerky. To make matters worse, the movements of these ostriches are very sluggish. I found myself pounding at the keys to no avail soon to get splattered by a much more manoeuvrable enemy ostrich. Also, why are the scores in the high score table so high? And what happened to all the extra features we have come to expect from Beeb games such as freeze and sound off?

It's almost a shame to criticise the game in this way because the original game was a fantastic game and this implementation would have been fantastic too if it hadn't been for the rather poorly animated characters. **S.S.**

Ratings Table:

SOUNDS	70%
GRAPHICS	50%
DOCUMENTATION	30%
VALUE FOR MONEY	65%
OVERALL	54%

Title	Jet Boot Jack
Publisher	English Software Company
Machine	Model B
Price	£7.95

Not to be confused with Jet Pac and Jet Power Jack, this is an entirely different type of game altogether. Jet Boot Jack is already a popular game for the Atari and Commodore machines and this version for the Beeb is every bit as good. Your task is to guide Jack,

the jet-booted jogger, through the vaults of a record pressing plant collecting the music note as he goes. Along the way he meets the inevitable bugs and gremlins who are out to thwart his efforts. These nasties hang from the ceilings and must be dislodged by Jack jumping up and down on the floor above to kill them off. A further hazard to our hero's progress is the varying heights of the ceilings at certain points but Jack can shrink momentarily to negotiate these.

Access to the different floor levels is provided by lifts and sliders, but the lifts behave in a somewhat erratic fashion and have a habit of sometimes going up instead of down, giving Jack a nasty headache if he happens to be on the top floor.

Power for the jet boots must be replenished from time to time and this is obtained from the pods that hang from the ceilings on each level.

There are ten screens to work your way through and six different skill levels you may choose. The skill level determines the number of gremlins on each screen and the amount of fuel available to complete you task. A nice feature is that, once you have reached a certain screen and are then killed off, you have the option of jumping back to it when you start a new game.

Points scoring depends on the skill level, the screen you are on and the time taken to finish the screen. Keys are the usual

Z,X,*,? plus the RETURN key, but there is no joystick option. This is hardly surprising though as I reckon the game would be almost impossible to play using a joystick. Options provided are escape game and freeze game but there is no sound on/off provided or a high score table.

Graphics are really excellent with smooth, totally flicker-free animation. Sound is good too throughout the game, but I could have done without having to listen to a tune before starting every new game, even if it was rather pleasant.

Overall this is a really classy game that, despite being a lifts and girders romp with a daft storyline, does provide plenty of new features to make it worth adding to your collection. I enjoyed playing Jet Boot Jack very much indeed and will be surprised if it doesn't achieve the success on the Beeb it has with other machines. Very highly recommended. **P.R.**

Ratings Table:

SOUNDS	70%
GRAPHICS	80%
DOCUMENTATION	90%
VALUE FOR MONEY	90%
OVERALL	85%

Title	Duck!
Publisher	Firebird
Machine	Model B
Price	£2.50

This should have been called Duck Invaders or Duck Galaxians, because basically that's what it amounts to. Instead of aliens you have ducks and instead of a space ship there is a gun-toting farmer.

It's a shoot-em-up game of the type we have all seen before and probably most of us don't really want to see again. Nothing new here that hasn't already been done one way or another in so many other games and in most cases, far better.

You probably have the impression by now I don't like this game and you're dead right! I can only guess that Firebird have released it with young kids in





mind who don't have £7.95 to spend and want a fairly simple cheapo game. If this is the case, I don't see the sense in it when the Beeb is such an up-market machine. The verdict of my eight-year-old nephew and his pals after playing Duck! was "too boring and too easy".

The only thing I found good about this game was the title tune

Title	Mr EE
Publisher	Micro Power
Machine	Model B
Price	£6.95

The recent price drop of Micro Power games to £6.95 makes them even better value and this has to be especially so in the case of Mr EE. It is a great game by all the standards.

The sprite character representing Mr EE is one of the quaintest in software. He looks like a pirate, but I will settle for gypsy since he is carrying a crystal ball. The game is a typically colourful, smooth action Micro Power effort. Mr EE is piloted around the maze, cutting tunnels through the background, which changes scene by scene, loosing apples from their moorings so that they drop on his pursuers and chucking his crystal ball at them if in extreme danger.

The pursuers of our wily wizard are the Umphs, who can turn into diggers and must be generally avoided. There is also the letter monster to deal with when the Umphs have proved ineffective.

The graphic apples and cherries are superbly drawn. The cherries have to be devoured to end the scene and the apples crack open when hitting the ground without clobbering an Umph or even Mr EE himself if he doesn't get out of the way. 500 points are available for clearing a group of eight cherries, thousands for knocking over multiple Umphs with an apple and more besides for ending their arcade careers by other methods.

I am convinced (bad loser) that I didn't always get the 5090 I deserved for clearing cherries but it hardly matters as you charge around the screen trying to bring order to the chaotic chase in hand. Keyboard is better than joystick control in this one but it is still easy to get caught out on the cornering.

Sound brilliantly punctuates the proceedings and my favourite bit is after Mr EE has thrown his crystal ball, when it comes shooting back to his hand from all corners of the screen.

Micro Power may be sneaking off to the Commodore 64 and other newer machines but their BBC software is still hot stuff. **M.W.**

Ratings Table:

SOUNDS	80%
GRAPHICS	85%
DOCUMENTATION	80%
VALUE FOR MONEY	90%
OVERALL	85%

that plays during loading which is an excellent rendition of Offenbach's "La Belle Helene".

Incidentally, the last part of the game is loaded independently of the computer's cassette filing system using the program's own routine. You won't get this game onto Replica in a month of Sundays!

All in all, Duck! gets the big thumbs down from me, I'm sad to say. **P.R.**

Ratings Table:

SOUNDS	60%
GRAPHICS	30%
DOCUMENTATION	50%
VALUE FOR MONEY	40%
OVERALL	35%



Title	Drawstick
Publisher	BBC Publications
Machine	Model B
Price	£9.95

Upon receiving a copy of Drawstick I was immediately impressed by the standard of both the packaging and documentation. Unfortunately this cannot always be relied upon as a good guide to the standard of the software itself. I was therefore pleasantly surprised when the program lived up to the initial promise of the packing.

BBC Soft must be congratulated for their user-friendliness, the tape contained two versions of the program, one for a tape based system and one for discs. They even provided a loader program which loaded the appropriate programs and then saved them to disc without any intervention by the user.

Drawstick, as its name suggests, is an on screen drawing package designed for use with a fully proportional joystick, though it can still be used with the

keyboard.

As all drawing is performed on a Mode 1 screen the user is limited to one paper and three ink colours. These colours can be selected from a palette of eight at any time during the drawing process.

A grid at the bottom of the screen displays all of the drawing options available. The required option can be selected by simply placing the cursor over the correct box and pressing either the space bar or fire button.

Drawing options include Rectangle, Circle or Arc, each of which can be drawn in outline or filled. Line drawing can be of four types, Rubberbanding, Freehand, and Straight or Dotted line between two points. The latter two lines use automatic correction of horizontal or vertical lines. Should a line be drawn which is almost vertical, the computer will calculate the correct coordinates and draw the line exactly vertical. This facility makes technical drawing a dream using this package.

Other facilities aimed at the technical user are the provision of dotted "centre lines" and also Dimension lines. Dimension lines are the ones with an arrow at either end used to indicate the dimensions of an object — having drawn the line the user is prompted for a value to be displayed on the line. Unfortunately these last two facilities are only available on the disc version.

Complete or selected areas of the design can be stored on tape or disc. When using the disc version it is possible to reload a partial screen and place it at any position on the screen, with the tape version the design is always reloaded at its original coordinates.

Drawstick is a thoroughly professional package capable of producing some highly detailed designs even in the hands of a novice. **J.R.**

Ratings Table:

GRAPHICS	90%
DOCUMENTATION	95%
VALUE FOR MONEY	90%
OVERALL	90%

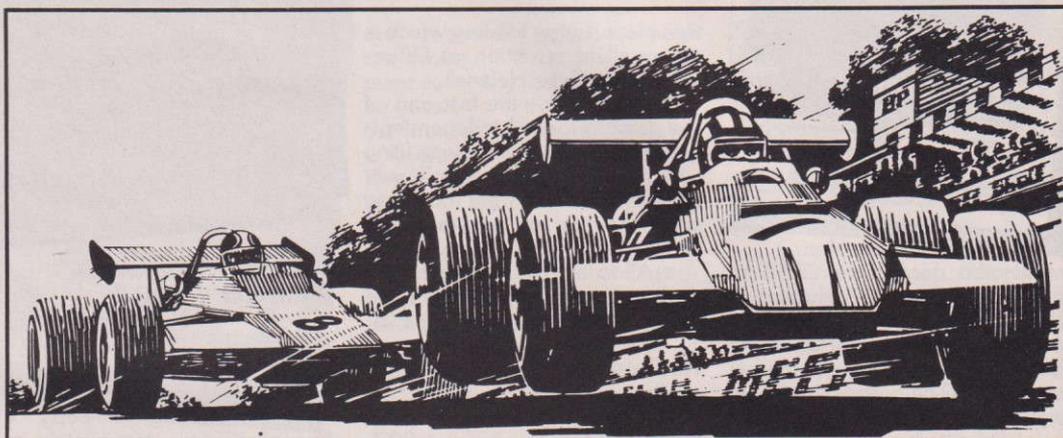


Grand Prix

Peter Mujtaba

You are the driver of a powerful turbo charged Formula 1 car. It is your task to complete a difficult and treacherous course in a respectable time.

With your "hand" on the accelerator you leave the starting line. Suddenly you see a spectator on the race track. If you hit him you will certainly be disqualified. Using all your concentration and driving skills you must steer past the oncoming spectators... but remember... it is a race against the clock.



MAIN VARIABLES

CO%	Determines whether the fence or the track side markings are to be displayed
V%	Velocity of the car (used in a delay loop at line 150)
H%	Horizontal position of the car
D%	A random number which specifies where and when the spectator will appear
U%	Distance travelled by the car ($U\% * 10$)
X%	Determines the logical colour which is to be changed (using VDU19)
M1%,M2%,M3%	Specify whether the sequence used to print the spectators is in progress
A%,A1%	Used to determine the horizontal position of the spectators on the right and left of the track
B%,B1%,B2%	Used to determine the vertical position of the spectators on the right, left and centre of the track
N%,N1%,N2%	Used to determine which spectator character is to be printed
SCENE%	Actual colour of the landscape

HOW THE PROGRAM WORKS

10-120	Assembles machine code. Draws the track and the landscape. Sets up variables and defines actual colours using VDU19
130-350	This is the main loop of the program. When a certain distance has been travelled the program will leave this loop
140	Selects whether the track side markings or the fence is to be animated
150-180	Accelerates and decelerates the car
190	Engine sound. The pitch of the sound varies with the velocity of the car
200-240	Moves the car from side to side and prints it on the screen
250-300	The random selection of spectators determines whether a spectator will appear on the left, in the centre or on the right of the track
310-320	Prints the distance travelled by the car (metres). Increases the distance
330	If a certain distance has been travelled the scene will change (there are four scenes; Meadows, Night-time, Snow, Desert)

This quick 3D racing game is nothing if not fun! Even Niki Lauda does not have to deal with spectators on the track!

340	Prints a real time clock which starts at the beginning of each race
360-380	At the end of the race the player's time is displayed
390-1940	The various procedures are defined

PROCEDURES

PROCROAD	Draws the track, the landscape, the fence and the track side markings
PROCTRACK	The actual colour of logical markings 8,9,10 is altered, thus giving the effect of motion
PROCASMB	Machine code which prints the car on the screen
PROCCHAR	Defines the characters used in the game
PROCCONE	Draws a spectator on the left hand side of the track
PROCTWO	Draws a spectator in the centre of the track
PROCTHREE	Draws a spectator on the right hand side of the track
DEFPROCSCENE	Changes the scene (using VDU19)
PROCFENCE	The actual colour of logical colours 13,14,15 is altered thus giving the effect of motion
DEFPROC VARIABLES	Defines the variables
PROCSETUP	Sets up the screen layout
PROCINTRO	Prints the instructions and also the functional keys
PROCFINISH	Displays the time and distance travelled at the end of the race
PROCCRASH	If a spectator is hit the car will crash and the driver will be disqualified

Racer

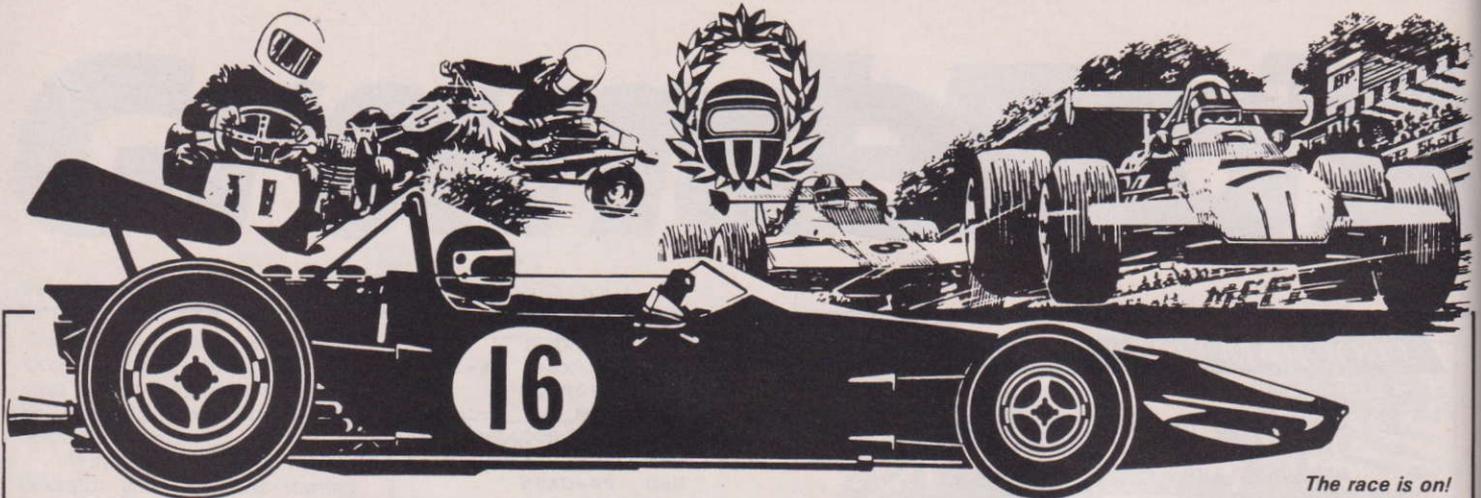
PROGRAM LISTING

```

20  MODE7
30  VDU23;8202;0;0;0;
40  PROCINTRO
50  DIM CAR% 100
60  DIM MAN$(8)
70  PROCASMB
80  MODE2
90  PROCCHAR
100 PROCSETUP
110 PROCVARIABLES
120 TIME=0
130 REPEAT
140 IF CO%=1 PROCFENCE ELSE PROCTRACK
150 FOR PX=0 TO VX:NEXT
160 IF INKEY(-99)V%=V%-50 ELSE V%=V%+25
170 IF V%<0 V%=0
180 IF V%>2000 V%=2000
190 SOUND1,-1,100-V%/20,1:SOUND&10,-15,3,10
200 IF INKEY(-98)H%=H%-1
210 IF INKEY(-67)H%=H%+1
220 IF H%<3 H%=3
230 IF H%>10 H%=10
240 COLOUR1:VDU31,H%,28:CALL CAR%
250 DX=RND(10)
260 VDU5
270 IF DX=1 OR M1%=1 PROCONE
280 IF DX=2 OR M2%=1 PROCTWO
290 IF DX=3 OR M3%=1 PROCTHREE
300 VDU4
310 PRINTTAB(12,2);UX*10
320 UX=UX+1
330 IF UX=200 OR UX=400 OR UX=600 PROCSCENE
340 PRINTTAB(12,4);(TIME DIV 6000) MOD 60:"";(
TIME DIV 100) MOD 60:" "
350 UNTIL UX=800
360 MODE7
370 PROCFINISH
380 GOTO 80
385 REM_____Draws road and scenery_____
390 DEFPROCROAD
400 GCOLO,2:MOVE0,0:MOVE1279,0:PLOT85,1279,600:
MOVE0,600:PLOT85,0,0
410 X%=0:X=1200:Y%=0:QX=50:KX=79
420 FOR LOOP=0 TO 10
430 FOR COL=3 TO 1 STEP -1
440 GCOLO,COL+7
450 MOVE600,600:MOVEX%,Y%:PLOT85,X,Y%
460 GCOLO,COL+12
470 MOVEX+QX+20,Y%+QX:DRAWX+QX+20,Y%+QX*5
480 MOVEX-QX-20,Y%+QX:DRAWX-QX-20,Y%+QX*5
490 X%=X%+KX:Y%=Y%+KX:X=X-KX:KX=KX*8/9:QX=QX*9/
10
500 NEXT COL
510 NEXT LOOP
520 MOVE600,600:GCOLO,2:DRAW1200,0
530 MOVE0,600:MOVE1279,600:GCOLO,4:PLOT85,1279,
1023:MOVE0,600:PLOT85,0,1023
540 GCOLO,0:MOVE600,592:MOVE92,0:PLOT85,1129,0:
MOVE0,600:MOVE200,620:PLOT85,550,600:MOVE610,600:M
OVE700,650:PLOT85,1200,600:MOVE0,550:DRAW550,600
550 ENDPROC
555 REM_____Animates track markings_____
560 DEFPROCTRACK
570 VDU19,XX+7,7;0;
580 IF XX=1 VDU19,10,1;0; ELSE VDU19,6+XX,1;0;
590 XX=XX+1
600 IF XX=4 XX=1
610 ENDPROC
615 REM_____Prints car on the screen_____
620 DEFPROCASMB
630 FOR PASS=0 TO 2 STEP 2
640 PX=CAR%
650 [OPT PASS
660 LDA#32:JSR&FFEE
670 LDA#224:JSR&FFEE
680 LDA#225:JSR&FFEE
690 LDA#226:JSR&FFEE
700 LDA#32:JSR&FFEE
710 LDA#8:JSR&FFEE
720 LDA#8:JSR&FFEE
730 LDA#8:JSR&FFEE
740 LDA#8:JSR&FFEE
750 LDA#8:JSR&FFEE
760 LDA#10:JSR&FFEE
770 LDA#32:JSR&FFEE
780 LDA#227:JSR&FFEE
790 LDA#228:JSR&FFEE
800 LDA#229:JSR&FFEE
810 LDA#32:JSR&FFEE
820 RTS
830 ]
840 NEXT
850 ENDPROC
855 REM_____Defines characters and envelopes_____
860 DEFPROCCHAR
870 VDU23,224,&0,&0,&F,&F,&F,&3,&FC
880 VDU23,225,&0,&0,&3C,&7E,&FF,&7E,&E6,&D8
890 VDU23,226,&0,&0,&0,&FO,&FO,&CO,&3F
900 VDU23,227,&FC,&FD,&FD,&FF,&FD,&FC,&FC
910 VDU23,228,&FF,&FF,&81,&FF,&AB,&AB,&FF,&0
920 VDU23,229,&3F,&BF,&BF,&FF,&BF,&BF,&3F,&3F
930 VDU23,230,0,0,0,8,0,0,0,0
940 VDU23,231,0,0,0,8,8,0,0,0
950 VDU23,232,0,0,8,8,8,0,0,0
960 VDU23,233,0,0,24,60,24,24,0,0
970 VDU23,234,24,24,0,60,24,24,24,24
980 VDU23,235,0,0,0,24,24,0,60,90
990 VDU23,236,24,60,60,36,36,36,36,36
1000 VDU23,237,0,153,153,66,126,60,24,24
1010 VDU23,238,60,60,36,36,36,36,36,36
1020 MS$=CHR$(235)+CHR$(8)+CHR$(10)+CHR$(236)
1030 ML$=CHR$(237)+CHR$(8)+CHR$(10)+CHR$(238)
1040 MAN$(1)=CHR$(230)
1050 MAN$(2)=CHR$(231)
1060 MAN$(3)=CHR$(232)
1070 MAN$(4)=CHR$(233)
1080 MAN$(5)=CHR$(234)
1090 MAN$(6)=MS$
1100 MAN$(7)=ML$
1110 ENDPROC
1115 REM_____Draws spectator on the left_____
1120 DEFPROCONE
1130 M1%=1:GCOLO,0:MOVE590-AX,550-BX:PRINT MAN$(
NX)
1140 IF NX=7 AND POINT(590-AX,464-BX)=1 PROCCRAS
H:GOTO 1170 ELSE IF NX=7 M1%=0:NX=1:BX=6:AX=3:GOTO
1170
1150 BX=BX*2:AX=AX*2:NX=NX+1
1160 GCOLO,6:MOVE590-AX,550-BX:PRINT MAN$(NX)

```

CONTINUED OVER



The race is on!

```

1170 ENDPROC
1175 REM_____Draws spectator in the centre_____
1180 DEFPROCTWO
1190 M2%=1:GCOL0,0:MOVE590,550-B1%:PRINT MAN$(N1
%)
1200 IF N1%=7 AND POINT(600,464-B1%)=1 PROCCRASH
:GOTO 1230 ELSE IF N1%=7 M2%=0:N1%=1:B1%=6:GOTO 12
30
1210 B1%=B1%*2:N1%=N1%+1
1220 GCOL0,6:MOVE590,550-B1%:PRINT MAN$(N1%)
1230 ENDPROC
1235 REM_____Draws spectator on the right_____
1240 DEFPROCTHREE
1250 M3%=1:GCOL0,0:MOVE590+A1%,550-B2%:PRINT MAN
$(N2%)
1260 IF N2%=7 ANDPOINT(580+A1%,464-B2%)=1 PROCCR
ASH:GOTO 1290 ELSE IF N2%=7 M3%=0:N2%=1:B2%=6:A1%=
3:GOTO 1290
1270 A1%=A1%*2:B2%=B2%*2:N2%=N2%+1
1280 GCOL0,6:MOVE590+A1%,550-B2%:PRINT MAN$(N2%)
1290 ENDPROC
1295 REM_____Changes colour of landscape_____
1300 DEFPROCSCENE
1310 IF UX=200 SCENEX=0
1320 IF UX=400 SCENEX=7
1330 IF UX=600 SCENEX=3
1340 VDU19,2,SCENEX,0,0,0
1350 IF COX=1 VDU19,13,SCENEX,0,0,0:VDU19,14,SCE
NEX,0,0,0:VDU19,15,SCENEX,0,0,0
1360 IF COX=-1 VDU19,8,0,0;:VDU19,9,0,0;:VDU19,1
0,0,0;
1370 COX=-COX
1380 ENDPROC
1385 REM_____Animates track-side fence_____
1390 DEFPROCFENCE
1400 VDU19,12+X%,0,0,0,0
1410 IF X%=1 VDU19,15,SCENEX;0; ELSE VDU19,11+X%
,SCENEX;0;
1420 X%=X%+1
1430 IF X%=4 X%=1
1440 ENDPROC
1445 REM_____Defines initial variables_____
1450 DEFPROCVARIABLES
1460 H%=8:COX=1:SCENEX=2:X%=1:UX=0:V%=1000:M1%=0:
M2%=0:M3%=0:AX=3:A1%=3:B%=6:B1%=6:B2%=6:N%=1:N1%=1
:N2%=1
1470 ENDPROC
1475 REM_____Draws the screen layout_____
1480 DEFPROCSETUP
1490 CLS:VDU23;8202;0;0;0;:VDU19,8,0,0,0,0:VDU19
,9,0,0,0,0:VDU19,10,0,0,0,0:VDU19,13,2,0,0,0:VDU19
,14,2,0,0,0:VDU19,15,0,0,0,0:PROCROAD
1500 PRINTTAB(1,2)"DISTANCE"
1510 PRINTTAB(5,4)"TIME"
1520 ENDPROC
1525 REM_____Prints instructions and functional
keys_____
1530 DEFPROCINTRO
1540 CLS
1550 PRINTTAB(11,8) CHR$(141);CHR$(129);CHR$(136
);"FORMULA 1!"
1560 PRINTTAB(11,9) CHR$(141);CHR$(129);CHR$(136
);"FORMULA 1!"
1570 PRINTTAB(0,11)"You are a FORMULA 1 racing d
river! The object of the game is to complete the
course in the shortest time."
1580 PRINTTAB(0,15)"          Some over-enthus
iastic Spectators,however,have found their wa
y onto the track.If you run over one of them you
will be disqualified"
1590 PRINTTAB(5,22);"Press the SPACE BAR to cont
inue"
1600 IF INKEY(-99)THEN 1610 ELSE 1600
1610 CLS
1620 PRINTTAB(12,4)"KEYS"
1630 PRINTTAB(12,5)"          "
1640 PRINTTAB(5,12)"SPACE          Accelerate"
1650 PRINTTAB(5,14)"Z          Left"
1660 PRINTTAB(5,16)"X          Right"
1670 FOR X%=0 TO 5000:NEXT
1680 PRINTTAB(5,22)"Press SPACE to continue"
1690 IF INKEY(-99) THEN 1700 ELSE 1690
1700 ENDPROC
1705 REM_____Displays the time and distance trav
elled_____
1710 DEFPROCFINISH
1720 CLS
1730 VDU23;8202;0;0;0;0;
1740 PRINTTAB(10,13);(TIME DIV 6000)MOD60;" mins
";(TIME DIV 100)MOD60;" secs"
1750 PRINTTAB(2,10)"You have completed the course
in a Time of..."
1760 PRINTTAB(4,16)"You travelled a distance of 8
000 m"
1770 PRINTTAB(5,20)"Press ' Y ' for another game
"
1780 IF INKEY(-69) THEN 1790 ELSE 1780
1790 ENDPROC
1795 REM_____Displays a crash if a spectator is
hit_____
1800 DEFPROCCRASH
1810 FOR X=0 TO 100
1820 VDU19,0,RND(7);0;
1830 VDU19,4,RND(7);0;
1840 SOUND&11,-1,RND(100),1
1850 SOUND&10,-15,7,5
1860 NEXT
1870 CLS
1880 VDU20
1890 VDU4:COLOUR7
1900 PRINTTAB(0,9)"Due to the fact thatyou ran o
ver a spectator you have been disqualified
from the race"
1910 PRINTTAB(0,17)"Press 'Y'for anothergame"
1920 IF INKEY(-69) THEN 1930 ELSE 1920
1930 PROCCHAR:PROCSETUP:PROCVARIABLES:TIME=0
1940 ENDPROC

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Bookshelf

Disk Systems for the BBC Micro by Ian Sinclair. Published by Granada. Price £6.95.

This book on utilising disc drives alongside the BBC has been around for a few months but is now particularly relevant as more and more Beeb owners turn to discs as a storage medium. Ian Sinclair is steeped in detailed knowledge of how disc systems work with most micros that support them and is an ideal candidate to produce an introduction for the BBC.

Sinclair's knowledge of other micros (Tandy, Apple) enables him to go as far as advising on transfer of text (ASCII) files from one computer system to another (the Beeb's) — a complex process. At the other end of the extreme, great care is taken to explain in simple terms how the software handles disc storage and how the user can handle the software.

A great many disc drives are being purchased independently of the DFS, and documentation in most cases is poor. There are also two viable alternative filing systems by AMCOM and Watford Electronics. The author continually cites examples from these systems, usually in more detail than for the Acorn version. A case in point is the chapter on using disc utilities. AMCOM's package allows for direct disc surgery, with sector editing and the like, and is an ideal example. Much of the advice applies to using Disc Doctor or Disc Recovery.

An introductory chapter about discs and drives leads into a look at filing system commands. There are lots of examples to try out as you go along and hints on the thorny problem of tape to disc transfer. "Digging Deeper" investigates some of the more subtle uses of wildcards, COPY, BACKUP, RENAME and so on. It also explains some of the problems you might encounter, like "can't extend" messages — when a new, longer version of a file is SAVED with the same name, but the disc has not reserved extra space.

The book covers machine code programs, saving chunks of memory, *BUILDING !BOOT



files, text files (a whole chapter mainly concerned with Wordwise) and filing techniques. The chapter on the latter is clear, comprehensive and full of examples; the best contribution to a very useful guide for disc users new and old.

Interfacing the BBC Microcomputer by Colin Opie. Published McGraw Hill. Price £8.95.

The dazzling silver cover of this book disguises a highly technical but clearly presented look at interfacing the BBC. The book makes full use of line drawings, illustrating both general architec-

ture and complex circuit and program flow.

There are helpful tables (especially memory maps) in the text and the appendices. These appendices also contain the circuits and board layouts for the hardware projects introduced during the last section. Where relevant, chapters are concluded with a useful bibliography.

First off, there is an introduction to the basic micro system and a look at how the various elements communicate. It looks at 6502 operation, serial/parallel communication, Boolean logic, interrupts, A/D conversion types, TTL devices and buffers. Pretty comprehensive as you can

imagine. Anyone coming to interfacing anew need not worry since the author takes care to explain the basics before going on.

Time for FRED, JIM and SHEILA, those important I/O related pages of BBC memory. Colin Opie rightly emphasises the need to use O.S. calls rather than directly changing memory. The second processors are with us and changing software can be hard work.

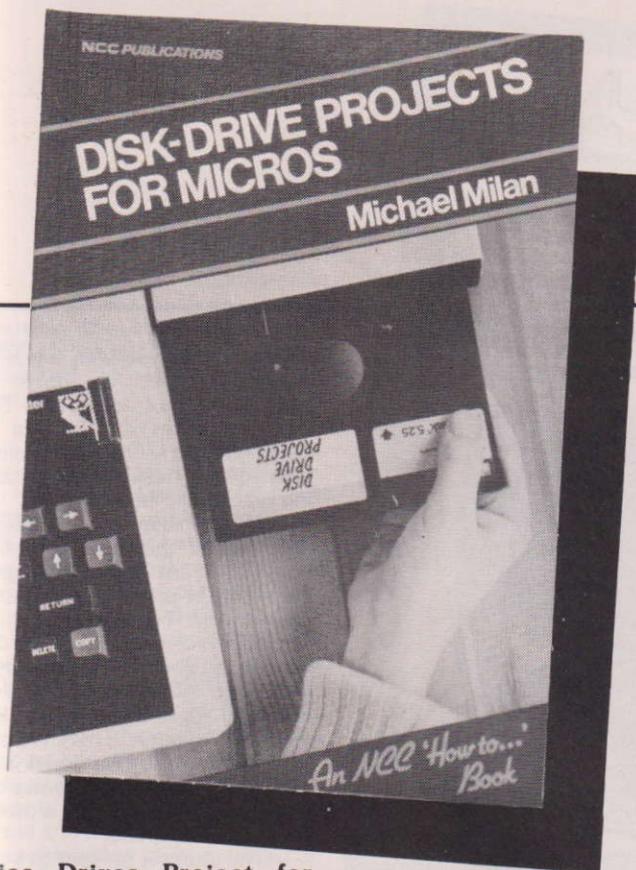
We get excellent and lucid accounts of the user and parallel printer ports, with circuit diagrams and pin functions. Same treatment for the analogue to digital port. For this part of the book you will need a general understanding of symbolic representation of components in circuit diagrams. The RS423 and 1Mhz bus are now investigated. The usefulness of the 1Mhz bus for control applications becomes clear and its design is explained in detail.

The hardware now over, Part 2 starts on programming it. There is clear tabular information relating addresses in memory to registers in the hardware. Each I/O port is treated individually and read/write routines listed in BASIC and Assembler forms. There is also line by line explanation in some cases.

The reading of this section results in a comprehensive study of programming the devices which link the Beeb to the outside world, analogue or digital, serial or parallel.

For Part 3, the publishers have got together with Watford Electronics to supply a motherboard and application boards so that theory can be put into practice. Real results do wonders for the concentration. The ready availability of hardware also makes the book a useful guide for self study or for work in the classroom.

If you are thinking in terms of using your BBC for control applications or you would just like to understand more about what is going on when you plug in your interfacing box, or even when Acorn come up with their home control system, then you can't really do better than getting hold of this book on the subject.



Disc Drives Project for Micros by Michael Milan. Published by National Computing Centre. Price £5.95.

Don't be put off by the title. No mention of a BBC? Nothing about the Plus 3? Whatever it says on the jacket, the picture is a dead giveaway. The whole book is based upon handling disc based information with a BBC Micro and Acorn DFS. If I owned another computer and bought this book on the understanding that there might be some worth in it for me, I might be very disappointed. As a BBC owner with disc drives, I can feel delighted.

The book covers everything you need to know about actually putting your disc system to work, it does not go into all the hardware and software details but helps you get your system up and running and only then pursues some more advanced features that discs provide.

There are general points about the sort of hardware available, and pointers on what you might need. The software side starts simply and extends up to the heights of software subtlety, random access filing.

This book would in fact make ideal documentation for any one of the current multitude of disc drives available for the BBC and Electron Plus 3.

This is one of a series of NCC publications which thankfully makes a point of not

jumping in at the deep end, leaving the reader, and proud owner of new disc drives, drowning in *commands, hex locations, sectors and cryptic abbreviations.

Each new element of disc use, from simple saving and loading, to complex file handling, is approached as from new. Throughout the book examples of what you will see on the screen are provided in the form of screen dumps. There are also a number of example listings which can be attempted by the reader as he/she works through the various commands now at his/her disposal. Having the power of disc drives available means that the user is tempted to do many things which seemed tedious when working with tape, like saving and loading screens.

High resolution screens take up quite a bit of memory and loading them in block by block from tape is boring. With discs it takes just a few seconds and is easy to execute. The book takes us into the areas of *SAVE, *EXEC and *SPOOL. Discs are more fun. Next up are serial files, another area where the speed of drives makes all the difference. This section and the next, on Direct Access Files, are full of examples and conclude with complete listings of useful filing programs.

The final project is a graphics drawing suite, which uses discs to store the current screen image.

Two quick appendices take in error messages and "other computers". Don't doubt it, this is a BBC book and a very good introduction to disc handling on all levels.

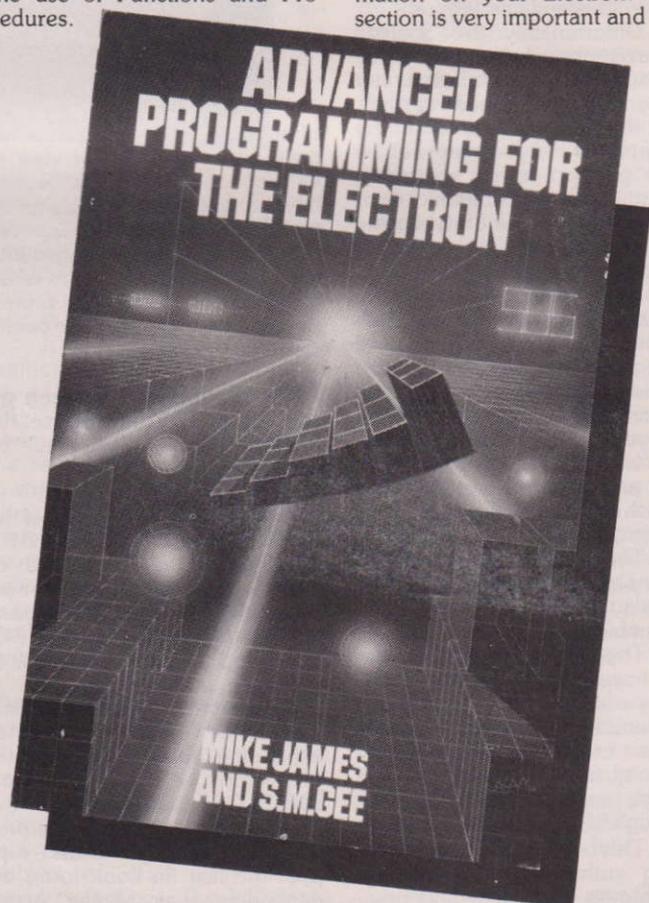
Advanced Programming for the Electron. by Mike James and S.M.Gee. Published by Granada. Price £6.95.

This book sets out to tackle the problems of writing larger BASIC and Assembler programs on the Electron. The authors' approach is designed to produce organised programs, carefully planned and designed before coding. They look for reliability through the use of the natural structures of BASIC, like REPEAT...UNTIL and FOR...NEXT, and through the use of Functions and Procedures.

book. The authors go into "step-wise refinement", testing and perfecting the individual components of the program. They discuss the use of parameters and local variables as well as the physical appearance of listings, formatting and use of REMs.

On the Assembler side, there are discussions on the natural structures of assembly language, details of how the Electron assembler can be used and a few paragraphs on Macros and some of the problems associated with implementing them.

As the book gets more involved, and the O level Maths get a bit strained, we move onto data types, arrays, look-up tables, handling a stack structure; everything you need to know about storing and accessing information on your Electron. This section is very important and well



The key to this organisation is the modular structuring and building of programs — a theme which crops up throughout the

explained, with lots of examples and step by step runs through.

CONTINUED OVER

USING SOUND AND SPEECH on the BBC MICROCOMPUTER



Martin Phillips

These techniques are used by every program worth its salt, from databases to arcade thrillers. A section follows on both BASIC and Assembler control of sequential filing.

An interesting contribution appears in the form of "Making Programs Work" — pretty important! It looks at the testing of programs, the location and eradication of bugs, common errors and program presentation.

Chapters eight, nine and eleven are based upon full-scale programs, Spelling Checker, Execution Tracer and Dissassembler. Each is built in stages, including design. All have major elements of Assembler (spelling checks are useless if they are slow) but use BASIC to hold them together and present them in an organised and understandable fashion.

Unfortunately the Spelling Checker, though it works, is, by the authors' own admission, not a completely finished version. Still, if you take all the rest of the information in, you may well be in a position to do something about it! The Execution Tracer takes up the theme of debugging and could be a useful program for the new programmer.

On either side of the Disassembler project are chapters on the MOS and on fundamental background in Bits, Binary and Boolean. The Machine Operating System and the part it plays in the everyday functioning of the Electron is explained. Work on OS calls and interrupt handling lead to the construction of a background clock.

The final chapter looks at binary hex and logic in relation to the way Acorn BBC BASIC and Assembler handle numbers.

The Disassembler itself does not have enough facilities to be really useful (but is open to improvement), but introduces some more complex programming techniques and the final result is good enough for "Leafing through" Electron software.

This book is for the programming enthusiast. Although the techniques discussed, and practiced throughout, would enable the writing of efficient programs

of all types, the approach is entirely from the point of view of writing code. It will be beyond anyone who is not already an interested and fairly experienced programmer. For the ambitious Electron programmer, who wants to acquire the skills of a professional, this book is an excellent start.

Using Sound and Speech on the BBC Microcomputer by Martin Phillips. Published by MacMillan. Price £6.95.

Perhaps it is the complexity of the SOUND and ENVELOPE statements in BBC BASIC or perhaps the romantic idea of sitting back for an evening's musical entertainment with your BBC, but sound/music books seem to spring up at regular intervals.

This one by Martin Phillips covers much of the usual ground, expanding upon the official explanations of SOUND and ENVELOPE, looking at the physics of sound and the programming of music. It also supplies the first (in book form) independent look at the Acorn speech synthesis add-on.

The explanations of sound are an interesting path into the BBC Micro's own production of

pitch, amplitude and timbre. The author has written some nice programs to graphically demonstrate the production of wave forms, including a representation of air displacement. This sort of technical information is interlaced with three and four line program examples as well as larger listings. As explained in the introduction, considerable care has been taken to provide well-documented and readable listings. The technical appreciation continues with a fascinating investigation into the whereabouts and functioning of the sound buffers and an highly accurate table of measured frequencies for note production, highlighting the inadequacies of the sound chip.

There is a brief appendix on the mixer and amplifier circuits and reproduction of the circuit drawings for sound and speech.

A chapter on assembly language control of speech is disappointing although it hints at the possibilities. Ian Birnbaum's assembly language book in the same Macmillan series will prove more fruitful reading for those venturing into this area, alongside the user guide. The use of macros for generating both speech and sound (something I

find a natural use with tables of encoded notes or parts of speech) is not covered. The author touches on the use of event handling in conjunction with speech, resulting in a "talking typewriter" program.

Music making on the BBC is difficult and the chapter in this book does not really investigate the theory or practise of programming music. Music and musical notation are introduced for the layman and much of the programming goes into producing graphical representation of (out-moded?) notation. There is a full scale program to play tunes and display the appropriate notes on a staff at the same time, a useful educational exercise.

The chapter on speech synthesis uses much the same approach as with sound. We get an introduction to the hardware, the methods of reproducing human speech, an analysis of speech itself and how the problems of storing it in computer memory have (to an extent) been overcome. There is a detailed look at how to use the words and parts of speech provided by the Acorn system, culminating in an example of how to implement a full speech application into your own programs. Speech is amazingly popular with children especially and does much to enhance educational programs. Games scores and high-score tables can similarly benefit. Reading this chapter will probably persuade a good many people that speech synthesis is a fair investment if you are willing to do some programming.

Informative on some points and original on others, this book would make an ideal first book about using sound and speech on the BBC. If you have already gone into sound, or already own the speech synthesis system, then much of the information here is already available to you. Nor is this book for music makers, unless to gain a more technical understanding of the internal operations of the sound chip and operating system software. If you have always fancied delving into sound or speech then Martin Phillips' book will prove a precise and informative partner.

CLIVE WILLIAMSON

GETTING THE MOST FROM YOUR BBC MICRO



THE INDISPENSABLE GUIDE TO YOUR HOME COMPUTER

Getting the Most from your BBC Micro by Clive Williamson. Published by Penguin. Price: £5.95.

Clive Williamson has done a fair job producing yet another follow up to the BBC User Guide. New BBCs are continually being purchased and new owners are still apparently being bewildered by Acorn's own manual.

If the user were to actually "take on" the User Guide then this sort of book wouldn't have much of a market. Most of the information here is paralleled in the guide. Yes, there are more examples and the flow of the book is more logical than the guide, but there is not enough difference to make it in any way an addition to the information or its availability.

There is a gap in the standard documentation which accompanies the BBC — filled nicely in the Electron package by Yazdani's Start Programming — but this new attempt to fill it is a lot less interesting especially on sound and graphics than its already established rivals from Prentice-Hall, Granada and Addison-Wesley.

Adventure Games for the Electron by A.J. Bradbury. Published by Granada. Price: £6.95.

This very impressive book is a bit more technical than its sci-fi cover suggests but this should not deter the Electron (and, I see no reason why not, unless Granada are going to come up with a BBC version, the BBC) adventurer from going straight out and buying it. If you bought Peter Kilworth's Penguin/Acorn guide then don't worry. There is some overlap in subject matter, naturally, but with both you will be as clued up on the subject as most.

There's the obligatory history lesson, Standford Research versus Massachusetts Institute of Technology. Colossal Caves versus Dungeon. The latter's Infocom language is compared with Melbourne House's English, found in the Hobbit. Language recognition is all part of the believability of Adventures.

Later in the book, chapter eight goes into the tokenising and

crunching techniques needed to squeeze "language" into a micro Adventure. This chapter presents some very interesting ideas and demonstrates them with a set of programs for encoding and decoding text/descriptions — similar methods, we are told, to those used by Level 9.

For those new to programming, there is a line by line analysis of each largish program. The method used is one of assigning character groups to ASCII codes above 127. A string analysis program lists the most common letter groupings and this information is used by the encoder.

Strings are stored above HIMEM in byte arrays and accessed with a pointer table. Electrons with only Mode 6 and not a lot of memory to play with, will especially benefit from this sort of crunching.

However, Adventure Games is not just about the coding. The author deals with the creative side, the necessary elements to maintain interest, the plot, problems and clues. He also looks at planning, internal consistency and comprehensibility. Creating characters, keeping track of movement, not just of

the player but other creatures, saving games, analysing player input; all these aspects and more are discussed with programming examples. Finally there is a chapter on limited use of sound and graphics.

It's fairly obvious that the author did not develop all his ideas on an Electron, or even a BBC. As an ardent adventurer, steeped in the American game, he reveals himself as an Apple owner. No matter. Even if he does use subroutines rather than procedures. Electron adventurers would not want to miss out on a wonderfully enthusiastic, breezily written and technically comprehensive manual on Adventure writing.

Drawing your own BBC programs by Jonathan Grieg. Published by Century Communications. Price £6.95.

Despite the rather strange title this is a good, interesting book on the subject of BBC and Electron graphics facilities. The 160 pages of main text split up into six main sections, each covering a major point of the machine's capabilities or of the mathematics involved in

using the graphics to get the effect that you need.

The first section "High resolution graphics" explains how the various PLOT and DRAW options work and how data can be scaled, translated and rotated to change its effect on screen. This section involved some mathematics and despite my being decidedly rusty on these matters it soon started to make sense and fall into place.

The next section is about "Block graphics" which are usually referred to as character graphics in the case of the BBC and Electron. Once again there was a good introduction on the subject of character definition and movement around the screen. Each part of the discussion is punctuated with short procedures or program lines ready for you to try the effect and experiment as you go along.

Then comes the section on colour and animation which starts appropriately enough with an explanation on how colour screens work. There follows an explanation of the various colour options available and their effects on the screen, including the use of truth tables for logical operations. This chapter closes with a discussion of the various types of animation that can be achieved by colour manipulation, a common technique on the BBC machine.

The following sections deal with the uses of graphics in other programs such as graphs and charts and covers the various methods of circle drawing that you might like to try. The section on three dimensional graphics was rather too mathematical for my liking but there were plenty of examples to try and a number of well defined formulae to use when writing your own programs.

The book closes with a chapter on the block graphics of Mode 7, therefore only of interest to BBC owners. This section was well written and contained a great deal of interesting information well presented with little programs to try.

All told this book provides a good introduction to the mathematics and programming

CONTINUED OVER

of graphics on these machines and whilst it isn't at a high enough level for those to whom the mathematics is relatively easy, I can see a number of young people and indeed their parents getting a good grounding in the subject from this text. Well worth the £6.95 for a good, steady easy-to-read book.

BBC Software Projects by Rudolf Smit. Published by Melbourne House. Price: £6.95.

It strikes me, after reading this book, that you shouldn't assume that because a company has a good reputation for producing software of distinction that they can also produce books about programming. This is a poor book by any standard, for all the reasons that I give below, but to have such a book published under this company's name is a double tragedy.

This is a teaching text with the avowed aim of giving you a good grounding in programming and in project management. It takes, what I am presuming is, a rather unique approach to its teaching. It proposes a project and then gives a full description of the program required but doesn't actually provide the program. That is where you come in and the book is therefore comprised of six projects all in a half finished state. This is a good idea and if done well would be an efficient and involving way of learning to program. Unfortunately here it is not well done and the book is riddled with contradictions and mistakes, enough to leave me feeling that it was rushed onto the presses without anywhere near enough checking and attention to detail.

There is a program that makes no sense at all because part of it is missing, there are wrong line numbers mentioned in the text and there are even mistakes in variable names. All of these could be simple typing errors but it doesn't stop there, there are errors of fact included too. The book states, quite firmly, that you cannot have DEF FN code, ie used defined functions,

that aren't in the first procedure called. This is nonsense, if they are initialised in this way they work faster, but to say that they cannot be anywhere else is fanciful. Add to this the fact that the book is about good structured programming yet there is not one mention of input validation and you have real problems.

The projects in the book claim to be interesting but, to be honest, they are boring and I think that most readers will find them this way too. The first three

projects are simply variations on a theme, data storage, and simply change the method from project to project. The level of the text is low as you might expect but there are a number of restrictions placed on the programs that you have to write. A good example of this is the way that variable names are specified, in order that the rest of the program can use the same names. This too would be fine, if the author actually practised what he preached — he suggests the use of long and

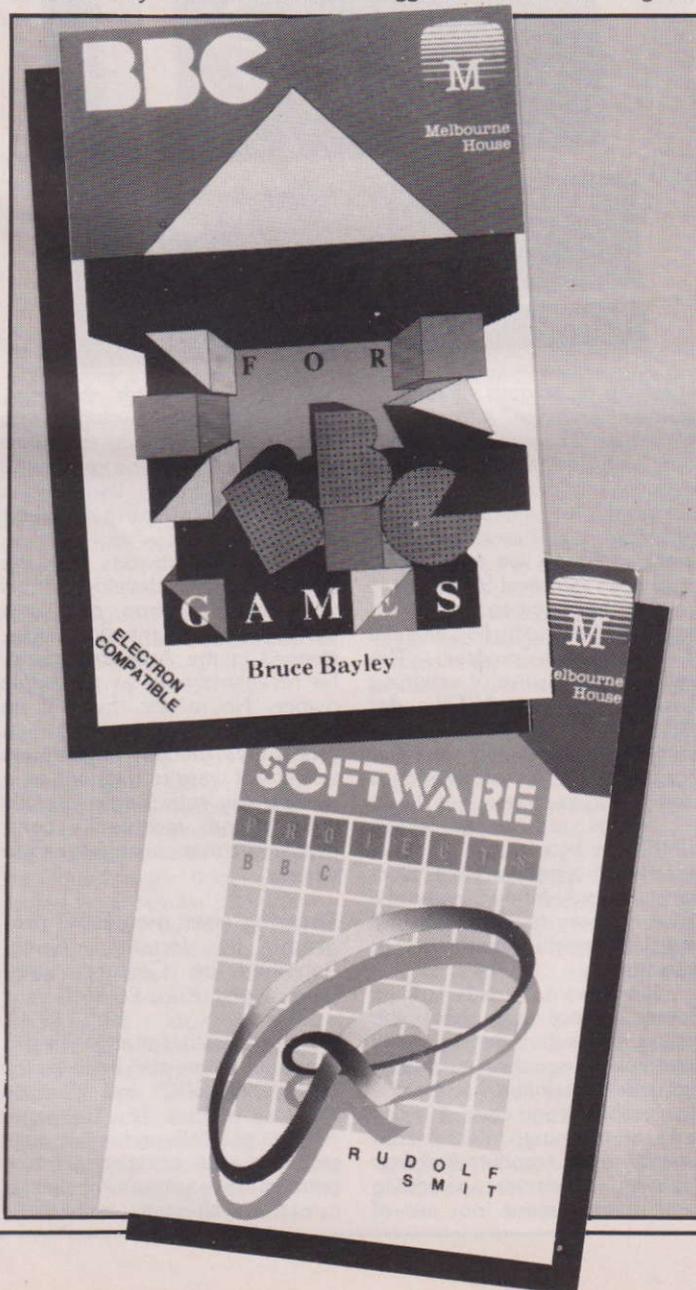
meaningful variable names yet regularly uses single letter names himself. That isn't the end of the list but I've run out of space. This book is based on a good idea, in teaching terms, but it has been so badly thought out as to be rendered useless.

Building Blocks for BBC Games by Bruce Bayley. Published by Melbourne House. Price: £8.95.

This book, "for all BBC enthusiasts" according to the blurb, suggests that one way to make games writing easier is to have a set of pre-programmed modules to do the common jobs within a program. Then it goes on to show how the modules can be used to provide "exciting and original games". Far from being exciting and original, games like River Frog, Luna Landa, Simon and Brick Out are more likely to elicit a groan than a smile in this day and age.

The first section of the book on programming and how to manage a game writing project is fairly good and accurate. The diagrams are clear and the use of good programming structure is emphasised. I do wish though that authors wouldn't confuse "Top — Down design" with "Structured Programming", there is a difference. The last part of this chapter contains a procedure called "chexsum" which is a method of checking programs as they are input and seeing where any typing mistakes might be. This is a great idea for machines that have a poor error reporting system, which cannot be said of the BBC or Electron machines. With these machines the procedure is almost redundant as the reports tell you a great deal more than a checksum ever could. It helps the writer however, each program is followed by the full "chexsum" list and by my quick calculation that takes up over 20 pages of the book!

The next section contains three utility programs, a character definer, a sound definer and a background builder. The first two are both reasonable but are far less well organised and capable



A BEGINNER'S GUIDE TO



than a number of such programs that you have read in magazines. The character definer will give you the VDU 23 lines for the characters but will not allow any colour changing within a character. The sound aid allows you to redefine envelopes but only the pitch envelope section. This is probably because the amplitude envelope is fixed on the Electron but means that it is less flexible than most others I have seen. The background aid is a very strange invention for developing DATA lines to be used to draw backgrounds in games.

The actual program modules themselves are a surprising collection to say the least. They comprise modules to move a character around the screen, clear a message off the screen, build up a deck of cards, pick a card from the deck and build backgrounds from DATA lines. Apart from a machine code version of the move module that is it, five modules. No mention of high score tables, multicoloured sprites, title screens, instruction routines etc. The routines seem to work alright but they leave a great deal to be done by the programmer. In a matter of minutes I could produce a list of modules of far more value than these.

Even the author doesn't exactly use them extensively. Of the seventeen finished games in the book, five don't use any of the "building blocks" and only a couple use three of them at once. By far the most valuable is the movement procedure, which is called different names in some parts of the text! This is rather too little a core on which to base a book and as such I could only recommend it to those who are interested in having a collection of simple listings to type into their machine. Don't think that you will learn a great deal from doing so however, there is a very minimum of program documentation. Save your money.

A Beginner's Guide to the Acorn Electron by Richard and David Graves. Published by Kingfisher Books. Price: £2.50.

This simple and practical guide

provides a useful introduction to learning to use the Electron. It was written by a teacher with the help of his 11-year-old son because they found many of the standard books on introducing programming were far too complicated. It gives step-by-step instruction on writing simple programs, using number and string variables and producing sound, colour and simple graphics.

The book is written in a light style and its colourful pages are filled with humorous illustrations. While it will be helpful for beginners of any age it is clearly aimed at young people. The reader is taken through the chapters in stages from initial familiarisation with the machine to a final summary of programming words, and a series of problems and solutions runs through the book. Each chapter ends with "A reminder" to summarise what has been taught.

Although the book gives clear explanations of what it is teaching, the text is as brief as possible and filled with practical examples to keep children interested. As early as the second chapter, three very short but complete programs are given to show what the computer can do with colour and sound. The theory is detailed in later chapters

but hopefully readers will be encouraged to continue through the book if they know what they have to look forward to. Longer programs in the later chapters include a guessing game demonstrating both number and string variables, a birdsong program using procedures and a "ghosthunt" program which contains examples of everything taught in the book.

At just £2.50 this book would make an ideal gift for any young person who is beginning to realise that there is more to computers than just playing games. If they can understand and appreciate all that is explained, they will be well on the way to writing their own simple programs.

The Better Guide To The Acorn Electron by Geoff Bains. Published by Zomba Books. Price: £3.95.

This book, described as the "alternative user's manual", explains how to use the Electron without assuming any previous knowledge but only an interest in the subject. It is written in a light, straightforward and conversational style and takes the reader through the most popular aspects of programming, with plenty of encouragement to experiment

further.

The guide covers every topic in detail, starting with a simple explanation of how a microcomputer works and continuing through using the keyboard; words and numbers including real, integer and string variables and arrays; using the screen for display; modes and colours; sound facilities, music and noise; graphics; data-day programs, animated graphics and finally converting BBC programs to run on the Electron. The book is concluded with two appendices explaining how to load, save and catalogue programs and how to compact programs to save memory and speed up running time.

Each chapter starts with an illustration but after that the pages are crammed with text, broken up only by programs and occasional diagrams and tables. The book's design will not appeal to young people but those who want to read as much as possible will appreciate the value for money it offers. Any beginner with enough concentration and interest in the book could go through it page by page and feel they had learned a great deal at the end.

It is not a very easy book to pick up and put down, mainly due to the poor presentation. There is no contents page or index and no summary of what each chapter explains. Even the chapter headings do not shed much light on their subject and there are no sub-headings to break them up. It becomes very annoying when you can vaguely remember reading something useful and want to check it again but have no idea where to find it, and chapters titled "Graphic Details" and "More Graphic Details" don't really help. This is a pity because the text is enjoyable to read and makes the subject matter interesting and appealing.

The book will be useful to anyone who has bought an Electron and wants to learn how to use it fully, but finds the User Guide rather dry. While it could be improved simply with better presentation, it is well written and

CONTINUED OVER

provides very clear and helpful instruction on the various aspects of simple programming.

Basic on the BBC Micro
Further Basic on the BBC Micro
Assembler on the BBC Micro, a Beginner's Guide
 by Richard d'Silva. Published by M.U.S.E. Price £1 each, £7.50 for a set of ten, or bulk rates for 30+.

Micro Users in Secondary Education is a well-respected body, leading as it has the development of micros in schools. These pamphlets are produced as a very inexpensive source of teaching material for a group of children beginning to learn on the BBC Micro. The idea, obviously, is that each student should have an individual copy of the booklet, and in that way it turns out to be a very cost-effective scheme.

Mr d'Silva is a teacher, and obviously these booklets reflect the way in which his teaching has ironed out all the wrinkles that most teachers find in their working. My one source of a little concern is that some of the Model A, but there again, I suppose there must be a few of those still around. Each TASK appears to be about right for a lesson, albeit a slightly short one, and appears to be quite self contained. This is followed by a section of further ideas which the student should try. As with all activities of this nature, it is during the experimental stage that real learning takes place. Short instructions are given, but these should generally be sufficient. There will presumably be a teacher around anyway to deal with problems. Again more information on the commands can be found from the User Guide.

I like the level of advancement between subsequent lessons in the first booklet. This continues into the second Basic book, but I think many students might find the TASKS in the Assembler booklet a little demanding. All in all, this is a

novel idea, and many less confident teachers might well benefit from Mr d'Silva's buoyant style. Even those teachers with their own strengths might find his ideas a welcome alternative, being clear yet concise. Above all, I am sure the student would find the process enjoyable and would benefit from having the text constantly available.

Business Applications on the BBC Micro by Susan Curran and Margaret Norman. Published by Granada. Price: £7.95.

I cannot recommend this book to anyone who is seriously thinking of using their BBC for business and I think it would bore the rest of the Beeb user community stiff.

It is almost entirely a descriptive work. It describes the general functions of wordprocessing, keeping accounts and so on. This is partly culled from a similar book for the Commodore 64. It also describes various pieces of commercially available software for the BBC plus DFS and the

BBC plus Torch Z80 disc pack. There is software from Gemini, MicroAid, BBC Publications, Acornsoft and Software for All as well as many of the CP/M favourites.

Unfortunately there is no comparison of products unless you wish to do the job yourself. Nor — and the author confirms this for us — can we rely on the packages having been fully tested. Much information has merely been culled from the manuals and we know how reliable they are!

The book has tried to keep up to date but recent interesting releases such as the Acorn Z80 software, DataGem, Sage, and Systematic, are not included.

Nor can such a book take time off to explain about business practice or give advice on installing a computer system. As it stands it is more a compendium of commercial software, and to be fair, not just an uncritical one.

There is no doubt that a substantial amount of information is packed into the book but I think a few telephone calls to the com-

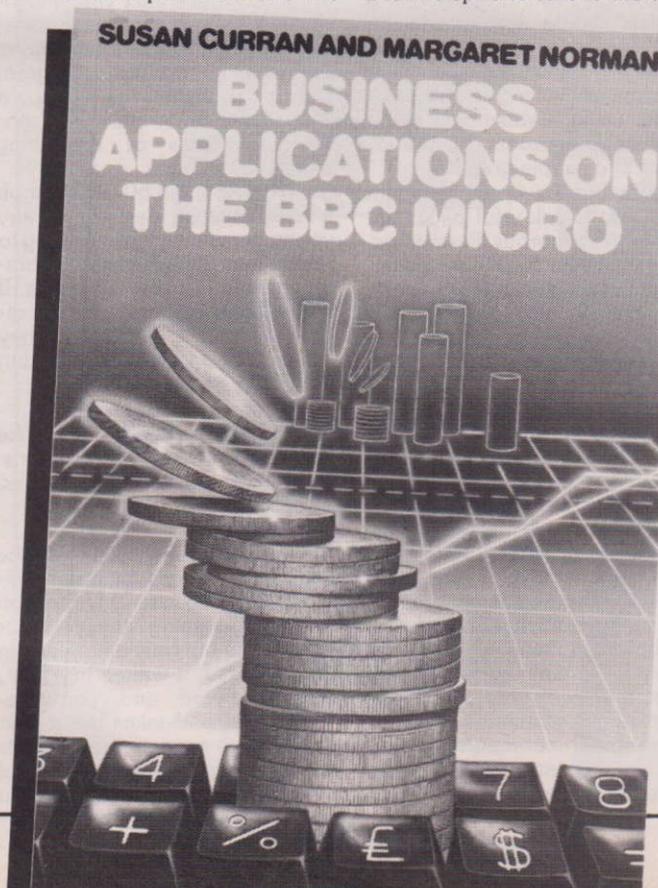
panies concerned would result in a substantial bundle of sales literature and spec sheets (up to date) and would save you the £7.95.

Using the BBC Micro in Education by Don Thorpe. Published by Interface Publications. Price: £5.25.

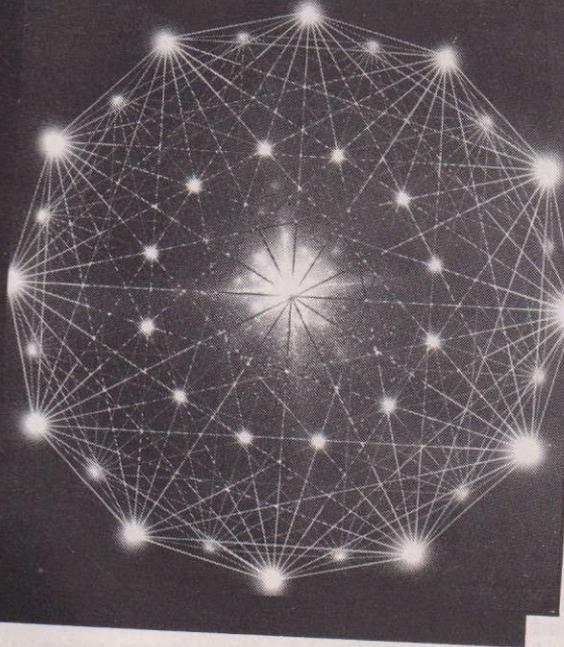
I have never read a book quite like this before! I started to read, expecting to find the usual mish-mash of educational programs, or sadly what is often passed off as educational, with listings of these ready to type in. Instead, I found myself as a teacher being drawn into this book, which attempts to show how a course of study might be set up using a BBC micro, or two. The course is explained in detail, but this is only one of four sections within this book.

The first section is rather sadly called "First steps in a new land", a title which hardly helps to lessen the aura of mystery surrounding micros in schools. I found that this section would be extremely interesting reading matter for a non-computing colleague, but I was also shown a couple of ways to looking at things anew myself! Who says old dogs can't learn new tricks!?

Running a first course in BBC Basic is indeed a challenge. I have attempted to teach some elements to young children, and am currently teaching computer programming at night school, where my class includes a gentleman of 75. This course is aimed fair and square at school, but the general points of consideration are very similar. Some seem quite important to consider, such as the establishing of rules, and the importance of "games", but other questions such as "Should a charge be made for damage?" seem to be beyond any general answer in a book. The explanation of Keywords begins in promising fashion, but I was unable to follow the train of thought which the author followed. Most of the information in this part would perhaps be better gleaned from the excellent User Guide, which is not too difficult for Secondary school pupils.



FILING SYSTEMS AND DATABASES FOR THE BBC MICRO



The third section is entitled "Designing an Educational Program". Here, I feel, the author has assumed that his audience are perfectly conversant with BBC Basic, because little explanation is given as to the use of certain instructions, and yet the same audience is assumed to be incapable of designing a title screen! I found this a rather odd approach. However, Mr. Thorpe redeems himself with a rather nice selection of special effects demonstrations. These provide enough information for the keen teacher to adapt to his own personal purposes.

The final section describes the system employed by the author to set into motion the writing of a program required by a non-computing colleague. I confess I have always steered well clear of this kind of activity, as I generally seem to be working a ten or eleven hour day anyway, what with lesson preparation and marking etc. Should the reader be foolish enough to bite off even more, then this section might perhaps finally put him off! I found this final section out-of-place, and would have been happier if it had been left out.

Overall, this is not a great book, but there is enough of interest and contention to enliven many a staff meeting!

Filing Systems and Databases for the BBC Micro
by A.P. Stephenson and D.J. Stephenson. Published by Granada. Price: £7.95.

This time last year the sole database contender for the BBC was Psion's Vufile. It's still a best seller but now just one, and a limited one, such program amongst a sea of software.

While the BetaBases, Star-dataBases, DataGems, Indexes (Indices?), Record Keepers, Club Managers etc etc, were being hatched, the Stephenson partnership spotted the trend. They produced a book of great interest to those who use the various aspects of the BBC filing system, in programming or in using one of the many databases, spreadsheets or even save facilities in an

Adventure, or the loading of data from tape or disc into a main program.

The book looks at the physical methods of storage on cassette and disc and the design of filing systems around the requirements of the potential user. Each chapter has the familiar and welcome summary of points and self-test section.

Anyone coming new to this area will find a clear description of both the concepts and specific programming methods employed. We start with a simple RAM based sequential file (the RAM based Vu-file remains the best bet for tape users) and build on it, introducing more complex functions, opening and closing files, reserving space, taking orders from a menu, selecting, amending and searching records. All these tasks are coded within PROCedures and FN's and the listings not difficult to follow. A full implementation of a RAM based system is listed and the programming and operation explained.

As a footnote to this program the authors introduce the idea of reserving space on disc for more than one file. This is taken

up again later, after a lengthy chapter on searching and sorting. It's actually nearly all about sorting. Different sorts are demonstrated in BASIC and machine code, with timings for various combinations of data, indicating their relative efficiency.

Back to file types with serial, sequential and indexed sequential files. Full examples of a serial and indexed system are listed and the definitions gone into in great detail. At this stage I would have appreciated some shorter examples to type in, to clarify the rules of operation I was reading about, rather than have to tackle another long program. I decided to work out some of my own, but this might put off the beginner.

The final example is of a direct access filing system with fixed length records. The limitations of this system lead to the introduction of hash-coding techniques and tombstone markers. I will leave the authors to explain them.

For me this book greatly improved my understanding of the techniques being employed in the filing system software I use with the BBC. It may also encourage me to have a go myself

sometime, to add my personal version to the many already available. The problem with any system is a certain lack of flexibility and personalisation may be the answer. This book will supply the know how, you must supply the task and the time.

Educational Programs for the Electron by Ian Murray. Published by Century Communications Ltd. Price: £6.95.

Ian Murray is a secondary school teacher, and was at a London school when these programs were originally written for the BBC micro. They were tested out in the classroom, and proved to be very successful, according to the author. However, I would imagine that Mr. Murray himself must be writing rather better programs than these nowadays. They give the feel of early, "pioneering" work with a new micro, as the BBC was then, but they now appear to be a little old-hat.

It's not that they are bad programs, some have a fairly good style, but for educational purposes they are not written with much clarity. Also, I would question the educational content of some, although they might therefore appeal to a wider audience!

Quite a few are long, but those with slow fingers will be able to obtain a cassette for a further £6.00. Certainly the long Stockmarket program is well worth typing in, but it does run to about nineteen pages! You have to be dedicated to give your fingertips that kind of bashing.

None of the programs appear to be scaled down for the Electron, but I've not seen the full BBC versions. I would imagine that the BBC listings would make a little more use of sound, for instance, than the new listings in this book.

Overall, I am torn between a great admiration for some of these programs, clearly written and free of errors, and a feeling of surprise as to why others are included in this same volume. I feel that Century might have done better to prune down the number of programs, and to throw in the cassette for free.

Edsoft

Reviewers this issue: Dave
Carlos, Mike Kent

SOFTWARE FOR STUDENTS

Title	Revise GCE/CSE Mathematics 1 & 2
Publisher	Acornsoft/Ivan Berg
Machine	BBC or Electron
Price	£12.95

Any program aimed at this particular market has to go for a fusion of two separate concepts — those of teaching, or revising in the case, a concept by giving examples and detail and the concept of testing to see if it has been learned adequately. In the past I have seen packages that do the first very well but skimp on the second and vice versa. This package seems to have got the balance just right and has done it in a very attractive and interesting way.

Don't think that these programs can replace good teaching or hard work, they can't, but they might be able to make some of the boring bits seem just a little more enjoyable. The package is based on a menu program from which you select the topic or area of the syllabus that you wish to cover. The range is comprehensive and whilst I cannot give a full list, some of the topics are; Arithmetic, Algebra, Geometry, Trigonometry and Statistics in Part 1 and all these plus Matrices and Probability in Part 2.

On selecting the area, you are told to insert the data tape and the correct section is loaded. There then follows a number of tutorial screens explaining the area, sometimes with graphics. On occasions there may be other "overlay" screens which you can select. At the end of each section there is a test of ten questions on the material covered. These contain references to the appropriate section of the tutorial and the screen can be recalled by pressing the f0 key.

It is at this point that the quality of the package starts to show for, besides the main screen, pressing Escape takes you to a "scratchpad" where you can enter expressions to be evaluated just as you might on a calculator. These are left on the bottom of the screen so that you

can use them in your answers. This is a good idea and I'm surprised that some other packages haven't featured it too.

The final selection from each menu is an examination made up of twenty questions to be answered in one hour. Once again this is a good idea and the questions cover those areas in the tutorial sections. There is a range of question types and they are selected at random from the store within the data tape, meaning that the option can be used more than once.

The quality of good educational software is obvious at every turn and this package has that quality. I have no reservations at all about recommending its use to all those who need such a suite.
D.C.

Ratings Table:

SOUNDS	N/A
GRAPHICS	80%
DOCUMENTATION	80%
VALUE FOR MONEY	90%
OVERALL	95%

Title	The Magic Sword
Publisher	Database Publications
Machine	Model B/ Electron
Price	£8.95

Adventure programs can often command children's attention for much longer periods than the average educational program, as they demand careful and logical thought on the part of the child.

The Magic Sword is a very nice example aimed at six to ten year olds, with the package consisting of a book and a tape, one side of which is for the Electron and the other for the BBC.

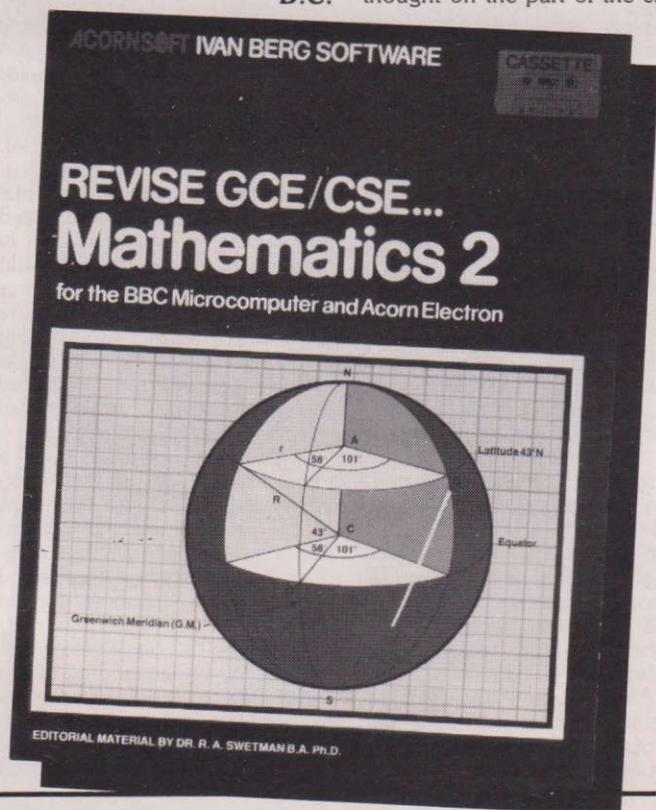
The storybook tells of Princess Poppy, who is lonely because she has nobody to play with, since everybody else is too busy preparing for her birthday. Eventually, she meets Prince Fred and they play a game of hide and seek. In trying to find the prince, she is captured by Bad Bertha the witch and locked in a tower. Bad Bertha soon discovers Prince Fred too, and steals his magic sword before turning him into a frog.

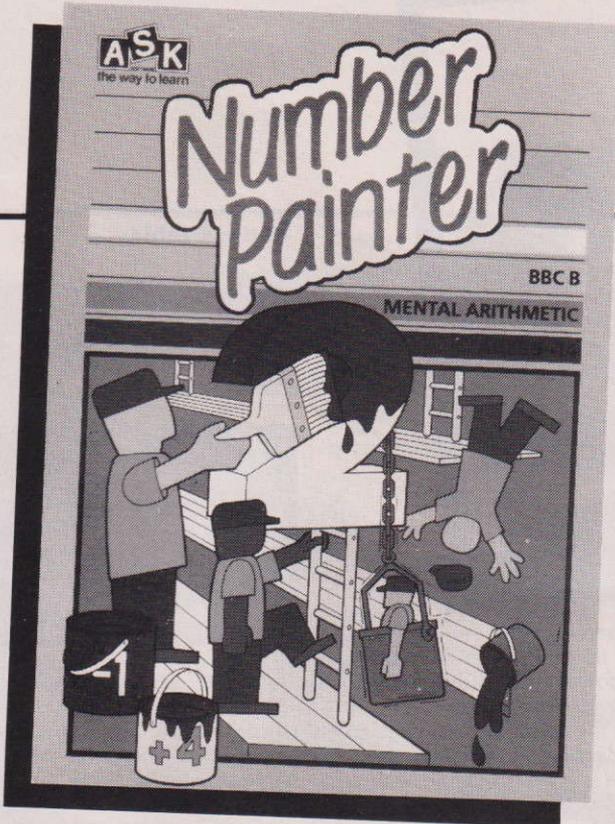
Here the story ends, and the computer program takes over. The idea is to find your way around the witch's house, collect her magic objects, and then use them to rescue the prince and princess, ultimately banishing Bad Bertha for ever!

Since the program is designed for children I read the story to my "review group" of infants and juniors in my school. They listened with great interest because the story itself has all the ingredients children like and is colourfully illustrated.

"Okay, everyone," I said as the story ended "Off to your Acorns to deal with Bad Bertha!" The children set off enthusiastically, and I wandered from group to group watching their progress, though as there aren't any additional guidance notes for teachers or parents I was as much in the dark as they were!

The program begins with an introductory page giving instructions and outlining the object of the game. Though the direction moves, etc, are the standard adventure ones, the children found it best to make a note of them initially, since you can't get back to them half way through the game. The program is written in Mode 7, with large chunky lettering, good use of colour and simple but effective block graphics. At each stage you're told where you are and shown a picture together with a compass illustrating your next direction options. The sound effects are sim-





ple and perfectly adequate as you wander into each room, and there are several nice touches of humour, too. Try to pick up the frog, for example, and the computer responds with "Ugh... you wouldn't, would you?"

Initially, many of the children kept going back on themselves, and ended up being burned to a cinder in Bertha's oven. But more progress was made when they realised it would be a good idea to draw out a plan of the house as they discovered where each room was, and they soon began to collect some of Bertha's magic objects.

To date, nobody has actually managed to complete the game, and there is possibly an argument here for more comprehensive instructions to aid the teacher or parent, especially those new to adventure games. It can be very frustrating going round and round in circles, or collecting objects and not being sure what to do with them!

Nevertheless, the children haven't tired of the game, and the package is good value for money. We have bought a copy for our school software library, and it would be a worthwhile addition to the collection of any parents wishing to wean their offspring away from alien zapping!

M.K.

Ratings Table:

SOUNDS	60%
GRAPHICS	60%
DOCUMENTATION	50%
VALUE FOR MONEY	80%
OVERALL	75%

Title	Number Painter
Publisher	Acornsoft/ASK
Machine	BBC or Electron
Price	£9.95 cassette, £11.50 disc

I have to admit that I have been impressed with the vast majority of the output from this company both in terms of content and quality. Yet for some reason I don't feel the same enthusiasm for this program.

Although it is aimed at the five to 14 age group, I can really

see it being most useful with the seven to 11 year olds. The aim of the game is to make a target number from another number by adding, subtracting, multiplying or dividing your current score using the various "flags" that you find around the screen. In order to make the whole idea more motivated the game is based on a ladders and levels type screen with a little man painting the numbers that you need. Time is marked by the raising of a bucket and can become a problem on the higher levels. You have three men to work on each level and are automatically moved to a higher level if two or more are successful.

The game is fairly good and the graphics are exceptional for this type of game, looking almost as good as those you might find in an arcade game. The problem is that this company already produce a game of a very similar nature in number gulper and I cannot see why they should have brought out the same game in a different guise. I also feel that there is too little control for the teacher or parent over the level of difficulty of the task presented. The early levels contain addition and subtraction whilst the later ones have more multiplication and division. It would have been nice and possibly more useful to have these user selectable.

Finally, I cannot see how it is possible to see whether the child is achieving the result without watching them all the time. This can be important, especially as the game is supposed to teach that repeated addition is inefficient when compared to multiplication. A good fusion of arcade and educational game concepts but I'm not totally convinced that it won't encourage bad habits if used unsupervised.

D.C.

Ratings Table:

SOUNDS	80%
GRAPHICS	90%
DOCUMENTATION	80%
VALUE FOR MONEY	70%
OVERALL	80%

Title	Make A Face
Publisher	Spinnaker Software Corporation
Machine	Model B/ Electron
Price	£8.65

Make A Face is one of the range of "Learning Tree" programs from the Spinnaker Software Corporation and, although it comes under the educational

banner, is more of a fun activity than a learning exercise. The program will run on the BBC or Electron, and is the computer equivalent of the magnetic toy we bought as children, which made thousands of faces with iron filings. Hands up those old enough to remember!

Once the program is loaded, the top right section of the screen shows a blank face shape, and there are three options on the menu. The first is for actually compiling a face, and the child can choose from a variety of mouths, ears, noses and hair styles until something is found that appeals. Once the face is completed, Option 2 will animate it. The face can wink, frown, smile, cry, wiggle its ears or poke its tongue out, accompanied by suitable sound effects. Alternatively, the child can program a series of actions, including delays if wanted, by typing the initial letter of the required movement into the box shown on the middle of the screen.

Finally, a game is provided as Option 3, which is a variation on the "Simon" theme. The face will perform an action, and the child has to remember which feature moved and then type it in. If the answer is correct, the face will then move two features, and so on.

The program was tried out with a class of very young infants, and initially they found the on-screen instructions a little confusing, though all became clear once the teacher had explained it a few times. The children had the most difficulty with Option 3, as the actions happen fairly quickly, and caused much amusing discussion about the order of movement. After a while though, the more able children began reaching scores of five.

The tape is inexpensive, and being designed for both Electron and BBC naturally means a few compromises. The face, for example doesn't do justice to the excellent graphics capabilities of the Beeb or make full use of the sound. I don't think any of the options would sustain interest over a long period, especially as

CONTINUED OVER

MAKE-A-FACE



there are more effective (though more expensive) versions of the "make a face" ideas around. Young children tend to like things big and colourful, and this program is a bit lacking in these departments.

Kids On Keys (what a dreadful title!) is for three to nine year olds and has three simple games for learning about words, though I would be a little concerned if nine years olds in my school hadn't progressed beyond the words here! Again, the program is suitable for BBC or Electron, and the first game has numbers and letters floating down the screen. The child has to find the letter or number on the keyboard, and then type it in. After fifteen numbers and letters, a balloon carrying a little boy displaying a word appears. If the child can type in the whole word, extra points are gained. For children who pick up the idea quickly, the dropping speed can be increased. Even so, you can only have three or four letter words.

Game 2 is a variation on the first, with small pictures of objects such as a lamp, a key, a plane etc slowly gliding down the screen. The child has three chances to type in the first letter of the object, and if enough points are scored there is a bonus round where only part of a picture is shown.

Game 2 has, in fact, a reasonable degree of flexibility, since there are four levels of difficulty, and in the harder levels the entire word must be typed in.

The final game shows pictures which are numbered from one to five. A word appears on

the screen, and the child has to type in the number that identifies it before the word disappears. As before there are three chances to type the correct answer, the scoring decreasing with each try, and there is a bonus round with partial pictures if the child is successful.

The instructions provided with these tapes are very good, and there is no doubt that the programs could be helpful in an infant classroom, or with slightly older children who have learning difficulties. The graphics are less than exciting though, with a limited use of colour, and it is sometimes difficult to recognise the objects. Balanced against this is the fact that the tapes are reasonably priced.

M.K.

Ratings Table:

SOUNDS	50%
GRAPHICS	40%
DOCUMENTATION	70%
VALUE FOR MONEY	50%
OVERALL	55%

Title	Chemical Equations
	Graph Plotter
	Gore Point
	Projectiles
Publisher	Garland Computing
Machine	Model B
Price	£11.75 disc

As the use of computers in schools becomes more widespread there are a number of companies who want to provide software for schools covering areas of the curriculum that might not be associated with computing at first glance. The major criterion in my mind as I review these programs is whether the task concerned can be done well on a computer or is it a rather contrived use of such a machine. Most of the programs in this selection are fair uses of a machine but that doesn't mean that everything in the garden is wonderful.

Each of the programs is supplied on a cassette or disc with a six or eight page manual, most of

which are printed straight from the typescript. Each loads by the usual SHIFT/BREAK principle, you would probably be surprised by how many programs don't even do this simple thing, but then the problems begin.

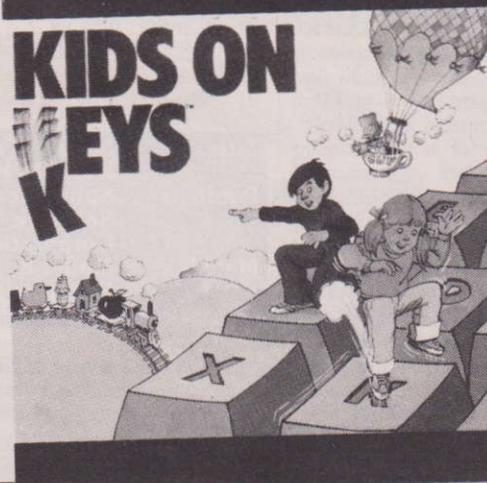
Garland use a standard header program that lists the programs on the disc and then allows you to select which one you want from this list. It instructs you to use the cursor keys to move the bar up or down. This is fine when there is more than one program on the disc but in the case of three of these discs there is just one program and try as I might, I couldn't get the bar to move. Silly, I know, but it wasn't until I saw the fourth disc that I worked out the problem. It is touches like the tidying up of details that sort the wheat from the chaff in this field.

When I finally got the first program loaded I was rather impressed by "Projectiles". The aim of the program is to demonstrate the movement of a mass, with a given horizontal and vertical force, over time. The program accepts a huge range of values and displays the result in three different ways.

Firstly you see the movement in real time, as it were. Then you see the frame by frame build up to the movement and then you see a stroboscopic photo effect at 0.2 second time intervals. The most fascinating view of all is the scaled stroboscopic display on which the time and height values are displayed. It is possible to dump this picture to an Epson printer if you wish. From this you are able to set new values and watch the effect. It is also possible to include or exclude the effect of gravity on the movement. In all this is a well designed program that will be of use in most physics courses and possibly a number of maths ones too. The one criticism that I would make is that it doesn't really go far enough in some ways. I'm certain that a version that showed two projectiles and their interaction would have been of even more use and certainly of greater interest.

The Gore Point program has another fascinating screen display, though in my opinion it is

KIDS ON KEYS



SPINNAKER
We make learning fun.

not as well designed as the first. The aim of this program is to demonstrate the effects of changes in distribution of five seashore organisms in changing exposure and fresh water flow conditions. It is a long time since I sallied forth with my quadrat to count *Balanus Balanoides*, barnacles to you, on a wet Yorkshire beach and I cannot say that I long to repeat the experience. I am convinced, however, that there is no substitute for wet feet and frozen fingers and I would want all my pupils to have the experience once. That being said, this program can do "what if" type calculations that would be very difficult to simulate in any other way and therefore will have a place in many school curriculums.

There are several types of display available, from all the species to just one, and there is the ability to display a readout of the critical values of salinity, amount of over and exposure to sea water too. There is very little text in the program and this is a fairly good idea. The mode two screen is not the best of display mediums but the species, or more precisely families, are easy enough to see.

I really cannot recommend the Graph Plotting program. It is basic to say the least and whilst it does make a very good job of the Polar Graphs I cannot believe that it is meant to compete with some of the other programs that have similar functions. Graph Easy is better in almost every aspect and has much better documentation to boot! One to miss I feel.

The final disc contains three programs in total and I cannot say that I am impressed by these offerings either. Called Understanding Chemistry, the programs should really be titled Understanding Chemical Equations, for that is all that this package contains. I have no objections to the idea of teaching this type of concept using a computer, although it can be done perfectly well on paper, it is simply that there is much more to the understanding of chemistry than just formulae.

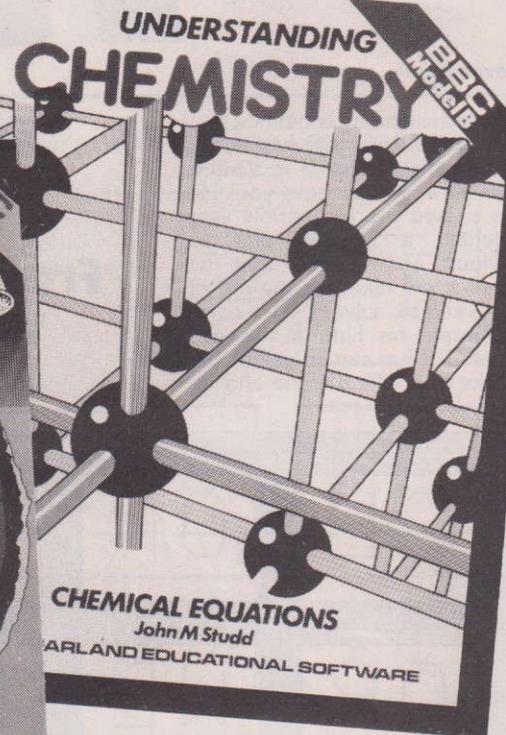
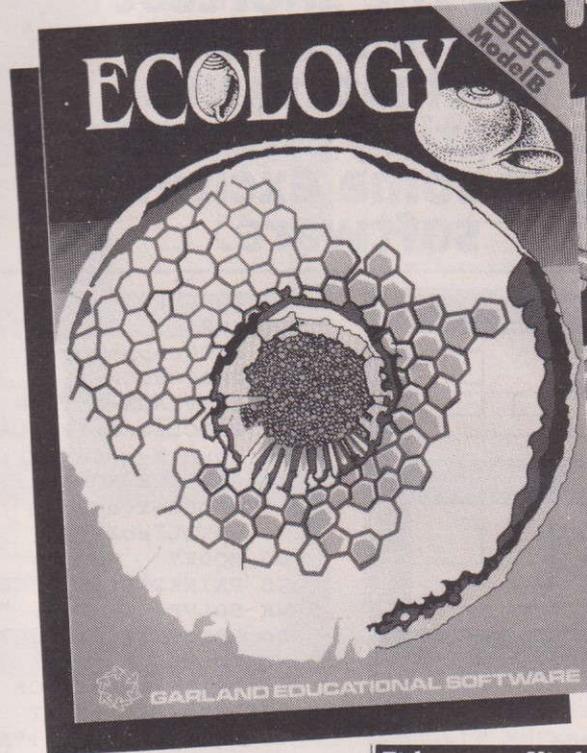
The first program is a com-

bination of tutorial and testing and gives a display of the major points that should be kept in mind when working out the formula. The other two programs are simple variations on a theme. In the first you have to choose which set of formulae and then which one within the set that you want to try. In the second, you are given a test of ten questions selected from all the formulae in memory. All very standard stuff and whilst neat and well thought out there is little to excite anyone in these programs

End of term, or at least review, report for Garland reads, should try harder to interest the pupil and extend ideas further whenever possible. **D.C.**

Ratings Table:

SOUNDS	N/A
GRAPHICS	70%
DOCUMENTATION	60%
VALUE FOR MONEY	50%
OVERALL	60%



Title	Kinder Comp
Publisher	Spinnaker
Machine	Software
Price	Model B/ Electron £8.65

Spinnaker is a successful educational software house from the United States. BBC and Electron owners can now benefit from some of its very interesting packages.

Kinder Comp is probably the simplest and most straightforward learning package for the Acorn computers. I think that children within the stated age range of three to eight will all be able to get something from the variety of "games" supplied on this cassette.

Simplicity and clarity are the keys to success with children who do not wish to be confused by any operations irrelevant to achieving their drawing, or matching the groups of objects, or finishing off the sequence of numbers.

There is plenty of colour and sound, some nice tunes, large lettering, single key press entry

(with all irrelevant keys disabled), and consistency in use of Escape to return at all times to the menu. There is no doubting the basic educational value of the exercises, but of course they are fun as well, a challenge for a young mind.

The simplest exercise involves typing a letter or number and then watching it printed with sound onto the screen. An extension of this is the "find a keyboard character" exercise. Success is rewarded with the bit by bit drawing of a friendly character (who winks at you!) or a yacht or other object.

The most complex exercise allows the child to draw freehand on the screen, with single key changing of foreground colour. It's easy to use which means quick and impressive results, and encouragement to experiment further.

Kinder Comp proves to be a marvellous educational plaything and introduction to the computer for kids. **M.W.**

Ratings Table:

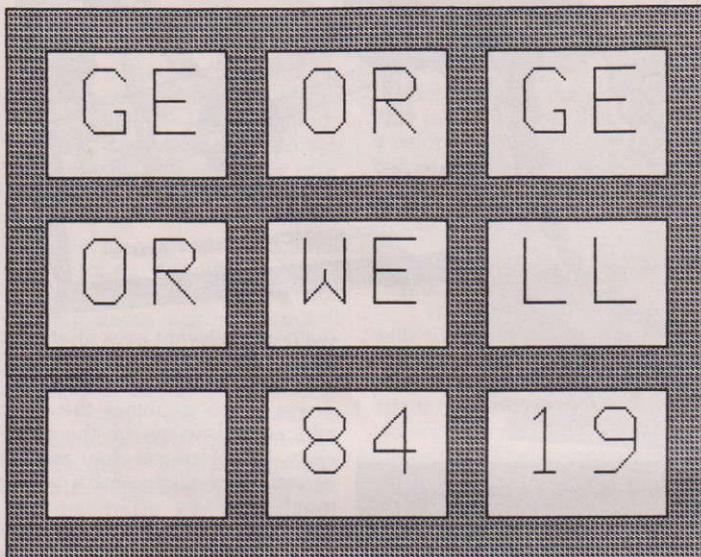
SOUNDS	90%
GRAPHICS	85%
DOCUMENTATION	70%
VALUE FOR MONEY	85%
OVERALL	90%

1984

Trevor Truran

At last the waiting is over.

BIG BROTHER has finally emerged from his lair in darkest Wessex and challenges you! He has passed the last terrible year hatching a fiendish plot so devious and twisted that he thinks it will take you the rest of this year to solve it. To commemorate his birth in Orwell's novel, BB has carved eight huge blocks of Portland stone and inscribed them to read:



PROGRAM LISTING

```

10 ON ERROR GOTO 1310
20 REM***NINETEEN EIGHTYFOUR***
30 REM***Copyright Trevor Truran.198
4***
40 MODE2
50 VDU5
60 VDU24,0;0;1279;720;
70 VDU28,0,6,19,0
80 DIM L$(3,3):DIM SOL$(300):DIM ANS$(
(3,3)
90 FOR x%=0 TO 2:FOR y%=0 TO 2
100 READ L$(x%,y%):NEXT y%:NEXT x%
110 DATA " ",OR,GE,84,WE,OR,19,LL,GE
120 FOR x%=0 TO 2:FOR y%=0 TO 2
130 READ ANS$(x%,y%):NEXT y%:NEXT x%
140 DATA " ",OR,GE,19,WE,OR,84,LL,GE
150 PROCGRID
160 FOR A%=0 TO 2:FOR B%=0 TO 2
170 PROCBOX(A%,B%):NEXT B%:NEXT A%
180 PROCERASE(0,0)
190 EMPX%=0:EMPY%=0
200 REPEAT
201 *WINDOW

```

Find the shortest solution to this fascinating yet frustrating puzzle and win some exciting software.

As you can see the master brain has deliberately set the blocks with the date the wrong way round. Neither the National Trust, Tony Benn nor BBC Micro owners can bear to see the Dorset countryside defiled like this and so, as the arch-dictator knows full well, will spare no effort to set the memorial to rights. The blocks are set in a deep gravel bed and the only way to move them is to slide a block horizontally or ver-

```

202 *GDUMP
203 END
210 PROCinputmove
220 PROCcheck
230 IF FLAG%=1 THEN 210
240 PROCLEGAL:IF FLAG%=1 THEN 210
250 count%=count%+1:SOL$(count%)=CHR$(
COL%+65)+STR$(ROW%+1)
260 PROCsolved
270 UNTIL sol%=9
280 MODE7
290 PRINTTAB(0,10)CHR$131;CHR$141;"YOU
HAVE SOLVED IT IN...";count%;"MOVES."
300 PRINTTAB(0,11)CHR$131;CHR$141;"YOU
HAVE SOLVED IT IN...";count%;"MOVES."
310 PRINT:PRINT:FOR X%=1 TO count%:PRI
NTSOL$(X%);" ";:NEXT
320 PRINTTAB(0,22)"Another try? (Y/N).
..":A$=GET$
330 IF A$="Y" THEN CLEAR:RUN
340 END
350 DEFPROCGRID
360 GCOL0,1
370 MOVE80,80:DRAW1080,80:DRAW1080,660
:DRAW80,660:DRAW80,80
380 MOVE240,720:PRINT"A":MOVE580,720:P
RINT"B":MOVE920,720:PRINT"C"
390 MOVE1120,170:PRINT"1":MOVE1120,370
:PRINT"2":MOVE1120,570:PRINT"3"
400 ENDPROC
410 DEFPROCBOX(C%,D%)
420 X%=100+(C%*340):Y%=100+(D%*200)
430 GCOL0,6:MOVEX%,Y%:MOVEX%+280,Y%:PL
OT85,X%+280,Y%+140
440 MOVEX%,Y%+140:PLOT85,X%,Y%
450 GCOL0,0
460 MOVE X%+50,Y%+80:PRINTLEFT$(L$(C%,
D%),1)
470 MOVEX%+180,Y%+80:PRINTRIGHT$(L$(C%
,D%),1)
480 ENDPROC
490 DEFPROCERASE(X%,Y%)
500 X%=100+(X%*340):Y%=100+(Y%*200)
510 GCOL0,0:MOVEX%,Y%:MOVEX%+280,Y%:PL
OT85,X%+280,Y%+140
520 MOVEX%,Y%+140:PLOT85,X%,Y%:ENDPROC
530 DEFPROCinputmove
540 VDU4:CLS
550 PRINTTAB(0,2)"Which column A,B,C"

```

1984

tically into the empty space next door to it.

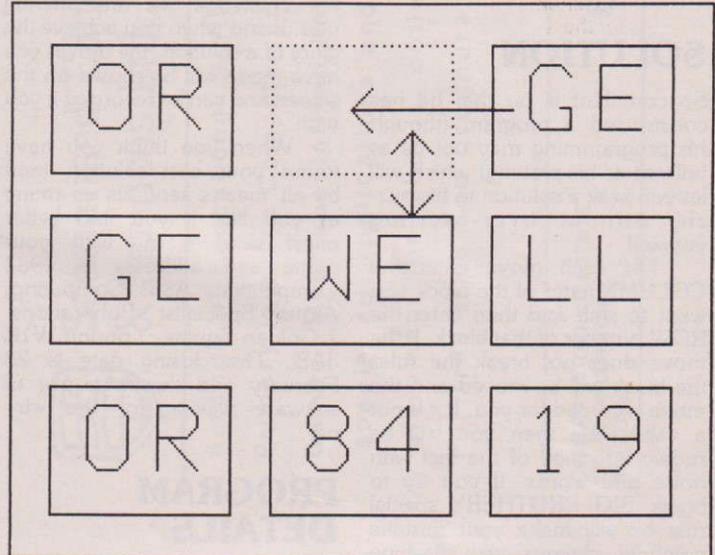
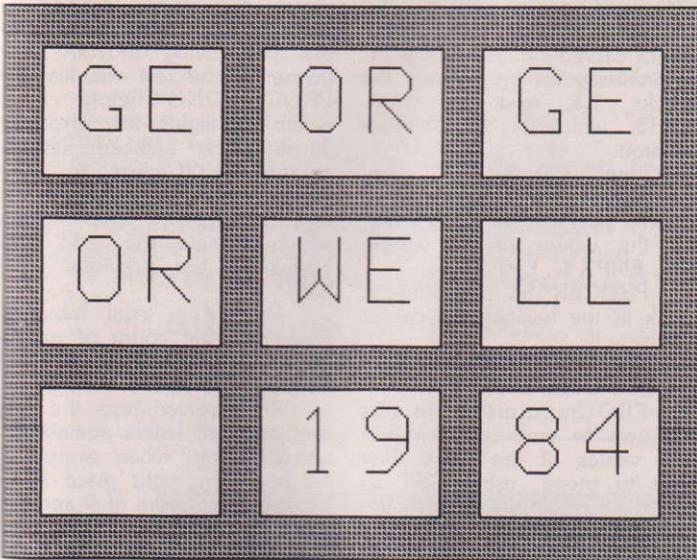
It should be possible, if the right order for heaving about can be made, to rearrange the display to read :

And it is — except for the rule which BIG BROTHER insists is followed to the letter — at no time may a block be moved so that the same letter on two different blocks are placed next to

each other.

If you had moved the blocks to look like this:

then you could not move the G E to the left as the E would be next to the E of W E in the centre.



```

560 REPEAT:COL%=GET
570 UNTIL COL%>64 AND COL%<68
580 COL%=ABS(65-COL%)
590 PRINTTAB(0,4)"Which row 1,2,3"
600 REPEAT: ROW%=GET
610 UNTIL ROW%>48 AND ROW%<52
620 ROW%=ROW%-49
630 VDU5:ENDPROC
640 DEFPROCcheck
650 FLAG%=0
660 IF ABS(COL%-EMPX%)+ABS(ROW%-EMPY%)
=0THEN PROCerror:ENDPROC
670 IF ABS(COL%-EMPX%)+ABS(ROW%-EMPY%)
>1THEN PROCerror:ENDPROC
680 ENDPROC
690 DEFPROCerror
700 VDU4:CLS:PRINTTAB(0,2)"No such mov
e"
710 FOR X=10 TO 30:SOUND1,-15,X,1:NEXT
:FLAG%=1:ENDPROC
720 DEFPROCpause(T)
730 finishtime=TIME+T:REPEAT:UNTIL TIM
E=finishtime:ENDPROC
740 DEFPROCLEGAL
750 LOCAL P$,Q$
760 L$(EMPX%,EMPY%)=L$(COL%,ROW%)
770 L$(COL%,ROW%)=""
780 PROCERASE(COL%,ROW%):PROCBOX(EMPX%
EMPY%)
790 P$=LEFT$(L$(EMPX%,EMPY%),1):Q$=RIG

```

```

HT$(L$(EMPX%,EMPY%),1)
800 IF EMPX%=0 THEN 820
810 IF RIGHT$(L$(EMPX%-1,EMPY%),1)=P$
THEN PROCWRONG(EMPX%,EMPY%,EMPX%-1,EMPY%
,"L"):ENDPROC
820 IF EMPY%=0 THEN 840
830 IF LEFT$(L$(EMPX%,EMPY%-1),1)=P$ T
HEN PROCWRONG(EMPX%,EMPY%,EMPX%,EMPY%-1,
"L"):ENDPROC
840 IF EMPY%=2 THEN 860
850 IF LEFT$(L$(EMPX%,EMPY%+1),1)=P$ T
HEN PROCWRONG(EMPX%,EMPY%,EMPX%,EMPY%+1,
"L"):ENDPROC
860 IF EMPX%=3 THEN 880
870 IF LEFT$(L$(EMPX%+1,EMPY%),1)=Q$ T
HEN PROCWRONG(EMPX,EMPY%,EMPX%+1,EMPY%,"
L"):ENDPROC
880 IF EMPY%=0 THEN 900
890 IF RIGHT$(L$(EMPX%,EMPY%-1),1)=Q$
THEN PROCWRONG(EMPX%,EMPY%,EMPX%,EMPY%-1
,"R"):ENDPROC
900 IF EMPY%=2 THEN 920
910 IF RIGHT$(L$(EMPX%,EMPY%+1),1)=Q$
THEN PROCWRONG(EMPX%,EMPY%,EMPX%,EMPY%+1
,"R"):ENDPROC
920 EMPX%=COL%:EMPY%=ROW%
930 ENDPROC
940 DEFPROCWRONG(E%,F%,G%,H%,Z$)
950 EE%=100+(E%*340):GG%=100+(G%*340)
960 FF%=100+(F%*200):HH%=100+(H%*200)
970 GCOL0,11

```

CONTINUED OVER

1984

And that, he thinks, makes a challenge us ordinary mortals will not solve for years.

SOLUTION

So confident is he that he has constructed a program (though his programming may not be as brilliant as his plotting) which will let you seek a solution to his puzzle without over-exerting yourself.

For each move enter the COLUMN letter of the block you want to shift and then enter the ROW number of that block. If the move does not break the rules the block will be moved and the move recorded for you. If it is not a valid slide then you will be rudely informed of the fact with noise and words. If you try to break BIG BROTHER's special rule he will make your mistake painfully obvious with flashing letters before putting the blocks back the way they were.

No less than 300 moves are DIMensioned for the solution string so if you go beyond that everything will collapse in a heap. You may, even after several tries, be unwilling to believe it, but the

problem can be solved in far fewer moves than that. Just how few moves are, in fact, needed is the challenge we are offering you. If and when you achieve the glory of a solution, the moves you have made will be shown on the screen and can be recorded if you wish.

When you think you have found your best solution (and by all means send us as many as you like if you find better ones) send it in, with your name and address, to 1984 Competition, A&B Computing, Argus Specialist Publications, 1 Golden Square, London W1R 3AB. The closing date is 28 February and there's a pile of software waiting for the winner.

PROGRAM DETAILS

The program is constructed from several fairly simple procedures.

The error routine called by line 10 simply checks for an accidental press of the escape key instead of the adjacent figure 1 and returns the user to

the main loop if it was not deliberately pressed.

Lines 40 to 80 set up the initial conditions for windows and array dimensions. If 300 moves is not enough then SOL\$ can be increased.

Lines 100 to 140 put the letters carved on the blocks into an array for printing on the blocks, L\$, and an array, ANS\$, which is the solution position.

Lines 150 to 190 draw the outer grid and reference letters, put in the blocks and set the values of the empty box, EMPX%, EMPY%.

PROCERASE just draws a block in the background colour to delete it.

The main loop run from line 200 to line 270.

PROCinputmove invites the user to enter column and row values of the block they wish to move, using GET so that the RETURN key does not have to be pressed.

PROCHECK makes sure that the block to be moved is adjacent to the empty space. If it is not then PROCerror is called which gives audible and visual notice that the move is

not legal and sets FLAG% to 1. Line 230 then returns the loop to its start.

PROCLEGAL tests for BIG BROTHER's rule about adjacent letters by making the move and then testing the value of each adjacent letter to the pair being moved. Any failure of the test will lead to PROCWRONG being called which highlights the error by flashing the adjacent letters, calling PROCerror to give backup notice of a false move and then calling PROCrestore which re-sets the grid and blocks to the previous position.

Only if a legal move is made will the count of moves be updated and the last move added to the solution string.

PROCSolved tests the current array of letters against the answer array; when every letter is in the right place sol% will have the value of 9 and the main loop will end.

Lines 280 to 240 print the solution and number of moves taken and invite another run.

Electron users can rewrite this section to avoid MODE 7.

```

980 IF E%=G% THEN 1060
990 IF E%>G% THEN 1030
1000 MOVE EE%+50, FF%+80: PRINTLEFT$(L$(E
%, F%), 1)
1010 MOVE GG%+180, HH%+80: PRINTRIGHT$(L$(
G%, H%), 1)
1020 PROCpause(300): PROCerror: PROCresto
re: ENDPROC
1030 MOVE EE%+180, FF%+80: PRINTRIGHT$(L$(
E%, F%), 1)
1040 MOVE GG%+50, HH%+80: PRINTLEFT$(L$(G
%, H%), 1)
1050 PROCpause(300): PROCerror: PROCresto
re: ENDPROC
1060 IFZ$<>"R" THEN 1100
1070 MOVE EE%+180, FF%+80: PRINTRIGHT$(L$(
E%, F%), 1)
1080 MOVE GG%+180, HH%+80: PRINTRIGHT$(L$(
G%, H%), 1)
1090 PROCpause(300): PROCerror: PROCresto
re: ENDPROC
1100 MOVE EE%+50, FF%+80: PRINTLEFT$(L$(E
%, F%), 1)
1110 MOVE GG%+50, HH%+80: PRINTLEFT$(L$(G
%, H%), 1)

```

```

1120 PROCpause(300): PROCerror: PROCresto
re: ENDPROC
1130 DEFPROCrestore
1140 VDU5: FLAG%=1
1150 L$(COL%, ROW%)=L$(EMPX%, EMPY%)
1160 L$(EMPX%, EMPY%)=" "
1170 CLS: PROCGRID
1180 FOR A%=0 TO 2
1190 FOR B%=0 TO 2
1200 PROCBOX(A%, B%)
1210 NEXT B%
1220 NEXT A%
1230 PROCERASE(EMPX%, EMPY%): ENDPROC
1240 DEFPROCSolved
1250 sol%=0
1260 FOR xx%=0 TO 2: FOR yy%=0 TO 2
1270 IF L$(xx%, yy%)=ANS$(xx%, yy%) THEN
sol%=sol%+1
1280 NEXT yy%
1290 NEXT xx%
1300 ENDPROC
1310 CLS
1320 IF ERR=17 THEN PRINTTAB(0, 2)"ARE Y
OU SURE? (Y/N)"
1330 Y$=GET$
1340 IF Y$<>"Y" THEN 200
1350 MODE 7: END

```

SOURCE LIBRARY MANAGER (SLM)

&

TEXT LIBRARY MANAGER (TLM)

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- * Allows upto 99 versions of the same "member" to be retained in the library.
- * Will simply and easily "construct" programs developed in a modular fashion.
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- * Incorporates a full set of library management functions (to maintain, compress, etc).
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- * Supplied on two ROM chips for a price normally associated with single chip software.
- * Includes comprehensive User Guide and fitting instructions.

ACORN USER said: Source Library Manager works very well and, being ROM-based, it takes up no user RAM. The disc capacity, in terms of the number of members that can be held, is a great improvement on the 31 files allowed by the DFS.

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Machine Code Made Easy

It is all very well me giving you lists of commands and address modes, but nothing beats an example. This month we look at a simple SOUND routine which I wrote to save space in a long BASIC program and thus prevent the dreaded 'No Room' message.

The routine itself is not very elegant but can easily be modified for your own use. It does however demonstrate many principles which we have looked at in previous articles. It is loaded and set up by a heading program, which subsequently chains the main program, and this assembles the routine and sets up a data store.

Both the routine and the data reside in the area below the normal BASIC program storage space. Thus they don't count in 'room' calculations.

THE THEORY OF THE ROUTINE

As the routine is written, data for tunes is stored as a sequence of pitch and duration values, in this case the data starts at &D80. The routine itself utilises two of the machine code calls provided by Acorn — namely OSBYTE and OSWORD. The OSWORD call requires an eight-byte sequence known as a parameter block for which I have used zero-page space reserved for user routines — &71 to &7A.

Right, so how do we go about writing such a routine? The flowchart in Figure 1 illustrates the sequence which I wanted, and in the following explanation I have indicated which boxes relate to the discussion.

Well the principle is that a number of tunes can be stored, note by note, in sequence. To play them we need to know how far through the data they start and how many notes are to be played. Thus this information must be provided by the BASIC program calling the routine — the INPUT to the routine — box 1.

The parameter block required by the OSWORD call is to provide the same information as a SOUND command — i.e. Channel, Volume, Pitch, Duration. Each of the four is provided

Name that tune! In keeping with the rest of the mag, Machine Code goes musical.

by two bytes, one of which is, for our purpose, fixed. So then we must set up this block in a suitable place, providing the four fixed parameters at the beginning and then feeding the variable values required for each note in turn.

The sequence of information required for the block is shown in Figure 2 and is supplied by box 2 for the fixed values and box 3 as each note is passed in the loop for playing the tune. We have now entered the tune playing loop!

Having collected the information required for a note in the parameter block we now check to see if the sound buffer is full. This is achieved by using one of the OSBYTE calls, namely that with the accumulator containing &80 osword. The osword call we test again, repeating this process until there is free space in it — thus we loop around box 4 in the flowchart until a space occurs.

Once the buffer has room we send a note to channel 1 using the OSWORD parameter block and call, then the volume, pitch and channel are changed to give a second note. This is two octaves higher than the first to give a harmony effect as the two will play all but simultaneously — machine code being so fast! This note is in effect sent to the buffer for channel 2 by calling OSWORD again and the delay between the two is in the order of 20 microseconds, hardly an audible delay.

Having sent the note to both channels we are not ready to get the second note from the data store! Thus the offset counter is incremented to the next set of data and the count of notes to be played is decremented. If the count is not zero there are still notes to be played, so we test the count and go back for another

note if required. Otherwise the routine ends and returns control to the main program.

THE ROUTINE — BASIC / ASSEMBLER PROGRAM

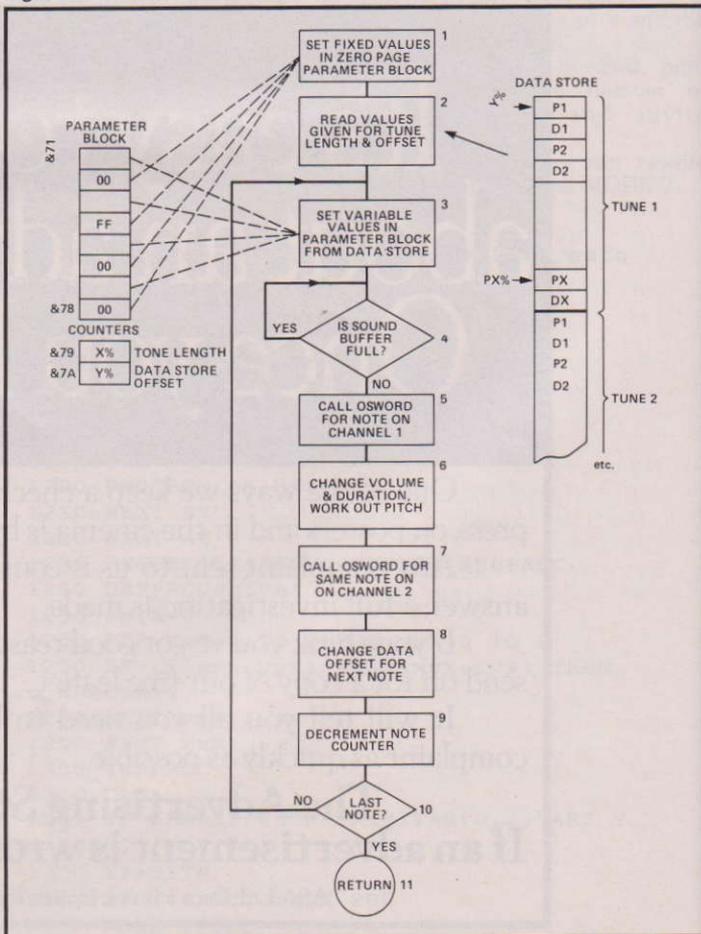
The program that I have given here is part of a program that

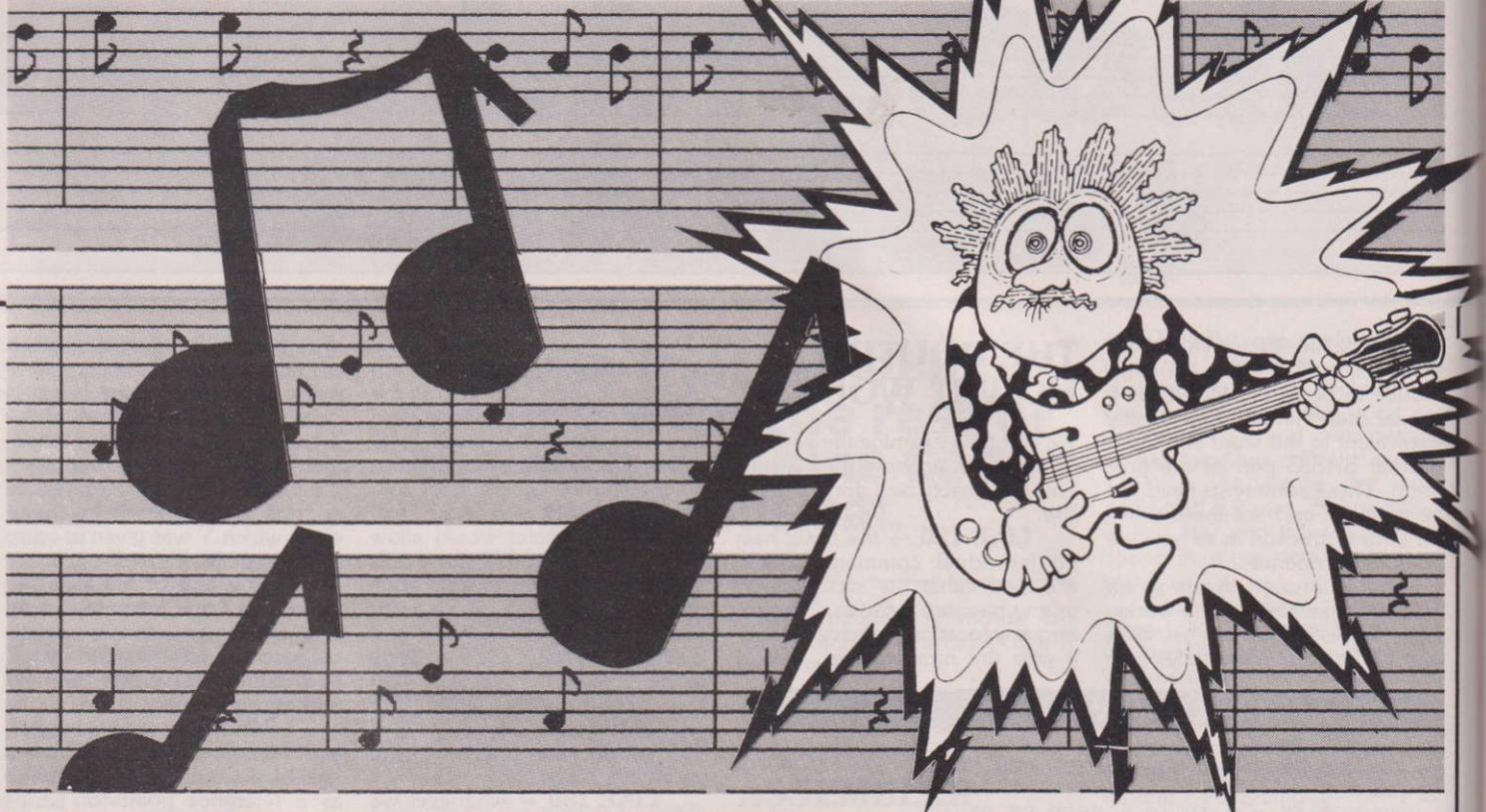
would display game titles, set up character definitions etc before chaining the main program. It first creates the 'data store' by reading DATA and then putting in into locations &D80 onward. This is followed by the ASSEMBLER part, commencing at line 100 and this we will examine in more detail in a moment.

First, however, note two things in this program. In line 110 we load P% with the value &D00 — on entering the ASSEMBLER we must tell it where to assemble the code and the value of P% on entry gives the start address (we will examine this more fully next month). Forgetting to set P% means that your code could end up almost anywhere!

Secondly, note the comments that I have added in the

Figure 1





OSWORD call with A=7 (SOUND) requires 8 byte parameter block. Address of start of block given by Y (hi) and X (lo) on entry.
e.g. X=&71, Y=&0 for &0071

PARAMETERS

Address chosen	Function	Byte	Value
&71	Channel	LSB	0-4
&72	Channel	MSB	&00
&73	Amplitude	LSB	&FF-&F1
&74	Amplitude	MSB	&FF
&75	Pitch	LSB	&00-&FF
&76	Pitch	MSB	&00
&77	Duration	LSB	&00-&FF
&78	Duration	MSB	&00

OSBYTE call with A=128 (BUFFER CHECK)

Y=&FF
X=&FB channel 0
X=&FA channel 1
X=&F9 channel 2
X=&F8 channel 3

On return X equals the number of free spaces in the channel buffer.

Other values of X cause ADC and other machine buffers to be tested.

Fig 2. OSBYTE and OSWORD calls used.

block starting at address &71. We can tell the OSWORD system this by loading the X and Y registers before the call is made - Y contains the high two bytes of the address, X the lower two bytes. Thus we make Y = 0 and X = &71 and then make the call which will make the first note play on channel one.

LINE 170 - To give a harmony effect we now change the volume and channel information stored in our parameter block. This is achieved simply by loading the accumulator with each of the required values in turn (LDA#) and storing them in the required memory location (STA&).

LINE 180 - We achieve the harmony by picking a note two oc-

taves (96 semitones) higher than the main channel 1 note. Thus as we go to call the OSWORD7 routine again we clear the carry flag (CLC), load the contents of our pitch location (at &75) to the accumulator, then add 96 (ADC#&60) and put the resulting value back at &75 in our parameter block. Then it's 'Play it again Sam!' on the second channel.

LINE 190 - Having loaded both the channel 1 & 2 buffers with the note, they will play almost simultaneously as I mentioned above. So we now move the offset pointer to the data for the next note and then reduce the number of notes to be played (DEC&79). If this reduces to zero then the zero flag will again be set.

If the flag is set then there are no more notes to play so a branch is made to the line labelled 'end' (200 which returns control to the main program. Otherwise that returns control to the main program. Otherwise the next instruction JuMPs us back to the 'start' line for the next note.

LINE 200 - This line labelled 'end' is purely the return from subroutine (RTS) and bounces us back to the BASIC program.

Finally the tune is played for your amusement - assuming you loaded it in properly!

Hopefully this little program will encourage you to play around with short tunes. Then perhaps with the routine itself to load say all channels - there is nothing stopping you defining more information by using the data store and then loading all the variable parameters in the block individually.

Having played a little with the assembler, next month we will look at it in more detail. This will introduce you more to its flexibility and the various ways of defining machine code space (P% remember).

A&B COMPUTING

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Mark Webb

This Christmas, the traditional time for gathering around the tree to find out just what peripherals we have got *this* year, there is no doubt that the disc drive was one of the most wrapped and quickly unwrapped gifts.

BETTING ON DISCS

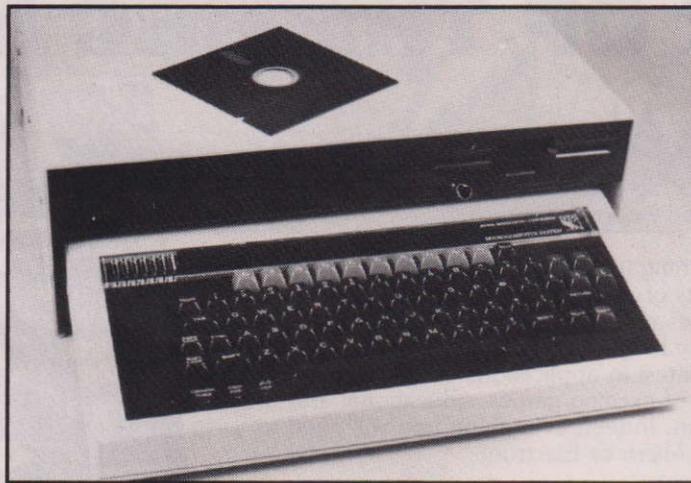
During autumn 1984 the speculative percentage figure for BBC owners with disc drives was 20% and both hardware and software manufacturers all seemed to think that they had spotted a trend in the market.

The new year will see if they were right. If the American example is anything to go by, but it need not be, then discs will eventually perform the job of magnetic storage in the home, as they do in business.

September saw the launch of a new floppy disc brand name, Elephant. Attractively packaged and with the backing of an American based company, Denison — with a turnover of \$600,000,000, Elephant is designed to feed on the new consumer base of disc drive owners, in business and the home. We must remember that Acorn claim 12% of the business market with the BBC a favourite with small concerns, both alone and with the Z80 second processor, allowing access to the traditional CP/M business software.

Even on the games front, software companies are betting considerable resources on making their products available on disc. Micro Power have joined Acornsoft in this respect. Island Logic, a new company associated with the Island record company, have naturally plumped primarily for disc based software. They intend to produce a brand of useful, even intellectual software for the more sophisticated user! Their first product for the BBC is The Music System. It comes on two discs and in four main parts. The disc storage is needed to supply the "Macintosh style" graphics based on the use of icons. No more menus for the more sophisticated users!

Disc Drives are worth considering as your number one peripheral. We plot the trend.



NO DISCS WITHOUT THE DRIVES

The big problem facing the owner of a BBC (or Electron now that Solidisk, PACE and Acorn themselves have got moving with the interfaces) who wants to upgrade the discs, is the mass of hardware he can choose from. Dave Carlos has covered this ground in Random Access, December and his is experienced advice. The answer is to completely think through what will be required from the system you buy, now and in a couple of years time.

By way of example, we decided to look at a range of disc drive types from Akhter, Acorn dealers and well known as suppliers of hardware for BBC systems. They offer two distinct sets of drive, based around the 40 and 80 track formats. If you intend to either use your disc storage for record keeping or for developing software, then the 80 track drives immediately present themselves as having more disc space and, in the long run, price efficient options.

Akhter supply three configurations: the single, double sided 80 track drive; the vertically stacked dual drives, double sided, and switchable between 40 and 80 tracks; and the side by side dual drives, double sided switchables. This latter option has its own built in power supply, which is an important feature if you already put strain in the BBC power supply with ROM boards or if you own or intend to own one of the many interfacing devices which take power from the BBC auxiliary power supply.

LOOKS AREN'T EVERYTHING

I am not going to suggest that the visual appearance of a disc drive should be a main influence upon the choice of product. Akhter drives however do benefit, like many others, from a cream finish which comes close to matching that of your BBC. The side by side unit is sturdily built from metal which has been given the BBC colour treatment. The single and stacked units are cased in the appropriate coloured plastic.

All units come with sufficient

lengths of cable for connecting to your interface and to the auxiliary power supply. The power supply cable on the side by side units is generously long and schools or businesses should have no problem finding a socket within range. The auxiliary power supply connection is not as firm as one would like but this is to do with the design of the connections rather than any fault with the drives.

The ribbon cable connecting your disc drives with the disc interface beneath the BBC actually pushes onto an edge connector on the drive PCB and within the drive housing. In one case the cable of a drive had worked free in transit and the drive appeared to be faulty. A quick look within the housing cleared up the problem. The important screws to undo are unfortunately underneath the rubber feet of the drive base, so don't be tempted to undo the visible ones unless you want to start taking the whole thing apart! The look inside also confirmed the Japanese (Mitsubishi) origin of the hardware.

BBC SUPPORT

As well as providing BBC compatible disc drives, anyone who wants to sell to the BBC market has to try and meet the needs of the user with documentation and software. Even if you have your DFS installed by an Acorn dealer, you will not get a utilities disc unless you purchase Acorn drives. Their recent price drop recognised their uncompetitiveness in a cut-throat market but there remain better hardware options. By leaving out formatting and verifying commands from the DFS, Acorn left the market open for alternative DFSs. Both Pace and Watford Electronics moved in to fill the gap but that rare breed, the 8271 floppy disc controller, has made it difficult for them to supply the complete upgrade.

Akhter have recognised the need for both documentation and software for the owner new to disc operations. The manual introduces the filing system commands of the DFS as well as explaining the software utilities sup-

Drive-In

plied on disc. The manual is typical of the "home made" documentation which abounds in the home computer market. It is a word processed document, printed on a daisywheel and not properly typeset. In one or two places this means poor legibility. Overall it is accurate although not as helpful as it could be when explaining how to implement some of the commands. For instance, there are two sections on Auto-Boot, neither of which takes the user through the necessary stages to implement the command. The beginner would find himself resorting to trial and error in some cases.

The software is bundled on one disc alongside a pointless advert for M.G.B., a program displaying the full disc menu and a utilities menu. First up is a conventional Disassembler. It does what it should, disassembling between given memory locations but, being menu driven, is much less flexible than the usual command driven monitors/disassemblers.

Once in the disassembly function, you cannot get out until the given end address and at this point it has been known to crash, thus needing a restart with Escape — which is set up for the purpose. The nicest feature is the ROM status report. It lists the ROMs in your machine, their socket numbers and their type. ROM disassembly is catered for. The Disassembler can be used in conjunction with the MDUMP utility — which amends portions of memory — for patching disc files.

FORMAT is an essential command for disc users and this one is reliable and fairly quick. It both formats and verifies each track individually. There is a separate VERIFY utility if you still have any doubts. Other disc orientated programs are MERGE, RELOC, DUP, and FREE.

MERGE allows the merging of two files, across directory or drive boundaries if necessary. It embraces all kinds of disc file. RELOC is that wonderfully useful routine for disc users who want to run their tape software from disc. It moves a BASIC program down

from &1900 to &E00. It has no pretensions at loading, moving and running anything but straightforward BASIC programs.

DUP is a useful addition to the filing system commands, allowing a file to be copied and renamed at the same time, even onto the same disc surface if required. FREE provides information about the disc surface, the number of sectors, those already used and those left free. Unless of course you have Beebugsoft's Toolkit installed. Toolkit will intercept the *FREE command and tell you about memory not disc space. Retitling the routine or *RUNning FREE will do the trick.

SDUMP is a screen dump routine, which will come in handy if you haven't already got one,

but there are many better on the market and in magazines. It reduces the screen to a dump about two thirds the width of 80 column paper and one third depth. It prints shades of grey and is fairly fast.

TO THE TEST

The only way to be fully sure of disc hardware is to use it, use it and use it again. This I have done with the Akhter side by side switchables and they come out of it very well. The unit is nicely designed to span the back end of your Beeb, the two metal feet either side. This is much better than the Torch idea of putting the drives beneath the computer. The drives are easily accessible and the top acts as a plinth for your monitor. It does make ac-

cess to the rear connections awkward if you are the sort who is continually plugging and unplugging joysticks or cassette.

The single drive and stacked dual drive proved just as reliable, they handled a disc soak test which I typed in from Michael Coleman's "Disk Programming Techniques for the BBC Microcomputer" (Prentice Hall). This sets up random files on a new disc and gets the drive to constantly repeat the actions of starting up, accessing a file and stopping again. Half an hour was the recommended time and the drives performed without fault.

While using the switchables it is necessary to take a bit of time to check which format you are currently working in. Little harm can be done by trying to read or write to the wrong format outside of a program, but from within a database or wordprocessor you could end up losing the file. Unfortunately the DFS has no trouble reading the directories of 40 or 80 track discs even if the drives are switched to the opposite format. This may lead to some confusion. Care must be taken not to format an 80 track disc while the drive is switched to 40 and vice versa. The formatting will appear to succeed but the disc will not safely store your files.

Spending money on disc drives for your BBC is very worthwhile since their speed and convenience of operation can enhance the performance of your system beyond any other peripheral. The range of Akhter drives impressed on reliability and the three configurations they have chosen should satisfy most users' requirements. The documentation could be better presented but is reliable information. The software similarly could be more user friendly but the utilities do their job and it's better than paying for them on top of your drives — even if you could get them separately. An all-in package then, which should reliably bring you into the rapidly growing fold of BBC disc system owners.

Further information about Akhter disc systems from Akhter Computer Group, 28/9 Burnt Mill, Harlow, Essex CM20 2HU.



Tokenising f-keys

Allen Hardy

By using BASIC tokens instead of full-length or abbreviated keywords in soft (function) key definitions, the 239 bytes allocated of the 256 in page &B, can be made to hold considerably more instructions. First, though, a few words on how keywords are stored in programs and in soft key definitions. Page and Section numbers refer to the User Guide.

Although the BBC micro does not have single-key entry of keywords as some other microcomputers do, most keywords may be abbreviated to two to four characters. COLOUR and ENDPROC, for example, may be abbreviated to C. and E. respectively. This facility is time saving but there is no saving in memory using these abbreviations in programs. This is because Basic uses a translation table to "tokenise" keywords so that they are stored as only one byte whether or not you abbreviate them. A list of abbreviations and tokens can be found on page 483. "Left" and "right" here refer to the side of the "=" on which the keyword appears. This applies only to the pseudo-variables HIMEM, LOMEM, PAGE, PTR and TIME, which have different tokens according to whether they are being read or written. In fact the User Guide has them the wrong way round, so "left" means read and "right" means write.

Soft key definitions, however, remain unchanged because all "star" (*) commands, such as *KEY, are sent to the operating system which does not have access to the token table. As a result the definitions are stored as strings of ASCII characters and pointed to by a directory at the beginning of page &B, in case you were wondering what had happened to the other 17 bytes. The definition

*KEY CL.

will therefore occupy two bytes less than

*KEY 0 CLEAR

but two bytes more than a token.

So our task is to replace with tokens the keywords or their ab-

Replace function keywords with BASIC tokens to increase your BBC's computing capacity.



abbreviations when they occur in key definitions. This can be achieved for all but three keywords, the exceptions being LISTO, OPT and TOP — more about these later.

Inserting control characters, that in those with ASCII codes 0 to 31, in to key definitions is a process with which most readers will be familiar. Using the ! character any VDU code in Section 34, "VDU Drivers", can be generated. The most common one used is Return (not to be confused with the keyword RETURN) produced by prefixing

M with ! M is equivalent to CTRL M which has the same ASCII as Return. Table 1 lists the six VDU codes which are equivalent to Basic keywords and can be used in key definitions the same way as Return. For example to define f0 as COLOUR1 type:

*KEY0 ! Q1

Note that no Return is necessary. It is important to understand that this inserts not tokens but control characters into the key definitions.

If the Teletext mode is used

some characters will appear to be different due to the variations between the Teletext (Mode 7) and ASCII (Modes 0-6) character sets. The latter set has been used throughout because it appears on the actual keyboard keys. Additionally, some Teletext control codes may be produced but if the tokens are put into a program they will be transformed into keywords when the program is listed. The VDU code summary is duplicated on page 507 and page 497 gives the ASCII codes produced by each key.

Section 25 explains the use of in defining soft keys more fully, and introduces us to the sequence which has the effect of adding 128 (&80) to the ASCII value of the character which follows. At the expense of readability we may use to insert tokens for most keywords into key definitions. Hence

*KEY 0 F! 0

defines f0 as AUTO Return because &80 plus ASCII code for F, &46, equals &C6, which is the token for AUTO. A complete list of tokens which may be obtained in this way is given in Table 2.

Where possible the abbreviations in Table 1 should be used instead of those in Table 2 since a following return is not required. But note that k for MODE will reset HIMEM whereas V will not.

To obtain the keywords not given in Table 2, ie TRACE and those with tokens &80 to &9F, both , to add &80, and , for control characters, must precede the character. Another example to make things clear:

*KEY0 T

T produces &14 and adds &80 to it giving &94, the token for ABS. Remember that these four characters represent only one byte which is inserted in the soft keys buffer. Table 3 lists the keywords which may be produced by this technique. With OS 1.0 or more recent versions, however, most tokens in the table can be typed directly using the soft keys with SHIFT or CTRL and may be used in programs,



soft keys or in command mode. To check this type

PRINT CTRL-f0 Return

and the current value of PAGE should appear, but don't worry if this isn't entirely clear to you yet.

VERSATILITY

In fact the soft keys in combination with SHIFT and CTRL are extremely versatile and can be made to return any ASCII codes, which may be either keyword tokens, Teletext codes, control characters or simply keyboard characters.

The combinations provide four modes:

- Without SHIFT or CTRL
- With SHIFT only
- With CTRL only
- With both SHIFT and CTRL

The modes have dedicated *FX calls controlling their action, which are *FX225, *FX226, *FX227 and *FX228 respectively. Hence *FX228 controls the value returned by SHIFT-CTRL-soft key, but has no effect on other combinations. The description of *FX225 which follows may be extended to the other three *FX calls:

*FX225,0 causes the soft keys to be ignored

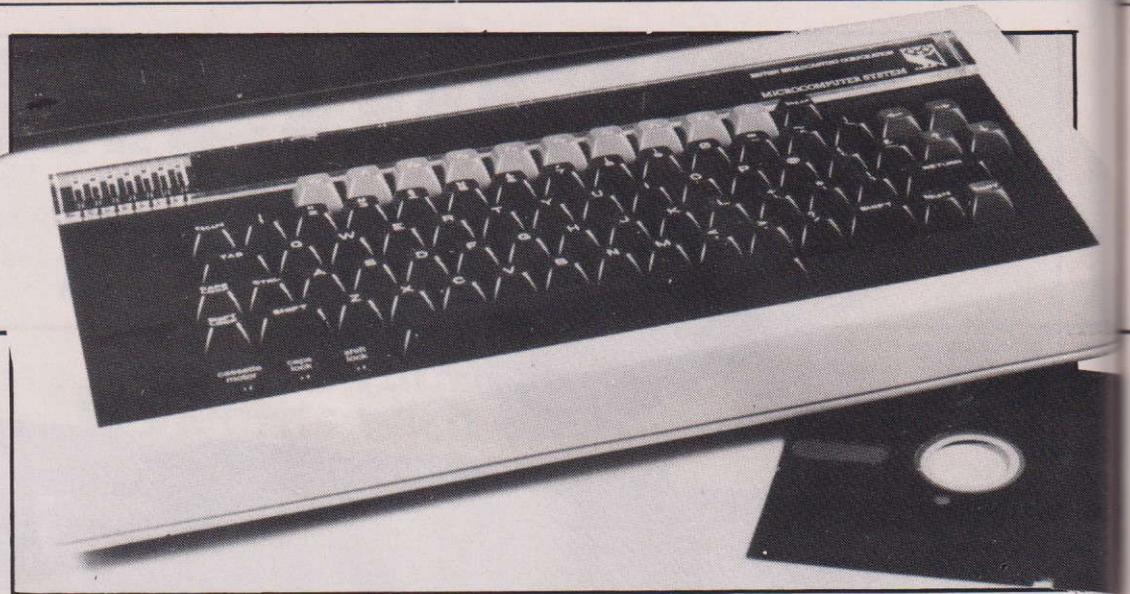
*FX225,1 causes the soft keys to return the character strings defined by *KEY

*FX225,n where n (the "base") is from 2 to 225, causes the soft

keys to return the ASCII code given by n + key number. (That is, if n=&EB then f0 returns &EB, f1 returns &E9, f2 returns &EA, etc.)

Keyword	VDU Code (Hex)	Character
CLS	C	L
CLG	10	P
COLOUR	11	Q
GCOL	18	R
MODE	16	V
PLOT	19	Y

CONTINUED OVER



The default values, which are those set after a hard reset are:

- *FX225,1
- *FX226,&80
- *FX227,&90
- *FX228,0

It should be clear now why the soft keys when used with SHIFT or CTRL produce these codes shown in Table 3. If we execute *FX228,200 we will have access to yet more keywords by using the SHIFT-CTRL-soft key combination. 200 (&C8) is the token for LOAD and will be produced by SHIFT-CTRL-f0; SHIFT-CTRL-f1 will produce LIST, and so on. (We must remember to use only decimal numbers in * commands because the operating system doesn't understand "&".) Thus setting all four modes to return a useful set of keyword tokens and using *FX4,2 (see page 422) to allow the editing keys to act as soft keys f11 to f15, enable us to type any one of up to 60 keywords at a single combination key-stroke. The only disadvantages seem to be that the keyword itself doesn't appear on the screen unless it is in a listed program, and that f10, the BREAK key, cannot be disabled to allow four more codes.

WORDWISE

It will be of some interest to Wordwise users, if they haven't realised it already, that Wordwise makes use of *FX225 but on being exited does not restore the default value with the result that the soft keys appear to be permanently programmed with the codes &A0 to &AF. To cure the problem just type *FX225,1.

The reason that LISTO,OPT and TOP cannot be abbreviated to single tokens is simply that they are not tokenised by Basic in the same way. The LIST part of LISTO is tokenised as LIST, so LISTO should be abbreviated to

10. Similarly, the TO part of TOP is tokenised as TO, so TOP should be abbreviated to 8P. OPT contains no other keywords

TABLE 2

Prefix Character with !!

Keyword	Token (Hex)	Character	Keyword	Token (Hex)	Character
AUTO	C6	F (C)	MODE (T1)	EB	k (L)
BPUT	D5	U (C)	MOVE	EC	l (L)
CALL	D6	V (C)	NEW	CA	J (C)
CHAIN	D7	W (C)	NEXT	ED	m (L)
CHR\$	BD	=	NOT	AC	, (Comma)
CLEAR	D8	X (C)	OLD	CB	K (C)
CLG (T1)	DA	Z (C)	ON	EE	n (L)
CLOSE	D9	Y (C)	OPENIN (B1)	AD	- (Minus)
CLS (T1)	DB	[	OPENOUT	AE	. (Period)
COLOUR (T1)	FB	{	OPENUP (B2)	AD	- (Minus)
DATA	DC	\	PAGE (Write)	D0	P (C)
DEF	DD	J	PI	AF	/
DELETE	C7	G (C)	PLOT (T1)	F0	p (L)
DIM	DE	^	POINT(	B0	0 (N)
DRAW	DF	_ (U/line)	POS	B1	1 (N)
END	E0	f	PRINT	F1	q (L)
ENDPROC	E1	a (L)	PROC	F2	r (L)
ENVELOPE	E2	b (L)	PTR (Write)	CF	0 (C)
EOF	C5	E (C)	RAD	B2	2 (N)
EVAL	A0	(Space)	READ	F3	s (L)
EXP	A1	!	REM	F4	t (L)
EXT	A2	"	RENUMBER	CC	L (C)
FALSE	A3	#	REPEAT	F5	u (L)
FN	A4	\$	REPORT	F6	v (L)
FOR	E3	c (L)	RESTORE	F7	w (L)
GCOL (T1)	E6	f (L)	RETURN	F8	x (L)
GET	A5	%	RIGHT\$(	C2	B (C)
GET\$	BE	>	RND	B3	3 (N)
GOSUB	E4	d (L)	RUN	F9	y (L)
GOTO	E5	e (L)	SAVE	CD	M (C)
HIMEM (Write)	D3	S (C)	SGN	B4	4 (N)
IF	E7	g (L)	SIN	B5	5 (N)
INKEY	A6	&	SOUND	D4	T (C)
INKEY\$	BF	?	SQR	B6	6 (N)
INPUT	E8	h (L)	STOP	FA	z (L)
INSTR(	A7	' (Apostrophe)	STR\$(	C3	C (C)
INT	AB	(	STRING\$(	C4	D (C)
LEFT\$(	CO	@	TAN	B7	7 (N)
LEN	A9	)	TIME (Write)	D1	Q (C)
LET	E9	i (L)	TO	BB	8 (N)
LIST	C9	I (C)	TOP	BB,50	8P (N,C)
LISTO	C9,4F	ID (C,C)	TRUE	B9	9 (N)
LN	AA	*	UNTIL	FD	}
LOAD	C8	H (C)	USR	BA	:
LOCAL	EA	j (L)	VAL	BB	;
LOG	AB	+	VDU	EF	o (L)
LOMEM (Write)	D2	R (C)	VPOS	BC	<
MID\$(	C1	A (C)	WIDTH	FE	~

C=Capital; L=Lower case; N=Numeral; Remainder are other characters
B1=BASIC I; B2=BASIC II; T1=See Table 1

Beeb Lab

Alan G Rowley

The BBC Model B has a number of interfaces as standard, but the ones of most use in the science laboratory are the analogue input and the digital interface, the latter being one of the facilities accessed via the User Port.

I dealt with some uses of the analogue input in my article in the December issue of *A & B Computing* and I now want to turn my attention to the digital interface. Let us just get the difference between the two interfaces absolutely clear before we continue.

The analogue input translates continuously varying voltages into digital form for the computer and returns a number proportional to the input voltage. A digital input, however, only recognises whether an input voltage is above or below a threshold voltage — in the case of the BBC this is about five volts. If the input voltage is above five volts the input is said to be high, or if you prefer "on" and this state is communicated to the computer by the appearance of a value of one in a particular memory location. If the input is "low", that is the voltage is less than five volts, then this location will contain zero. The kinds of application for a digital input which immediately spring to mind are the detection of the closure of a switch, for example a joystick fire button or a key on a keyboard, or as a frequency measurement device, where the rate of generation of voltage pulses from an external circuit could be measured provided that the voltage was swinging above and below the threshold.

So far I have mentioned only the use of the digital interface as an input but, in the case of the BBC, it is equally possible to use it as an output. In the output configuration the interface generates a five volt signal if a one is written to the appropriate memory location and if the location has a zero written to it the voltage output is zero. This now opens some very exciting possibilities since we can use the interface to allow software to throw switches by attaching suitable relays or solid state devices which are turned on by

The second part of our series on using the BBC as a laboratory instrument considers its digital interface, accessed via the User Port.

five volts and off by zero volts or vice versa.

Let me now issue a warning. Do not rush out and start connecting things to your BBC User Port. Although the port is designed to respond to, or to generate, voltages of up to five volts it is not intended to pass more than a little current and you could have a very expensive disaster if you try to persuade it to do so. The best way to experiment with the port is to buy one of the commercially available interface boxes which plug into the User Port and then make your connections to this. These interfaces can be bought with a variety of capabilities and usually include protection circuitry to prevent disasters such as mains getting onto your Beeb! When writing this article I used the Minor Miracles P4/4R interface which has four outputs capable of switching up to 240 volts AC at one amp, and four inputs which will tolerate up to 25 volts DC.

ACCESSING THE USER PORT

The BBC User Port is controlled by a special chip, the 6522 VIA (Variable Interface Adapter). This is a very sophisticated piece of hardware and is programmed via its own registers, of which there are 16, although in this article we will only need to use two of them. We do not, in fact, read or write the VIA registers directly since they are "memory mapped" into the BBC's main memory. This means that there are memory locations in the BBC, actually on the page of memory beginning at

&FE00 and affectionately called SHEILA, which the operating system always ensures will reflect the VIA register contents. Thus we can read or write the VIA registers by reading from, or writing to, the appropriate locations in SHEILA.

The BBC User Port is an eight bit port, which means that it has eight channels each of which can be high, that is contain one, or low, contain zero. The overall state of the port can thus be represented by one byte in memory with the state of each bit representing the corresponding state of each channel of the port. The VIA register which contains this information is mapped into location &FE00. If you examine this location after resetting your machine and with nothing connected to the port, you will find that each bit is high i.e. it contains the binary number %11111111, which is &FF or 255 decimal.

To find the status of a particular channel of the port it is necessary to determine whether the corresponding bit in &FE00 is equal to one, that is "set", or equal to zero, "re-set". Similarly if we want to change the status of a particular channel in the port we will want to set or re-set a particular bit in this location, usually without affecting the other bits. In order to carry out this type of operation we have to delve into the use of the bitwise logical operators "AND", "OR" and "EOR". I do not propose to embark on a full exposition of bitwise logic here, it is dealt with in most books on Assembly language. A few rules of thumb will suffice but before we begin you should understand the following points about binary numbers.

The bits of an eight bit binary number are numbered from zero to seven starting at the right hand end. So in the binary equivalent of two, which is %00000010, we would say that bit one is set and that the remaining bits are re-set. The binary number with only bit *n* set is equivalent to the decimal number two to the power of *n*. So if I wanted to set only channel five of the port to "on", I would write into &FE60 the number 25, i.e. 64 decimal. This is not quite what we want to achieve normally, however, because we will usually want to switch just one channel and leave the rest alone. It is here that bitwise logic comes to our aid.

RULES OF THUMB FOR BITWISE LOGICAL OPERATIONS

1. To set a specific bit in a number it should be logically ORed with a masking number in which only the bit corresponding to the bit to be set is equal to one.

e.g. %0001000 OR
%1000000 = %1001000

Notice that only bit seven in the first number is affected otherwise the number remains unaltered.

2. To reset a specific bit in a number it should be ANDed with a mask in which only the bit corresponding to the bit to be re-set is equal to zero.

e.g. %11011111 AND
%11110111 = %11010111

3. To invert the state of a particular bit in a number it should be EORed with a mask in which only the bit to be inverted is set.

e.g. %11011111 EOR
%00100000 = %11111111

4. The AND operation can be used to detect whether a particular bit is set or re-set. The number to be tested should be ANDed with a mask in which only the bit corresponding to the



one to be tested is set. If the bit being tested is set a non-zero result will be returned. This follows from rule 2 above since all the bits corresponding to zeros in the mask will be re-set, i.e. made zero. The bit being tested will not be affected and so if it is also zero the result will be zero, whereas if it is one a non-zero result will be given.

You will see these operations in use in the program so do not be too worried if you find them hard to follow in the abstract.

CONFIGURING THE USER PORT

I have already mentioned that the User Port can function as both input and output, in fact you can configure the eight channels to operate as any combination of inputs and outputs. This is achieved by the "data direction register" of the VIA which is mapped into location %FE62 of the BBC's memory. If you examine this location after a reset you will find that it contains zero which cor-

responds to a port configuration in which all eight channels are inputs. To specify a channel as an output you simply set the corresponding bit in &FE62. For example writing %11110000, which is &FO, to this location will make channels zero to three inputs and channels four to seven outputs. If you have an interface connected you will, of course, need to set up your port configuration to match that of the interface otherwise some very weird happenings may occur. Moreover it is possible to do damage by applying volts to a channel configured as an output.

READING AND WRITING SHEILA

Firstly a word of warning. SHEILA is in a very sensitive area of the BBC's memory. Writing to some of the locations can cause a dreadful crash, and some of the locations are even read sensitive, so do not run any programs which access SHEILA without saving them first, just in case you have a number wrong and you belt somewhere sensitive!

You can read and write using the "?" indirection operator, provided of course that you do not get caught in this dreadful act by a spy from Cambridge but, seriously, it is better to use the OSBYTE calls provided so that your software will be TUBE compatible.

The full details are contained in the program description but essentially calling OSBYTE &97 allows you to write to SHEILA and OSBYTE &96 is used to read SHEILA. In both cases the offset of the address to be accessed from &FE00 must be in X% when the call is made, i.e. to read %FE60 call OSBYTE &96 with X% = &60.

USING THE USER PORT TO PASS NUMERICAL DATA

So far I have only talked about using each channel of the port in

isolation to detect or generate voltage changes and these are probably the most commonly used facilities in the teaching laboratory. It is possible, however, by using several channels of the port in conjunction, to use it to accept or send numerical information.

Suppose we set up the port with all eight lines as outputs and then write a number between zero and 255 to the register. The value can be read from the port, as a binary number, by any externally connected device which recognises the high outputs as ones and the low outputs as zeros. This is, in fact, the way in which data is sent to the Centronics printer port on the BBC. Since a whole byte is sent at once, i.e. eight bits side by side, the process is described as parallel data transfer.

In an exactly similar manner, with the port set up as eight inputs, numbers can be received from external devices which apply appropriate voltages to the input lines. A good example of this type of usage would be the connection of a subsidiary keyboard.

THE PROGRAM

What I have tried to provide is a program that will help you to understand the User Port by letting you interact with it from the keyboard. You can change the input/output configuration and switch outputs on and off. When the program is run it will display a screen which shows the port configuration and the on/off state of each channel. The default condition will show each channel as an input and, if nothing is connected to the port all channels will be high, i.e. switched on. (If you have an interface connected the channels will still be inputs but their logic status will depend on the design of the interface.) You can invert the configuration of any channel by pressing SHIFT and the corresponding function key e.g. SHIFT/f0 will re-configure channel zero as an output. You can now switch channel zero on and off by pressing "0". During all these operations the

CONTINUED OVER

port status and the contents of the VIA registers in binary and hexadecimal are continually kept up to date.

If you have a suitable interface connected you can, of course, see the external effects, and switch things on and off from your keyboard. You will also be able to see the effects of applying signals to the inputs on the port status.

The program also contains facilities to add your own control sequence. This should be added as a procedure called PROCexecute and should only be exited by pressing ESCAPE or from within the software by *FX125 which has the same effect. This will return to the main screen. It is a good idea to give the port channels meaningful names, by declaring variables equal to the bit number. For example if channel zero is an output designed to control a switch for a lamp you should declare lamp% = 0. This will let you write meaningful lines such as:

```
PROCswitch(1 amp%,"ON") and
IF
FNswitch__state(1 amp%) =
"OFF" THEN...
```

As an illustration of these ideas I have included as my PROCexecute a simulation of a routine for holding the temperature of a thermostat tank at 37 degrees by switching on a heater or cooling coil as required. The temperature fluctuations are simulated in this instance by a random number routine but in reality a sensor connected to the analogue port would monitor the temperature.

The simulation assumes that the heater is connected to chan-

nel six of the port and the cooling circuit to bit seven. The state of the port register is shown as the switches are thrown and a graphic representation of the thermostat is displayed.

HOW IT WORKS

The main control structure of the program is contained within the REPEAT...UNTIL loop between lines 10 and 19. This starts by calling PROCreportstatus to display the current data direction and port registers. A check for a key being pressed is carried out at line 15 and the keyboard buffer is flushed to prevent any build up of spurious key presses.

Line 16 responds to shifted function keys and line 17 to numeric keys, provided that the correspondingly numbered port bit is configured as an output. Line 18 responds to the space bar by calling the control routine in PROCexecute. The loop is exited and the program terminated by CTRL/E at line 19. Lines 22 to 73 are the utility procedures used to carry out the various control functions and to read the port followed, at line 74, by the control sequence which you can add to your own requirements.

- Line 7 Set MODE and switch off cursor and keyboard repeat.
- Line 8 Error trapping. Escape re-runs the program otherwise errors are reported as normal.
- Line 9 Variable initialisation. You should give the user port bits meaningful variable names here.

Lines 10-19 Main control loop.

PROCEDURES AND FUNCTIONS

PROCswitch Sets or re-sets bit number bit% of the port register at location &FE60. Notice how, in line 27, the mask is obtained by EORing 2bit% with &FF, i.e. (%11111111). This inverts the logic of each bit to give a mask in which only bit number bit% is re-set. Remember that in 2bit% this bit is the only one set.

- PROCpoke** Writes val% to &FE00+offset% using OSBYTE &97. The value to be written is passed to the Y register.
- PROCreport-status** Prints the main screen which shows the port condition and presents the menu.
- FNswitch__state** Tests bit% of the port register by ANDing with 2bit% and returns the switch state as a meaningful string. The brackets around the logical expression in line 54 are very important since "=" has a higher priority than "AND" and so if the brackets are left out the expression will not work properly.
- FNchannel__direction** Tests one bit of the data direction register and returns the sense of the channel as a meaningful string.
- FNpeek** Reads location &FE00+offset%. The USR call returns a four byte parameter block which represents the processor registers. This is poked into four locations on page zero, starting at &70, so that the byte to be read, which is returned in the Y register, can be easily extracted. USR is described in the User Guide on page 371.
- FNbinary** Returns a string representing the binary equivalent of the eight bit number passed as n%. Each bit of n% is tested and a one or zero concatenated to the string as appropriate.
- PROCToggle** Reverses the logical sense of a chosen bit of the contents of memory location addr% by using EOR and a mask.
- PROCexecute** This is the main loop for the thermostat simulation. The initial temperature is set at random in line 82 and the port configured with bits 0-3 as inputs and bits 4-7 as outputs, line 83. This happens to match the interface that I used when writing the program.

The main control sequence is the loop between lines 86 and 93. Note the time delay at line 86 which is necessary to allow the switches to operate. There is no point in testing the temperature more frequently than the maximum switching rate. This kind of consideration is always necessary in control applications.

- PROCscreen** Sets up the graphic representation of the thermostat tank.
- PROCelement** Used by PROCscreen to draw the heating and cooling coils in the bath.
- FNwhat__temp** Simulates the temperature changes due to the heater or cooler. If the target temperature has been achieved line 109 gives a random change with a bias towards cooling.
- PROCcolours** Sets appropriate colours for the heater and cooler with respect to their being on or off. Also reveals appropriate messages against the background by changing their actual colours from black to visible colours.

PROGRAM LISTING

```
1 REM*****
2 REM*   BBC USER PORT DEMONSTRATION *
3 REM*       by *
4 REM*   Alan G. Rowley *
5 REM*   Copyright September 1984 *
6 REM*****
```

```

7 MODE7:VDU23,1,0;0;0;0;:FX11,0
8 ON ERROR CLS:IF ERR=17 THEN RUN ELSE :REPORT:PRIN
T" AT LINE ";ERL:END
9 osbyte=&FFF4:heater%=6:cooler%=7:temp%=37
10 REPEAT
11 PROCreportstatus
12 PRINT""*PRESS SPACE BAR TO EXECUTE THE ROUTINE**
PRESS CTRL/E TO EXIT FROM THE PROGRAM**
13 PRINT"Shift/fn to re-configure channel n and n
to switch channel n if it is an output";
14 PRINT"USER PORT DEMONSTRATION PROGRAM (C)1984";T
AB(18);"by"TAB(12);"Alan G. Rowley"
15 a$=INKEY$(0):*FX15,1
16 IF ASC(a$)>127 AND ASC(a$)<136 PROCtoggle((ASC(a$
)-128),&62)
17 IF INSTR("01234567",a$) AND FNchannel_direction(V
AL(a$))="OUTPUT" AND a$<>" " PROCtoggle(VAL(a$),&60)
18 IF a$=" " MODE2:PROCexecute
19 UNTIL a$=CHR$(5)
20 CLS:END
21
22 REM*SWITCH ONE BIT ON or OFF*
23 DEFPROCswitch(bit%,onoff$)
24 IF onoff$<>"ON" AND onoff$<>"OFF" PRINT"You must
say ON or OFF":END
25 LOCALn%
26 IF onoff$="ON" n%=(2^bit%) OR FNpeek(&60)
27 IF onoff$="OFF" n%=(2^bit%) EOR &FF:n%=n% AND FNp
eek(&60)
28 PROCpoke(n%,&60)
29 ENDPROC
30
31 REM*WRITE val% to SHEILA with offset%*
32 DEFPROCpoke(val%,offset%)
33 A%=&97:X%=offset%:Y%=val%
34 CALL osbyte
35 ENDPROC
36
37 REM*DISPLAY CURRENT PORT STATUS*
38 DEFPROCreportstatus
39 LOCALi:VDU30
40 PRINTTAB(9)"*CURRENT STATUS*"
41 FORi%=0TO7
42 PRINTTAB(7)"CHANNEL ";i%:" ";FNchannel_direction(
i%);" ";FNswitch_state(i%);" "
43 NEXT
44 PRINTTAB(0,11);"?FE62 DATA DIR. REG.=& ";CHR$(8
);CHR$(8);~FNpeek(&62);TAB(26,11);" (%";FNbinary(FNpeek
(&62));)"
45 PRINTTAB(0,12);"?FE60 PORT REGISTER =& ";CHR$(8
);CHR$(8);~FNpeek(&60);TAB(26,12);" (%";FNbinary(FNpeek
(&60));)"
46 ENDPROC
47
48 REM*OBTAIN LOGIC STATE OF BIT bit%*
49 DEF FNswitch_state(bit%)
50 IF (2^bit% AND FNpeek(&60))=0 ="OFF" ELSE ="ON"
51
52 REM*OBTAIN DATA DIRECTION OF bit%*
53 DEF FNchannel_direction(bit%)
54 IF ((2^bit%) AND FNpeek(&62))=0 THEN ="INPUT " EL
SE ="OUTPUT"
55
56 REM*READ SHEILA WITH offset%*
57 DEFFNpeek(offset%)
58 A%=&96:X%=offset%
59 !&70=USR(osbyte)
60 =?&72
61
62 REM*CONVERT NUMBER TO STRING REPRESENTING BINARY*
63 DEF FNbinary(n%)
64 LOCALi%,n$
65 FORi%=7TO0 STEP-1
66 IF ((2^i%)ANDn%)=0 n$=n$+"0" ELSE n$=n$+"1"

```



```

67 NEXT
68 =n$
69
70 REM*REVERSE LOGIC OF bit% OF address addr%*
71 DEFPROCtoggle(bit%,addr%)
72 PROCpoke((FNpeek(addr%)) EOR (2^bit%)),addr%)
73 ENDPROC
74 REM*****
75 REM* YOU MAY ADD ANY CONTROL ROUTINE *
76 REM* OF YOUR OWN AS PROCexecute *
77 REM* EXIT SHOULD BE BY PRESSING THE *
78 REM*ESCAPE KEY OR BY A SOFTWARE CALL *
79 REM* TO *FX125 *
80 REM*****
81 DEFPROCexecute
82 curtemp%=RND(50):VDU23,1,0;0;0;0;
83 PROCpoke(&F0,&62)
84 PROCscreen
85 COLOUR7:PRINTTAB(2,0)"Target Temp. ";temp%
86 REPEAT:TIME=0:REPEAT UNTIL TIME>50
87 PRINTTAB(2,2)"Temperature ":PRINTTAB(15,2);FNwhat
_temp%;" "
88 IF curtemp%>temp% PROCswitch(cooler%,"ON"):PROCsw
itch(heater%,"OFF")
89 IF curtemp%<temp% PROCswitch(cooler%,"OFF"):PROCS
witch(heater%,"ON")
90 IF curtemp%=temp% PROCswitch(cooler%,"OFF"):PROCS
witch(heater%,"OFF")
91 PROCcolours
92 PRINTTAB(0,4)"PORT &";~FNpeek(&60);" ";TAB(8,4)"
(%";FNbinary(FNpeek(&60));)"
93 UNTIL FALSE
94 DEFPROCscreen
95 GCOLOR,4:MOVE140,710:MOVE140,160:PLOT85,1150,160:M
OVE1150,710:PLOT85,140,710
96 GCOLOR,7:MOVE140,750:DRAW140,160:DRAW1150,160:DRAW
1150,750
97 VDU19,2,3,0,0,0,19,5,0,0,0,0,19,6,0,0,0,0
98 GCOLOR,2:COLOUR5:PROCElement(160):PRINTTAB(2,28)"H
EATING"
99 GCOLOR,3:COLOUR6:PROCElement(800):PRINTTAB(11,28)"
COOLING"
100 COLOUR7:PRINTTAB(2,31)"ESCAPE FOR MENU";
101 ENDPROC
102 DEFPROCElement(n%)
103 LOCALi%
104 MOVEn%,800:DRAWn%,200:FORi%=1TO5:PLOT1,30,30:PLOT
1,30,-30:NEXT:PLOT1,0,600
105 ENDPROC
106 DEF FNwhat_temp
107 IF FNswitch_state(heater%)="ON" curtemp%=curtemp%
+1:=curtemp%
108 IF FNswitch_state(cooler%)="ON" curtemp%=curtemp%
-1:=curtemp%
109 IF RND(2)=2 curtemp%=curtemp%+2-RND(4)
110 =curtemp%
111 DEFPROCcolours
112 IF FNswitch_state(heater%)="ON" VDU19,2,1,0,0,0,1
9,5,1,0,0,0
113 IF FNswitch_state(heater%)="OFF" VDU19,2,3,0,0,0,
19,5,0,0,0,0
114 IF FNswitch_state(cooler%)="ON" VDU19,3,2,0,0,0,1
9,6,2,0,0,0
115 IF FNswitch_state(cooler%)="OFF" VDU19,3,3,0,0,0,
19,6,0,0,0,0
116 ENDPROC

```

Music Machine

R.K. Reading

Make music with the micro maestro.

Musical Machine is primarily a teaching aid for people learning a musical instrument like the flute. The program enables you to enter a tune you want to be able to play directly from the sheet music and then make the computer store it as a file, edit it or play it a number of times. This enables the instrument player to hear how his tune should be played. Also the program can be used to play the second part of a duet or can be used to write your own music.

To use the program first load "musica". This contains the instructions for the main program that follows. This program is automatically loaded when the instructions have been read. The program operates at its best if there is a disk drive, for this allows quick and easy access but it will work on tape as long as you remember whereabouts on the

tape your files are situated.

LIST OF VARIABLES

- DIM N(X) For the different types of note.
- DIM R(X) For the different types of rest.
- DIM V(X) For the value of each note.
- DIM L(X) For the length of each note.
- DIM P(X) For the length of rest between the notes.

LIST OF PROCEDURES

- PROCload Loads a tune on tape/disk.
- PROCsave Saves a tune on tape/disk.
- PROCplay Enables you to hear

- PROCmake a tune. Enables you to enter music.
- PROCedit Enables you to change entered music.

HOW THE PROGRAM WORKS

The first problem I encountered when formulating my ideas for the program was how the information was to be entered for each note. Was the music going to be entered when playing a tune on the computer or from sheet music? From my own use of such programs I rejected the first idea, on the grounds that one could not make very good tunes. Therefore I opted for the second which allows proper and interesting playback.

The next decision was how to enter the music. It became obvious that it would have to be a note and each note would have different variables like the length

$l(x)$, the gap between notes $p(x)$ and the different pitches of the notes $v(x)$. I decided to store these in arrays and therefore every note had a pitch length, value length and gap length.

I then realised that the length of notes and rests varies depending on the time signature of the tune and therefore I had to set the length of the different types of note or rest according to the time signature. This is done in line 900-970.

The best way to understand how the program works is to look at the sound statement. From this you can see that you need at least two variables, the pitch of the note and the length.

You know what you want to end up with, but if you are entering notes from music you have to work out their pitch and length in different stages because the note could have a sharp or a flat or it could be dotted. This is taken into consideration after the type of note is given its original length and pitch values.

So first you enter the time signature and from this the computer sets the length the note or rest should be played for. Then it will ask questions about the note; if it is dotted it will add more to the original note value, if it is a sharp it will add more pitch value and if the note is a flat it will deduct a bit from the pitch value.

Thus the program works by first setting the initial values and then adding or subtracting, depending on the factors of the particular note.

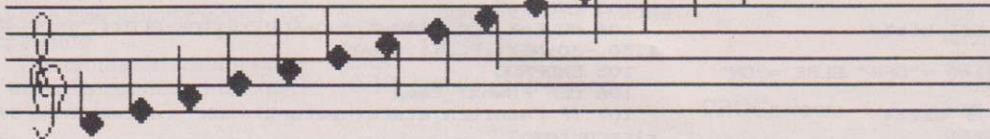
If a note is slurred a gap between it and the next must be a zero. Therefore the program has to incorporate a delay loop which will be long or short depending on the note being slurred or not. This is done at line 1400 by changing the variable $p(x)$.

The original pitch value of the note is created by choosing a note from the ascending order on the screen and entering 1 to 19. From this number the computer allocates the correct pitch by reading it from data. If you enter 19, which means rest, the computer cannot sound a note that does not exist so it increases the gap from the last note entered by adding to $p(x)$ of the previous note.

MUSICAL MACHINE

=====

1 = 	4 = 	7 = 	10 = 
2 = 	5 = 	8 = 	
3 = 	6 = 	9 = 	



1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9

1 LOAD TUNE	5 EDIT TUNE
2 SAVE TUNE	
3 PLAY TUNE	
4 MAKE TUNE	

ENTER CHOICE?4

The hard part of the program was setting the right lengths for the different notes in each time signature. If you want to insert an envelope into the program it may cause the program to speed up or slow down. To counteract this the variables in lines 900-970 would have to be changed.

MAIN PARTS OF THE PROGRAM

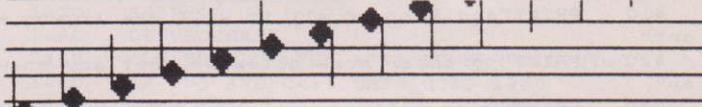
- 10-760 Sets up screen display.
- 859-1320 Allows you to enter tune.
- 1340-1430 Plays the tune.
- 1440-1490 Deals with entry of rest.
- 1510-1650 Saves tune.
- 1670-1810 Loads tune.

PROGRAM DETAILS

- 10-40 Notes about program.
- 50 Sets mode.
- 70-100 Sets variables.
- 120-300 Defines user defined characters.
- 320-440 Print text graphics on screen.
- 450 Joins text cursor to graphics cursor.
- 460-490 Print text at graphic locations.
- 500-560 Print notes in ascending order.
- 570-600 Draws staves from data.
- 610-620 Data from staves.
- 630-680 Draws ledger lines from data.
- 690 Data for ledger lines.
- 700 Sets up a text window.
- 730-760 Prints menu on screen.
- 770 Accepts choice.
- 780-820 Depending on choice does procs.
- 860-870 Accepts time signature.
- 880-890 Checks for illegal entry.
- 900-970 Depending on time signature sets up length of notes and rests.
- 980 Accepts note number.
- 990-1000 Checks for illegal entry.
- 1010 Accepts note value if 19 goto procrest.
- 1020-1030 Checks for illegal entry.
- 1040-1060 Gives pitch value to note entered.
- 1070 Data for pitch value.
- 1080 Accepts if note has flat or sharp.
- 1090-1100 Checks for illegal entry.
- 1110-1120 Increase or decrease pitch value accordingly.
- 1130 Accepts type of note.
- 1140-1150 Checks for illegal entry.
- 1160 Accepts if dotted note.
- 1170-1180 Check for illegal entry.
- 1190-1200 Increase length value of the note accordingly.
- 1210 Accepts if slurred.
- 1220-1230 Checks for illegal entry.
- 1240 If slurred then makes gap between notes.
- 1250 Accepts enter edit any more notes.
- 1260-1270 Checks for illegal entry.
- 1280 If answer yes then goto 980.
- 1290 If answer no accepts no. of notes in tune.
- 1300-1310 Checks for illegal entry.

- 1320 Goto menu.
- 1350 Accepts how many times tune to be played.
- 1360-1370 Checks for illegal entry.
- 1380 Sets loop for times to be played.
- 1390 Sets loop for no. of notes in tune.
- 1400 Produces gap between notes.
- 1410 Plays note.
- 1420 Loops: stops sound after last note.
- 1430 Goto menu.
- 1440-1480 Accepts rest no. goto 1010.
- 1510 Save tune procedure.
- 1520 Accepts file name.
- 1530 Check file name not longer than three letters.
- 1570-1600 Saves variables into file.
- 1610 Closes file.
- 1630-1640 Delay loop.
- 1650 Goto menu.
- 1670 Load file procedure.
- 1680 Accepts file name.
- 1690 Check file name not longer than three letters.
- 1730-1760 Loads file.
- 1770 Close file.
- 1790-1800 Delay loop.
- 1810 Goto menu.

PROGRAM LISTING



```

50  MODE4
60  CLS
70  VDU23;8202;0;0;0;
80  VDU19,1,6,0,0,0,19,2,4,0,0,0
90  COLOUR2:COLOUR129:PRINT;SPC(50);"INSTRUCTI
ONS";SPC(18)
100 COLOUR3:COLOUR128
110 PRINT:PRINT
120 PRINT"This program contains the instructio
ns"
130 PRINT"for the music program that follows.W
hen"
140 PRINT"the next program has been loaded and
is"
150 PRINT"running the first thing you will be"
160 PRINT"confronted with is a screen display"
170 PRINT"On the screen will be a series of no
tes"
180 PRINT"in ascending order with a code numbe
r"
190 PRINT"under them.Above these notes will be
the"
200 PRINT"different type of note which you can
"
210 PRINT"choose followed by there code number
"
220 PRINT"The computer will first ask you to e
nter"
230 PRINT"1 LOAD TUNE,2 SAVE TUNE,3 PLAY TUNE"
240 PRINT"4 MAKE TUNE,5 EDIT TUNE and you repl
y"
250 PRINT"with the number you want.When making
a"
260 PRINT"tune the computer will first ask"
    
```

CONTINUED OVER

```

270 PRINT"NUMBER OF THE NOTE this means you en
ter"
280 PRINT"1 if it is the first note in the tun
e"
290 PROCWAIT
300 PRINT"Next it will ask you to enter the CO
DE"
310 PRINT"NUMBER OF THE NOTE this being the nu
mber"
320 PRINT"directly below the note which is in
the"
330 PRINT"ascending order of notes.Next it wil
l"
340 PRINT"ask DOES IT HAVE A SHARP OR FLAT the
"
350 PRINT"answer being 1 for sharp,2 for flat
and"
360 PRINT"RETURN for neither.It will then ask
for"
370 PRINT"THE TYPE OF NOTE it is i.e. the code
"
380 PRINT"number which refers to,for example,a
"
390 PRINT"crotchet.Next is it a DOTTED NOTE an
swer"
400 PRINT"y or n.Next is it SLURRED answer y o
r n."
410 PRINT"And last of all it will ask if you w
ant"
420 PRINT"to enter more notes or edit any answ
er"
430 PRINT"y or n.If there is a rest you enter
o"
440 PRINT"when it asks for the note number"
450 PRINT"then enter the type of rest it is."
460 PRINT"It won't except a file name greater"
470 PRINT"than three letters long.To edit"
480 PRINT"you enter the number of the note"
490 PRINT"you want to edit and follow the"
500 PRINT"normal procedure for entering a new
tune"
510 PROCWAIT
520 CLS:PRINTTAB(8,20);"LOADING MUSICAL MACHIN
E";:PRINTTAB(15,21);""::CHAIN"MUSICB"
530 DEF PROCWAIT
540 PRINTTAB(8,25);"<PRESS ANY KEY TO CONTINUE
>";:A$=GET$
550 CLS
560 ENDPROC

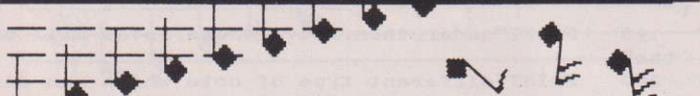
```

```

150 VDU 23,243,255,255,255,255,129,129,129,255
160 VDU 23,244,255,129,129,129,255,255,255,255
170 VDU23,245,0,24,36,66,66,66,66,66
180 VDU23,246,66,36,36,36,36,36,24,16
190 VDU23,247,48,83,156,184,168,164,180,147
200 VDU 23,248,0,128,64,64,32,32,16,16
210 VDU23,249,81,81,77,65,65,33,33,31
220 VDU23,250,16,16,32,32,64,64,64,192
230 VDU23,251,1,1,1,1,66,34,36,24
240 VDU23,252,128,128,128,128,128,128,128,128
250 VDU23,253,128,128,128,128,135,156,240,224
260 VDU23,254,135,156,240,224,135,156,240,224
270 VDU23,226,56,8,16,48,56,12,24,32
280 VDU23,255,128,128,128,128,128,128,128,128
290 VDU23,227,2,4,4,8,8,0,0,0
300 VDU23,225,2,252,4,8,8,0,0,0
310 REM SCREEN DISPLAY
320 PRINTTAB(13,2);"MUSICAL MACHINE";
330 PRINTTAB(12,3);"=====";
340 PRINTTAB(3,5);"1 = ";CHR$(241);" 4 = ";
CHR$(240);" 7 = ";CHR$(242);" 10 = ";CHR$(22
6)
350 PRINTTAB(25,6);CHR$(225)
360 PRINTTAB(16,12);CHR$(227)
370 PRINTTAB(3,8);"2 = ";CHR$(240);" 5 = ";
CHR$(240);" 8 = ";CHR$(243)
380 PRINTTAB(3,11);"3 = ";CHR$(240);" 6 = "
;CHR$(242);" 9 = ";CHR$(244)
390 PRINTTAB(3,21);"1 2 3 4 5 6 7 8 9 0 1 2 3
4 5 6 7 8 9";
400 PRINTTAB(1,15);CHR$(245);
410 PRINTTAB(1,16);CHR$(246);
420 PRINTTAB(1,17);CHR$(247);CHR$(248);
430 PRINTTAB(1,18);CHR$(249);CHR$(250);
440 PRINTTAB(1,19);CHR$(251);
450 VDU5
460 MOVE255,752:PRINTCHR$(252):MOVE543,848:PRI
NTCHR$(252)
470 MOVE255,720:PRINTCHR$(252):MOVE543,816:PRI
NTCHR$(254)
480 MOVE543,752:PRINTCHR$(253):MOVE543,720:PRI
NTCHR$(254)
490 MOVE254,656:PRINTCHR$(252):MOVE254,624:PRI
NTCHR$(253)
500 LET X=96:LET Y=416
510 FOR T=1 TO 18
520 MOVEX,Y:PRINTCHR$(240)
530 IF T>=7 THEN MOVEX+31,Y-16:PRINTCHR$(252):
MOVEX+31,Y-48:PRINTCHR$(252):GOTO550
540 MOVE X,Y+16:PRINTCHR$(255):MOVE X,Y+48:PRI
NTCHR$(255)
550 LET X=X+64:LET Y=Y+16
560 NEXT
570 FOR X=1 TO 5
580 READ A:READ B:READ C:READ D
590 MOVE A,B:DRAW C,D
600 NEXT
610 DATA 0,416,1280,416,0,448,1280,448,0,480,1
280,480
620 DATA 0,512,1280,512,0,544,1280,544
630 Y=576
640 FOR P=1 TO 16
650 READX
660 MOVEX,Y:DRAW X+48,Y

```

PROGRAM LISTING 2



```

50 MODE4:CLS
60 REM SET VARIABLES
70 DIM N(5):DIM R(10):DIM V(200):DIM L(200):D
IM P(200)
80 FOR X= 1TO 200
90 LET P(X)=1
100 NEXT
110 REM DEFINE CHARACTERS
120 VDU 23,240,24,60,126,255,255,126,60,24
130 VDU 23,241,24,60,126,194,194,126,60,24
140 VDU 23,242,0,32,112,249,115,37,57,2

```

```

670 IF P=7 OR P=12 OR P=15 THEN LET Y=Y+32
680 NEXT
690 DATA 795,859,923,987,1051,1115,1179,923,98
7.1051,1115,1179,1051,1115,1179,1179
700 VDU4
710 REM PRINT COMMANDS
720 VDU28,0,31,39,23
730 PRINT"1 LOAD TUNE 5 EDIT TUNE":VDU10
740 PRINT"2 SAVE TUNE":VDU10
750 PRINT"3 PLAY TUNE":VDU10
760 PRINT"4 MAKE TUNE"
770 PRINTTAB(20,28);"          ENTER CHOIC
E":INPUT J
780 IF J=1 THEN PROCLOAD
790 IF J=2 THEN PROCSAVE
800 IF J=3 THEN PROCPLAY
810 IF J=4 THEN PROCMAKE
820 IF J=5 THEN PROCMAKE
830 GOTO 730
840 REM ENTER TUNE
850 DEFPROCMAKE:CLS
860 PRINT"ENTER TIME SIGNATURE TOP NO. FIRST"

870 INPUT A:INPUT B
880 IF A>1 AND A<7 AND B>3 AND B<9 THEN GOTO 9
00
890 CLS:GOTO 860
900 IF A=6 AND B=8 THEN LET N(1)=10.5:N(2)=5.2
5:N(3)=2.625:N(4)=1.3125:N(5)=0.65625
910 IF A=4 AND B=4 THEN LET N(1)=14:N(2)=7:N(3)
)=3.5:N(4)=1.75:N(5)=0.875
920 IF A=3 AND B=4 THEN LET N(1)=10:N(2)=5:N(3)
)=2.5:N(4)=1.25:N(5)=0.625
930 IF A=2 AND B=4 THEN LET N(1)=8:N(2)=4:N(3)
)=2:N(4)=1:N(5)=0.5
940 IF A=6 AND B=8 THEN LET R(6)=2.625:R(7)=1.
3125:R(8)=21:R(9)=10.5:R(10)=5.25
950 IF A=4 AND B=4 THEN LET R(6)=3.5:R(7)=1.75
:R(8)=28:R(9)=14:R(10)=7
960 IF A=3 AND B=4 THEN LET R(6)=2.5:R(7)=1.25
:R(8)=20:R(9)=10:R(10)=5
970 IF A=2 AND B=4 THEN LET R(6)=2:R(7)=1:R(8)
)=16:R(9)=8:R(10)=4
980 CLS:PRINT"ENTER NOTE NO.":INPUTX:CLS
990 IF X>0 THEN GOTO 1010
1000 GOTO 980
1010 PRINT"ENTER NOTE VALUE":INPUT C:IF C=19 TH
EN PROCREST:GOTO1250
1020 IF C>0 AND C<20 THEN GOTO 1040
1030 CLS:GOTO 1010
1040 FOR T=1 TO C
1050 READ D:NEXTT
1060 LET V(X)=D
1070 DATA109,117,121,129,137,145,149,157,165,16
9,177,185,193,197,205,213,217
1080 CLS:PRINT"DOES IT HAVE A SHARP OR FLAT 1 0
R 2":INPUT Z
1090 IF Z=1 OR Z=2 OR Z=3 THEN GOTO 1110
1100 GOTO 1080
1110 IF Z=1 THEN LET V(X)=V(X)+4
1120 IF Z=2 THEN LET V(X)=V(X)-4
1130 CLS:PRINT"ENTER TYPE OF NOTE":INPUT E
1140 IF E>0 AND E<6 THEN GOTO 1160
1150 GOTO 1130
1160 CLS:PRINT"IS IT A DOTTED NOTE":INPUT C$
1170 IF C$="N" OR C$="Y"THEN GOTO 1190
1180 GOTO 1160

1190 IF C$="Y"THEN LET L(X)=N(E)+(N(E)/2)
1200 IF C$="N"THEN LET L(X)=N(E)
1210 CLS:PRINT"IS IT SLURRED":INPUTC$
1220 IF C$="N" OR C$="Y"THEN GOTO 1240
1230 GOTO 1210
1240 IF C$="Y"THEN LET P(X)=0 ELSE P(X)=1
1250 CLS:PRINT"ENTER OR EDIT MORE NOTES":INPUT
C$
1260 IF C$="N" OR C$="Y"THEN GOTO 1280
1270 GOTO 1250
1280 IF C$="Y"THEN RESTORE1070:GOTO 980
1290 CLS:PRINT"ENTER AMOUNT OF NOTES IN TUNE":I
NPUTQ
1300 IF Q>0 THEN GOTO 1320
1310 GOTO 1290
1320 CLS:RESTORE1070:ENDPROC
1330 REM TUNE
1340 DEFPROCPLAY
1350 CLS:PRINT"HOW MANY TIMES":INPUTC
1360 IF C>0 THEN GOTO 1380
1370 GOTO 1350
1380 FOR T=1 TO C
1390 FOR Y=1 TO Q
1400 SOUND &0001,0,0,P(Y)
1410 SOUND &0001,-15,V(Y),L(Y)
1420 NEXT:NEXT:SOUND &0001,0,0,0:CLS
1430 ENDPROC
1440 DEFPROCREST
1450 CLS:PRINT"ENTER REST NUMBER":INPUT C
1460 IF C>5 AND C<11 THEN GOTO 1480
1470 GOTO 1450
1480 LET P(X)=1+R(C)
1490 ENDPROC
1500 REM SAVE FILE
1510 DEFPROCSAVE
1520 CLS:PRINT"ENTER FILE NAME":INPUT FILE$
1530 LET FILE=INT(VAL(FILE$)):IF LEN(FILE$)>3 T
HEN PRINT"FILE NAME TOO LONG":GOTO1390
1540 FILE$="FILE"+FILE$
1550 Y=OPENOUT FILE$
1560 PRINT"SAVING"
1570 PRINT#Y,X,Q:FOR S=1 TO Q
1580 PRINT#Y,V(S),L(S),P(S)
1590 NEXTS
1600 PRINT#Y,A,B
1610 CLOSE#Y
1620 CLS:PRINT"FILE HAS BEEN SAVED"
1630 FOR V=1 TO 1000
1640 NEXT
1650 ENDPROC
1660 REM LOAD FILE
1670 DEFPROCLOAD
1680 CLS:PRINT"ENTER FILE NAME":INPUT FILE$
1690 LET FILE=INT(VAL(FILE$)):IF LEN(FILE$)>3 T
HEN GOTO 1680
1700 FILE$="FILE"+FILE$
1710 Y=OPENIN FILE$
1720 PRINT"LOADING":FILE$
1730 INPUT#Y,X,Q:FOR S=1 TO Q
1740 INPUT#Y,V(S),L(S),P(S)
1750 NEXTS
1760 INPUT#Y,A,B
1770 CLOSE#Y
1780 CLS:PRINT"FILE HAS BEEN LOADED"
1790 FOR V=1 TO 1000
1800 NEXT
1810 ENDPROC

```

Secret Agent

Steve Lucas

The fate of the world is in your hands. Secret Agent sends you on a dangerous mission in exotic locations. When you have solved the Adventure, you can use the datafile generator to write your own games.

My name is BOND... Sidney Bond (well you didn't expect my brother did you?). Agent 009 Licensed to kill. My superior, M, has sent me on a difficult and dangerous assignment. Xoltan, that famous scientist has defected to the East, having stolen the plans for the nuclear submarine LUBINAR and even now he is in the process of building a replica so that he can hold the world to ransom.

I must destroy Xoltan and save the world. Q has prepared a few special devices to help me in my task, but M has sent me off in my quest before I have had a chance to find out what they are. You must help me in my task by giving me instructions in the form of one or two words. Here are some examples of the words I understand:
N, S, E, W, GO, IN, OUT, UP, DOWN, GET, TAKE, DROP, LEAVE, PUT, WAIT, CLIMB, JUMP, CUT, DRIVE, INVENTORY, SWIM, EXAMINE, SEARCH, RIDE, PAY, HELP, PRAY, USE, INSERT, UNLOCK, LAND, FLY, PULL, KILL, STAB, SHOOT, MEND, REPAIR, PUSH, PRESS, READ, EAT, DRINK, SCORE, LOOK, NORTH, SOUTH, EAST, WEST, PAY

On my journey, I will come across many different forms of transport and will face many difficult problems which I hope you will help me to solve.

What is the secret of the beautiful lady, the mysterious fisherman and the broken computer?

HINTS

With 158 locations and over 40 items, you may encounter a number of problems. The fun of playing adventure games is in solving these problems and I would advise you NOT to read these hints until you are pulling your hair out in frustration!

1. The key is needed for two purposes!
2. Beware of the fisherman! He is carrying something of use.
3. Barbed wire fences can be cut.
4. EXAMINE items carefully. Q has a habit of manufacturing things which are not all they may seem! You must be holding them to EXAMINE them carefully.
5. You do have a JET pack on your back which should get you out of any difficulty.
6. There is only one way of killing XOLTAN! All others will result in your death.
7. There are a number of occasions where you should WAIT around to see what happens.
8. You can DRIVE, FLY, RIDE and LAND all sorts of vehicles.
9. Taxi drivers do like payment!
10. Don't get locked in a cell by CUSTOMS men.
11. CREDIT cards are very useful.
12. EXTRA items may be

found by SEARCHING in locations or EXAMINING things.

13. BEWARE of all people...they may be enemy agents!
14. Trees can be climbed.
15. You can always try JUMPING from high places!!!

PROGRAM 1

This program is used to write the data file. If you are using disc or econet, you must type *TAPEA <return> and set PAGE = &E00 <return> because there is not enough room in the memory otherwise.

Take care when entering the program that you enter the DATA statements exactly as listed or the program will not read the data into the correct array elements and the data file created will not work in the main program properly. You should NOT type in the REM statements as there is not enough room.

There are 158 locations to be visited, 41 phrases and 29 objects to be found in this data file (there are extra objects to be found in the game itself). These are READ into the variables as follows:

S%(X%,Y%) holds the map of the locations to be visited

Q\$(X%) holds the descriptions of the locations

X\$(x%) holds the messages

G\$(X%) holds the items to be found

B%(x%,0)

N\$(X%)

holds the locations of the items

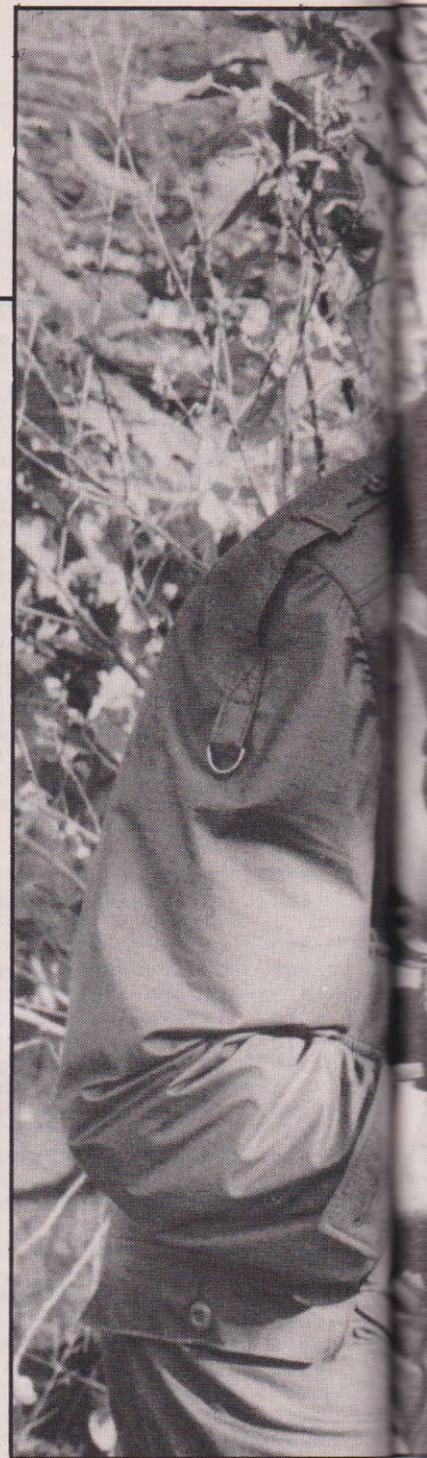
holds the word understood for the item

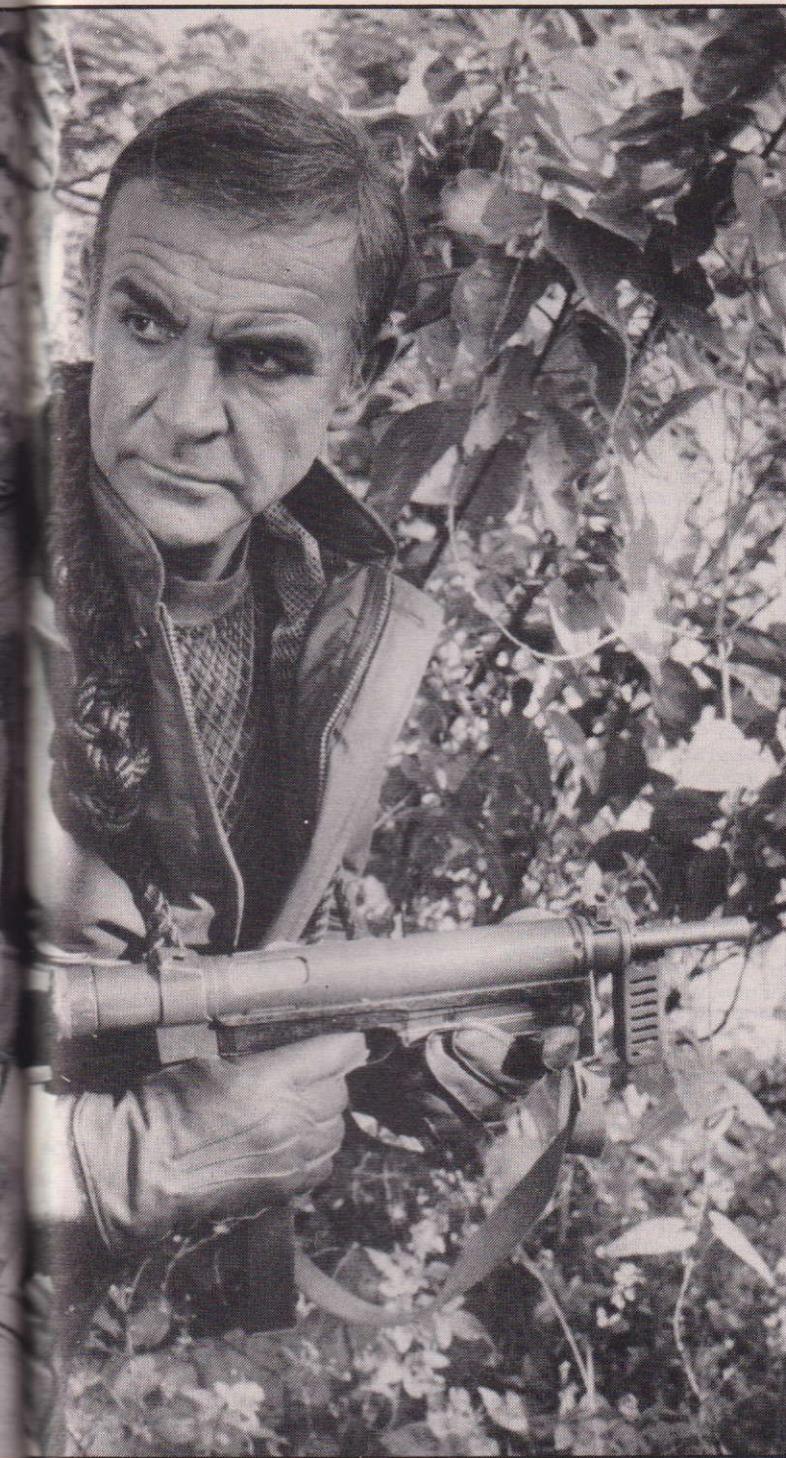
PROGRAM BREAKDOWN

30	disables escape
10-50	reads data into arrays as above
60-70	writes the data file to tape
80-650	holds the data for the game

Before running the program, I would advise you to save a copy. Once you have done this, you can run the program. If you have

entered the data correctly, you will be asked to insert a tape to record the data file. I would recommend that you save this





data file after the main program "GAME" on the tape so that loading the game involves merely typing CHAIN""

PROGRAM 2

There is only just enough room in memory for this game and therefore I decided to include the instructions in the loader program. This program serves a number of other functions. Firstly, it is used to disable the escape key and to redefine the BREAK

key. Once this has been done, it will be carried over to the main program and therefore I would recommend that you switch the machine off and then on again before typing in program 3. The value of the resident integer variables is then set to their initial value. These values are also carried over to the main program. Integer variables are widely used because they use less memory overhead and also cause the program to run much faster. The final function of this program is to set PAGE to &E00 and CHAIN

the main program (which should be saved with the Filename "GAME") so that disc users do not need to adjust the setting of PAGE.

TECHNICAL DETAILS

When I decided to write an adventure game with over 150 rooms which would be compatible with both Acorn Electron and BBC microcomputer, it was obvious that I would not be able to READ the DATA for the locations into ARRAYS, because there would not be sufficient room in the memory when using MODE 6. I could have used MODE 7, but this would have made the program incompatible with the ELECTRON.

The BBC micro is very inefficient in its use of memory when reading the data into an array and I therefore looked at the idea of only reading a description of a location into the variable when you have reached that location. This can be achieved by using RESTORE (line number). This is unfortunately very slow and therefore in order to get a rapid response to instructions and to make economical use of

machine with BASIC 2. This uses the keywords OPENIN, OPENOUT and OPENUP. Users with BASIC 2 do not have OPENUP keyword available and should replace this with OPENIN (line 30 program 3). Users with

BASIC 2 should use OPENUP rather than OPENIN because it uses the same TOKEN for the keyboard as OPENIN in BASIC1 and only then will a tape be compatible with all machines. To find out if you have BASIC 1 or BASIC 2 type REPORT <return>. BASIC 2 will give a copyright message dated 1982 rather than 1981.

PROGRAM 3

This is the main program. Switch the computer off and on again before typing this program in and save a copy of the program on tape immediately after PART 1. Do not attempt to run the program itself, as it will not work properly unless the values of the integer variables are carried over from PART 1. Because of the nature of this program, debugging will be extremely difficult once the program has been chained from PART 1 and I would advise you to check and double check

100	selects TAPE filing system
110	chooses Mode 6 — this is carried over to the main program
120	chooses background colour blue — change to colour you would like
180	disables escape
200	disables break
210-240 and 270-320	give instructions
250-260	sound effects
330-340	set value of initial variables
360	set PAGE to &E00
370	CHAINs the main program
380	DATA for sound effects

memory, I decided to read the data for the game in from a data file.

The first task, therefore was to write a program which creates the data file for the adventure game.

NOTE

The programs were written on a

each statement as you type it in and save a copy before running it. Any errors in the data file will also cause errors in the main program and you must be certain that the data file is fully debugged or you could spend a long time looking for typing errors in the main program when the mistake is in fact in the data file.

Do not type in the REM

CONTINUED OVER

VARIABLES USED

The arrays used for the locations, items etc are the same as for PART 1. In addition, the following variables are used:-

- P% holds current position
- E% acts as flag to check whether item is there
- Z\$ holds INPUT sentence:- this is split into two parts
- L\$ holds the second input word
- C\$ & B\$ hold first few letters of input into statement
- M%,N%,O% etc are used as flags to check if certain events have taken place!
- X\$ holds messages
- R holds item number being asked for

There is virtually no extra room in this program in MODE 6. BBC owners could use MODE 7 because this will release an extra 7K of memory, which could be used to insert extra obstacles or to implement a SAVE GAME routine. FOR EXAMPLE:- you could try adding the following:

statements as there is not enough room left in MODE 6. BBC users could use MODE 7 instead and this would leave enough room for a save game routine, for which there is not enough room in the Electron.

- 10 error handling routine... to save space, an error is generated when someone attacks
- 20 dimensions the arrays
- 30 reads in the data file (which should be saved on tape immediately after the main program)
- 40-90 decides the directions you can go in. These are chosen by N,S,W,E, Up, DOWN
- 10-130 describes the items to be seen
- 140 asks for your actions
- 150-260 calls different PROCs depending upon your actions
- 40-270 main control loop:-REPEAT UNTIL you reach location 158
- 280-300 procedure for going up
- 310-330 procedure for going down
- 340-360 jump routine
- 370-400 GO IN routine
- 410-430 GO OUT routine
- 440-460 procedure for losing life
- 470-500 WAIT routine
- 510-580 GET procedure
- 590-630 procedure to determine whether item is in location
- 640-670 INVENTORY routine
- 680-730 DROP procedure
- 740-760 SWIM routine
- 770-810 EXAMINE routine
- 820-840 RIDE routine
- 850-900 PAY routine
- 910-930 HELP procedure
- 940-970 FLY plane routine
- 980-1000 LAND plane procedure
- 1010-1030 PROCcheck(C%) — checks if you are carrying item number C%
- 1040-1060 CUT fence routine
- 1070-1100 DRIVE car routine
- 1110-1120 SEARCH routine
- 1130-1150 PULL routine
- 1160-1170 use key procedure
- 1180-1190 SAY routine
- 1200-1220 STAB routine
- 1230-1250 SHOOT procedure
- 1260-1270 REPAIR or MEND routine
- 1280-1290 PUSH procedure
- 1300-1310 READ book/magazine routine

PROGRAM LISTING 1

```

10 MODE6
20 DIM SZ(216,4),Q$(216),X$(41),G$(29),B%(29,0),N$(
29)
30 *FX229,1
40 VDU19,0,4,0,0,0:PRINTSPC(2)"DATA FILE CREATOR for
'SECRET AGENT'"Reading data into arrays...please w
ait."
50 FORX%=1TO158:FORY%=1TO4:READS%(X%,Y%):NEXT:READQ
$(X%):NEXT:FORX%=1TO41:READX$(X%):NEXT:FORX%=1TO29:READ
G$(X%),B%(X%,0),N$(X%):NEXT
60 PRINT""Now place tape in recorder ready to SAVE
data file and press <space bar> ":REPEAT UNTIL GET=32
70 Z=OPENOUT("DATA"):FORX%=1TO158:FORY%=1TO4:PRINT#
Z,S%(X%,Y%):NEXT:PRINT#Z,Q$(X%):NEXT:FORX%=1TO41:PRINT#
Z,X$(X%):NEXT:FORX%=1TO29:PRINT#Z,G$(X%),B%(X%,0),N$(X%
):NEXT:CLOSE#Z
80 DATA 2,0,0,0,by a large locked gate,0,1,3,0,in a
desolate clearing,5,0,4,2,in a forest,6,0,0,3,lost in
a forest,7,3,6,0,in a forest,0,4,0,5,in a forest,0,5,0,
8,by an open garden gate,0,0,7,9,in a well tended garde
n
90 DATA 0,0,8,0,at the door of an old mansion,0,0,1
1,0,by the front door,0,0,12,10,in a long hallway,0,0,1
3,11,at the bottom of a stairway,14,15,16,12,at the end
of the hall
100 DATA 0,13,0,0,in a library. It is full of cobweb
s,13,0,0,0,in an empty room,0,0,0,13,in a broom cupboar
d,20,0,18,19,at the top of the stairs,0,0,0,17,in a bat
hroom,0,0,17,0,in a small bedroom,0,17,0,0,in a large b
edroom
110 DATA 0,24,22,23,by a locked gate. A sign here re
ads 'Trespassers will be prosecuted',0,0,0,21,by a
n enormous chemical plant,0,25,21,0,outside a locked hu
t,21,0,0,0,by a barbed wire fence
120 DATA 23,0,0,0,by a locked building,24,28,27,0,by
a barbed wire fence. A footpath leadseast,0,0,29,26,on
a narrow footpath,26,0,0,0,in a timber yard,30,32,31,2
7,in a naval dockyard,0,29,0,0,by a large crane
130 DATA 0,0,33,29,by a nuclear submarine,29,0,0,0,0
n the quay,0,0,0,0,in a submarine hatch,25,35,0,0,insid
e a disused factory,34,0,0,36,by some machinery.I hear
a distant noise,0,37,35,0,in a wide passageway,36,39,0,
0,by some pipes
140 DATA 0,0,0,39,in a computerised control room,37,
0,38,0,in a small corridor,0,41,0,0,in the hatch of a s
ubmerged submarine,40,0,42,0,by a control panel,0,43,0,
41,by a torpedo tube,42,0,44,0,by a ballast tank
150 DATA 0,46,45,43,in the engine room,0,0,0,44,in t
he cargo hold. It is full of boxes,44,0,0,0,by some str
ange looking machinery,0,48,0,0,by an open hatch,47,0,4
9,50,on a sandy beach. There is a submarine to the Nor
th
160 DATA 0,51,0,48,on a sandy beach,0,52,48,53,by a
beach hut,49,0,54,0,on a footpath,50,0,0,0,inside a bea
ch hut,0,0,50,0,by a small cafe selling ice cream,0,55,
56,51,on a garage forecourt
170 DATA 54,0,0,0,by a parked car,57,0,0,54,by some
petrol pumps,0,56,58,0,on a long road,0,0,58,57,on a lo
ng road stretching East,0,0,0,0,in a parked car,0,0,0,0
,driving along a narrow winding road
180 DATA 0,0,0,0,inside the car. I can see a town to
the East,0,63,64,0,on the outskirts of a town. There i
s a car here,62,63,0,0,on a long road leading South,0,
65,66,62,by a set of traffic lights,64,67,0,0,by a smal
l airfield
190 DATA 0,0,68,64,by a shopping arcade,65,0,69,0,on
a grass runway. There is a Tiger Mothairplane to the
East,72,70,71,66,in a small shopping arcade,0,0,0,67,in
the Tiger Moth plane,68,0,0,0,in a shop selling Motor
Bike accessories

```

200 DATA 0,0,0,68,in a cake shop,0,68,0,0,in a shoe shop,0,0,0,0,flying high above the clouds...HELP!,0,79,0,0,in the cockpit of the Tiger Moth,0,0,0,79,by a locked hanger

210 DATA 79,0,77,0,in the airport building,0,78,80,76,in the customs hall.A notice here reads Nothing to declare.. East,77,81,0,0,by a desk. The custom's officer knows meand lets me through

220 DATA 74,76,75,0,on a runway by the side of a Tiger Moth,0,0,0,0,locked in a cell. The customs officers have arrested me for attempted smuggling,78,82,0,0,by an airport bookstall,81,83,0,0,in the airport foyer

230 DATA 82,0,84,85,at a taxi rank,0,0,0,83,in a vast car park,0,0,83,0,by a locked barrier,0,0,0,0,riding in a taxi,0,0,0,0,in a stationary taxi,0,0,89,0,in a taxi. The driver has opened the door

240 DATA 0,0,90,88,outside a military base. The gate is locked,0,0,0,89,by a tall tree at the side of a militarybase,0,0,0,92,in the branches of a tall tree,0,0,91,0,on a branch which hangs over the base

250 DATA 0,0,95,94,inside the perimeter fence of a militarybase,0,0,93,0,by a locked gate. I can see soldiers in the distance

260 DATA 0,96,0,93,by some fuel tanks,95,0,97,0,in the entrance of a large building,0,98,0,0,in a large store room,97,99,100,0,in an area full of boxes,98,0,0,0,at the bottom of some steps

270 DATA0,0,102,98,in an open doorway,0,0,0,0,in a small office,0,0,103,100,by a small amphibious vehicle,0,0,104,102,on a road,0,0,0,103,by the side of a deep dark lake,0,0,0,0,sat at the controls of an amphibious vehicle

280 DATA 0,107,108,0,driving an amphibious vehicle in a yard,106,0,0,0,at a dead end,0,0,109,106,driving along a road,0,0,110,108,driving into a deep lake,0,0,112,11,109,in the dark depths of the lake,0,113,0,110,in the deep lake

290 DATA 110,0,113,0,in the deep lake,111,114,113,112,in the deep lake,113,115,114,118,in the deep lake,114,116,115,117,in the deep lake,115,119,0,0,at the entrance to an underwater cave,118,117,115,117,in the deep lake

300 DATA 0,117,114,0,by a large rock,116,120,0,0,driving into a cave entrance,0,0,0,0,parked in a small airlock. The door has closed behind me and it has filled with air,0,123,0,122,in an airlock. There is an amphibious vehicle here

310 DATA 0,0,121,0,at the bottom of some stairs,121,0,0,0,in a control room,0,0,0,125,at the top of some steps,126,128,124,0,in a narrow corridor,0,125,127,0,by a small doorway,0,0,127,126,on a small platform.There is a train in

320 DATA 125,0,0,0,at the top of a deep well,0,0,0,0,riding on a tube train,0,0,0,131,on a stationary tube train,0,132,130,0,on a platform,131,133,0,0,on a staircase,132,134,0,0,at the top of the staircase

330 DATA 133,0,135,0,at the West end of a vast chamber,0,136,0,134,at the East end of a vast chamber,135,137,0,0,in a low passageway,136,138,0,0,in a wide passage

340 DATA 137,140,139,0,in a brightly lit cavern full of men in overalls

350 DATA 0,0,0,138,in a crowded lift

360 DATA 138,0,0,0,by a sheer rock face. A rope hangs from above

370 DATA 0,0,142,0,at the top of a rock face. A rope hangs down

380 DATA 0,0,0,141,in a secret laboratory

390 DATA 0,144,0,0,in a crowded lift

400 DATA 143,145,146,0,in a hotel foyer

410 DATA 144,147,0,0,in a hotel bar

420 DATA 0,0,149,144,by a hotel desk

430 DATA 145,0,0,0,by a swimming pool

440 DATA 147,148,148,148,swimming in the pool

450 DATA 0,150,0,146,at the rear entrance to a hotel . A path leads South

460 DATA 149,151,0,0,at the entrance to a campsite

470 DATA 150,153,152,0,by the camp shop

480 DATA 0,0,0,151,in the camp shop

490 DATA 151,154,0,0,on a path. There are tents to the left and right

500 DATA 153,0,155,0,on a path. There is a dark gloomy forestto the East

510 DATA 0,156,0,154,in a dark forest

520 DATA 155,0,0,157,in a forest. There is a cave to the East

530 DATA 0,0,156,0,in the secret hideout of Xoltan

540 DATA 0,0,0,0,at the end of my goal. Xoltan is dead

550 DATA not likely!,sorry,how?,no!

560 DATA I would if I could,It's too dangerous,not here

570 DATA nothing happens,I can't see anything special,O.K.,I see something,I haven't got it

580 DATA I shoot the gun,its dead,He shoots first,I'm dead would you like another game?,it glistens,What do I do now?

590 DATA I can go, North,South,East,West,I can see,I forgot my glasses,I'm not hungry,I don't drink alcohol ,That's not much use,I'm sorry I don't have a clue,don't swear at me!,HELP,don't be silly!,he refuses,she doesn't like that

600 DATA I've never done this before,this is fun,whoops!,I slipped and broke my neck,SPLAT!,Zap,BANG

610 DATAa small key,20,KEY,a stiff brush,16,BRUSH,some mushrooms,6,MUSHROOM,an oil drum,27,DRUM,a computer repair manual,38,MANUAL,an armed guard,77,GUARD

620 DATAa crash helmet,70,HELMET,a pair of shoes,72,SHOES,a cake,71,CAKE,a torpedo,43,TORPEDO,a can of soup,45,SOUP,some sunbathers,48,SUNBATHERS,a bath towel,52,TOWEL,an attendant,54,ATTENDANT

630 DATAa red lever,105,LEVER,an old tramp,108,TRAMP,a fish,112,FISH,a revolver,97,REVOLVER,Xoltan himself!,157,XOLTAN

640 DATAsome firelighters,152,FIRELIGHTER,a golden bullet,142,BULLET,a beautiful lady who is swimming,148,LADY,a blue button,41,BUTTON,a magazine,81,MAGAZINE,a Rolls Royce,84,ROLLS

650 DATA a credit card,14,CARD,a fisherman,32,FISHERMAN,a waiter,144,WAITER,a broken computer,101,COMPUTER

PROGRAM LISTING 2

```

10 REM *****
20 REM ** SECRET AGENT :- part 1 **
30 REM ** <c> January 1984 **
40 REM ** BBC micro and Acorn Electron **
50 REM ** do not type in REM statements**
60 REM ** PAGE must be set to &E00 **
70 REM ** if used from disc RELOCATE **
80 REM *****
90 REM ** CHANGE FILING SYSTEM
100 *TAPE
110 MODE6
120 VDU19,0,4,0,0,0: REM CHANGE COLOUR TO BLUE
130 PRINTTAB(10)"SECRET AGENT"
140 PRINT""My name is BOND, SIDNEY BOND !"
150 PRINT""009 -- licenced to KILL"
160 SOUND 0,-15,100,5
170 REM ** NOW TURN OFF ESCAPE KEY
180 *FX229,1
190 REM ** DEFINE BREAK KEY
200 *KEY 10 OLD:M RUN:M
210 PRINT""I have been chosen by M for an exciting and (perhaps) dangerous mission."
    
```

CONTINUED OVER

```

220 PRINT "The secret plans for the nuclear submarine LUBINAR have been stolen by that evil scientist Xoltan, who, even now, is building an exact replica so that he can hold the world to ransom."
230 PRINT "I have to destroy Xoltan and rescue the world from a fate worse than death!"
240 PRINT ""press <Space Bar> to continue"
250 REPEAT UNTIL GET =32
260 FORX=0TO20:READD: SOUND1,-15,D,3:NEXT
270 CLS
280 PRINT "You must try to help me in my mission by giving me instructions in the form of two word instructions such as EAT BEANS"
290 PRINT "Here are some of the instructions I understand :-"
300 PRINT ""GET, TAKE, DROP, GO, SCORE, INVENTORY, PUT, BUY, SHOOT, KILL, SEARCH, EXAMINE,"
310 PRINT "HELP, PRAY, DRINK, SWIM, GO, WAIT""There are more words I understand !"
320 REM ** SET RESIDENT INTEGER VARIABLES TO THEIR INITIAL VALUES
330 AX=0:BX=0:CX=0:DX=0:EX=0:FX=0:GX=0:HX=0:IX=0
340 JX=0:KX=0: LX=0:MX=0:NX=0:OX=0:PX=1:QX=0:RX=0: SX=0:TX=0:UX=0:VX=0:WX=0:XX=0:YX=0:ZX=0
350 PRINT ""Please wait for the program to load."
360 PAGE=&E00
370 CHAIN"GAME"
380 DATA 97,101,97,101,109,117,121,129,133,101,129,101,97,101,109,117,121,129,133,101,129,101

```

PROGRAM LISTING 3

```

10 ON ERROR X$="someone attacks me from behind!":PX=2:PROCLOSE
20 UX=0:OX=0:JX=0:TX=0: SX=0:MX=0:AA=0: X$="":score%=0:DIMV$(3),S$(158,4),Q$(216),X$(41),G$(29),B$(29):CLS:PRINT"PLEASE INSERT DATA TAPE NOW""and leave tape running!"
30 Z=OPENUP("DATA"):FORXX=1TO158:FORYX=1TO4:INPUT#Z,SX(X%,Y%):NEXT:INPUT#Z,Q$(X%):NEXT:FORXX=1TO41:INPUT#Z,X$(X%):NEXT:FORXX=1TO29:INPUT#Z,G$(X%),B$(X%),N$(X%):NEXT:CLOSE#Z
40 CLS:PRINT"Secret Agent 009.....Sidney Bond"":SC%=0:REPEAT:PRINT""I am :-"Q$(%):A$="":IFS$(PX,1)>OTHENAS$="North"
50 IFS$(PX,2)>OANDLEN(A$)>OTHENAS$=A$+", South"ELSEIFS$(PX,2)>OTHENAS$="South"
60 IFS$(PX,3)>OANDLEN(A$)>OTHENAS$=A$+", East"ELSEIFS$(PX,3)>OTHENAS$="East"
70 IFS$(PX,4)>OANDLEN(A$)>OTHENAS$=A$+", West"ELSEIFS$(PX,4)>OTHENAS$="West"
80 IFPX=124ORPX=141ORPX=17THENAS$=A$+", down"ELSEIFPX=12ORPX=1ORPX=21ORPX=140ORPX=122ORPX=90ORPX=99ORPX=122THENAS$=A$+", up"ELSEIFPX=101THENAS$="down"ELSEIFA$=""THENAS$="nowhere obvious"
90 PRINT""I can go :-"A$:E=0:FORTX=1TO29:PPX=0:IFBX(TX)=PXTHENPPX=1
100 IFPPX=1THEN120
110 NEXT:GOTO140
120 IFE=0THENPRINT""I can see :-"
130 PRINTG$(TX):E=E+1:GOTO110
140 INPUT""What should I do ",Z$:CLS:B$=LEFT$(Z$,2):C$=LEFT$(Z$,3):SC%=INT(PX/158*100):IFSC%>score%THENscore%=SC%
150 VDU7:K=0:IFC$="LOO"THENK=1ELSEIFC$="SCO"THENPRINT""You have scored "score%":K=1ELSEIFC$="EAT"THENPRINTX$(26):K=1ELSEIFLEFT$(Z$,5)="DRINK"THENPRINTX$(27):K=1
160 ZZ$=LEFT$(Z$,4):IFZZ$="GO N"THENB$="N"ELSEIFZZ$="GO S"THENB$="S"ELSEIFZZ$="GO E"THENB$="E"ELSEIFZZ$="GO W"THENB$="W"
170 IFB$="N"ANDS$(PX,1)<>OTHENPX=S$(PX,1):K=1ELSEIFB$

```

```

="S"ANDS$(PX,2)<>OTHENPX=S$(PX,2):K=1ELSEIFB$="E"ANDS$(PX,3)<>OTHENPX=S$(PX,3):K=1ELSEIFB$="W"ANDS$(PX,4)THENPX=S$(PX,4):K=1
180 IFB$="FU"ORB$="PI"THENPRINTX$(30):K=1ELSEIFB$="CL"ORB$="UP"ORZ$="GO UP"THENK=1:PROCUP ELSEIFB$="DO"ORZ$="GO DOWN"THENK=1:PROCdown ELSEIFB$="JU"THENK=1:PROCjump
190 IFB$="WA"THENK=1:PROCwait ELSEIFC$="IN"ORLEFT$(Z$,4)="GO I"THENK=1:PROCin ELSEIFB$="OU"ORLEFT$(Z$,4)="GO O"THENPROCout ELSEIFB$="CU"THENK=1:PROCcut
200 IFC$="GET"ORC$="TAK"THENPROCget ELSEIFC$="DRO"ORC$="LEA"THENK=1:PROCdrop ELSEIFZ$="DRIVE"THENK=1:PROCdrive ELSEIFC$="INV"THENK=1:PROCinv ELSEIFC$="SWI"THENK=1:PROCswim
210 IFC$="EXA"THENPROCexam ELSEIFC$="SEA"THENPROCsear ELSEIFC$="RID"ORLEFT$(Z$,4)="GO T"THENPROCrid ELSEIFC$="PAY"THENPROCpay ELSEIFC$="HEL"THENPROCHELP ELSEIFC$="PRA"THENK=1:PRINT"NOTHING HAPPENS!"
220 IFC$="USE"ORC$="INS"ORC$="UNL"THENPROCkey ELSEIFC$="FLY"THENPROCfly ELSEIFC$="LAN"THENPROCland ELSEIFC$="PUL"THENPROCpull ELSEIFC$="KIL"THENPRINT"by what means?" :K=1 ELSEIFC$="SHO"THENPROCshoot ELSEIFC$="STA"THENPROCstab
230 IFPX=32ANDOX<>1THENJX=JX+1:IFJX>2THENX$="Aaaagghhh ... he stabbed me!":JX=0:PROCLOSE ELSEIFC$="SAY"THENPROCsay ELSEIFPX=77THENSX=SX+1:IFSX>1THENX$="He attacks":PROCLOSE ELSEIFPX=148THENTX=TX+1:IFTX>2THENX$="She stabs me":PROCLOSE
240 IFC$="MEN"ORC$="REP"THENPROCrep ELSEIFC$="PUS"ORC$="PRE"THENPROCpush ELSEIFPX=84THENUX=UX+1:IFUX>2THENX$="It drives straight at me!":PROCLOSE
250 IFC$="REA"THENPROCread
260 IFK=0THENPRINT""I'm sorry I can't do that here"

```

```

Escape at line 260
>L.260,3000
260 IFK=0THENPRINT""I'm sorry I can't do that here"
270 UNTILPX=158:CLS:PRINT"well done .. you have killed XOLTAN. TheWorld is a safer place to live!":END
280 DEFPROCup:X=X$(3)
290 IFPX=99THENPX=101:X=X$(10)ELSEIFPX=12THENPX=17:X=X$(10)ELSEIFPX=1THENPX=21:X$="I climb over"ELSEIFPX=21THENPX=1:X$="I climb over"ELSEIFPX=140THENPX=141:X=X$(10)ELSEIFPX=122THENPX=124:X=X$(10)ELSEIFPX=90THENPX=91:X=X$(10)
300 PRINTX$:ENDPROC
310 DEFPROCdown
320 X=X$(3):IFPX=124THENPX=122:X=X$(10)ELSEIFPX=101THENPX=99:X=X$(10)ELSEIFPX=141THENPX=140:X=X$(10)ELSEIFPX=17THENPX=12:X=X$(10)
330 PRINTX$:ENDPROC
340 DEFPROCjump
350 X=X$(3):IFPX=147THENPX=148:X$="Splash"ELSEIFPX=91THENPX=90:X=X$(10)ELSEIFPX=92THENPX=93:X=X$(10)ELSEIFPX=141THENX=X$(40):PROCLOSE
360 PRINTX$:ENDPROC
370 DEFPROCin
380 K=1
390 X=X$(3):IFPX=9THENPX=10:X=X$(10)ELSEIFPX=102THENPX=105:X=X$(10)ELSEIFPX=121THENPX=120:X=X$(10)ELSEIFPX=55THENPX=59:X=X$(10)ELSEIFPX=62THENPX=61:X=X$(19)ELSEIFPX=25ANDAA=1THENPX=34:X=X$(10)ELSEIFPX=25THENX$="its locked!"
400 PRINTX$:ENDPROC
410 DEFPROCout
420 K=1:X=X$(5):IFPX=10THENPX=9:X=X$(10)ELSEIFPX=34THENPX=25:X=X$(10)ELSEIFPX=105THENPX=102:X=X$(10)ELSEIFPX=120THENPX=121:X=X$(10)ELSEIFPX=59THENPX=55:X=X$(10)ELSEIFPX=61THENPX=62:X=X$(10)
430 PRINTX$:ENDPROC
440 DEFPROCclose
450 CLS:PRINTX$'X$(16):REPEATD$=GET$:UNTILD$="Y"ORD$="N":IFD$="Y"THENPX=2:RUN ELSE END

```

```

460 ENDPROC
470 DEFPROCwait
480 X$=X$(10):TIME=0:REPEATUNTILTIME>200:IF(PX>39ANDP
X<47)THENX$="The submarine docks!":PX=47ELSEIFPX=33THEN
PX=40:X$="The submarine submerges"ELSEIFPX=86THENPX=87:
X$="The driver holds his hand out!"
490 IFPX=139THENX$="going up!":PX=143ELSEIFPX=129THEN
PX=130
500 PRINTX$:ENDPROC
510 DEFPROCget
520 K=1:PROCch :IFLX<>1THENENDPROC
530 EX=0:FORHX=1TO29:IFB$(HX)=P%ANDB$(R)=P%THENEX=1
540 NEXT:IFEX=0THENPRINT"It's not here!":ENDPROC
550 IFR=6ORR=10ORR=12ORR=14ORR=16ORR=19ORR=22ORR=25OR
R=16ORR=23THENPRINTX$(32):ENDPROC ELSEIFR=21ANDP%=142AN
DNX<>1THENPRINT"It's in a locked case!":ENDPROC ELSEIFR
=27ANDOX<>1THENPRINTX$(32):ENDPROC
560 EX=0:FORDX=1TO3:IFV$(DX)=" "THENV$(DX)=G$(R):EX=1:
DX=5
570 NEXT:IFEX=0THENX$="My hands are full!":ENDPROC
580 B$(R)=0:ENDPROC
590 DEFPROCch
600 L$=" ":FORHX=1TOLEN(Z$):IFMID$(Z$,HX,1)=" " THENL$=
RIGHT$(Z$, (LEN(Z$)-HX)):HX=HX+40
610 NEXT:R=0:LX=0:IFLEN(L$)<2THENENDPROC
620 FORHX=1TO29:IFLEFT$(N$(HX),LEN(L$))=L$ THENLX=1:R
=HX
630 NEXT:ENDPROC
640 DEFPROCinv
650 X$=" ":F%=0:PRINT"I have :-" "A jet pack..one of Q
's specials ..on my back. To use it I must SAY 'FIRE' i
nto my radio/watch""and":FORHX=1TO3:IFV$(HX)<>""THENP
RINTV$(HX):F%=1
660 NEXT:IFFX=0THENPRINT"nothing else!"
670 PRINT:K=1:ENDPROC
680 DEFPROCdrop
690 PROCch :IFLX<>1THENPRINT"I don't see a":L$:ENDPRO
C
700 EX=0:FORDX=1TO3:IFV$(DX)=G$(R)THENV$(DX)=" ":EX=1
710 NEXT:IFEX<>1THENPRINT"I haven't got it":ENDPROC
720 B$(R)=P%:CLS
730 ENDPROC
740 DEFPROCswim
750 IFPX=49ORPX=48ORPX=148THENPRINTX$(36)ELSEIFPX=32T
HENPRINTX$(6)ELSEIFPX=147THENPX=148:PRINTX$(10)ELSEPRIN
TX$(32)
760 ENDPROC
770 DEFPROCexam
780 K=0:IFPX=48THENK=1:PRINT"WOW...those costumes are
very revealing"ELSEIFPX=32THENK=1:PRINT"He has a sharp
knife"ELSEIFPX=101THENK=1:PRINT"looks like a 74LS04 ch
ip has burnt out"
790 PROCch :IFR=2THENPROCcheck(2) :IFEX=1THENPRINT"Th
is is no ordinary brush!!.. It's one of Q's patent wir
e cutters!":K=1
800 IFK=0THENPRINTX$(7):K=1
810 ENDPROC
820 DEFPROCrid
830 X$=X$(5):K=1:IFPX=83THENPX=86:X$=X$(10)ELSEIFPX=1
27THENPX=129:X$=X$(10)
840 PRINTX$:ENDPROC
850 DEFPROCpay
860 K=1:IFPX=87ORPX=72ORPX=71ORPX=70THEN870ELSEPRINTX
$(32):ENDPROC
870 EX=0:FORX=1TO3:IFV$(X)=G$(26)THENEX=1
880 NEXT:IFEX=0THENPRINT"I have no money":ENDPROC
890 IFPX=87THENPX=88
900 PRINTX$(10):ENDPROC
910 DEFPROCchelp
920 K=1:IFPX=69THENPRINT"You are a qualified pilot!"E
LSEIFPX=91THENPRINT"I think you could jump!"ELSEIFPX=24
THENPRINT"wire cutters would be useful"ELSEPRINT"I have
n't a clue..you could try waiting or praying or somethi
ng"
930 ENDPROC
940 DEFPROCfly
950 K=1:IFPX=69ORPX=73THEN960ELSEPRINTX$(7):ENDPROC
960 IFPX=73THENPRINTX$(10)"I'd try landing it!":ENDP
ROC ELSEEX=0:FORX=1TO3:IFV$(X)=G$(7)THENEX=1
970 NEXT:IFEX<>1THENPRINT"I need a helmet!":ENDPROC E
LSEP%=73:PRINTX$(10):ENDPROC
980 DEFPROCland
990 K=1:IFPX<>73THENPRINTX$(7):ENDPROC ELSEPRINT"I CA
N SEE THREE LEVERS""RED","GREEN","BLUE""They are no
t labelled""Which one should I pull?":REPEAT:AA$=GET
$:UNTILAA$="R"ORAA$="G"ORAA$="B"
1000 IFAA$<>"R"THENX$="The engine explodes in a ball o
f flames":PROCclose ELSEP%=74:CLS:PRINT"good choice...sa
fe landing":ENDPROC
1010 DEFPROCcheck(C%)
1020 EX=0:FORX=1TO3:IFV$(X)=G$(C%)THENEX=1
1030 NEXT:ENDPROC
1040 DEFPROCcut
1050 IFPX<>24THENPRINTX$(1):ENDPROC ELSEPROCcheck(2):I
FEX<>1THENPRINTX$(3):ENDPROC
1060 PRINTX$(10):S$(24,2)=26:Q$(24)="by a broken fence
":ENDPROC
1070 DEFPROCdrive
1080 K=1:IFPX<59ORPX>61THENPRINTX$(32):ENDPROC ELSEIFP
X=60THENMM%=MX+1:IFMX>2THENPX=61:MX=0:PRINT"Out of gas!":
ENDPROC
1090 PROCcheck(1) :IFEX<>1THENPRINT"I havn't got a car
key!":ENDPROC
1100 IFPX=59THENPRINT"The car starts!":PX=60:ENDPROC E
LSE ENDPROC
1110 DEFPROCsear
1120 K=1:IFPX<>27THENPRINT"nothing here!":ENDPROC ELSE
PRINT"I have found a large lever behind the drum":END
PROC
1130 DEFPROCpull
1140 K=1:IFPX=27:PROCch :IFR=15THENX$="Aagghh a hole o
pens beneath my feet and I fall to the SHARKS!":PROCclos
e ELSEIFPX=105THENPX=106:PRINT"The engine starts":ENDP
ROC
1150 PRINTX$(3):ENDPROC
1160 DEFPROCkey
1170 K=1:PROCcheck(1):IFEX<>1THENPRINT"no key":ENDPROC
ELSEIFPX<>142THENPRINTX$(7):ENDPROC ELSEEX=1:PRINTX$(1
0):ENDPROC
1180 DEFPROCsay
1190 K=1:PROCch:IFL$="FIRE"THENPRINT"The jet pack tran
sports me!":SOUND0,-15,100,20:P%=RND(20)+1:ENDPROC ELSE
PRINTX$(10):ENDPROC
1200 DEFPROCstab
1210 K=1:PROCcheck(27) :IFEX<>1THENPRINT"no knife!":EN
DPROC ELSEIFPX=108ORPX=144ORPX=54ORPX=77THENX$="He atta
cks me!":PROCclose ELSEIFPX<>157THENPRINTX$(7):ENDPROC
1220 PX=158:ENDPROC
1230 DEFPROCshoot
1240 K=1:PROCcheck(18):IFEX=0THENPRINT"No gun!":ENDPRO
C ELSEPROCcheck(21):IFEX=0THENPRINT"No bullet!":ENDPROC
ELSEIFPX=157THENX$="Too slow.. He attacks":PROCclose E
LSEIFPX<>32THENPRINTX$(41):ENDPROC
1250 IFOX=0THENPRINT"He's dead. A knife drops to the f
loor":OX=1:G$(27)="a knife":N$(27)="KNIFE":ENDPROC
1260 DEFPROCrep
1270 K=1:PROCcheck(5) :IFEX<>1THENPRINT"I have no manu
al!":ENDPROC ELSEIFPX<>101THENPRINTX$(7):ENDPROC ELSEPR
INTX$(10)"A message flashes on the screen..." "HAVE YO
U BOUGHT THE LATEST ISSUE OF A&B?":ENDPROC
1280 DEFPROCpush
1290 K=1:IFPX<>41THENPRINTX$(7)ELSEX$="There is an exp
losion!":PROCclose
1300 DEFPROCread
1310 K=1:PROCcheck(24) :IFEX<>1THENPRINTX$(25):ENDPROC
ELSEPRINT"It is the latest issue of A&B computing":END
PROC

```

Decision Maker

J.M. Tissander

As the title implies this is a very useful program that can help an individual or a group of people to choose with discrimination between a number of different options. For example, it could be used to choose a holiday, a house or a job applicant. The list is endless.

The programming is straightforward and the use of procedures and meaningful variable names should make it fairly easy to follow.

The main program loop is from lines 70 to 160. The value of s% given by this FOR...NEXT loop sets the various conditions necessary for each section of the program. There are eight sections as follows:

- s% = 1 Input the names of the people making the decision
- s% = 2 Input the various options
- s% = 3 Input all the factors involved in choosing the best option
- s% = 4 Give each factor an importance score
- s% = 5 Review the factors and their scores and alter if necessary
- s% = 6 Give each option a score in terms of satisfying each of the factors in turn
- s% = 7 Review the options and alter if necessary
- s% = 8 Sort the options and print out with best choice first

INSTRUCTIONS

1. On running the program the user is asked to name all the people who will be involved in making the decision. Names can be up to 25 characters long and up to 12 names can be included. On typing in each name press RETURN.

When all the names have been included press the red function key f0 to exit from this section.

A message will appear at the bottom of the screen asking the user if he or she wishes to alter anything. If "Y" is pressed then another message will ask which item. Typing "2", say, and pressing RETURN will place the cursor at the second name which can now be altered. (NB. It is possible to alter existing data but not to

The Beeb might not understand your feelings but it can certainly make democratic decisions for you.



add or to delete.) If "N" is pressed then the program moves on to the next section.

2. This section is organised exactly the same as above and is for the input of all the options. For example, if the decision was concerned with which home to buy, then it could consist of the addresses of the properties (up to a maximum of 12).

3. Again, this section is organised exactly the same as the first two (they all use PROCinputstr ie. input the string data) and is for the input of all the relevant factors. In our house buying example these might include items such as:

- a) Good value
- b) Plenty of room
- c) Near to shops
- d) Has a garage
- e) Pleasant surroundings
- f) Economical heating system

HINT: I have found it helpful to

have the factors spelt out clearly and expressed in a positive sense ie. in terms of what one is after, rather than what one is trying to avoid.

4. Now in any decision making where various factors are involved it is fairly obvious that they are not going to be equally important. In the house buying example the buyer might be writer who wants peace and quiet, so he would rate the surroundings far higher than say someone with a large family where the number of rooms might be a priority.

In this section, therefore, each factor is listed in turn and each person involved in the decision making gives it an "importance score" from one to ten, where ten means very important and one means not at all important.

5. In the next section all the fac-

tors are listed, together with their importance score averaged for the group if more than one person is involved in making the decision.

It is now possible to alter the important scores if desired by pressing "Y" when prompted. If "N" is pressed then the program goes on to the next section.

6. It is now necessary to give each option a series of scores by deciding how much it satisfies each factor in turn.

The screen will display the first option and underneath the first factor. Each person in turn gives that option a score from one to ten, where ten means that that option completely satisfies the factor being considered and one means it satisfies it little, if at all.

So if the option was "1 Golden Square" and the factor: "Plenty of room", a score of seven would mean that particular office offers quite a lot of room, while a score of three would mean on the cramped side.

"1 Golden Square" stays as the option and the next factor appears on the screen, which might be: "Nearness to a good pub". The decision makers input their scores.

Having worked through all the factors the next option (which would be another address in this example) appears on the screen and once again the program goes through the factors one by one and scores are awarded.

7. This section reviews the options. For each one it lists all the factors and the scores given in the previous section, averaged for the group if more than one person was involved.

Note that at this stage it is not possible to see which is the best choice because the program has not yet taken into account the important scores given to the factors.

Finally, all the options are listed with a number so that it is possible to select one and enter new values if desired.

8. The program now does some more calculations. See PROC-calculate 1570-1670.

- A. For option 1:
- (a) Score given to indicate how

far it satisfies the first factor x importance score given to the first factor.

(b) Add this product to the cumulative total for that option.

(c) Repeat (a) and (b) until no more factors.

(d) Put the final score in result%(1) ie corresponding to option 1.

B. Go on to next option and repeat (a), (b), (c) and (d), but put final score in result%(2).

C. Repeat until no more options.

The array result%() is now sorted and the best choices displayed in order. Just before this the program asks if the results are to be sent to the printer.

USES AND ABUSES

I hope the above has made things clear! When RUN the program is in fact easy to use. However, to get the best results it is important to bear the following in mind.

This program is extremely useful in choosing rationally between a number of options. It is particularly useful in a group or committee situation, because it necessarily ensures that all the members have an equal say in the final outcome and not just one or two dominant individuals. Also, to some extent it overcomes prejudices because it forces the participants to focus on specific elements of the problem, rather than jumping to habitual conclusions.

However, because it is a powerful method it has its dangers. If many factors and many options are involved it can take a long time to work through. Because of this effort one may attribute to it a great deal of influence. But supposing some vital factor has been missed out at the input stage?

Obviously the value of this program depends on the self-awareness of the users and their perspicacity in carefully choosing all the relevant factors and possible options.

Another point is the importance of feelings. All the factors may point to one option, but supposing one feels unhappy about it? Ultimately, feelings will rebel

against and undermine a decision which totally ignores them.

This sort of program cannot really cope with the intuitive and emotional, though it is possible to accommodate them to some extent. For example, in the original house buying situation, one of the factors could be "positive feelings about the place". Some of the people making the decision might want to give it an importance rating of 10.

PROGRAM NOTES

It is a feature of the program that the same procedures and functions are used by different parts of the program eg. PROCmessage for the messages that appear at the bottom of the screen, PROCget(str\$) for the user's responses and PROCw(window), where window can be 1 (TRUE) or 0 (FALSE).

Notice how PROCtext (1n%) is used by all the sections of the program to print the title and explanation. The titles and text are in DATA statements at the end of the program. Line 440 "RESTORE 1n%" restores the appropriate data, where 1n% stands for line number and is the formal parameter used when calling PROCtext.

Also, the main procedures eg. PROCinputstr and PROCinputnum (ie. input the numerical data) are used for both the input and the altering of the data. In the latter case the flag "change" is TRUE, and the program enters and exits from the loops within these procedures at different places than during the initial input of data.

Notice also how the REPEAT...UNTIL loop in PROCchange (lines 1870-1970, for altering the data) has two exits. If the user's response to PROCmessage(2) ie. "Do you wish to alter anything (Y/N)?" is "Y", then the program will keep looping because of the UNTIL FALSE at line 1960, and further amendments can be made. However, when the response is "N" then the UNTIL TRUE at line 1920 is noticed and the procedure ends.

PROGRAM LISTING

```

10 REM DECISION MAKER
20 REM J.M Tissandier
40 *IVZ55
50 MODE6
60 PROCinit
70 FOR s%=1 TO 8
80 PROCtext(s%*20+data%)
90 PROCw(1)
100 IF s%<4 THEN PROCinputstr
110 IF s%=4 OR s%=6 THEN PROCinputnum
120 IF s%=5 OR s%=7 THEN PROCview
130 IF s%=8 THEN PROCbestchoice
140 IF INSTR("12357",STR$(s%)) THEN PROCchange
150 PROCw(0)
160 NEXT
170 END
180
190 DEF PROCinit
200 data%=2230
210 DIM people$(12),option$(12),factor$(12)
220 DIM facscore%(12),optscore%(12,12),result%(1
2)
230 PROCdimension
240 *FX229,1
250 *KEY0 ...!M
260 VDU19,0,4;0;
270 @%=&04
280 change=FALSE
290 ENDPROC
300
310 DEF PROCdimension
320 LOCAL str$,1%
330 str$=STRING$(25,"*")
340 FOR 1%=1 TO 12
350 people$(1%)=str$
360 option$(1%)=str$
370 factor$(1%)=str$
380 NEXT
390 ENDPROC
400
410 DEF PROCtext(1n%)
420 LOCAL t$,n%,x%,1%
430 CLS
440 RESTORE 1n%
450 READ t$,n%
460 x%=15-INT(LEN(t$)/2)
470 PRINT TAB(x%,1);"*** ";t$;" ***"
480 FOR 1%=1 TO n%
490 IF 1%=1 THEN x%=3 ELSE x%=1
500 READ text$
510 PRINT TAB(x%);text$
520 NEXT
530 ENDPROC
540
550 DEF PROCinputstr
560 LOCAL c%,data$
570 IF change THEN c%=item%-1 : PROCmessage(4) E
LSE c%=0 : PROCmessage(1)
580 REPEAT
590 c%=c%+1
600 PRINT TAB(0,c%-1) c%;". "
610 data$=FNinput(6,c%-1,25)

```

CONTINUED OVER



```

620 IF s%=1 THEN people$(c%)=data$
630 IF s%=2 THEN option$(c%)=data$
640 IF s%=3 THEN factor$(c%)=data$
650 UNTIL c%=12 OR data$="..." OR change
660 IF change THEN ENDPROC
670 IF data$="..." THEN c%=c%-1 : PRINT TAB(2,VP
DS-1);STRING$(32," ")
680 IF s%=1 THEN numpeople%=c%
690 IF s%=2 THEN numopt%=c%
700 IF s%=3 THEN numfac%=c%
710 ENDPROC
720
730 DEF FNinput(x%,y%,hi%)
740 LOCAL valid,input%
750 REPEAT
760 valid=TRUE
770 IF s%<4 AND x%=6 THEN PRINT TAB(x%,y%);STRIN
G$(hi%,".")
780 INPUT TAB(x%,y%) input$
790 IF s%<4 AND x%=6 THEN input%=LEN(input$) ELS
E input%=VAL(input$)
800 IF input%<1 OR input%>hi% OR (input$="..." A
ND y%=0) THEN valid=FALSE : VDU7 : PRINT TAB(x%,y
%);STRING$(LEN(input$)," ")
810 UNTIL valid
820 =input$
830
840 DEF PROCinputnum
850 LOCAL c%,d%,l%,y%,total%,score%,a%
860 IF s%=7 AND change THEN c%=item%-1 ELSE c%=0
870 IF s%<6 THEN y%=2 ELSE y%=4
880 REPEAT
890 IF s%=5 AND change THEN d%=item%-1 ELSE d%=0
900 c%=c%+1
910 REPEAT
920 d%=d%+1
930 total%=0
940 CLS
950 IF s%>5 THEN PRINT " OPTION: ";option$(c%)
960 PRINT " FACTOR: ";factor$(d%)
970 FOR l%=1 TO numpeople%
980 PRINT l%;". ";people$(l%)
990 score%=VAL(FNinput(35,l%+y%,10))
1000 total%=total%+score%
1010 NEXT
1020 a%=FNaverage(total%)
1030 IF s%<6 THEN facscore%(d%)=a% ELSE optscore%
(c%,d%)=a%
1040 UNTIL d%=numfac% OR (change AND s%=5)
1050 UNTIL c%=numopt% OR s%=4 OR change
1060 ENDPROC
1070
1080 DEF FNaverage(tot%)
1090 LOCAL average
1100 average=tot%/numpeople%
1110 average%=INT(average)
1120 IF average-average%>0.5 THEN average%=averag
e%+1
1130 =average%
1140
1150 DEF PROCview
1160 LOCAL c%,l%,spc%
1170 c%=0
1180 REPEAT
1190 c%=c%+1
1200 CLS
1210 IF s%=7 THEN PRINT " OPTION: ";option$(c%)
1220 PRINT
1230 FOR l%=1 TO numfac%
1240 PRINT l%;". ";factor$(l%);
1250 IF s%=5 THEN PRINT TAB(33) facscore%(l%) ELS
E PRINT TAB(33) optscore%(c%,l%)
1260 NEXT
1270 IF s%=7 THEN PROCmessage(5) : spc%=FNget(" "
)
1280 UNTIL c%=numopt% OR s%=5
1290 IF s%=7 THEN PROClistopt
1300 ENDPROC
1310
1320 DEF PROClistopt
1330 LOCAL l%
1340 PROCw(0) : PROCtext(data%+180) : PROCw(1)
1350 PRINT
1360 FOR l%=1 TO numopt%
1370 PRINT l%;". ";option$(l%)
1380 NEXT
1390 ENDPROC
1400
1410 DEF PROCbestchoice

```

```

1420 LOCAL ans$,i%
1430 PROCcalculate
1440 PROCsort
1450 PROCmessage(6)
1460 ans$=FNget("YyNn")
1470 IF INSTR("Yy",ans$) THEN VDU2
1480 CLS
1490 FOR i%=1 TO numopt%
1500 IF i%=1 THEN PRINT TAB(3);STRING$(34,"*")
1510 PRINT i%;". ";option$(i%),TAB(33) result%(i%
)
1520 IF i%=1 THEN PRINT TAB(3);STRING$(34,"*") :
PRINT
1530 NEXT
1540 VDU3
1550 ENDPROC
1560
1570 DEF PROCcalculate
1580 LOCAL k%,i%,total%,score%
1590 FOR k%=1 TO numopt%
1600 total%=0
1610 FOR i%=1 TO numfac%
1620 score%=optscore%(k%,i%)*facscore%(i%)
1630 total%=total%+score%
1640 NEXT
1650 result%(k%)=total%
1660 NEXT
1670 ENDPROC
1680
1690 DEF PROCsort
1700 LOCAL c%,i%,finish
1710 c%=numopt%-1
1720 REPEAT
1730 finish=TRUE
1740 FOR i%=1 TO c%
1750 IF result%(i%)<result%(i%+1) THEN PROCswap(i
%) : finish=FALSE
1760 NEXT
1770 c%=c%-1
1780 UNTIL finish
1790 ENDPROC
1800
1810 DEF PROCswap(i%)
1820 LOCAL t%,t$
1830 t%=result%(i%):result%(i%)=result%(i%+1):res
ult%(i%+1)=t%
1840 t$=option$(i%):option$(i%)=option$(i%+1):opt
ion$(i%+1)=t$
1850 ENDPROC
1860
1870 DEF PROCchange
1880 LOCAL ans$
1890 REPEAT
1900 PROCmessage(2)
1910 ans$=FNget("YyNn")
1920 IF INSTR("Nn",ans$) THEN UNTIL TRUE : change
=FALSE : ENDPROC
1930 change=TRUE
1940 IF FNmaxitem=1 THEN item%=1 ELSE PROCmessage
(3) : item%=VAL(FNinput(28,16,FNmaxitem))
1950 IF s%<4 THEN PROCinputstr ELSE PROCw(0) : PR
OCtext((s%-1)*20+data%) : PROCw(1) : PROCinputnum
: PROCw(0) : PROCtext(s%*20+data%) : PROCw(1) : PR
OCview
1960 UNTIL FALSE
1970 ENDPROC
1980
1990 DEF FNmaxitem
2000 IF s%=1 THEN=numpeople% ELSE IF (s%=2 OR s%=
7) THEN=numopt% ELSE IF (s%=3 OR s%=5) THEN=numfac
%
2010
2020 DEF PROCmessage(m%)
2030 LOCAL m$,x%
2040 IF m%=1 THEN m$="Press red key f0 for next s
ection."
2050 IF m%=2 THEN m$="Do you wish to alter anythi
ng (Y/N)? "
2060 IF m%=3 THEN m$="Which item (1-"+STR$(FNmaxi
tem)+")? "
2070 IF m%=4 THEN m$="Insert new data."
2080 IF m%=5 THEN m$="Press SPACE BAR to continue
"
2090 IF m%=6 THEN m$="Printer on (Y/N)? "
2100 x%=19-INT(LEN(m$)/2)
2110 PRINT TAB(0,16);STRING$(39," ")
2120 PRINT TAB(x%,16);m$;
2130 ENDPROC
2140
2150 DEF FNget(str$)
2160 REPEAT
2170 get$=GET$
2180 UNTIL INSTR(str$,get$)
2190 =get$
2200
2210 DEF PROCw(window)
2220 IF window THEN VDU28,0,24,39,7 ELSE VDU26
2230 ENDPROC
2240
2250 DATA PEOPLE
2260 DATA 3,"Name all the people who will be","in
volved in making the decision, up to","a maximum o
f twelve."
2270 DATA OPTIONS
2280 DATA 3,"List all the options from which you"
,"must make a decision, up to a maximum","of twelv
e."
2290 DATA FACTORS
2300 DATA 3,"List all the relevant factors to be"
,"considered in choosing between the","options, up
to a maximum of twelve."
2310 DATA IMPORTANCE OF FACTORS
2320 DATA 4,"Decide on the relative importance","
of each factor by giving it a score","from 1 to 10
, where 10 means crucial"."and 1 means trivial."
2330 DATA REVIEW FACTORS
2340 DATA 4,"This lists all the relevant factors"
,"and their relative importance scores","( average
d for the group if more than","one person involved
)."
2350 DATA EVALUATE OPTIONS
2360 DATA 4,"Decide how much each option","satisf
ies the relevant factors by","giving it a score fr
om 1 to 10, where","10 means very satisfactory."
2370 DATA REVIEW OPTIONS
2380 DATA 3,"This preliminary overview does not",
"yet take into account the relative","importance s
core given to each factor."
2390 DATA BEST CHOICE
2400 DATA 3,"The options in order of suitability",
","taking into account all relevant","factors and
their relative importance."
2410 DATA OVERVIEW OPTIONS
2420 DATA 4,"If having reviewed the scores given"
,"to the options you are dissatisfied","it is poss
ible to go back and enter","new values."

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Software Listings

Finding and choosing the correct software for your needs is a daunting task indeed, whether you are looking for a word processing package or for a new game to test your alien destroying, treasure seeking, path-finding talents!

Often you can be put off even looking through the pages of advertisements which tempt you with vivid descriptions of the amazing graphics and sound effects of the game being offered, you sit there with pen poised above cheque book and your eye catches the small print that tells you that the game will run on just about every available machine except the one sitting beside you!

But BBC and Electron owners need despair no longer

Want a program for your BBC Micro or Acorn Electron? Look no further than our listings to make your choice.

— help is at hand in the following pages. We have put together as comprehensive a list as possible of the software available for these machines. In order to fit in as many as possible we have had to use codes in some columns. The title of the software, whether it is for the BBC or the Electron, the company which produces it, the

form in which it is available, the supplier code and price; all are given for each piece of software listed. The codes used are:

Code	Explanation
Gm	Game
Bs	Business
Ut	Programming utility
Do	Domestic

Ed
A
B
E
C
D()
R

Educational
Model A BBC
Model B BBC
Electron
Cassette
Disc (40 or 80)
Rom or Eprom

As you are probably aware, new software is surfacing all the time so do not assume that there is no such item as the one you are looking for, if it is not included in the following list. Remember that much BBC software is being converted for the Electron and to avoid disappointment it is best to wait for a specifically written program. If you are aware of a piece of software that is not listed here, whether you are a user or a producer, feel free to let us know.

SOFTWARE LISTINGS

Title	Type	Manufacturers	Memory	Software Supplier	Price								
ABC	Ed	Acornsoft	B	C,D	AL	£9.95							
ABC	Ed	Bryants	B	C	HW	£4.85							
Abductor	Gm	Salamander	A,B	C	NZ	£7.95							
ABM	Gm	Alligata	A,B	C	AG	£5.95							
Abyss	Gm	Cases	B,E	C	CE	£6.95							
A Cluster of Curves	Ed	Chaddington	B,E	C,D	CN	£10.00							
Action of the Heart	Ed	Garland Comp.	B	C	JX	£11.76							
Accounting Ratios	Bs	Microplex	B	C	MP	£7.95							
Accounts Receivable	Bs	Acornsoft	B	D	AL	£24.95							
Accounts Payable	Bs	Acornsoft	B	D	AL	£24.95							
Accurate	Ed	MP Software	B	C,D		£11.00/ £14.00							
Acids and Alkalis	Ed	Scholar	B	C,D	SC	£5.50, £7.50							
Addcomm	Yt	Vine	B	R	VI	£28.00							
Add-Tabs and Mul-Tabs	Ed	Cottage Soft	A,B	C	CT	£7.50							
Ade	Ut	System	B	R	SY	£60.00							
Adventure	Gm	Micro Power	A,B,E	C	GK	£7.95							
Adventure 1	Gm	Odyssey	B	C	OG	£4.50							
Adventure 2	Gm	Odyssey	B	C	OG	£4.50							
Adventure	Gm	Program Direct	B	C	NP	£5.99							
Adventureland	Gm	Adventure International	B,E,	C	AI	£7.95							
Adventure Quest	Gm	Level 9 Computing	B	C	CU	£9.90							
Adventure Quiz	Ed	Dial	B	C,DL		£4.95, £6.50							
Airline	Gm	Cases	B	C	CE	£6.95							
Algebraic Manipulation	Ut	Acornsoft	B	C	AL	£9.95							
Alien	Gm	FBC	B	C	FB	£6.00							
Alien Break-in	Gm	Romik	B,E	C	RO	£6.99							
Alien Destroyer	Gm	Beebug	B	C	BE	£7.50							
Alien Destroyers	Gm	Micro Power	B	C	GK	£7.95							
Alienswirl	Gm	Amcom	B	C	AO	£5.95							
Alien Swirl	Gm	Micro Power	B	C	GK	£6.95							
Airlift	Gm	Bug Byte	B	C	KP	£5.50							
Allaboard	Ed	Arnold-Wheaton	B	C	AW	£9.95 + VAT							
Alligatacalc	Do	Alligata	B	C	SY	£9.95							
Alpha Graph	Ed	Arnold-Wheaton	B	C,D	AW	£15.00 + VAT							
Alien Dropout	Gm	Superior Software	B,E	C	SE	£7.95							
All Fingers Go	Ed	NEC	B	C	NC	£14.95							
Alpha	Ed	Golem	B	C	OB	£8.05							
Alphachopper	Ed	Sulis	B	C	SU	£9.95							
Alphabet	Ed	J B Software	B	C	JS	£4.95							
Alphabeta	Bs	H and H Software	B	C	HH	£28.50							
Amazing Ollie	Ed	Storm	B	C,D	SX	£6.05, £9.95							
Anagrams	Do	Cylindrical Software	A,B	C	CY	£3.95							
Analysar	Bs	Number One Systems	B	C,D	NO	£33/45							
Angles and Parallel Lines	Ed	Scholar	B	C,D	SC	£5.50, £7.50							
Angles and Triangles	Ed	Scholar	B	C,D	SC	£5.50, £7.50							
Angle Tutor	Ed	Pee Bee	B	C,D	PB	£9.95, £12.45							
Android Attack	Gm	Computer Concepts	B	C	GJ	£7.80							
Anagram	Ed	Ed.Soft	B	C	ES	£4.95							
Angles Navigate	Ed	Primary Programs	B	C	PP	£5.95							
Angle(4)	Ed	Chalksoft	B	C	KT	£6.95							
Angle Turner	Ed	Arnold-Wheaton	B	C,D	AW	£15 + VAT							
Anglezap	Gm	Gem	B	DC	GM	£7.50							
Animal/Vegetable/Mineral	Ed	Bourne	B,E	C	BO	£8.97, £10.98							
Animal, Vegetable, Mineral	Ed	Arnold-Wheton	B	C,D	AW	£15 + VAT							
Animated Arithmetic	Ed	LCL	A,B,E	C,D	LA	£6.50 £7.50							
Answer Back	Do	Kosmos	B,E	C	KM	£10.95							
Android Attack	Gm	Computer Concepts	B	C	GJ	£8.95							
Animated Arithmetic	Ed	Ludinski CAL	B	C/ D	KA	£6.50/ £7.50							
Animator	Ut	Screenplay	B	C	SC	£11.95							
Animator	Ed	Arnold-Wheaton	B	C,D	AW	£9.95, £12.00 + VAT							
Apollo	Gm	Software Invasion	B	C	IS	£6.95							
Append It	Ut	Aztec S/W	B	C	IB	£3.00							
Apocalypse	Gm	Red Shift	B	C	RS	£9.95							
Arcadians	Gm	Acornsoft	B,E	C	AL	£9.95, £9.20							
Arcade Action	Gm	Acornsoft	B	C	GA	£11.90							
Arcade 1	Gm	Odyssey	B	C	OG	£3.00							
Arcade Games	Gm	Ganymede Systems	B	C	GY	£9.95							
Area of Rectangles	Ed	Scholar	B	C,D	SC	£5.00, £7.00							
Area of Triangles	Ed	Scholar	B	C,D	SC	£7.00, £9.00							

Area Radar Controller	Gm	Software For All	B	C	KN	£6.95
Arithmetic Plus 1-4	Ed	Fernleaf	B	C,D	FE	£35.95
Arrow of Death (1)	Gm	Digital Fantasia	B	C	JT	£6.95
Arrow of Death (2)	Gm	Digital Fantasia	B	C	NT	£8.95
Art Designer	Ut	Pica	B,E	C,D	PI	£7.95, £9.75
Artist	Ut	MRM	B	C	MR	£6.95
Artisan I	Ut	OIC	B,E	C	OI	£12.75
Artist	Ut	MRM	B	C	MR	£6.95
Asteroid Storm	Gm	Micro Power	B,E	C	GK	£7.95
Asteroids/Frong	Gm	Aardvark Software	B	C	IU	£4.00
Asteroid Belt	Gm	Electronics Applied	B	C	IF	£11.50
Asteroid Belt	Gm	Computer Concepts	B	C	GJ	£7.80
Asteroid Miner	Gm	Optima	B	C	OP	£8.95
Astro Navigator	Gm	Micro Power	B	C	GK	£6.95
Astronomy	Do	BBC	B	C,D	KB	£9.95, £11.50
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
Bailiff	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
Ballooning	Ed	Heinemann	B	C	HE	£7.25 + VAT
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
Banner	Do	Micro-Aid	A,B	C	IZ	£2.95
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
BCPL Stand Alone Generator	Ut	Acornsoft	B	D	AL	£49.90
BCPL Calculations	Ut	Acornsoft	B	D	AL	£9.95, £11.50
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
Beebart	Ut	Quicksilva	B	C	QS	£14.95
Bee Base	Ut	GCC	B	E	GL	£45.94
Beeb-Chase	Gm	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	Gm	Dial	B	C,D	DL	£4.95, £6.50
BEEP-BEEP	Gm	IJK	B	C	IJ	£3.95
Beep-Beep (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

SOFTWARE SUPPLIERS

Supplier
Code

AA	Anthony Aspitel Software Systems 56 London Road Harleston Norfolk IP20 9BZ	BB	Bug-Byte Mulberry House Canning Place Liverpool L1 8JB
AB	ABC Primary 19 Crumstone Court Longmeadow Estate Killingworth Neucastle Upon Tyne	BE	Beebugsoft PO Box 109 High Wycombe Bucks HP11 2TD
AC	ACK Data 21 Salcombe Drive Nottingham NG5 8JF	BJ	BJ Software 26 Fore Hill Avenue Doncaster DN4 7EU
AD	Dial Software 72 Downend Road Downend Bristol	BK	BAKsoft 34 Humberstone Road Cambridge
AG	Superior Systems Ltd 178 West Street Sheffield WS1 4ET	BM	Blue Moon Software Co. Freepost Swanley Kent BR8 7UY
AJ	AJ Software 61 Jeddo Road London W1Z 9ED	BO	Bourne Educational Bourne House The Hundred Romsey Hampshire SO5 8BY
AK	A.S.K. Ltd London House 68 Upper Richmond Road London SW15 2RP	BO	Bourne Educational Software Headbourne Worthy Winchester Hants SO23 7SQ
AL	Acornsoft Ltd 4a Market Hill Cambridge CB2 3NJ	BR	Bridge Software 36 Fernwood Marple Bridge Stockport Cheshire SK6 5BE
AM	Microplus Software 6 Litton Way Leeds	BS	Beamscan 20 Vaughan Avenue Hendon London NW4 4HU
AN	Addison-Wesley 53 Bedford Square London WC1B 3DZ	BT	Beast International Mustians Eton, Windsor Berkshire SL4 6EX
AO	Amcom 23 Hivings Hill Chesham Bucks HP5 2PG	BU	Busco 16 Colwill Walk Mafinstone Plymouth
AP	Processor Applications 22 Mercer Close Basingstoke Hants	CA	Carvella 3/7 Bank Street Rugby
AR	Aardvark Software 100 Ardleigh Green Road Hornchurch Essex RM11 2LG	CR	Carswell Computers Carswell Barn Faringdon Oxon SN7 8JN
AS	ASP Software Number One Golden Square London W1R 3AB	CD	Carsondale Enterprises Ltd 44 Kingsway Stoke-on-Trent Staffordshire ST4 1JH
AT	ATM King's Chambers Queen Street Derby DE1 3DA	CG	Challenge Games 64 Ferndale Road London E11
AV	A J Vision Service Ltd 61 Jeddo Road London W12 9ED	CH	Chalksoft Ltd 37 Willowslea Road Worcester WR3 7QP
AW	Arnold-Wheaton Software Software Publishing Division Parkside Lane Leeds LS11 5TD	CL	Clwyd Technics Ltd., Microprocessor Centre Coach House Kelsterton Road Flint Clwyd CH6 5TH

CONTINUED OVER

SOFTWARE LISTINGS

Title	Type	Manufacturers	Memory	Software Supplier	Price
Beebon Mon	Ut	McKeran	A,B C	MK	£2.00
Beebmon	Ut	Watford	B R	WA	£22.00
Beebsynth	Ut	Clares	A,B C	CL	£7.95
Beeb-Tote	Gm	Micro Power	B C	GK	£5.95
Beefeater	Gm	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
Binary Numbers	Ed	Chaddington	B,E C,D	CN	£10.00
Birds of Prey	Gm	Romik	B,E C	RO	£6.99
Bismark	Gm	ASP Software	B,E C	AS	£6.99
Black Box and Gambit	Gm	Acornsoft	B C,D	AL	£9.95, £11.50
Blackjack/Textpro	Gm	Software Invasion	B C	IS	£6.95
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
Blue Dragon	Gm	MP	B,E C,D	MP	£7.48, £10.50
Boat Race	Ed	Pee Bee	B C,D	PB	£8.50, £11.00
Boeing 767	/Ut GM	Flightdeck	B C	FL	£7.67
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
Bouncer	Gm	Acornsoft	B C,D	AL	£9.95, £11.50
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
Boxer	Gm	Acornsoft	B C,D	AL	£9.95, £11.50
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	Do	Micro-Aid	B C,D,F	IZ	£9.95, £11.70
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,E 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	ABC 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
CESCIL	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	Davensoft	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	CY	£3.95
Character Orientating	Ut	Cylindrical Software	A,B C	CY	£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 Definer	Ut	Electronics Applied	B C	IF	£5.50
Chard	Ut	System	B C	SY	£9.00
Chargen	Ut	Odyssey	A,B C	OG	£4.50
Chemical Analysis	Ed	Acornsoft	B C	AL	£13.80
Chemical Collisions	Ed	Cambridge Micro	B D	CM	£15.00 +VAT
Chemical Simulations	Ed	Acornsoft	B C	AL	£13.80
Chemical Structures	Ed	Acornsoft	B C	AL	£13.80
Chemistry	Ed	Micro Power	B,E C	GK	£6.95
Chess	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
Chess	Gm	Superior	B,E C	SE	£7.95
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
Claude	Gm	Alligata	B C	AG	£7.95
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
COMAL	Ln	Acornsoft	B	R	AL	£49.85
Comatch	Ed	Clares	A,B	C	CL	£4.95
Combination Business Pack 1	Bs	Gemini	B	C,D	GM	£159.00
Combination Business Pack 2	Bs	Gemini	B	C,D	GM	£79.95
Combination Business Pack 3	Bs	Gemini	E	C	GM	£79.95
Combination Home Pack 1	Do	Gemini	B,E	C,D	GM	£79.95
Commercial Accounts	Bs	Gemini	B	C	GM	£19.95
Commstar	Ut	PACE	B	R	PA	£34.00
Community	Gm	Ixon	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
Contribution Analysis	BS	Micropax	B	C	MP	£7.95
Cookbook Wizardry	Do	Database Software	B	C	NU	£7.50
Copter Capers	Gm	A&F	B	C	GE	£6.90
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
Coucapcur	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
Dairy Farmer	Ed	Heinemann	B	C	HE	£9.25 +VAT
Dallas	Gm	Cases	A,B,E	C	CE	£6.95
Dambusters	Gm	Alligata	B	C	SY	£7.95
Danger! UXB	Gm	Micro Power	B,E	C	GK	£7.95
Dap 1	Ut	Gnomonica	B,E	C	GN	£15
Dap 2	Ut	Gnomonica	B	C	GN	£20
Dare Devil Dennis	Gm	Visions	B	C	VI	£7.95
Darts	Gm	Superior	B	C	SE	£6.95
Database	Ut	Computercat	B	C	CC	£12.95
Database	Bs	Gemini	B	C	GM	£19.95
Data-Quiz	Ut	Bryants S/W	B	C	HW	£4.88
Database	Ut	R. H. Electronics	B	C	RH	£12.95
Database	Bs	Acornsoft	B	C,D	AL	£11.90, £15.35
Database	Ed	Ed. Soft	B	C	ES	£19.95
Database	Bs	Primasoft	B	C	CT	£9.95
Database	Bs	Computercat	A,B	C	IJ	£11.95
Database	Bs	Software for All	A,B	C	KN	£9.95
Data File	Do	Kansas	B	C	KA	£12.50
Datext	Ut	Optima	B	C	OP	£9.95
Dating Game	Do	Acornsoft	B	C	AL	£12.65
Decay	Ed	GSN	B	D	GS	£15.00
Defchr	Ut	Micro-Aid	A,B	C	IZ	£2.95
Demon Decorator	Gm	Micro Power	B	C	GK	£6.95
Demon Knight	Gm	ASP Software	B,E	C	AS	£6.99
Density and Circuit	Ed	Acornsoft	A,B	C	AL	£11.90
Descender	Gm	FBC Systems	B	C	FB	£7.50
Desert Trek	Ed	Trekkasoft	B	C,D	TR	£5.50
Design	Ut	Beebug	B	C,D	BE	£10.00, £19.00
Desk Diary	Bs	Acornsoft	A,B,E	C	AL	£9.95
Desperate Dan	Gm	Thor	B	C	TH	£5.95
Detective	Gm	ASP Software	B,E	C	AS	£6.99
Detective	Gm	Computersmith	B	C	LC	£5.50
Determination of Electrostatic	Ed	GSN	B	C,D	GS	£14.00, £15.00
Devil's Causeway	Gm	Anirog Computers	A,B	C	OA	£6.00
DFM Database	Bs	Dialog	B	C/D	DG	£24.00
DFS Upgrade	Ut	Alligata	B	E	SY	£29.95
DFM Mail Labels	Bs	Dialog	B	C/D	DG	£10.00
Dictator	Gm	D. K. Tronics	B	C	DK	£6.95
Digger	Gm	Visions	B	C	VI	£7.95
Disassembler	Ut	Superior	E	C	SE	£7.95

SOFTWARE SUPPLIERS

CM	Comsoft	7 Roman Drive Leeds West Yorkshire LS8 2DR	DY	Dynatech Microsoft	Rue du Commerce Bouet St. Peter Port Guernsey C.I.
CN	Chaddington Software	14 Selkirk Close Worthing BN13 1PR	EB	Ebury Software	National Magazine House 72 Broadwick Street London W1V 2BP
CO	Computer Rentals Ltd	CRL House 9 Kings Yard Carpenters Road London E15 2HO	EG	SESS Ltd	Central Trading Estate 275-277 Bath Road Bristol BS4 3EH
CO	Comsoft	7 Roman Drive Leeds Yorkshire LS8 2DR	EH	Heinemann	Computers in Education 22 Bedford Square London
CY	Cylindrical Software	177 College Road Moseley Birmingham B13 9LJ	EJ	Logic Systems	85 Hemingford Road Cambridge
CS	Stable Software	Compton Street Compton Nr Winchester Hants	EL	ECL Software	29 Richmond Close Ware Herts SG12 0EN
CT	Cottage Software	Heather Cottage Selly Hill Whitby North Yorkshire	ET	Etna Software	West End House West End Lane Marshchapel Lincs
CU	Level 9 Computing	229 Hughenden Road High Wycombe Buckinghamshire HP13 5PG	EU	Educare	139a Sloane Street London SW1X 9AY
CX	Contex Computing	15 Woodlands Close Cople Bedford MK44 3UE	FB	FBC Systems	10 Castlefields Main Centre Derby
DA	Davy Computing Ltd	Moorcroft House 2 Clarence Lane Sheffield S3 7UZ	FE	Fernleaf Educational	Fernleaf House 31 Old Road West Gravesend Kent DA11 0LH
DB	Dynabyte Software	31 Topcliffe Mews Wide Lane Morley Yorks	FL	Flight Deck Software	25 Halsey Road Kempston Beds. MK42 8AP
DC	D.A.C.C. Ltd	23 Waverly Road Hindley Greater Manchester WN2 3BN	FM	4MAT Educational Software	Linden Lea Rock Park Barnstaple Devon EX32 9AQ
DD	DDT Software	Southfield House 11 Liverpool Gardens Worthing West Sussex BN11 1RY	FY	Wida Software	2 Nicholas Gardens London W5 5HY
DK	DK Tronics	Unit 2 Shire Hill Industrial Estate Saffron Walden Essex CB11 3AX	GA	Galaxy Software	123 Links Drive Solihull West Midlands B91 2DJ
DG	Dialog	19 Short's Gardens London WC2H 9AT	GC	Golden Challenge Software	2-4 Chichester Rents Chancery Lane London WC2A 1EG
DO	Doctor Soft	258 Coneygree Road Peterborough PE2 8LR	GD	70 Stoke Road	Bletchley Milton Keynes
DS	Diamondsoft Ltd	Cheadle Hulme Cheadle Cheshire SK8 5YB	GE	A&F Software	83 Hyde Road Gorton Manchester M18 7JD
			GJ	Computer Concepts	16 Wayside Chipperfield Hertfordshire WD4 9JJ

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SOFTWARE LISTINGS

Title	Type	Manufacturers	Memory	Software Supplier	Price								
Disassembler	Ut	Simonsoft	A,B C	MS	£6.95	Eiffel Tower	Ed	Chalksoft	B C	CH	£9.25		
Disassembler	Ut	Micro Power	A,B C	GK	£5.95	Einstein's Quanta Simulation	Ed	GSN	B C,D	GS	£14.00		
Disassembler	Ut	Program Direct	A,B C	NP	£3.00						£15.00		
Disassembler	Ut	Davansoft	A,B C	NX	£5.95	Eldorado Gold	Gm	Micro Power	B C	GK	£6.95		
Disassembler	Ut	C J E	A,B C	NV	£5.00	Electric	Ed	Database Software	A,B C	NU	£5.50		
		Microcomputers				Electricity	Ed	Primary Programs	B C	PP	£5.95		
Disassembler	Ut	A.J.	B C,D	AJ	£5.95	Electron-Aid	Ut	Dynabyte	E C	DB	£6.95		
					£7.95	Electronic Colouring Book	Do	Addison-Wesley	B,E C	AN	£9.95		
Dis-assembler	Ut	Crystalsoft	A,B C	CS	£3.50	Elem-add and Elem-sub	Ed	Cottage Soft	B C	CT	£7.50		
Discdex	Ut	Clares	B D	CL	£15.00	Elite	Gm	Acornsoft	B,E C,D	AL	£12.95		
					£18.00						E,		
					(3")						£17.65,		
Distances	Ed	Micro-Aid	B C	IZ	£4.95	Empire	Gm	Shards	B,E C	SH	£14.95		
Dissembler	Ut	Rainbow S/W	A,B C	KS	£2.50	English skills I/II	Ed	Griffin	B,E C	GR	£11.95		
Digital X-Word Compiler	Gm	N. Darwood	A,B C	JB	£6.00	Entrepreneur	Gm	Vulcan	B C	VC	£7.95		
Dmon	Ut	Alligata	A,B C,			Envelope Generator	Ut	System	B C	SY	£7.00		
			D, E	AG	£7.95	Equation Balance	Ed	RJE Software	B C	RJ	£7.95		
					£11.95,	Eric the Viking	Gm	Mosaic	B C	MO	£9.95		
					£19.95	Escape From Moonbase Alpha	Gm	Program Power	B,E C	GK	£7.95		
Dmove	Ut	FBC Systems	B C	FB	£12.50	Essential French Verbs	Ed	Carsondale	B C	CD	£11.50		
DNA Replication	Ed	Garland Comp.	B C	JX	£17.65	European Studies	Ed	Aztec S/W	B C	IB	£6.50		
Dodgy Dealer	Gm	OIC	B C	OI	£6.50	Escape from Pulsar 7	Gm	Digital Fantasia	B C	NT	£8.95		
Dracula Island	Gm	Kansas	B C	KA	£9.50	Examiner	Ed	Acornsoft	B C	AL	£9.95		
Dragon Rider	Gm	Salamander Software	B C	SA	£7.95	Exmon	Ut	Beebug	B CE	BE	£10.00,		
					£11.50	Explorer	Ed	Longman	B C,D	LM	£9.95,		
Dragon Quest II	Gm	Bug Byte	B C	KP	£11.50	Extended Colour Fill Graphics	Ed	Gaelsett Software	B C	GS	£12.95		
Dragon Quest	Gm	Bug Byte	B C	KP	£11.50	Experiments in Artificial Intelligence	Ed	Ganymede Systems	B C	GY	£9.95		
Draughts	Gm	Micro Poer	B C	GK	£6.95	Eye	Ed	Longman	B C	LM	£14.50		
Draughts/Reversi	Gm	Acornsoft	B,E C	AL	£9.95,	Facemaker	Ed	A.S.K.	B C	AK	£9.95		
					£9.20	Factfile	Ed	Cambridge Micro	B C,D	CM	£20.08		
Draughts	Gm	Superior	B,E C	SE	£6.95	Factors and Fractions	Ed	Edsoft	B C,D	ES	£5.95		
Draw	Ut	Micro Power	B,E C	GK	£9.95	Fair Share	Ed	Griffin	B,E C	GR	£9.95		
Drawing	Ut	B.B.C.	A,B C	KB	£10.00	Family Finance	Do	R.H. Electronics	B C	RH	£12.95		
Drawing Pictures and Puzzles	Ed	Ega Beva	B C	EB	£9.95	Family Games	Gm	I.J.K. Software	A,B C	IJ	£4.50		
Drawstick	Ut	BBC	B C	KB	£9.95	Fantasy Adventure	Gm	Dial	B C,D	DL	£6.50,		
Drilla Kill	Gm	Vampire Soft	B C,D	VA	£6.90,	Fairground	Gm	Superior Software	B C	SE	£7.95		
					£7.90	Fairyland Adventure	Gm	O.K.	B C	OK	£10.00		
Droгна	Gm	Acornsoft	B C,D	AL	£9.95,	Fairytale	Gm	Molimerx	B C	AJ	£10.06		
					£11.50	Fall of Rome	Gm	ASP Software	B C	AS	£6.99		
Dr. Who: The First Adventure	Gm	BBC Pubs	B C	KB	£10.00	Feasibility Experiment	Gm	Digital Fantasia	B C	NT	£10.29		
Dumpout 3	Ut	Watford	B R	WA	£19.00	Female Reproductive Cycle	Ed	Garland	B C	JX	£12.00		
Dune Rider	Gm	Micro Power	B C,D	GK	£7.95,	Felix and the Fruit Monsters	Gm	Micro Power	B,E C	GK	£7.95		
					£9.95	Felix In The Factory	Gm	Micro Power	B C	KA	£9.50		
Dungeon Adventure	Gm	Level 9 Computing	B C	CU	£9.90	F For Freddie	Gm	Kansas	B,E C,D	GK	£6.95		
Dynamic Nuclear Magnetic Resonance Spectroscopy	Ed	Microwave	B C	MW	£3.95	Felix Meets the Evil Weevils	Gm	Kansas	B C	KA	£9.50		
						Fighter Pilot	Ut	Dial	B C,D	DL	£6.50,		
Eagle Empire	Gm	Salamander	B C	SA	£7.95	File Handler					£8.00		
Eagle Empire	Gm	Alligata	B C	SY	£7.95	File Plus	Do	Data tap	B D	DA	£49.95		
Early Learning	Ed	B.B.C.	A,B C	KB	£10.00	Finance Pack	Bs	Dial	B C,D	DL	£4.95,		
Early Numbers	Ed	Bryants S/W	B C	HW	£4.80						£6.50		
Early Warning	Gm	A&F Software	A,B C	GE	£6.00	Filer	Bs	Micro Power	A,B,E C	GK	£8.95		
Easycalc	Bs	Zero Software	B C	AZ	£12.95	Final Accounts Program	Gm	Gemini	B C,D	GM	£59.95		
Easy Graphics	Ut	Hexagon Software	B C	HX	£13.50	Firebug		Acornsoft	B C,D	AL	£9.95,		
Easy Junior	Bs	Harrison	B D	HA	£	Firefight	Ed	Highlight	B C,D	HI	£6.00,		
Easy Times	Ed	Soft Centre	B C	SN	£6.00	First Count	Ed	Scholar	B C,D	SC	£5.00,		
Easywrite	Ed	System Software	B C	SY	£10.00	First Steps in Algebra	Ed	Small School	B C	SM	£6.95		
Ecological Simulations	Ed	Garland	B C	JX	£16.50	First Steps with Mister Men	Ed	Mirror	B,E C	MR	£8.95		
E.D.G. Graphics Package	Ut	Salamander	B C,D	SA	£19.95,	Firehawks	Gm	Postern	B C	PT	£6.95		
					£24.95	Fishy Business	Gm	Salamander	B C	SA	£9.95		
Edit 7	Ut	Crystalsoft	B C	CS	£5.00	5 in a row	Ed	Hill MacGibbon	B C	HM	£6.95		
Ed-master	Ed	R. H. Electronics	B C	RH	£12.95	Flint's Gold	Gm	Micrograf	B C,D	MF	£6.95,		
Educare's 50	Ed	Educare	A,B C	EU	£7.95						£9.95		
Education (1)	Ed	Microplus	A,B C	AM	£4.25	FIZZ BUZZ	Ed	G.E.D. Software	B C	GD	£4.50		
Educational (1)	Ed	Golem	A,B,E CD	OB	£8.00,	Fizz Buzz	Ed	Bourne	A,B C	BO	£4.50		
					£10.00	Flags	Ed	IJK Software	B C	IJ	£4.50		
Educational (2)	Ed	Microplus	A,B C	AM	£5.25	Flags	Ed	Micro-Aid	B C	IZ	£5.95		
Educational (2)	Ed	Golem	A,B,E CD	OB	£8.00,	Flanders	Ed	Focusplan	A,B C	FP	£5.95		
					£10.00	Fletcher's Castle	Ed	Fernleaf	B C,D	FE	£9.95,		
Education (3)	Ed	Microplus	B C	AM	£5.25						£12.95		
Edword	Ed	Clwyd Technics	B R	CL	£38.95	Flexibase	Dm,	Alligata	B C	AG	£9.95,		
Egg the Upgrade	Gm	Crystalsoft	B C	CS	£3.50	Flint's Gold	Bs	Micrograf	B C,D	MF	£6.95,		
						Floater	Gm	Cambridge Micro	B D	CM	£15.00		
							Ed				+ VAT		

Flowers of Chrystal	Ed	4MAT	B	C,D	FM	£16.00, £17.65
Flush	Ut	Micro-Aid	A,B	C	IZ	£1.00
Football Pools Predictor	Do	Mayday Software	A,B	C	IX	£4.99
Footer	Gm	Program Power	B	C	GK	£7.95
Forecast	Bs	Acornsoft	B	C	AL	£11.90
Forecasting-single exponential	BS	Micropax	B	C	MP	£4.95
Forecasting-double exponential	Bs	Micropax	B	C	MP	£7.95
Forth	Ut	Aztec	B	C	AZ	£16.85
Forth	Ut	H.C.C.S.	B	C	HC	£34.72
Forth	Ut	Level 9 Computing	A,B	C	CU	£15.00
Forth Toolkit	Ut	Level 9 Computing	B	C	CU	£12.00
FORTH	Ut	Acornsoft	B,E	C	AL	£16.85, £16.10
Four-in-a-Row	Gm	Dial	B	C,D	DL	£4.95, £6.50
Frac Attack	Ed	Shards	B	C,D	SH	£6.95, £9.95
Fraction Chase	Ed	GED Software	B	C	GD	£4.00
Fractions	Ed	Garland	B	C	JX	£7
Fracts	Ed	Cottage Soft	B	C	CT	£7.50
Franklins Tomb	Gm	Salamander	B	C	SA	£9.95
Freefall	Gm	Acornsoft	B,E	C	AL	£9.95, £9.20
French Connections	Ed	Cambridge Micro	B	C,D	CM	£15.00 + VAT
French Vocabulary	Ed	Dial	B	C	DL	£8.50
French Irregular Verbs	Ed	Carsondale	B	C	CD	£18.86
French Mistress A/B	Ed	Kosmos	B,E	C	KM	£9.95
French Vocabulary	Ed	Hargreaves	B	C	HG	£6.50
French Text Fill	Ed	Carsondale	B	C	CD	£9.95
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
Frak	Gm	Aardvark	B	C	AR	£8.95
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
Friend or Foe	Ed	Hill MacGibbon	B	C	HM	£6.95
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	KB	£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 House	Ed	Clares	B	D	CL	£10.00, £13.00 (3")
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
Galaxy's Edge	Gm	Magic	B	C	MG	£7.45
Game Core	Ut	BBC	B	C	KB	£10.95
Games Compendium B1/2	Gm	Salamandar	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
Gamemaker	Ut	Holly	E	C	HO	£12.99
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

SOFTWARE SUPPLIERS

GK	Micro Power Ltd Northwood House North Street Leeds LS7 2AA	HY	Honeyfold Software Standfast House Bath Place, High St. Barnet London EN5 1ED
GM	Gemini 9 Salterton Road Exmouth Devon EX8 2BR	IB	Astec Software 25 St Mark Road Deepcar Sheffield S30 5TS
GN	Gnomonica 2 Stable Cottages Pleystone, Rusper Rd Capel, Dorking Surrey RH5 5HE	IC	Ian Copestake 23 Copnought Crescent Brookwood Woking Surrey GU24 0AN
GR	Griffin Software 285 Ealing Road Alperton Wembley Middlesex HA0 1HJ	IF	Electronics Applied 4 Dromore Road Carrickfergus County Antrim BT38 7PJ
GS	Gaelsett Software 44 Exeter Close Stevenage Herts SG1 4PW	IJ	I J K Software 9 King Street Blackpool Lancs
GY	Huntsman Walk Rugeley Staffs WS15 2SN	IN	Ixon Software 10 The Crescent Lympham Weston-Super-Mare Somerset BS24 0BN
HA	Harrison Associates Unit 307 16 Brune St London E1 7NJ	IO	Icon Software 65 High Street Goaforth Tyne & Wear NE3 4AA
HC	H.C.C.S. Associates 533 Durham Road Low Fell Gateshead Tyne and Wear NE9 5EY	IS	Software Invasion 50 Elborough Street Southfields London
HE	Heinemann Computers in Education Freepost EM17 The Windmill Press Kingswood Tadworth Surrey KT20 6BR	IU	Aardvark Software 15 Queensberry Avenue Hartlepool Cleveland TS26 9NW
HG	J Hargreaves Updown Pewley Way Guildford Surrey	IV	James Hager 7 Basset Street Camborne Cornwall TR14 8SW
HH	H&H Software 53 Holloway Runcorn Cheshire WA7 4TJ	HS	Simon Hessel Software 15 Lytham Court Cardwell Crescent Bershire
HM	Harris McCutcheon Systems 40Huntingdon Street London N1 1HM	IX	Mayday Software 181 Portland Crescent Stanmore Middlesex HA7 1LR
HN	Hutchinson 17-21 Conway Road London W1P 6JD	IY	Persoft Freepost Balldon Shipley West Yorkshire BD17 5SX
HO	Holly Computers PO Box 17 Bingley W.Yorkshire BD16 3JQ	IZ	Micro Aid 25 Fore Street Prase Camborne Cornwall TR14 0JX
HW	Bryants (Educational) Software 1 The Hollies Chalcraft Lane North Bersted Bognor Regis PO21 5SX	JL	Joe the Lion 213/215 Market Street Hyde Cheshire SK14 1HF
HX	Hexagon Software 17 Straits Road Gornal Dudley West Midlands DY3 2UR	JS	J.B. Software 57 Meadow Crescent Carleton Poulton-le Fylde Lancashire FY6 7QX

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SOFTWARE LISTINGS

Title	Type	Manufacturers	Memory	Software Supplier	Price
Games of Strategy	Gm	B.B.C.	A,B C	KB	£10.00
Games Pack II	Gm	Micromail	B C	OE	£6.75
Gauntlet	Gm	Micro Power	E C	GK	£6.95
Gateway to Karos	Gm	Acornsoft	B C	AL	£9.95
G.B. Geography	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
Ghost Town	Gm	Adventure International	B,E C	AI	£7.95
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
Golden Voyage	Gm	Adventure International	B,E C	AI	£7.95
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 Software	B C	NZ	£24.95
Graph and Charts Pack	Bs	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
Great Britain Ltd	Gm	Hessel	B C	HS	£5.95
Greater and Smaller	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					
Happy Numbers					
Harlequin					
Harlequin					
Harmony					
Headway					
Heist					
Helicopter Rescue/Tunnel/Roadrace					
Henry IV Part 1					
Hi-VIEW					
Hi-Bouncer					
Hide and Seek					
History Quiz					
Hitch Hiker					
Home Accounts					
Home Accounts					
Home Accounts					
Home Accounts					
Home Accounts					
Home Accounts					
Home Filewriter					
Home Finance					
Hooked on Numbers					
Hoop-La					
Hopper					
Horror Castle					
Horserace					
Hot Cakes					
Housekeeper					
Howzat					
Human Blood Groups					
Hunchback					
Hydraulics					
Hyperdrive					
Identikit					
'...I Do'					
Identikit/Word Finder					
Index					
Index Numbers-Basket					
Index Numbers-Changer					
Indexit					
Inhabitant					
Inheritance					
Inheritance					
Inkosi					
Intergalactic Trader					
International Special Agent					
Intervention commercial					
Intervention educational					
In the Grip of Ice					
Intro					
Introducing Map Skills 1/2					
Introduction to Microcomputing in Teaching					
Invaders					
Invasion					
Invisible Man					
Invoicing					
Invoices and Statements					
ISO-Pascal					
Janepus					
Jars					
JCB Digger					
Jet Power Pack					
Jigsaw Puzzle					
MP S/W					
Bourne					
Bourne					
LTS					
LTS					
Doctor Soft					
GSN					
Softspot					
A Lane					
Acornsoft					
Penguin					
Micro Power					
Mirrorsoft					
A.S.K					
Acornsoft					
Computer Concepts					
Harris					
BJ Software					
Diamondsoft					
Gemini					
Persoft					
BJ Software					
Dynatech					
B.B.C.					
Acornsoft					
Soft Centre					
Acornsoft					
A&F					
Dynabyte					
Private Tutor					
Heinemann					
A&F					
Garland					
Superior Software					
Database Software					
IJK					
Stell					
Acornsoft					
Heinemann					
Microwave NW					
Micropax					
Micropax					
Williams					
Longman					
S.W. Hessel S/W					
Garland Comp.					
Chalksoft					
Micro Power					
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System					
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Clares					
Cambridge Micro					
Hutchinson					
Software Invasion					
Superior Software					
Software for All					
Hexagon S/W					
ASP Software					
Chalksoft					
Acornsoft					
Gemini					
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Longman					
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Micro Power					
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EB					

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
Julius Caesar	Ed	Penguin	B,E	C	PE	£5.95
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	Trekasoft	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
Kopfjäger	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
L	Ed	ATM	B	D	AT	£10.00
Labdis	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 Development Pack	Ed	LTS	B	C,D	LT	£12.95
Language Development Pack	Ed	LTS	B	C,D	LT	£12.95
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 Probe	Ed	Hill MacGibbon	B	C	HM	£6.95
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	Ixion	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
LINKWORD French, German, Spanish	Ed	Acornsoft	B	C	AL	£14.95
Lisp	Ut	Acornsoft	B,E	C,R	AL	£16.85, £16.10
Lisp	Ut	Aztec	B	C	AZ	£16.85
LISP Demonstrations	Ut	Acornsoft	B	C,D	AL	£9.95, £11.50
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

SOFTWARE SUPPLIERS

KA	Kansas City Systems Unit 3 Sutton Springs Wood Chesterfield S44 5XF	MK	David McKeran 23 Warwick Drive East Herrington Sunderland Tyne and Wear
KB	BBC Publications British Broadcasting Corpora- tion 35 Marylebone High Street London W1M 4AA	MM	M and M Software 1391 Leek Road Abbey Hulton Stoke-on-Trent Staffs ST2 8BW
KF	Kingfisher Computer Services Durley Lane Keynsham Bristol BS18 2AQ	MN	Merlin Computer Products 18 Mansel Street Swansea SA1 5SG
KH	Superior Software 69 Leeds Road Bramhope Leeds	MO	Micromode 32 West End Avenue Gatley Cheshire
KM	Kosmos 1 Pilgrims Close Harlington Dunstable Bedfordshire LU5 6LX	MO	Molimerx Ltd 1 Buckhurst Road Town Hall Square Bexhill-on-sea East Sussex
KN	Software for All 72 North Street Romford Essex	MR	MRM Software 17 Cross Coates Road Grimsby South Humberside
KS	K. A. Spencer 74 Dovers Park Bathford N. Bath Avon	MS	Musicoft 12 Fallosefield Amphill Beds
KU	Kudosoft 130 Main Street Tweedmouth Berwick-upon-Tweed TD15 2AW	MW	Microwave NW 24 Belford Road Stretford Manchester M32 0DL
LA	Ludinski Computer-Assisted Learning 24 Avondale Avenue Staines Middlesex	OI	OIC Ltd 15 Burglead Close College Town Camberley Surrey GU45 4XL
LC	Computersmith 40 Greenfields Avenue Bromborough Wirral Merseyside L62 6DD	OP	Optima Software Ltd 36 St. Petersgate Stockport SK1 1HL
LM	Longman Group Longman House Burnt Mill Harlow Essex	OT	Oxhey Tutors 19 Tudor Walk Watford Herts. WD2 4NY
LO	Lothlorien 56a Park Lane Poynton Cheshire SK12 1AE	PB	Pee Bee Software PO Box 175 High Wycombe Bucks.
MA	MP Software and Services 165 Spital Road Bromborough Merseyside L62 2AE	PU	Pumpkin Programs 35 Hammerfield Avenue Aberdeen AB1 6LL
MB	Microbyte Software Freeport Newquay TR7 2BR	SA	Salamander Software 17 Norfolk Road Brighton East Sussex BN1 4AA
MD	MED 640 Melton Road Thurmaston Leics	SC	Scholar Soft Coniscliffe Woolington Gdns Woolington Newcastle Upon Tyne NE13 8AP
MI	Microgame Simulations 73 The Broadway Grantchester Cambridge CB3 9NQ	SC	Screenplay 134 St. Vincent Street Glasgow
MG	MGB Software Support 52 Barley Croft Harlow Essex	SC	Starcade 2 Elworthy Avenue Liverpool L26 7AA

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SOFTWARE LISTINGS

Title	Type	Manufacturers	Memory	Software Supplier	Price						
Looking at Graphs	Ed	Heinemann	B C	HE	£9.25	Memocalc	Bs	Microaid	B C	IZ	£9.95
Looking at Scales	Ed	Heinemann	B C	HE	£9.25	Mental Arithmetic Tests	Ed	Small School	B C	SM	£6.95
Look it up	Ed	GED Software	B C	GD	£4.50	Mental Maths and Place Value	Ed	Edsoft	B C,D	ES	£4.95
Look Sharp!	Ed	Mirror	B,E C	MR	£7.95	Merchant of Venice	Ed	Penguin	B,E C	PE	£5.95
LOGO	Ln	Acornsoft	B R	AL	£69.00	Mercy Mission to Mars	Gm	D.A.C.C.	B C	DC	£5.95
Logo Challenge	Ed	Addison-Wesley	B C,D	AN	£29.95	Merlins Castle	Ed	Pumpkin	B C	PU	£5.00
Lorry/Farm	Ed	Primary	B C,D	PP	£37.95	Meteor Mission	Gm	Acornsoft	B C,D	AL	£9.95
Lords of Time	Gm	Level 9	B C	CU	£5.95	Meteor Mission	Gm	Acornsoft	B C,D	AL	£9.95
Lost City	Gm	Superior Software	B C	SE	£7.95	Meteors	Gm	Acornsoft	B,E C	AL	£9.95
Lost In Space	Gm	Salamander	B C	SA	£9.95	Metrics (5)	Ed	Chalksoft	B C	KT	£9.95
Lunar Rescue	Gm	Alligata	B C	AG	£7.95	Microbial Pop. Dynamics	Ed	Chalksoft	B C	KT	£9.95
L Trap	Gm	Gem	B C	GM	£8.50	Microbug	Ed	Microwave NW	B C,D	MW	£7.00
Lunar Lander	Gm	A&F Software	B C	GE	£6.90	Micro Man	Gm	Pro S/W	B C	LD	£8.00
Macbeth	Ed	Penguin	B,E C	PE	£5.95	Micro Maths	Ed	LCL	A,B,E C,D	KA	£24.50
Mach 1	Ut	Gnomonica	B E	GN	£39.95	Micros in Classroom 1-5	Ed	Longman	B C,D	LM	£20.00
Magic Adventure	Gm	Kansas	B C	KA	£8.50	Milikan's Oil Drop	Ed	GSN	B C,D	GS	£14.00
Mailer	Ut	ASD Ltd	B C	AS	£5.75	Micromon	Ut	Molimerx	B C,R	MO	£14.00
Mailing List	Bs	Gemini	B C	GM	£19.95	Middle Kingdom	Gm	Pro Software	A,B C		£7.95
Mailing	Bs	Micro-Aid	A,B C	IZ	£7.95	Microtext	BS	Acornsoft	B C	AL	£49.85
Mailing System	Bs	Acornsoft	B D	AL	£24.95	Microtype	Ed	Kansas	B C	KA	£12.50
Map Rally	Ed	Bourne	B,E CD	BO	£8.97	Micros in Maths Classroom	Ed	Longman	B C,D	LM	£26.00
Making Ends Meet	Ed	Cambridge Micro	B C,D	CM	£10.98	Millionaire	Gm	Incentive Software	B,E C	IN	£6.50
Manage	Gm	Cases	B C	CE	£15.00	Million Mazes	Gm	Ludinski	B,E C	KA	£6.50
Mansion Murders	Gm	Challenge Games	B C	CG	£6.95	Mined Out	Gm	Quicksilva	B C	QS	£6.95
Mapping Skills	Ed	Heinemann	B C	HE	£9.25	Miner	Gm	Ixion	B C	IN	£6.90
Mark Book	Ed	Carvells	A,B C	CA	£5	Minefield	Gm	Eduquest	A,B C	NW	£5.95
Mark Book	Ed	BBC	A,B C	KB	£15	Minefield	Gm	A&F Software	A,B C	GE	£6.00
Martian Attack	Gm	Micropower	B C		£7.95	Missile Base	Gm	Acornsoft	B C	AL	£9.95
Mass	Ut	DDT	B R	DT	£34.95	Missile Control	Gm	C J E	B C	NV	£9.00
Masterbard Hamlet	Ed	Sulis	B C	SU	£12.95	Missile Control	Gm	Gemini	B C	GM	£9.95
Master Copier	Ut	Aztec S/W	A,B C	IB	£6.50	Missing Signs	Ed	Acornsoft	A,B C	AL	£11.90
Masterfile	Ut	Beebug	B CD	BE	£10.00	Missing Strike	Gm	Superior	B C	SE	£7.95
Mastermind	Gm	Micro Power	A,B C	GK	£3.95	Missing Length	Ed	Scholar	B C,D	SC	£6.50
Matchup	Ed	Edsoft	B C	ES	£5.95	Mission Impossible	Gm	Aztec S/W	A,B C	IB	£6.50
Mathgrid	Ed	Soft Centre	B C,D	SN	£8.00	Mitosis	Ed	Garland	B C	JX	£15
Maths Invaders	Ed	Stell	B,E C	ST	£7.95	Mixed Games	Gm	I.J.K. S/W	A,B C	IT	£3.95
Mathskills I/II	Ed	Griffin	B,E C	GR	£11.95	MMaths	Ed	Ed. Soft	B C	ES	£4.95
Maths Man	Ed	GED Software	B C	GD	£4.00	Model A Invaders	Gm	I.J.K. S/W	A,B C	IT	£4.95
Maths Pack	Ed	Ega Beva	B C	EB	£11.95	Model B Invaders	Gm	I.J.K. S/W	B C	IT	£6.95
Maths Pack	Ed	Dial	B C,D	DL	£4.95	Moli-Tool	Ut	Molimerx	B R	MO	£28.00
Maths Topics 1	Ed	Cambridge Micro	B C,D	CM	£10.00	Moments + Van	Ed	RJE Software	B C	RJ	£4.95
Maths Topics 2	Ed	Cambridge Micro	B C,D	CM	£13.95	Monaco	Gm	Alligata	B C	SY	£7.95
Mathspell	Ed	Diamondsoft	B C	DS	£7.95	Money Box	Ed	Bryants	A,B C	HW	£4.85
Maths Topics 1	Ed	CUP	B C	UP	£18	Moneyplus 1-4	Ed	Fernleaf	B C,D	FE	£35.95
Maths Translation	Ed	Corona S/W	B C	JY	£6.00	Monster Maths	Ed	Shards	B C,D	SH	£6.95
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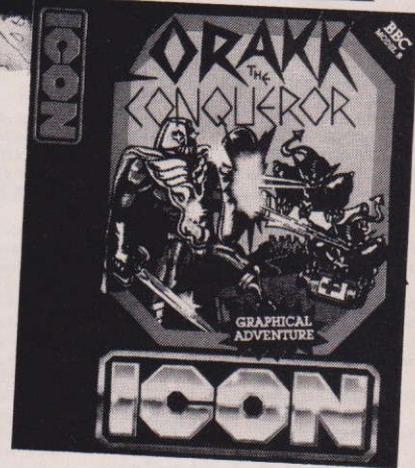
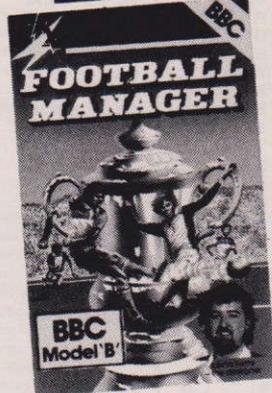
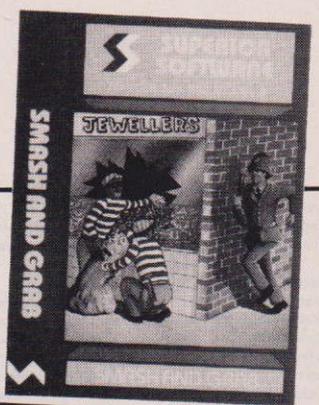
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						£6.50	Space Fighter	Ed	LTS	B	C,D	LT	£11.95
Science Fiction Quiz	Do	Acornsoft	B,E	C	AL	£12.65	Space Invaders	Gm	Kansas	B	C	KA	£7.25
Sets and Operators	Ed	Shiva	B	C	SV	£14.95	Space Pirates	Gm	Superior Software	B	C	SE	£7.95
737 Simulator Flight	Gm	Salamander	B,E	C	SA	£9.95	S-Pascal	Gm	Bug-Byte	B	C	BB	£5.50
Scramble	Gm	Bug-Byte	A,B	C	BB	£6.95	Spacex	Gm	Bug-Byte	A,B	C	BB	£5.50
Scred	Bs	Stable	B	C	CS	£18	Spaceguard	Ut	Acornsoft	B	C,D	AL	£16.85,
Scribe	Bs	Merlin	B	C	MN	£29.95	Space Hi-way	Ed	4MAT	B	CD	FM	£19.90
Scribe II	Do	Alligata	B,E	C,D	SY	£9.95,	Space Kingdom	Gm	MP Software	B	C	MP	£6.50
						£14.95	Space Maze	Gm	Amcom	B	C	AO	£7.45
Sea Cliff Erosion	Ed	Cambridge Micro	B	C,D	CM	£15.00	Spaceflight	Gm	Software For All	B	C	KN	£7.95
						+ VAT	Space Warp	Gm	Micro Power	B	C	GK	£7.95
Sea Lord	Gm	Bug-Byte	B	C	BB	£7.50	Space Fighter	Gm	Miking S/W	B	C	KC	£7.95
Sea Wolf	Gm	Optima	B	C	OP	£8.95	Space Fighter	Gm	Bug Byte	B	C	BB	£11.50
Search for the Jewels	Gm	SJG Soft	B	C	SJ	£8.95	Space Games Pack 1	Gm	MP S/W	B	C	JZ	£8.50
Searchbas	Ut	Micro-Aid	A,B	C	IZ	£1.95	Space Games Pack 2	Gm	Superior S/W	B	C	KH	£7.00
Secret Mission	Gm	Adventure International	B,E	C	AI	£7.95	Space Games Pack 3	Gm	Futura S/W	A,B	C	JC	£3.99
							Space Games Pack 4	Gm	Futura S/W	A,B	C	JC	£3.99
Seed Germination	Ed	Garland Comp.	B	C	JX	£18.82	Space Station Alpha	Gm	Futura S/W	A,B	C	JC	£4.99
Seige	Gm	Postern	B	C	PT	£6.95	Space Station Jailer	Gm	Icon	B,E	C	IO	£6.95
Sentence Maker	Ed	Arnold-Wheaton	B	C	AW	£9.95 +	Space Journey	Gm	Micro Power	B	C	GK	£6.95
						VAT	Space Ranger	Ed	Honeyfold	B,E	C,D	HO	£9.95,
Sequences	Ed	Chalksoft	B	C	CH	£5.95	Space Station Alpha	Gm	Microbyte	B	C	MB	£7.95
737 Flight Simulator	Gm	Salamander	B,E	C	SA	£9.95	Space Station Sid	Gm	Icon	B,E	C	IO	£7.95
Shirley Conran's Magic Garden	Do	Acornsoft	B	C	AL	£9.95	Space Trek	Gm	English Software	B,E	C	EN	£7.95
Sheepdog	Ed	Longman	B	C	LM	£9.95,	Space Pirates	Gm	Program Direct	B	C	NP	£5.99
						£12.95	Spanish Tutor A/B	Gm	Bug Byte	A,B	C	KP	£8.00
Sheepdog Trials	Ed	Bryants S/W	B	C	HW	£4.80	Special Agent	Ed	Kosmos	B,E	C	KM	£9.95
Share Analyser	BS	Synergy	B,E	C,D	SY	£14.95,	Speechparts	Ed	Heinemann	B	C	HE	£9.25 +
						£19.95	Speed and Light	Ed	Bryants S/W	B	C	HW	£4.88
Shoot/Top Shot	Ed	Soft Centre	B	C	SN	£6.00	Spellbound (lrg/hrq)	Ed	Acornsoft	A,B	C	AL	£11.90
Shootout	Gm	MP S/W	B	C	JZ	£5.00	Spellcheck (Wordwise)	Ed	GSN	B	C,D	GS	£14.00,
Seek	Gm	Micro Power	A,B	C	GK	£6.95	Spellcheck	Ut	Beebug	B	D	BE	£19.00
Sentence Sequencing	Ed	Acornsoft	A,B	C	AL	£11.90	Spelling	Ed	Edsoft	B	C,D	ES	£4.95
Sentence Shaker	Ed	GED Software	B	C	GD	£4.50	Spell 7 + /9 +	Ed	Soft Centre	B	C	SN	£6.00
747	Gm	Doctor Soft	B	C	DO	£7.95		Ed	Primarv	B	C,D	PP	£5.95,
Shadowfax	Gm	D.A.C.C.	B	C	DC	£9.95							£7.95
Shape Generator	Gm	Postern	B	C	PT	£6.95							
Shapes Package	Ut	Software for All	B	C	KN	£11.50							
Shape Snap	Ed	GED Software	B	C	GD	£8.00							
Shop Keeper	Ed	Ega Beva	B	C	EB	£11.95							
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							

CONTINUED OVER

SOFTWARE LISTINGS

Title	Type	Manufacturers	Memory	Software Supplier	Price
Spelltest	Ed	Bryants	A,B C	HW	£4.85
Spellings	Ed	ECL	B C	EL	£5.99
Spiderman	Gm	Adventure International	B,E C	AI	£7.95
Spitfire Command	Gm	Superior	B C	SE	£7.95
Spitfire Flight Simulator	Gm	Alligata	B C	SY	£7.95
Sphinx Adventure	Gm	Acornsoft	B,E C	AL	£9.95
Splashdown	Ed	Highlight	B C,D	HI	£9.20
Sploosh	Ed	Highlight	B C,D	HI	£6.00
Spreadsheet	Ed	Contex	B C	CX	£7.00
Sprites	Ut	Beebug	B C,D	BE	£7.99
Spy	Ut	System	B C	SY	£10.00
Squash	Ut	Pica	B C,D	PI	£24.15
Squash	Gm	Aztec S/W	A,B C	IB	£9.75
Squeeze	Ed	ASK/Acornsoft	B,E C,D	AL	£11.50
Staircase Stampede	Gm	Comsoft	B C,D	CM	£7.50
Standards and Variances	Bs	Micropax	B C	MP	£9.50
Starbattle	Gm	Kudusoft	B C	KU	£7.95
Star Battle	Gm	Superior	B C	SE	£5.50
Star Gazer	Ed	Heinemann	B C	HE	£7.95
Starlander	Gm	Kudusoft	A,B C	KU	£9.25 + VAT
Star Patrol	Gm	Kudusoft	B C	KU	£3.50
Starship Command	Gm	Acornsoft	B,E C,R	AL	£6.50
Star Seeker	Do	Mirrorsoft	B C,D	MR	£9.95
Star Trader	Gm	FBC Systems	B C	FB	£9.20
Star Striker	Gm	Superior	B C	SE	£9.95
Starfighter	Gm	FBC Systems	B C	FB	£12.95
Star Trek Adventure	Gm	Superior Software	B C	SE	£9.50
Star Trek	Gm	Micro Power	A,B C	GK	£7.95
Star Maze	Gm	Database Software	B C	NU	£5.95
Star Patrol	Gm	Kudusoft	B C	KU	£7.50
Startrek/Candy Floss	Gm	I.J.K.S/W	A,B C	IT	£6.50
Star Trek	Gm	Hexagon S/W	A,B C	JA	£5.95
Starpac	Ed	Micro-Aid	B C	IZ	£5.50
Starter Word Splits	Ed	Sulis	B C	SU	£9.95
Stats 1	Bs	ME & P Products	A,B C	KK	£9.95
Statistics 1/2	Ed	Chaddington	B,E C,D	CN	£15.00
Stock	Ed	System	B C,D	SY	£10.00
Stock Car	Gm	Micro Power	B C	GK	£14.95
Stock Control	Bs	Acornsoft	B D	AL	£7.95
Stock Control	Bs	Gemini	B C	GM	£24.95
Stock Control, classification	BS	Micropax	B C	MP	£19.95
Stock Control-EOQ	BS	Micropax	B C	MP	£7.95
Stock Control-Roq and Rol	BS	Micropax	B C	MP	£7.95
Stockmarket	Gm	Micro-Aid	B C	IZ	£7.95
Stockmarket	Gm	ASP Software	B,E C	AS	£4.95
Story	Ed	HRH	B C,D	HH	£6.99
Story A - Spanish Gold	Ed	Chalksoft	B C	CH	£5.65
Storybuilder	Ed	Bryants S/W	B C	HW	£6.95
Stock Valuation	Bs	Micropax	B C	MP	£7.95
Story	Ed	H&H	B C,D	HH	£7.50
Stranded	Gm	Superior	B,E C	SE	£9.50
Strange Odyssey	Gm	Adventure International	B,E C	AI	£10.50
Stunt Flyer	Gm	Phoenix Software	B C	PH	£7.95
Subkiller	Gm	D.K. Tronics	B C	DK	£6.99
Submarines	Ed	GED Software	B C	GD	£6.95
Suffixes	Ed	Golem	B C	OB	£4.00



Sum Fun	Ed	GSN	B C	GS	£8.00
Summit (hrq/lrg)	Ed	GSN	B C,D	GS	£9.00
Super Fruit	Gm	Simonsoft	B,E C,D	SI	£5.95
Super Fruits	Gm	D.K. Tronics	B C	DK	£6.95
Super Invaders	Gm	Acornsoft	B C	AL	£9.95
Superlife	Ed	Golem	B,E CD	OB	£4.95
Supersquare	Ed	GSN	B C,D	GS	£6.95
Superplot	Ut	Beebug	B C	BE	£10.00
Super Spell	Ed	Aztec	A,B C	AZ	£5.50
Supergolf	Gm	Squirrel Softwre	B C	SS	£7.50
Super Hangman	Gm	I.J.K. S/W	B C	IT	£3.95
Survival	Ed	System	B C	SY	£14.95
Survivor	Gm	MP Software	B,E C,D	MP	£7.48
Swag	Gm	Micro Power	B,E C,D	GK	£10.50
Swamp Monsters	Gm	M P Software	B C	JZ	£6.50
Swamp Monsters	Gm	M P Software	B C	JZ	£6.50
Swordmaster	Gm	Micrograf	B,E C,D	MF	£7.95
Tables Test	Ed	Bryants S/W	B C	HW	£4.88
Tables	Ed	ECL	A,B C	HW	£4.85
Table Sums	Ed	Griffin	B C	GR	£5.99
Table Adventures	Ed	A.S.K	B C	AK	£9.95
Tables Wizard	Ed	Hill MacGibbon	B C	HM	£6.95
Take It Away	Ed	Arnold-Wheaton	B C	AW	£6.00 + VAT
Talkback	Ed	Acornsoft	E,B C,D	AL	£9.95
Tank Attack	Gm	Gem Software	B C	GC	£11.50
Tanks	Gm	Salamandar	B C	SA	£7.95
Tape Catalogue	Ut	A.J.	B C	AJ	£5.95
Tape Copy	Ut	Davansoft	A,B C	NX	£7.50
Tarzan	Gm	Alligata	B C	AG	£7.95
Taxcalc	Ut	BBC Pubs	B C	KB	£17.25
Teacher in the Custard	Ed	Pee Bee	B C,D	PB	£8.50
Teacher's Toolkit	Ed	Wida Software	B C	FY	£11.00
Teletext Pack	Ut	Beebug	B C,D	BE	£30.00
					£10.00
					£12.00

Temperature Control Simulation	Ed	Acornsoft	B	C,D	AL	£9.95, £11.50	Toolstar Touch Typist Touch Type Tutor	Ut	PACE Computercat Technical Education	B	R	PA	£34.00
Ten Little Indians	Gm	Digital Fantasia	B	C	NT	£10.29	Towering Inferno	Ed	Sulis	B	C	CC	£9.95
Tense French	Ed	Sulis	B	C	SU	£9.95	Tower of Alos	Ed	A&F Software	A,B	C	GE	£6.90
Tessalations	Ed	Cambridge Micro	B	D	CM	£25.00 + VAT	Towers	Ed	Bryants	A,B	C	HW	£4.85
Tess	Ed	HRH	B	C,D	HH	£6.55, £7.85	Town Planner	Ed	Heinemann	B	C	HE	£9.25 + VAT
Tesselator	Ut	Addison-Wesley	B	C	AN	£21.95 + VAT	Towns of Britain	Ed	Aztec S/W	A,B	C	IB	£6.50
Test Match	Gm	CRL	B	C	CO	£7.95	Townstest	Ed	Silverlind	B	C	SL	£6.50
Tetrapod	Gm	Acornsoft	B	C,D	AL	£9.95, £11.50	3-D Ice Hockey	Gm	Computersmith	B	C	LC	£5.50
Text Grader	Ed	Hutchinson	B	C	HN	£28.75	3 in 1	Gm	R. H. Electronics	A,B	C	RH	£7.50
Text Print Extension	Ut	Ratco Soft	A,B	C	RA	£2.00	Trafalgar	Gm	Squirrel Software	B	C	SS	£8.00
Text Processing Pack	Bs	Eduquest	B	C	NW	£10.00	2002	Gm	Superior Software	B	C	SE	£7.95
Theatre Quiz	Do	Acornsoft	B,E	C	AL	£12.65	Trailblazer	Ed	Arnold-Wheaton	B	C	AW	£12.95 + VAT
The Animator	Ut	Screenplay	B	C	SC	£11.95	Tramix	Gm	D. K. Tronics	B	C	DK	£6.95
The Count	Gm	Adventure International	B,E	C	AI	£7.95	Tree of Knowledge	Ed	Acornsoft	A,B,E	C	AL	£9.95
The Complete Cocktail Maker	Do	Acornsoft	B	C,D	AL	£9.95, £11.50	Trek	Gm	Micrograf	B,E	C,D	MF	£7.95, £10.95
The Horse Lord	Gm	Century	B	C	CY	£7.95, £12.95 + book	Transistors Revenge	Gm	Soft Spot	B	C	SF	£6.95
The Hulk	Gm	Adventure International	B,E	C	AI	£7.95	Triangles/Shapes	Ed	Primary	B	C,D	PP	£5.95, £7.95
The Mystery Fun House	Gm	Adventure International	B,E	C	AI	£7.95	Tripute	Gm	Dial	B	C,D	DL	£4.95, £6.50
The Seventh Star	Gm	Acornsoft	B	C	AL	£9.95	Triangle Tutor	Ed	Pee Bee	B	C,D	PB	£6.50, £9.00
The Golden Baton	Gm	James Hager	B	C	IV	£6.50	T-Squared Timetabling	Ed	Yorke House	B	D	YH	£25.00
The Frog	Gm	Digital Fantasia	A,B	C	NT	£8.95	Turbo Compiler	Ut	Salamander	B	C	SA	£9.95
3-D Mouse Maze	Gm	Rainbow S/W	B	C	KS	£3.50	Turtle Graphics	Ed	Acornsoft	B	C,D	AL	£9.95, £11.50
3-D Maze	Gm	Hexagon S/W	A,B	C	JA	£6.00	Twelfth Night	Ed	Penguin	B,E	C	PE	£5.95
3D Maze	Gm	Earthshock S/W	A,B	L	KI	£3.00	Twenty Crosswords	Gm	NEC	B	C	NC	£6.90
3D Maze	Gm	I.J.K. S/W	B	C	IT	£3.95	Twin Kingdom Valley	Gm	Bug-Byte	B,E	C	BB	£9.50
The Alien Planet	Ed	Honeyfold	B,E	C,D	HO	£9.95, £11.95	Type Easy	Ed	Carswell	B	C	CR	£8.95
The Basic Lesson	Ed	Ega Beva	B	C	EB	£11.95	Type Invaders	Ed	Carswell	B	C	CR	£6.95
The Bunsen	Ed	Scholar	B	C,D	SC	£6.00, £8.00	Typing Tutor	Ed	Context	B	C	CX	£9.99
The Computer Programme Programs Vol 2	Do	B.B.C	B	C	KB	£10.00	Ultima-File	Dm	Ixion	A,B	C	IN	£7.50
The Computer Programme Programs Vol 1	Do	B.B.C.	A,B	C	KB	£10.00	Ultracale	Bs	BBC Publications	B	R	KB	£74.95
The Golden Baton	Gm	Digital Fantasia	A,B	C	NT	£10.29	Understanding Your Weather	Ed	Heinemann	B	C	HE	£9.25 + VAT
The Graphics Lesson	Ed	Ega Beva	B	C	EB	£11.95	Unimo	Gm	Dial	B	C,D	DL	£3.95, £5.50
The Generators	Gm	Quicksilva	B	C	QS	£6.95	Utilities Package	Ut	Salamander	B	C	SA	£9.95
The Halls of Time	Gm	OK	B	C	OK	£10.00	Unoriginal Games	Gm	McKeran	A,B	C	MK	£2.00
The Lemming Syndrome	Gm	Dynabyte	B,E	C	DN	£7.95	Unorthodox Engineers	Gm	Mosaic	B	C	MD	£9.95
The Frog	Gm	Software For All	B	C	KB	£7.95	Util-1	Ut	Gem Software	B	C	GC	£9.95
The Guns of Navarone	Gm	D.A.C.C.	B	C	DK	£7.95	Utility EPROM	Ut	A.J.	B	R	AJ	£19.95
The Mine	Gm	Micro Power	B	C	GK	£7.95	Utility Pack	Ut	Computersmith	B	C	LC	£5.50
The Theorem of Pythagoras	Ed	Small School	B	C	SM	£6.95	Utilities	Ut	Qualitysoft	A,B	C	QT	£4.00
The Ring of Time	Gm	Kansas	B	C	KA	£9.50	Utilities	Ut	ASD Ltd	B	C	AS	£5.75
The Typing Master	Do	Anthony Ashpitel	B	C	AA	£20.00	Utility A	Ut	Golem	A,B,E	CD	OB	£5.95, £7.95
The Wizard of Akryz	Gm	Digital Fantasia	B	C	NT	£10.29	Utility Pack	Ut	Micro-Aid	A,B	C	IZ	£5.95
The Garden	Ed	Clares	A,B	C	CL	£6.95	Vader Raid	Ut	Ega Beva	B	C	EB	£7.95
The Time Machine	Gm	Digital Fantasia	A,B	C	NT	£8.95	Valley	Gm	FBC Systems	B	C	FB	£7.50
There	Ed	Golem	B	C	OB	£8.05	Valley of the Pharoahs	Gm	ASP Software	B,E	C	AS	£11.45
3-Deep Space	Gm	Postern	B	C	PT	£7.95	Varkman/Meannies	Gm	FBC Systems	B	C	FB	9.50
3D-Tankzone	Gm	Dynabyte	B	C	DB	£8.95	Vampire Castle	Gm	Aardvark Software	A,B	C	IU	£4.00
Time	Ed	Stell	B,E	C,D	ST	£7.95	VASM	Gm	Micrograf	B	C,D	MF	£6.95, £9.95
Timeman Two	Ed	Bourne	B,E	C	BO	£8.97, £10.98	VAT Traders Ledger	Ut	Vida	B	R	VR	£35.00 + VAT
Timeman One	Ed	Bourne	B,E	C,D	B	£8.97, £10.98	Velocity of Light	Bs	Harris	B	D	HM	£21.50
Time Series Analysis	Bs	Micropax	B	C	MP	£7.05	View Printer Drivers	Ed	GSN	B	C,D	GS	£14.00, £15.00
Timetable Clock	Ed	Primary	B	C,D	PP	£5.95, £7.95	View Printer Driver	Ut	Acornsoft	B	C	AI	£9.95
Timetabling OPT 1-6	Ed	Hutchinson	B	C	HN	£17.25	Views/Faces	Ut	Alligata	B	C	SY	£7.95
Timetabling TT 1-6	Ed	Hutchinson	B	C	HN	£17.25	Viewindex	Ed	Primary Programs	B	C	PP	£3.95
Time Traveller	Ed	Sulis	B	C	SU	£9.95	Viewsheet	Ut	Acornsoft	B	D	AL	£14.95
Timetrek	Gm	Micro Power	B,E	C	GK	£6.95	Viking England 1-4	Bs	Acornsoft	B	R	AL	£59.80
Tiny Pascal	Ut	H.C.C.S.	A,B	R	HC	£59.00	Viper	Ed	Ed	B	C,D	FE	£45.95
Titration	Ed	System	B	C	SY	£14.95	Vocab	Gm	R. H. Electronics	B	C	RH	£8.95
Tomb Adventurer	Ed	Heinemann	B	C	HE	£9.25 + VAT	Vogon Attack	Do	Beebug	B	C	BE	£10.00
Thombs of Arkenstone	Ed	Arnold-Wheaton	B	C	AW	£15.00 + VAT	Volcano	Gm	Micromail	B	C	OE	£6.33
Tom Thumb Adventure	Gm	OK	B	C	OK	£10.00	Vortex	Gm	Acornsoft	B	C,D	AL	£9.95, £11.50
Toolbox	Ut	BBC Pubs	B	C	KB	£21.00		Gm	Software Invasion	B	C,D	IS	£7.95, £11.95
Toolkit	Ut	Beebug	B	R	BE	£27.00							

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SOFTWARE LISTING

Title	Type	Manufacturers	Memory	Software Supplier	Price
Voodoo Castle	Gm	Adventure International	B,E C	AI	£7.95
Vu-calc	Bs	Psion	B C	PS	£14.95
Vu-file	Bs	Psion	B C	PS	£14.95
Vu-type	Ed	BBC Pubs	B C	KB	£16.10
Wall	Gm	Micro Power	B C	GK	£5.95
Watch Your Weight	Do	Acornsoft	B C,D	AL	£9.95, £11.50
Watts in Your Home	Ed	Cambridge Micro	B C,D	CM	£13.95 + £1.62
Weather Station	Ed	Arnold-Wheaton	B C,D	AW	£15.00 + VAT
Web Runner	Gm	Alligata	B C	SY	£7.95
Whatsit	Ed	Ed. Soft	B C	ES	£4.95
What's it Worth?	Ed	Arnold-Wheaton	B C	AW	£10.00 + VAT
What's to Eat?	Do	Shumwari	B C,D	SH	£10.45, £13.45
Where?	ED	Primary Programs	B C	PP	£3.95
Where?	Ed	Micro Power	B,E C	GK	£6.95
Where...Their	Ed	Primary	B C,D	PP	£5.95, £7.95
Which Salt?	Ed	Micro Power	B C	OK	£6.95
White Barrows	Gm	ASP Software	B,E C	AS	£6.99
White Knight	Gm	BBC Pubs	B C	KB	£11.50
Whitewash	Gm	Amcom	B C	AO	£5.95
Whole Number Arithmetic	Ed	RJE Software	B C	RJ	£7.95
White Barrows Conquering Everest	Gm	ASP Software	A,B C	AS	£11.45
Wilt-Spelling	Ed	Longman	B C,D	LM	£9.95, £12.95
Wizard	Gm	Quicksilva	B C	QS	£6.95
Wizard's Challenge	Gm	Micro Power	B C	GK	£7.95
Wolfpack	Gm	Doctor Soft	B C	DO	£7.95
Woodland Terror	Gm	MP	B,E C,D	MP	£7.48, £10.50
Woodstock	BS	Micropax	B D	MP	£29.50
Wordflash	ED	Ed. Soft	B C	ES	£4.95
Word Fun	Ed	GSN	B C,D	GS	£8.00, £9.00
Wordgames	Ed	Griffin	B,E C	GR	£9.95
Word Hang	Ed	Bourne	B,E C,D	BO	£8.97, £10.98
Word Hunt	Ed	Acornsoft	A,B C	AL	£11.90
Wordmaster	Ed	Sulis	B C	SU	£9.95
Word Master	Ut	R.H. Electronics	B C	RH	£9.95
Word Mover	Do	BBC	B C	KB	£9.95
Word Perfect	Ut	Doctor Soft	B C	DS	£9.95
Wordpower	Ed	Sulis	B C	SU	£9.95
Word Processor	Bs	Gemini	B C	GM	£19.95
Wordprocessor	Ut	ASD Ltd	A,B C	AS	£5.75
Wordsmith	Do	A.J.	B C,D	AJ	£19.95, £24.95
Word Tray Wizard	Ed	Hill MacGibbon	B C	HM	£6.95
What's Your Reason?	Ed	Arnold-Wheaton	B C	AW	£10 + VAT
Wordscan	Gm	Dial	B C,D	DL	£6.50, £8.00
Workshop	Ed	Acornsoft	B,E C,D	AL	£9.95, £11.50
Word Sequencing	Ed	Acornsoft	A,B C	AL	£11.90
Wordspell	Ed	Griffin Software	BE C	GR	£9.95
Words, Words, Words	Ed	A.S.K	B C	AK	£9.95
Wordsworth	Ut	Ian Copestake	B C	IC	£17.25
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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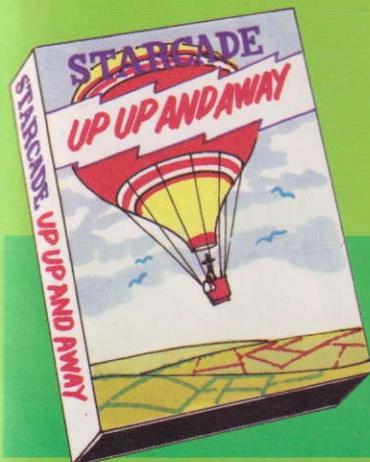
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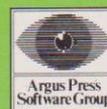


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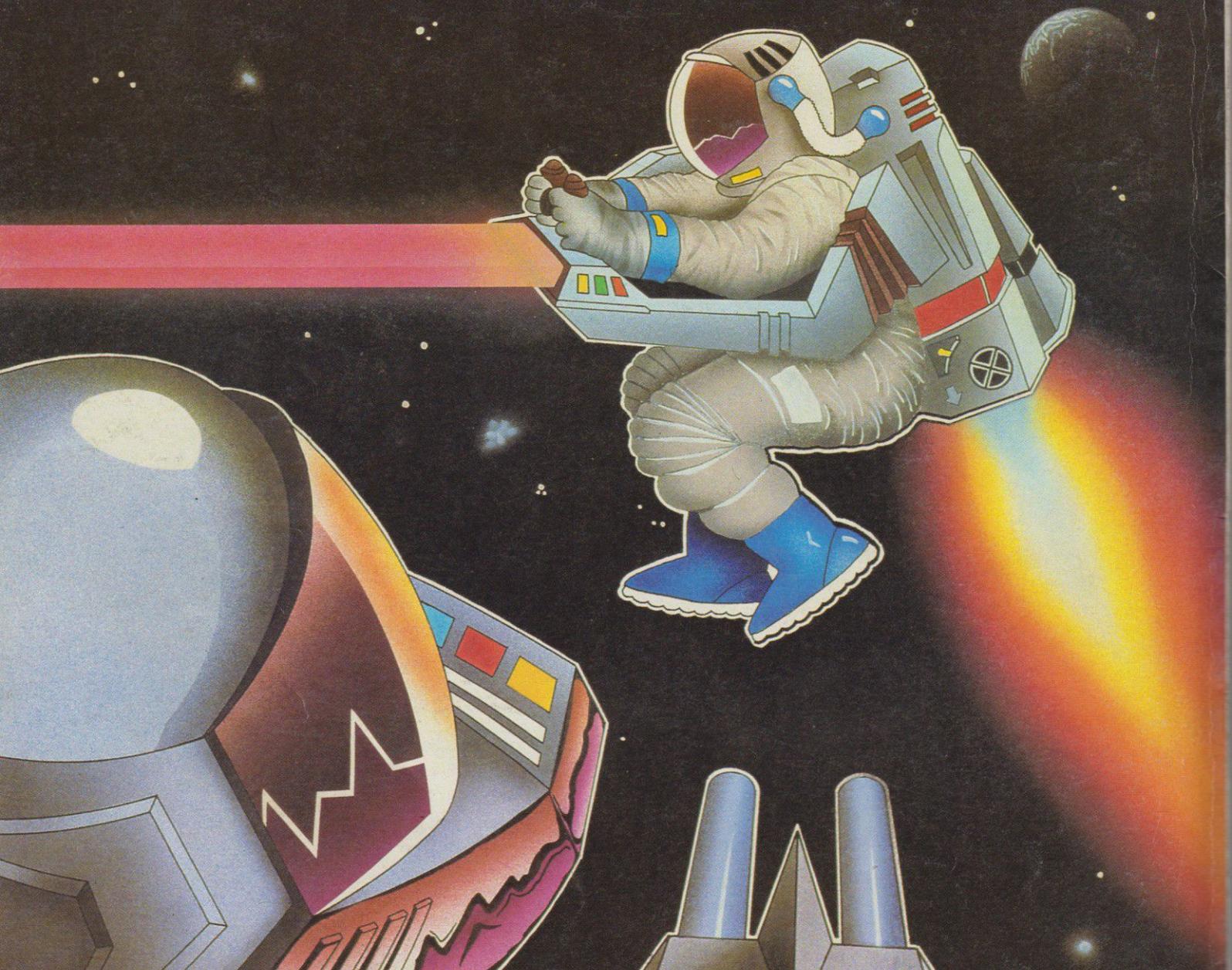
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