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November 1984

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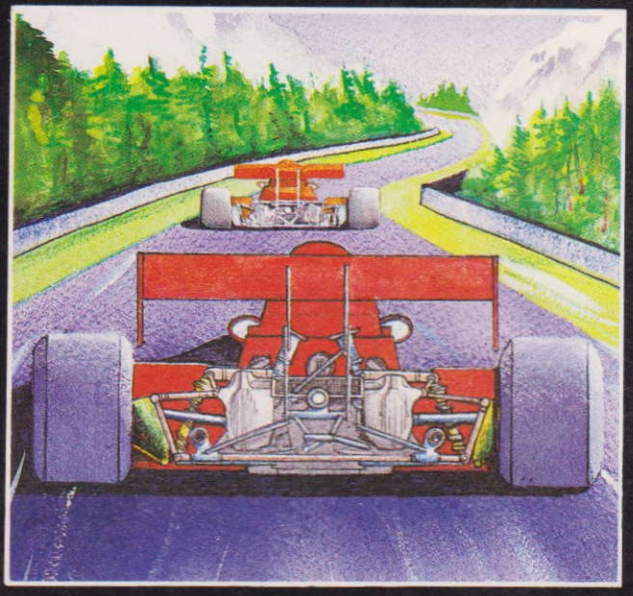

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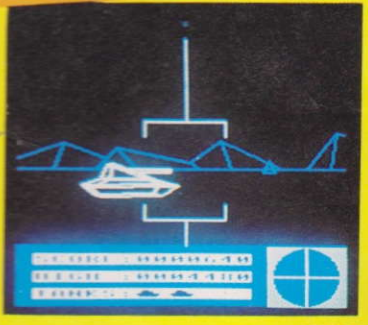

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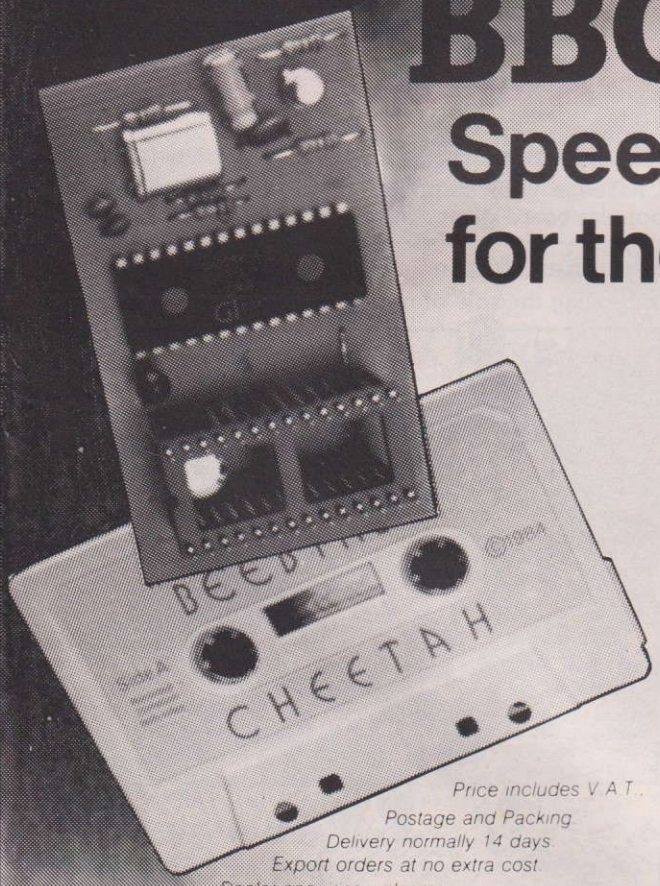

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A&B

Volume One Number

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

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

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

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Ten November 1984

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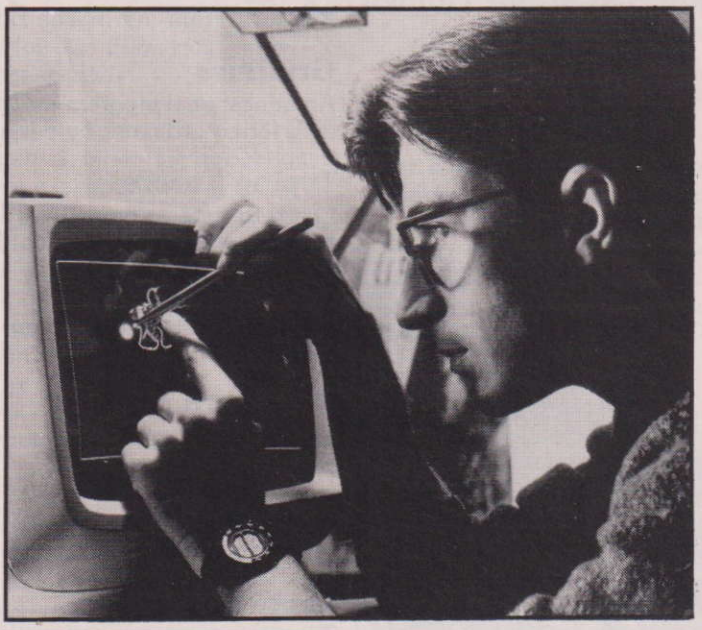
& Questions Answers

Bruce Smith

This month A&B has launched itself with abandon into the world of discs and drives. Bruce Smith can't resist diving in.



This month's Q&A has a decidedly disc orientated bent to it. People have obviously been spending their left over holiday spending money to improve their computing centres!

Q: The first question comes from Charles Canavan in Lee who writes... "I originally bought my BBC micro by mail order with a disc interface fitted. Just recently I have splashed out on a pair of disc drives. However there seems to be very little documentation concerning using the disc commands. I understand that there is a DFS User Guide printed by Acorn but this can only be bought in conjunction with a formatting disc. As a similar disc was supplied with the drive I am reluctant to purchase a second formatting disc purely to obtain the DFS User Guide.

Is there any way I can obtain a DFS User Guide as at the moment I can do little with my disc system other than load and save items as I have no information available to me?"

A: As far as an actual Acorn DFS User Guide goes I'm afraid you have little chance as Acorn are quite strict on their policy of selling it with their formatting disc.

There are however a few good books around concerning the Disc Filing System and I would strongly recommend one of these to you. The two available at the moment are 'Disk Systems for the BBC Micro' and 'The BBC Microcomputer Disk Companion'. The former by Ian Sinclair is published by Granada at £6.95 and covers the three major DFS, ie Acorn, Amcom and Watford. The latter by Tony Latham is published by Prentice/Hall at £7.95. Both are good value and cover most aspects of using the DFS although the Sinclair book is a better book for true beginners. In fact both would be good additions to the bookshelf.

Century Publications are also publishing a disc user book though I have no further information on this at present. (See Bookshelf for a new and very relevant NCC publication — Ed.)

Q: Dave Beecham of Potter's Bar wants to upgrade his Beeb to a DFS and writes ... "I am not sure as to which disc filing system I should choose. There seem to be three major ones, the Acorn, the Amcom and the Watford DFS's. Could you advise me on which one I should get?"

A: The Acorn DFS is referred to as the 'stand' version and the other two you mention both offer the same features. However both the Amcom and Watford DFSs have extra commands. For example with the Acorn DFS there are no *FORMAT or *VERIFY commands which is quite absurd. These programs are supplied on disc, so must be loaded in before you can format and verify a disc before using it! These commands are included in the Amcom and Watford DFSs.

Another major difference is that the Acorn DFS only allows you to have a maximum of 31 files on a disc. If these files are just short programs this can be very wasteful of disc space. The two other discs allow you to use up to 62 files per disc.

There are of course many other differences and you should refer to the advertisements to see what these are.

There is a major disadvantage in that disc utility programs appearing in the computer press are generally written for the Acorn DFS and address its workspace directly. Nine times out of ten these will not run on the Amcom or Watford DFSs.

The Amcom DFS is not really suitable if you are using your Beeb in control applications as it disturbs the TIME function.

The Watford DFS has many more features than both the others. However I find it unreliable, which is not really acceptable in a DFS.

If you are willing to spend the money I personally would recommend the Acorn DFS and the Computer Concepts Disc Doctor ROM which adds all the other commands the Acorn DFS lacks. If your budget won't stretch that far then the Amcom DFS would be okay.

Q: A letter from Jim Smith (no relation!) of Barnet asks ..."Am I right in suggesting that there is a new Super Basic available for the BBC micro called 'Hi-BASIC'. I have BASIC II and I would be interested in learning what new extras this BASIC adds to the Beeb."

A: Hi-BASIC is in fact simply a version of BASIC II that will run in the Second Processor. The distinction is made because Hi-BASIC is located at &B800 in the Second Processor rather than the more standard &8000 in the Beeb.

Q: "I think I remember reading somewhere that the BRK command in assembly language can be used to print an ASCII string to the screen. Is this correct and if so how do I go about implementing this in an assembler program on my Electron?", is the question asked by Karen Strong of Bolton.

A: Yes is the answer Karen. All that is required is to place a BRK mnemonic before and after the ASCII string you wish to print as the following program demonstrates:

```
10 P% = &C00
20 (.demo
30 LDA #7
40 JSR &FFEE
50 BRK
60 EQUS"String Print"
70 BRK
80 )
```

Note that this will cause the machine code program to stop with control returning to BASIC so it should only really be used to issue error messages or a final message from the program.

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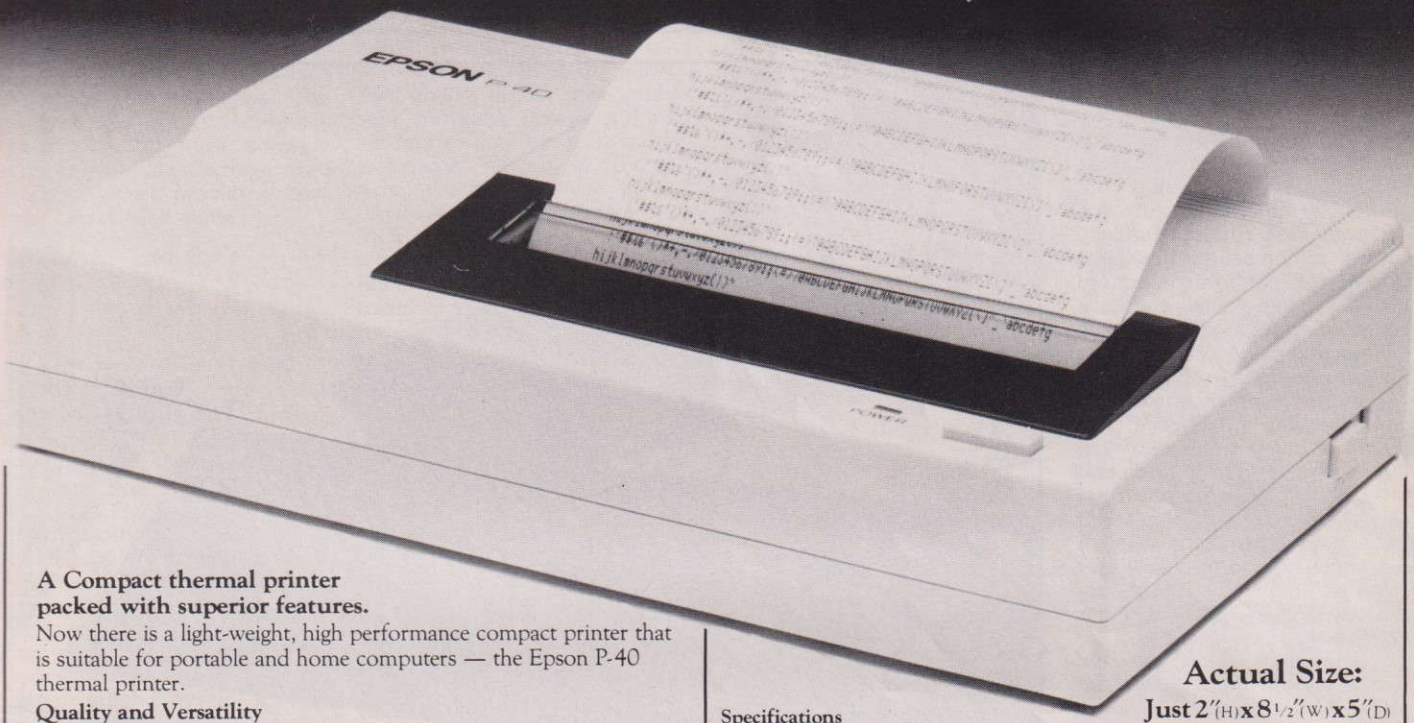

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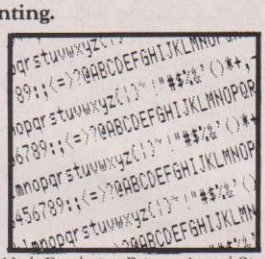

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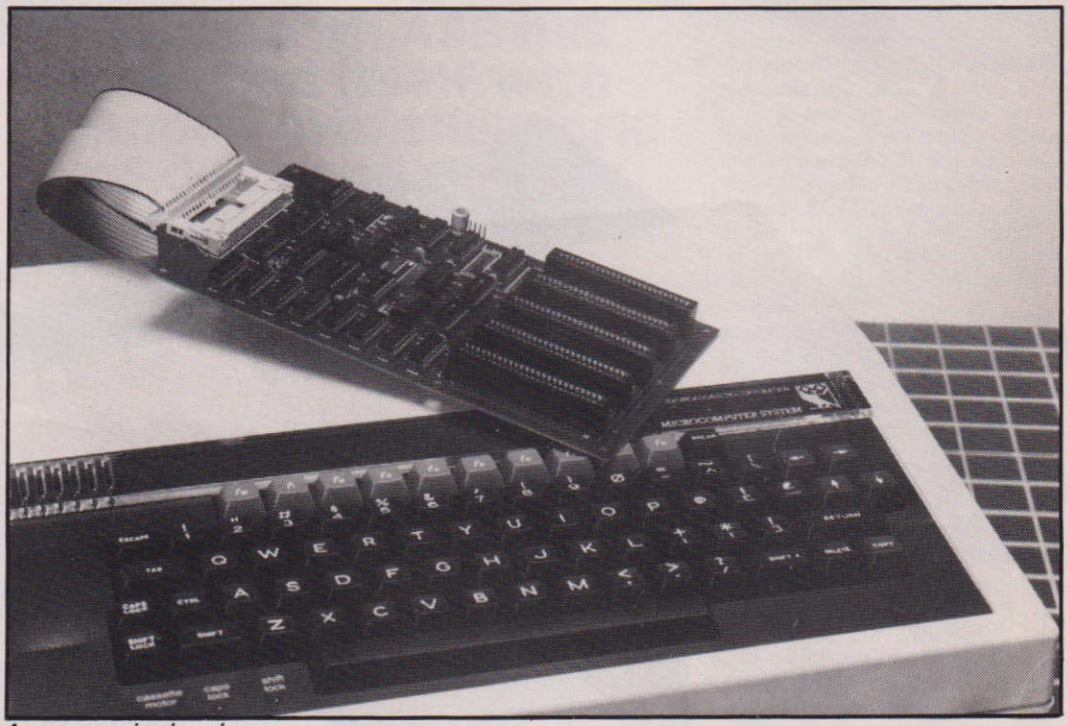


Apex expansion board

For a long time Acornsoft has been worried about the way their programs leak out and are pirated by "friends" before the company has a chance to sell any copies. To combat this they have thrown a security blanket around the new game "Elite" and as a result we've not seen it, but have put together this view of the game from several sources.

It is an interplanetary trading game but with a difference. The screen is divided into two windows, one in a high resolution two colour mode which gives the view out of your spaceship's window and the other in a multicolour mode (probably four colours), providing a colour control panel which displays things like status and fuel.

The display through the screen is stunning. Planets are represented as large 3D shapes which tumble towards you. It is not clear if it is possible to shoot at anything but, as one source described it as Starship Command in 3D and another as a bit like the Space Duel arcade game, we would assume that you do. Elite is rumoured to be 80K long on disk with a shrunken version available for tape-based systems, where it is necessary to choose which star system you wish to visit before playing the game. Acornsoft games have been a little dull lately and "Carousel" was not exactly a bargain at £9.95. "Elite" will be the game to re-establish Acornsoft's reputation.

Another major leak from Cambridge is a maze-type game similar to Atic Attac for the Spectrum in which you move from room to room armed with a "thing". Many arguments took place as to whether the "thing" was a rock or a barrel so we'll settle for a barrel-shaped rock, which you don't need on the first level but is essential on subsequent ones. You explore a series of rooms until you reach one where you have to find a diamond in order to pass a barrier allowing you to the next level. The rooms are protected by assorted aliens who have to be shot. Collision with an alien costs you valuable energy which can be replenished by eating some of the beautiful fruit which decorate the rooms. On the early levels there are apples, later there are water melons and then pineapples for the higher levels, where the aliens get quite bizarre and much more frequent. Each level is denoted by a new mozaic pattern on the floor. The graphic and colour resolution is surprisingly high. The program really squeezes the most out of the Beeb's memory — we've seen it played for a quarter of an hour without all the rooms being explored.

Other unreleased programs worth waiting for are "Malice" from Aardvark software who brought "Frak" into the world and a version of the "Tempest" arcade game which is as yet unnamed and not yet sold to a software house. This Tempest has the best 3D shape movement we've seen on any home micro but is a long way from being finished.

BBC programmers should be quaking in their shoes at the news that Ultimate, the king of Spectrum software, has rewritten Jet-Pac for the Beeb. Ultimate's games for the Spectrum are more than just games, they are feats of programming. Jet-Pac's story line is simple — you have to climb into a spaceship and fly to the next level, but first you have to build the spaceship from the parts which lie around on ledges and then fuel the ship with similarly placed canisters. There are also odd bits of treasure to be picked up. To retrieve all the objects it is necessary to fly amongst the ledges using your Jet Pack. The denizens of the planet do not relish the idea of your leaving so they hurl themselves at you, causing you to lose a life if you are hit. You are armed with a "Planetoids" type laser and you can either shoot or dodge the aliens. Once the ship is built and

ws News

fuelled you can climb in and fly to a more difficult planet on which to repeat the experience. The programmers at Ultimate have some amazingly fast software sprite routines akin to those used in Zalaga which provide a non-stop, action filled game.

Now where's that joystick...

MAGIC MUSHROOM

Following the recent launch of their User Port Printer Interface, Broadway Electronics have produced another add-on for the Electron.

Their Sideways ROM Card transforms the Electron into a business machine, allowing the user to tackle commercial-type applications such as word processing, graphic design, spreadsheet preparation and accounts.

The card, costing £29.95, is compatible with most ROMs and has a four-ROM capacity. It plugs into the Electron's extension port without modification and means software can be called up instantly, instead of having to be loaded from a cassette.

For futher information see our ROM In A Box feature.

LAWRIE LOGIC

A new, low cost approach to logic analysis using standard equipment has been announced by Lawrie T&M Ltd. Their Logic Analysis Package is aimed at users of microprocessors in education and industry with a limited budget who need flexible and easy to use equipment.

The system is designed around the Zicon 701, 40 channel data and signature analyser. Software and hardware are provided to link the Zicon 701 to the BBC Micro which translates captured data into relative timing diagrams.

Features of the system include disassembly, data storage and retrieval using disc or tape, single or dual moniters, listing and signature dump to printer. The timing display has expansion, moveable cursors and auto readout of time between cursors and trigger. Any 16 of 40 channels may be displayed in any order. Maximum clock rate is 10 MHz.

Further development is underway to provide software based auto comparison routines for ATE and service applications.

BEEB AT BRANDS

If you watched the British Grand Prix back in July and were impressed with the commentry from an unusually smooth-talking Murray Walker, you'll be interested to know he owed his calm exterior and up-to-the-minute knowledge to the BBC Micro.

For the first time ever at a Formula One motor racing event a networked microcomputer system was installed at Brands Hatch, designed to speed up the distribution of information on race, driver, team, practice and organisational matters. A Beeb was positioned in the pit area as a sender unit and information was networked via Econet to a large number of moniters, for the benefit of the press, officials and VIPs.

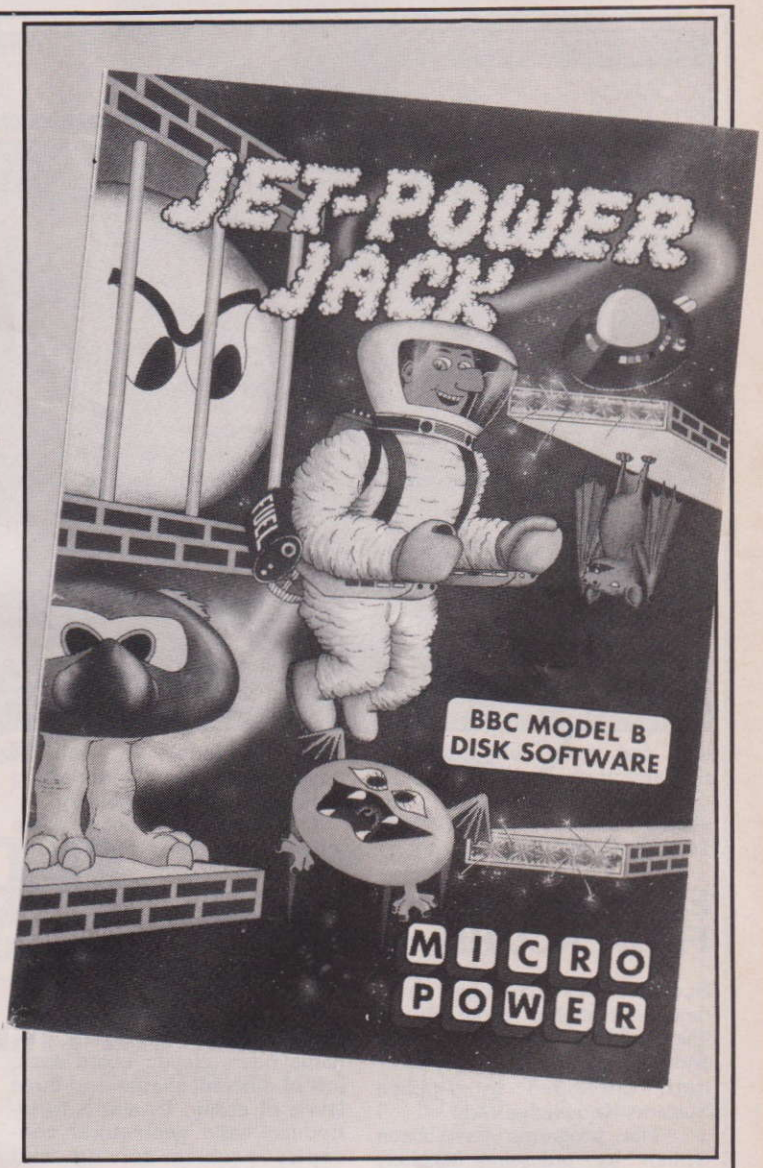
Teletext and Prestel pages contained in the system allowed world news and progress of other sporting events to be displayed around the network at the operator's discretion. Acorn also provided BBC Micro word processing systems allowing journalists to send out perfect copy to be read all over the world the following day.

IN THE OUTBACK

An Input/Output Backplane is now available for the BBC from Xcaliber Computers. This unit allows extra Input and Output cards to be used, so increasing the Beeb's usefulness and range of application. The Backplane also adds a further 64K RAM.

The unit also allows expansion using standard Apple cards which can be plugged in and run from BBC Basic or Machine Code. In use, the input/output addresses of the Apple are mapped into defined addresses on the BBC, which can then drive the card through Basic or Assembler commands.

Typical cards available include analogue/digital converters, multi-channel counters, multi-port communications, graphics processors, calender/clocks, plotters, digitizers, bar code wands/readers etc.



DISK POWER

If you're one of the 20% of BBC Micro users who owns a disk drive you can now add Micro Power Ltd to your list of companies providing software.

They've put all their top selling titles onto disk and also launched three new games: Dune Rider, Felix In The Factory and Ghouls. The disks will run on both 40 and 80 track drives as well as single and double density formats. They are priced at £9.95

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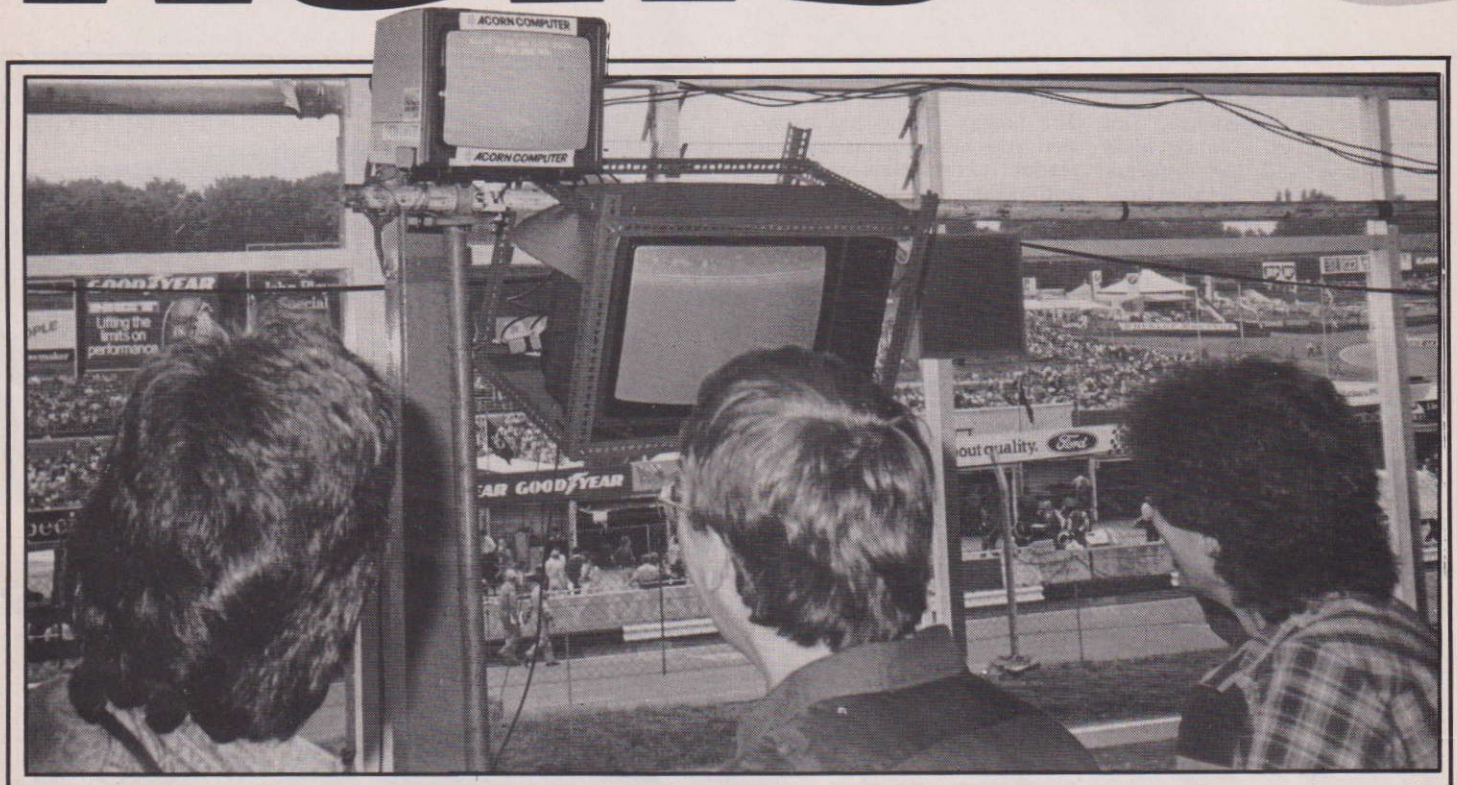

and for those who wish to upgrade their cassettes, a mail order service is provided to exchange tapes for disks at a cost of £4.95.

EDUCATION FROM ACORN

Acornsoft have launched three new educational programs to help children in maths, literacy and logic for the BBC and Electron, developed by Applied Systems Knowledge Ltd.

The programs have been written by practising teachers working with professional programmers and are designed to make learning fun whether at home or in school. They make full use of the computer's extensive sound and graphics capabilities and capitalise on the enormous motivating power of the computer for young children.

Podd is designed to help young children improve their vocabulary and develop language skills. Podd is a character who will carry out the user's commands — for example he can "jump", "run", "fly" and even "explode" as well as anything else from the remaining 116 words in his vocabulary.

Squeeze is a board game where children must plan strategic moves in order to beat their opponent. Each player is given a randomly generated shape made up of five squares and must try to get as many of these shapes onto the board without overlapping, to try and squeeze out the opponent. The game offers eleven board sizes, lots of different shapes and three levels of ability. Its aim is to introduce basic geometrical concepts, problem-solving and spatial relationships.

Juggle Puzzle is based on the concept of the puzzle cube and is designed to help children practice their skills of memory and logic. Pictures are broken up into nine or 16 piece puzzles and the aim is to twist a set of any four pieces to get back the original pictures. The game requires concentration and teaches logical skill.

The new titles cost £9.95 on cassette (£11.50 on disk) and are available from Acornsoft dealers. They will be reviewed in full in a future issue of *A&B*.

ADD-ONS FROM WATFORD

Watford Electronics claim to have produced the "ultimate expansion system" in the form of APEX — a system of cards allowing 146 ROMs or 148 RAMs to be paged by the BBC.

Apex consists of two main sections: the internal mother board which expands the Beeb's capacity to 15 ROMs; and up to eight external cards, capable of holding 16 ROM, connected to the complete system bus via a ribbon cable.

The system is fully powered by the BBC since each card only draws 100mA. This is possible due to a power switching circuit which ensures that only one device is powered at any one time.

Apex comes with controlling software in ROM which offers filing system facilities such as catalogues of the devices present, loading and saving to memory and a RAM-DISC facility which treats all available RAM in the system as a disc drive.

Cards which may be plugged into the Apex system include EPROM programmers, second processors, Winchester disc drives, real time clocks etc.

Also new from Watford is BEEBMON — designed to help write machine code programs and show how other programs work.

Beebmon is not only a machine code monitor but also a 6502 emulation system in ROM. Once installed, any program run does not go through the 6502 microprocessor but is processed by Beebmon itself and therefore the user can watch what is happening within the program or check that the machine code is performing as designed.

Beebmon offers three types of facilities — (a) memory display and editing, allowing the user to disassemble memory from any address; (b) block memory contents or search for various sequences and (c) emulation, i.e. the ability to simulate the processing of the CPU but at a rate where the user can observe and control.

Finally, new from Watford, is a screen dump ROM designed for use with dot matrix printers. DUMPOUT 3 costs £19.00 and will produce dumps in any of the graphics modes available on the BBC.

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MONITORS – Green / Amber **£76**
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MTC – High Res. **£108**

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MWS 400K DRIVE **£267**
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(BBC MODEL B + DFS) **£484**

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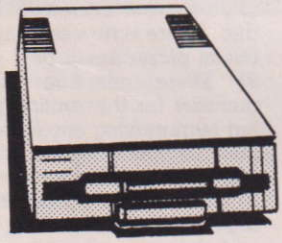

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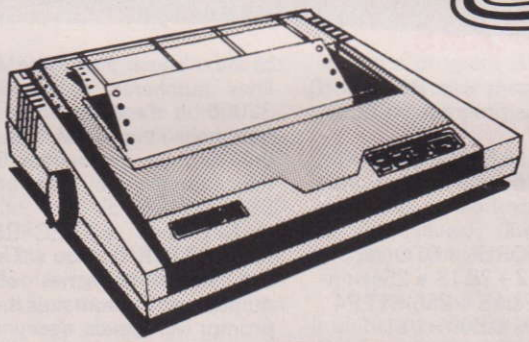

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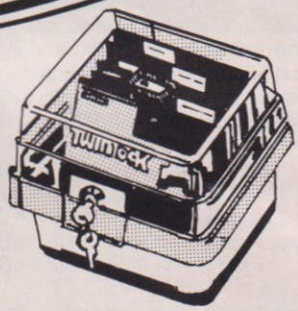

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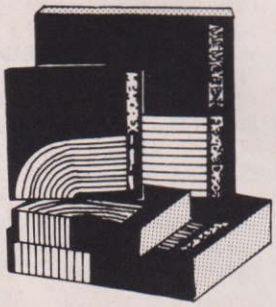

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Random Access

Dave Carlos

Disc drive dilemma? Don't despair, we'll do our best to help.

The number of disc drive users is growing at a fantastic rate and therefore we have decided to start a Disc Users Problem Page. If you have a problem using the drives or disc interface, struggle no more, drop us a line at A&B and we will try to answer your question and help others with similar problems too. As an introduction to this whole area here is a piece on the problems of relocating programs to RUN, on disc systems, which were produced to use all the memory available with cassette filing.

RELOCATION OF CASSETTE BASED PROGRAMS

You will have noticed by now that the disc interface which you need to use with the disc drive incurs a memory cost, that is, you have less memory to play with when using discs than you had before!

If you wish to prove this simply type PRINT PAGE followed by RETURN and you should get the result 1900. If you check the User Guide it says that page is &E00 when using the cassette filing system. This means that you now have three and a half Kilobytes less memory available for your programs!

This can cause problems (an understatement!!). Programs which worked perfectly before the disc system was fitted may start giving "Bad mode" errors due to their lack of memory. The ways to get around this problem are many and various.

One obvious answer is to go through the programs changing the MODE statements to those modes which take up less memory e.g. changing MODE 2 to MODE 5 but if you do you will lose the extra colours the original modes gave. Another possible answer would be to delete all spaces and REMs in the program in order to make it shorter. BUT the best way is to relocate the program after loading to recover your lost memory!!

There are many ways to do this too, but we can only cover a few in this first column.

BASIC PROGRAMS

If the program is in BASIC only then try this program 'RELOC'.

```
0IF ?&18<>&E GOTO32000
1CLEAR:?&E04=244

32000   *T.
32010   FORI%=0TO(?&
        12+?&13*256)-
        (?&18*256)STEP4
32020   I%!&E00=I%!
        PAGE:NEXT
32030   ?&13=?&
        13-(?&18-&E)
32040   ?&18=&E:RUN
```

Before you do anything else type in this program and save it using the following commands (each followed by RETURN):

```
*DISC
*SPOOL RELOC
LIST
*SPOOL
```

You will then have an EXECable file for use in the future.

The way you use this program is as follows:

a) LOAD the original program in the normal way by typing *TAPE then LOAD" " (each followed by RETURN of course).

b) Next check that there are no lines numbered 0,1 or above 32000. If there are then try to renumber them, as otherwise they will be overwritten by the relocation routine.

c) Next type *EXEC RELOC (then RETURN). You will see on the screen a series of line numbers and commands then the prompt will appear again.

d) If you now list the program it will have the extra lines needed to relocate it each time it is RUN. DONT RUN it at this stage! SAVE it first.

e) After doing this the program will RUN and CHAIN as normal BUT is likely to "hesitate" for a few seconds before working due to the relocation routine.

The only problems you might have are:

1) The first instruction performs a *TAPE i.e. changes the filing system so that the vital disc pointers are not corrupted. This means that if the program you have just relocated CHAINs another program itself, it will try to do so from Cassette NOT from disc. There is no easy way round this at present!

2) There may be too little memory for the routine to work but by removing any REMarks in the original program this can often be made to work.

3) Pressing BREAK will reinitialise the disc filing system and thus corrupt your program. The obvious method of typing *TAPE followed by PAGE=&E00 will not work either! You will just have to reload but as you are using discs it won't take all night, will it?

Another technique some use, which doesn't use any memory either, is to program a red key to do the job something like this:

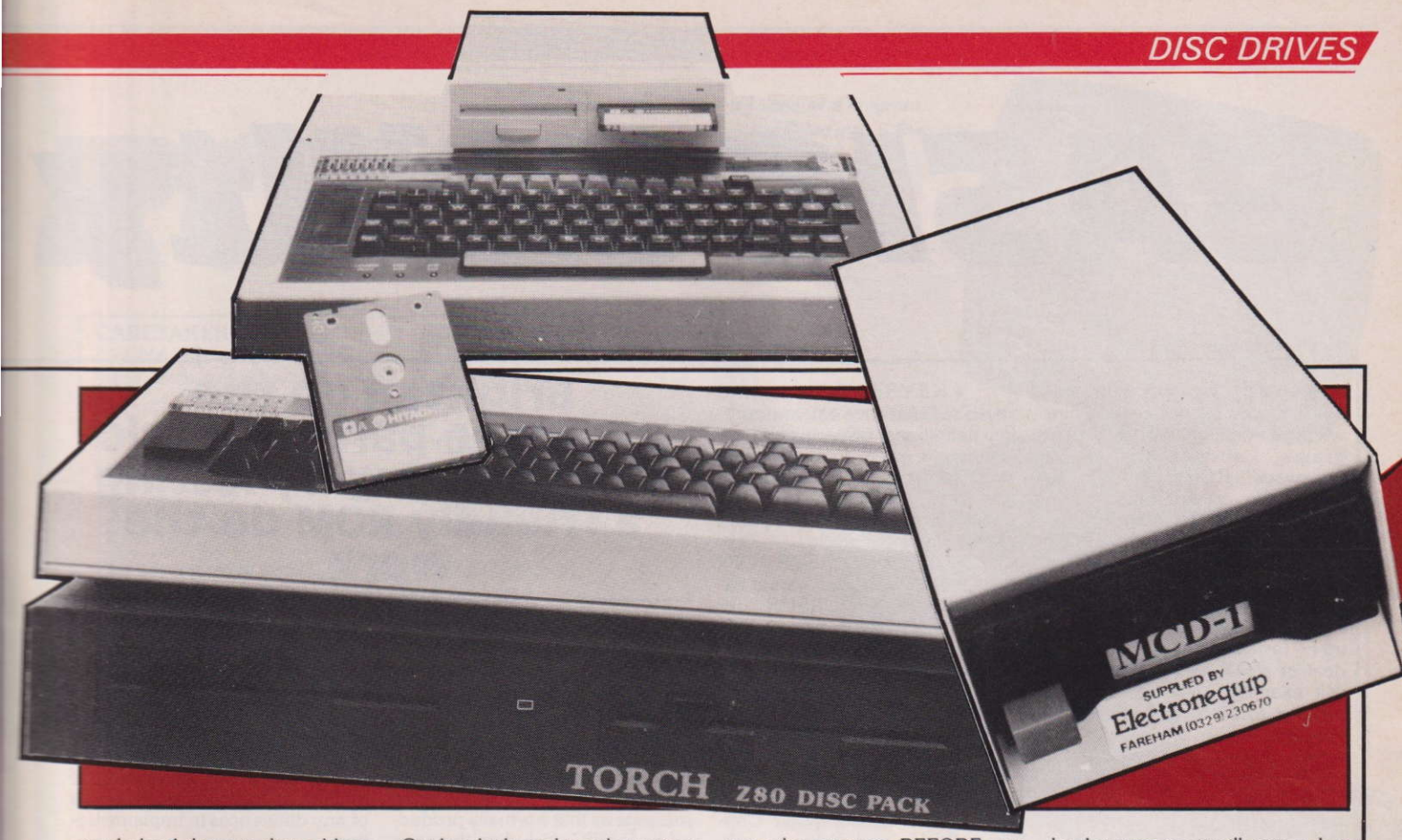
```
*KEY5 *TAPE|M FOR
LOC%=PAGE TO TOP:
?(LOC%-&B00)=?LOC%:
NEXT: PAGE=&E00 |M
OLD |M
```

This works in a very similar way and has all the same drawbacks as well as its, memory saving, advantage.

MACHINE CODE PROGRAMS

Many machine code programs developed for the cassette based system are assembled to run at &E00 and due to their use of "absolute addressing" cannot be made to work at another location.

Unfortunately you cannot



simply load them to that address (&E00) as it throws the disc workspace into havoc AND corrupts your program too! Therefore a relocation program is also required and once again there are many versions but in all cases you need to do the following first:

To get the machine code program onto disc in the first place follow this plan

a) Type the following (all followed by RETURN).

*TAPE

*OPT1,2

*LOAD "progname" 1900 (you could simply type *LOAD"" if you prefer)

This forces the program to load at &1900 which is the disc system page address, ready for you to relocate it later.

b) Write down exactly what appears on the screen which will look something like this:

FREDPROG 1A 1A9F 000E00 0010A9

An explanation of these is as follows:

FREDPROG is the name of the program!

1A is the number of whole blocks to load

1A9F is the exact length of the program

E00 is the usual load address (the leading zeros don't matter).

10A9 is the CALL address when the program is *RUN

This is vital information that you will need later. If you are not familiar with the use of *OPT 1,2 read PAGE 392 of the User Guide which explains the various numbers.

c) Save the program onto a disc to user later by following these steps:

i) type *DISC

ii) type *SAVE "FRED1" 1900 +1A9F

This second number is the length of the program taken from the information you got on loading (see above).

You are then in a position to relocate it in the future when you load it back into memory.

That's the easy bit done! Now for the hard part.

A relocater which works with some programs is this one: (You can type this direct from the keyboard if you wish, although I would advise against it. If you do so, though, you should miss out the line numbers.)

```
10 *LOAD "FRED" 1900
20 *TAPE
30 FOR LOC% = 0 TO &1A9F
STEP 4 (you should put the
length of your program here)
40
LOC%!&E00 = LOC%!&1900
50 NEXT
60 CALL &10A9 (put the CALL
address here)
```

This relocates the program in just the same way as the BASIC relocater above. You could save this as a "loader" program, using the line numbers, if you find it works and instead of *LOADing FRED, CHAIN"FREDLD" if that is what you called it! Do remember to save the program BEFORE you RUN it though.

PROBLEMS

Now if all has gone well your program should work straight away! If, alternatively, you have had problems what could have gone wrong?

First look at the list of numbers you wrote down earlier. Did you put the right one in each of the places? Then check that the third of the numbers is E00 as this routine will only work if this number is indeed E00. If it still doesn't work then you are going to have to try a few modifications.

If you noticed on *LOADing the program that the load address was not E00 then changing the address on line 40 may do the trick. It may be that the program you wish to relocate already has its own loader program: What then? If the original loader program is in BASIC then the first thing to do is load it and have a look at it.

You should see somewhere in the program a statement like this

*LOAD"PART2" or

*RUN"PART2" (obviously the name of the program is unlikely to be PART2 but we shall use this as an example)

These should be replaced by deleting the original program line and inserting one to CHAIN the relocater program.

If you decide to use this as a loader program it will not work at the normal PAGE setting of &1900 as it will be overwritten by the first program loaded. Therefore before you load this program you must set PAGE to a high value so there is room for the machine code. I suggest you use PAGE = &6500 or even PAGE = &7000 if it is very short. Unfortunately you will need to type this in every time you use the program BEFORE CHAINing it! or put the instructions into an EXECable file (but more on this in another issue).

Some original loader programs do reset PAGE before they load a second part. You need to change this value to one high enough to fit above the original program when it is loaded at &1900, plus a little for safety, (say &6500 or even &7000) then you won't need to reset it each time before loading!

Needless to say, none of these methods is foolproof and the software companies spend rather a lot of effort trying to stop you copying their programs so don't be too suprised if they don't work. But do try a few times before giving up, when you have got the first one to work the second is far easier. It took me two weeks to get the first one done.

You could however try asking the company concerned if you can return your cassette copy in part exchange for a disc copy. They have been known to do this in the past if the cassette copy was in good condition.

BASIC Utility

Trevor Attewell

Brighten up the mundane parts of Basic programming by letting a friendly ROM do the work.

A little help with the nuts and bolts is always welcome when writing or debugging BASIC programs, and both these "sideways" ROMs do help to make the programmer's life easier. As to pedigree, CARETAKER is from Computer Concepts, and TOOLKIT is a BEEBUG product. While they inevitably share common features, each also has facilities not provided by the other. To avoid a good deal of repetition, therefore, we will examine first those utilities peculiar to each, and then compare the ways in which the common ones are implemented.

CARETAKER

Probably the most significant of the unduplicated commands is one which allows single-key entries of all the most used BASIC keywords while the TAB key is pressed. This function is turned on by *SINGLEKEY and off by *NORMALKEY, the default from a cold start being "on". The keys used for each keyword correspond with those provided for the same purpose on the ELECTRON. Most are easy to memorise (eg L for LIST), and self-adhesive labels are also supplied to stick on the fronts of the keys. The normal TAB function is achieved by SHIFT-TAB when the single-key facility is enabled.

*TABSTOPS allows up to eight tabulation positions to be defined as on a typewriter. They can be cancelled by *NOTAB, and defaults are set at 9-column intervals if no argument follows the command. Two resident integers are used to store defined tab stops, but not for the defaults.

Another very useful feature is the expansion of "squashed" programs to restore their readability, using *EXPAND. This avoids the need to keep separate copies of the original program on file, thus saving disc space. The command restores spaces before keywords, and separates multi-statement lines into multi-line statements. The program in memory is not affected, the expanded result appearing on screen (and on a printer if enabled) when the command is issued.

*KEYSAVE and *KEYLOAD save and load soft-key definitions, respectively. If no filename is given, then the name used will be "keez" — chosen only (one hopes!) for the unlikelihood that it has been used already for another file.

Finally, *CURSOR OFF does exactly what you would expect, while *CURSOR (or *CURSOR ON) holds no surprises, either. These commands save you from having to look up unmemorable VDU numbers, so reducing programming time. On much the same general theme, CARETAKER gives syntax prompts in appropriate circumstances — this feature is common to all Computer Concepts ROMs and helps to normalise your blood pressure when you have forgotten where you put that ! *!!?? manual!

TOOLKIT

The most important solo feature here is the excellent screen editor, called by *EDIT. On entry either the first line or a specified line of the current program is displayed, with the cursor below the first character. Corrections can by made by insertion or overwriting, and new lines can also be added. The cursor keys are used to move laterally along the line and forward or backward through the program, and provision is made for jumping to either end of a line, or to the first or last lines.

*NEW and *OLD allow the corresponding BASIC commands to be used within programs, giving useful added flexibility, for instance when self-relocation is necessary. Three commands are concerned with error handling — *ON turns on TOOLKIT error-reporting, which automatically enters the screen editor after displaying the normal BASIC error message. The line being executed is then listed, with the cursor position at or near the error. This generally makes error connection very easy, though it cannot be infallible — BASIC may sometimes read past the error before the TOOLKIT routine is called and as always, an error is reported by BASIC at the line in which it first comes to light, which is not necessarily the line that is incorrect. *ONF does the same job as *ON, but sets two function keys to call EDIT and *UTIL as well. *OFF cancels both *ON and *ONF. Associated with error handling, REPORT gives the same error message as that normally produced by BASIC, including the error number, but works even if the error was in ROM.

Among miscellaneous commands *CHECK compares a program in memory with a specified file, stopping and reporting at the first byte which is not common to both. *CLEAR does the same job as the BASIC command, but also clears the resident integers. *MEMORY is a perfectly standard memory dump in hex and ASCII. Finally, *SCREEN fsp saves the current screen to a user-specified file.

TOOLKIT makes use of colour, which is turned on by *ON, and can be turned off by *OFF if you have a monochrome monitor and do not mind losing the "on error edit" facility, or if you are using a printer (which may be upset by colour codes).

A comparison between the similar features of CARETAKER and TOOLKIT is most easily carried out in tabular form. Equivalent command names are given, with a brief description of their function, followed by details of any differences in implementation.

These two products provide handy and very friendly functions to aid the BASIC programmer in some of the more mundane tasks. Both do their jobs well, both can be recommended and both religiously obey the appropriate sub-section of Murphy's Law which states that no utility will ever be produced with all those features that you consider so obviously essential, and without those that you will not use in a month of Sundays. Since their features overlap, the question of which one to buy can only be answered after considering which extra goodies you want most badly, and which you can best manage without. If it's a dead heat you could always buy both, especially if you have a birthday due soon!

Need to see the values assigned to variables? Either ROM can tell you — this is CARETAKER.

```
*HELP CARETAKER

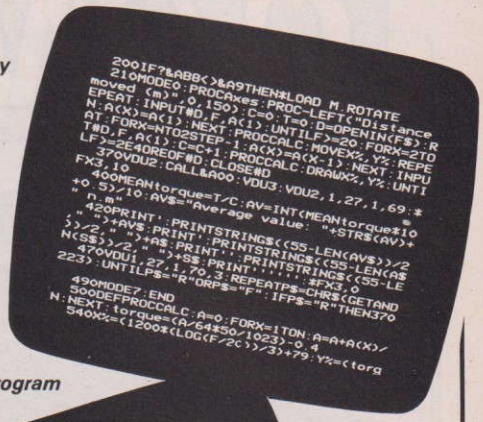
CARETAKER 1.03
  CURSOR (ON/OFF)
  EXCHANGE <old> <new> G/S (<length>)
  EXPAND (<start>) (<end>)
  INSERT <fsp> (<lineno>)
  KEYLOAD (<fsp>)
  KEYSAVE (<fsp>)
  LVAR (F)(I)(S)(A)(P)
  MERGE <fsp> (<fsp>)...
  MOVE <address>
  NORMALKEY
  NOTAB
  PARTSAVE <fsp> (<start>) (<end>)
  RENUMBER (<1st> <inc> <start> <end>)
  RETRIEVE (<bytes>)
  SINGLEKEY
  SQUASH (S)(R)(M)
  STATUS
  TABSTOPS (<columns...>)

OS 1.20
>_
```

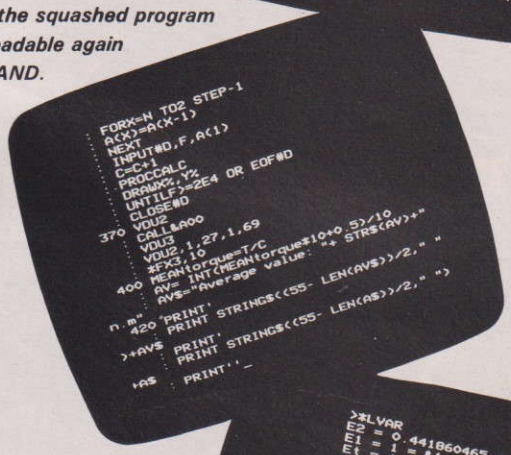
ROMs

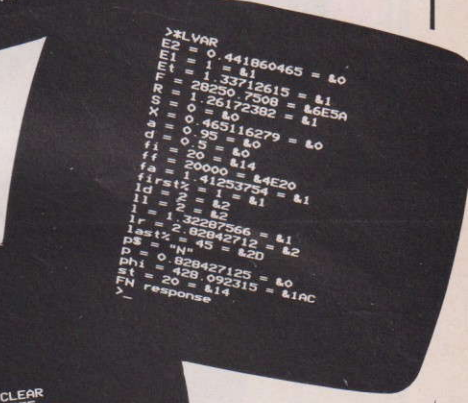
CARETAKER	TOOLKIT
EXCHANGE (Search & Replace) Searches whole program only.	*UTIL1 (S) & UTIL 2 (S&R)* Can select part with UTIL 9.
Accepts wildcards.	Accepts wildcards.
Target keywords must be tokenised. (List provided).	Auto-tokenising by prefix, but left brackets must be inserted.
Can specify string length (eg 'big' alone but not in 'bigger').	Not possible.
Can replace a string of specified length OR only the target portion if the string starts with, OR ends with OR contains the target.	Possible only is so far as wildcards can be used.
Global or selective replacement with no-replace option (can be used as search only).	Global replacement only.
Lists original line during selective S&R only.	Has separate search.
LVAR (Lists variables) Selectively lists floating-point and integer variables (not resident integers), strings, arrays, Procedures and Functions.	Lists original (S) and amended lines (S&R) with highlighting.
	UTIL 4 to UTIL 8 As CARETAKER, plus all resident integers whether used or not.
MERGE (Merges two BASIC files) Neither ROM prevents overwriting by duplicate lines — TOOLKIT issues a subsequent warning.	*MERGE*
MOVE (Relocate program in memory) Both move the current BASIC program up or down in memory to a specified address.	*MOVE*
RENUMBER (Renumber BASIC program) Both can renumber any part of the current program, using specified starting number and increment for the renumbered part.	*RENUMBER*
RETRIEVE Both similarly clean up corrupted programs.	*RECOVER*
SQUASH (shortens BASIC programs) Removes unnecessary spaces and/or REMs and/or creates multi-statement lines. Does not remove machine code comments.	*PACK* Removes spaces and/or REMs and m/c comments, but will not create multi-statement lines.
STATUS (For general information) Both list values of PAGE, LOMEM, HIMEM and TOP, the top of variable storage, the current program length and the number of free bytes in memory.	*FREE*
**C....* Both can accept prefixes to avoid common clashes with each other or with other ROMs.	**B....*

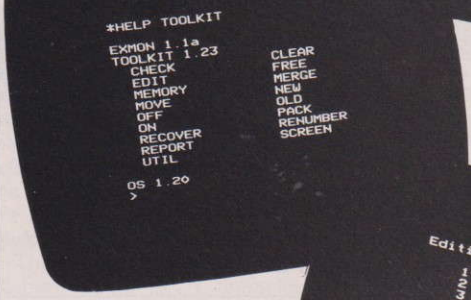
36 lines of a program SQUASHed into 9 lines by CARETAKER.



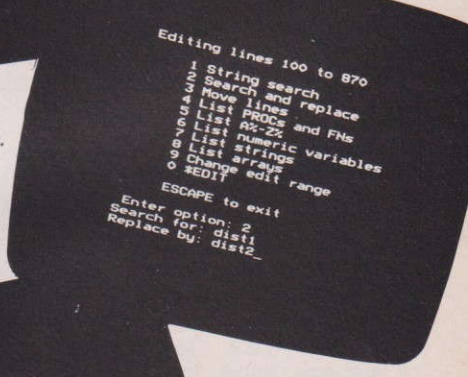
Part of the squashed program made readable again by EXPAND.

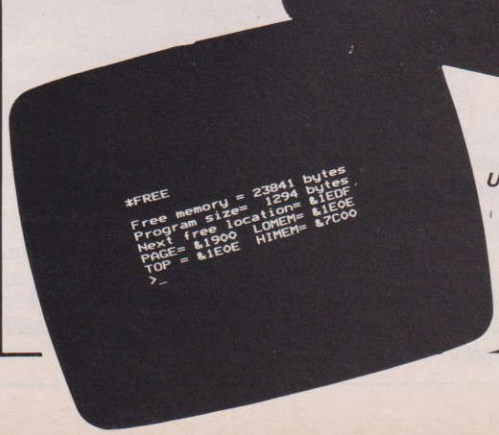






TOOLKIT's UTILITY menu. Each option is also available independently.





Useful information — this is the TOOLKIT version.

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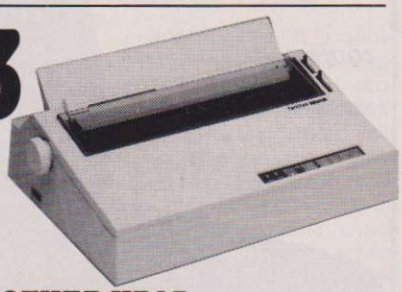

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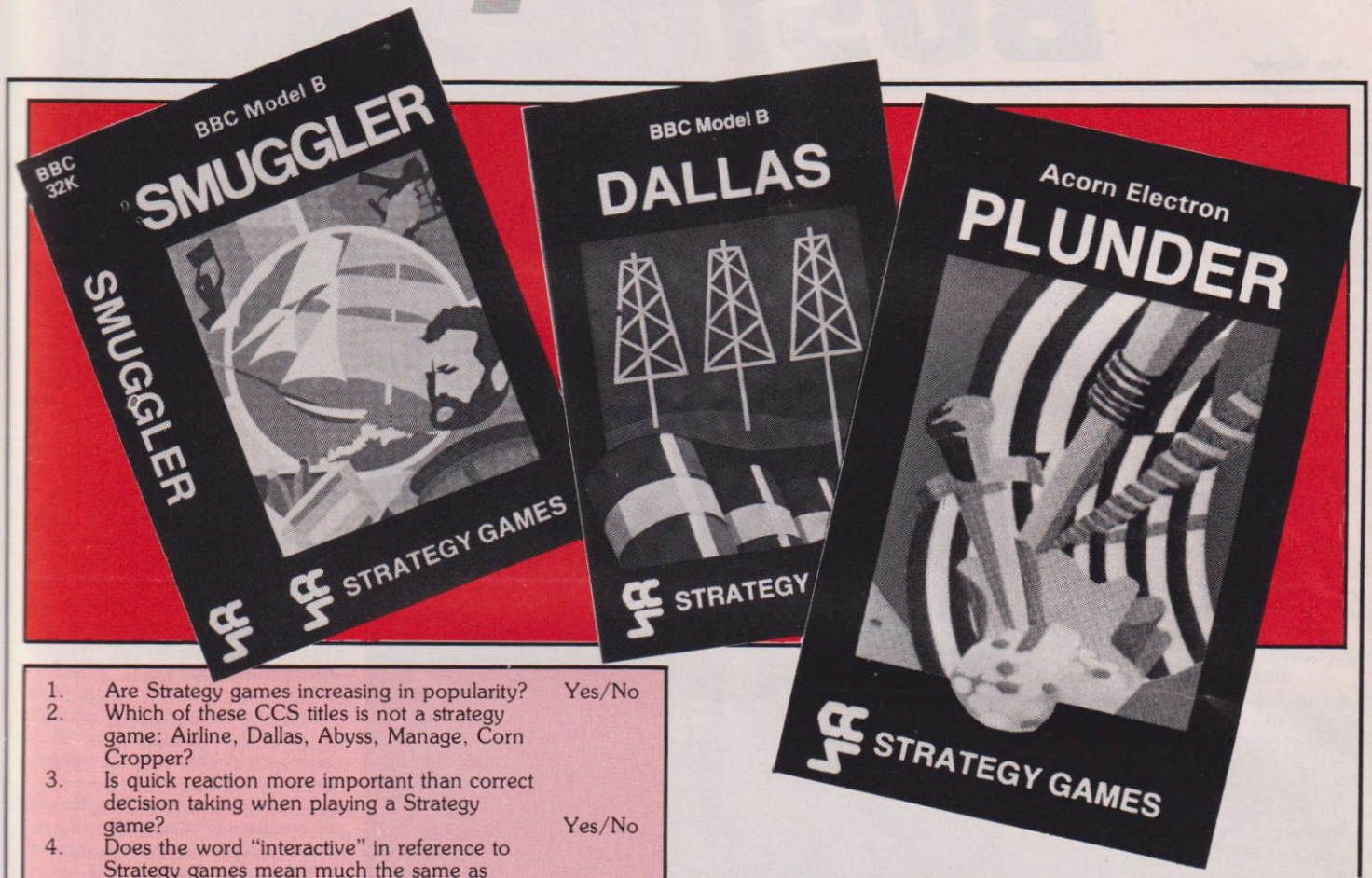
Competition



1.	Are Strategy games increasing in popularity?	Yes/No
2.	Which of these CCS titles is not a strategy game: Airline, Dallas, Abyss, Manage, Corn Cropper?	
3.	Is quick reaction more important than correct decision taking when playing a Strategy game?	Yes/No
4.	Does the word "interactive" in reference to Strategy games mean much the same as "metathetical" in another context?	Yes/No
5.	If a program is truly interactive, does this mean that chance is eliminated?	Yes/No
6.	"The game is different every time you play"... Is this due to (a) an element of chance or (b) its interactive character?	
7.	Is the word "addictive" derived from the Latin verb "adicere", meaning to adjudge and hence adjudged and therefore enslaved?	Yes/No
8.	Are allophone based speech synthesizers restricted in the number of words which can be made up?	Yes/No
9.	Would you expect current and near future hardware developments to:-	
	(a) Result in more sophisticated Strategy games?	Yes/No
	(b) Enable you to Multi-task?	Yes/No
	(c) Support a wider range of peripherals?	Yes/No
	(d) Simplify certain aspects of programming?	Yes/No
10.	Which of the following are usually associated with Strategy games:-	
	(a) Gold	Yes/No
	(b) Maps	Yes/No
	(c) Blondes	Yes/No
	(d) Weapons	Yes/No
	(e) Money	Yes/No
	(f) Dragons, Meanies, Vampires	Yes/No
	(g) Star Wars	Yes/No
	(h) Evaluation	Yes/No

Cases Computer Simulations have left a big pile of Strategy games for the BBC and Electron cluttering up our palatial office at the moment and sadly we're left with no alternative but to give them away.

There's a choice of four titles available. You'll need financial wizardry to turn £3 million to £30 million and take over British Airways in **Airline; Dallas** calls for an eye for the main chance in the cut throat oil business against the likes of the Ewings; CCS's newest game, **Plunder**, engages you in fierce battle against Spanish ships on the high seas and you'll be transported into the illegal world of customs dodging and pirates in **Smuggler**.

These games will all challenge your mind and winning is going to involve a little thought and possibly a bit of research. CCS have come up with a range of questions that reflect the nature of the strategy games range so consider them carefully.

Twenty prizes of three games are on offer to entrants with all the correct answers. Please write down clearly each question number with your answer on a piece of paper and don't forget to state whether you have a BBC Micro or an Electron. All entries must be sent to our Golden Square address and postmarked before 7 November 1984 with envelopes marked "Strategy Game Competition". The winners will be notified once the competition has closed and the results will be published in a future issue of *A&B Computing*.

The competition is open to all UK and Northern Ireland readers of *A&B* except employees of Argus Specialist publications Ltd., their printers and distributors, employees of CCS or anyone connected with the competition. No correspondence will be entered into with reference to the results and it is a condition of entry that the editor's decision is accepted as final.

Down to Business

Jon Vogler

The Z80 means business for BBC owners. But which Z80? and how does the available software perform?

WHY BUY A Z80 SECOND PROCESSOR?

A second processor increases both the memory and the computing power of your BBC Micro. The additional memory provides, within an operating system known as "CP/M" (No panic; it stands for "Control Program Monitor for Microcomputers"), temporary storage for different chunks of information taken from the discs, which could not all be "resident" in the memory at once. These may be

— parts of the main program, (which can thus not only be longer than can be stored on a ROM chip, but far longer even than the computer's own memory)

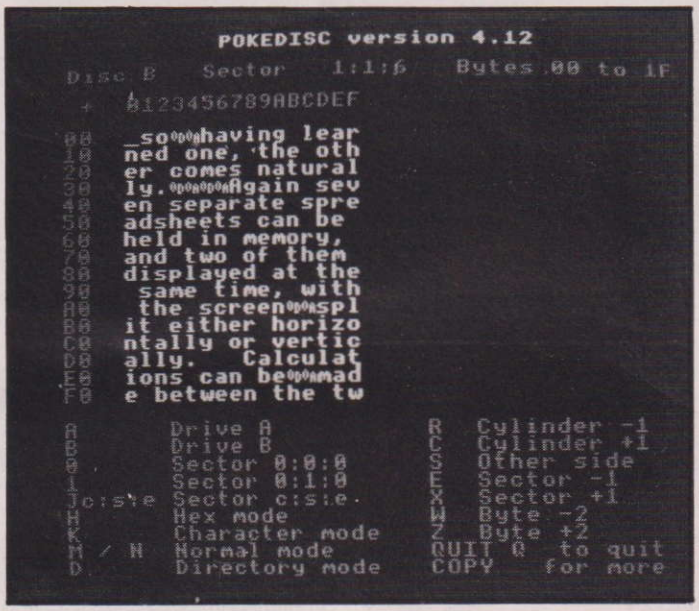
— sub-programs for extra functions (such as a spelling checker dictionary with a word-processor program)

— data not being used but wanted at short notice, (such as financial figures for previous years, to be referenced when compiling this year's financial plan)

— text of a very long document, (perhaps fifty or sixty thousand words: equivalent to 200 pages of typed A4).

This magic is done by letting the BBC "base processor" handle "housekeeping" operations, such as controlling the video screen or the disc drives, while leaving the Z80 processor free to hold the program and the data in memory.

So the program can be much better than those available for a 32K byte BBC, and can operate on much larger amounts of data. They are termed "professional" software and many are the same programs as are used for far more expensive business computers. Once the Z80 has been installed, any CP/M program that requires only 64K bytes of memory will run: but will need to be "configured" for it. Many programs are designed so the unskilled user can do this, but it may prove difficult. TORCH publish a catalogue of over a hundred professional programs that have been suitably configured: including such famous names as Wordstar, dBase-II, Personal Pearl and many others. ACORN, being that much newer in the marketplace, have not got so far but have announced that they have appointed a software house to configure a range of reputable programs, so no doubt these will become available soon.



1. TORCH has a lifesaving facility to recover overwritten disc files.

The big surprise is the cost. To buy the best available business software for the "straight" BBC-B, you would buy three ROM-based programs, say SCRIBE word-processor, ULTRA-CALC spreadsheet and STARBASE database. With a ROM-board to fit them in, the cost would come to around £230. This combination would still not do many of the tasks required in running even a small business! Yet for only £70 more you can buy one of two Z80 packages; one of which gives you a great deal of other software as well. What more need be said! Let us look at the packages in question.

Many of the remarks made in this review will actually refer to the software provided, not to the Z80 second processor itself. It has not proved possible to run ACORN CP/M material on TORCH, or vice versa, but in theory either could be configured for the other.

TORCH ZEP 100

The second processor is a small printed circuit board that clips to the inside of the lid of the BBC-B and connects to the "Tube", the right-hand connector under the keyboard. A ROM must also be fitted. The operation is simple and can be done by anyone with confidence and delicate fingers. The ROM holds CPN: TORCH's operating system which is a "look alike, sound alike" version of CP/M. (References to CP/M in this article refer also to CP/N). This leaves more memory (TORCH claim an extra 10K bytes) in the second processor available for use, compared with ACORN. In addition to a TORCH operating manual and programmers guide, there is a system disc which offers

— frivolities, such as a program that plays "Chariots of Fire" most sweetly

— valuable resources such as the ability to transfer, effortlessly, all one's BBC files (including, in my case, millions of words of WORDWISE text)

— neat procedures for user-defined start-up sequences (mine switches on printer, changes screen colour, speeds up cursor and loads program and file, all from a single key-stroke!)

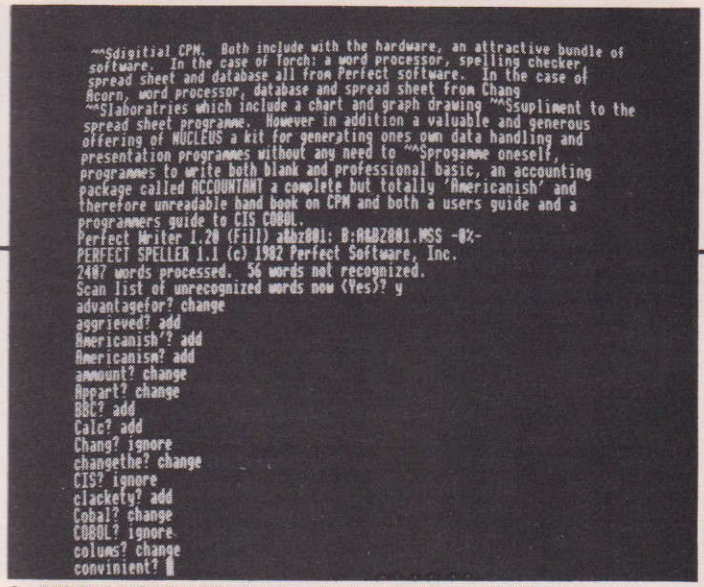
— lifesaving procedures for recovering damaged disc-files (which rescued this article from being rewritten, after I overwrote it and the back-up disc in a bleary-eyed late night editing session!).

There is an attractive bundle of integrated software: word processor, spelling checker, spread sheet and database all from PERFECT. The handbooks for these are superb: clear, well written, detailed and with a comprehensive index. Free-standing cards, concise and clear, summarise the hundreds of commands.

Once a BBC-B has been upgraded to a professional machine with a TORCH Z80, it can be incorporated in a TORCHNET networking system (several computers linked, sharing disc drives, printers, etc), can use a "hard" disc drive with storage for 20 million characters and can even be further upgraded with a third processor of great power, which can run the sophisticated (but expensive) UNIX software.

ACORN Z80

The ACORN second processor is housed in a separate cabinet which has to sit adjacent and to the right of the BBC, because the connecting cable, which likewise plugs into the Tube, is extremely



2. PERFECT SPELLER checks all your spelling and allows you to change a word, ignore it or add it to the dictionary.

short. It occupies an inconveniently large amount of desktop. No extra ROM is needed but the disc interface "DFS" chip has to be swapped for another called "DNFS". It uses "straight" CP/M for the operating system and makes full use of the user programmable keys (if anything rather over uses them) and provides a neat, spiral bound key template, with a separate page for each program.

The software package appears at first sight to be more generous than TORCH's: not only "PLAN" series word processor and database from Chang Laboratories, plus a spread sheet with graph drawing supplement, but also: NUCLEUS, a kit for non-programmers to generate one's own data handling and presentation programs; both "BBC" and "professional" BASIC; an accounting package; a complete handbook on CP/M and finally CIS COBOL, the well-known commercial programming language, with user's and programmer's guides. ACORN have tried to provide everything the smaller business might need to start a computerised system, and have concentrated on simpler (and, they say, easy to use) programs, to which more power can be added later if required. Thus MEMO PLAN is a very basic word processor but for complex "formatting" of documents an add-on called DOCU PLAN will shortly be available.

ACORN's screen instructions are excellent, fully up to the quality of the handbooks they produced themselves: for the PLAN software and BASIC. These are extremely well laid out and simple to follow, though not always adequately indexed. The American documentation for CP/M and CIS COBOL however is almost incomprehensible to anyone who is not a computer specialist.

ACORN do not currently offer further upgrades of any significance, although no doubt these will emerge in future.

OPERATING PROBLEMS & CUSTOMER SUPPORT

Both these impressive packages demand considerable experience and no little skill to operate; purchasers should allow at least a month before they can expect to be fluent in using them without constant reference to the handbooks. I experienced a number of difficulties with both:

— ACORN appears to have trouble operating with almost any "sideways ROMs" installed, especially DISC DOCTOR; I ended by taking them all out (except BASIC, the operating system and the disc interface). TORCH, in contrast, operated faultlessly in the presence of an extension board packed with ROM chips (and Torch assure me it will operate with the Watford DFS disc controller chip).

— With TORCH, my printer insisted on double-spacing. However a telephone call to TORCH Customer Support Unit was returned promptly, with succinct information to put the problem right in a minute. Subsequent difficulties have received equally prompt, courteous and effective attention.

— I never succeeded in getting this printer going with the ACORN Z80. It is a solidly built Tec Starwriter 25-character-per-second daisy-wheel printer and it works beautifully with all programs on the BBC and also with the TORCH Z80. The moment I loaded ACORN CP/M it stopped printing and nothing would induce it to start. ACORN provide a "select printer" program which lists 19 different printer models: I tried them all with no result. Unlike TORCH, ACORN's handbooks do not ask the basic questions, like:

* is the printer serial or parallel
* what is the data transmission rate and
* does the printer need a line feed instruction

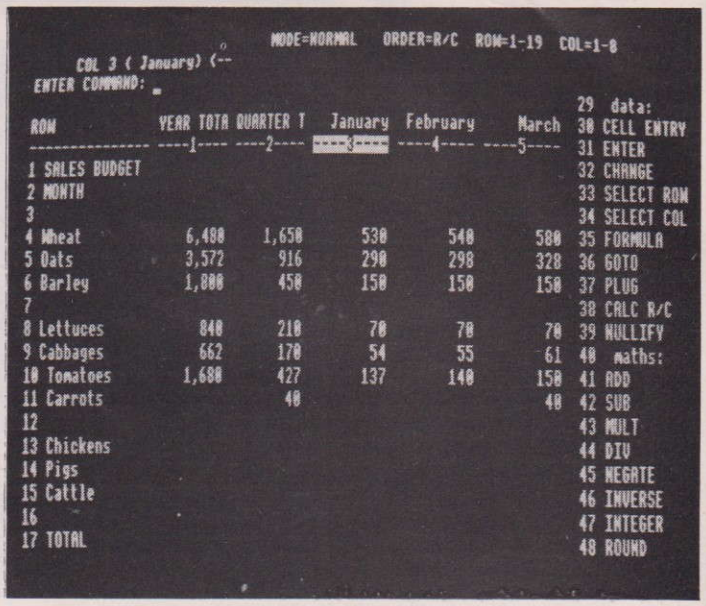
— Both systems demand guile from the user before they will accept the *FX commands which the BBC uses to direct the printer (and many other features). With TORCH you must enter them before loading your program but at least they remain. With ACORN, if you put these in *before*, the process of loading CP/M (pressing control and break keys) turns them off again. Do it *after* selecting CP/M and the screen echoes the command with a derisive question mark after it.

I made three telephone calls to ACORN about this. They took several days to return calls, implied that the problem was due to incompatible equipment, and referred me to my dealer when their suggestions did not work. In the end I borrowed a friend's EPSON printer on which there were no problems; well nearly none! In fairness it should be mentioned that ACORN have:

* insisted that Z80 distributors must attend a two-day familiarisation course, a responsible measure to ensure strong customer support, over such difficulties,
* subsequently pointed out that a procedure for entering *commands *is* to be found, but buried deep in that fearsome CP/M handbook.

Moral? — that anyone proposing to buy a Z80 to run with a printer that is at all unusual should take the printer into the dealer and get him to demonstrate that the two will run together before purchase.

— Perhaps the worst problem of all however is that of "crashing programs". Both systems have



3. CALC PLAN's horrid menu is hard to use and takes up a fifth of the screen.

CONTINUED OVER

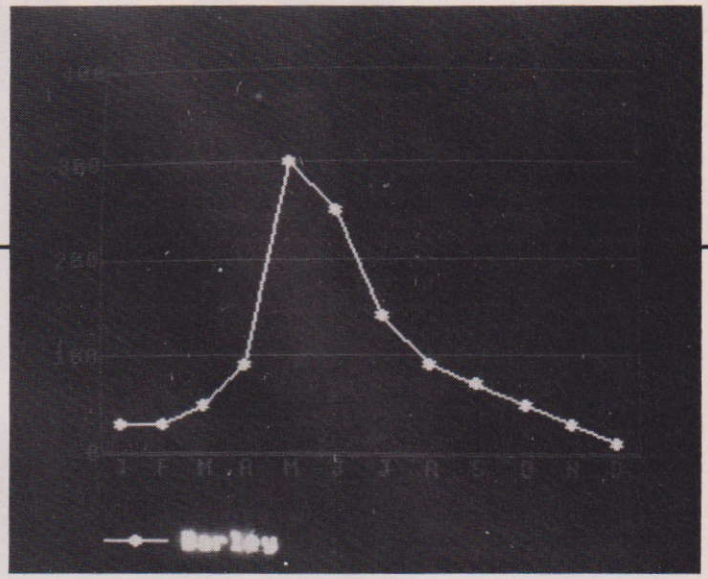
the nasty habit that, in the event of many kinds of error, they return you to the CP/M operating system, with the complete loss of all data from memory. This is not always as drastic as it sounds, because many of the programs save data onto disc as they go along, but not all. As my nightime fiasco demonstrated, it is quite possible to lose tons of pages of word-processed text if you are so imprudent as not to save it on disc as you go. (PERFECT WRITER has an optional facility for automatically saving every 512 characters.)

— FILE PLAN kept on allowing me to get started with designing my work sheet and then, with a whirr of disc drives, printed the words "FATAL ERROR" and crashed. As I had followed the instructions in the book implicitly, and purchased brand new 3M discs, I felt aggrieved about this. My experience has been that crashes become less frequent as the user gains familiarity with a program, and this is no reason for not buying; if there were serious defects in it a reputable manufacturer like ACORN would undoubtedly deal with it, although how quickly is another matter!

WORD-PROCESSOR SOFTWARE: COMPARISON OF MEMO PLAN WITH PERFECT WRITER

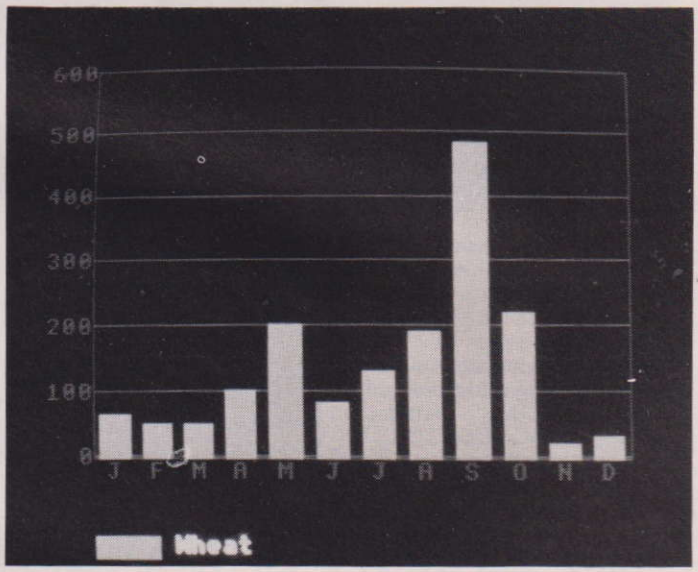
There is little difference in the speed with which a typist can churn out text but speed of editing can vary greatly between different word processors. MEMO PLAN concentrates all editing functions in the red and grey keys. To move the cursor around the screen it uses the cursor arrow keys with shift or control and I found this preferable to Perfect Writer which uses the red keys rather ineffectively, to duplicate functions which can also be done by a combination of keyboard keys with escape or control. Escape has to be depressed and released before the character key so that the double keystroke actually takes longer.

However PERFECT WRITER makes clever use of mnemonics, (so that, for example, *control* D Deletes the next character and *escape* D Deletes the word) which compensates for this. The commands to move the cursor to the beginning or end of documents on PERFECT WRITER are particularly clumsy as they require escape followed by shift keys. However PERFECT WRITER has a battery of additional commands, such as the ability to move one screen at a time, the most economical way of working systematically through a document, which is a sad lack on MEMO PLAN.



5. These can be pi, bar or line graphs.

the one in front of it). WRITER is clumsier. In both cases however, to change the mode may require the computer to call-up additional program from the disc and there is a pause while this is loaded, so one does it less frequently than with, say, WORDWISE. However PERFECT WRITER makes up for this by some very convenient key combinations that will switch two characters or two words or change a word to capital or small letters or to small letters with an initial capital. MEMO PLAN appears to have no facility to do any of these things. If the word is in the wrong case you would have to delete it and type it again.



4. GRAPH PLAN will quickly draw excellent charts of CALC PLAN data.

Both have entirely adequate arrangements for deleting, copying and moving words, lines or paragraphs but MEMO PLAN has a serious inability to change text width after a paragraph has been written. MEMO PLAN enables you to simply change the mode from "fill mode" (each letter is added to the one in front of it) to "overwrite" mode (replaces

INGENIOUS

Both have ingenious techniques to gather small pieces of text into a short term memory, accumulate them, position the cursor, then discharge them onto the screen. Anyone summarising a report into one or two short paragraphs would find this facility extremely convenient. Both have excellent search and replace facilities which work both forward and in reverse. PERFECT WRITER is far superior in its handling of underlining: MEMO PLAN will only underline before a paragraph is typed. Thereafter you cannot add or delete underlining. You have to erase the whole phrase and retype it. Nor has MEMO PLAN any facility for bold printing. PERFECT WRITER not only does both but offers a selection of underlining styles: continuous, only under characters or only under alpha-numeric characters, so that punctuation marks are not underlined.

Perhaps the most exciting features of both programs are the excellent facilities for operating with two texts simultaneously and the screen split horizontally into two. Both can have no less than seven texts in memory at any time, any of which can be pulled into one or other half of the screen. With either you can enlarge or reduce the size of either screen half. It is an inconvenience of CP/M that you cannot get a catalogue of your files without leaving the program. PERFECT WRITER will tell you the names of the texts you have in memory at any time, but you have then to type the full title, whereas with MEMO PLAN you

```
ENTER FIELD FORMAT   WORKSHEET:MEM0003   LIST:

)12
Fatal error in(MIN=0,MAX=75)

    FIELD HEADING    WIDTH KEY  TYPE  DEC PROMPT/EDIT LINE
==4== =======5======== ==6== ==7== ==8== =11 ==========================13=====
  1 CAT NO              4    12 NUMBE   0 Number from the stock catalogue
  2 ITEM               MMMM  12 ALPHA  __ ____________________________________
  3 _____________      12    12 ALPHA  __ ____________________________________
  4 _____________      12    12 ALPHA  __ ____________________________________
  5 _____________      12    12 ALPHA  __ ____________________________________
  6 _____________ ___ ___ ___ ___ __ ____________________________________
  7 _____________ ___ ___ ___ ___ __ ____________________________________
  8 _____________ ___ ___ ___ ___ __ ____________________________________
  9 _____________ ___ ___ ___ ___ __ ____________________________________
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 15 _____________ ___ ___ ___ ___ __ ____________________________________
 16 _____________ ___ ___ ___ ___ __ ____________________________________
```

6. Instead of a conventional record card, FILE PLAN uses a sheet, on which each record is one line. It is easy to "get lost" as much of the record disappears off the screen.

simply press one red key combination and it shuffles through all the texts (working documents it calls them) in turn.

MEMO PLAN's most astonishing omission is the ability to alter page lengths. The manual states blandly that "normally, MEMO PLAN treats each set of 55 lines of typing as a page." There is no further information to tell you how to alter this if, for example, you wish to use A5 paper, although there is a variety of print options.

Finally PERFECT WRITER has the benefit, (substantial for those educated in recent years!) of PERFECT SPELLER, a multi-thousand word dictionary which will, within seconds, display all the words spelt wrongly and give the option to alter them. It has some Americanisms but offers the choice of altering the dictionary, so that specialists can add the technical jargon for their profession, an enormous advantage for those whose secretaries do not know the difference between a spigot and a sprocket. In addition a range of foreign language dictionaries are available for PERFECT SPELLER and these would be of inestimable value for anyone engaged in the export trade.

Both programs integrate with a corresponding database program for the production of form letters and name-and-address labels.

To sum up: MEMO PLAN should be regarded as a tool for quick business memos or mail shots, which may be all the businessman needs. It in no way approaches the sophisticated word-processing capability of PERFECT WRITER, which will check your spelling, lay your text out in prose or poetry, collect all the words you need in an Index, collect all the headings and sub headings for the Contents, number them and, in short, do everything possible to make the author's task easier.

MEMO TO HEAD OF TYPING POOL
MEMO PLAN is adequate for simple business tasks provided your printer will operate and that you do not need to alter the page length settings.
PERFECT WRITER is exceptionally good: superb! Any writer, or person who uses a word-processor a great deal, should buy TORCH in order to get PERFECT WRITER. As token of this conviction, I have converted from my first love: WORDWISE, to use PERFECT WRITER in future.

SPREADSHEET AND GRAPH-DRAWING: PERFECT CALC, CALC PLAN & GRAPH PLAN

PERFECT CALC is a joy to use: simple, powerful and huge — up to 255 lines deep and 52 columns wide. Because all this data is stored on both sides of an 80 track disc there is no problem with running out of memory. It uses identical commands to WRITER, so having learned one, the other comes naturally.

FIG 7: SIMPLE SPREADSHEET PRODUCED ON CALC PLAN

28/6/84

ENGINE PRODUCTION

TRACTOR RANGE

1985

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOT
50 HP PETROL	50	47	44	35	38	35	32	14	26	23	20	10	0 374
80 HP PETROL	20	22	24	20	29	32	35	15	43	47	52	50	0 390
DIESEL	15	15	15	12	15	15	15	6	15	15	15	10	0 163
TOTAL UNITS	85	84	83	67	82	82	82	35	84	85	87	70	0 927

Again seven separate spreadsheets can be held in memory, and two of them displayed at the same time, with the screen split either horizontally or vertically. Calculations can be made between the two; suppose you drew up a production plan for a scrap metal business in tonnes of material, you can have that as one spreadsheet, with its sales value as the other. Change the output of copper and watch how the sales figure changes. Titles of rows or columns or both can be fixed, so you can roam over a huge spreadsheet, without losing your bearings for an instant.

My favourite feature, because I use spreadsheets for tables of text, such as last month's review of databases, is that text, as well as number values, can be typed straight in without need for quote marks or other delays and a text entry can span as many columns as desired, with no unsightly gap when it crosses the column boundary.

All necessary facilities for copying, calculating and replicating are provided and regions as well as the complete spreadsheet can be saved or loaded. The overwhelming virtue is power and ease, which means speed, of use.

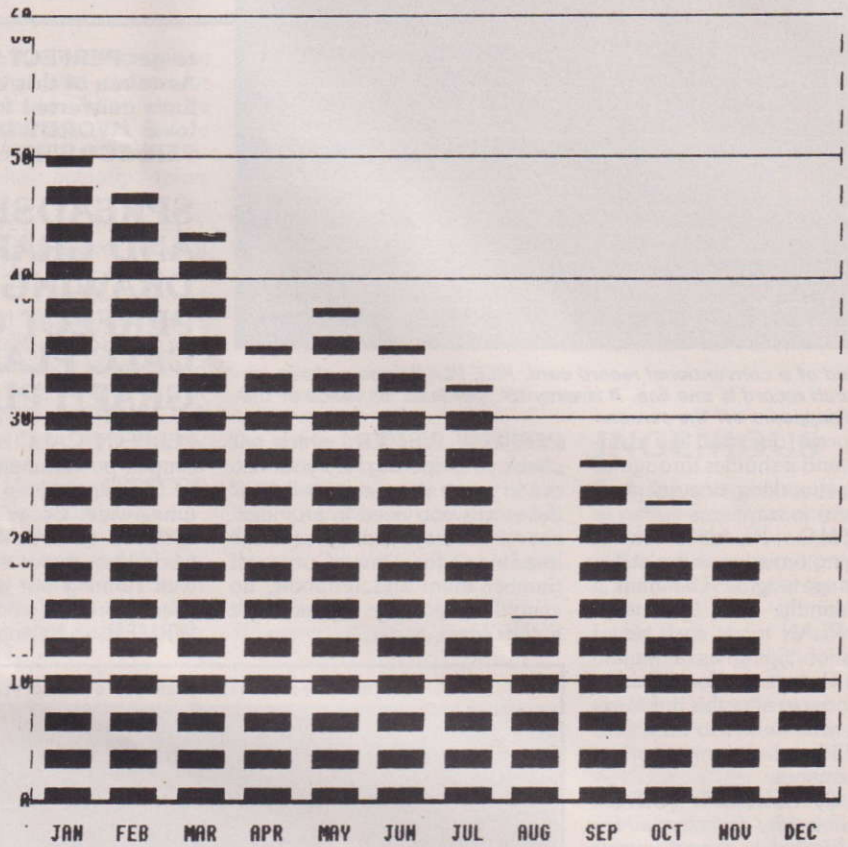
HARD WORK

CALC PLAN in contrast, is hard work to use and severely limited in the amount of space. If you specify 99 columns you can only have 10 rows and with 51 columns you can only have 22 rows. A fifth of the screen is taken up with the most ungainly menu I have ever seen, with over a hundred different numbers and meagre assistance in knowing which one to use. Of course, after using it regularly they would stick in one's mind, but a master and sub-menus would have been more elegant. Every command seems to need reinforcing with the return key. You cannot add additional rows or columns once you have started. Also, my pet hate, text would not continue across columns.

There are some good features: very convenient that, having entered "command number 20" to enter row titles, the cursor moves down after each, ready to enter the next, saving a lot of time. There is space for two lines of column titles and neat menus for rapid entry of values that stay constant or increase by a given increment or percentage. In particular the

CONTINUED OVER

FIG 8: FIRST ATTEMPT AT GRAPHING THIS SPREADSHEET RESULTED IN A BEAUTIFUL PICTURE OF A ZEBRA CROSSING



range of calculations and the facilites for exponential smoothing and analysing data (for example to discover rates of change) are excellent.

The great virtue however, is GRAPH PLAN, which, with remarkably little fuss, converts your spreadsheet data into line, bar or pie charts, with an impressive array of combinations and variations. The graphics quality is, as one would expect from ACORN, superb.

Sad that this power is not supported by a better handbook. This one is poorly organised and inadequately indexed: No entry for "LOAD", you have to track it down under "SPREADSHEET — LOADING." My first attempts at producing bar charts drew beautiful zebra crossings. Nothing in the handbook could offer any help at all. In the end I altered a switch on the printer (which has been working perfectly on my friend's BBC B for a year) and all was well; a simple matter which a good handbook should have suggested.

There is no chart-drawing facility in the TORCH package: to buy a separate program that intergrates with PERFECT CALC means GRAFOX's DATAPLOT PLUS at a cool £195. However TORCH are producing a basic program that will enable TORCH's own GRAPHICS PACK (£45) to draw charts from PERFECT CALC files.

MEMO TO PRODUCTION CONTROLLER
If you use large spreadsheets, get TORCH for PERFECT CALC, unless you frequently incorporate charts in your reports, in which case buy ACORN with GRAPH CALC.

DATA-BASES: FILE PLAN, NUCLEUS & PERFECT FILER

PERFECT FILER uses a conventional "card index" approach: each record occupies one full screen: the equivalent to a single card in an index drawer. The format is designed by the user and can contain as many *fields* (boxes into which the information is typed) as required, grouping together, in a compact screen display, fields which might be connected, for example a field containing initials with another containing the surname. FILE PLAN on the other hand uses *work sheets*, each of which contains 15 records down the page, which initially have only 5 *fields* across the sheet. This number can be increased but the extra records go off the screen, like a spreadsheet, and there is no facility to "fix" one reference field, so it is easy to get lost.

FILE PLAN is fairly simple to comprehend, because its facilities are limited. It offers a useful feature so that the user can insert "screen prompts"; PERFECT FILER has complete flexibility of titling the fields, so this is unnecessary. Both programs are menu operated, but PERFECT FILER uses a "cascade" of submenus which is far simpler than PLAN's clumsy number menu. Both programs run into problems with inserting dates: PERFECT FILER, slightly, because its useful "date template" is American notation (month, day, year) and PLAN's, seriously, because if dates are treated as numbers it rejects the initial zero (necessary to get sorting correct), while if they are treated as alphabetical it will not sort by date order at all. PERFECT FILER offers several templates that are American and therefore useless this side of the Atlantic, and sadly does not give the user the facility to redefine them. TORCH really should do this quickly, as it spoils an otherwise good product. They tell me this is in hand.

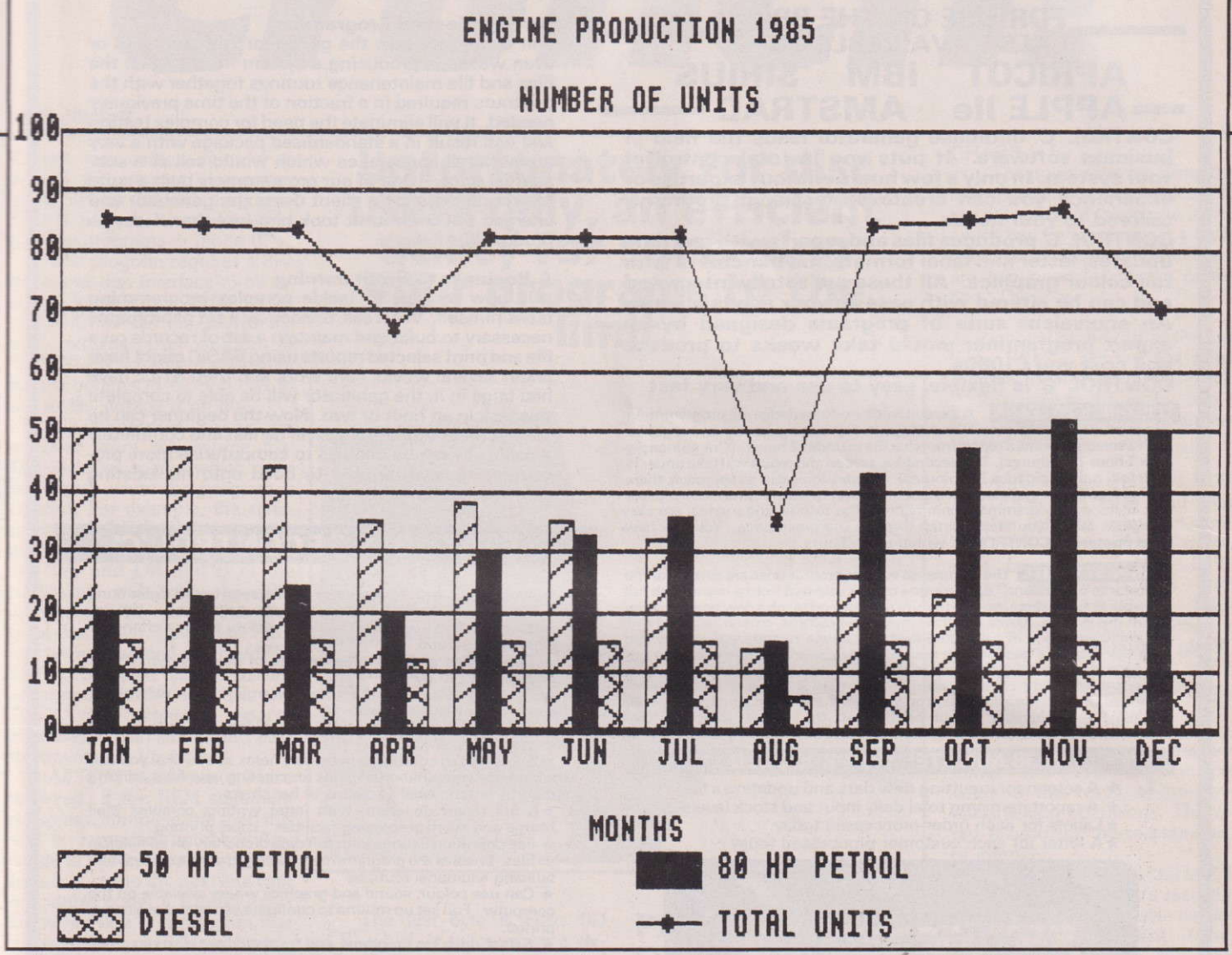
Where PERFECT FILER really scores over FILE PLAN is in its powerful facilities for tailoring lists, complete with headings and sub-headings, and generating mail, either alone or integrated with PERFECT WRITER, sorted by up to five different fields. PLAN will also do these things, but without the same power of flexibility. Neither program offers so much in the way of arithmetic: although PLAN will total numeric fields. PERFECT FILER will not even do that.

PERFECT FILER is the least good of the three programs in the TORCH package. However, because its output can be produced as a file that can be edited by PERFECT WRITER, I have been able to transfer my three-hundred long mailing list onto it and produce a flexible and rapid letter-writing system, far superior to what was possible on VIEW.

DO-IT-YOURSELF PROGRAMS

FILE PLAN's weakness is compensated by the presence of NUCLEUS, the program-writing program that comes with the ACORN package. NUCLEUS is aimed at the user who needs a

FIG 9: SUPERB FINAL GRAPHS PRODUCED WITH GRAPH PLAN



sophisticated combination of programs to run multiple files and extract from them mail, reports or matching entries, which cannot be provided by "off-the-shelf" software. To have a "dedicated" program written for him is *extremely* expensive; with NUCLEUS he can do it himself, even though he does not know how to program; at least this is the theory.

The practice is that he can only do so if he thoroughly understands how computers and their files work, and is able to spend perhaps several days quietly analysing exactly what he wants to do, plus a couple of complete days manipulating NUCLEUS to do it. For example, NUCLEUS recognizes that, if you put information onto a disc file, under most circumstances it is written backwards, and will read backwards when you take it off. It therefore provides an option for putting it on in reverse: problem solved *IF* the user knows what has to be reversed!

NUCLEUS can be regarded as an exceptionally powerful database, with the facility of linking files together and incorporating texts produced on MEMO PLAN. Suppose you have a file of customer orders, a second file of product stocks, and a third file of product prices. Each is kept separate from the others, so that it requires minimum effort to maintain up-to-date. But if the product field in each is *linked* using NUCLEUS, then an order from the first can stimulate a report on availability from the second and a price from the third, all gathered together as a set of despatch notes and an invoice.

NUCLEUS is without a doubt a powerful tool for the businessman or woman seeking a comprehensive business system, tailored to his company's special needs, without the cost of employing programmers: but *only* if he has the ability — and the time — to carry it through.

MEMO TO COMMERCIAL DIRECTOR

For mailing shots and lists, standardised letters and general correspondence buy TORCH with PERFECT WRITER and PERFECT FILER.

For comprehensive business systems, involving several interrelated files, for which standard software does not exist or is too expensive, buy ACORN with NUCLEUS *provided* you or your staff have the time and the computing ability to operate it.

MEMO TO MANAGING DIRECTOR

Buy a second-processor-with-software package rather than fill your BBC Micro with business ROMs.

For superb quality in general business control and admin, buy a TORCH Z80 with PERFECT software, especially if your system may need to expand in the near future.

Buy ACORN if you have a real need for any of the special programs bundled with it; in particular ACCOUNTANT if you need bookkeeping (and are content without proper-management accounting) or NUCLEUS if you want (and have the time and ability) to design your own system to generate documents and reports from interlinked data files.

NEW CONTROL 'C'

DATABASE GENERATOR

FOR USE ON THE BBC
ALSO AVAILABLE ON
APRICOT IBM SIRIUS
APPLE IIe AMSTRAD

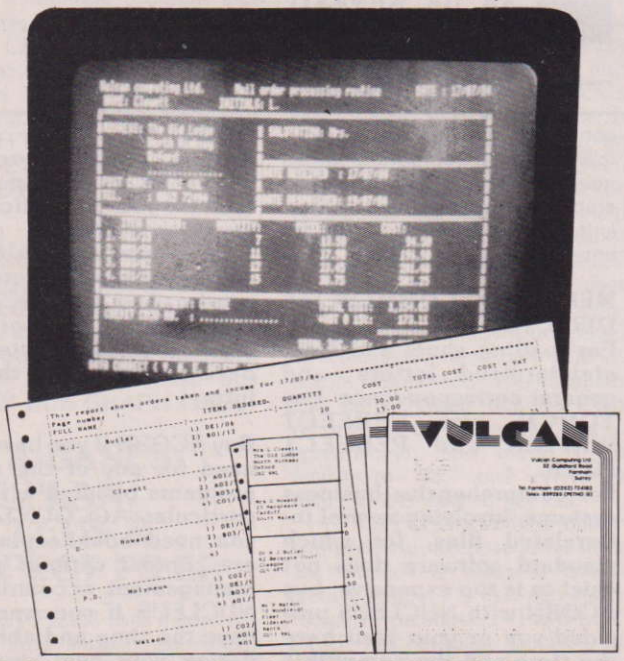
CONTROL 'C' database generator leads the field in business software. It puts you in total control of your system. In only a few hours without expertise or experience you can create professional programs, tailored to your needs.
CONTROL 'C' produces files and reports with real time updates; letter and label formats and bar-charts with full colour graphics. All these are totally integrated and can be altered with ease as your needs change. An equivalent suite of programs designed by an expert programmer would take weeks to produce and cost you £1000s.
CONTROL 'C' is flexible, easy to use and very fast.

IT IS QUICK TO LEARN A person with no knowledge of programming can produce his first screen and file with full editing facility and together with a selective printed report from that file in under 2 hours. (Our guinea pig took 1 hour 25 minutes). The second file, screen and report will take under ½ hour (our guinea pig took 27 minutes). It is very logical in its approach, there are full prompts at every step. It is not necessary to learn any new concepts or any additional programming commands. The tutorial and manual are easy to follow, taking you step by step through the procedures. You will have total mastery of CONTROL 'C' within a few hours.

IT IS FAST TO USE The completed suite of programmes are simple for the operator to understand. Each routine can be selected from a menu with full prompts at every stage, one 30 minute session can teach a new operator how to run the system. Users can then input new records, amend records (with automatic updating of calculated fields) or delete records very rapidly and save the data in a fraction of a second. They can edit letters and print out general reports, individual letters to customers, labels or selective reports of all records meeting chosen criteria. And then create bar charts of any combination from the information on file. And the speed at which it fufills this function is comparable, if not better than the typical speed of large supermicros or mini computers running under BASIC.

IN 38 MINUTES WE PRODUCED

★ A screen for inputting new data and updating a file
★ A report itemising total daily input and stock levels
★ Labels for each order proccessed today
★ A letter for each customer proccessed today



An Experienced Programmer
will appreciate how the generator will save days or even weeks in producing a system - creating all the files and file maintenance routines together with the printouts required in a fraction of the time previously needed. It will eliminate the need for complex testing and will result in a standardised package with a very professional appearance which would sell at a substantial price. (One of our programmers built a suite of programmes for a client using the generator and charged £800 for it. It took him less than 1 day to produce!).

A Beginner to Programming
will now be able to tackle complex programming tasks himself. Whereas, previously a set of programs necessary to build and maintain a set of records on a file and print selected reports using BASIC might have taken several weeks hard work and then STILL have had bugs in it, the generator will be able to complete this task in an hour or two. Now the beginner can be certain that programming will be fast and completely reliable. When he decides to computerise more procedures he will be able to build onto his existing database system.

FEATURES OF CONTROL 'C'

★ A full screen and file generator with 'screen based' definitions - the next generation from the standard 'menu driven' databases. It is very easy to add to, delete from or change a generated screen.
★ Record size is only limited by size of memory, typically in excess of 3000 bytes.
★ Files can be easily restructured, enlarged or shrunk without corruption of existing data.
★ Number of records per file is only limited by size of disc storage.
★ Each file can contain as many key fields as you like; you can sort in any combination of fields for creating new files, printing reports, letters, labels, screens or bar charts.
★ A full report generator with letter writing, complex Mail Merge and word processing facilities. Label printing
★ File definition listings with full data dictionary on all fields in all files. Enables the programmer to access the data easily when building additional routines.
★ Can use colour, sound and graphics where available on the computer. Full set up routine to configure your database to any printer.
★ Select drive for programs and for data; read disc directory, copy, delete, rename a file all within the generator.
★ Can implement all function keys where available into generated programs.
★ Very fast in use - on most computers a screen with 40 prompts saves and clears in under 1 second.
★ Creates files compatible with commonly used packages such as Wordstar, Multiplan and Supercalc.
★ Instantaneous update on screen of all figures simulating spread sheet programs.
★ Full error recovery feature implemented so programs will not crash when used by operator.
★ Simple screen editing of all files by end users.
★ Multi user access capability if used with a Network System.
★ Routine to design your own multi level menus to create complete system packages - also full password protection.

HOW TO ORDER

CONTROL 'C' comes to you on floppy disc together with tutorial instructions and a comprehensive manual. The BBC version costs £69.95 inc P & P; the version for all other computers is £99.95 inc P & P. When ordering please state type of machine and disc drive. Send your cheque for the complete system which includes file creation, bar graphics, report, label and letter generator to:

VULCAN COMPUTING LTD (BUSINESS DIVISION)
DEPT SF 2.32 GUILDFORD ROAD FARNHAM SURREY. PHONE FARNHAM (0252) 724182

Crunch!

A. D. Hackett

Unfortunately for disc users only, an efficient utility for squeezing your programs to the limit.

Crunch was written in order to reduce the amount of memory taken up by BASIC programs. This is particularly useful when running programs in mode 0.

The program requires a disc drive and disc interface to be fitted as it takes a disc file called "CRUNCHD" as the source file and returns the output in "CRUNCHD". This allows very long programs to be reduced in size as file storage is on disc.

All unnecessary spaces are removed from the source file. This includes spaces which must be present when the program is entered. For example, the statement IF A OR B THEN must be entered with a space between A and OR and OR and B or the computer will look for the variable AORB. After the program has been "crunched" this will be represented as IFAORB-THEN, however execution will be correct as the IF, OR and THEN are tokenised. Spaces contained within strings and data statements are unaffected.

All REM statements are also removed. If the REM statement occupies a complete line then this line is removed entirely. Any jumps to this line are recomputed so as to jump to the next line with executable code. If a jump exists to the last line of a program that consists of only a REM statement, the REM is removed and an END statement is inserted. However, the program will not cope with calculated GOTOs (e.g. GOTO (2 * A%)) when such a jump is to a line containing only a REM statement. The RENUMBER command would fail in the same way.

As an example of the savings in space to be gained, if this program is run on itself, the memory requirements for the program (TOP — PAGE) drop by approximately 25%.

LINE NUMBERING

Each line of a BASIC program has the following structure:

&0D High Low Length Tokens and characters Line number

The first byte is Hex. 0D (CR) which is followed by a sixteen bit binary representation of the line number, followed by the line length. After this, the BASIC line begins, consisting of a mixture of tokens and characters.

In a jump, the destination line number is stored at the byte sequence &8D CODE X Y and may be determined from the following table:

CODE	L	H
&40	X	Y
&44	X	Y-&40
&50	X-&40	Y
&54	X-&40	Y-&40
&60	X+&80	Y
&64	X+&80	Y-&40
&70	X+&40	Y
&74	X+&40	Y-&40

where L and H are the low and high bytes of the binary coded line number, respectively. For example, the line number 510 is stored as &8D &64 &7E &41.

PROGRAM OPERATION

The program may be split into three sections:
1. The removal of unnecessary spaces.
2. The removal of REM statements and lines.
3. The replacing of jumps to lines which have been removed.

Sections 1. and 2. are carried out concurrently, whilst section 3. is performed afterwards in order to cope with jumps in any direction.

The program works on one line of BASIC at a time. Each line is loaded into BUF% (lines 240-370 where it is checked to see if it is the program termination line (&0D,&FF). The line number is stored in line%, and the line length is in BUF%(4). The pointer to the buffer (CHAR%) is set to the first character in the line, i.e. CHAR% = 5.

The pointer moves along the line, checking each character to see if it is a REM token or a space which can be removed. If a REM token is found (line 390), there are two possible courses of action. These are:

1. Removal of the rest of the line if the REM is not the first statement in the line (lines 430-480).
2. Removal of the whole line if the REM is the first statement (lines 490-500).

The array LIN%(PNTER%,1) stores the line number of the removed line. PNTER% is the address of the next free location in LIN%. When the next line with statements other than REM statements is found, the program "backtracks" through LIN%, writing the number of this line in LIN%(PNTER%,2) until either a non-zero value for LIN%(PNTER%,2) is found or the start of the array is reached (lines 650-710). A non-zero value is the result of previous backtracking operations. This array is used for the reassignment of jumps.

As the pointer CHAR% moves along the line, a record is kept of whether it is inside a string or DATA statement (lines 510-560). If this is the case spaces are not removed. If a space is removed, the rest of the line is moved forwards and the line length modified (lines 570-630). When the end of the line is reached, the buffer is copied out into the file "TEMP" (if the line has not been deleted) and the next line is input.

At the end of the file, the program jumps to line 790, where if the last line has been removed an END statement is inserted and a final backtracking operation is performed (lines 790-880). An end of program marker is then written (line 890).

Lines 900 to 1160 check whether any jumps in the program are to now non-existent line numbers. As jumps are stored internally in an unusual format, PROCnumber converts a line

CONTINUED OVER

number to this format (which is preceded by the token 8D). The jump destination is stored in BYTE%(,3) and is compared with a converted version of the removed line numbers from LIN% stored in BYTE%(,1) (lines 940-980). If a match is found (lines 1010-1080) this value is replaced by the value in LIN%(,2), converted and held in BYTE%(,2) (lines 1090-1150).

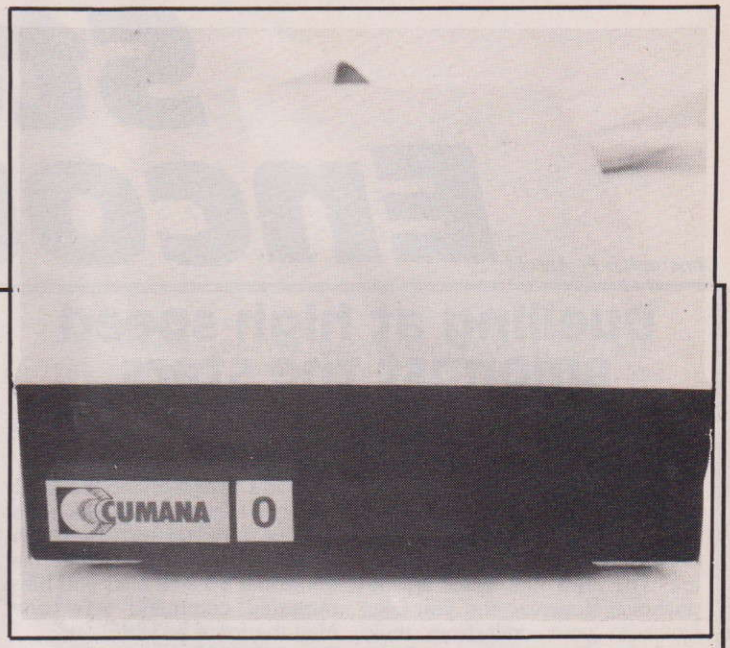
Unless TFLAG% is set the disc files are closed, and "TEMP" is copied to "CRUNCHD". TFLAG% is set if sufficient REM only lines were found to exceed the capacity of LIN% (an unlikely event). In this case "CRUNCH" is run again on the updated version of "CRUNCHD" until the file has been completely reduced.

VARIABLES

TABLE%(4,2	Array used as lookup table in line number conversion routine.
MAXLIN%	Maximum value of LIN%().
BUF%(255)	Line buffer.
BYTE%(3,3)	Array to hold result of PROCnumber.
LIN%(MAXLIN%)	Array to hold removed line numbers.
Line%	Number of current line being processed.
TFLAG%	LIN% overflow flag.
PNTER%	Pointer to BASIC line.
FLAG%	Indicates whether all backtracking has been performed.
STRF%	Indicates whether CHAR% is in a string.
DATFL%	Indicates whether CHAR% is in a DATA statement.
CHAR%	Pointer to BUF%().
TEMP%,I%,J%,K%	Temporary variables.
ASSFL%	Indicates whether CHAR% is in an assembly language routine.
JUMPFL%	Indicates whether current line of assembly language contains a label.

PROGRAM LISTING

```
   10  REM Program to remove all
   20  REM unnecessary spaces and comments
   30  REM from a BASIC program.
   40  REM The input file is "CRUNCHD"
   50  REM Output is returned to "CRUNCHD"
   60  REM A temporary file "TEMP" is also
   70  REM used, and is deleted afterwards
   80  REM
   90  DIM TABLE%(4,2)
  100  FORI%=0 TO 3:READ TABLE%(I%,1):READ TABLE%(
I%,2):NEXT
  110  PRINT"Running crunch..."
  120  MAXLIN%=1000
  130  X=OPENOUT("TEMP"):BPUT#X,0:CLOSE#X
  140  DIM BUF%(255) : REM LINE BUFFER
  150  DIM LIN%(MAXLIN%,2):REM LINES REMOVED
  160  DIM BYTE%(3,3)
  170  X=OPENIN("CRUNCHD")
  180  Y=OPENUP("TEMP")
  190  PTR#Y=0
  200  line%=0
  210  TFLAG%=FALSE:PNTER%=1:FLAG%=FALSE:ASSFL%=FA
LSE
  220  A%=BGET#X:IFA%<>&0D THEN PROCerror(1):PROCF
ATAL:END
  230  PTR#X=0
  240  STRF%=FALSE:DATFL%=FALSE:JUMPFL%=FALSE:CHAR
%=5
  250  FORI%=1 TO 255
  260  BUF%(I%)=0
  270  NEXT
  280  REM READ LINE INTO BUF%
  290  BUF%(1)=BGET#X
  300  BUF%(2)=BGET#X
  310  IF BUF%(2)=&FF THEN 790:REM End of program
  320  BUF%(3)=BGET#X
  330  line%=(BUF%(2)*256)+BUF%(3)
  340  BUF%(4)=BGET#X
  350  FORI%=5 TO BUF%(4):REM Read rest of line
  360  BUF%(I%)=BGET#X
  370  NEXT
  380  REM Look at current token
  390  IF BUF%(CHAR%)<>&F4 THEN 510
  400  REM Here if token is rem
  410  IF CHAR%=5 THEN 490
  420  REM not at start of line
  430  REPEAT
  440  CHAR%=CHAR%-1
  450  UNTIL BUF%(CHAR%)=&3A OR CHAR%=0
  460  IF CHAR%=0 THEN PROCerror(2):PROCFATAL:END
  470  BUF%(4)=CHAR%-1
  480  GOTO 730
  490  IF PNTER%=MAXLIN% THEN TFLAG%=TRUE:CHAR%=BU
F%(4)+1:GOTO 730
  500  LIN%(PNTER%,1)=line%:PNTER%=PNTER%+1:FLAG%
```




```
TRUE:GOTO 780
  510  IF BUF%(CHAR%)=&22 THEN STRF%=NOT STRF%:REM
 in/out of string
  520  IF BUF%(CHAR%)=&DC THEN DATFL%=TRUE:REM In
DATA statement
  522   IF STRF% OR DATFL% THEN 528
  524  IF BUF%(CHAR%)=&5B THEN ASSFL%=TRUE:REM Sta
rt of assembler
  526  IF BUF%(CHAR%)=&5D THEN ASSFL%=FALSE:REM En
d of assembler
  528  IF ASSFL% AND BUF%(CHAR%)=&2E THEN JUMPFL%=
TRUE
  530  IF BUF%(CHAR%)<>&20 THEN 640
  540  IF STRF% THEN 640
  545  IF JUMPFL% THEN 640
  550  IF NOT DATFL% THEN 580
  560  IF BUF%(CHAR%-1)<>&DC AND BUF%(CHAR%-1)<>&2
C THEN 640
  570  REM remove space
  580  FOR I%=CHAR%+1 TO BUF%(4)
  590  BUF%(I%-1)=BUF%(I%)
  600  NEXT
  610  BUF%(4)=BUF%(4)-1
  620  CHAR%=CHAR%-1
  630  GOTO 720
  640  IF NOT FLAG% THEN 720
  650  REM Valid line, so backtrack removed lines
  660  FLAG%=FALSE
  670  TEMP%=PNTER%-1
  680  REPEAT
  690  LIN%(TEMP%,2)=line%
  700  TEMP%=TEMP%-1
  710  UNTIL LIN%(TEMP%,2)<>0 OR TEMP%=0
  720  CHAR%=CHAR%+1
  730  IF CHAR%<=BUF%(4) THEN 390
  740  IFBUF%(4)<5 THEN 780
  750  FORI%=1 TO BUF%(4)
  760  BPUT#Y,BUF%(I%)
  770  NEXT
  780  GOTO 240
  790  IF NOT FLAG% THEN 890
  800  REM Insert END here
  810  TEMP%=PNTER%-1
  820  REPEAT
  830  LIN%(TEMP%,2)=line%
  840  TEMP%=TEMP%-1
  850  UNTIL LIN%(TEMP%,2)<>0 OR TEMP%=0
  860  BPUT#Y,&0D:BPUT#Y,(line% DIV 256)
  870  BPUT#Y,(line% MOD 256):BPUT#Y,5:BPUT#Y,&E0
  880  FLAG%=FALSE
  890  BPUT#Y,&0D:BPUT#Y,&FF
  900  PRINT"Checking jumps..."
  910  IF PNTER%=1 THEN 1170
  920  PTR#Y=0
  930  REPEAT
  940  IF BGET#Y<>&8D THEN 1160
  950  REM Jump found
  960  FOR I%=1 TO 3
  970  BYTE%(I%,3)=BGET#Y
  980  NEXT
  990  MATCH%=FALSE:I%=0
 1000  REPEAT
 1010  I%=I%+1
 1020  PROCnumber(LIN%(I%,1),1)
 1030  K%=0
 1040  FORJ%=1 TO 3
 1050  IF BYTE%(J%,1)=BYTE%(J%,3) THEN K%=K%+1
 1060  NEXT
 1070  IF K%=3 THEN MATCH%=TRUE
 1080  UNTIL MATCH% OR I%=PNTER%
 1090  IF I%=PNTER% THEN1160
 1100  REM Replace jump destination
 1110  TEMP%=PTR#Y:PTR#Y=TEMP%-3
 1120  PROCnumber(LIN%(I%,2),2)
 1130  FOR I%=1 TO 3
 1140  BPUT#Y,BYTE%(I%,2)
 1150  NEXT
 1160  UNTIL EOF#Y
 1170  CLOSE#Y
 1180  CLOSE#X
 1190  *DELETE"CRUNCHD"
 1200  *RENAME"TEMP" "CRUNCHD"
 1210  IF TFLAG% THEN RUN
 1220  END
 1230  DEF PROCnumber(L%,M%)
 1240  LOCAL hibyte%,lowbyte%,col%,row%,one%
 1250  hibyte%=L% DIV 256
 1260  lowbyte%=L% MOD 256
 1270  row%=4-((hibyte% DIV &40)*4)
 1280  col%=lowbyte% DIV &40
 1290  one%=TABLE%(col%,1)+row%
 1300  BYTE%(1,M%)=one%
 1310  BYTE%(2,M%)=lowbyte%+TABLE%(col%,2)
 1320  BYTE%(3,M%)=hibyte%+(row%*&10)
 1330  ENDPROC
 1340  DEF PROCFATAL
 1350  CLOSE#X:CLOSE#Y
 1360  ENDPROC
 1370  DEF PROCerror(X%)
 1380  IFX%=1THENPRINT"Input file not a basic sour
ce file"
 1390  IF X%=2THEN PRINT"Syntax error at line ";li
ne%;" of CRUNCHD"
 1400  ENDPROC
 1410  DATA 80,&40,64,0,112,-64,96,-128
```

Star Encounter

Christopher P. Arnold

Duelling at high speed amongst the stars.

This game is in the true Star Wars tradition, demanding skill and concentration from the player as he tots up hits against the alien foe. The alien spaceships are no pushover however and you take blows to your craft from their shield weakening missiles. Fight back with your laser weaponry to achieve higher command levels and the accolade of the high-score table.

The program can be easily changed to make your task easier but this does not achieve a high-score rating. You will find that things hot up a bit after you have mastered command level one. May the force be with you.

Z = Left
X = Right
* = Up
/ = Down
Return to fire.

PROCEDURE SUMMARY

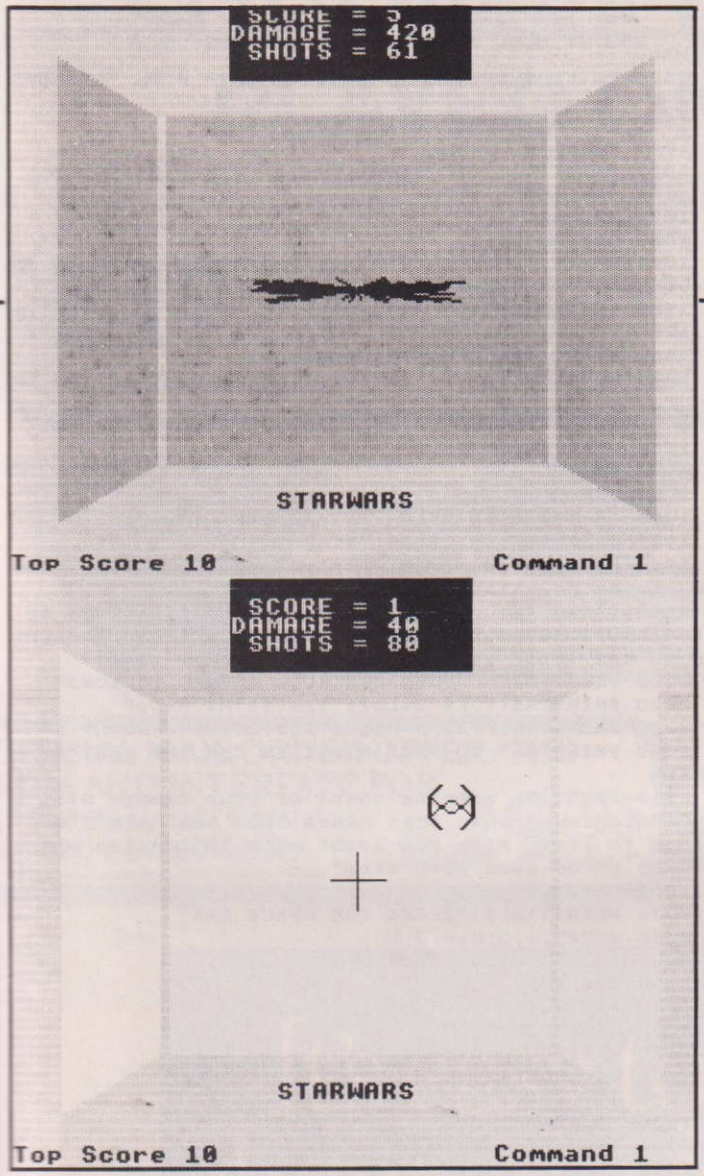
PROCdif1	Defines the first ship.
PROCdif2	Defines the second ship.
PROCship	Creates the string 'the ship$' which prints the ship.
PROCtargetsite	Produces the window from the cabin.
PROCtarget	Produces the other features of the cabin.
PROCscore	Prints the score onto the screen.
PROCfire	Displays the shooting routine.
PROCcrash	Displays the crash + the noise + the score.
PROCname	Used to input the player's name.
PROCdisplay	Display the final score and message.
PROCcommand	Calculates the difficulty of the next command.
PROCinit	Sets the variables at the beginning of the game.
PROCinstructions	Displays the instructions for play.
PROCcolourset	Creates the teletext characters for display.
PROCgame	This is the main routine of the game.

LIST OF VARIABLES

A$	Used in conjunction with an INKEY$ statement.
AGAIN	Contains the score which needs to be gained to go on to the next command.
B$	CHR$(132) teletext colour blue.
BESI	Keeps a record of the high score.
COMMAND	Keeps a record of the command number.
CRASH	Is the amount of damage which can be taken.
CRASH2	Is used to calculate CRASH.
D$	CHR$(141) teletext double height.
D%	Keeps a running total of damage taken.
E%	Used to calculate X% & Y%.
F%	Used to calculate X% & Y%.
F$	CHR$(136) teletext flashing.
FLAG	Indicates start of a new game.
G$	CHR$(130) teletext colour green.
H%	Used as a count.
HARDNESS	Used to increment AGAIN.
I%	Used to calculate X% & Y%.
J%	Used to calculate X% & Y%.
K%	Used to calculate X% & Y%.
K$	CHR$(134) teletext colour cyan.
M%	Used to calculate X% & Y%.
M$	CHR$(133) teletext colour magenta.
N%	Used to calculate X% & Y%.
NAME%	Contains the name of the high scorer.
O%	Used to calculate X% & Y%.
P%	Used to calculate X% & Y%.
Q%	Used to calculate X% & Y%.
R$	CHR$(129) teletext colour red.
S%	Used to calculate X% & Y%.
I%	Plots the stars.
TERMINATED	Indicates when the game is over.
theship$	Prints out the space ship.
V	The foreground colour of ship interior.
VA	The background colour.
W%	Used to calculate X% & Y%.
X% & Y%	The coordinates of the ship.
Y$	CHR$(131) teletext colour yellow.
Z%	Used to calculate X% & Y%.

PROGRAM LISTING

```
 10  REM Star Encounter
 20 REM By Christopher Arnold
 50  REM (c) 1984
 70 ON ERROR IF ERR=17 THEN 110 ELSE MODE7:NEW
 80 *TV0,1
 90 PROCcolourset
100 BEST=10:NAME$="Christopher Arnold"
110 MODE 7
120 VDU23,1,0;0;0;0;
130 PRINT''''''''''TAB(13)F$Y$D$"STARWARS"
140 PRINTTAB(13)F$R$D$"STARWARS"
150 PRINTTAB(14,23)Y$"HIT A KEY"
160 FLAG=0
170 REPEAT
180 PROCdif1:PROCship
190 PROCinit
200 A$=INKEY$(1000)
210 MODE7
220 PROCinstructions
230 REPEAT
240 MODE1
250 VDU23,1,0;0;0;0;
260 D%=0:CRASH=RND(300)+CRASH2:TERMINATED=0
270 PROCtargetsite
280 PROCtarget
290 VDU19,2,V,0,0,0
300 VDU19,0,7,0,0,0
310 VDU19,1,0,0,0,0
320 VDU19,3,V,0,0,0
330 PROCgame
340 MODE7
350 PROCname
360 MODE7
370 PROCdisplay
380 UNTIL FLAG=999
390 FLAG=0
400 UNTIL FALSE
410 DEFPROCdif1
420 VDU23,240,0,0,3,6,12,24,48,96
430 VDU23,241,0,0,192,96,48,24,12,6
440 VDU23,242,112,104,100,99,99,100,104,112
```




```
  450 VDU23,243,0,60,66,129,129,66,60,0
  460 VDU23,244,14,22,38,198,198,38,22,14
  470 VDU23,245,96,48,24,12,6,3,0,0
  480 VDU23,246,6,12,24,48,96,192,0,0
  490 VDU23,247,0,0,0,0,0,0,0,0
  500 VDU23,248,0,0,0,0,0,0,0,0
  510 ENDPROC
  520 DEFPROCdif2
  530 VDU23,240,0,0,0,0,0,0,127,-1
  540 VDU23,247,0,0,0,0,24,60,60,-1,0
  550 VDU23,241,0,0,0,0,0,0,-2,-1
  560 VDU23,242,-1,127,15,0,0,0,1,3
  570 VDU23,243,-1,-1,-1,60,102,195,129,0
  580 VDU23,244,-1,-2,240,0,0,0,128,192
  590 VDU23,245,2,6,15,31,49,49,31,14
  600 VDU23,248,0,0,0,0,0,129,129,0,0
  610 VDU23,246,64,96,240,248,140,140,248,112
  620 ENDPROC
  630 DEFPROCship
  640 theship$=CHR$(240)+CHR$(247)+CHR$(241)+CHR$(
10)+CHR$(8)+CHR$(8)+CHR$(8)+CHR$(242)+CHR$(243)+CH
R$(244)+CHR$(10)+CHR$(8)+CHR$(8)+CHR$(8)+CHR$(245)
-CHR$(248)+CHR$(246)
  650 ENDPROC
  660 DEFPROCtargetsite
  670 VDU19,131,VA,0,0,0
  680 VDU19,1,V,0,0,0
  690 GCOL0,131
  700 CLG
  710 GCOL0,1
  720 MOVE300,200
  730 DRAW300,800:DRAW1000,800:PLOT85,300,200
  740 DRAW1000,200:DRAW1000,800:PLOT85,300,200
  750 MOVE280,200
  760 DRAW100,100:DRAW100,900:PLOT85,280,200
  770 DRAW280,800:DRAW280,200:PLOT85,100,900
  780 MOVE1020,200:DRAW1020,800:DRAW1200,900:PLOT8
5,1020,200:DRAW1200,100:DRAW1200,900:PLOT85,1020,2
00
  790 GCOL0,0
  800 FOR T%=1 TO 80:PLOT 71,RND(1279),RND(1023):N
EXT
  810 VDU5
  820 ENDPROC
  830 DEFPROCtarget
  840 MOVE600,500:DRAW700,500:MOVE650,450:DRAW650,
550
  850 PROCscore
  860 MOVE 500,150:PRINT"STARWARS"
  870 MOVE 900,40:PRINT"Command ";COMMAND
  880 MOVE10,40:PRINT"Top Score ";BEST
  890 X%=RND(1000)+100:Y%=RND(300)+450
  900 ENDPROC
  910 DEFPROCscore
  920 COLOUR128
  930 VDU4
  940 VDU28,13,4,26,0
  950 CLS
  960 PRINT'" SCORE = ";S%
  970 PRINT"DAMAGE = ";D%
  980 PRINT" SHOTS = ";F%
  990 VDU5
 1000 ENDPROC
 1010 DEFPROCfire
 1020 VDU19,1,1,0,0,0
 1030 GCOL4,1
 1040 SOUND&13,2,200,4
 1050 MOVE400,200:DRAW650,500:MOVE900,200:DRAW650,
500
 1060 MOVE400,200:DRAW650,500:MOVE900,200:DRAW650,
500
 1070  IF X%>580 AND X%<620 AND Y%>530 AND Y%<570
THEN PROCcrash:ENDPROC
 1080 VDU19,1,0,0,0,0
 1090 ENDPROC
 1100 DEFPROCcrash
 1110 VDU19,2,V,0,0,0
 1120 GCOL0,1
 1130 MOVE600,500:DRAW700,500:MOVE650,450:DRAW650,
550
 1140 GCOL0,0
 1150 SOUND&10,-15,20,15
 1160 FOR H%=1TO80
 1170 MOVE650,500:DRAW(RND(400)-200)+650,(RND(40)-
20)+500
 1180 NEXT
 1190 S%=S%+1
 1200 FOR H%=-14TO0
 1210 SOUND0,H%,20,2
 1220 NEXT
 1230 VDU19,1,0,0,0,0:U%=U%+1
 1240 N%=N%+J%:M%=M%+P%
 1250 VDU4:VDU28,14,17,26,15:COLOUR129:CLS:VDU5
 1260 PROCtarget
 1270 ENDPROC
```

CONTINUED OVER

```
 1280 DEFPROCname
 1290 IF S%>AGAIN THEN PROCcommand:ENDPROC
 1300 FLAG=999
 1310 IF S%>BEST THEN BEST=S% ELSE ENDPROC
 1320 PRINT''TAB(7)D$;G$;"You have become head sla
yer"
 1330 PRINTTAB(7)D$;G$;"You have become head slaye
r"
 1340 PRINT'
 1350 PRINTM$;"Please type your names in, using th
e "'M$"keyboard.  It is not necessary to give"'M$"
me your real name.  When you have"'M$"finished jus
t press the <RETURN> button"M$"to continual the ga
me."
 1360 VDU28,0,24,39,12
 1370 PRINT'
 1380 *FX12,0
 1390 REPEAT
 1400 PRINT'Y$;"What is your name ] ";K$;
 1410 TIME=0:REPEAT:UNTILTIME=100
 1420 *FX21,0
 1430 NAME$=""
 1440 REPEAT
 1450 Z$=GET$:SOUND&13,2,200,4
 1460 *FX202,48
 1470 IF NAME$="" AND (ASC(Z$)=13 OR ASC(Z$)=127)
THEN PRINT''R$;"Please, you must have a name":Z$="
!"
 1480 IF NAME$="" AND ASC(Z$)=32THEN PRINT''R$;"Pl
ease, you must have a name":Z$="!"
 1490 IF NAME$<>"" AND ASC(Z$)=32THEN NAME$=NAME$+
Z$:PRINT;Z$;:GOTO 1450
 1500 IF ASC(Z$)>64 AND ASC(Z$)<123 THEN :NAME$=NA
ME$+Z$:PRINT;Z$;
 1510 IF ASC(Z$)=127 AND NAME$<>"" THEN PRINT ;Z$;
:A=LEN(NAME$):NAME$=LEFT$(NAME$,A-1)
 1520 UNTIL ASC(Z$)<65 OR ASC(Z$)>127
 1530 UNTIL NAME$<>"" AND Z$<>"!"
 1540 ENDPROC
 1550 DEFPROCdisplay
 1560 VDU23,1,0;0;0;0;
 1570 PRINT''D$;Y$;"   The Whole Universe Worships
 you."
 1580 PRINTD$;Y$;"   The Whole Universe Worships y
ou."
 1590 PRINT''D$Y$"   "NAME$
 1600 PRINTD$Y$"   "NAME$
 1610 PRINT''D$Y$"   The Slayer!!"
 1620 PRINTD$Y$"   The Slayer!!"
 1630 PRINT''''D$B$"Score needed to become Head Sl
ayer ";BEST+1
 1640 PRINTD$B$"Score needed to become Head Slayer
 ";BEST+1
 1650 PRINT'''TAB(10);D$;R$;"Your Score = ";S%
 1660 PRINTTAB(10);D$;R$;"Your Score = ";S%
 1670 *FX21,0
 1680 TIME=0:REPEAT UNTIL TIME=120
 1690 A$=INKEY$(300)
 1700 ENDPROC
 1710 DEFPROCcommand
 1720 COMMAND=COMMAND+1
 1730 AGAIN=AGAIN+HARDNESS
 1740 IF COMMAND=2 THEN PROCdif2:PROCship:J%=J%+2:
P%=P%+1:V=6:VA=134:F%=70:E%=40:O%=28:Z%=16:U%=9
 1750 IF COMMAND=3 OR COMMAND=4 THEN PROCdif1:PROC
ship:V=3:VA=131:O%=44:F%=60:E%=60:Z%=14:U%=11:J%=J
%+2:P%=P%+1
 1760 IF COMMAND>4 AND COMMAND<7 THEN PROCdif2:PRO
Cship:V=4:VA=132:F%=50:E%=30:Z%=12:U=12:O%=52
 1770 IF COMMAND>10 THEN PROCdif2:PROCship:J%=J%+2
:P%=P%+1:V=6:VA=134:F%=35:E%=30:O%=84:Z%=7:U=15
 1780 IF COMMAND>6 AND COMMAND<11 THEN PROCdif1:PR
OCship:V=5:VA=133:F%=40:E%=15:O%=60:Z%=10:U=13
 1790 VDU23,1,0;0;0;0;
 1800 PRINT''''''G$;"You have gained enough points
 to on to"
 1810 PRINT''''D$G$"           C O M M A N D  ";CO
MMAND
 1820 PRINTD$G$"           C O M M A N D  ";COMMAN
D
 1830 TIME=0:REPEAT:UNTILTIME=200
 1840 *FX21,0
 1850 PRINT''''''''''TAB(14);Y$;"HIT A KEY"
 1860 A$=INKEY$(400)
 1870 ENDPROC
 1880 DEFPROCinit
 1890 V=4:VA=132:O%=22:P%=0:J%=0:AGAIN=19:F%=80:S%
=0:E%=100:CRASH2=2950:Z%=20:U%=0:HARDNESS=10
 1900 ENVELOPE2,1,5,-10,-12,5,50,50,127,0,0,-5,126
,126
 1910 K%=24:N%=30:M%=15:COMMAND=1
 1920 ENVELOPE1,7,2,1,1,1,1,1,121,-10,-5,-2,120,12
0
 1930 ENVELOPE3,1,5,0,0,5,0,0,127,0,0,-5,126,126
 1940 Q%=0:W%=0
 1950 ENDPROC
 1960 DEFPROCinstructions
 1970 PRINTTAB(13)D$;R$;"STARWARS"
 1980 PRINTTAB(13)D$;R$;"STARWARS"
 1990 PRINT'"You are in control of a Starship whic
h  is being attacked by Enemy craft"
 2000 PRINT'"Your task as the Starship Captain is
to manoeuvre your ship to allow your front gun-cre
w to fix their sights on the     enemy craft"
 2010 PRINT'G$"   YOUR CONTROLS ARE AS FOLLOWS"'
 2020 PRINTTAB(7)K$"Z=Left"TAB(22)M$"*=Up"
 2030 PRINTTAB(7)B$"X=Right"TAB(22)Y$"/=Down"
 2040 PRINT'R$" TO FIRE MISSILES USE THE <RETURN>
KEY"
 2050 PRINT'"A running total of your damage will b
e"'"displayed when this nears 3000 you have"'"not
long to live  Also you start with 80missiles which
 need to be used with care"
 2060 *FX21,0
 2070 PRINTTAB(9)"PRESS THE SPACE BAR"
 2080 VDU23,1,0;0;0;0;
 2090 REPEAT UNTIL GET=32
 2100 *FX11,1
 2110 *FX12,1
 2120 ENDPROC
 2130 DEFPROCcolourset
 2140 R$=CHR$(129)
 2150 G$=CHR$(130)
 2160 Y$=CHR$(131)
 2170 B$=CHR$(132)
 2180 M$=CHR$(133)
 2190 K$=CHR$(134)
 2200 F$=CHR$(136)
 2210 D$=CHR$(141)
 2220 ENDPROC
 2230 DEFPROCgame
 2240 REPEAT
 2250 GCOL3,1
 2260 X%=X%+(RND(2)*16-K%+Q%+G%):Y%=Y%+(RND(2)*16-
K%+W%+G%)
 2270 IF X%<50 THEN X%=X%+38
 2280 IF Y%<240 THEN Y%=Y%+38
 2290 IF Y%>860 THEN Y%=Y%-38
 2300 IF X%>1150 THEN X%=X%-38
 2310 MOVEX%,Y%
 2320 PRINTtheship$
 2330 IF F%<1 OR D%>CRASH THEN TERMINATED=999:GOTO
2440
 2340 IF RND(Z%)=5 THEN VDU19,1,2,0,0,0:SOUND0,3,2
6,10:D%=D%+(10*(U%+1)):VDU19,1,0,0,0,0:PROCscore
 2350 I%=I%+RND(4)
 2360 IF I%>E% THEN I%=0:G%=(RND(N%)-M%)
 2370 MOVEX%,Y%:PRINTtheship$
 2380 IF INKEY(-74) THEN PROCfire:F%=F%-1
 2390 Q%=0:W%=0
 2400 IF INKEY(-98) THEN Q%=Q%-O%
 2410 IF INKEY(-67) THEN Q%=Q%+O%
 2420 IF INKEY(-105) THEN W%=W%-O%
 2430 IF INKEY(-73) THEN W%=W%+O%
 2440 UNTIL TERMINATED=999
 2450 ENDPROC
```

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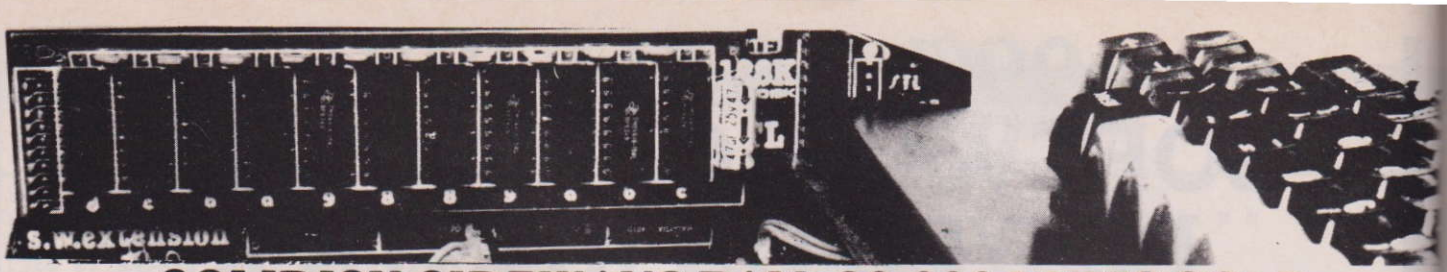

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Solidisk sideways RAM comes with lots and lots of free software (see list on opposite page). As a sideways RAM user, you will be able to get updated disks*, free local expert advice and free bi-monthly newsletters to keep you informed. Solidisk spend more than 1,000 man hours every month to produce free software for all sideways RAM users. More and more free software will be available every month.

4 — WHO USES SIDEWAYS RAM?
Solidisk sideways RAM is widely used in schools for ECONET, by programmers to develop new software, in small business systems for wordprocessing and database** and now at home, even for games. New applications are being found every day, such as moving screen memory to Sideways RAM (essential for increasing memory for VIEW and VIEWSHEET), Colour Imaging System, Teletext page logger and generator, computer typesetting etc.
Sideways RAM is such a versatile and flexible instrument that it will renew your interest continually.

5 — WHICH SIDEWAYS RAM DO YOU NEED?
Solidisk sideways RAM is available in multiples of 16k, each replacing a sideways ROM. Units are in 16k, 32k, 128k and 256k.

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Then consult the chart opposite.

You can buy a small unit to start with, and exchange it later for a larger one. Extra costs involved with upgrading are minimal. The SWR16, 16k sideways RAM is adequate for most simple tasks (running common programs or for Econet slave stations), including fast disk copying with a single disk drive.

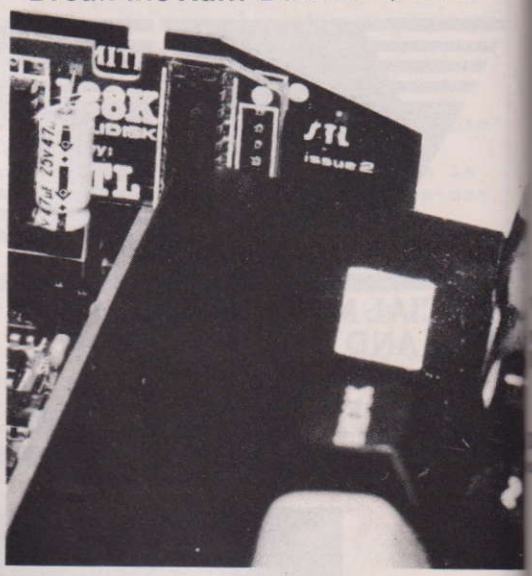
For wordprocessor: using VIEW or WORDWISE, a SWR32 will do. Large documents (20 page plus) will require something like SCRIBE and the 128k or 256k Solidisk**.

For database, unless very high speed is required, a SWR32 will suffice for most popular databases such as Beebase, Fileplus, Starbase, Datagem. Otherwise use the 128k or 256k Solidisk**. For the 6502 and the BITSTIK you will need the 256k Solidisk.

Remember — the more memory you instal inside the BBC computer, the more power you will get out of the machine.

All sideways RAM units come complete with 60+ page Sideways RAM User Manual, 1 utility diskette and 1 year warranty.

"Break the Ram Barrier" (A&B)



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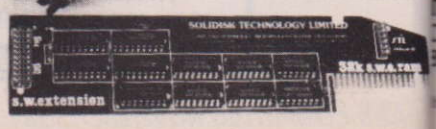

****Solidisk recommends SCRIBE and STARBASE because they exploit perfectly the inherent speed of RAM disc.** Quite often, some users try to solve a software problem (such as increasing the size of Wordwise) by a hardware solution (buying the 128k Solidisk). The better way is to buy Merlin's Scribe (or wait until we offer you one for free) and then increase its speed with the Solidisk. The situation regarding databases is much simpler as Solidisk works well with most of them (from 6 times speed increase with Beebug's Masterfile to 2 times with Starbase).

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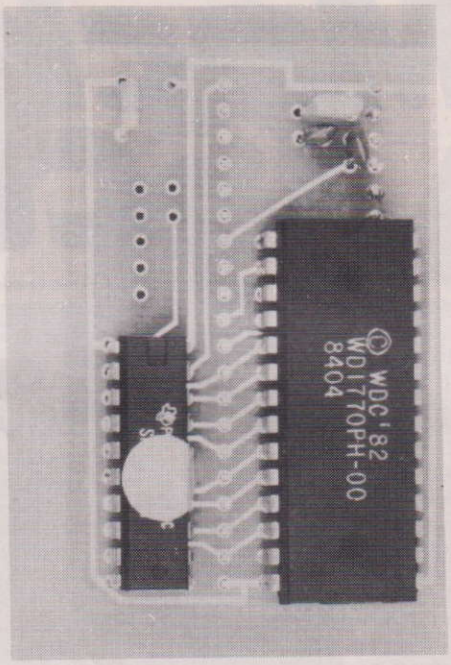

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Machine Code Capers

Peter Voke

Utilise the power of operating system routines within your own assembly programs.

If you have done any machine code assembling at all, you are likely to be familiar with at least one or two of the most useful operating system subroutines. The BBC micro gives very easy access to operating system routines, with a jump table in page &FF (right at the top of memory) for just about every routine you would ever want to use. Even though the routines themselves may move about in memory according to which operating system you have (0.1 or 1.2, for instance) these "entry points" in page &FF will not be moved, and programs using them should therefore always work, on every BBC micro.

The routines have abbreviated names, most of which are well know. OSWRCH and OSRDCH are the best known, respectively writing one character to the screen and reading one character from the keyboard. A fairly complete list of the available operating system calls is given in the User Guide, and an exhaustive list will be found in the Advanced User Guide by Bray, Dickens and Holmes (Cambridge Microcomputer Centre, 1983).

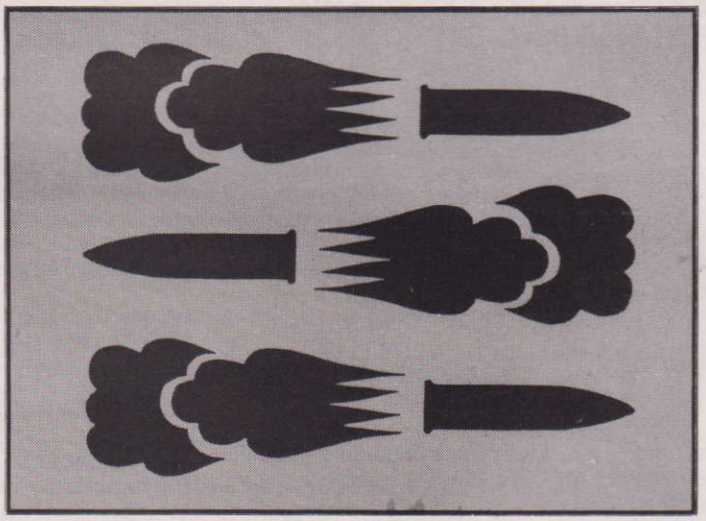
VECTORS

Several of the most commonly used operating system routines can not only be called by the machine code programmer, but can also be altered, to a limited extent, as the programmer wishes. This is possible because the routine is called through an address held in RAM (in page 2) called a "vector". For instance, the routine known as OSWRCH has its entry point at &FFE0— in other words, to use it you simply write JSR &FFEA0 in an assembly language routine. If you have a disassembler, take a look at the code at &FFE0. If not, take my word for it: at &FFE0 is the instruction JMP (&20E). This means that the machine code is switched immediately to the location pointed to by the contents of &20E and &20F. &20E and &20F contain the address where the real OSWRCH operating system routine starts.

This indirect way of entering the routine allows you, the user, to "intercept" the call. The vector address is in RAM rather than in ROM so that anyone can change it if they wish to. By changing the vector address to point to your own routine, you can replace the operating system routine by a routine of your own making.

EXAMPLE

For instance, Program 1 is a very simple example of intercepting OSWRCH — not a very useful example, admittedly, but simple to understand. First, the extra code that is going to be inserted into OSWRCH is set up. In this case it has been put at &C00, though any position would do so long as it does not interfere with anything more important.



The machine code, you will notice, does not end with an RTS normally, but with a JMP(&230) — another indirect jump. This is done because the code we are setting up at &C00 is not meant to replace OSWRCH lock, stock and barrel; rather, it is meant to end up jumping into OSWRCH and allowing the routine to do its normal job of putting a character on the screen.

Merely assembling the code at &C00 does nothing, however. It is brought into action by changing the contents of the OSWRCH vector locations at &20E and &20F (known as WRCHV for obvious reason) to point to &C000. This is done after the machine code has been assembled correctly at &C00, not before — otherwise calls to OSWRCH will jump to &C00 and find rubbish there, usually resulting in catastrophe!

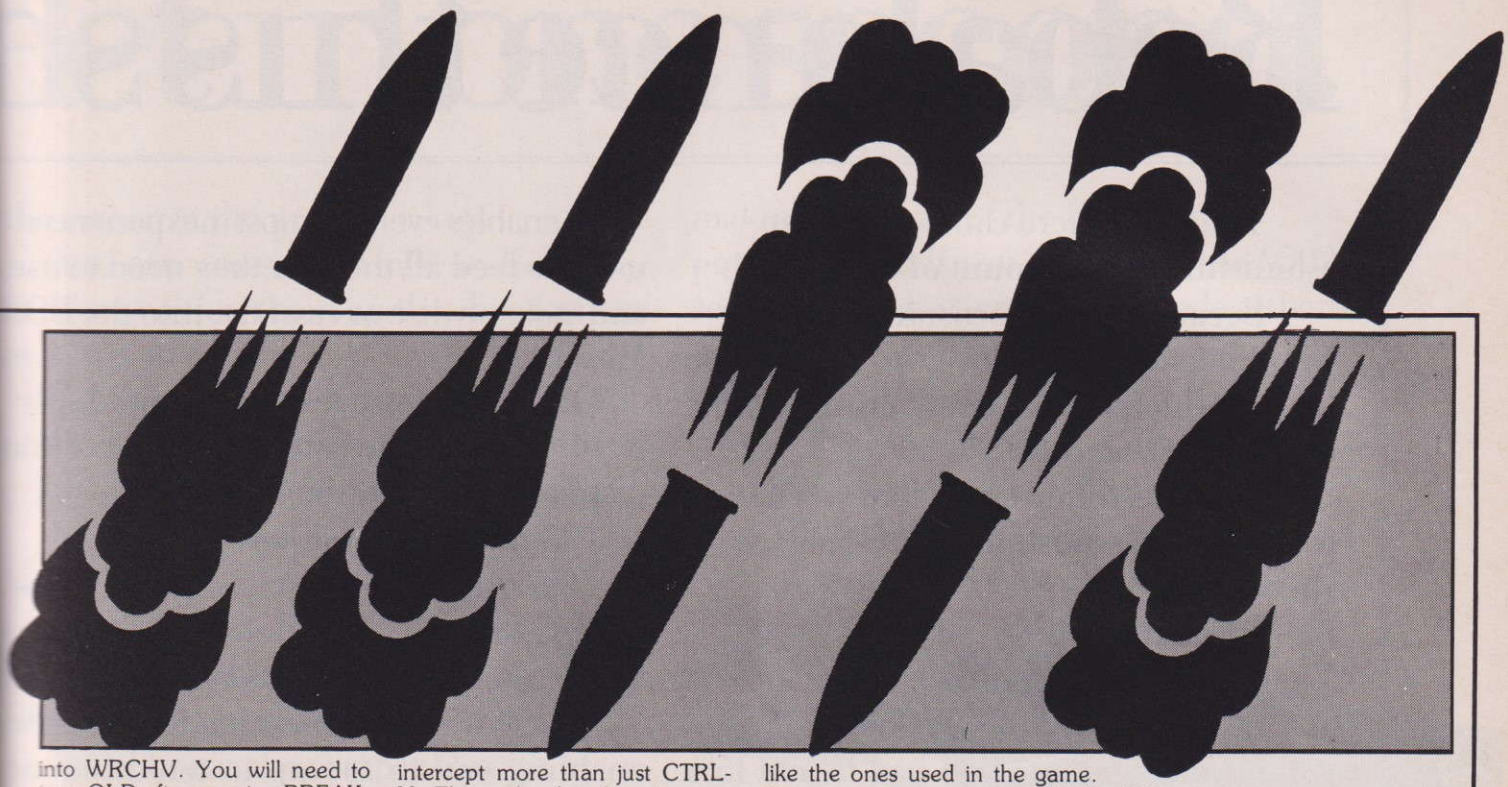
Notice also that the true OSWRCH vector address is taken out of WRCHV and placed in another location, in this case &230 and &231. This is done so that the intercept routine can eventually jump into OSWRCH by the JMP(&230). There is nothing special about the locations &230 and &231, except that they are not used for anything else important. The locations from &230 to &235 are "spare" vectors that are not used by operating system 1.2. WRCHV could just as easily have been transferred somewhere else, for instance into zero page between &70 and &8F. It doesn't matter where it is put so long as it is not going to be disturbed there, and the location is used in the intercept routine to jump into OSWRCH.

If you try running the program, you will find the computer starts to behave in a strange but predictable manner. The intercept routine simply prevents all calls to OSWRCH with values in the Accumulator less than 32 (&20) getting through. This means that characters with ASCII codes less than 32 will not be printed. This might not seem very dramatic, since all the ordinary printing characters have ASCII codes greater than 32.

So why does the intercept have the effect it does? Simply because OSWRCH not only puts visible characters on the screen, but also all the other effects like changing mode, setting up windows, paging, plotting and clearing the screen. These are all done by sending codes less than 32 to OSWRCH, in the accumulator. We all know that pressing CTRLL, typing VDU 12, PRINT CHR$(12), or CLS are (roughly) equivalent, and all clear the text screen. In the end, they all end up with the number 12 being loaded into the accumulator and OSWRCH being called, which is what you do to clear the screen in machine code.

The intercept produced in Program 1 stops all the codes less than 32 getting through, and so none of the effects mentioned above can occur. The most obvious effect, and probably the first you noticed, is that there are no proper new lines when you list the program or type anything in. This is because RETURN is character 13, and hence doesn't get through.

One warning: don't run intercept programs through twice unless you press BREAK in between. Whenever Program 1 is run, the contents of WRCHV are put into &230, and &C00 is put into WRCHV. If you run it twice, you will end up with &C00 in WRCHV and in &230 as well — so the JMP (&230) in the intercept will jump straight back to &C00 instead of going into OSWRCH. The result is an infinite loop. Pressing BREAK puts the proper vector address back



into WRCHV. You will need to type OLD after pressing BREAK.

SOME USEFUL INTERCEPTS

Program 2 is not very different from Program 1, but does do something that might be useful. It intercepts OSWRCH, but in this case capital letters are turned into lower case letters. It is amusing to be able to type "list" instead of "LIST", and not get an error message. Intercepts on OSWRCH are eliminated in usefulness because they not only prevent certain effects being produced from the keyboard, but also prevent the computer doing the same things — like changing mode, for example.

Program 3 illustrates an intercept on OSRDCH. Intercepting OSRDCH gets around some of the problems mentioned above, when the program must be able to do things like changing mode, but the keyboard must not be able to produce the same effect. The program given stops the user changing mode by typing CTRL-V, and instead outputs a period.

I suggest this might be useful for a game that has a high-score table, and which allows the player to type in a name. Without the intercept, there is nothing to stop a player typing CTRL-V and a number, and so producing a mode change! At best this would be inconvenient, but at worst it might wipe out part of the program.

In practice it is necessary to intercept more than just CTRL-V. The codes for changing text and graphics windows are also rather dangerous.

Program 4 is a little more ambitious, but its effects are rather more subtle. It is an intercept of OSBYTE, a general purpose operating system routine that does all sorts of things not covered by other routines. The *FX calls in BASIC are OSBYTE calls in machine code.

This intercept program checks the OSBYTE call with &91 (129) in the accumulator, which is not a normal *FX command but is closely related to the INKEY function in BASIC. I shall assume readers are familiar with the BASIC syntax: IF INKEY (−1) THEN ... This line checks to see whether the key with internal number 1 (the SHIFT key, as it happens) is being pressed.

The OSBYTE call with &81 in the accumulator, the Y register containing &FF, and the appropriate number in the X register, does a similar job, and is in fact used by the BASIC INKEY function.

The intercept routine in Program 4 does something rather interesting. If OSBYTE is called with A = &81, and the X register containing &FF (−1), then the routine replaces the &FF by &9D, replacing −1 by −99. −1 is the key number for SHIFT, while −99 is the number for the space bar. So any program that checks for SHIFT being pressed will respond to the space bar instead. This illustrates a quick way of changing arcade games over to your favourite keys, if you do not like the ones used in the game. The game must use OSBYTE &81, of course, though most games do.

If you want to check that the intercept works, type PRINT INKEY(−1), and keep your finger on the CTRL key as you press RETURN. Now try it again, with your finger on the space bar as you press RETURN. The computer acts quite differently before and after the intercept is in place.

PROGRAM 1

```
 10 REM PROGRAM 1
 20 REM OSWRCH INTERCEPT
 30
 40 FOR O%=0TO3STEP3
 50 P%=&C00
 60 [ OPT O%
 70 CMP #&20: BCC RT
 80 JMP (&230)
 90 .RT RTS
100 ] NEXT O%
110
120 ?&230=?&20E
130 ?&231=?&20F
140 ?&20E=0
150 ?&20F=&C
160 END
```

PROGRAM 2

```
 10 REM PROGRAM 2
 20 REM OSWRCH INTERCEPT
 30
 40 FOR O%=0TO3STEP3
 50 P%=&C00
 60 [ OPT O%
 70 CMP #&41 : BCC OK
 80 CMP #&5B : BCS OK
 90 CLC : ADC #&20
100 .OK JMP(&230)
110 ] NEXT O%
120
130 ?&230=?&20E
140 ?&231=?&20F
150 ?&20E=0
160 ?&20F=&C
170 END
```

PROGRAM 3

```
 10 REM PROGRAM 3
 20 REM OSRDCH INTERCEPT
 30
 40 FOR O%=0TO3STEP3
 50 P%=&C00
 60 [ OPT O%
 70 JSR RDCH : PHP
 80 CMP #22 : BNE RT
 90 LDA #46
100 .RT PLP : RTS
110 .RDCH JMP(&230)
120 ] NEXT O%
130
140 ?&230=?&210
150 ?&231=?&211
160 ?&210=0
170 ?&211=&C
180 END
```

PROGRAM 4

```
 10 REM PROGRAM 4
 20 REM OSBYTE INTERCEPT
 30
 40 FOR O%=0TO3STEP3
 50 P%=&C00
 60 [ OPT O%
 70 CMP #&81 : BNE BYTE
 80 CPX #&FF : BNE BYTE
 90 LDX #&9D
100 .BYTE JMP(&80)
110 ] NEXT O%
120
130 ?&80=?&20A
140 ?&81=?&20B
150 ?&20A=0
160 ?&20B=&C
170 END
```

Rebalance this sh

The BBC Micro can now give an astonishing new account of itself.

Because with Acornsoft's new 16K ViewSheet ROM, it develops a head for figures which can save you a vast amount of arduous brainwork.

Imagine, for instance, that you had to make several adjustments to a balance sheet.

If you made those adjustments on ViewSheet, it would revise the balance automatically in a split second.

Or imagine that you had to add 15% VAT to every figure on a price list containing 500 items.

ViewSheet can add the tax to each and every one of those items simultaneously. And once again, in virtually a second.

As simple as pencil and paper.

ViewSheet is a computer-based spreadsheet, the figure processing version of a word processor.

With 255 columns in width and 255 rows in depth, it's also one of the largest spreadsheets on the market.

Originating the sheet is as easy as originating an ordinary worksheet with pencil and paper.

Because ViewSheet comes with an easy-to-follow reference card.

It enables even the most inexperienced users to feed all the data they need to use, and store on disc or cassette, into the BBC Micro.

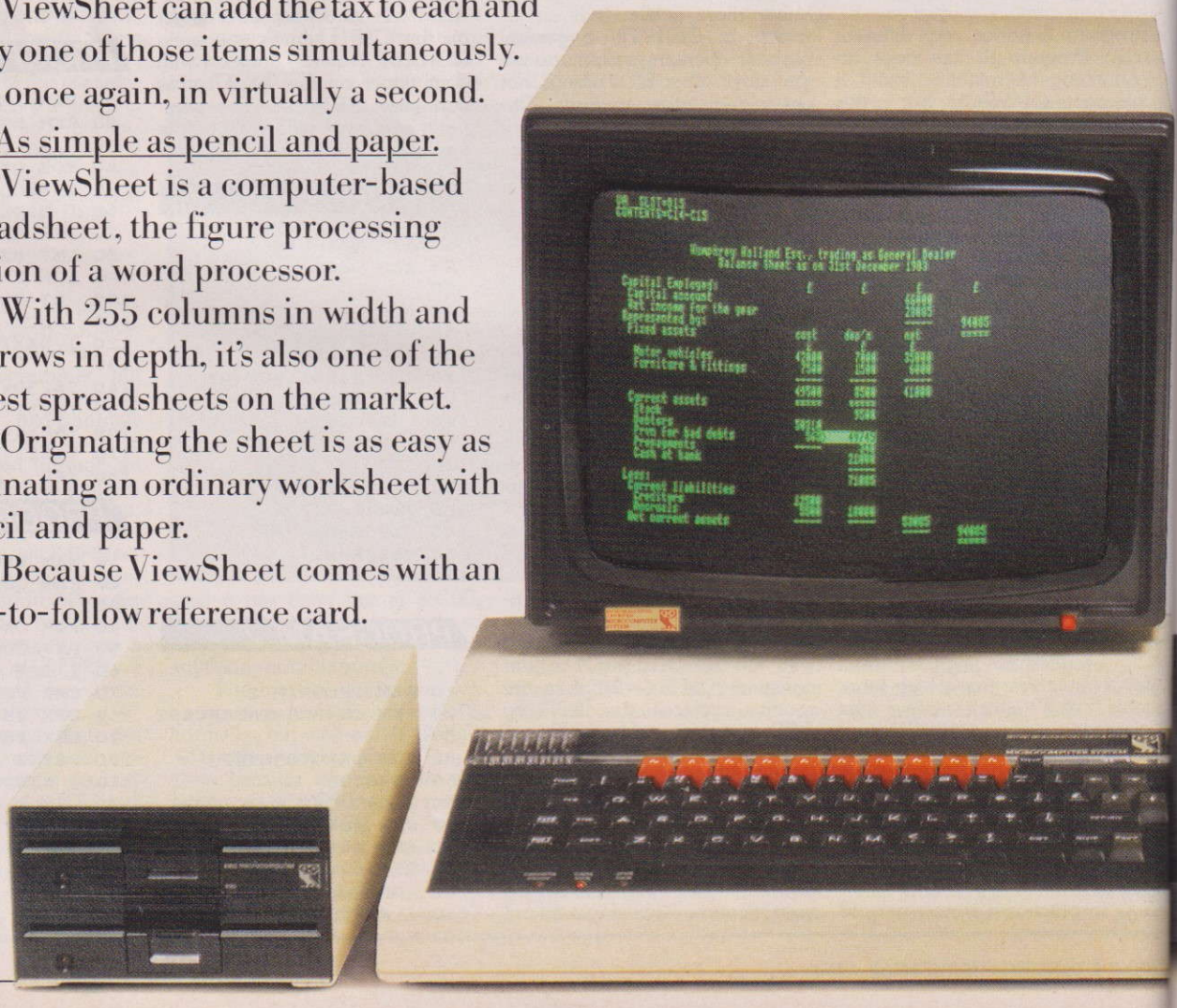
You can nominate headings and sub-headings. And you can create barcharts to display figures graphically.

Ten windows for perfect vision.

The sheer size of ViewSheet makes it impossible for the whole sheet to be visible on the monitor at once.

That's why ViewSheet has ten windows enabling you to see up to ten different sections of the sheet at any one time.

You can summon the windows onto



eet in one second.

the screen at the press of a key.

You can cross-reference sections, or even reposition them on the sheet, whenever you need to.

And you can print them out individually, as well as all together.

The possibilities are virtually endless.

By creating special disc files from ViewSheet, you can link two or more spreadsheets together. This means you can build models much bigger than the BBC Micro's considerable memory.

ViewSheet is also compatible with Acornsoft's View word-processing package. This enables you to produce reports and documents which combine text and figures.

In addition, you can use ViewSheet in any screen mode, making the most of the BBC Micro's potential. And if you use it with the 6502 second processor, you'll have no less than 30K of workspace in any mode.

For only £59.80, you too can have figures like this.

The ViewSheet ROM can be fitted by your BBC Micro dealer in less than three minutes. And with its straightforward user guide, function key card and reference card, it'll soon have you juggling figures at lightning speed.

Indeed, at only £59.80, it's an invaluable asset for anyone involved in professional or personal finance, forecasts, formulae and analysis.

Pixie

D. Guest

Create colourful graphics and illustrate your own programs with this teletext editor.

Pixie is a program for making pictures on your television or monitor screen. Full instructions are included in the program so just type it in and away you go!

PIXIE AT WORK

The program enables Mode 7 pictures to be created on the screen by making available the basic shapes (pixels) in the bottom window of the screen (1140-1160) and allowing the user to 'take' pixels to the upper window of the screen and to 'drop' them. The COPY key is used to take/drop (1300-1310). The cursor keys control movement (1240-1280) and DELETE rubs out the pixel at the current cursor position (1290). The function keys provide an added facility for O.S. 1.2 owners.

The special teletext control codes which set colour, flash, size and so on, can also be inserted anywhere on the picture. Selecting the control code section from the command menu (1180, 460-600) assigns a control code to the COPY key and allows the cursor and DELETE keys to operate as before (640-880). This section also tells you what control code if any is at the current cursor position (820-830).

Control codes are explained in the User Guide pages 150-155 and summarised on page 489. Use of this program is an excellent way of seeing the effect of each of these codes.

Finally, a utilities section allows pictures to be SAVEd and LOADed from tape by dumping the relevent screen memory section. This provides permanent storage of your masterpieces and is a useful development tool for designing title pages, graphic adventures etc (1359-1420).

The utilties section is expandable. Facilities such as picture scrolling, copying of screen memory to other unusual pages of memory, printer dumps etc should be placed here.

As written, there is a considerable amount of free memory remaining. The program should RUN unaltered on Model A machines.

ARRAYS AND VARIABLES

A$	control code descriptions.
C$	commands (main menu choices).
K%	pixel codes assigned to function keys (O.S.1.2 only).
X%,Y%	cursor position.
XX%,YY%	save cursor position while control code processing is in operation and reset it when pixel processing restarts.
Z%	pixel code currently associated with copy key.
C%	current control code.
S%	value of pixel or control code on screen at current cursor position.
G	last key pressed.
I%	FOR...NEXT loop control variable.
CL%	number of available command lines (menu options).

FEATURES

Those pixels considered to be the ten most used ones can be assigned to function keys 0 to 9 and added to the picture simply by pressing the relevant key. To accomplish this, the base value of the keys is changed (line 190) and the pixels defined in DATA at line 280. Relevant pages of the User Guide are 489 for pixel codes and 439 for *FX commands.

If desired, SHIFT-function key and ctrl-function key could also be used in this way to give up to thirty presets. Why not make your own function key strip to indicate the effect of each key?

Name of PROC	
i	Initialise variables and arrays.
d	Driver — operates the command selection procedure.
c	Command selection leading to pixel processing, utilities or end.
plist & pdraw	Pixel processing — display available pixels in bottom window of screen and allow pick and drop in top window via cursor and copy keys. Also allows function keys to directly insert pixels (O.S. 1.2).
cd, curr & next	Control code processing — cd allows selection of new control code using next to skip past invalid codes. curr displays currently selected code.
u	Utilities to SAVE and LOAD pictures to and from tape (or disc).
bw	Clears bottom window of screen.
end	Resets cursor and COPY keys to normal editing function if end of session is selected.

PROGRAM LISTING

```
 10 REM PIXIE ** MODE 7 PICTURE DESIGNER
 20 REM by D. GUEST , March 1984
 30MODE7
 40ON ERROR GOTO 80
 50PROCi:REM initialise
 60PROCd:REM driver
 70END
 80IF ERR=17 THEN 60 ELSE REPORT:PRINT'ERL
 90 REM RESET FUNCTION KEYS
100*FX225,1
110 REM RESET ARROW & COPY KEYS
120*FX4,0
130 END
135
140DEFPROCi
150 REM ENABLE ARROW & COPY KEYS
160 *FX4,1
170 REM CHANGE FUNCTION KEY CODES
180 REM ** ( O.S. 1.2 ONLY )
190*FX225,162
200I%=255
210C%=145
220VDU30
230 FORI%=1TO18:VDU148,157,147,234,13,10:NEXT
240VDU31,39,0
250FORI%=1TO18:VDU181,8,10:NEXT
260DIM A$(255),C$(3),K%(9):CL%=4
```

```
  270REM Function key codes
  280DATA 255,254,253,248,244,171,167,161,162,252
  290FORI%=0TO9:READK%(I%):NEXT
  300 REM Control Codes
  310FOR I%=129TO159:READA$(I%):NEXT
  320FOR I%=129TO135:A$(I%)="Alpha"+CHR$I%+A$(I%):NEXT
  330FOR I%=145TO151:A$(I%)="Graphic"+CHR$I%+A$(I%):NEX
T
  340DATARed,green,yellow,blue,magenta,cyan,white
  350DATAFlash,Steady,,,Normal Height,Double Height,,,,
RED,GREEN,YELLOW,BLUE,MAGENTA,CYAN,WHITE
  360DATAConceal Display,Contiguous Graphics,Separated
Graphics,,Black Background,New Background,Hold Graphics
,Release Graphics
  370FORI%=0TOCL%-1:READC$(I%):NEXT
  380DATASet Control Codes,Set PIXELS,Utilities,END
  390I%=0:X%=20:Y%=10
  400ENDPROC
  405
  410DEFPROCd
  420REPEAT
  430PROCc
  440UNTIL 0
  450ENDPROC
  455
  460DEFPROCc
  470PROCbw
  480PRINT'"Scroll Command line using SPACE bar.      Pr
ess RETURN to activate command"
  490REPEAT
  500I%=(1+I%) MOD CL%
  510VDU31,0,4:PRINTSPC(38);:VDU13:PRINT"COMMAND: ";:VD
U157,135,132
  520PRINTC$(I%)" "CHR$156;
  530REPEAT G=GET:UNTIL G=32 OR G=13
  540UNTIL G=13
  550VDU26
  560IFI%=0 PROCcd
  570IFI%=1 PROCplist:PROCpdraw:I%=-1
  580IFI%=2 PROCu:I%=I%-1
  590IFI%=3 PROCend
  600ENDPROC
  605
  610DEFPROCbw
  620VDU26,28,0,24,39,18,12
  630ENDPROC
  640DEFPROCcd
  650PROCbw
  660*FX15,1
  670PRINTSPC(8)"SET CONTROL CODES:"'"ARROWS move curso
r, COPY inserts code.  SPACE selects next value for COP
Y"'"Current COPY Code : "'"Code at cursor is :";
  680XX%=X%:YY%=Y%
  690IFY%>17 Y%=17
  700VDU26,31,X%,Y%
  710PRINTTAB(0,24);CHR$157CHR$132" M for COMMAND MENU
"CHR$156;
  720PROCcurr
  730G=0
  740REPEAT
  750IFG=32 C%=C%+1:PROCcurr
  760IFG=127 VDU32,8
  770IFG=135 VDUC%,8
  780IFG=136 X%=(X%+39)MOD40
  790IFG=137 X%=(X%+1)MOD40
  800IFG=139 Y%=(Y%+17)MOD18
  810IFG=138 Y%=(Y%+1)MOD18
  820S%=?(HIMEM+40*Y%+X%)
  830VDU31,20,23:PRINTSPC(19)STRING$(19,CHR$8);A$(S%);:
IFLENA$(S%)=0 PRINT"Not a control code";
  840VDU31,X%,Y%
  850G=GET
  860UNTIL G=77
  870X%=XX%:Y%=YY%
  880ENDPROC
  885
  890DEFPROCcurr
  900IFLENA$(C%)=0 PROCnext
  910VDU31,20,22:PRINTSPC(19)STRING$(19,CHR$8);A$(C%);
  920VDU26,31,X%,Y%
  930ENDPROC
  935
  940DEFPROCnext
  950IFC%>159 C%=129
  960IFC%=138 C%=140
  970IFC%=142 C%=145
  980IFC%=155 C%=156
  990ENDPROC
  995
 1000DEFPROCend
 1010PROCbw
 1020PRINT'" END ???"''"Y to confirm, any other key to
continue"
 1030*FX15,1
 1040G=GET
 1050IFG<>89 G=0:ENDPROC
 1060*FX4,0
 1070VDU26,12
 1080END
 1090ENDPROC
 1095
 1100DEFPROCplist
 1110PROCbw:VDU26
 1120PRINTTAB(4,18)"use ARROW keys to move cursor"
 1130PRINTTAB(0,19);CHR$151SPC(7);:FORI%=161TO175:VDUI%
,32:NEXT
 1140PRINTTAB(4,20);CHR$151;:FORI%=176TO191:VDUI%,32:NE
XT
 1150PRINTTAB(5,21);CHR$151;:FORI%=224TO239:VDUI%,32:NE
XT
 1160PRINTTAB(4,22);CHR$151;:FORI%=240TO255:VDUI%,32:NE
XT
 1170PRINTTAB(4,23)"use COPY to Take/Drop pixels"
 1180PRINTTAB(4,24);CHR$157CHR$132" M for COMMAND MENU
"CHR$156;CHR$136CHR$147;
 1190PRINTTAB(30,24)CHR$Z%" STORED";
 1200ENDPROC
 1205
 1210DEFPROCpdraw
 1220VDU31,X%,Y%
 1230REPEATG=GET
 1240IFG=136 X%=(X%+39)MOD40
 1250IFG=137 X%=(X%+1)MOD40
 1260IFG=139 Y%=(Y%+24)MOD25
 1270IFG=138 Y%=(Y%+1)MOD25
 1280VDU31,X%,Y%
 1290IFG=127 AND Y%<18 VDU32,8
 1300IFG=135 AND Y%>18 Z%=?(HIMEM+40*Y%+X%):VDU31,30,24
:PRINTCHR$Z%" STORED";:VDU31,X%,Y%
 1310IFG=135 AND Y%<18 VDUZ%,8
 1320IFG>161 VDUK%(G-162),8
 1330UNTIL G=77
 1340ENDPROC
 1345
 1350DEFPROCu
 1360PROCbw
 1370PRINT'"Type S to save picture"'"     L to load pic
ture from tape."''"Any other key for Command menu."
 1380*FX15,1
 1390G=GET
 1400IFG=83 THEN *SAVE"PICTURE" 7C00 +300
 1410IFG=76 THEN *LOAD"PICTURE"
 1420ENDPROC
```

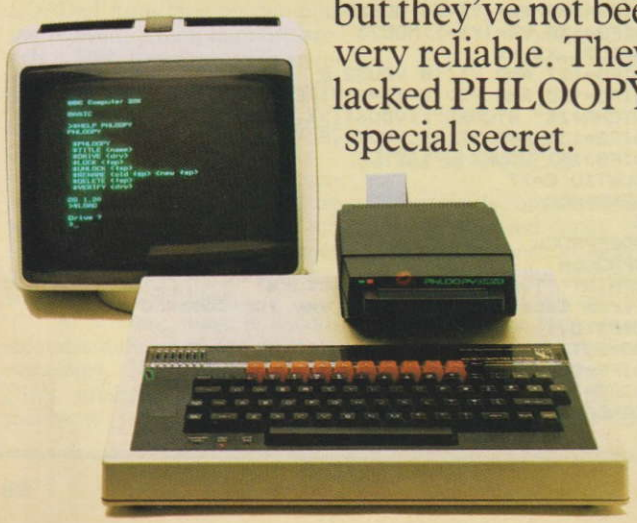
EUREK

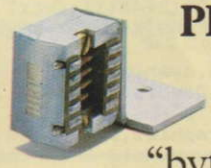
A 100k BBC-drive for £99 + VAT

We've done it! We've built a mass storage system for your BBC Micro with the power and convenience of a floppy disk drive, but at a fraction the price. Get to know PHLOOPY, the remarkable new 100k drive that costs only £99 plus VAT, and a further £26 plus VAT for the interface to your BBC, operating system and connecting cables.

How PHLOOPY does it

PHLOOPY does not use disks to store data, but a 12-foot loop of professional-quality quarter-inch magnetic tape contained in a robust cartridge. The drive has only one moving part, the motor which drives the tape loop – hence the low price and high reliability. As the loop is driven round, each file of data it contains passes across the magnetic head which reads it or writes to it. Other people have produced tape loop micro-drives, but they've not been very reliable. They lacked PHLOOPY's special secret.





PHLOOPY's special secret

The heart of the invention is a brilliantly designed "byte-wide" magnetic head, made by Phi Magnetronics who build multi-track heads for professional use. PHLOOPY's head records and reads nine tracks across the width of a quarter-inch tape. That means the tape loop can be much shorter, so the typical time to access a file is reduced to a mere 3 seconds. If you're used to waiting for a cassette tape to trundle programs into your BBC, you'll be amazed at PHLOOPY's performance.

Getting it right every time

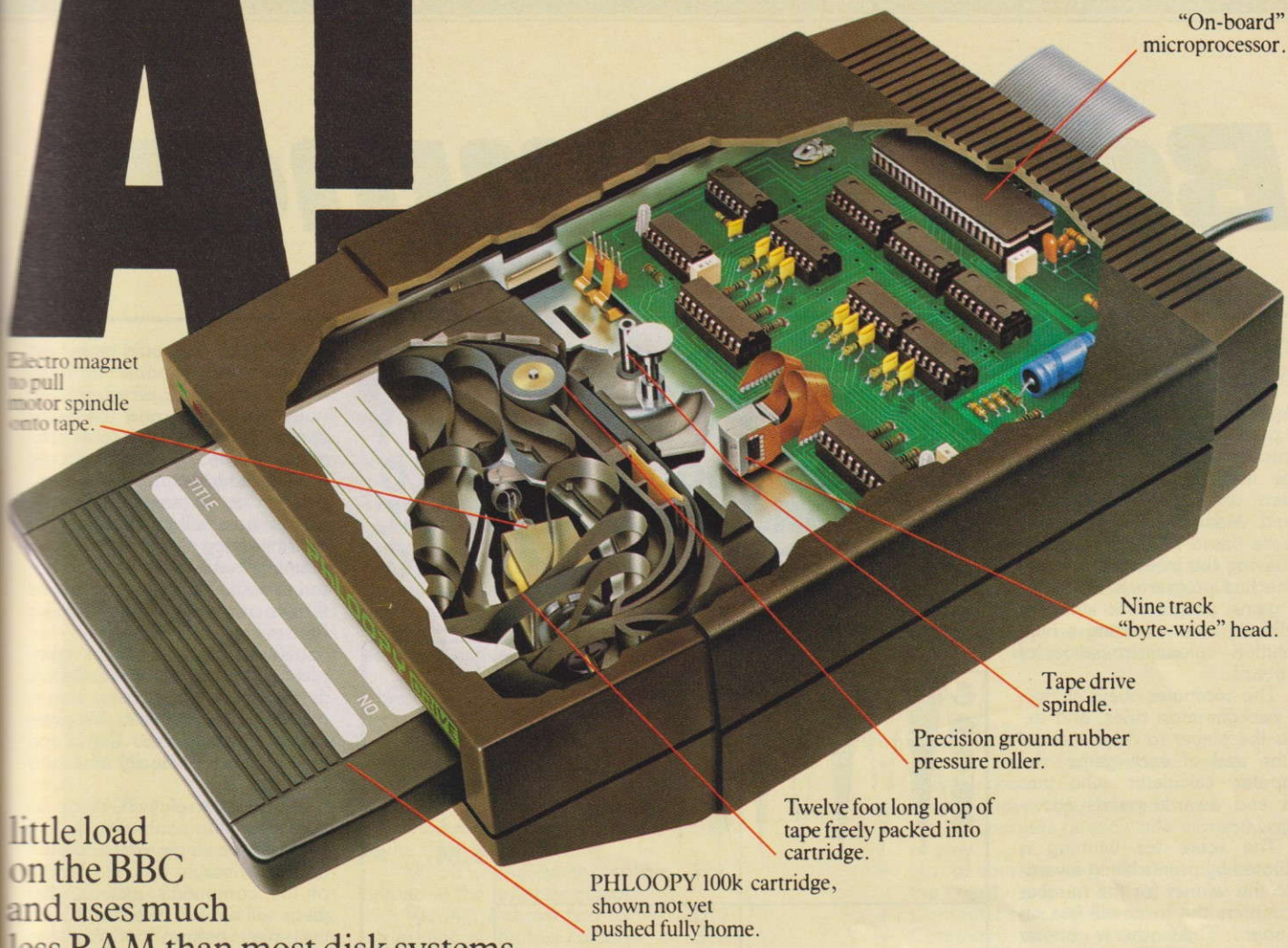
In addition, we've included a feature we know you will appreciate. PHLOOPY has full error detection and correction, so you can be certain you will get back what was originally written onto the tape.

Talking to your PHLOOPY

PHLOOPY's own software, contained in ROM, responds to standard BBC filing system and Basic commands. Most programs written to run on disk or cassette should run on PHLOOPY without problem.

And because PHLOOPY contains its own intelligent microprocessor – a second computer which does most of the hard work – PHLOOPY puts very

A



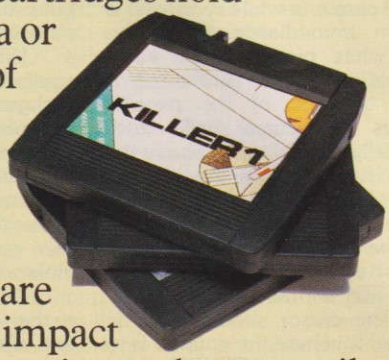
little load on the BBC and uses much less RAM than most disk systems.

Installing PHLOOPY on your BBC

You'll be amazed how simple it is to install PHLOOPY. Just plug in the interface cut two resistors (clearly marked in the instructions) and the job is done. If you should have problems our engineers are waiting to help you.

Making a PHLOOPY Library

PHLOOPY cartridges hold a full 100k of data or programs. Two of them come free with the drive and extra ones cost £3.75 each plus VAT. They are moulded of high impact polymers for protection and store easily on a bookshelf. Many programs will be available to purchase on PHLOOPY.



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- Please send me_____(qty) PHLOOPY starter pack(s) for my BBC Model B microcomputer, including PHLOOPY drive, BBC interface, leads, connections, operating system in firmware, manual, and two PHLOOPY 100k cartridges, at £147.75 each including VAT, postage and packing.
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  Amount £_____

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A&B

Backgammon

P.J. Kenworthy

Are you good enough to out-manoeuvre your BBC in this game of luck and skill?

BBC Backgammon is player/computer interactive simulation of the popular game of backgammon. The program is in two parts, the first containing the instructions and the second the game itself. The program was written on a DFS system so should naturally work on a cassette based BBC. The reason for having the instructions based in the first program is to enable the game program to work in MODE 1, thus providing a high resolution colour simulation of the board.

The computer obeys all normal backgammon rules, and expects the player to do the same! At the end of each game, the computer calculates who has won and awards points accordingly.

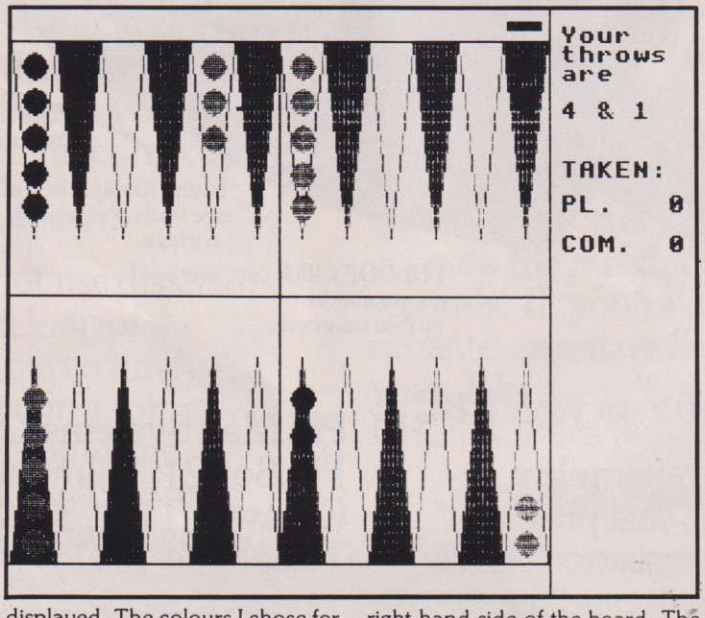
The score for winning is evaluated by points being awarded to the winner for the number of counters the loser still has on the board. The further a counter is from the destination point the more points it scores for the winner. (Since the player always plays white, the destination point is the right hand point in the player's inner table.) This program is for those who can already play backgammon. Available memory did not allow a teaching guide to be included.

As I stated earlier, the program was designed on a DFS system. To enable MODE 1 to be used PAGE had to be lowered from &1900 to &1388. This would not be necessary if the program was being run on a cassette filing system, so for those with such a system, line 200 in Program 1 can be ignored.

INSTRUCTIONS FOR USE

When program 1 has been loaded and run, the user is offered instructions. These are fairly rudimentary and just cover the bare essentials necessary in order to play. Should the user not wish to read the instructions or has finished reading them, then the main program BACKGAMMON is chained in.

Once this has been loaded in, the board is immediately displayed. The colours I chose for the board may appear on a colour screen to be rather dull, but these were the combination which showed up best on a green screen monitor. At present the points are coloured cyan, the player's counters white and the computer's green. These can of course be changed by the user and I shall explain how in due course.



Providing everything has been typed in correctly, the player is now expected to enter his/her moves. (The player always moves first.) This is done by using f0, f1 and the RETURN keys. Should the player ever be in a situation where he/she cannot move, the move may be abandoned by pressing SPACE-BAR and the computer will play its moves.

The dice throws are shown in the game displays area on the right hand side of the board. The number of pieces currently out of play are also shown below the dice throws. These will start at nought and consequently need not be worried about at the beginning of the game.

The player should move his pieces in the following way. The game cursor (a white rectangle) is shown immediately above the two white pieces in the computer's inner table. (At the beginning of each of the player's moves the cursor will automatically be positioned above the piece furthest from the player's inner table.) The player should move the cursor using f0 and f1 to the position of the piece he/she wishes to move. RETURN should then be pressed. The cursor should then be moved to where the counter is to be moved to and RETURN pressed again. Providing the move is legal, the piece should be moved on the screen. Should an illegal move be entered, a high pitched noise will sound and the game cursor will move back to its starting position. The player should then re-enter the move. Once the player has moved, the game display area will change to show the remaining dice throw. The remaining move should then be input as above. Should a double be thrown, the player has to enter four moves.

Once this has been completed, the computer will display its dice throws and carry out its moves, indicating with the game cursor where it is moving to and from, before it actually moves its counters.

Should a player's piece be taken by the computer (i.e. a point with a single white counter on, be moved to by one or more of the computer's pieces), that piece will have to be brought back into play before the play can carry out any ordinary moves. If a piece is taken, the number in the pieces taken display area will be incremented by one. Should the player attempt to carry out an ordinary move while one or more of his counters are out of play, the illegal move tone will sound.

To move a piece back into play, the user should move the game cursor to the point where the counter is to come back into play and press RETURN once. Providing that the move is legal, the counter will be brought back into play on that spot. Remember that only the six points in the top right hand corner of the board can be used to bring the player's pieces back into play. The computer uses the bottom right hand six points.

I should mention here a rule applicable to this version of backgammon which is sometimes not played to; that being that there is a maximum of five counters allowed on any point at any one time. This, in my mind, serves to heighten the difficulty of the game and consequently makes it more interesting.

The only other point to note is the entering of moves at the end of the game when the player has to cast his/her pieces off the board. This is carried out in the

following manner. The game cursor is positioned beneath the point where a counter is to be removed from. RETURN should then be pressed twice. If the move is legal, a counter will be removed from that point.

The game is won when either the computer or the player has removed all of their counters from the board. The computer then declares who has won, how many counters the loser still has on the board and the updated scores. The computer then asks if the player wants another game. If yes, a new game is started, otherwise the program ends.

BBC Backgammon works on 32K Model A and an Electron.

MODE 1: Graphics mode 1, using 20K of memory and offering four colours, a text resolution of 40 × 33 and a graphics resolution of 320 × 256.

MODE 7: The teletext mode on the BBC Computer, offering a text-only format of 40 × 25. In this mode CHR$141 generates double height characters, CHR$136 causes the line it is used in to flash on and off, CHR$129 to CHR$135 produces text of different colours whilst CHR$157 and CHR$156 are used to alter the background colour.Defaults to Mode 6 on Electron.

VDU19,X,Y,0,0,0 : Command telling computer to change logical colour X to Y.

VDU23,x,x,x,x,x,x,x,x : Creates user defined characters.

VDU23;8202;0;0;0; : Turns the flashing cursor off.

PROCyyyy : Carry out procedure yyyy. Can be replaced by GOSUB/RETURN on other systems. However PROC.... runs faster.

*FX15 : Flushes the keyboard buffer.

INKEY(−x) : Used to see whether a specific key has been pressed.

PRINTTAB(X,Y) : Print at horizontal position X and vertical position Y.

VDU28,X,X,X,X : Sets up text window in a defined section of the total screen area.

VDU5 : Enables text to be printed at the graphics cursor.

VDU4 : Returns text to being printed at the text cursor.

VDU22,X : Change to MODE X.

MOVE X,Y : Moves the graphics cursor to horizontal position X and vertical position Y.

GCOL0,X : SEts colour of graphics to logical colour X.

PLOT 85,X,Y : Complete and fill in a triangle between the last two points visited and X,Y.

PROCEDURES USED

PROCSETUP	Draws game board using data stored at end of program. Draws counters in correct colours and starting positions.
PROCsearch(A)	Reads all relevant data regarding point A on the board.
PROCcursor(A)	Draws game cursor above/below point A, using data obtained from PROCsearch(A).
PROCoff	Displays no. of pieces of each side which have been taken.
PROCLEGAL	Used primarily to check legality of player's moves. In addition, registers unusual moves such as casting off and the bringing of counters back into play.
PROCMOVE	Re-draws the points which the player has moved from and to, then draws on each, the new number of counters.
PROCPAUSE(A)	Adjustment pause, used when the player is moving the game cursor, in order to equalise the speed of its movements.
PROCHELP	Routine used by computer when it has to bring pieces back onto the board.
PROCCHECK(A)	Depending on value of A, this routine checks to see how near the player/computer is to casting off at the end of the game.
PROCFINISH	Used by computer to determine which piece to cast off with a particular dice throw.
PROCWAIT(A)	Pause for specified time A.
PROCREMOVE(A)	Completely removes point A and all counters on it.
PROCDRAW(A)	Draws point A using co-ordinates obtained from PROCsearch(A). The point is coloured in if A is odd.
PROCdisc(A,B,C)	Draws relevant number of counters on point A in appropriate colour.

VARIABLES

SPECIALISED VARIABLES

P(A,B)	=	Position array of all computer's and player's counters.
M()	=	Players move (from and to).
S()	=	No. of counters of each side currently out of play.
F()	=	No. of counters each side has played off the board.
D()	=	Computer's dice throws.
SC()	=	Computer's and player's score.
D1,D2	=	Player's dice throws.
IL	=	Flag used to indicate illegal move.
FIN	=	Value of counter furthest from home base.
M%,M1%,M2%	=	Variables which the computer uses to decide its move.
BASE%	=	Height value for which top and bottom lines of display are drawn.
H%	=	Height value for when top of individual points are drawn.

SPECIAL STRINGS

A1$,A2$	=	Strings which are used to draw the individual counters.
D$	=	String in which the current dice throws of computer and player are stored.

GENERAL VARIABLES
Z%, Z, PS%, AP, N, ZZ, XX, KK, N%, W%, A%, B%, C%, D%, C, AA%, Q, CT%, T%, W, A, A1
GENERAL STRINGS
A$

PROGRAM STRUCTURES

PROGRAM ONE

10 - 60	: Display titles and offer instructions.
70 - 190	: Print instructions.
200	: Reset PAGE for DFS systems.
210	: Load in main program.

PROGRAM TWO

10:	Dimension necessary variables.

CONTINUED OVER

20	: Set initial co-ordinates for game cursor.
30 - 80	: Define user-defined characters.
100	: Reset logical colours. It is at this point in the program that the colours should be changed if a colour monitor is being used.
110	: Turn cursor off.
130	: Choose player's dice throws and set up text window.
140	: Start player's move loop.
150	: Check to see if the player has finished moving his/her pieces off the board.
160	: Move game cursor to position (PS%) where the player's furthest counter currently is.
170	: Check to see whether any of the player's pieces are currently taken.
180	: Display player's dice throws.
190 - 200	: Begin loop for the entering of each of the player's moves.
210 - 250	: Check to see whether any of the game keys has been pressed.
260	: Check whether player's move is legal, if so, change the relevant variables and update the screen.
270	: If a double has been thrown repeat the whole loop.
290	: Move game cursor.
310	: Choose computer's dice throws.
320	: Check to see whether computer has won the game.
330	: Begin computer moves loop.
350	: Check whether any of the computer's pieces are currently out of play.
360	: Computer checks to see whether all of its pieces are in its inner table. If so, the clearing off procedure is carried out.
370 - 460	: Computer attempts to work out the best available moves with its dice throws. The best move will be stored in one of M, M1 or M2.
470 - 490	: Indicate with game cursor where the computer is moving from and to.
500 - 530	: Adjust position variables for the move and display revised points on screen.
540	: If the computer's throws were a double then repeat the main loop.
570 - 580	: Check to see whether it is possible to bring a piece back into play with the given dice throws. If not abandon turn.
590 - 600	: Investigate whether it is possible to bring a piece back into play and take a player's piece at the same time. If so, do it!
610 -640	: Choose which throw to use to bring a piece back into play from and adjust position variables.
650 - 670	: Ensure that the computer does not use that dice turn again and display counter in new position.
710 - 750	: Evaluate how close a side is to bearing off at the end of a game.
780	: Print current number of pieces taken in display area.
810	: Set up position variables for starting a new game.
820 - 840	: For each of the twenty four points on the board, read the position co-ordinates and draw the points in the relevant places and colours. If there are counters on any particular point then draw them.
850 - 860	: Draw in the board outline.
890 - 910	: Search for and obtain the co-ordinates used to draw any point.
940 - 950	: Delete game cursor at old position and draw it at the new one.
990 - 1010	: Differentiate as to whether the point to be drawn should be coloured in or not. Draw it accordingly.
1040 - 1050	: Delete a whole point and everything on it. (Achieved by drawing two black triangles in the form of a rectangle).
1090 - 1140	: Draw the relevant number of counters on a point, in the correct colour.
1200 - 1360	: Check legality of player's move. In addition adjust position variables if one of the computer's pieces has been taken or the player has brought a piece back into play.
1380	: Sound tone if illegal move attempted.
1420	: Carry out routines necessary to move a player's piece on the board.
1480 - 1500	: Work out the number of points the winner has gained.
1550	: Offer new game.
1570	: Reset relevant variables to initial values for new game.
1600	: Computer checks to see whether it can remove one of its pieces from the board.
1620	: If a piece can be removed, do so, then redraw relevant pointer.
1640 - 1670	: Game data.
1700	: Carry out special pause routine.
1740	: Carry out specified pause.

PROGRAM LISTING 1

```
   10 MODE7
   20 FORN=1TO2:PRINTTAB(8);CHR$141;CHR$130;CHR$15
7;CHR$129;" BBC BACKGAMMON   ";CHR$156:NEXT
   30 FORN=1TO2:PRINTTAB(7,8+N);CHR$141;CHR$130;"(
C) P.J.Kenworthy 1984":NEXT
   40 FORN=1TO2:PRINTTAB(2,14+N);CHR$141;CHR$131;"
Do you want instructions (Y/N) ?";:NEXT
   50 A$=GET$:IFA$<>"Y" THEN 190
   60 CLS:FORN=1TO2:PRINTTAB(6);CHR$141;CHR$130;"I
nstructions for use":NEXT
   70 PRINT'"This game actually involves the playe
r  playing the computer at Backgammon, witha score
card kept as games go by."
   80 PRINT'"The Player always plays white and alw
aysmoves first. All moves entered are      checked
 for their legality.If an illegalmove is made a hi
gh tone will be heard  and the move must be re-ent
ered."
   90 PRINT"The game played here observes the rule
  that there can be no more than five     pieces o
n any point at any time. Either side may take piec
es, and these must    be brought back into play ac
cording to  the usual rules of the game"
  100 PRINT'"The winner gains points from the numb
er of the opponent's counters left on the  board.
```

```
The further a counter is from thelast point the mo
re points it scores."
  110 PRINT'TAB(11);CHR$136;"PRESS ANY KEY";:A$=GE
T$:CLS
  120 PRINT"The moves are entered as follows:-"
  130 PRINT'TAB(5);"SPACEBAR....Abandon turn"
  140 PRINTTAB(5);"fo and f1...Move game cursor"
  150 PRINTTAB(5);"RETURN......Register move."
  160 PRINT'"To move a piece, move the game cursor
 tothe piece's current position.Press       RETURN,
 then move the cursor to where   the piece is to m
ove to. Press RETURN   again."
  170 PRINT"To bring a piece back into play, move
  the game cursor to where the piece is tobegin pl
ay from then press RETURN."
  180 PRINT"To cast a piece off of the board at th
e end of the game, the player should       position
 the game cursor on the piece tobe removed and the
n press RETURN twice."
  190 PRINT':FORN=1TO2:PRINTTAB(6);CHR$136;CHR$141
:CHR$131;"Loading Main Program":NEXT
  200  PAGE=&1388
  210  CHAIN"GAMMON"
```

PROGRAM LISTING 2

```
   10 DIMP(24,2),M(2),S(2),F(2),D(5),SC(2)
   20  X1%=1100:Y1%=100
   30 VDU 23,225,0,0,1,7,15,31,31,63
   40 VDU 23,226,0,0,128,224,240,248,248,252
   50 VDU 23,227,63,31,31,15,7,1,0,0
   60 VDU 23,228,252,248,248,240,224,128,0,0
   70 VDU23,229,0,0,255,255,255,255,0,0
   80 A1$=CHR$225+CHR$226:A2$=CHR$227+CHR$228
   90 MODE1
  100 VDU19,1,2,0,0,0,19,2,6,0,0,0
  110 VDU23;8202;0;0;0;
  120 PROCsetup
  130 XX=0:D1=RND(6):D2=RND(6):VDU28,32,30,38,2:CL
S
  140 D$=STR$(D1)+" & "+STR$(D2):FORZ=1TO2
  150 IFF(2)=15 GOTO1440
  160 Z%=24:REPEAT:Z%=Z%-1:UNTILP(Z%+1,2)>0 OR S(2
)>0:PS%=Z%+1:PROCsearch(PS%):PROCcursor(PS%)
  170 IFS(2)>0AP=1ELSE AP=2
  180 CLS:PRINT"Your"'"throws are"''D$:PROCoff:IF
D1=D2 PRINT''"Double"
  190 FORN=1TOAP:IL=0
  200 FORZZ=1TO1000:NEXT:*FX15
  210 IFINKEY(-114)ANDPS%<24 PS%=PS%+1:GOTO290
  220 IFINKEY(-74)THEN260
  230 IFINKEY(-99) Z=2:NEXTZ:GOTO310
  240 IFINKEY(-33)ANDPS%>1 PS%=PS%-1:GOTO290
  250 GOTO210
  260 M(N)=PS%:SOUND1,-10,25,5:NEXTN:PROCLEGAL:IFI
L=1 GOTO160 ELSE P(M(1),2)=P(M(1),2)-1:P(M(2),2)=P
(M(2),2)+1:PROCmove:NEXTZ
  270 IFD1=D2 AND XX=0 CLS:XX=1:GOTO140 ELSE GOTO3
10
  280 GOTO210
  290 SOUND1,-7,45,2:PROCsearch(PS%):PROCcursor(PS
%):PROCPAUSE(PS%):*FX15
  300 GOTO210
  310 XX=0:D(1)=RND(6):D(2)=RND(6):D(3)=D(2):D(4)=
D(1):D(5)=D(2):D$=STR$(D(1))+" & "+STR$(D(2))
  320 IFF(2)=15GOTO1440
  330 FORZ=1TO2
  340 CLS:PRINT"My"'"throws are"''D$:PROCoff:IF D(
1)=D(2) PRINT''"Double"
  350 IFS(1)>0THENPROCHELP:GOTO530
  360 PROCCHECK(1):IFFIN<19 GOTO370 ELSE KK=F(1):P
ROCFINISH:IFF(1)=15 THEN1440 ELSE IFKK<>F(1) THEN
530
  370 M%=0:M1%=0:M2%=0:N%=1:REPEAT:IFP(N%,1)>0 AND
 P(N%+D(Z),2)=1 ANDN%+D(Z)<19 M%=N%
  380 IFP(N%,1)=1 AND P(N%+D(Z),2)<2 AND P(N%+D(Z)
,1)<5 AND M1%=0 M1%=N%
  390 IFP(N%,1)>0 AND P(N%+D(Z),1)=1 AND FIN<19 M1
%=N%
  400 N%=N%+1:UNTILN%+D(Z)=24
  410 N%=24-D(Z):REPEAT:IFP(N%,1)>0 AND P(N%+D(Z),
2)<2 AND P(N%+D(Z),1)<5 M2%=N%
  420 N%=N%-1:UNTILN%=0
  430 IFM%=0 AND M1%=0 AND M2%=0 SOUND1,-9,5,10:PR
INT'"No move":PROCWAIT(100):GOTO 530
  440 W%=0:IFM%>0 W%=M%:GOTO470
  450 IFM1%>0 W%=M1%:GOTO470
  460 IFM2%>0 W%=M2%
  470 FORN=1TO2
  480 SOUND1,-7,45,2:PROCsearch(W%):PROCcursor(W%)
:PROCWAIT(150)
  490 W%=W%+D(Z):NEXT:W%=W%-(D(Z)*2)
  500 P(W%,1)=P(W%,1)-1:W%=W%+D(Z):P(W%,1)=P(W%,1)
+1:IF P(W%,2)=1  P(W%,2)=P(W%,2)-1:S(2)=S(2)+1
  510 W%=W%-D(Z)
  520 FORN=1TO2:PROCsearch(W%):PROCremove(W%):PROC
draw(W%):IFP(W%,1)=0 W%=W%+D(Z):NEXT ELSE PROCdisc
(W%,D%,B%):W%=W%+D(Z):NEXT
  530 NEXTZ
  540 IFD(4)=D(5) AND XX=0 XX=1:D(1)=D(4):D(2)=D(5
):GOTO330 ELSE GOTO130
  550 :
  560 DEFPROCHELP
  570 IFP(D(1),2)>1 ANDP(D(2),2)>1 Z=2:ENDPROC
  580 IFP(D(1),1)>4 ANDP(D(2),1)>4 Z=2:ENDPROC
  590 IFP(D(1),2)=1 P(D(1),2)=0:P(D(1),1)=1:S(2)=S
(2)+1:GOTO650
  600 IFP(D(2),2)=1 P(D(2),2)=0:P(D(2),1)=1:S(2)=S
(2)+1:D(2)=D(1):D(1)=D(3):GOTO660
  610 IFP(D(1),1)=1 P(D(1),1)=P(D(1),1)+1:GOTO650
  620 IFP(D(2),1)=1 P(D(2),1)=P(D(2),1)+1:D(2)=D(1
):D(1)=D(3):GOTO660
  630 IFP(D(1),2)<2 ANDP(D(1),1)<5 ANDD(1)<>0 P(D(
1),1)=P(D(1),1)+1:GOTO650
  640 IFP(D(2),2)<2 ANDP(D(2),1)<5 ANDD(2)<>0 P(D(
2),1)=P(D(2),1)+1:D(2)=D(1):D(1)=D(3):GOTO660 ELSE
 ENDPROC
  650 W%=D(1):D(1)=0:D$=STR$(D(2)):GOTO670
  660 W%=D(3):D(1)=0:D$=STR$(D(2))
  670 SOUND1,-7,45,2:PROCsearch(W%):PROCremove(W%)
:PROCdraw(W%):IFP(W%,1)<>0 PROCdisc(W%,D%,B%):PROC
WAIT(150)
  680 IFD(1)=0 AND D(2)=0 D(1)=D(4):D(2)=D(5)
  690 S(1)=S(1)-1:ENDPROC
  700 :
  710 DEFPROCCHECK(A%)
  720 IFA%=2 THEN 740
  730 N=1:FIN=0:REPEAT:N=N+1:UNTIL P(N-1,A%)>0:FIN
```

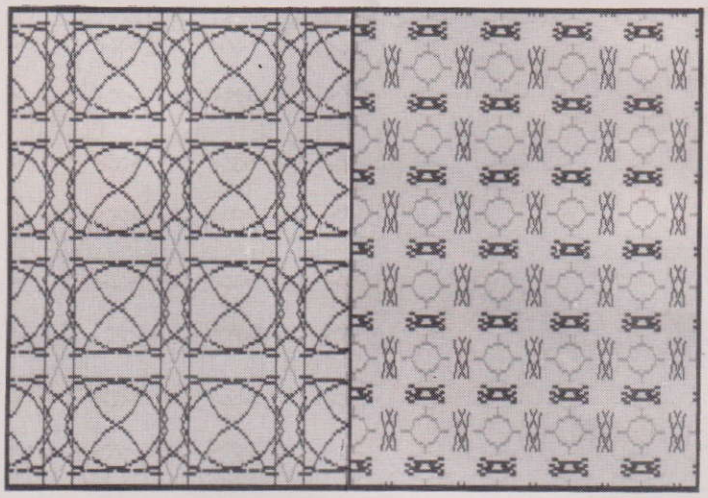
CONTINUED OVER

```
=N-1:GOTO750
  740 N=25:FIN=0:REPEAT:N=N-1:UNTIL P(N,A%)>0:FIN=
N
  750 ENDPROC
  760 :
  770 DEFPROCoff
  780 PRINT'''"TAKEN:"''"PL.    ";S(2);'"COM.   ";S(1
):ENDPROC
  790 :
  800 DEFPROCsetup
  810 RESTORE1670:FORA%=1TO8:READB%,C%,D%:P(B%,1)=
C%:P(B%,2)=D%:NEXT
  820 RESTORE1640:FORA%=1TO24:READ B%,C%,D%
  830 PROCdraw(A%):IFP(A%,1)>0 OR P(A%,2)>0 PROCdi
sc(A%,D%,B%)
  840 NEXTA%:GCOL0,3
  850 MOVE0,0:DRAW1270,0:DRAW1270,990:DRAW0,990:DR
AW0,0
  860 MOVE0,58:DRAW1004,58:MOVE0,932:DRAW1004,932:
MOVE0,500:DRAW1004,500:MOVE1004,0:DRAW1004,990:MOV
E520,58:DRAW520,930
  870 ENDPROC
  880 :
  890 DEFPROCsearch(X%)
  900 RESTORE1640:C=0:REPEAT:READB%,C%,D%:C=C+1:UN
TIL C=X%
  910 ENDPROC
  920 :
  930 DEFPROCcursor(X)
  940 VDU5:GCOL0,0:MOVEX1%,Y1%:VDU229:VDU229:GCOL0
,3:IFX>12 Y1%=975ELSE Y1%=45
  950 X1%=C%-30:MOVEX1%,Y1%:VDU229:VDU229:VDU4
  960 ENDPROC
  970 :
  980 DEFPROCdraw(A%)
  990 IFA%<13H%=400:BASE%=60 ELSE H%=600:BASE%=930
 1000 GCOL0,2:IFA%/2=INT(A%/2) MOVEB%,BASE%:MOVED%
,BASE%:PLOT85,C%,H%:ENDPROC
 1010 MOVEB%,BASE%:DRAWC%,H%:DRAWD%,BASE%:ENDPROC
 1020 :
 1030 DEFPROCremove(AA%)
 1040 IFAA%<13H%=400:BASE%=60:Q=5 ELSE H%=600:BASE
%=930:Q=-5
 1050 GCOL0,0:MOVEB%-Q,BASE%:MOVED%+Q,BASE%:PLOT85
,B%-Q,H%:MOVED%+Q,H%:PLOT85,D%+Q,BASE%
 1060 ENDPROC
 1070 :
 1080 DEFPROCdisc(A%,C%,B%)
 1090 VDU5:IFP(A%,1)>0 GCOL0,1 ELSE GCOL0,3
 1100 IFP(A%,1)>0 CT%=P(A%,1) ELSE CT%=P(A%,2)
 1110 IFA%>12PL%=-10:T%=B% ELSE PL%=60:T%=C%
 1120 FORX%=1TOCT%
 1130 MOVET%+12,BASE%+PL%:PRINTA1$:MOVET%+12,(BASE
%+PL%)-30:PRINTA2$
 1140 IFA%>12PL%=PL%-60 ELSE PL%=PL%+60
 1150 NEXT:VDU4
 1160 ENDPROC
 1170 :
 1180 DEFPROCLEGAL
 1190 IFS(2)=0THEN1260
 1200 IF25-M(1)<>D1 AND 25-M(1)<>D2 THEN1380
 1210 IFP(M(1),1)>1 OR P(M(1),2)=5 THEN 1380
 1220 S(2)=S(2)-1
 1230 IF25-M(1)=D1 D$=STR$(D2) ELSE D$=STR$(D1)
 1240 P(M(1),2)=P(M(1),2)+1:M(2)=M(1):W=1
 1250 GOTO1360
 1260 IFM(1)<>M(2) THEN1320
 1270 PROCCHECK(2):IFFIN>6 THEN1380
 1280 IFP(M(1),1)<>0 OR P(M(1),2)=0 THEN1380
 1290 IFM(1)>D1 AND M(1)>D2 THEN1380
 1300 F(2)=F(2)+1:P(M(1),2)=P(M(1),2)-1:IF M(1)=D1
 D$=STR$(D2) ELSE D$=STR$(D1)
 1310 GOTO1370
 1320 IFM(1)-M(2)<>D1 AND M(1)-M(2)<>D2 THEN1380
 1330 IFP(M(2),1)>1 OR P(M(2),2)=5 OR P(M(1),2)=0
THEN1380
 1340 IFZ=2 ANDM(1)-M(2)<>VAL(D$) THEN1380
 1350 W=2:IFM(1)-M(2)=D1 D$=STR$(D2) ELSE D$=STR$(
D1)
 1360 IFP(M(W),1)=1 P(M(W),1)=P(M(W),1)-1:S(1)=S(1
)+1
 1370 ENDPROC
 1380 SOUND1,-13,130,8:IL=1:ENDPROC
 1390 :
 1400 DEFPROCmove
 1410 IFM(1)=M(2) N=1 ELSE N=2
 1420 FORAA=1TON:PS%=M(AA):PROCsearch(PS%):PROCrem
ove(PS%):PROCdraw(PS%):IFP(PS%,2)=0 NEXT ELSE PROC
disc(PS%,D%,B%):NEXT
 1430 ENDPROC
 1440 IFF(1)=15 A=1:A1=2 ELSE A=2:A1=1
 1450 VDU22,7
 1460 FORI=0TO1:PRINTTAB(8,I)CHR$141CHR$136CHR$131
CHR$157CHR$129"  SCOREBOARD    "CHR$156:NEXT
 1470 IFA=1 PRINT'''CHR$(130)"I won that game" ELS
E PRINT'''CHR$(130)"You won that game":GOTO1500
 1480 Q=0:FORN=1TO24:IFP(N,A1)>0 Q=Q+P(N,A1):SC(A)
=SC(A)+(P(N,A1)*N)
 1490 NEXT:GOTO1520
 1500 Q=0:FORN=24TO1 STEP -1:IFP(N,A1)>0 Q=Q+P(N,A
1):SC(A)=SC(A)+(P(N,A1)*(25-N))
 1510 NEXT
 1520 PRINT''''"The loser had ";Q;" counters left"
 1530 PRINT'''CHR$131"Computer's Score = ";SC(1)
 1540 PRINT''CHR$131"Player's Score   = ";SC(2)
 1550 PRINTTAB(8,22);"Another Game (Y/N)?":*FX15
 1560 A$=GET$:IFA$<>"Y" END
 1570 FORN=1TO24:P(N,1)=0:P(N,2)=0:NEXT:S(1)=0:S(2
)=0:F(1)=0:F(2)=0:GOTO90
 1580 :
 1590 DEFPROCFINISH
 1600 N%=23-(D(Z)-1):REPEAT:N%=N%+1:UNTIL P(N%,1)>
0 OR N%=24
 1610 IFP(N%,1)=0 ENDPROC
 1620 F(1)=F(1)+1:P(N%,1)=P(N%,1)-1:SOUND1,-7,45,2
:PROCsearch(N%):PROCcursor(N%):PROCremove(N%):PROC
draw(N%):IFP(N%,1)<>0 PROCdisc(N%,D%,B%):PROCWAIT(
150)
 1630 ENDPROC
 1640 DATA1000,960,920,920,880,840,840,800,760,760
,720,680,680,640,600,600,560,520,520,480,440,440,4
00,360,360,320,280,280,240,200
 1650 DATA200,160,120,120,80,40,40,80,120,120,160,
200,200,240,280,280,320,360,360,400,440,440,480,52
0,520,560,600
 1660 DATA600,640,680,680,720,760,760,800,840,840,
880,920,920,960,1000
 1670 DATA1,2,0,6,0,5,8,0,3,12,5,0,13,0,5,17,3,0,1
9,5,0,24,0,2
 1680 :
 1690 DEFPROCPAUSE(A%)
 1700 TIME=0:REPEAT UNTIL TIME=(25-A%)
 1710 ENDPROC
 1720 :
 1730 DEFPROCWAIT(A%)
 1740 TIME=0:REPEAT UNTIL TIME>A%:ENDPROC
```

Summer MUSE

Mark Webb

In the sweltering heat of July we joined the keenest of educational computer users at the MUSE Summer Conference.



One of the hottest days in July in the idyllic surroundings of Nottingham University campus, buildings new and old hidden away amongst the trees, the river meandering below. And what are the diligent visitors to the MUSE summer conference doing? The answer is: listening to some fascinating lectures, including an opening address by John Coll of MEP; visiting an exhibition of hard and software; attending courses on various aspects of computing; comparing notes over lunch; and then back, greedy for more information about state of the art computing in education. The evening finds them in discussion groups. This evening a visiting Japanese professor has offered to talk about educational computing in the land of MSX!

MUSE?

Richard Green, MUSE Secretary, gave me a potted history of the organisation. It started 11 years ago as the representative of Mini Computers Users in Secondary Education. Only the independants had enough money to own minis in those days, so it was an exclusive club.

When micros came along, they were incorporated into the name and "Micro" eventually took over. MUSE benefited from considerable government funding in 1980 to launch it as an active body, supplying help to those using micros in secondary schools. Now established, MUSE has to stand much more on its own feet.

There is a separate organisation MUSE Ltd. (a prerequisite of government money) through which software is sold on behalf of authors, to schools. The schools are safe in the knowledge that all programs have been rigourously tested by a review panel. Constructive criticism is returned to any author who does not quite make the grade. MUSE also publishes some well received handbooks aimed at specific areas of programming.

ON COURSE

Typical of the courses on offer at the conference were Music Education with a Micro, Structured Programming with BBC BASIC, Networking, the Walsall LOGO project, Communicative language work and Measurement, Magic and the Vela Micro.

The whole range of companies involved in educational computing were present at the exhibition, from the giant publishers Longman and Hutchinson to the new faces, like Pilot One, a new company with some exciting ideas for interfacing your BBC. The BBC was certainly the dominant micro on view.

FRIENDLY BUT BUSINESSLIKE

The whole show was faultlessly organised by the MUSE officals and the atmosphere friendly but definitely businesslike. Here was a chance to see the latest in educational hardware and software and to meet the people supplying it. There were plenty of questions to be asked.

As well as figuring prominently in the exhibition, the BBC was put to good use disseminating up to date information and messages on a local Viewdata system operating in the foyer of the building being employed by MUSE for their more serious activities.

The system was based upon that used in the school by Secretary, Richard Green. Messages like "Mr Smith would like to meet a Viewdata expert to get some advice" and "Macmillan books are looking for prospective authors" and so on.

The evening discussion groups made interesting reading: Nelcal's stat pack, Preview of Acornsoft's COMAL, Primary Panel, Computer Science. Three groups were set up to discuss Acorn, RML, and Sinclair products. The Acorn sheet had signatures crammed into every corner, Sinclair's was empty. No doubting the dominant hardware in the classrooms of these enthusiasts.

OPEN ENDED

The most interesting new software on show as Homerton College's projects. This Cambridge college specialises in postgraduate work in education. Fred Daly, who masterminded the design, and professional programmer Wac Brodski, demonstrated programs as diverse as the chemistry and physics simulations Chemical Collisions and Lift; modern language aids, Quelle Tête and Kofjager; and Tessellations, of interest both to mathematics and art and design departments.

What all these programs do have in common is an "open-ended" approach. Each program has numerous options, accessible through simple key combinations, for screen display. Parameters can be changed as required and new directions investigated. This means that a particular line of enquiry inspired by questioning from the class, can be pursued within the program.

The language programs are exceptionally friendly. The one thing they will **not** do is reject an attempt at an answer as totally wrong. The Homerton team especially stressed the need to create "enjoyable learning environments". It is hard to deny that they have done just that with this new range of software marketed by Cambridge Micro. Quelle Tête inspired the idea that one day, classrooms on both sides of the channel would exchange descriptions of their respective teachers via a telephone network!

IMPORTANT ROLE TO PLAY

After a somewhat chequered career, MUSE is settling down as a respected and vigorous body of opinion in this rapidly growing and far from mature field. The summer conference brought together a very important band of micro-using enthusiasts from secondary education. These people are back in school this autumn, campaigning for the time and money to improve the role that microcomputers play across the whole curriculum.

Will you be the first Earthling to win a pe

Acornsoft are issuing a nationwide challenge to all Acorn Electron and BBC Micro users.

It's the challenge to join a new and exclusive group of computer games players: The Elite.

With 3-dimensional graphics, Elite is a game which is light years ahead of any other.

It strictly defines the rank of each and every player.

As your prowess improves, you move into higher ranks.

But make no mistake, to reach the top rank, your performance must become exceptional.

Then, and only then, will you qualify to call yourself a member of The Elite.

From harmless, you must become lethal.

In Elite, all players start as equals.

With the initial rank of "Harmless," you will embark upon an experience unlike any that y have known before.

You will be a space trader who roams the universe, making your living from buying a selling the cargo in your Cobra space craft.

On your travels, you will encounter aggress who are eager to put an end to your dealings.

Only the fittest will survive.

As you establish yourself as a survivor, y will win the right to a higher rank.

In all, there are nine, from "Harmless" t "Elite." And your computer will continually you where you stand.

Trade with 2,000 planets in eight galaxies

Besides survival, your success also depe on the rewards you reap from the cargo that you carry.

pe among the Elite?

That cargo can be anything from foodstuffs o contraband. If you decide to trade in contra-and, the rewards will certainly be higher. But so ill the risks you take.

To ply your trade, you can dock at any of 000 planets in eight galaxies.

However, before you dock, you must use your its to assess the planet's political climate and the erils which may be waiting for you.

Also, in any of the eight galaxies, you may nd yourself being asked to perform acts of con-derable heroism and selfless courage.

Although these will bring you into danger, ey can bring considerable rewards too.

We're waiting to recognize your skills.

Achieving higher status in Elite will tax your ills to the limit. Which is why you must down-load your game onto cassette or disc each time you take a break from play.

When you reach the rank of "Competent" or higher, you should send us the secret code number revealed to you by your computer.

We will send you in return a special document which certifies your achievement. And you stand to win a valuable prize.

Are you ready to accept the challenge?

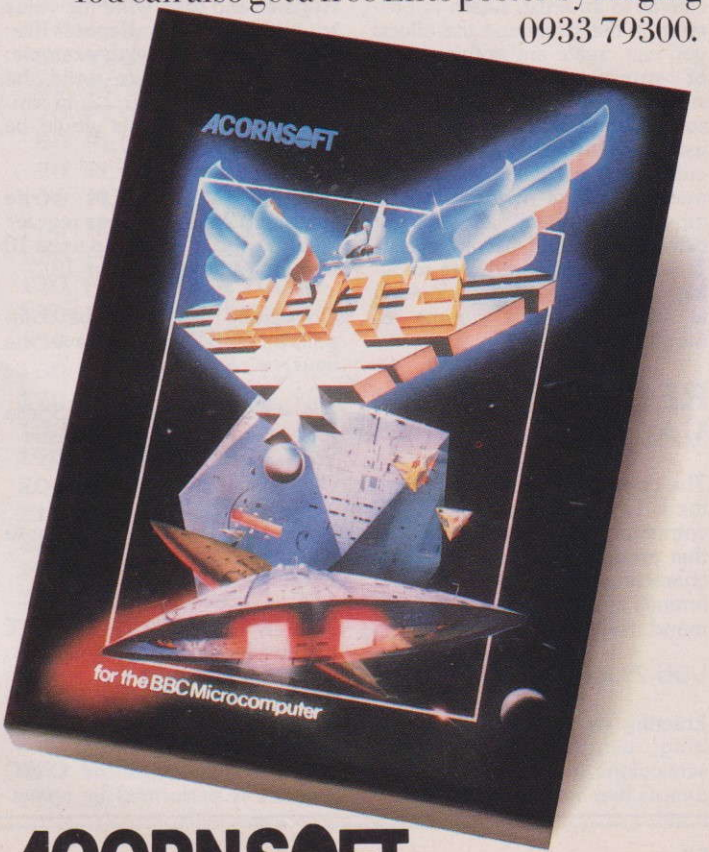
Elite is available on both disc and cassette for the BBC Micro and on cassette for the Acorn Electron.

With either, you will get "Elite: The Dark Wheel," a compelling novel which sets the whole mood of your adventure. You'll also get a flight training manual which will get you fit to roar into the unknown in your Cobra spacecraft.

Your Acornsoft dealer now has the entire package at £14.95 on cassette, or £17.65 on disc (for the BBC Micro) and £12.95 for the Electron. (For the address of your local stockist, call 01-200 0200.) Credit card holders can simply telephone 0933 79300 during office hours.

Alternatively, you can order by post from: Acornsoft, c/o Vector Marketing, Denington Estate, Wellingborough, Northants NN8 2RL.

You can also get a free Elite poster by ringing 0933 79300.



ACORNSOFT

Advanced Graphics

Bruce Smith

Take the tube

Following last month's look at the Video ULA we'll take a step further along the line and examine the main stay of the Beeb's video display circuitry, the 6845 Cathode Ray Tube Controller, CRTC for short. In simple, though technical terms the CTRC performs two main tasks. Firstly it is used to generate the raster scanned video display and secondly it is used to refresh the dynamic RAM. In plain English these couple of lines mean that it displays a picture of the screen memory on the monitor or TV screen you're using and also ensures that the programs you have in memory do not get lost!

The CRTC is a memory mapped device consisting of 18 registers; 14 of which are write only registers, two read only registers and two read and write registers. The ability to write to a device immediately makes it open to the programmer to do what he likes best — program it!

However, the CRTC is a complex device — to the serious graphics programmer it is like a canvas to an artist. Learn to program it effectively and the effects you can create are nothing short of stunning, instantaneously stunning at that. Why the superlatives? Well for example by using just two simple pokes the entire contents of say MODE 2, a massive 20K of memory can be moved up, down, left or right before you could bat an eyelid. This is known as hardware scrolling, a subject we shall be looking at over the next couple of months.

REGISTERING A VALUE

The correct way of programming the CRTC is to use the VDU 23 command. This is the same call that programs the user definable characters but it is interpreted differently as we shall see. The command itself takes the form,

```
VDU 23,0,r,v,0,0,0,0,0,0
```

Entering six zeros can be a little long winded so by using semicolons instead of colons to denote two byte words the whole command syntax can be condensed to,

```
VDU 23;r,v;0;0;0
```

where the letters r and v stand for register and value to be written respectively.

A second legal method of programming any register is to use an OSBYTE call to Sheila. Writing to a particular register is performed in a somewhat odd manner however. If you look at the address map of Sheila (page 437 of the User Guide Britanicus (sic)) you will see that just two registers are actually mapped. These are the Address register at &00 and the Register file at &01. To write to a particular register it is first necessary to program the register number into the Address Register and then write the value to it through the Register file. Consider the following example: suppose we wish to write the value 10 into register 12, in simple poking terms this would be performed as,

```
?&FE00=12 : REM Write Register 12 into Address register
?&FE01=10 : REM and write 10 into that register (register 12)
```

Converting this into tube compatible OSBYTE we have the lines,

```
A%=&97 : REM write to Sheila
X%=0 : REM address register
Y%=12 : REM register 12
CALL OSBYTE
X%=1 : REM register file
Y%=10 : REM value to write to register 12
CALL OSBYTE
```

This is the offical OSBYTE method but as we have just seen it is possible to poke the locations directly, though Acorn seem to put this on a par with wife beating.

Reading any of the CRTC registers is performed by reversing the OSBYTE process. The register to be read is programmed into the address register and the contents of the Register file peeked. To read Register 13 the following would suffice,

```
A%=&97 : REM write to Sheila
X%=0 : REM address register
Y%=13 : REM Register 13
CALL OSBYTE
a%=&96 : REM read from Sheila
X%=1 : REM Register file
R%=USR(OSBYTE) : REM execute and return registers
Y%=R% AND &FF0000 : REM isolate Y register
```

Again a simple poke and peek could be used, the above example could be condensed into two short lines,

```
?&FE00=12
Y%=?&FE01
```

CASHING IN ON THE REGISTERS

To make full use of the CRTC it is important to have a good understanding of the layout and function of each register, so here we go.

Register 0
This is a write only register and holds the total number of character cells (displayed and undisplayed) minus one. There can be a difference between the number of displayed characters and the number of characters per line. The reason for this is that the number of bits per pixel is a variable value and is dependent on the actual number of colours available in the chosen mode (see the March/April instalment). In MODEs 0 to 3 this register should contain 127 and 63 in MODEs 4 to 7.

By reprogramming this register the screen display can be made to break up and reappear, rather like an old tube TV on the blink. Program 1 illustrates the dubious technique!

Register 1
This register determines the actual number of displayed character cells per line for each of the screen modes. In normal use the register contains 80 in MODEs 0 to 3 and 40 in MODEs 4 to 7. As you may notice these values are different from the number of characters that are actually seen, for example in MODE 2 there are only 20 characters per line displayed, once again this is due to the pixel configuration per mode. In MODE 2 four bits are used to store the colour details therefore the 80 characters 'seen' by the CRTC is formed as 20 characters each of four bits =80.

Register 1 is a write only register.

Register 2
A write only register which determines the location of the synchronisation pulse on the horizontal line. The position is defined in terms of the number of characters across the line. By reprogramming the register the screen can be moved left or right by increasing or decreasing its value.

Register 3
The horizontal and vertical sync. widths are controlled by this register. The low nibble controls the horizontal sync. and the upper nibble the vertical sync.

Registers 4 & 5
These two registers are used in tandem to ascertain an exact refresh rate. Register 4 uses seven bits to determine the integer number of vertical character lines, while Register 5 determines the fractional fine adjust. Only four bits are used.

Register 6
Another seven bit write only register that simply contains the number of displayed verticle characters per mode.

Register 7
A write only register that sets the position of the vertical sync.

Register 8
This register controls both interlace and blanking (these terms mean literally what they infer). A better TV picture can sometimes be obtained by turning the interlace on or off using *TV 255,0 (move down line & interlacing on) or *TV 255,1 (move down line & interlacing off).

Register 9
A five bit write register which sets the number of scan lines in each row including the spaces.

Register 10
This register is a seven bit write only register which is directly associated with the cursor. Bits 0 to 4 set which scanline the cursor starts (the start is defined as its top). The cursor will flash if bit 6 is set, while bit 5 defines a slow flash rate (bit 5 = 1) or fast flash rate (bit 5 = 0). The cursor will be invisible if bit 6 is clear while bit 5 is set.

Register 11
This is the cursor end register and its five operative bits determine on which scan line the cursor ends.

Registers 12 & 13
This register pair are used to form a 14 bit write only register, register 12 contains the low eight bits. When in MODEs 0 to 6 this register contains the screen start address divided by eight. This means that by reprogramming this register the screen memory can be addressed anywhere else in memory. This can lead to some interesting half hours. By setting the screen memory to start in zero page the whole of the Beeb's workspace can be viewed going about its business. These registers are important in that they can be used to perform hardware scrolling.

Registers 14 & 15
A 14 bit read/write register that contains the address of the cursor in MODEs 0 to 6, the low eight bits of the address are held in Register 14.

Registers 16 & 17
Finally these two registers form a 14 bit read only register which is used in conjunction with a line pen attached to the LPSTB line of the analogue port.

A fair amount of theory to plough through this month, but really it's unavoidable. The best way to learn how to create effects is really just to experiment by poking values here and there. If you can't get the screen display back hit the panic button, BREAK.

Next month lots of practical programmed examples of hardware scrolling, but to whet your appetite try the swirling display created by Program 2. I think you'll find the effect very interesting!

PROGRAM LISTING 1

```
>LIST
  10 REM *** PROGRAMMING REG.0 ***
  20 contents=63
  30 byte=contents
  40 flag=1
  50 REPEAT
  60 ?&FE00=0
  70 ?&FE01=byte
  80 IF byte=0 THEN flag=-1
  90 IF byte=contents then flag=1: PROCdelay
 100 byte=byte-flag
 110 UNTIL FALSE
 120 END
 130 :
 140 DEF PROCdelay
 150 FOR N=0 TO 500
 160 NEXT
 170 ENDPROC
```

PROGRAM LISTING 2

```
 10 REM *** PROGRAMMING THE 6845 CRTC ***
 20 REM ***       (c) Bruce Smith       ***
 30 MODE 2
 40 count=80
 50 VDU 23;1,0;0;0;0;
 60 MOVE 100,100
 70 PLOT 1,0,850
 80 PLOT 1,1080,0
 90 PLOT 1,0,-850
100 PLOT 1,-1080,0
110 MOVE 150,150
120 PLOT 1,950,0
130 PLOT 1,0,200
140 PLOT 1,-950,0
150 PLOT 1,0,-200
160 FOR Y=150 TO 350
170 PLOT 77,200,Y
180 NEXT
190 PRINT TAB(2,8);
200 PRINT"THE BEEB COMETH"
210 PRINT TAB(8,12)"by"
220 PRINT TAB(4,15);
230 PRINT"Bruce Smith"
240 PRINT TAB(3,23);"A&B COMPUTING"
250 FOR value=0 TO count
260 VDU 23;1,value;0;0;0;
270 FOR wait=0 TO 75:NEXT wait
280 SOUND1,-15,value,1
290 SOUND2,-15,1,1
300 SOUND3,-15,1,1
310 NEXT
```

Old English Font

John Kortink

Give your documents old-fashioned atmosphere with beautiful characters created by computer.

This program generates characters in old-English style for printer output. The characters have been designed on an unusually large grid of 40 × 40 pixels and are therefore very detailed and beautifully accurate. The program really consists of a single procedure which can be called with a couple of arguments in the following brackets.

All you have to do is call the procedure with your texts from your own program and it will completely print your text in old-English. Anything is possible — you can use the program to print titles or for one character at the beginning of a paragraph, as was done in the past or you can print out whole texts, if you're crazy enough! As you can see from the sample printout, the result is absolutely fantastic.

The program was designed for an ITT 3351 printer, but should work with some adjustments on various other printers too, especially the Epson range. This is due to the essentially simple things that have to be printed, as I will explain later on.

The following range of characters can be printed:
A,B,C,D,E,F,G,H,I,J,K,L,M,
N,O,P,Q,R,S,T,U,V,W,X,Y,Z,
a,b,c,d,e,f,g,h,i,j,k,l,m,n,
o,p,q,r,s,t,u,v,w,x,y,z,
0,1,2,3,4,5,6,7,8,9, the ae character, !, ?,&,:,;,.,.,,-,', and ".

These are all in the original, official "old-English" form of characters.

PARAMETERS

In general the call will take the form of: PROColdenglish (D.1.Print$). The parameters represent the following:

D Stands for Density of printing. The ITT 3351 can print graphical information, referred to as "bit-image" in two modes. The first is called "normal density" which prints the data in the normal width. This mode can be chosen with D = 1. With D = 2, the printer will print in "double density", which prints the pixels twice as close to each other than in "normal density". In "normal density" mode the characters will be printed out with 12 characters on one line, and in "double density" mode this becomes 24. All the characters in Print$ will be printed out in the chosen mode. Don't try other numbers than 1/2!

I Stands for Inverse and ca be 0 or 1. When it is 0 all the characters in Print$ will be printed out normally, that is black on the white paper. When it is 1, all characters will be printed out inverse, that is white on black (see printout).

Print$ Stands for the text that is to be printed on the paper and can be, of course, a variable-string or direct ". . ." text. It can be of any length, and will be printed out exactly as it stands, so you will have to watch for words that are going to break on two lines. Just add sufficient spaces to get the next word on the next line if it doesn't fit the 12 or 24 characters you have on one line. The printout example shows this too.

Examples:
PROColdenglish(1,0, "Hello there, how are you") will print:

Hello there,
how are you

PROColdenglish(1,1, "Hello, there, how are you") will print the inverse, PROColdenglish (2,0,"This is a test for the procedure") will print:

This is a test for the p
rocedure

and PROColdenglish (2,1, "This is a test for the procedure") will print the inverse. Note how the printout as shown above breaks the word 'procedure' into 'p' and 'rocedure'. This can easily be solved by adding an extra space between 'the' and 'procedure'. Thus, PROColdenglish (2,0, "This is a test for the extra procedure") would print:

This is a test for the
procedure

Finally, all characters that are in Print$, but cannot be printed, will be printed as spaces. Thus PROColdenglish (1,0,"£$%_()½+=") or something like that, will only print spaces!

HOW IT WORKS

line 50 Switches the printer on with VDU2, and instructs the printer to set the line-spacing to 8/72 inch, i.e. eight times the distance between the printed pixels. These are printed vertically, 8 dots, in which the lowest one represents bit 0, and the highest one represents bit 7. All the codes the printer receives when it is in bit-image mode are printed in this way, so each dot can be addressed individually. E.g. code 255 will print a complete vertical line, as 255 is 11111111 binary; code 85 will print a dotted line, as 85 is 01010101 binary. As for one character the printer has to print on 5 subsequent lines, the line-spacing is set in such a way that the dots lay neatly against each other, thus forming a solid character in the end.

60-90 Print examples as can be seen in the example printout, using the procedure.

100 Switches the printer off, and ends the program.

120-270 PROColdenglish (D,I, Print$)

130 D has been transferred to variable B%,I to I% and the string to Q$.M% now represents the number of characters that can be printed on one line, 12 in "normal density" mode and 24 in "double density" mode. B% is adjusted so that it represents the code to be sent to the printer to put it on the right bit-image mode. Finally I% now represents the number with which the codes sent to the printer have to be EORed, this is 255 when printing inverse and O when printing normal.

140 Cuts 12 or 24 characters from Q$ and puts them in P$. This is repeated until Q$ is empty (250).

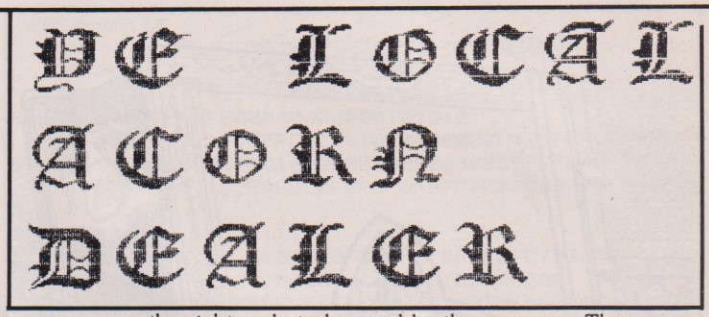
150 N% is set to the number of characters in P$, L% is set to be the number of codes to be sent to the printer on one line of printing.

160 H% now represents the code to be sent to the printer representing the high-byte of the number of codes to be printed, L% is now set to the low-byte (see 170).

170 Sets up loop, sets up printer. Opens the loop with Y%, which holds the position of Y inside the character that is printed. Thus if Y% is 3, the third part of the characters, seen vertically, is going to be printed. It also sets up the printer with the right bit-image mode, and the right number of codes for that line.

180 Sets up loop with P%, which represents the P%th character that is to be printed (on the Y%th line). C% is now set to the code of that character in the string P$.

190 This part decodes the ASCII code of that character to



the right code to be used by the program. The number represents a line-number in which the data starts for that particular character (see 200).

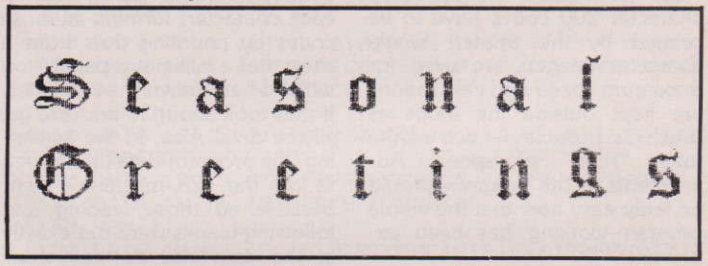
200 Restores the Data pointer to that line.

210 Skips over data until the right data is there, depending on the vertical Y%-position, of course. It forms the data from three arguments, SP1%, SP2% and C$. The first represents the blank codes that precede the real data ("00"), the second the number of blanks behind the real data. C$. All the codes form one string, in which each two digits represent a hexadecimal code that is going to be sent to the printer. The length of C$ is thus always $40 \times 2 = 8$. All these 40 codes that are extracted from C$ one after the other, are thus printed as the Y%th row of the character that is being printed. All those codes represent a part of that character, and are all printed vertically one after the other, forming one row-part of the character.

220 Does all the printing, 40 codes per row-part of the character. It sends this code to the printer, inverting it as appropriate with EORI%.

230 Terminates the P%-loop and lets the printer go to the next row-line to do the next parts of all the characters in P$, one after the other.

240 Terminates the Y%-loop, and lets the printer go to the next line, thus creating a space between each completed line of text.



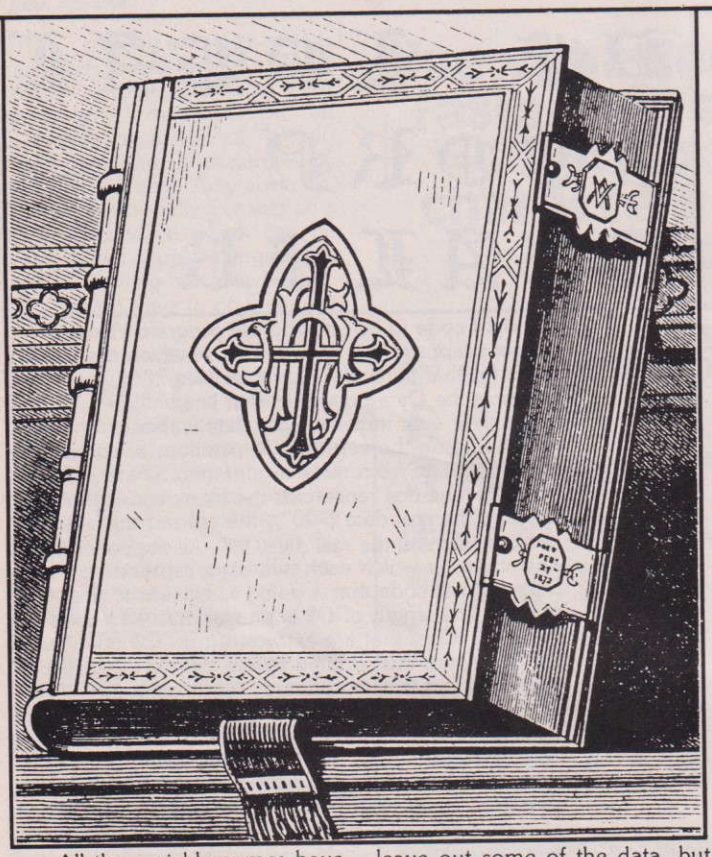
250 Terminates if Q$ is empty, and that means that there is no more text left to be printed.

260 Advances the printer paper one line after the whole text has been printed.

270 Ends the procedure.

300-3250 All contain data for all the characters. Each character has four lines, the first is a REM line, which indicates the character of which the data follows. The three following lines contain all the data for the character. For each row (see 210) three codes, which represent the leading blanks, following blanks, and real data respectively.

CONTINUED OVER



All the variable-names have been kept as short as possible to gain some valuable speed, as it takes about 10 minutes to print a complete page of text. This is obvious of course, as for each character 200 codes have to be printed by the printer! Single character integers are used for maximum speed and calculations are kept outside the loops as much as possible — two of the main "rules" of speed! Adjustments to the program should be fairly easy now that the whole program-working has been explained.

All printers with a similar "bit-image" mode as the ITT 3351 should be able to handle the program, as all it has to do is print those lots of data and sometimes advance the paper! The program will only work on 32K machines as it is quite long, about 18K bytes, and this is of course due to the enormous amount of data that it takes for one character. The user can leave out some of the data, but will then have to adjust line 190, or avoid characters that cannot be printed.

It may be nice to know that I worked for about half an hour on each character, forming all those codes by counting dots from a sheet of millimetre-paper on which I had drawn the character. It thus took about 36 hours to get all the data! Also, in the beginning, the program-data didn't even fit into the 32K machine I own, because all those leading and following blanks were put exactly in the data-lines as they were! When I had A-Z, a-z and 0-9 in the computer, it was completely out of memory. You couldn't even RENUMBER the program, and thus I got the message "Renumber Space" for the first time!

All in all it was a rewarding job, but sometimes I just didn't want to go further with all that coding! Hopefully this program will be used intensively by other people. Fantastic results are guaranteed. GOOD LUCK!

NOTE
The following little program can be used to check if all the data has been typed in properly. Just add these lines and RUN it; the result will be number which will be given if all is well:

```
    1 ONERRORIFERR=42PRINTA%:STOP ELSERE
PORT:PRINTERL:END
    2 A%=0:RESTORE
    3 REPEAT READ F%,G%,C$:A%=A%+F%+G%
    4   IFC$<>""FORX%=0TOLENC$DIV2-1:A%=
A%+EVAL("&"+MID$(C$,X%*2+1,2)):NEXT
    5   UNTIL FALSE
>RUN
    801969

STOP at line 1
>
```

PROGRAM LISTING

```
  10 REM*********************************
  20 REM Oldenglish 1.2 by John Kertink
  30 REM 4-1984 (C)
  40 REM*********************************
  50 VDU2,1,27,1,65,1,8
  60 PROColdenglish(1,0,"OLDENGLISH  NORMAL
ABCDEFGHIJKLMNOPQRSTUVWXYZabcdefghijklmnopqrstuvwx
yz0123456789@!?&:;.,-'""")
  70 PROColdenglish(1,1,"INVERSE")
  80 PROColdenglish(2,0,"OLDENGLISH
DOUBLE                ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz0123456789@!?&:;.,-'""")
  90 PROColdenglish(2,1,"INVERSE")
 100 VDU3:END
 110
 120 DEFPROColdenglish(B%,I%,Q$)
 130 M%=B%*12:B%=B%+74:I%=255*I%
 140 REPEATP$=LEFT$(Q$,M%):IFLENQ$>=M%Q$=MID$(Q$,
M%+1)ELSEQ$=""
 150 N%=LENP$:L%=N%*40
 160 H%=L%DIV256:L%=L%MOD256
 170 FORY%=0TO4:VDU1,27,1,B%,1,L%,1,H%
 180 FORP%=1TON%:C%=ASCMID$(P$,P%,1)
 190 IFC%>31IFC%<35C%=C%-32 ELSEIFC%=38ORC%=39C%=
C%-35 ELSEIFC%>43IFC%<47C%=C%-39 ELSEIFC%>47IFC%<6
0C%=C%-40 ELSEIFC%>62IFC%<91C%=C%-43 ELSEIFC%>96IF
C%<123C%=C%-49 ELSEC%=0
 200 RESTORE(310+40*C%)
 210 FORT%=0TOY%:READSP1%,SP2%,C$:NEXT:C$=STRING$
(SP1%,"00")+C$+STRING$(SP2%,"00")
 220 FORX%=0TO39:VDU1,EVAL("&"+MID$(C$,X%*2+1,2))
EORI%:NEXT
 230 NEXT:VDU1,10,1,13
 240 NEXT:VDU1,10,1,13
 250 UNTILQ$=""
 260 VDU1,10,1,13
 270 ENDPROC
 280
 290 ************************************
 300 REM !!!!! SPC !!!!!
```

```
  310 DATA 40,0,,40,0,
  320 DATA 40,0,,40,0,
  330 DATA 40,0,
  340 REM !!!!! ! !!!!!
  350 DATA 18,18,01030301,15,15,387FFFFFFFFFFFFF7F
38
  360 DATA 16,16,C0FCFFFFFFFFCC0,18,18,E0FCFCE0
  370 DATA 16,16,10387CFEFE7C3810
  380 REM !!!!! " !!!!!
  390 DATA 13,13,040E1F1F0F000000000040E1F1F0F,13,1
4,1030E0C0000000000001030E0C0
  400 DATA 40,0,,40,0,
  410 DATA 40,0,
  420 REM !!!!! & !!!!!
  430 DATA 11,15,01030707070E0C1C1C3C3F3F3F1F07,9,15
,7EFFFFFFFF03010000000001FFFFFCE0
  440 DATA 10,6,C0E0F8FDFFFF7F3F3F67C180000000000
0,01030301010101,5,6,0103070F1F3763C1800080E0F0FDFFF
FFF3F1F3763C0C0E0E0E0E0C080
  450 DATA 6,6,80C0E0F0F8FCFEFC783060C0800080C0F0F
8FCFCFCFC7C7C7C7870E0
  460 REM !!!!! ' !!!!!
  470 DATA 17,18,040E1F1F0F,17,19,1030E0C0
  480 DATA 40,0,,40,0,
  490 DATA 40,0,
  500 REM !!!!! , !!!!!
  510 DATA 40,0,,40,0,
  520 DATA 40,0,,20,15,040E1F1F0F
  530 DATA 20,16,1030E0C0
  540 REM !!!!! - !!!!!
  550 DATA 40,0,,26,12,0103
  560 DATA 12,12,020C3C787878787870F0F0F0F0E080,
40,0,""
  570 DATA 40,0,
  580 REM !!!!! . !!!!!
  590 DATA 40,0,,40,0,
  600 DATA 40,0,,18,18,01030301
  610 DATA 16,16,60F0F8FCFCF8F060
  620 REM !!!!! 0 !!!!!
  630 DATA 15,14,0103070F0F1F0F0F070301,10,10,0107
1F3FFEF0E08000808C0E0F0FCFFFF3F0F01
  640 DATA 9,9,1EFFFFFFFF0300000000000000000000000C
3FCFFFF1F,10,9,E0F8FCFFFF7F1F07030100000000000030F3
FFC0080
  650 DATA 14,13,80C0E0F0F8F8FC7C7C38F0E0C0
  660 REM !!!!! 1 !!!!!
  670 DATA 12,18,01030607 0F1F1F0F0F07,12,17,800000
0080FFFFFFFFFFFF
  680 DATA 17,17,FFFFFFFFFFFF,17,17,FFFFFFFFFFFF
  690 DATA 15,13,2070F8F8FCFCFCF8783060C0
  700 REM !!!!! 2 !!!!!
  710 DATA 13,14,0101030707 0F1F1E0F0F070301,9,11,1
0397CF8F0E0C0C0800000000080FFFFFFFF7F3F
  720 DATA 18,12,01030F1F7FFEFEFCF8E0,10,12,010307
0E1C3871E1E3C383830303010101
  730 DATA 7,7,0C3CF8F8B03070F0F0F0F0E0E0E0E0E0E0E
0F0F0F0F8F8F87060
  740 REM !!!!! 3 !!!!!
  750 DATA 15,13,0103070F1F1E1E1E0F070301,13,11,60
F0F0E0C080000000000 81FFFFFFFF3E
  760 DATA 16,12,1818181818 3C7EFFFFEFC783,11,11,06
0F0F0F0707030100000000000C7FFFFFEF8
  770 DATA 13,14,80C0E0F0F8FCFC7C7870E0C080
  780 REM !!!!! 4 !!!!!
  790 DATA 18,15,03070F1F0F0703,12,14,01030F1E78F0
C080080FFFFFFFFFF
  800 DATA 8,10,071F7FF1E1C1010101010101 01FFFFFFFF
FF01010101,9,8,80C0E0E0E0E0E0E0E0E0E0E0E0FFFFFFFFFFE
0E0E0E0E160
  810 DATA 19,9,70F0F8FCFCFCF8F87060C080
  820 REM !!!!! 5 !!!!!
  830 DATA 12,11,011F1F1E1E1E1E1E1E1E1E1E1E1E1E1C1
8,11,16,01FFFFFE0000000000001010101
  840 DATA 11,11,FEFCFC18387070E0E0F0F8FCFFFF7F3F1
F07,11,11,0103030101000000000000000083FFFFFFFEF0
  850 DATA 10,13,C0E0E0F0F0F8F8FC7C7C383870F0E0C08
0
  860 REM !!!!! 6 !!!!!
  870 DATA 15,11,0103070F1E1F1F0F0F0707030301,10,1
1,071F3F7FFFF8E0800000000018383C1E0E0C080
  880 DATA 9,10,FFFFFFFFFF03060C183060E0F0F0FCFEFF
7F3F1F03,9,10,80F8FFFFFFFF3F0F030101000000000083FF
FFFFFC
  890 DATA 12,12,80C0E0F0F8F8FCFCFC7C7C7878F0E0C0
  900 REM !!!!! 7 !!!!!
  910 DATA 10,9,030F1F1F1F1E1E1E1E1E1E1E1E1E1E1E1F
1F1F1C18,9,12,E0C0808000000000000000000001071F3FFEF0
C0
  920 DATA 18,15,071F7FFFFFF8C0,15,17,073FFFFFFFFF
F880
  930 DATA 15,19,FCFCF8F8F0E0
  940 REM !!!!! 8 !!!!!
  950 DATA 13,10,0103070E1E1E1E1E1E1E1F0F0F0F07030
1,11,10,1E7FFFFF8F0703010000000000081FFFFFEF0
  960 DATA 12,10,81E3F7FFFEFCFCFCFC7C7E7EFFBF9F0F0
701,9,10,1E7FFFFFE781000000000000000000080C1FFFFF
E
  970 DATA 10,12,80C0E0F0F0F8787C7C7C7C787870F0E0C
080
  980 REM !!!!! 9 !!!!!
  990 DATA 11,13,03070F1F1E3E3E3F3F3F1F1F0F070301,
9,10,3FFFFFFFC1000000000008080C0F0FCFFFFFF7F1F01
 1000 DATA 9,10,C0F8FCFEFF7F3F0F0F07060C183060C0FF
FFFFFFFF,10,11,0103070783C1C180000000001071FFFFEFCF
8E0
 1010 DATA 10,16,80C0C0E0E0F0F0F8F878F0E0C080
 1020 REM !!!!! : !!!!!
 1030 DATA 40,0,,18,18,01030301
 1040 DATA 16,16,60F0F8FCFCF8F060,18,18,01030301
 1050 DATA 16,16,60F0F8FCFCF8F060
 1060 REM !!!!! ; !!!!!
 1070 DATA 40,0,,18,18,01030301
 1080 DATA 16,16,60F0F8FCFCF8F060,17,18,040E1F1F0F
 1090 DATA 17,19,1030E0C0
 1100 REM !!!!! ? !!!!!
 1110 DATA 17,15,0101030303030101,12,12,071F7EFEFC
F8F0F0F0FFFFFFFFFF7F3F
 1120 DATA 19,15,030FFFFFFEF8E0C0,19,17,F8F8F0C0
 1130 DATA 16,16,10387CFEFE7C3810
 1140 REM !!!!! @ !!!!!
 1150 DATA 40,0,,15,15,07070E0E1E1E1F1F1F0F0F07070
F0F1F0F070301
 1160 DATA 15,13,01C3FF3E0606030381FFFFFFFFFFFF81C
3E6FCF8F060,13,19,0E7FFFFFFF030000000080FFFFFFFFFF
FF80
 1170 DATA 14,13,C0F0F8FCFEFC7830307 8F8F8FCFCFEFEF
E7C3C18303060
 1180 REM !!!!! A !!!!!
 1190 DATA 8,6,0103070F1F1E3E3E3C3C3C3C3C3C3E3F1
F1F1F0F1F3C787060,5,10,073FFFFFF0C080000C183870717
3777F7E78F0E0FFFFFFFFFF
 1200 DATA 5,10,E0F8FEFF07010001070F1F7BF3E3830303
030303FFFFFFFFFF,7,10,03079FBFF7E3C3C1C1C0C0C0C0C0
C0C0C0C0FFFFFFFFFF
```

CONTINUED OVER

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 1210 DATA 6,6,F8FCFC8C80C0C0E0E0E0F07878383030606
0C0C0F0F8FCFC3C1C1830
 1220 REM !!!!! B !!!!!
 1230 DATA 4,4,040E1C3C1C0E0F07070707 0F0E1C1D393B3
B370E0C181838383C3E1F0F0F0703,7,4,0101010F3FFFFFFF
007FFFFFFFFF8000030303000000007FFFFFFFEF8
 1240 DATA 4,4,2070F0E1E1F1FFFFFFFFFF00FFFFFFFFFF0
000FFFFFF383070F0FFDF9F1F0F0F,5,4,38F8F0E1E3FFFEFE
F9E30FFFFEFCF8F00000FFFFFFCCCCCCCCFFFFFFFFFFFF
 1250 DATA 6,5,38FCFEFF72F0E0E0E0E0E0F0F0F0F8FC7CF
CFCF8706060C0C0C0C0C080
 1260 REM !!!!! C !!!!!
 1270 DATA 10,4,0103030706000001030707 0F1F1F1F0F07
0703010101010101 01,4,4,01071F3F7EF8E0C08F1F3F7FFFF
FC08000FFFFFF80C0C0E0E0F0F0F0F0E0C080
 1280 DATA 4,16,FFFFFFFF0F010000FFFFFFFFFFFE000000
FFFFFF,5,4,C0F0FCFEFF7F3FFFFFEFC70703030101FFFFFF0
1010101010307070F1E3830
 1290 DATA 10,8,80C0E0E0F0F0F8F8F8FCFCFCFCFCFCF8F0
F0E0C0C080
 1300 REM !!!!! D !!!!!
 1310 DATA 3,7,783C1E1F1F0F0F0F0F0F0F0F0F0F0F0F0F0
F0F0F0F0F0F0F0F0F07070301,8,3,80C1C3C7EFFFFEF8F3EF
FCE0E0FFFFE0E0E0E0F0F0F8EFFFFFF7F3F0F
 1320 DATA 6,3,01007FFFFFFFFFFF0000FFFF000000FFFF1
80C060606060C18FFFFFFFFFFFF,3,3,3060E0E0E1FFFFFFFE
FCF1030FFFF3030303FFFF1931606060603018FFFFFFFFFFFF
 1330 DATA 3,3,0214346CD898387870F0F0F0F0F0F0F0F8F
8F8F8F8FCFCFCFCFE7E7CFCF8F0E0E0C0
 1340 REM !!!!! E !!!!!
 1350 DATA 10,4,0103030706000001030707 0F1F1F1F0F07
0703010101010101 01,4,4,01071F3F7EF8E0C08F1F3F7FFFF
FC08000FFFFFF80C0C0E1E3F7FDF9F1E0C080
 1360 DATA 4,6,FFFFFFFF0F010000FFFFFFFFFFFE000000F
FFFFF3878F8F8F8F8F0E0C0,5,4,C0F0FCFEFF7F3FFFFFEFC
70703030101FFFFFF0101010101030707 0F1E3830
 1370 DATA 10,8,80C0E0E0F0F0F8F8F8FCFCFCFCFCFCF8F0
F0E0C0C080
 1380 REM !!!!! F !!!!!
 1390 DATA 17,4,0707070707070E0F1F1F3F7F7C7E7E3E1E
0604,8,4,01070F0F1F3E3E3E3EFFFFFFFFFFF0000FFFFFFFFF
F3E3E3E3E3C3820
 1400 DATA 8,11,8080800000000000000FFFFFFFFFF0000FF
FFFFFFFF,17,11,FFFFFFFFFF0001FFFFFFFFFE
 1410 DATA 4,12,0E1E3C3C7C7C7C3E3E1C1C1C38F8F8F0D0
3070E0E0C0C080
 1420 REM !!!!! G !!!!!
 1430 DATA 11,6,0103070F0F1E1F3F3F7F7F7F3F1F1F0F0F
0707070706 06,5,6,01071F3F78E0FFFFFFFFFF00000183 83C
7C7EFFFFFFFDFDF8F0F070301
 1440 DATA 4,4,3FFFFFFF000000FFFFFFFFFFE0C0C0FFFF0
000000000000080C0C0F0FFFFFF3F,5,4,E0FCFE7F1F0FFFF9
F0E0E0000000FFFF000000000000000103071FFEFCF8E0
870F0E0C080

 1460 REM !!!!! H !!!!!
 1470 DATA 5,9,040E1C3C1C0E0F07070707 0F0E1C1D393B3
B370F0E1E1C181810,8,5,0101010F3FFFFFFF007FFFFFFFFF
818307070E1C1C3E3F3F1F0F07
 1480 DATA 5,5,2070F0E1E1F1FFFFFFFFFF00FFFFFFFFFFD
8980C0C0C0C1818FFFFFFFFFF,6,5,38F8F0E1E3FFFEFEF9F3
0FFFFEFCF8F0303060616363363 1FFFFFFFFFE
 1490 DATA 7,7,38FCFEFF72F0E0E0E0E0E0F0F0F0F8FCFCF
8F0E0987CFEEEC480
 1500 REM !!!!! I !!!!!
 1510 DATA 7,7,03070E1E3E3E3E1E1F0F0F0F0707070F0F0
E1C0103070F0F1E18,17,9,0F3F7FFFFFE000007FFFFFFFFFF
F
 1520 DATA 10,9,0C3C7870707078FFFFFFFFFF000000FFFF
FFFFFFFF,9,9,0101030303030307FEFEFCFCF0000003FFFFF
FFFFCF8
 1530 DATA 6,12,70F0E0E0C0C0C0E0F0F0F0707038383870
F0F0E0C080
 1540 REM !!!!! J !!!!!
 1550 DATA 7,3,071F3F3B7978787C7C7C7E7E7E7E3C3D3D3
F1F1F1E1E1D1F3F3C38306040,8,8,8080830707030303010F
1F3F7FFFFCE080871F7FFFFFFF80
 1560 DATA 11,9,0C8ECFCFE7FFFFFFFFFFFF000000FFFFFF
FFFFFF,16,9,80E0F0FFFFFF000003FFFFFFFFFFFC
 1570 DATA 2,11,060E1C3C7C78F8F0F0F0F87C7C3C3C3E7E
EECE1C3C7CF8F0E0C0C0
 1580 REM !!!!! K !!!!!
 1590 DATA 4,13,1C3C38383C3C3C1D1F1F3F3800071F1800
0000000000001,3,9,03030303011F1FFFFFFFFF0000FFFF010
3060C183078FDFFFE7C3810
 1600 DATA 3,13,018181C1E0FFFFFFFFFFFF0000FFFF8307
0F1F3F67C78301,2,7,60E0C0C0C1F7FFFFFFFEF8F00107FEF
80000008080C0E0F8FEFF7F1F0F0301
 1610 DATA 3,3,0E1E7CFCFCDC9C383870F0F0F0F0F8F8F8F
CFC7E3E3C1C38B0E0F0F8FCFCFC783060
 1620 REM !!!!! L !!!!!
 1630 DATA 5,9,0E1E3C3C3C3C3E3E1F1F1F1F1F1C1833070
F1F1C1C3C3C383818,10,17,0F3FFFFFFFFF80007FFFFFFFFF
 1640 DATA 6,17,0C1E1E1FFFFFFFFFFFF0000FFFFFFFFFF
,6,9,30707070FFFFFFFEF8C3073FFEFCF1E183030303030303
030101
 1650 DATA 5,5,0C1C3C78F8F8F070F0E0E0E0E0E0E0E0E0E
0E0E0F0F0F0F8F8FCFC7C7860
 1660 REM !!!!! M !!!!!
 1670 DATA 10,2,0101030707 0E0E0F1F1F0F0701010103030
70 60E1F0F0703010103 06,5,3,030F3F7FFFF8E0FFFF00000
000FFFFFFFFFF808000FFFF00000080FFFFFFFFFF
 1680 DATA 2,3,030707FFFFFFFFFF0000FFFF0C3C7C7CFFF
FFFFFFF7C7C7CFFFF7C786000FFFFFFFFFF,1,3,C0C0C080C0
FFFFFFFF0000FFFF00000003FFFFFFFFFF03060CF8F8300000
00FFFFFFFFF
 1690 DATA 1,1,060E1E3C3CFCDCDC1C3C78F0C000000000 8
0C0E0C0800000000000000000000E0F0F8FCFC3830
 1700 REM !!!!! N !!!!!
 1710 DATA 12,7,01030707 0E0F1F1C3C3C3C3E3E1F1F1F0F
0F0703 01,6,5,0101010100FFFFFFFF0000FFFF060303010 10
10183E3FEFFFFFFFFF3F
 1720 DATA 4,5,02868ECECEE7FFFFFFFFFF0000FFFF060C0
C98989898 0C0C07FFFFFFFEF8C0,4,3,307060606070F8FFFF
FFFE0001FFFF000000000000071FFFFBE383030301010303
 1730 DATA 3,4,0C1C38387C7C7CFCFCFCBC78F0E0C000000
0000000C0E0E0E0C0C0E0E0E0E0E0C0
 1740 REM !!!!! O !!!!!
 1750 DATA 15,11,0101030307070707070703030101,7,5,
030F1F3C387F7FFFFFFF808080FFFFC0C0C0E0E0F0F8FE7F3F
0F0701
 1760 DATA 5,5,077FFFFFC70000FFFFFFFFFF000000FFFFC
1C163636363C1C1C0FFFFFFFE,6,6,E0F8FCFE7F3FFFE7C383
01010000FFFF80810103070E9EBCF8F0E080
 1770 DATA 12,14,80C0E0E0E0E0E0E0E0E0C0C080
 1780 REM !!!!! P !!!!!
 1790 DATA 5,7,060C183838383C3F1F1F0F0301033F3F0C1
81C3C3C3E3F1F0F070301,8,5,0103060CFFFFFFFFFFF8000FF
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FF060301010101183F6FFFFFFFF7F0F
 1800 DATA 7,5,C0E0F0FC7FFFFFFFFFFF0000FFFF060C989
898980C06FFFFFFFFFFF,5,5,01030707F0E9EFFFFFFFFFF
0000FFFF3E3E1F1F0F0F0707FFFFFFFEFCF8
 1810 DATA 4,10,C0800080000000000FCFCFCFCFC0C0CFCFC
00000000808080808080
 1820 REM !!!!! Q !!!!!
 1830 DATA 13,13,0101030307070707070703030101,5,7,
030F1F3E387F7FFFFFFF808080FFFFC0C0C0E0E0F0F8FE7F3F
0F0701
 1840 DATA 3,7,077FFFFFC70000FFFFFFFFFF000000FFFFC
1C163636363C1C1C0FFFFFFFE,4,4,E0F8FCFE7F3FFFE7C383
0101000FFFF8081010307 0E9FBFFFFE7830100000 1
 1850 DATA 10,4,80C0E0E0E0E0E0E0E0E0E0C0C080000000
80C0E0F0F8F8F0E080
 1860 REM !!!!! R !!!!!
 1870 DATA 4,10,060C183838383C3F1F1F0F030001010303
06060E0F1F1F0F0701,7,9,0103060CFFFFFFFFFFC080FFFF0
00000181E3FCFCF8F870
 1880 DATA 6,9,C0E0F0FC7FFFFFFFFFFF0000FFFF60E0F0F
0F8FCFF7F3F1F03,5,5,0101030303 83FFFFFFFFF0303FFFF
0100000101018 0F0FEFFFFFF1F0703
 1890 DATA 3,3,60E0C0C0C0C0C0C0E0E0E0F0F0F8F8F8F
8F0E0C0800000000080C0C0E0F0F0E0C0
 1900 REM !!!!! S !!!!!
 1910 DATA 12,10,0103070F1E1E1E1E1F1F0F0F070703010
306,6,11,01030707 0EFCFFFF8F0707070707070787 8FDFF3C
38101
 1920 DATA 5,5,7CFEFFFFFF0F070787C7C7C7C7CFDFF7C7C
7E7E7E3F1F0F8FE7F3F1F0703,4,5,03070E1C1C9C9E9E9E9E
FF8F8F8F8F878783878DF9F8F0E001038FFEFCF8C0
 1930 DATA 4,10,80C060606060606060C0C0808080 80C0C0
E0E0F0F0E0E0C0C080
 1940 REM !!!!! T !!!!!
 1950 DATA 5,5,03070F1E1E3C3D7D7F7F7E7C3F3F3F3F1F1
F1F0F0F0F0F0F0F0E0E0C1810,5,12,81871F3F7FFEF8E0C00
00000FFFFFFFFFF00000000FFFF
 1960 DATA 4,12,3FFFFFFFFFFF0000000000000000FFFFFFFF
FF00000000FFFF,4,6,80F0FCFEFFFF7F1F0F07030F3DF9F0E
0C000000000000FFFF0103070F1E38
 1970 DATA 9,9,80C0E0E0F0F0F0F8F8F8F8787878F8F0F
0E0E0C080
 1980 REM !!!!! U !!!!!
 1990 DATA 2,6,1E3C787878707173373E3C393B3F3F78707
F7F000003071F3F7F3F1F0F1F1C30,3,8,030F3F7FFFFCE080
00FFFFFFFFFF0000FFFF030101010 3FFFFFFFFFFF
 2000 DATA 2,8,FFFFFFFFFFFF00000000FFFFFFFFFF0000F
FFF03868686 03FFFFFFFFFFF,2,8,80F0FCFEFFFF7F1F071F
F9F1E0C0800000FFFF0000000001FFFFFFFFFFF
 2010 DATA 7,3,80C0E0E0F0F0F0F8F8787878F8F87070E0E
0C08000C0E0F0F8FC7C7870C0
 2020 REM !!!!! V !!!!!
 2030 DATA 8,8,03070F1F1F1F07030100000001030606 0C0
E1F3F3F1F0707,8,8,800000C0F8FFFFFFFF7FC7C181000000
0001C1FFFFFFFFFE
 2040 DATA 10,9,01010101E1FFFFFFFF8181C3C3C3C38181
FFFFFFFE,8,10,60E0C0C0C0C0E1FFFFFEC0808101010 1039F
FFFEF8C0
 2050 DATA 13,15,1CFCF8F870F0E0E0E0F0F0E0
 2060 REM !!!!! W !!!!!
 2070 DATA 1,2,03070F1F1F1F07030100000001030606 0C0
E1F3F3F1F0700000001030 60C0E1F3F3F1F0707,1,2,800000
C0F8FFFFFFFF7FC7C181000000000 1C1FFFFFFFF7FC1C18000
000001C1FFFFFFFFFE
 2080 DATA 3,3,01010101E1FFFFFFFF8181C3C3C3C38181F
FFFFFFFE18183C3C3C3C38181FFFFFFFE,1,4,60E0C0C0C0C0
E1FFFFFEC0808101010103BFFFFEF8C0808080001010101BF
FFFEF8C0
 2090 DATA 6,8,1CFCF8F870F0E0E0E0F0F0F0F8FC7C78787
0F0E0E0E0F0F0E0C0
 2100 REM !!!!! X !!!!!
 2110 DATA 5,5,03060E1E1E1E1F1F1F0F0701000000000000
0000000000030C1E1E1F0F0F06,11,13,80E0F8FEFFFF7F1F07
01000 1030C30C0
 2120 DATA 8,7,0C3C3C3C3C3C3CBCFCFFFEFFFFFFBF3F3D3
C3C3C3C3C3C3C30,6,8,0103030301010 1030C30C0000080E0
F8FEFFFF7F1F0701000101
 2130 DATA 6,9,80C0C0E0E0E0C0000000000000000000000080
0C0E0E0E0E0C080
 2140 REM !!!!! Y !!!!!
 2150 DATA 7,6,1018181C1F1F1F0F07030306 0F0F1E1E1E1
F1F0F0F0F0F07070301,7,5,30381C1FFFFFFFFFFFFF0000FF
FF0303010101 83C3C3FFFFFFFFFF7F
 2160 DATA 6,5,40607078FEFFFFFFFFFFFF0000FFFF06068
C8C8C060707FFFFFFFFFFFE,7,6,01030306FEFEFEFEFEFE06
06FEFE0606060E1E7EFCFCFCF8F8E080
 2170 DATA 6,15,F8FC8E0E0E0E0E0E0E1C1C1818303030 3E
1E0C
 2180 REM !!!!! Z !!!!!
 2190 DATA 6,7,070C1E1E1F1F0F0F0F0707070707070707070
7070707070F1F1E3820,11,10,808080C0C0C0C0C0C1C3C78F
9F3F7FFFFCE080
 2200 DATA 8,7,0103032363636367 7F7FFFFFFFFFFFFFBF
3E3636362606040,11,18,030F7FFEFCFCF8F0E08080
 2210 DATA 8,6,1C3CF8F8B83030707070F0F0F0F0F0F0F8F
8787878787070E0C0
 2220 REM !!!!! a !!!!!
 2230 DATA 40,0,,17,20,010101
 2240 DATA 13,13,387F67E0F0F0F8F87F7F3F3F3F60,11,1
4,071F3F7FF1C0C0606030FFFFFFFFFF
 2250 DATA 11,11,E0F8FCFEFE7E3E1C3060F8FCFEFEFE0C1
C18
 2260 REM !!!!! b !!!!!
 2270 DATA 12,18,101C1F0F070F0F1E1810,11,15,070707
FFFFFFFFFF000000000101
 2280 DATA 14,11,FFFFFFFFFF183060E0F8FFFF7F3F0F,14
,11,FFFFFFFFFF0000000000FFFFFFFFFF
 2290 DATA 12,11,40E0E0E0F0F0F8F87C7E3E3CF8F8F0F0E
0
 2300 REM !!!!! c !!!!!
 2310 DATA 40,0,,17,16,0103070703030 1
 2320 DATA 15,14,FFFFFFFFFFC0E0F0F0F060,15,20,FFFF
FFFFFF
 2330 DATA 14,14,30F8F8FCFCFE3E1E1C183020
 2340 REM !!!!! d !!!!!
 2350 DATA 10,26,03030101,10,11,E0F0F0F8F8FD7D7F3F
3F1F1F0F0F070703070E
 2360 DATA 13,12,7FFFFFFFFF0000808 0C0FFFFFFFFFF,13
,12,FFFFFFFFFF0000000000FFFFFFFFFF
 2370 DATA 11,12,40E0E0E0F0F0F8F87C7E3E3CF8F8F0F0E
0
 2380 REM !!!!! e !!!!!
 2390 DATA 40,0,,15,17,0103070F0F070301
 2400 DATA 14,14,FFFFFFFFFFC0E1F3FEFC7830,14,19,FF
FFFFFFFC080
 2410 DATA 13,14,30F8F8FCFCFE3E3E1C1C181830
 2420 REM !!!!! f !!!!!
 2430 DATA 17,14,03070F1F3F3C1C1E1C,14,15,060606FF
```

CONTINUED OVER

```
FFFFFFFF060606
 2440 DATA 17,18,FFFFFFFFFF,17,18,FFFFFFFFFF
 2450 DATA 16,14,30F8FCFEFEFE7C383060
 2460 REM !!!!! g !!!!!
 2470 DATA 14,13,0101030303030100000000001,11,13,
7FFFFFFFFC0C0E0E0FFFFFF7F7FE0E0
 2480 DATA 11,15,FFFFFFFFFF00000000FFFFFFFFF,11,1
2,E0F0F0F8FF7F3E1830FCFEFFFFF0F0301
 2490 DATA 10,10,0C1C3C7CF8B8383878787878 3CBCFCFCF
CF8F060
 2500 REM !!!!! h !!!!!
 2510 DATA 12,19,040603030107 0F1C18,11,12,060606FF
FFFFFFFF000103070F0F070301
 2520 DATA 14,11,FFFFFFFFFC0800000E0FFFFFFFF7F,13
,11,01FFFFFFFFFF000000000FFFFFFFFF
 2530 DATA 12,11,80C0E0F0F8F0E2C6860E1C3CFCF8F0E08
0
 2540 REM !!!!! i !!!!!
 2550 DATA 16,18,010307070301,16,18,0183C7C78301
 2560 DATA 15,17,C0E0FFFFFFFFFFC0,17,18,FFFFFFFFFF
 2570 DATA 17,15,F0FCFEFEFE3C1810
 2580 REM !!!!! j !!!!!
 2590 DATA 18,16,040E1F1F0E04,16,16,03060E1F3F1F0F
07
 2600 DATA 18,17,1FFFFFFFF0,18,16,F8FFFFFF3F07
 2610 DATA 16,17,060E3CF8F0E0C0
 2620 REM !!!!! k !!!!!
 2630 DATA 10,20,181C0F07070F1F1C3020,9,13,0C0C0CF
FFFFFFFFF00000001030 70F070301
 2640 DATA 12,13,FFFFFFFFFF3061C3878FDFF7E3C080,12
,13,FFFFFFFFFFC0800080C0F1FFFFFF1F
 2650 DATA 10,10,1038F8FCFEFEFC78383060C080E0F8FEF
E7C3830
 2660 REM !!!!! l !!!!!
 2670 DATA 15,15,181C0F07070F1F1C3020,17.18,FFFFFF
FFFF
 2680 DATA 17,18,FFFFFFFFFF,17,18,FFFFFFFFFF
 2690 DATA 15,15,1038F8FCFEFEFC783830
 2700 REM !!!!! m !!!!!
 2710 DATA 40,0,,5,5,0103030707070300000000010303 0
707030000000001030307070300 0103
 2720 DATA 7,6,80FFFFFFFFFF3060C080C0FFFFFFFFFF306
0C080C0FFFFFFFFFF80,8,7,FFFFFFFFFF00000000000FFFFFF
FFFF000000000000FFFFFFFFFF
 2730 DATA 6,5,1038FCFEFEFEFC3810001038FCFEFEFEFC3
810001038FCFEFEFEFC3810
 2740 REM !!!!! n !!!!!
 2750 DATA 40,0,.10,13,0103030707070300000000001030
3070703
 2760 DATA 12,12,80FFFFFFFFFF3060C080C0FFFFFFFFFF,
13,12,FFFFFFFFFF0000000000FFFFFFFFFF
 2770 DATA 11,10,1038FCFEFEFEFC3810001038FCFEFEFEF
C3810
 2780 REM !!!!! o !!!!!
 2790 DATA 40,0,,18,18,01030301
 2800 DATA 13,13,3F3F3F7FFFE0E0F0F0FFFF7F7F7F,13,1
3,FFFFFFFFFF00000000FFFFFFFFFF
 2810 DATA 12,13,18F8F8F8FCFC3E3E1C1CF8F8F0F0E0
 2820 REM !!!!! p !!!!!
 2830 DATA 10,12,0103070F0F0F0701000000010307 0F0F0
703,13,11,FFFFFFFFFF3060C080C0F8FFFFFFFF3F
 2840 DATA 11,11,0101FFFFFFFFFF0000000000F FFFFFF
FFF,10,11,80C0C0FFFFFFFFFF0F878787C3CF8F0E0C080
 2850 DATA 11,20,0E3CF8F8F8FCFE0E06
 2860 REM !!!!! q !!!!!
 2870 DATA 11,13,0103030707 0F1F1F0F0707030301010 1,
11,12,FFFFFFFFFF00008080C0FFFFFFFFFFC080
 2880 DATA 11,14,FCFFFFFFFF0701010306FFFFFFFFFF,13
,14,80C0E0E0C0800000FFFFFFFFF
 2890 DATA 18,12,02061EFCFCF8FCFE0E02
 2900 REM !!!!! r !!!!!
 2910 DATA 40,0,,13,13,0103070703010000000103070301
 2920 DATA 12,12,C0C080FFFFFFFF7F60C08080C0E0C080,
15,20,FFFFFFFFFF
 2930 DATA 13,17,1038F8FCFEFCF8383060
 2940 REM !!!!! s !!!!!
 2950 DATA 25,13,0101,12,12,0307070F0F1C3E3E1E1E0E
0E0C1FFEF8
 2960 DATA 12,13,FFFFFFFFFF0303010307 1F3FC78301,12
,11,80C0C0E3F6FCF0E08080C0E0FFFFFFFF7F
 2970 DATA 11,11,061E7CFC787878787C7C7E3E3CFCF8F8F
0F0
 2980 REM !!!!! t !!!!!
 2990 DATA 40,0,,14,14,03070F1F3F7FFF0707070707
 3000 DATA 16,19,FFFFFFFFFF,16,19,FFFFFFFFFF
 3010 DATA 14,15,1038F8FCFCFEFE7C383060
 3020 REM !!!!! u !!!!!
 3030 DATA 40,0,,9,12,0303070F0F0F07020000000000207
0F0F0F0702
 3040 DATA 11,13,FFFFFFFFFF0000000000000FFFFFFFFFF,
11,13,FFFFFFFFFF000000000000FFFFFFFFFF
 3050 DATA 11,9,F0F8FCFEFE3E3C183060C0F0F8FCFEFE1E
1C3830
 3060 REM !!!!! v !!!!!
 3070 DATA 14,24,0101,11,11,3F7FFFFF8F07030103060C
1C3E3F1F0F0701
 3080 DATA 12,11,E0FFFFFFFFFF800000000000FFFFFFFFF
F,13,11,FFFFFFFFFF000000000000FFFFFFFFFF
 3090 DATA 11,11,40E0E0E0F0F0F0F8FC7E7E3C38F0F0E0E
0C0
 3100 REM !!!!! w !!!!!
 3110 DATA 40,0,,5,6,3F7FFFFF8F07030103060C1C3E3F1
F0F07010103060C1C3E3F1F0F0701
 3120 DATA 6,6,E0FFFFFFFFFF8000000000000FFFFFFFFFF8
000000000000FFFFFFFFFF,7,6,FFFFFFFFFF000000000000FF
FFFFFFFF000000000000FFFFFFFFFF
 3130 DATA 5,6,40E0E0E0F0F0F0F8FC7E7E3C38F0F0E0E0E
0F8FC7E7E3C38F0F0E0E0C0
 3140 REM !!!!! x !!!!!
 3150 DATA 40,0,,10,10,0101030707070301000000000000
0000307070301
 3160 DATA 9,10,C0C0C080C0E0F8FEFF7F1F07030D30C000
C0E0C080,15,13,010698E0F8FEFFFF7F1F0701
 3170 DATA 9,10,307C7E3C1860800000000000080E0F8FEFE
FE7C7060
 3180 REM !!!!! y !!!!!
 3190 DATA 40,0,,11,12,03070E1F1F1F0F0703060C183E3
F1F0F07
 3200 DATA 14,12,FFFFFFFFFF0000000001FFFFFFFC,12,1
4,0103FFFFFFFFFE0C1C3870E0C080
 3210 DATA 11,17,F8FCCCCE860606060606C3830
 3220 REM !!!!! z !!!!!
 3230 DATA 40,0,,14,15,03060C1E3F3F1F0F070703
 3240 DATA 15,16,0103070F9FF7E7C381,18,16,01C3FFFF
FEFC
 3250 DATA 16,18,78FCE6C68404
```

COMPUTER CONCEPTS

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for the BBC Micro

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

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

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

Just some of PRINTMASTER's commands are listed below:

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

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

*TDUMP copies any text currently on the screen.

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

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

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

```
PRINTMASTER (Epson) 1.02
  DEFINE (<chr>)
  FDUMP (<fsp>)
  FONT (<country>)
  GDUMP (<or,op>) (<X,Y>) (<gap>)
  GPRINT <str> (X,Y) (<or,op>) (<gap>)
  INITIALISE
  ITALIC (<on/off>)
  LINCH (<lines per inch>)
  LINESPACE (<a>) (<b inches>)
  MARGIN (<left>) (<right/width>)
  PAGELEN (<inches/+lines>) (<skip>)
  PCODE (<codes/$ASCII>)
  PROPORTION (<on/off>)
  STYLE (<str>)
  TAB (columns   >
  TDUMP (<udc width>)
  TEXT (<width>) (<shade>) (<height>)
  TPRINT <str> (chr) (X,Y) (<or,op>)
  ULOAD (<fsp>)
  UNDERLINE (<on/off>)
  USAVE (<fsp>)
  WINDOW
  WVALS
OS 1.20
```

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

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

```
WORDWISE
(C) Computer Concepts 1982

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

ESC Edit Mode

Please enter choice_
```

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

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

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

ARIES compatible WORDWISE

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

VISA

COMPUTER CONCEPTS

Access

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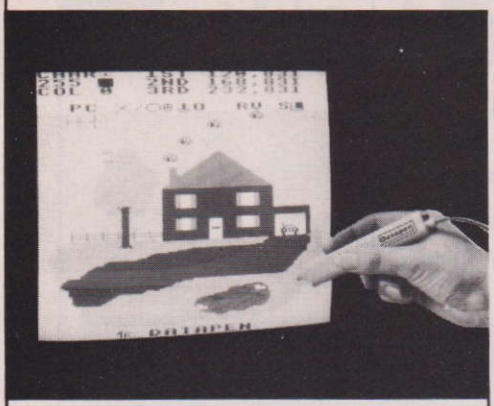
Datapen BBC Lightpen Programs Datapen



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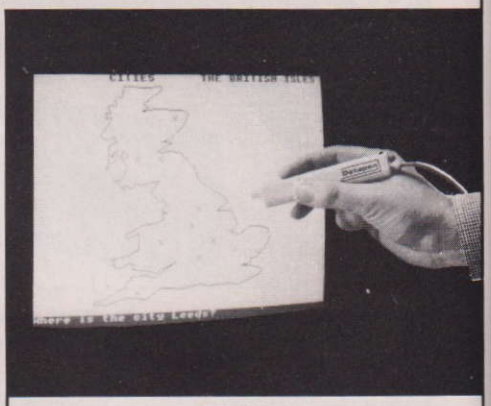
TELETEXT DISPLAY CREATOR/EDITOR
Allows the busy programmer to quickly create Mode 7 colour graphics and test screens for combination into his or her own programs. Movable on screen menu allows use of complete screen for graphics. Full instructions and a discussion on teletext features are provided. **PRICE £9.95 Introductory Offer £7.95**



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- Switch for program control

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The Datapen Lightpen itself comes complete with handbook, software on tape including two drawing programs and a printed listing showing useful routines.

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Has coin and note analysis.
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Comprehensive facility for selecting and printing using any user definable criteria.

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Parfitt Plotting

Mark Webb

Meet the plotter which is not content with pens. It is a CNC machine into the bargain.

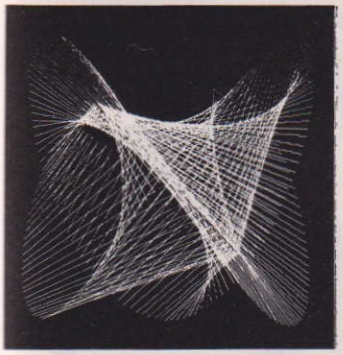
You may have seen the Parfitt Plotter at one of the many shows devoted to the BBC or perhaps the local school has invested in one. If so, you will have noticed that it is never without a small gathering of interested people asking what it can do and then making suggestions!

The Parfitt Plotter is one of those additions to a microcomputer system which opens up whole new areas, some of which have apparently nothing to do with computing. New skills away from the keyboard/monitor environment have to be learned.

The basic plotter itself is a somewhat Heath-Robinson looking device but turns out to be wonderfully functional. "Minimal engineering" is one of the phrases used by the designers. There is no doubting the reliability of the Parfitt. Some of the original plotters have now been going for nearly four years without a change in the threads which guide the plotting arm around the base.

FLAT AND FUNCTIONAL

The Parfitt Plotter is a traditional flat-bed plotter. The melamine covered bed can take sheets of paper up to A3 size and, more interestingly, other, thicker, sheet materials.



The basic £270 unit consists of the bed, the rails along which the pen holder travels in the X and Y axes, the two stepper motors which control the movement and the interfacing with the micro.

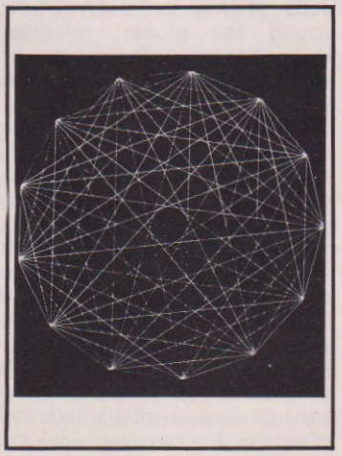
The plotter plugs into the user port of the BBC and takes its power from the auxiliary power port on the Beeb. There is also a purpose-built power supply, the PS12, and an enhanced version needed for the drill/router attachment, the PS24.

Under software control, the Parfitt Plotter can use any of the three colour pens to draw anything from a printed circuit board to a bunch of sine waves plotted on your screen, and lots more in between. Graphs and charts play an important part in many areas of a school curriculum and the plotter is an ideal way of producing hard copy.

There is no reason either why business graphics should not be produced although the Parfitt Plotter does lack some of the finer points of software control now built into the newest business plotters from Epson and Hal. Here too the advantages of being a flat-bed rather than a moving drum plotter, can benefit the user.

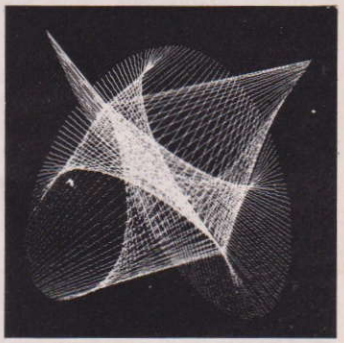
Parfitt are currently developing a larger version of the DP 025 for a business user who wants to produce packaging materials.

Hard copy of computer graphics is the most straightforward use to which the Plotter can be put, from the Logo graphics of primary school children to the complex functions of an A level mathematics course. Some of the available software includes a program to do the latter, but since the Plotter is entirely under software control then anything on the screen except for "painted" areas can be sent to the Plotter.



SOFTWARE SENSE

The Parfitt Plotter comes complete with demonstration programs on disc or tape. The method by which the control software has been implemented is sensible and practical. A number of machine code routines which control things like orientation, size, X,Y movement, current pen in use and plotting speed, can be called from within a BASIC program. Each routine resides at a set memory location, which can be allocated a meaningful name. The routine can therefore be called with ease by the most inexperienced programmer. Each call can involve the passing of various parameters to the routine.



The routines and ASCII look-up table used by the Plotter software is stored from &1900 upwards and PAGE appropriately altered. The routines are however free to be placed anywhere in free memory. Their positions merely have to be known to the rest of the program calling them.

PMOVE moves the pen carriage within the allocated logical plotting area with the pens up. PDRAW selects a specified pen and draws to any X,Y position. PLINE needs to start and end co-ordinates and pen. It then draws the line with the pen and lifts it at the end of the operation. PBOX uses two X,Y co-ordinates plus pen to work out and draw a rectangle. POFFSET moves the logical origin to a new point, X,Y. This is a quick and convenient way of relocating complete

CONTINUED OVER

drawings. PINIT resets all the internal variables.

PORIENT and PSTRING are used in combination to produce characters. The one parameter of PORIENT sets the direction in which the plotter will draw its characters. PSTRING takes a specified string, size of character and choice of pen and plots away. You can plot out a whole listing if you wish though it takes a bit of time. Regular western character sets are a bit boring and survive the dot-matrix approach. However, if you are interested in producing something more enterprising; a Chinese vocabulary or a medieval manuscript, then the Parfitt Plotter should turn out an attractive finished product.

PSEED varies the plotting speed between 1 (slowest) and ten (fastest without getting out of step). Nine is set as standard speed. Better quality can be achieved with slower speeds and they are a necessity when using the carriage to carry heavier devices like the opto/sensor or when the scriber has to actually cut away the surface of a metal or glass sheet.

VISIBLE EXAMPLE

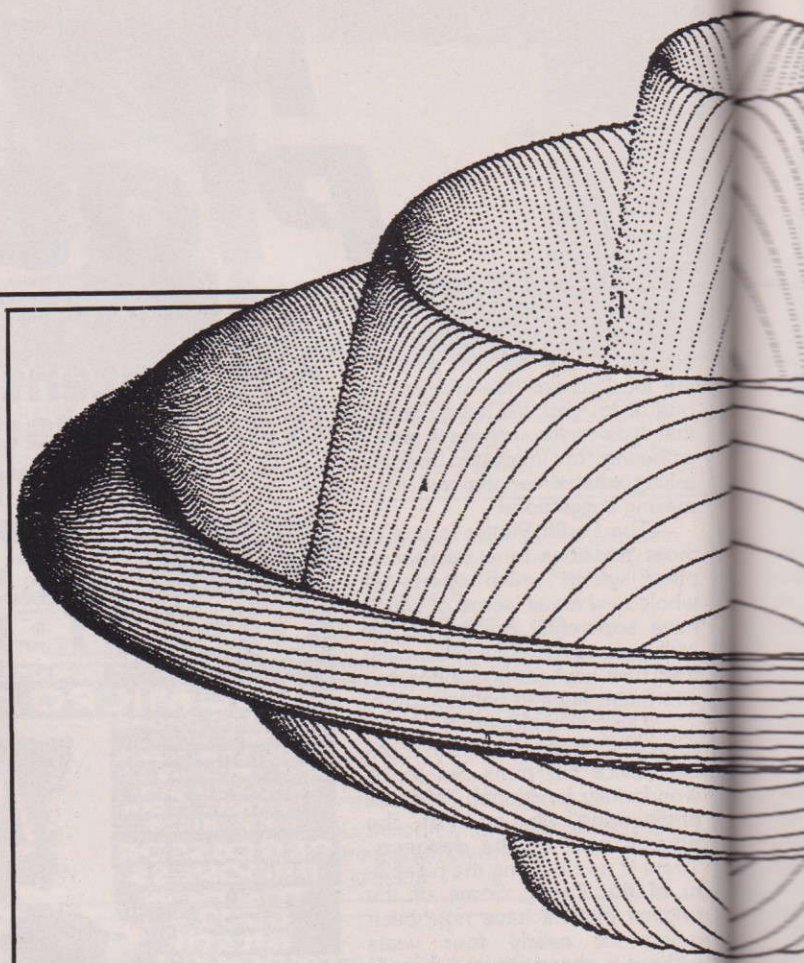
As well as providing for programming basics, the documentation goes into some of the more useful memory locations, their uses and how they effect the control of the plotter steppers via the user port.

This information is essential for those using the Parfitt Plotter as an example of control via the user port as well as for those programming new applications.

The plotter is an ideal example of a practical device under computer control. It should prove an excellent introduction to students tackling stepper motors for the first time, and an inspiration for individual projects. With the addition of the drill/router (the PS 24 power supply is needed for this option) the Plotter becomes a CNC workstation. Students can be trained to think in the X,Y and Z movements of the devices which can result in a finished product in a variety of materials.

The drill/router attachment can drill holes in wood or plastic or rout polystyrene or balsa wood. Polystyrene tiles are ideal for this purpose and cheap! All sorts of projects could revolve round the plotter, involving design teams, discussions on manufacturing techniques and so on.

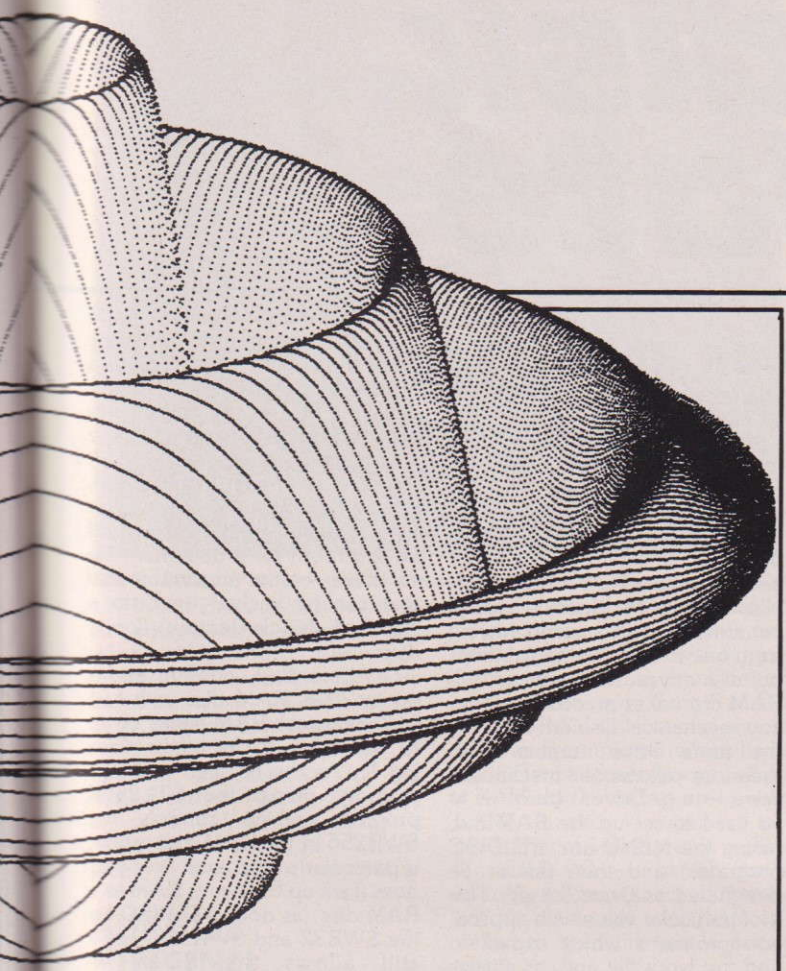
The scriber can be used to etch scraperboard directly with its tungsten point or to remove photresist from glass or copper plates. One can imagine some of the more artistic results going like hot-cakes at the school fete. The idea of etching has inspired the idea of producing computer pictures for the blind. The final solution involves a "first", a computer controlled panel beater, which can produce readable text for blind people and opens up the possibility of recreating black and white photographs for blind people to "read" with their fingers.



```
RAD=SQR(X↑2+I↑2)/HX
Y=(RAD-1)*COS(18*RAD)
```

Another unexpected addition to the Parfitt Plotter comes in the form of an opto-sensor. The plotter, usually associated with receiving information from the computer, can now supply it in the form of an optical scan of a black and white drawing or photograph. The sensor fits into one of the guide tubes, ½ inch cylinders which can hold various sorts of pen and just about anything else providing it is the right sort of size. Users will come up with their own ideas.

The opto sensor produces a picture of greater resolution than the normal monitor can handle and given the correct contrast in the original, can produce an accurate representation on your VDU. Even without the full contrast of black and white.



reasonable results are possible — witness the scan of A&B's July/August front cover. A new line-following algorithm, now being incorporated into the support software for the plotter, makes it possible to quickly store the image of a drawing and then reproduce it again with the plotter's normal pen operation. The line following routine is a great improvement upon the "dump" which had to scan the whole image, plotting bit by bit. The routine needs unbroken lines so there is a zoom feature which allows the user to patch up breaks.

PARFITT PIONEERS

When working with the plotter and talking to the two men behind its design and current success, one gets the feeling of being in at the start of something important. The plotter is a pioneer in the field of computer control and will be responsible for the introduction of many students to the basics of boring holes and cutting slots with computer controlled equipment.

The MEP are currently converting some of their graphics packages to interact with the plotter so that output to the VDU can become hard copy for further study and discussion, and redesign. The possibility exists of writing an all purpose program which would intercept standard BASIC VDU calls (commands like MOVE and DRAW and PLOT are all essentially VDU calls).

The program would send output to the screen and the plotter if required. This would bring a vast range of simple CAD Packages into use with the plotter, for example a CAD CAM starter pack for all BBC owners. One can visualise small craft industries growing up around such a system. Simple moulds can be cut and objects cast in materials like clay and acryllic.

In industry, commercial CNC programs designed, say, to produce a steel gear wheel read like Chinese to anyone but the actual programmers. The friendly software environment provided by the BBC means programs that are easier to understand, which means that more people can learn more quickly. Students can learn techniques directly relevant to manufacturing processes.

The two men behind Parfitt Electronics and the Parfitt "Wonder Station", as the plotter will be known in the United States, are the eponymous Andrew Parfitt and former Chartered Patent Agent, Ian Mackenzie. Andrew Parfitt designed the plotter to help teach teachers of Design and Technology. The three pen arrangement is entirely due to the fact that the Parkers it uses only came in three colours.

Like all good computer advances, the plotter was initally built in a garage solely by its designer. Then Mike Bostock of MEP stepped in and ordered the plotter in some numbers. He also put Ian Mackenzie, who was thinking along the same lines of a cheap plotter for educational purposes, in touch with Andrew Parfitt. About 18 months ago Parfitt Electronics was launched as a joint venture with the plotter as their number one product.

RIGHT BLEND

The Parfitt plotter has turned out to be the right blend of well designed hardware, useful and fairly friendly software. The starting price of £270 (including manual, cassette software, pens and delivery) is very attractive. A full system with extra power supply, drill/router, opto-sensor and scriber will cost you £490 — a reasonable investment in the future. Like everything else to do with the BBC the only element lacking will be time to implement all one's ideas. You may even find it invaluable in your work, like the teacher who, apparently, took the plotter off its base and rigged it up to his blackboard. All he had to do was replenish the guide tubes with chalk and sit back. If you can think of an original use for the Parfitt plotter then you can get one from Parfitt Electronics, 6 View Road, London N6 4DA. Telephone: 01 348 1973.

Solidisk Update

Gordon Taylor

A further look at the recently improved sideways system.

The review of the Solidisk Sideways RAM system published in the May/June issue showed it to be an add-on with unique capabilities. Enough has already happened since then to justify an update. Several important changes have been made to the software — and there has been a major hardware development as well.

FLEXIBILITY

After fitting a Sideways RAM system, the MENU program is used — as before — to load files from disc. Depending on their load addresses, they are loaded either into the normal user RAM area — from PAGE to HIMEM (which lies between &0000 and &7FFF) — or into the Sideways RAM area (which lies between &8000 and &BFFF) (See Fig. 1). Notably, such Sideways files can include images of your ROMs or EPROMs. These may be created (while the ROM is installed) by pressing (@) from the MENU program. The Solidisk Sideways RAM System is thus a more flexible alternative to a Sideways ROM Expansion board.

Again as before, the number of files that can be loaded into the Sideways area depends on the number of 16K RAM banks provided by the Sideways System — one for a SWR16, two for a SWR32 and eight for a SWR128. However, instead of just being loaded in succession from the lowest to the highest bank available, they may now be loaded in any order. This is done by using the < and > keys to set the number of the next bank to be loaded.

The Solidisk utility disc still contains the two programs — STLOE00 and STL150. The former enables PAGE to be at &0E00 while still retaining all file operations — with up to five channels open — as standard. It has been re-written as an Acorn-compatible Disc Filing System (DFS). The latter still "patches" the Acorn 0.90 DFS (which must therefore be present to use it) to provide an extended catalogue capable of accepting up to 150 files — together with an appropriate formatter and verifier.

The ability to load Sideways files into RAM banks in any order enables a major advance in RAM Disc operations. This is because the STLDisc program — which sets up Sideways RAM banks as an electronic equivalent of a disc drive — can now be positioned in any bank from eight to F. this enables the available Sideways RAM to be set up in various combinations of RAM disc and RAM banks. Thus, for example, a SWR32 can be set up as a small RAM disc of 4 or 20K, while a SWR128 can provide RAM discs of from 4 to 100K, together with from eight down to one Sideways RAM bank.

The new version of STLDISC also is now a DFS program in its own right (rather than just a "patch" for the Acorn 0.90 DFS as before). This means that the Acorn 0.90 DFS does not need to be present to set up a RAM disc and the MENU program can be run using any Acorn-compatible DFS — such as other Acorn DFSs and any of the Watford DFSs.

As before, STLDISC offers several improvements over the Acorn DFSs by including routines for formatting 40 and 80-track discs and for verifying them after formatting. Moreover, the formatter is capable of formatting RAM discs of any size from 4 to 100K.

The Solidisk DFS — in the new STL0E00, new STLDISC and STL256K versions — is faster than the standard Acorn 0.90 DFS. Indeed, it is just as fast in disc operations as later Acorn-style DFS such as the DNFS supplied with the 6502 Second Processor. The difference in speed is significant — being between two and two and a half times, depending on the operation.

Another new feature of the latest version of STLDISC is that the Drive Number of the RAM disc can be set to any number between zero and four. This allows the RAM disc to be used in conjunction with systems having from one to four mechanial (floppy) disc drives. Furthermore, the RAM disc takes precedence over any mechanical disc drive having the same Drive number. This therefore allows a mechanical drive — e.g. Drive 0 (zero) — to be used to set up the RAM disc (using the MENU and STLDISC programs) and then this to be designated as Drive 0 itself. This is of particular value with application programs which expect to find the work file and/or utilities on Drive 0 — as in the case of the Merlin Scribe Word Processor (work file and utilities) and the GCC Starbase (work file) (see *A&B*, October issue). This enables Scribe (and Starbase) — among many other programs — to enjoy the benefits of RAM disc operation — as foreseen in the earlier article on Soidisk.

244K RAM DISC

While the advantages in speed and silence may be enjoyed with RAM discs of any size, realising the full potential clearly depends upon the size of the RAM disc — which in turn controls the size of the document or data file that can be accommodated. A 100K RAM disc would hold a document file corresponding to about 22 single-spaced A4 pages while a 200K RAM disc would hold twice as much.

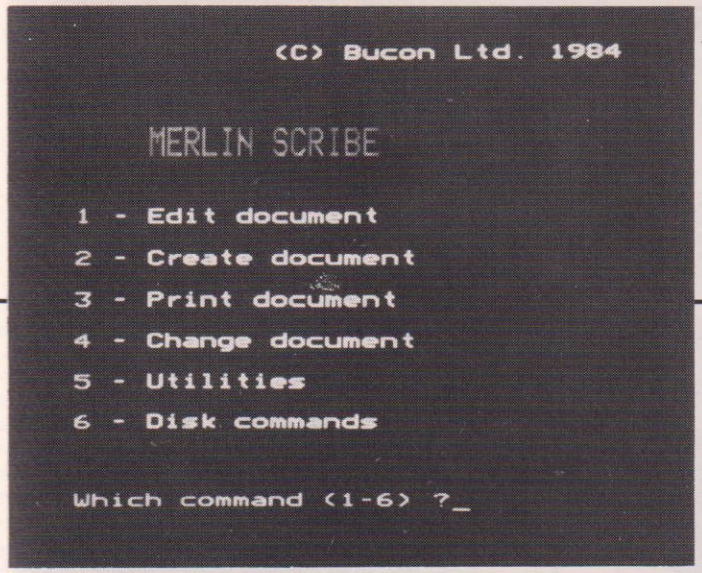
A foretaste of things to come was enjoyed with the opportunity to try out a pre-production version of the recently-announced SWR256. This uses the new 256 × 1 byte RAM chips, in place of the present 64 × 1 chips. With the help of a special version of the STLDISC program known as STL256K, the SWR256 can be set up as a RAM disc of as large as 244K (with no Sideways RAM banks). Although this is larger than the 200K of a standard 80-track drive using single-density (FM) recording, there are occasions when such a large RAM disc can be very useful. One such is when running Scribe, since it can hold all the utilities (which take some 32K) while still having room for a document file of 200K — the maximum size that can be backed up onto a standard (single-density) floppy disc.

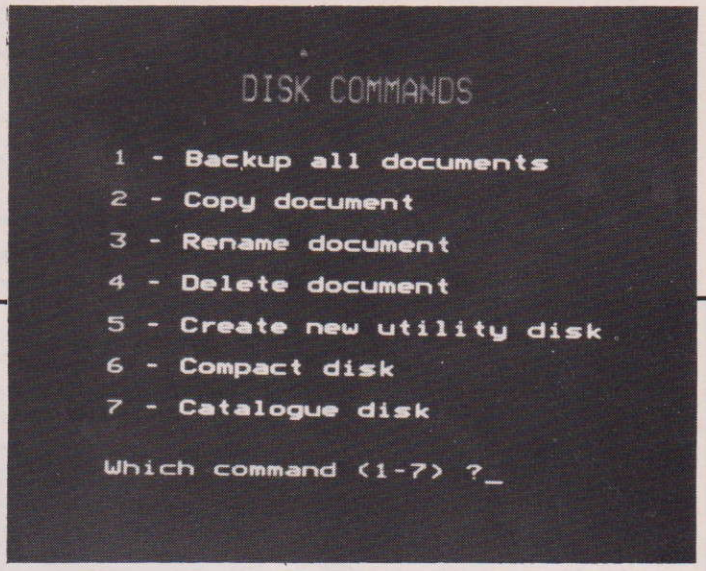
Alternative configurations are a 200K RAM disc with two 16K Sideways RAM banks or up to 13 × 16K RAM banks (See Fig. 1). As can be seen from the memory maps, the STL256K program, which controls the SWR256 in the RAM disc mode, is particularly ingenious. Not only does it set up Sideways RAM as a RAM disc (as does STLDISC for the SWR32 and SWR128) but it still allows the ROMs in sockets/banks zero, one and two (which are "shaded" by a Sideways System of this size) to operate.

All the Solidisk Sideways Systems have been designed for maximum compatibility with other add-ons and peripherals. To this end, all the external sockets on the Beeb are left physically free. However, the SWR32, SWR128 and SWR256 use several of the connections to the User Port for their control requirements, and this limits the operation of other devices plugged into it. RAM discs of any size are not compatible with devices using PB0 to PB4 of the User Port.

Of course, a RAM disc of at least 200K can be considered fully equivalent to a standard 80-track (single density) disc drive for all copying and backup operations. For users with only a single floppy disc drive, this means that such operations can be carried out quickly and with minimum risk of error, rather than by interchanging discs some 20 times. This is of particular value in business, where frequent backing up is essential.

The SWR256 will be available from October for £256, including VAT. At this price, it is





Merlin Scribe is recommended use with a RAM disc of appropriate size.

not much more expensive than an equivalent mechanical disc drive, even though it is much faster and includes lots of Utility Software. Also — as with all other Solidisk Sideways Systems — it can be obtained as an upgrade, in exchange for the smaller system and the difference in price. Upgrading from a SWR128 to a SWR256 — for example — would cost only £105.

SPEEDY EDITING

The advantages of a RAM disc clearly depend upon the disc intensity of the operations in question. It is particularly effective with the Merlin Scribe word processor — which uses Drive 0 as a virtual memory for holding large documents. After the RAM disc has been set up (as e.g. Drive 1 — the default) and Scribe has been entered, the Scribe utilities may be copied into it using Utility 6.5, then the document file using Utility 6.2 and finally the RAM disc re-assigned to Drive 0 using Utility 5.1 with *OPT2,0.

The speed advantage is especially dramatic in the case of word count operations. While counting the 15,000-odd words in a 40-page document takes a very respectable 62 seconds with a mechanical disc drive, it takes only six seconds when the same document is held on a RAM disc. Search (and replace) operations in the same document are also shortened — from 150 seconds to 40 seconds. Hence the speed is increased by from four to 10 times.

Just as important in practice however is the fact that stepping from page to page — as in the case of block operations (move and copy) during editing — is almost instantaneous — and of course takes place without any noise or wear. This level of performance raises the combination of the Beeb with Scribe and a Solidisk RAM disc beyond almost all other 8-bit micros (which have insufficient address space to allow a RAM disc to be set up in user RAM). Indeed, it equals or exceeds that of 16-bit micros — like the IBM PC — (which have enough address space but may not have enough user RAM installed to hold the whole document).

In so doing, it puts this combination far beyond what is possible with, for example, "View" even with a 6502 second processor. This would only allow a document file of up to 32K with the standard version of View and up to 44K with the relocated, or "Hi-", version that will be available from September. View can benefit from use of a RAM disc for "continuous processing" — although the maximum document size is halved by the need to hold both input and output files on the same disc. With Scribe, however, a document file can be as large as 100 or 200K (depending on the size of the SWR — and hence the RAM disc — available) and an 80-column display retained, even with the standard single processor.

Solidisk continue to include ORD64 on the utility disc. This "patches" Wordwise to allow a document file of up to 64K (also by using a disc as virtual memory). However, they have no plans to extend this to 100 or 200K. Instead, they recommend creators of long documents (and programs) to use Scribe — in conjunction with a RAM disc of appropriate size.

Incidentally, this article is being created on a Beeb fitted with Scribe and a Solidisk SWR256 — set up as a 200K RAM disc.

SPEEDY SPELLING

One of the most useful and impressive items of Solidisk Sideways Software is the SILEXICON spelling checker. In use, the SILEX program is loaded into main user RAM memory, the document file is held on a floppy disc — e.g. Drive 0 — and the tree table and dictionary files are held on a RAM disc, e.g. Drive 1. The contents of the document file are then compared with those of the dictionary at 1000 words per minute. The dictionary (which as supplied holds some 5000 words) can hold some 15,000 on a 100K RAM disc or some 30,000 words on a 200K RAM disc. (Hence the number of comparisons is at least 5 million per minute!)

The original version of SILEXICON was written to work with files output from Wordwise and View (and will work with any file that has been spooled i.e. containing no control characters). A special version will be produced shortly to work directly on the files output from Merlin Scribe (especially because of its attractions when used with a Solidisk RAM disc).

Solidisk can also supply a special version of SILEXICON which may be used to create dictionaries. This uses one or more reference documents as input, by automatically adding all new words to the dictionary. This can be very useful for creating specialised dictionaries for fields such as Engineering, Law, Medicine, Science etc.

In addition to the partial, 5000-odd word English dictionary included in the standard utility software bundle, Solidisk will soon be able to supply (at extra cost) the following full size dictionaries:-

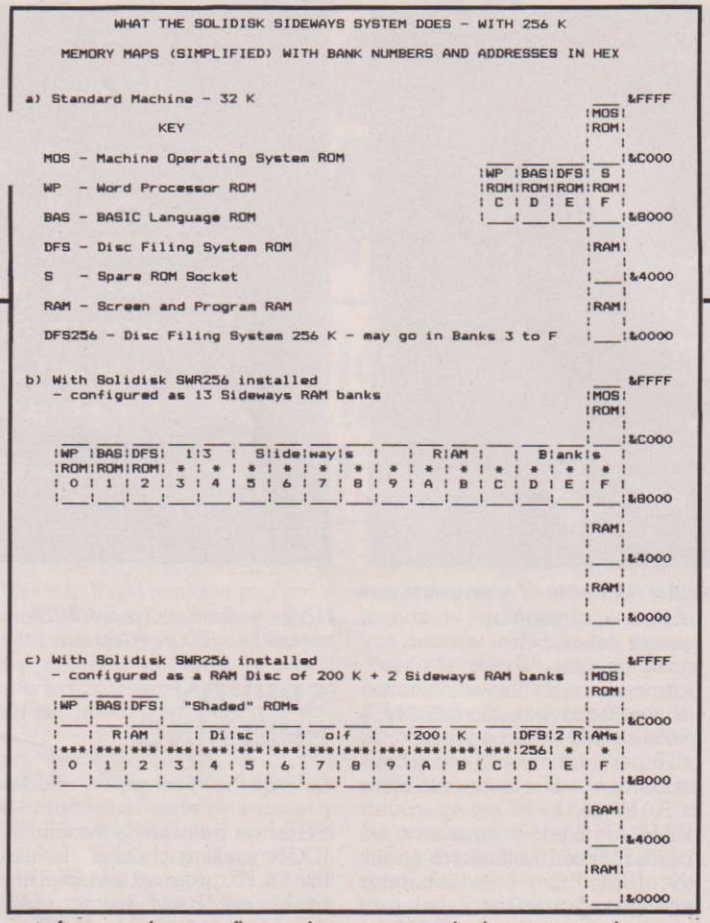
. a 15,000 word English dictionary occupying 100K
. a 15,000 word French dictionary occupying 100K
. a 15,000 word German dictionary occupying 100K
. a 30,000 word English dictionary occupying 200K

SPEEDY ANSWERS

The advantages of a RAM disc may also be enjoyed in the operation of random-access database programs — whether ROM or disc-based. They are especially evident with programs which have their most important time-critical routines written in machine code — as in GCC Starbase — but would be less evident with programs written wholly in BASIC e.g. Beebug Masterfile. The time-critical routines include searching for one or more selected records and sorting a group into numerical, date or alphabetic order.

With Starbase, holding the utilities on the RAM disc is less practical — and luckily, less necessary — than with Scribe. This is because they total some 75K as supplied (and can easily be increased by users writing their own). Also, Starbase is designed to allow the utilities to be found on any drive number from zero to three. However, holding the data file on the RAM disc has real advantages during inserting, amending, browsing, searching and sorting — since all of these are high disc-intensive. During inser-

CONTINUED OVER



ting and amending of course, the file should be periodically copied over to a floppy disc to guard against data loss.

The speed advantage of using a Solidisk RAM disc with Starbase may be illustrated by the following examples:-

. With a data file occupying 164K, searching it from end to end takes 46 seconds when held on a 200K floppy disc drive but only 21 seconds when held on a 200K RAM disc (both using the STL256K DFS).

. With the same data file as above, picking up and sorting all 125 entries on one field takes 60 seconds on a floppy disc versus 32 seconds when held on the RAM disc (both using the STL256K DFS).

Hence the advantage is an approximate doubling of speed, together with operation that is both silent and free from wear and tear.

The only drawback to the use of a RAM disc is that it may not be as big as the application program can use. In the case of Starbase, this is up to two disc surfaces — which total 400K for a double-sided 80-track drive using single density recording.

MORE NEW SOFTWARE

As well as enhancing the operation of other database programs (through them using a RAM disc), the current Solidisk Utility Software includes a small database program of its own — known as INDEX. It can give instant access by key field to any record in a sequential file such as

- a mailing list
- a customer account file
- a stock inventory
- patients' records

INDEX is an index sequential datafile program for use with any Sideways RAM system. More precisely, it is used to create indexes for datafiles which have themselves been created in a word processor or otherwise. The resulting index — SI.(filename) — is first saved onto a floppy disc (Drive 0) and then loaded into a Sideways RAM bank for use, while the datafile is held on Drive 1 (which may be a Solidisk RAM DISC). This makes for very fast retrieval of records by the key field(s) on which they have been indexed. This datafile system can handle up to about 1100 index items — being limited by the number of record key fields that can be held on a single Sideways RAM bank of 16K — i.e. more indexes per record, fewer records.

The records themselves may be of any, and variable, length as may the datafiles — up to the overall limit of the current disc drive. This may be 100 or 200K (or 256K in double density) for a floppy disc or e.g. 100, 200 or even 228K for a RAM disc (one 16K Sideways RAM bank is needed to hold the index file). With variable length records, this index sequential filing system differs from the more usual direct-or random-access datafile (database) program — which uses fixed, equal length records. Variable length records are much more efficient in their use of disc storage space. Moreover, the indexes are sorted when created — and so searching and retrieval can be much faster. Furthermore, with more than one index for each datafile, records can be retrieved almost instantly according to more than one attribute.

Another very useful program in the current Solidisk Utility Software bundle creates a printer buffer of 15K — equivalent to about four A4 pages of text — in a Sideways RAM bank. Known as PRINTER, the effect is to avoid long waits for printing, since it feeds the printer "in the background" so that you can continue with another task — such as entering or editing another text file "in the foreground". (This foreground/background operation is only possible if the whole background file (or number of files) can fit into the printer buffer. It cannot permit printing from one disc drive while entering or editing on another.) If the printer in question is a low-cost daisy-wheel one — taking some five minutes per A4 page — using the printer buffer can avoid a wait of as long as 20 minutes.

This printer buffer is equally suitable for graphic screens — up to the limit of 15K. This corresponds to the whole screen for Modes 4 & 5 (10K) but less than the whole screen for Modes 0, 1 & 2 (20K).

Operation of this printer buffer is completely transparent (just as if it was in the printer itself) and it is compatible with ROM word processors — such as Wordwise, View and Scribe — as well as with BASIC and other languages.

The current Solidisk Software also includes a program called SWR Utils. This comprises a number of additional system (*) commands concerned with the management of Sideways RAMs and ROMs. The operations include:-

. loading and saving files between the current filing system and a particular ROM/RAM socket or bank,

. listing all the ROMs and RAMs installed in the computer,

. disabling and re-enabling any ROMs/RAMs — to avoid clashes between them.

LIGHT RELIEF

Finally, by way of light relief, the Solidisk Software includes a program called Keyboard. This turns the Beeb into a simple electronic organ — with some of the main (black) keys as the keyboard and the red function keys being used to select various pre-programmed envelopes — from steady to varying.

The manual for the Solidisk Sideways Systems has been completely re-written and expanded to 40 pages. The explanatory and installation sections are much improved and it now covers all the new software supplied by Solidisk. Existing owners of Solidisk systems will be glad to know that they can obtain the latest software and manual for the cost of a new disc (or sending in their old one) and the postage.

Thus, the latest software has further increased the utility of the present Solidisk Sideways Systems — the SWR16, costing £43.65, the SWR32, costing £59.95, and the SWR128, costing £150.95. In particular, the RAM disc provided by the SWR128 enables the speed of disc-intensive application programs — like virtual-memory word processors and random-access databases — to be greatly increased. Having seen it in action, many users will find it very hard to resist adding it — or the forthcoming SWR256, costing £256, — to their Beeb and thereby out-performing many 16-bit computers.

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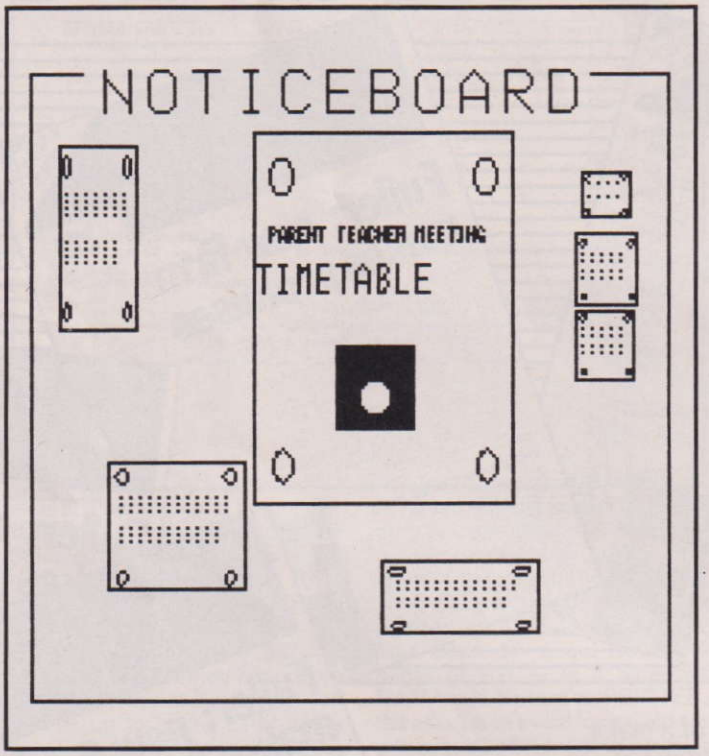
Parent Teacher Planner

G.W. Gallagher

An administrative nightmare made simple.



During the course of each year, in almost every school there is a day or evening put aside for the parents of a section of the school to meet the teachers who have the responsibility for the education of their children. During the course of the recent series of administration programs, a reader suggested that the making of the appointments for such an occasion would be a useful exercise for the computer. Here then is a suggested program to carry out the task.

The basis for the program is that the interviews take place on one day, over a period of several hours, with allowance for a tea-break! Before starting to write the program some factors will need to be known so that the amount of array space allocated is not unnecessarily large, remembering how extravagant array space is in using memory. The maximum number of members of staff involved, and the number of minutes allocated to each interview must also be known.

VARIABLES USED

TF for the time at which the first appointment should begin.
TL for the time at which the last appointment should end (!).
GF for the beginning of any break.
GL for the end of any break.
T for the number of minutes for one interview e.g. 5, 7.5 (this should be a factor of 60).
TT the number of interviews per hour.
NINT is the total number of interviews possible.
NPAR is the number of records of parents whose appointments have already been fitted and filed.
FR$ is the form reference of the child (4 line spaces allowed),
name$ is the name of the child (24 spaces).
A$ for one complete record of form, name and interview times.
PTF is the earliest time at which the parent is available.
PLT is the latest time at which the parent is available.
STF is the earliest time at which a member of staff may not be able be present.
STL is the latest staff time as above.
NSTAFF is the total number of staff present.

ARRAYS USED

SST$(30,50) where 30 is the number of staff used and 50 the maximum number of appointments possible.
ST$(30) where 30 is again the number of staff being used.
PAR$(55) holds the record for one parent as the appointments are being made. There is the allowance for 50 separate appointment times plus five extra spaces to record the names of members of staff with whom interviews could not be arranged.
PT(10) is a temporary home fo the numbers of the members of staff with whom appointments are wanted by a particular parent. Ten is the maximum number of appointments allowed per parent.

The size of each of these arrays should be adjusted to suit your own requirements.

In trying to fit the appointments, the program begins by trying to fit alternate appointment times into the parent's schedule, considering that they may have to walk some distance to reach the next member of staff. If this is not possible, then adjacent appointments will be tried.

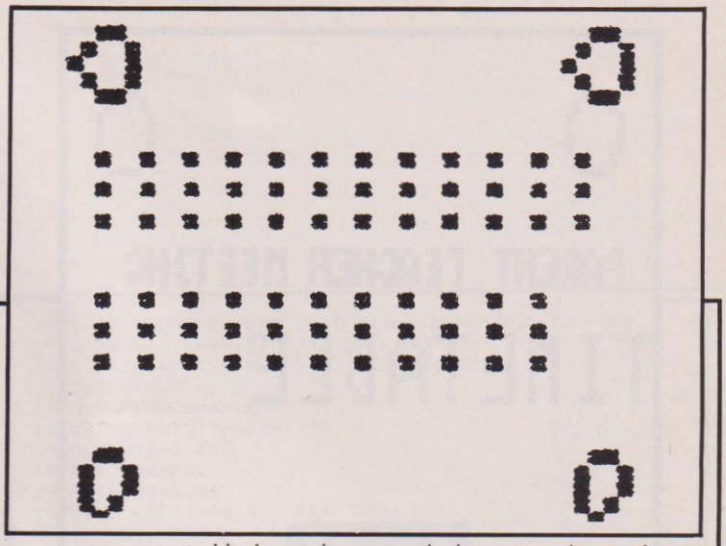
It is assumed that the details will be available in batches, and not all at once. In fact, some appointment lists may be given to parents before all the requests are received. In view of this, no attempt has been made to go back over all the records already completed to see whether any interchange is possible. The final parent listing will show the name of any member of staff with whom an appointment could not be made.

There are three files in use:
"staff" which holds the names of the members of staff involved, using up to three letters i.e. the contents of array ST$(30).
"stint" which holds the appointment records for the staff i.e. the contents of ST$(30,50).
"parents" which is a file holding the parent records.

The last file could be lengthy, and I would suggest that it may be safer to allow it a disc to itself. Wherever information is to be taken from a disc or saved on a disc, there is a 'waiting' period to allow time for the correct disc to be in place.

THE PROCS USED

PROCstaff (1000-1150)	In this section the names of the staff are taken in when the program is first used. The staff reference is an abbreviated one which is made up to three letters to be consistent.
PROCsavestaff (1160-1240)	The list of staff names are saved on file.
PROCinstaff (1250-1340)	The names of the staff are loaded at the beginning of each run of the program.
PROCadd (1350-1410)	Each parent record is added to the file as it is completed.
PROCparentsthere (1420-1460)	At the beginning of each run, the program checks the number of records which are already filed (NPAR).
PROCform (1470-1510)	Makes the form reference up to four spaces.
PROCsavestaffint (1520-1600)	The staff lists appointments are



saved at the end of each run.

PROCinstaffint (1610-1690) The staff appointments list already arranged is fed into the array STT$ at the beginning of each run after the first.

PROCprintparents (1700-1870) The parent interview lists are printed in form order. The PROC looks for the form reference as the first four characters of an 80-character record. Each individual parent's list of appointments is then printed out.

PROCtime (1880-1930) In this section the number which represents the appointment time is converted into real time.

PROCsearch (1940-2050) The "parents" file is opened up and searched for the correct form reference.

PROCprintstaff (2060-2230) Prints out the appointment schedule for a particular member of staff.

PROCinttime (2280-2430) In this section the appointment schedules of the teachers whom the parent wishes to see are checked against the times at which the parent is available, to find a matching time. The fixed time is placed into the array PAR$ at the appropriate place, allowing five spaces for each appointment, made up of three for the staff reference and two for the time reference. If no appointment can be made, the staff reference is stored in one of the five spare members at the end of the array with a time reference '00'.

PROCnewparents (2440-2470) Opens up the "parents" file for the first time.

PROCspot (2480-2510) Removes any '.' from the staff reference if it has been necessarily used to make up the three characters.

PROCmenu (2520-2580) Gives the choice of adding names or printing lists.

THE MAIN PROGRAM

10 The arrays are set up. N.B. CHECK THE SIZES.

20-30 The string members of the arrays are put equal to " " and the numerical values to 0.

40-130 The various time limits are taken in.

140 Works out the total number of possible appointment times i.e. NINT

150-190 Takes in the staff list, either from file or the keyboard.

200-230 Checks whether the parent file exists. If it does, then finds NPAR. If the file does not already exist it is opened.

240 Calls up the menu.

250-450 Takes in a form reference and name. If there is a limit to the times at which the parent is available, spaces in the PAR$ array are filled with 'XXXXX' to block out the ones which may not be used.

460 S = 0 begins the counting of the appointments asked for by one parent.

480-530 The teachers references are taken in, checked against the list of staff available during that day. The number of staff position in the array ST$ is then placed in the array PT.

540 PROCintime to fix the appointments.

550-570 The appointments from PAR$ are added to A$ after the form and name.

580 Saves the parent record.

590-610 Asks if another parent is to be dealt with, and if so clears PAR$ and PT.

620 Saves the staff appointment lists. N.B. MAKE SURE THAT THE CORRECT DISC IS AVAILABLE.

630 Return to menu.

640 Print staff lists.

660 Print parent lists.

990 END.

Throughout the program, staff references are used in initial or abbreviated form. If you wish to print out the staff name in full on the 'parent' list of appointments, then an extra procedure will be needed which matches the staff reference with the full name.

Such an amendment could be:

```
1820 PROCspot:PROC-
fullname:PRINT times$,NM$
```

PROCfullname would then convert the variable SH$ to NM$ e.g. IFSH$ = "CJS" THEN NM$ = "MR.C.J. Smith"

At this stage, if you wish to add a room reference for the appointment, NM$ could be NM$ = "MR C.J. Smith Room 45"

This PROC would need to contain a conversion for every member of staff used, and could therefore be quite lengthy. It may however dispense with extra lists of rooms and be time-saving as well as convenient in the end.

When saving the program, it should be remembered that the disc system reads "PARENTS" and "parents" as the same file, so there must be some distinction between the name of the file and the program. It is very easy to be caught!

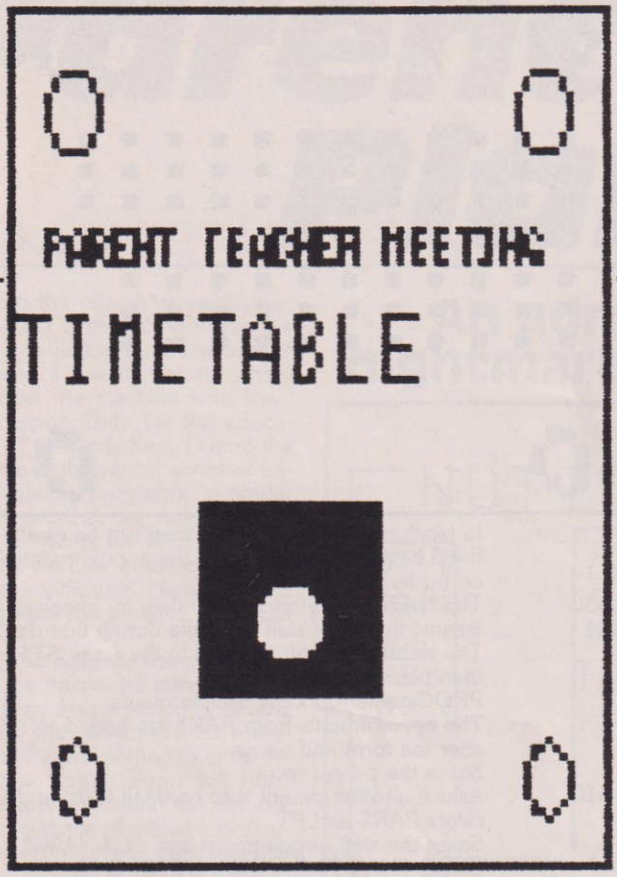
Printouts should be fitted to the size of paper which you wish to use. The staff appointment list will be a complete list of appointment times available, with a child reference filled in where an appointment has actually been made. The list should in most cases fit on the standard sheet of printer paper (60+ lines).

Each list for a parent will consist of just the appointments made and is followed by two empty lines. To have greater separation between one parent and the next, alter line 1830.

When you are ready to print out the lists, add the appropriate printer instructions to lines 640 and 660. This will lead to any staff list being printed on request, and the complete set of parent lists for a particular form.

The file in which the parent records are stored is a random access file of the type use in the previous programs, and the command OPENUP is again used to add records to the file as they are prepared.

CONTINUED OVER



PROGRAM LISTING

```
    0 REM...G.W.GALLAGHER..PARENT-TEACHER
   10  DIM STT$(30,50),ST$(30),PAR$(55),PT(10)
   20 FOR I=1 TO 30:FOR J=1 TO 50:STT$(I,J)=" ":NEXT:ST
$(I)=" ":NEXT:FOR I=1 TO 55:PAR$(I)=" ":NEXT
   30 FOR I=1 TO 10:PT(I)=0:NEXT
   40 CLS:PRINT''"What is the earliest time available"
   50 PRINT"in hours,e.g. 4 for 4 p.m. or 4.5 for   4.
30."
   60 INPUT TF:PRINT"At what time should the last inte
rview  end?":INPUT TL
   70 PRINT"Is there a gap?(Y/N)":INPUT N$:IF N$="N" O
R N$="n" THEN 110 ELSE 80
   80 IF N$="Y" OR N$="y" THEN 90 ELSE 70
   90 PRINT"At what time does the gap begin?":INPUT GF

  100 PRINT"At what time does the gap END?":INPUT GL:G
OTO 120
  110  GL=0:GF=0
  120 PRINT"Number of minutes per interview?":INPUT T:
IF INT(60/T)<60/T THEN 120
  130 TT=60/T
  140 NINT=(TL-TF)*TT - (GL-GF)*TT
  150 PRINT"Is the staff list already on file?(Y/N)":IN
PUT N$
  160 IF N$="N" OR N$="n" THEN 180 ELSE  170
  170 IF N$="Y" OR N$="y" THEN 190 ELSE 150
  180 PROCstaff:PROCsavestaff:PROCsavestaffint:GOTO 200
  190 PROCinstaff:NSTAFF=I:PROCinstaffint
  200 PRINT''"Are there some parent times on file?     (
Y/N)":INPUT N$:IF N$="N" OR N$="n" THEN 210 ELSE 220
  210 PROCnewparents:NPAR=0:GOTO 240
  220 IF N$="Y" OR N$="y" THEN 230 ELSE 200
  230 PROCparentsthere:PRINT"There are ";NPAR;" records
 on file.":PROCWAIT
  240 PROCmenu:ON N GOTO 250,640,660,990
  250 CLS:PRINT"Times are given at intervals of ";T;"
min"
  260 PRINT"beginning with ";TF;" hours  and ending "
  270 PRINT"with ";TL;" hours"
  280 PRINT"The form reference?(4 spaces allowed)":INP
UTFR$:PROCform
  290 A$=FR$
  300 PRINT"Pupil's name?":INPUT name$
  310 A$=A$+name$:A$=LEFT$(A$,28):PRINTA$
  320 L=LEN(A$):IF L>27 THEN 340 ELSE 330
  330 A$=A$+" ":GOTO 320
  340 PRINT"Is there a time limit for the parents?    (
Y/N)":INPUT N$
  350 IF N$="Y" OR N$="y" THEN 360 ELSE 450
  360 PRINT"The earliest time available?":INPUT PTF:PR
INT"The end of the time available?":INPUT PTL
  370 IF PTF>GF THEN 400 ELSE 380
  380 IF PTF=TF THEN 410 ELSE 390
  390 FOR K=1 TO (PTF-TF)*6:PAR$(K)="X":NEXT:GOTO 410
  400 FORK=1 TO (PTF-GL+GF-TF)*6:PAR$(K)="XXXXX":NEXT
  410 IF PTL>GL THEN 430 ELSE 420
  420 FOR K=(PTL-TF)*TT+1 TO NINT:PAR$(K)="X":NEXT:GOTO
 460
  430 IFPTL=TL THEN460 ELSE 440
  440 FOR K=(PTL-TF-GL+GF)*TT+1 TO NINT:PAR$(K)="X":NEX
T:GOTO 460
  450 PTL=TL:PTF=TF
  460 S=0
  470 PRINT"A teacher's reference?(maximum 10..      Ty
pe = when complete)":INPUT S$:IF S$="=" THEN 540
  480 J=1
  490 SH$=ST$(J):PROCspot:IF SH$=S$ THEN 520 ELSE 500
  500 J=J+1:IF J<NSTAFF+1 THEN 490 ELSE 510
  510 PRINT"Staff not available.":GOTO 470
  520 S=S+1:PT(S)=J
  530 IF S+1<11 THEN 470 ELSE 540
  540 PROCinttime
  550 FOR I=1 TO 55
  560   IF PAR$(I)="XXXXX" OR PAR$(I)=" " THEN 570 ELSE
 A$=A$+PAR$(I)
  570   NEXT:PRINTA$
  580 NPAR=NPAR+1:PROCadd
  590 PRINT''"Another parent?":INPUT N$
  600 IF N$="Y" OR N$="y" THEN 610 ELSE 620
  610 A$="":FORK=1 TO 55:PAR$(K)=" ":NEXT:FOR I=1 TO 10
:PT(I)=0:NEXT:GOTO 250
  620 PROCWAIT:PROCsavestaffint
  630 GOTO 240
  640 PROCprintstaff:GOTO 240
  650 PROCWAIT
  660 PROCprintparents:GOTO 240
  990 END
 1000 DEFPROCstaff
 1010  PRINT''"Please give the members of staff,typing
= when the list is finished."
 1020 I=1
 1030 PRINT"Staff member number ";I:INPUT ST$(I):IF ST$
(I)="=" THEN 1150
 1040 IF LEN(ST$(I))>2 THEN 1060 ELSE 1050
 1050 ST$(I)=ST$(I)+".":GOTO 1040
 1060 PRINT"Give the first time at which the member of
staff is not available."
 1070  PRINT"Enter 0 if  available all the time.":INPUT
STF:IF STF=0 THEN 1130
 1080 PRINT"Give the LAST time at which the member of s
taff is not available.":INPUT STL
 1090 IF STF<GF THEN 1100 ELSE STF=STF-(GL-GF)
 1100 IF STL>GF THEN STL=STL-(GL-GF)
 1110 J1=(STF-TF)*TT:J2=(STL-TF)*TT
 1120 FOR J=J1+1 TO J2:STT$(I,J)="X":NEXT
 1130 IF I>NINT-1 THEN 1150 ELSE 1140
 1140 I=I+1:GOTO 1030
 1150 NSTAFF=I:ENDPROC
 1160 DEFPROCsavestaff
 1170 X=OPENOUT("staff")
```

```
1180 I=1
1190 REPEAT
1200   PRINT#X,ST$(I)
1210   I=I+1
1220   UNTIL I=NSTAFF
1230 CLOSE#X
1240 ENDPROC
1250 DEFPROCinstaff
1260 X=OPENIN("staff")
1270 I=1
1280 REPEAT
1290   INPUT#X,ST$(I)
1300   PRINTST$(I)
1310   I=I+1
1320   UNTIL EOF#X
1330 CLOSE#X
1340 ENDPROC
1350 DEFPROCadd
1360 X=OPENUP("parents")
1370  PTR#X=(NPAR-1)*80
1380 PRINT#X,A$
1390 PTR#X=PTR#X+80
1400 CLOSE#X
1410 ENDPROC
1420 DEFPROCparentsthere
1430 X=OPENIN("parents")
1440 NPAR=EXT#X DIV 80
1450 CLOSE#X
1460 ENDPROC
1470 DEFPROCform
1480 L=LEN(FR$)
1490 IF L>3 THEN 1510
1500 FR$=" "+FR$:GOTO 1480
1510 ENDPROC
1520 DEFPROCsavestaffint
1530 X=OPENOUT("stint")
1540 FOR I=1 TO NSTAFF
1550   FOR J=1 TO NINT
1560     PRINT#X,STT$(I,J)
1570     NEXTJ
1580   NEXTI
1590 CLOSE#X
1600 ENDPROC
1610 DEFPROCinstaffint
1620 X=OPENIN("stint")
1630 FOR I=1 TO NSTAFF
1640   FOR J=1 TO NINT
1650     INPUT#X,STT$(I,J)
1660     NEXT J
1670   NEXT I
1680 CLOSE#X
1690 ENDPROC
1700 DEFPROCprintparents
1710 PRINT'"Form?":INPUT FR$:PROCform
1720 I=1:F=0
1730 PROCsearch
1740 L=LEN(A$):NUMINT=(L-28)/5
1750 PRINTMID$(A$,5,24)
1760 FOR J=1 TO NUMINT
1770   time=VAL(MID$(A$,32+(J-1)*5,2)):SH$=MID$(A$,29+
(J-1)*5,3):PROCspot
1780   IF SH$="" THEN 1830 ELSE 1790
1790   IF time=0 THEN 1810 ELSE 1800
1800   PROCtime:GOTO 1820
1810   PRINTTAB(10);SH$;" not fitted":GOTO 1830
1820   PROCspot: PRINTtime$,SH$
1830   NEXT:PRINT:PRINT
1840 IF F=1 THEN 1860 ELSE 1850
1850 I=I+1:GOTO 1730
1860 PRINT"ANOTHER FORM(Y/N)?":INPUT N$:IF N$="Y" OR N
$="y" THEN 1710
1870 ENDPROC
1880 DEFPROCtime
1890  HOUR=TF+((time-1)*60/TT) DIV 60
1900 IF HOUR<GF THEN 1910 ELSE HOUR=HOUR+(GL-GF)
1910 MIN=((time-1)*60/TT MOD 60)
1920  time$=STR$(HOUR)+"."+STR$(MIN)
1930 ENDPROC
1940 DEFPROCsearch
1950 X=OPENIN("parents")
1960 PX=(I-1)*80
1970 PTR#X=PX
1980 INPUT#X,A$
1990 IF LEFT$(A$,4)<>FR$ THEN 2010
2000  GOTO 2040
2010 I=I+1:PX=PX+80
2020 IF PX>EXT#X THEN 2030 ELSE 1970
2030 F=1
2040 CLOSE#X
2050 ENDPROC
2060 DEFPROCprintstaff
2070 PRINT"Staff reference?":INPUT ST$
2080 IF LEN(ST$)<3 THEN 2090 ELSE 2100
2090 ST$=ST$+".":GOTO 2080
2100 J=1
2110 SH$=ST$(J):IF SH$<>ST$ THEN 2120 ELSE 2140
2120 J=J+1:IF J<NSTAFF+1 THEN 2110 ELSE2130
2130 PRINT"Staff not available":GOTO 2070
2140 PRINTST$
2150 totime=((TL-TF)-(GL-GF))*TT
2160 FOR time= 1 TO totime
2170   PROCtime
2180   PRINTtime$;TAB(10);STT$(J,time)
2190   NEXT
2200 PRINT"Another list?(Y/N)":INPUT N$
2210 IF N$="Y" OR N$="y" THEN 2070 ELSE 2220
2220 IF N$="N" OR N$="n" THEN 2230 ELSE 2200
2230 ENDPROC
2240 DEFPROCWAIT
2250 PRINT''"Press the space bar to continue"
2260 X=GET:IF X<>32 THEN 2260 ELSE 2270
2270 ENDPROC
2280 DEFPROCinttime
2290 NNT=0:FOR I=1 TO 10:IF PT(I)>0 THEN NNT=NNT+1:NEX
T:PRINTNNT
2300 J=1
2310 time=1
2320 K=PT(J):IF STT$(K,time)<>" " OR PAR$(time)<> " "
THEN 2350 ELSE 2330
2330 STT$(K,time)=A$:IF time <10 THEN PAR$(time)=ST$(K
)+"0"+STR$(time) ELSE PAR$(time)=ST$(K)+STR$(time):PRIN
TPAR$(time)
2340 J=J+1:IF J<NNT+1 THEN 2310 ELSE 2430
2350 time=time+2:IF time<NINT+1 THEN 2320 ELSE 2360
2360 IF INT(time)<INT(time/2) THEN 2370 ELSE 2380
2370 time=2:GOTO 2320
2380 ODD=55
2390 IF PAR$(ODD)<>" " THEN 2400 ELSE 2410
2400 ODD=ODD-1:IF ODD>NINT THEN 2390 ELSE 2430
2410 PAR$(ODD)=ST$(K)+STR$(0)+STR$(0)
2420 GOTO 2340
2430 ENDPROC
2440 DEFPROCnewparents
2450 X=OPENOUT("parents")
2460   CLOSE#X
2470 ENDPROC
2480 DEFPROCspot
2490 IF RIGHT$(SH$,1)<>"." THEN 2510 ELSE 2500
2500 SH$=LEFT$(SH$,2):IF RIGHT$(SH$,1)<>"." THEN 2510
ELSE SH$=LEFT$(SH$,1)
2510 ENDPROC
2520 DEFPROCmenu
2530 CLS:PRINT'"TYPE 1. to add names"
2540 PRINT'"      2. to print staff lists"
2550 PRINT'"      3. to print parent lists"
2560 PRINT'"      4. to end"
2570 INPUT N:IF (N-1)*(N-2)*(N-3)*(N-4)<>0 THEN 2570
2580 ENDPROC
```

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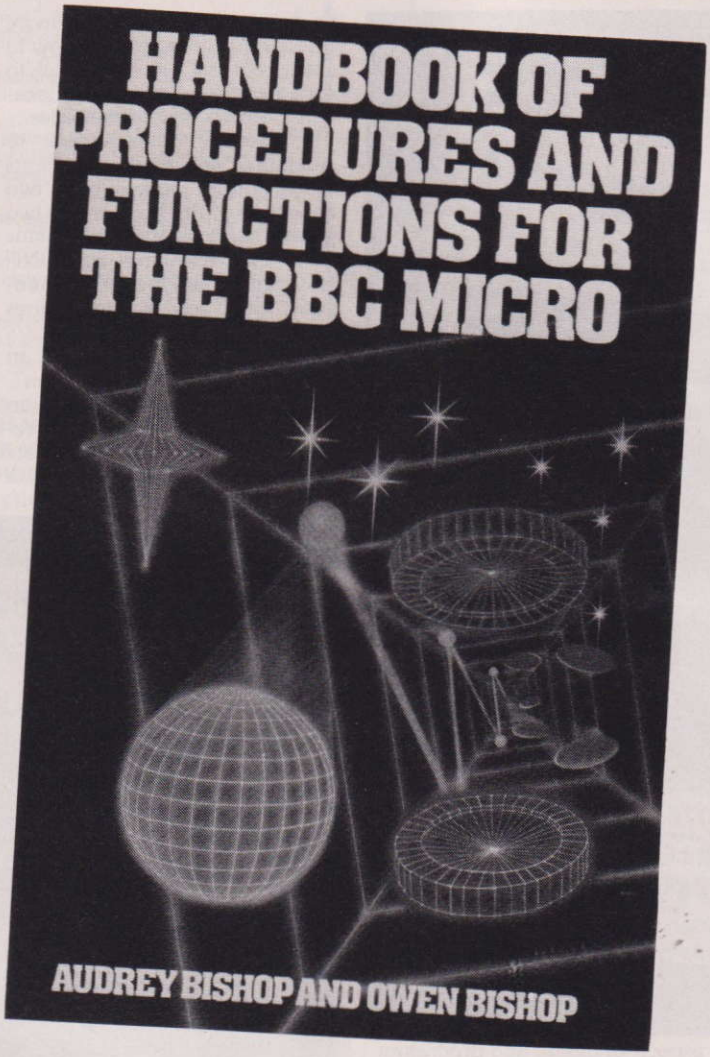
Bookshelf

Handbook of Procedures and Functions for the BBC Micro by Audrey and Owen Bishop. Published by Granada. Price: £6.95



Functions and procedures are unique to BBC BASIC among the first generation of home computers. The QL and Amstrad are taking a leaf out of the Acorn book with their similar features. Since procedures and functions can be called from BASIC programs simply by naming them, then BBC BASIC allows programs to be built up from separate elements. Lines of programs can easily be merged together with *EXEC and *LOAD.

All this means that a library of functions and procedures is a very handy thing to possess if you intend to do some programming yourself, lack a library of your own, and want professional results without spending too much time on it. This book is an ideal reference for anyone writing unambitious but useful programs for their BBC (there is bound to be an Electron version since most of the coding is done in the BASIC common to both machines).

The authors feel the need to explain that the choice of programs is a purely personal one, and by no means comprehensive. And here of course is the problem with any such book. Useful though these routines undoubtedly are, they are unlikely to be exactly what you want. A programmer may find themselves adjusting the aims of the original program in order to take advantage of a ready-written piece of code. Those with experience of BASIC will be able to fine tune the routines to their own specifications but newcomers to their computers would be advised to practice BASIC programming a while before investing in this or any similar book.

The presentation of each of the programs is faultless. Each function or procedure is fully documented, with variables, formal and actual arguements listed, and an explanation of how the program works, what it is supposed to do and how to call it from another part of your program. There are also clear introductory chapters on what procedures and functions are and how they operate in BBC BASIC.

The routines vary in difficulty and indeed usefulness. The authors appear to have gone for variety as well as value. Some of the sound and graphic procedures are redundant although there are some suitable routines to animate objects and check for positions in order to implement an arcade game. These are the sort of 10 liners which can result from experimental programming. Less individual and less exciting routines such as sorts and setting up data tables, are more useful if you have not already got something along these lines.

There are a few routines based around character definition and changing background and foreground colour. These are mixed in with scrolling, mathematical and string handling programs. It is possible that, by typing in and trying out a selection of the functions and procedures in this book, the reader will come to understand more about how the calls work and more about programming in general. The problem is then that the reader will have outgrown the book and will wish to apply more individual solutions. The book however supplies a wonderful head start for anyone beginning to program seriously in BASIC.

Creative Assembler. How to Write Arcade Games. By Jonathan Griffiths. Published by Penguin. Price £5.95.

Who better to write a book about creative assember i.e. coding games, than Acornsoft's own Jonathan Griffiths. After all he is part of a team who produce some of the very best BBC and Electron games.

The book itself is nicely thought out with some colour shots of well-known Acornsoft games and all program listings in a boldly readable blue.

The author starts us off, necessarily so considering the target audience, with an introduction to use of binary and hexadecimal and fundamental reason behind using the built-in Beeb assembler. He does not get bogged down in a treatise on the subject but keeps his ideas relevant to the task in hand, creating a passable arcade game.

The early chapters, demonstrating the basic routines which become component parts of most assembler programs, do an excellent job in documenting and explaining the example listings. Unfortunately as things get more complex and the path of programs harder to follow, the explanation seems to thin out somewhat.

The chapters on macros reveal a simply implemented but powerful tool in assembler. The author is naturally well versed in the special abilities of BBC BASIC and assembler to combine forces.

A section on dealing with the management problems of longer programs should prove especially useful for the aspiring programmer as well as a whole host of general-purpose routines listed in the book.

The final example, "Space Invaders!" (the author's explantion mark) is a bit of a let down but is intended as an exercise for the reader, who by now should be suitably inspired to have a go at converting the BASIC components into assembler.

Even if the idea that learning about computers through *playing*

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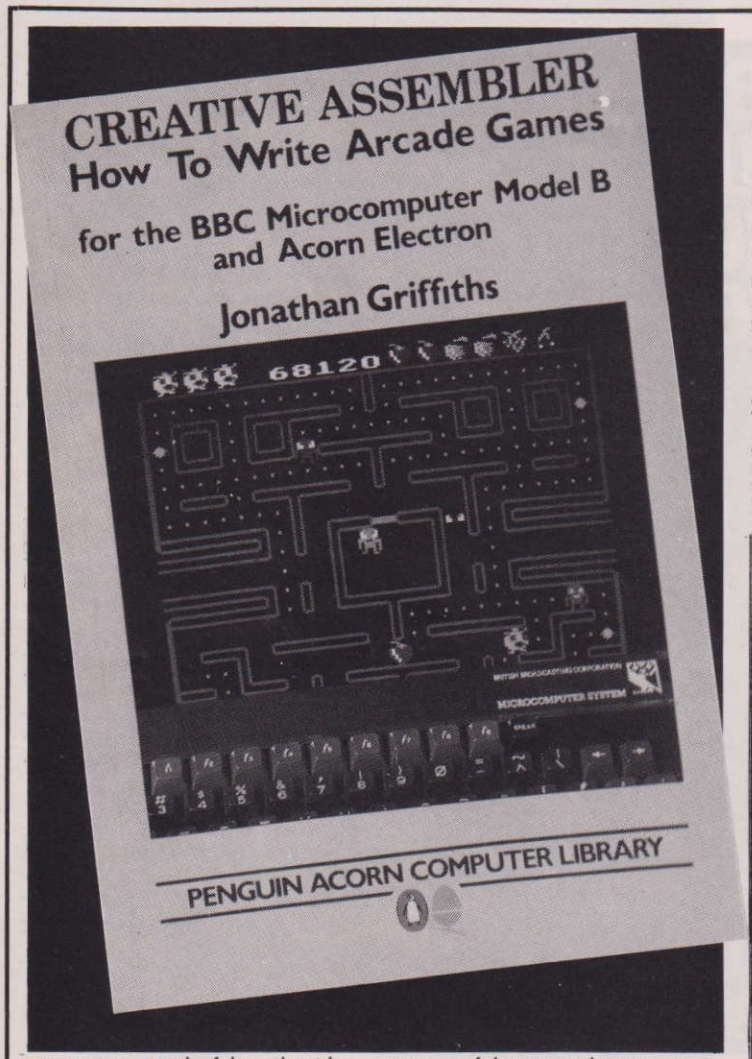


games is patently false, the idea that learning through *writing* them is transparently true. This book gives away few secrets but is a great introduction to coding games. As the author admits, the most difficult part is being original and that remains in the hands of the individual reader.

How to Write Adventure Games by Peter Killworth. Published by Penguin. Price: 5.95.

Peter Killworth is a well-known Adventure writer with games like Kingdom of Hamil for Acornsoft under his belt. Now he turns his hand to writing about both the aspects of design and programming which go into the typical Adventure.

I am not sure that reading this book will help anyone play his games more successfully but it will give an insight into the imagination and hard graft which goes into them.

The book confirms a few trade marks however, with ingenious puzzles and well-known phrases like "You seem to have lost your life" and "You have departed this world, alas."

The author's meticulous nature means a book full of detail, lists of points to take into consideration and explicit looks at technique.

Writing an Adventure on the BBC, it seems, is a continual battle to preserve enough memory (the author demonstrates how to use every last bit — literally) to squeeze in the desired plot, locations, objects and personalities.

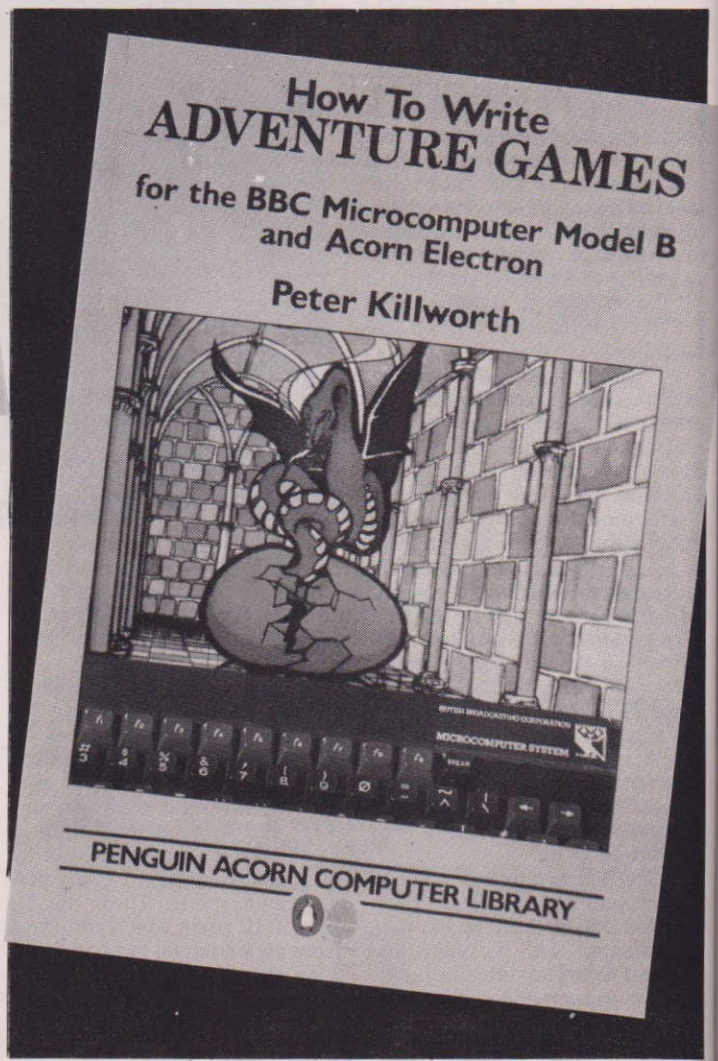
After an introduction to Adentures and the requirements of Adventure writing, parts two and three of the book create two games; a "hack and slash" game called "caves" and a "MINI" Adventure, designed to demontrate many of the techniques employed full scale later on.

Parts four to seven build an advanced game called "Roman". They involve the creation of an Adventure shell which can be reused by the reader to create his/her own games and a database writing program which is used to add substance to the game with rooms, vocabulary, objects, people and messages. Various sub-programs manage the course of this particular creation.

Roman is a great game in its own right and is available from Acornsoft on tape — best to play before reading all about it!

The final part outlines some further ideas on plot creation and exotic problems which can be set for the players bafflement/enjoyment during the game.

Peter Killworth's book is the best available for the BBC and Electron adventurer and unbelievable value at £5.95.



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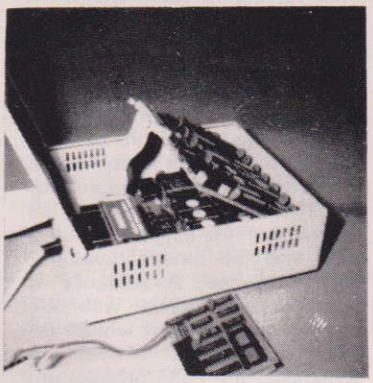

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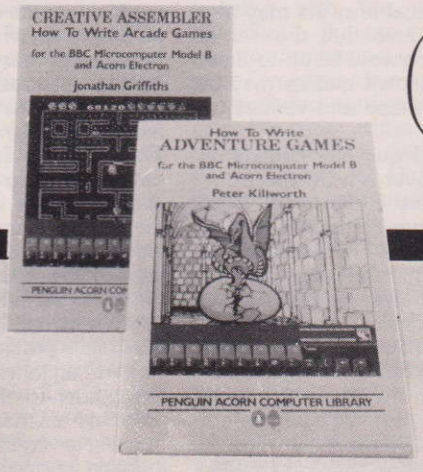


Edsoft

A bumper batch of educational programs for the young covering a wide range of subjects from general knowledge to map reading.

Title Kosmos Answer-Back Quiz – JUNIOR
Publisher Kosmos
Machine BBC(32K) and Electron
Price £10.95

The Kosmos Senior Quiz in general knowledge has been around for a while now, featuring a robot and distinctly space-inspired scenes. Now comes the equally well-produced Junior version. However, the Robot and his like have gone in favour of a setting far more suitable for the age of the children this tape is aimed at. The idea this time is that every correct answer allows the child to try to fly a hot air balloon over a castle to try to drop a sandbag onto a rather hungry-looking dragon who is attempting to fly across the screen to devour the princess who throws the questions onto the screen with her wand.

After the loading screen and the main part have been run, there appears an options page. This allows the user to load a quiz from tape, to begin a loaded quiz or to edit the quiz in some way. These features have proved of immense value, meaning that there can be a quiz on tape about any required subject, the current class project for instance. Extra questions may be added at any point during an existing quiz, so that the quiz may become longer than the 50 questions already in store. Questions may be deleted, and individual answers may also be changed so that this set of quizzes will always be up-to-date. New or adapted quizzes may be stored onto tape and verified for future use.

The 15 quiz files already on the tape cover a wide spectrum, from Nursery Rhymes to Word Fun and from Famous People to Brain Strainers! There are various options within the quiz, with the user being able to select either multiple choice, yes-no, incomplete answer questions, or a blend of all three. There are also options for the teacher/parent, who may turn off the sound, although it is set to a sensible level.

All in all, this is a superb program which has a vast potential already in the quiz files themselves (15 subjects, providing some 750 questions and up to 3000 possible answers), but even more so in the master program which will allow any parent or teacher, with no programming experience whatever, to adapt or invent quizzes to suit the specific abilities and interests of the children involved. All the necessary documentation is given, very simply and clearly.

Ratings Table:

SOUNDS	85%
GRAPHICS	85%
DOCUMENTATION	100%
VALUE FOR MONEY	100%
OVERALL	94%

Title The Readright
Publisher Daco Software
Machine BBC Model B
Price £9.95

This piece of software actually contains a suite of eight interlinked programs, which together provide the primary school teacher with a diagnostic reading test, and exercises to strengthen those areas of diagnosed problems. The first provides the test itself, dand adult help is essential here. A sequence of words appear on the screen, and each is read aloud by the child. The adult then presses the appropriate key for the response, and in this way, the micro can build up a picture of the child's problems.

At the conclusion of the test, it suggests to the child an appropriate exercise from the remaining seven files, and the level to begin at on that exercise. Being cassette based is a real problem here, with the child having to wait (patiently?) so for review purposes I transferred the whole set to disc. With this change, the whole program becomes much easier to use, and the subsequent exercises could be accessed and used by the child with a minimum of adult intervention.

One drawback of the test progam was its 'one word' approach. Most teachers now favour reading tests in which the child can use the context of a sentence to decide words, rather than having to read one word totally out of the context. The exercises, fortunately, redress the balance, and are more sound educationally. Each exercise seeks to practise a particular problem area (e.g. digraphs or silent letters), and uses a game format to keep the child interested. Adult intervention has already set the volume, the length of the test itself and the time allowed for each response. A sentence is printed on the screen with one missing word. When words appear individually above the sentence, the child presses any letter key to register the response, with no key at all being touched for a poor choice of word. If the word is correct, it moves into its correct position in the sentence, while any incorrectly chosen word has its particular area of study highlighted before it is driven off the screen. A small but important point is that even when the time is up, the program will not stop until the child makes a correct response, so that success is always the last impression of the program.

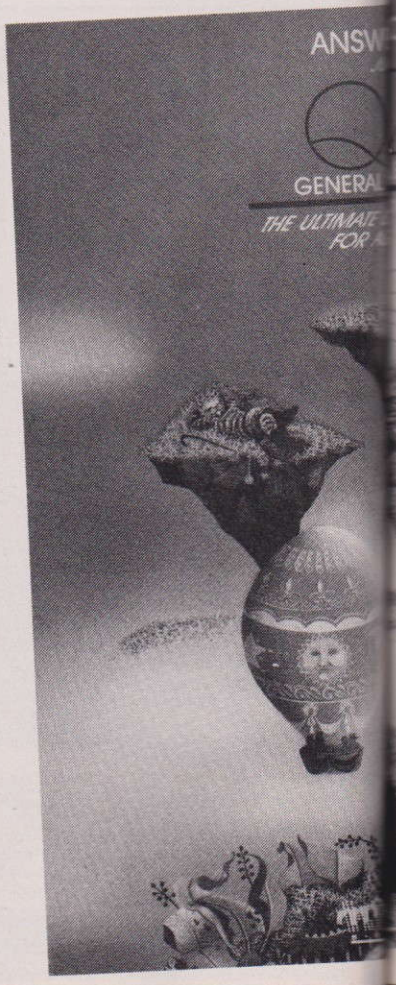
For busy teachers with many reading problems within their classes, this is a program well worth looking at.

Ratings Table:

SOUNDS	50%
GRAPHICS	65%
DOCUMENTATION	75%
VALUE FOR MONEY	75%
OVERALL	75%

Title Mathematics Software
Publisher Chaddington Software for Students
Machine BBC B & Discs
Price £10.00

There were three discs in the package that I received, two of which were for O level students titled Matrices and Statistics — Frequency Diagrams. The final disc was for A levels students and



called 'A Cluster of Curves'. I first tried the Matrices package which starts with a menu, as do all the others. From this menu you could select seven different programs, the bulk of these have some teaching element where a type of animated screen is used to show how the elements of the matrix should be combined.

It is at this stage that the short comings of the programs become rather obvious. Whilst the mathematics is sound and carefully explained, the screen displays are both badly organised and poorly designed. To take one example, the combinations are displayed after an equal sign but with a plus sign in front of each and every product including the first, and gaps of various sizes between them.

This shows a lack of the type of care which one would expect in software at this level. One of the programs in the series stopped part way through with a 'No room' error and in another, which shows matrix transformations, there is no checking to see if plotting is going off screen and no mention of the action of a determinant of 0. All told this is a brave attempt to explain the concepts involved, that falls down in almost all the non-mathematical parts of the program.

The statistical package shows similar faults too. Here you are allowed to build up and store data sets for plotting into three types of diagrams. These are frequency graphs, histograms and cumulative frequency curves. They all provide reasonable results although large data sets take a long time to process. In the curve drawing sections there is no attempt to smooth and the scaling can be poor, especially on the x axis. One major omission is the facility to display and edit an old file of data points; this means that you must have a paper copy handy to see it the output is reasonable. There is no error trapping and pressing ESCAPE is fatal to any data. There is a slight problem about deciding which is the median value on some occasions too. This is another package which, whilst mathematically sound, leaves a great deal to be desired in terms of facilities and displays.

Unfortunately the A level disc package proved to be faulty and so only the documentation could be reviewed. I should explain that each package is supplied on a disc in a plastic folder containing several A4 sheets of well written and presented information. These are by far the most impressive parts of the various packages, being a good reference guide to the area involved. In the case of the A level package this includes an explanation of the curves from those drawn with Polar co-ordinates to the Confocal conics, including diagrams, formula and explanations of possible values for use in the program.

There is no doubt that if one of these areas is a real problem for you and you are desperate for help then these packages will give some. Unfortunately they are all ill prepared in computer software terms for commerical sale and I'm surprised that the software house concerned hasn't spent more time in presentation and design.

Ratings Table:

SOUNDS	n/a
GRAPHICS	30%
DOCUMENTATION	90%
VALUE FOR MONEY	50%
OVERALL	40%

Title Intermediate Maths II
Publisher Scisoft Software
Machine BBC Model B
Price £6.95

This tape contains five programs which, the authors claim, are approved by teachers. I'm sure they have been, but I had a very hard job loading three of the files, and two would only RUN after using *OPT2,0 and some patching. I'm sure teachers would not approve of this business before a classroom session! The final program, the well-known Towers of Hanoi, refused all my coaxings and so I cannot comment on that particular program.

The most 'child-centered' idea is Lemonade, which has cropped up for most micros on various tapes, and in a variety of presentations. The child is asked to make some simple decisions about running a lemonade stall, and thus makes a profit or goes bust within the week. I've always found the educational value of this program to be a little suspect with young children, but perhaps budding entrepreneurs of the future might put it all down to this program . . . .

This version is rather uninspiring, in black and white, with no graphics to hold the attentions, but is otherwise quite competent. Angle is a rather formal test on the sizes of angles, and helps in estimation. The trouble with my review copy was that a poor guess caused the program to crash, which left me reading again Scisoft's claim that the programs were all comprehensively crashproofed.

Percentage asks the child to guess what part of a square is shaded in — I cannot imagine many children wanting to spend very long with this. The final program, Glass, is also the best, and allows a wire-frame-model to be drawn on the screen. A number of points can be plotted on the screen, and then this two-dimensional shape can be tilted through any angle up to 90° and the resulting 3-D effect is quite impressive. What a pity the rest of the programs aren't as good as this one!

Ratings Table:

SOUNDS	n/a
GRAPHICS	45%
DOCUMENTATION	70%
VALUE FOR MONEY	40%
OVERALL	50%

Title PASSWORD
Publisher M.P. Software & Services
Machine BBC
Price £11 cassette £14 disc

The little booklet — subtitle Educational English — which accompanies the cassette states that 'the package has been designed to aid the teaching of spelling and comprehension skills to children of junior age'. It goes on to explain in detail how the programs, PASSWORD and WORDFILE work, and this, together with the instructions available in the program, make the documentation one of the most comprehensive for this type of structured reinforcement program I've come across, and many other publishers could benefit from viewing it. Unfortunately that's where my praise for the package ends.

In PASSWORD, which is set on an alien planet, the game presents the child with a series of sentences, each containing a missing word and with the number of missing letters shown. This is the password, which, if typed in correctly, opens a cell door and releases a

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prisoner — will it be a starship captain? — and points are added to the score either when a prisoner is released or when the mission to rescue 20 prisoners has been successful. It's doubtful if the low resolution graphics will encourage even the newest recruit to computers to use the progam more than once, and the sentences included must have been taken from one of the earliest grammar text books, e.g. ———— comes from sheep. A ———— is a horse's foot. How inspiring can you get?

If you still want to go further, WORDFILE allows the creation of alternative files.

You already have a better version in BRICKUP — free with the MEP Primer Pack! — which my youngsters have enjoyed using and altering to beat their friends.

Ratings Table:

SOUNDS	n/a
GRAPHICS	10%
DOCUMENTATION	80%
VALUE FOR MONEY	10%
OVERALL	20%

Title	**First Steps with the Mr.Men**
Publisher	**Mirrorsoft**
Machine	**Electron**
Price	**£8.95**

This tape has long been a favourite among our infants, having been available for the BBC Machine for some while. Many parents will be delighted to know that there is now a version available for the Electron.

As can be assumed from the title, the heroes of the four programs on the tape are the Mr.Men, originally drawn by Roger Hargreaves. There can be few children who do not know each by sight, and probably by name, and their appeal is obvious. Mr.Silly,Mr.Greedy and Mr.Forgetful appear in the games, which are indeed well named; for they seek to give children their first experiences on the computer.

Mr. Greedy is searching for an ice-cream, and the child helps him by using certain keys to control his movement. These need not be remembered, for there is a clear key-strip which the children find easy to use. The same direction keys are used throughout, which saves confusion. When Mr. Greedy has reached his target, a harder course appears, but there is no time limit, and nothing nasty happens to Mr. Greedy should an over-enthusiastic hand direct him too far into a wall.

When the child has gained confidence here, Mr. Silly is in need of help buying hats. A series of hats are drawn on various shelves, and they differ both in shape and colour. The hat Mr. Silly requires is shown, and the child uses the same RIGHT key to move along the shelves, or he can move up a shelf by use of the P key. The trouble is that having picked one, he in turn picks all the rest!

Much language work can result from this program. The other two are related, and in each Mr. Forgetful is faced with two identical rows of wardrobes. By moving one, and using a special OPEN key, the contents are revealed, which might be a boot or a skate etc. Its twin is in one of the opposite row of wardrobes , and the idea is to find matching pairs. If a matching pair is found, the two doors remain open, but incorrect choices are hidden again. One of the two games has items of clothing in the wardrobes, while the second has pairs of letters waiting to be discovered.

Many children with Electrons at home will find these programs delightful to play, while schools with the micro will find this an invaluable aid to concentration and a welcome first step on the computer.

Ratings Table:

SOUNDS	90%
GRAPHICS	85%
DOCUMENTATION	100%
VALUE FOR MONEY	100%
OVERALL	92%

Title	**Count with Oliver**
Publisher	**Mirrorsoft**
Machine	**BBC Model B / Electron**
Price	**£6.95**

This cassette contains two programs, each of which will encourage children during their early stages with counting and simple number bonds. On one side of the cassette, the programs are recorded in one order, while the reverse order is found on the other side, so that loading from cassette becomes a little easier.

Toyshop introduces Oliver, who immediately appealed to my young children. Oliver stands beside a shop window, and various toys appear in a variety of colours. Oliver asks questions of the child, and these begin in a simple way with letters written boldly and clearly in large letters. Adult helpers could introduce much vocabulary about sets, with there being three types of toys and three colours. When the child has mastered the earlier stages, there are more advanced questions, but they remain at a reasonable standard for most children.

Oliver appears again in Lollipops, in which another shop window shows his liking for lollipops. These again fall into several types, both in shape and colour. The child begins by answering a question about one sort, and then another set is selected. Simple addition is introduced by Oliver asking how many he has now. I was pleased to notice any remaining lollies in the window disappearing so that the child would not be distracted. Oliver decides to eat some, and this leads naturally enough to subtraction. Later, there are more questions which ask the child to predict, e.g. 'How many would I have if . . .' and this produces another challenge. Oliver grows visibly with each set of lollies, and my children couldn't wait to see the inevitable.

Schools or parents wishing to use a good quality pair of programs which will delight, amuse or educate their children need to look no further than this tape. The sound, which can be turned

on or off at will, contains some catchy tunes, and the screen display is bright and colourful.

Ratings Table:

SOUNDS	90%
GRAPHICS	75%
DOCUMENTATION	90%
VALUE FOR MONEY	90%
OVERALL	85%

Title	**Quick Thinking!**
Publisher	**Mirrorsoft**
Machine	**Electron**
Price	**£6.95**

This tape contains two programs, Robot Tables and Sum Vaders, and is aimed fairly straight towards the junior age group, although it is the sort of tape that I think will have a greater impact at home than in the school market. It seeks to brighten up two aspects of number work, and in this respect it certainly succeeds, although I found Robot Tables especially to have more gimmick that real educational content.

Robot Tables is set in a robot factory, with the robots being formed out of lumps which are themselves formed by crushing numbers. At the start of the conveyor belt, numbers appear at a reasonable speed.

If the current number is the next in the selected table, the child presses the 1 key, while SPACE rejects the number. If a correct choice enters the machine, it emerges as a robot, and the intention is to complete a row of ten perfect robots. Yes, there are curious misshapen robots which appear as a result of entering false numbers. Actually the children I tried this with, preferred to make the renegades, although they soon tired of the whole idea.

Much better is Sum Vaders, in which the child has to defend the Earth . . . . yes, you've guessed the rest! Either addition or subtraction is the theme of this game, otherwise they are identical. An alien craft appears at the top of the screen, and after hovering, it drops a robot. Before it can land, the child has to either type the sum or the difference of the two numbers, one on the craft and the other on the robot. A scoring system operates, and the robots explode rather nicely when the correct number is given. When the child gets the idea, and needs a harder challenge, the spacecraft fly further down the screen, thus shortening the time the child has to think of the answer. There are various levels, so that it could suit young children, or even parents. Simple sound effects can be retained or turned off, and the graphics are well drawn and smoothly animated.

Ratings Table:

SOUNDS	65%
GRAPHICS	75%
DOCUMENTATION	100%
VALUE FOR MONEY	85%
OVERALL	80%

Title	**Look Sharp!**
Publisher	**Mirrorsoft**
Machine	**BBC Model B / Electron**
Price	**£7.95**

For my money this is one of the best tapes I've seen for a long time, aimed at young children either at home or in the early school years. It is inexpensive, and contains two superb programs which quickly captured my own three youngsters and provided them with much enjoyment and activity, while at the same time teaching them subtly and in an entertaining manner.

Old MacDonald's Farm features this well-known theme, and the old gentleman appears on screen as a kindly looking farmer. He wants to play three games, Memory, Odd One Out and Snap. Perhaps the easiest is Snap, which my three-year-old could handle with ease. It is possible to play against a friend or against the computer, each having a certain colour in which it is hoped to draw Old Mac.

If two children play, the keys 1 and 0 are used, and the child tries to press the correct button when the two pictures of animals in the centre of the screen match. If a mistake is made, a piece is given to the other player, as each tries to build up the picture of the farmer.

Odd One Out uses the same group of animals, and shows three pictures. Old MacDonald moves to stand over each one in turn, and the child presses SPACE when the odd-one-out is chosen.

Memory fills four fields with animals, and the child has to select the correct animal to fit into each field when the original animals have been removed. Again the only response necessary is to press the space bar. The animals and the farmer are all beautifully drawn, and attractively coloured.

Space Observer Recruitment Test is shortend to S.O.R.T. in the title, but the format is certainly Spacelike throughout. The idea is that a new recruit is needed for the mission, and each candidate takes a series of three tests. It is possible to practise each subject first, before the test itself is taken. Visual perception is tested by placing on the screen, one above the other, three pictures to make a scene. Two columns are printed, next to each other, and the child presses any key if the pictures match in any of the positions. I found some keys less easy to register than others.

The second test, Differences, shows six pictures, identical in all respects except one. The arrows move beneath each in turn, and the student again presses a key to register a choice. As correct choices are made, a blue rocket moves upward, while a red rocket moves up for wrong choices.

Memory Test is very difficult,

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with a space scene split into nine component pictures. As each position is drawn in each of the pictures, a key has to be pressed to select the choice. I found this part very challenging indeed, and rather frustrating! The test itself consists of all three parts, joined to stretch the memory and concentration of children from around six to the top of the junior school. The only criticism I have is that this program cries out for sound but although Old MacDonald has sound a'plenty, the S.O.R.T. program is silent. What a shame!

Both programs have superb use of colour in Mode 2, and are fast and responsive. Teachers will be delighted to know that while ESCAPE returns to the Menu, BREAK is totally protected, even a CTRL-BREAK. The only way a child could crash the program is to pull out the plug! Many choices are given within each program, and I recommend it in the highest terms.

Ratings Table:

SOUNDS	80%
GRAPHICS	99%
DOCUMENTATION	100%
VALUE FOR MONEY	100%
OVERALL	95%

Title	**Roadcraft 1**
Publisher	**Highlight**
Machine	**BBC B**
Price	**£6 cassette, £7 disc**

This program introduces a character called Roger Roadcraft, who has to be taken across three roads. For each road crossed safely, two stars are awarded, with an additional two if a crossing is used or an adult is "asked" for help. The four cursor keys together with the RETURN key are all that are required to operate the program and screen instructions are available, if required, after the title page. They suggest that it is necessary to press RETURN when Roger is standing on the pavement alongside an adult or in line with the traffic on that road — the version I used didn't need this in the first example, the traffic stopped automatically!

The program offers five skill levels — the higher the level, the slower Roger crosses the road and the greater the volume of traffic. Zebra and Pelican crossings, policemen and crossing patrols offer a variety of methods of crossing the roads safely, and the graphics are almost up to the very high level we've come to expect from Highlight. I say almost, because I'd have liked to see the occasional cyclist pedalling, furiously along the road and perhaps a motor cyclist to give a little more variety. The quality of traffic noise I found disappointing, particularly comparing it with the appropriate sounds on their other programs — and again, no sound level!

This is a program that could be used very effectively in any work on road safety and with most ages in the primary school. I'm not sure whether children will enjoy the 'accidents' more than the number of stars and the sound accolade at the end, but it'll certainly make learning the Green Cross Code more fun! As the title is Roadcraft 1, I assume this is the first of a suite of programs on the subject. Perhaps an option which allows the computer to present comments regarding the user's capability of taking Roger across the roads might be more useful to older children than the star system.

Ratings Table:

SOUNDS	40%
GRAPHICS	85%
DOCUMENTATION	On Screen
EDUCATIONAL	75%
VALUE FOR MONEY	75%
OVERALL	70%

Title	**Polar Traveller, Desert Trek, Jungle Journey**
Publisher	**TREKKAsoft**
Machine	**BBC B**
Price	**£17**

TREKKAsoft have produced a suite of three adventure programs with geographical settings. The 'traveller' has to survive and/or reach his destination through a sometimes hostile environment. As the instruction program for Jungle Journey suggests, just getting to the base should not be considered as having successfully solved the adventure — can they get there a second time, can they survive indefinitely, have they been to every location and learnt as much as they can about the area?

The first two programs had map options which the children could refer to at each stage — the teacher could always limit the number of times this was allowed, but I thought this was good training for the keeping of records in more advanced adventures. The last gives some answers and a map of locations — 'but don't tell the children!' — in the instruction program. The instructions, which are very clear in all three programs, also give a list of the geographical vocabulary used in the programs and some suggestions for use of the programs: writing diaries, stimulus for creative writing, discussion on pros and cons of decisions made, and linked with a project on the region. So far some very pleasing touches!

POLAR TRAVELLER is intended for children in the 7-11 age range, and would be suitable in most schools for the younger children. In making a safe journey to base camp across the polar regions, the user has to avoid polar bears, blizzards, crevasses, and accept help from friendly Eskimoes, e.g. in the building of a kayak. I must admit this program took me back to my early days of teaching and the Archer & Thomas geography books, and I would question some of the information contained. A colleague, who was kind enough to try out this program with her class, said that the program didn't crash once and the children needed no help in working with it. First time I ran the program, I landed in a crevasse and was rescued by a helicopter and taken back to base. I then pressed the space bar and found myself back in the crevasse for another three days!

The children didn't like the fact that the scene never showed the traveller in relation to the hazards — they felt that their proximity to the bear was an important factor in the decision whether to shoot it. They also wondered why the keys 1-5 were used for the choice of direction and map, when N, S, E, W and M appeared more logical to them. There was a disappointingly small variety of hazards if this was to be the basis for creative writing, and as a result could also be extremely repetitive. There was no use of sound — the rescue plane, shouts for help — and snow goggles would have come in useful for prolonged journeys!

DESERT TREK is slightly more difficult than Polar Traveller, but not beyond the average 7-8 year old. Progress through the game is charted on a map in the same way as Polar Traveller. Decisions have to be taken on which equipment to take from the broken down vehicle — whether or not to shoot raiders or go with nomads, and the traveller has to survive snakes and sandstorms. The colours used on the yellow background made the program visually tiring. The children found it very confusing that having chosen East as their direction of travel, they saw the man walking right to left in an apparently westerly direction. They were not required to respond to or use any of the new vocabulary in any active way, in fact they could ignore it completely without detriment to their progress, and there was no incentive to go away from the computer and find out more.

In JUNGLE JOURNEY the children have to make a journey to a village in the Amazon Jungle after having crash landed. They encounter animals and Indians, have to cross pirahna-filled rivers and shoot rapids. This time there's no map for the children to refer to — they're expected to make their own — so the program is more suitable for the slightly older groups. The children found this program easy to use, attractive to look at and highly motivating.

Three teachers tried out these programs with groups of children, and all reported that the

children had enjoyed using them. The graphics were very unsophisticated (camels more like brontosauri!) — some might think amateurish by some standards — and the pictures so slow to form, I found it boring, although it's true to say that the easy ride didn't worry the children! In fairness, they did improve in the Jungle Journey. I much prefer the simplicity of the Mode 7 double height script to that used to give instructions in the programs and think the provision of a grid on the maps in the first two programs would have increased their 'training' potential.

These programs should be a worthwhile addition to an adventure program resource. Although they have only slight intrinsic educational content, they should provide motivation for creative writing and art work, and a useful introduction to the concept of adventure programs.

Ratings Table:

SOUNDS	30%
GRAPHICS	60%
DOCUMENTATION	80%
EDUCATIONAL	60%
VALUE FOR MONEY	75%
OVERALL	65%

Title	**Story**
Publisher	**H & H Software**
Machine	**BBC B**
Price	**£6.50 cassette, £7.25 disc**

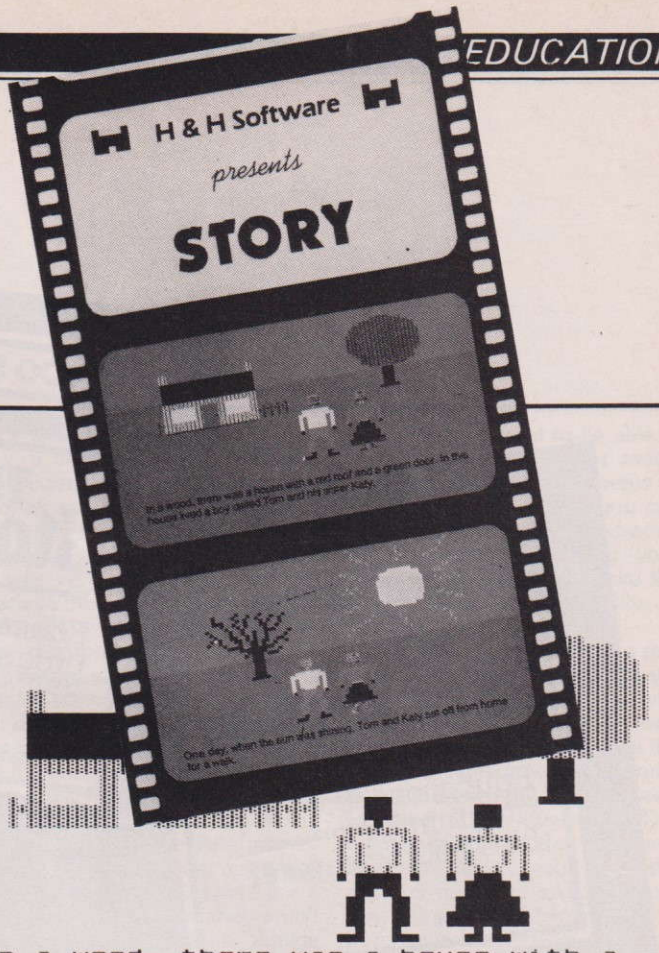
My initial reaction to this program was very favourable — the sort of open-ended, creative program pointing a way forward — but the more I tried it out, the more unsure I became. So I asked three teachers, all experienced in the use of computers in the primary classroom, for their impressions. Well, we do live in a democracy, but a committee of one often makes the decision much easier to reach! One thought that it was one of the "next generation" of computer programs, one thought it was splendid idea, but. . ., and the third thought that there was a basic dichotomy in the program which made it difficult to see how it could be used educationally! Let's have a look at what the program offers.

The sixteen page handbook which accompanies the program is divided into two sections:
Part One: Learning to use Story. If you want young children to use Story, guide them through this section.
Part Two: Reference — designed for experienced users and describes all the features of Story, how they work and how to use them.

The program runs from a menu which offers six options:
1. Tell a story
2. Draw a picture
3. Write a story
4. Save a story
5. Load a story
6. Print a story

It includes a sample 3-page story entitled WALK. The instructions for loading this on the screen and in the handbook are very easy to follow. Changing or adding to the story is straightforward using cursor keys and overtyping or using the delete key. The program provides an automatic wraparound, and if a story of more than four lines is written, the print size shrinks to make room for up to seven lines. Of course, it's always possible to add another page to the story! This gives a useful introduction to word processing.

Drawing or adding to a picture using any of the 64 pictures available in the computer's memory is easily achieved. The names of the pictures available (a strange choice, e.g. girl, but no boy, man or woman) scroll across a window at the bottom of the screen under the control of the RETURN key. For young users, a single line of words would have been easier to use. When the name required has been reached, this is typed in and by pressing the SPACE bar, the figure appears on the screen. It is moved into the position required by using the cursor keys and then "fixed" by pressing RETURN. Unfortunately, it is not always possible to move the figures to the position required, and this can be frustrating. The scale and colour of the pictures were sometimes surprising, e.g. the bee.

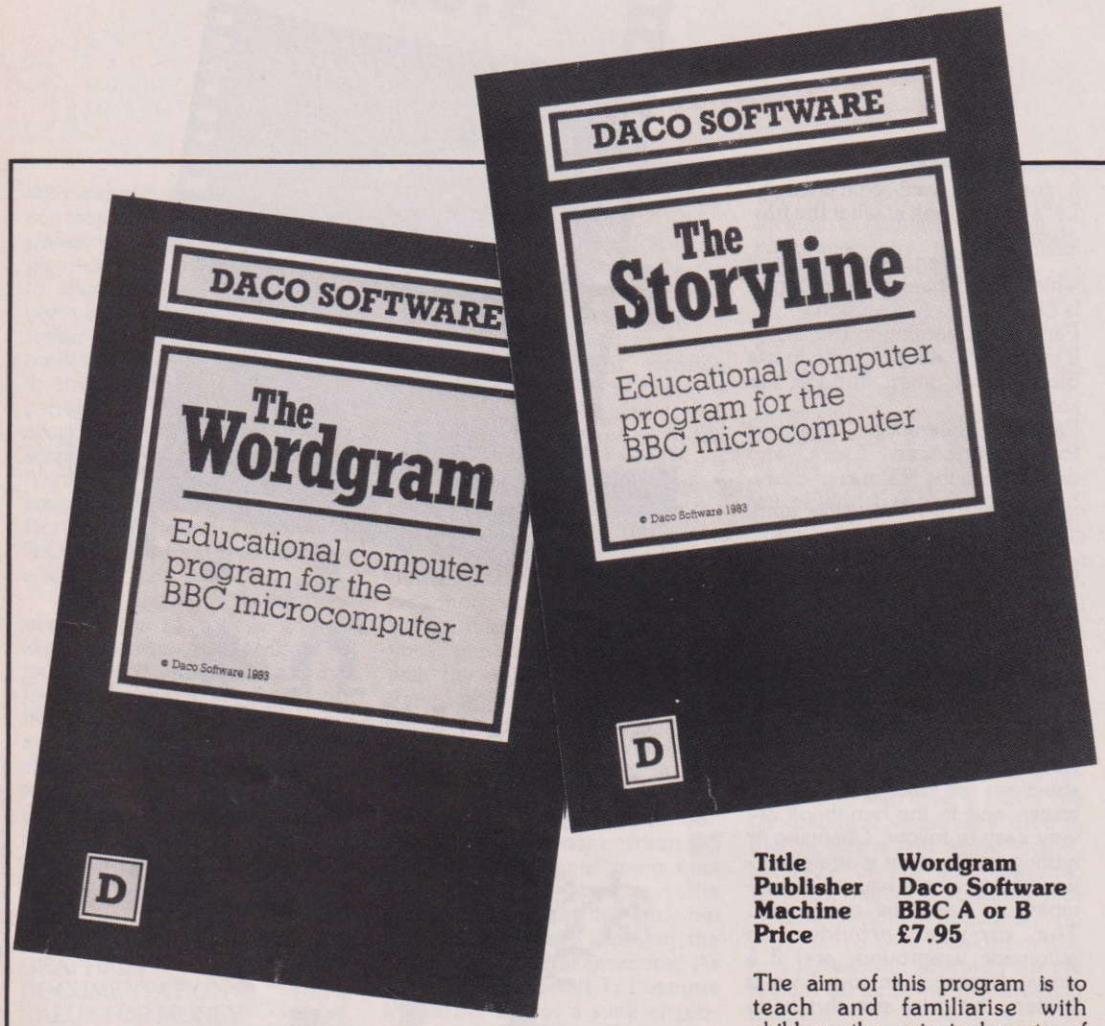


In a wood, there was a house with a red roof and a green door. In this house lived a boy called Tom and his sister Katy.

One day, when the sun was shining, Tom and Katy set off from home for a walk.

On their walk, they saw a fox running and a duck on a pond. They had lots to tell mummy when they were home again.

CONTINUED OVER



The revised/new story and pictures can be saved and/or dumped to a printer. Routines are included to work with Epson FX & RX and Seikosha printers or memory space allowed for your own printer routine.

So far all is fairly straightforward and most young children will enjoy using the facilities and achieve success within a short space of time but here comes the dichotomy my colleague mentioned. The level and amount of writing which the program will support without the need for the children to generate their own graphics is limited, but the majority of children are likely to be frustrated by the complexity of the facilities for changing the picture and drawing their own. If the children are up to cheating the graphics for their own pictures, it is likely that the level of their writing would be limited by the program's capacity, and perhaps a program such as EDFAX would give them greater scope.

The introduction to word processing is good; the introduction to mode 7 graphics is very well done. At some future point in time when we have numerous computers in every class with children and teachers who are computer literate, this type of program could be a great help in the creative writing lesson. Personally, I'd like to see a version of this program using a light pen for the graphics! In the meantime, if you've got any computer whizkids who have used this program, why not send some of their creations to the Editor!

Ratings Table:

SOUNDS	n/a
GRAPHICS	70%
DOCUMENTATION	80%
EDUCATIONAL	60%
VALUE FOR MONEY	70%
OVERALL	70%

Title	**Wordgram**
Publisher	**Daco Software**
Machine	**BBC A or B**
Price	**£7.95**

The aim of this program is to teach and familiarise with children the principal parts of speech in the English language by using them in a practical way. Its basis is a story writing program in which you write a story by selecting from the various word types offered and after choosing a type of word, e.g. verb, you are offered a number of alternative verbs from which to select the one for your story. You can choose from the following parts of speech: nouns, adjectives, pronouns, prepositions, verbs, adverbs and conjunctions. There are two levels of difficulty and these change the titles of the words offered. That may seem a little confusing but the idea is you first become familiar with a word type being described in detail, e.g. with verbs being described as "Action words" and when this is thoroughly understood you use the correct title, ie "verbs" in level two.

The program is based on a good sound idea and is more likely to foster a good understanding of the structure of English than say the old "Grammars" you may have been more familiar with, simply because you can see the words in their context. One criticism I would make however, is that the stories you create are not checked in any real way and if you insist you can write utter and complete nonsense (no this review was not written with the program!). This is probably due to the program being designed for both 16K and 32K models. It must be said, though, that if you use this on a model A you will only be able to write 50 word stories. Despite all this children will find the idea interesting to say the least and are likely to think more carefully about their language as a result of using it.

Ratings Table:

SOUNDS	n/a
GRAPHICS	n/a
DOCUMENTATION	70%
VALUE FOR MONEY	60%
OVERALL	70%

Title	**Accurate & Cut 'n' val**
Publisher	**MP Software and Services**
Machine	**BBC B**
Price	**£11.00 cassette, £14.00 disc**

These two programs have many similarities and therefore can be reviewed side by side but this doesn't mean that they are copies of each other by any means. Both are mathematical in origin and involve calculation on the students behalf. Both have the ability to accept many different test types and levels and there is even the opportunity to use a "variable" as part of the question. So what is the difference?

Accurate is meant to encourage students to estimate answers to a given degree of accuracy rather than be forced always to give a fully accurate result. This is a difficult skill to acquire and it is difficult to give practice in too. With this program the required degree of accuracy is set and then the questions appear for your answers. Unfortunately as far as I'm concerned there is no timing device within the pro-

gram. This is a sad omission for it means that there is no penalty for being accurate but very long winded. Remember that we are trying to encourage estimation, not pure accuracy, and often we do such things for speed and because accuracy is unnecessary; so there should be a penalty for taking too much time. Having said all that there is a place for this program, and the ease with which the data can be changed will be much appreciated by the users.

Cut 'n' val's greatest drawback is the poor documentation which totally fails to explain how the program works, what you are to do and why, and what the educational value is. I was so confused that I had to play the program before I understood at all. As far a I can tell you are given problems of either maths or logic and you can remove bits that you find difficult from either end of the problem. Say the problem was '2+3+5' and you couldn't find the answer, you might decide to remove the 2 and the + to leave 3+5 and then answer that by pressing 8. You would get the point for that problem but what have you proved?

One of the problems I tried was 'LOG (10)', all I had to do was to remove the 'LOG (' from the front and then the '), from the back and then answer 10 to get it correct. Did I cheat or did I just use the rules to win? In its favour I would recommend the printout and branching routine to other manufacturers. What made them special was the way you could signal that you found a problem hard and an easier one would be provided; but at the conclusion of the program the hard problems would be shown as well as all those you got wrong.

Returning to common features, both programs use the Mode 7 screen to good effect but do have an option for users of monochrome televisions which is a good idea. Both have printer routines, which are disabled in the standard versions but can be enabled if you so wish. Neither program has any kind of reward or incentive structure however which is a pity as there may be little intrinsic motivation for children to do well in this kind of program.

Ratings Table:

Accurate

SOUNDS	n/a
GRAPHICS	n/a
DOCUMENTATION	60%
VALUE FOR MONEY	70%
OVERALL	70%

Cut 'n' val

SOUNDS	n/a
GRAPHICS	n/a
DOCUMENTATION	40%
VALUE FOR MONEY	60%
OVERALL	50%

Title	**Astro Maths and Jungle Maths**
Publisher	**Scisoft**
Machine	**BBC A or B**
Price	**£5.00**

Perhaps I should admit that one of the programs that I review here is the first ever educational program that I ever bought for the BBC machine. I bought it because at the time it was the best maths program I had seen for junior and middle school aged children and I have used it with this age group to good effect since. This was "Jungle Maths"and it aims to give practice in basic computational skills involviong the four rules, ie addition, subtraction, multiplication and division.

In order to fit into a Model A machine there are two programs,one with addition and subtraction routines, the other with the multiplication and division ones. There are a number of options to choose from and these include maximum value of numbers, whether to include negative numbers or not and if you require decimals. The theme is to find your way across a jungle by answering the probelms correctly. Any failure is signalled by a graphic death in full colour on screen. These are truly wonderful and show great imagination. So that the child is not encouraged to get problems wrong however, all the deaths are replayed to those who get to the end with only a few mistakes.

I really should admit that there are better and more educational products on the market now, but the children do like this program and it is a firm favourite. I was very pleased therefore to recieve the company's newer title "Astro Maths"; but I became a little disappointed fairly quickly. The aim of this program is to teach conversion from fractions to decimals and from fractions to percentages. Unfortunately many of the features of the first program are missing from this one. Firstly there is a rather plain and boring screen display with little interest for a child. Then there is the lack of accurate options. There are a number of levels but they aren't as easily controlled as in "Junlge Maths". Finally the reward game is pathetic to say the least, a simple shoot the aliens game with very little to recommend it at all. For these reasons I would advise you to see this program and be conviced that it is what you need before purchase as I cannot really recommend it heartily.

Ratings Table:

Jungle Maths

SOUNDS	70%
GRAPHICS	80%
DOCUMENTATION	60%
VALUE FOR MONEY	60%
OVERALL	75%

Astro Maths

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

Title	**Mayday**
Publisher	**Tutorial Software Ltd**
Machine	**BBC B or Electron**
Price	**£11.95**

There has been a dearth of good educational software for some time now. This package is planned to help the teaching of ordinance survey maps and symbols, as well as the use of co-ordinates and bearings. For this reason it is claimed to be able to help those preparing for maths examinations too. The theme of the program is to see if you can stop too much oil spillage from a stricken tanker by using your knowledge of maps to make the moves required as quickly as possible.

You are provided with a section of an O.S. map of Anglesey and a rather nice plastic grid protractor to help you in your task. The teacher's book covers all the main concepts involved in some detail and even gives the answers to some of the questions. This means, of course, that the questions for which you have the answers are fixed and therefore this isn't the ideal program for a home purchaser, who will soon come to know the answers by heart. If you get the correct answers to the grid reference and symbol sections you are allowed to try to save the ship using bearings. There are problems here, however, as a slight miscalculation can move you off the map, and this is not prevented by the program. It is then very difficult to work out what bearing to take next. Overall the program is a brave attempt to give practice in an interesting and lively way, but there is too much fixed data and not enough flexibility to make it worthwhile for a single student to purchase.

The second program in the package is a little better in this respect as it chooses 10 questions, multiple choice variety, from a pool of 50. That ratio is still not over generous and there is a great likelihood that a question will occur twice in two consecutive runs of the program.

The final part of this package worthy of mention, is the advice and a couple of questions of 'O' level standard in the manual. These provide a nice finishing touch but overall I would prefer to spend my money on a book of past papers than on this package!

Ratings Table:

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

Big Ben

Freda and Andrea Perrow

Time to learn. A clock teaching utility for young children.

The regular, observant reader (that's all of you folks!) will have noticed that my last few programs have had an educational bias towards the very young. This probably reflects the fact that I have two young children of my own, Michael, 9 and Andrea, 7, (please put away your calculators — I married young, very young!).

Looking back over the past issues of *A&B Computing* I found it very surprising that little attention had been made to providing a time teaching aid. So when Andrea came home from school recently saying that she was having a little bit of difficulty learning to tell the time, with gay abandonment I pushed aside my current project (I'll tell you about that some other time) and directed my thought waves to producing a simple clock utility.

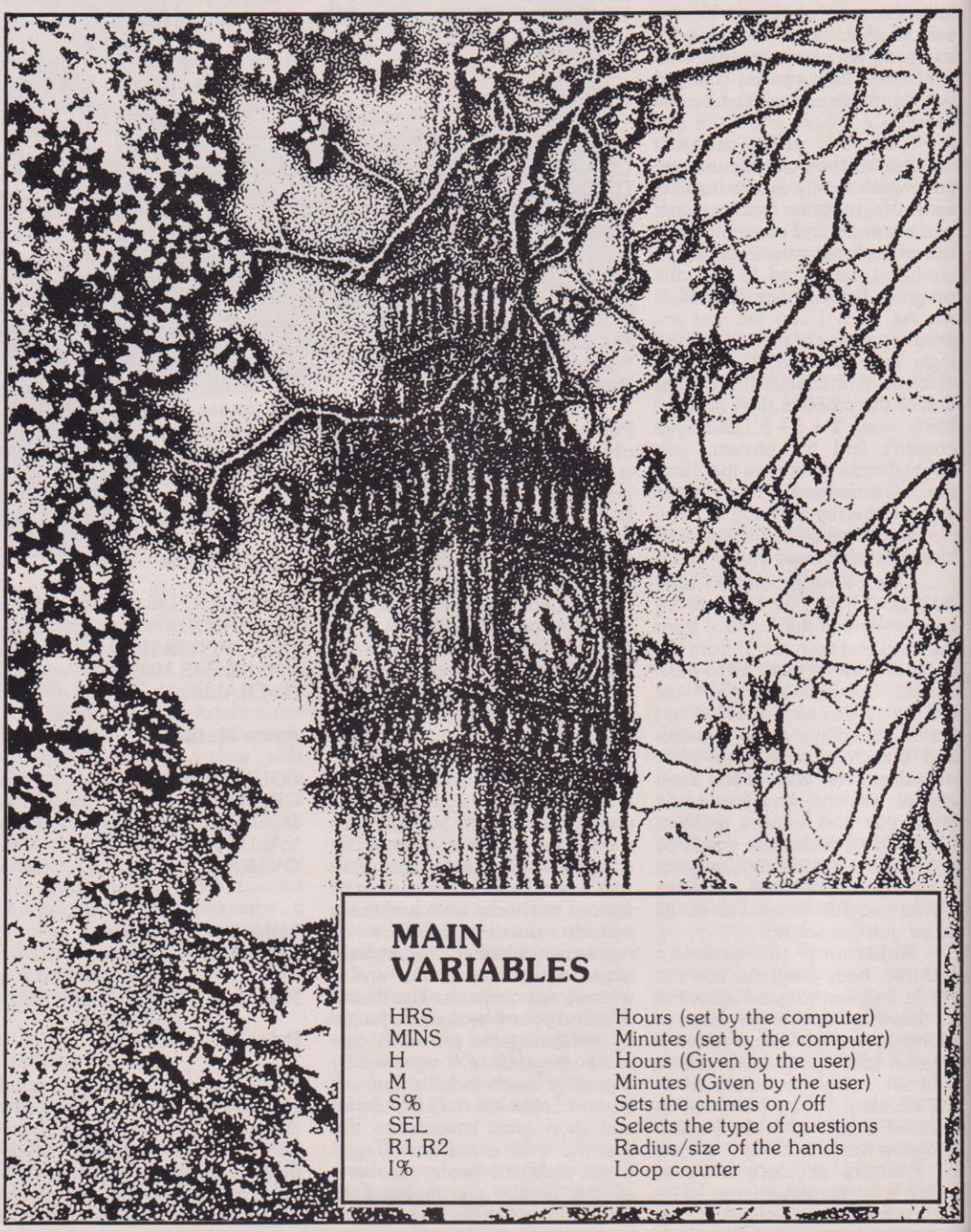
TWO GREAT MINDS

I had my own ideas of how I thought the program should be presented but Andrea had hers (we're two of a kind). In the end I had to bow to the fact that the program had to run and be presented in the same way as her school were teaching her. So Andrea's "modifications" were incorporated. If a different presentation is required or a more embroided program wanted here are a few suggestions and pointers.

Andrea pointed out that when the time was 15, 30 or 45 minutes past the hour the teacher expected the answer to be given as quarter past, half past and quarter to respectively. This is taken into account of in DEFPROCQUARTER. If your school teaches differently omit line 730.

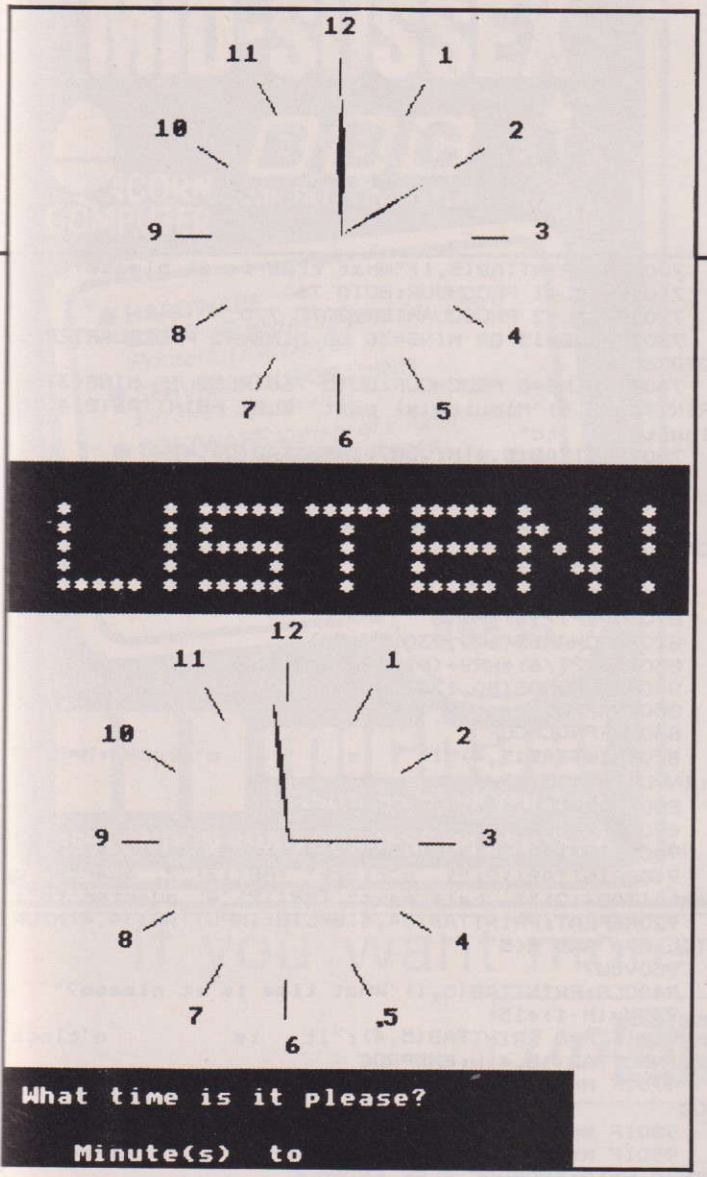
If the numbers on the face of the clock are not required leave out lines 480 to 510. Pressing ESCAPE at anytime directs the program back to the menu page, (leave out line 150 until you have the program running correctly).

As it stands the program is simply a teaching aid with no scoring or reward procedures except for checking the correct answer. To extend the program to include these features I suggest adding extra procedures which can be called from within DEFPROCRIGHT and DEFPROCWRONG. To aid with adapting the program and tailoring it to your own requirements a list of main variables and a breakdown of how the program works is given.



MAIN VARIABLES

HRS	Hours (set by the computer)
MINS	Minutes (set by the computer)
H	Hours (Given by the user)
M	Minutes (Given by the user)
S%	Sets the chimes on/off
SEL	Selects the type of questions
R1,R2	Radius/size of the hands
I%	Loop counter



HOW IT WORKS

40-190 Main body of the program.
40 Selects 4 colour mode.
50 Set envelope 1 parameters.
60 Alters red on colour palette to blue.
70 Sets graphics colours to white with blue background.
80 Sets text window black with yellow background.
100 Turns off auto repeat of keys.
110 Calls clock face procedure.
120 Sets main variables.
130 Call pointer drawing procedure.
140 Calls chime procedure (if selected).
150 Directs program to menu if ESCAPE pressed.
160 Calls menu page.
180 Main program procedure.
200-300 DEFPROCSELECT
210 Sets text print to black & clears text window to yellow.
220-270 Prints out the menu.
280 Waits for a valid key to be pressed.
290 Toggles chime on and off.
310-370 DEFPROCHANDS
Draws the hands size R1,R2 at position dictated by TH & F.
380-540 DEFPROCFACE
390 Joins text and graphics cursors.
400 Sets the centre of the clock.
420 Graphics foreground to black.
430 Graphics foreground to white every 5 mins, position.
470 Ensures graphics foreground is white for numbers.
480-510 Prints the numbers in the correct position.
520 Separates the cursors.
550-590 DEFPROCMESS
560 Clears the screen & sounds tone.
570 Prints error message.
580 Pause.
600-790 DEFPROCLEARN
610 Graphics foreground to blue & erases old hands.
620 Selects random hours.
630-670 Selects random minutes.
680 Graphics foreground to yellow. Draw new hands.
700 Clears text window. Prints out text.
710 If hours only selected calls hours procedure.
720 If ¼ hours selected calls ¼ hours procedure.
730 If random mins. falls on a ¼ hour calls ¼ hour procedure.
740 Determines type of message displayed.
750 Prompts answer.
760 Makes corrections to variables as required.
770 Checks for obvious errors.
780 Checks validity of the answer.
800-850 DEFPROCHAND
810 Sets position of minute hand.
820 Draws the minute hand.
830 Sets the position of the hour hand.
840 Draws the hour hand.
860-880 DEFPROCHOUR
870 Prompts input for hour.
1000-1040 DEFPROCRIGHT
1010 Prints text.
1020-1040 Jingle.
1050-1080 DEFPROCWRONG
1060 Sound.
1070 Text and pause.
1090-1200 DEFPROCCHIME
1100 Clears text window. Ends procedure if chimes off.
1100-1150 Prints message whilst chimes ring out.
1160-1190 Produced the required number of chimes and pauses in between each chime.

PROGRAM LISTING

```
10REM ***** B I G   B E N *****
20REM * FREDA & ANDREA PERROW *
30REM ***** (C) MAY  1984 *****
40MODE1
50ENVELOPE1,134,255,0,1,3,1,2,127,255,253,253,1
26,120
60VDU19,1,4;0;
70GCOL0,129:GCOL0,3:CLG
80VDU28,0,31,39,24,17,0,17,130,12
90PRINTTAB(12,2)"B I G  B E N"'''TAB(6)"By Fred
```

CONTINUED OVER

```
a and Andrea Perrow."
  100*FX11,0
  110PROCFACE:GCOL0,2
  120HRS=2:MINS=0:S%=1
  130PROCHAND
  140PROCCHIME(HRS)
  150ON ERROR GOTO160
  160PROCSELECT
  170REPEAT
  180PROCLEARN
  190UNTIL FALSE
  200DEFPROCSELECT
  210COLOUR0:CLS
  220PRINT"What would you like to practice? (1 - 4
)"
  230PRINTTAB(10)"1. o'clock"
  240PRINTTAB(10)"2. 1/4 Hours"
  250PRINTTAB(10)"3. 5 Minuites"
  260PRINTTAB(10)"4. Full Clock."
  270IF S%<>1 PRINTTAB(10)"5. Chimes on." ELSE PRI
NTTAB(10)"5. Chimes off."
  280REPEAT:SEL=GET:UNTIL SEL>48 AND SEL<54
  290IF SEL=53 VDU7:S%=NOT S%:GOTO210
  300SEL=SEL-48:ENDPROC
  310DEFPROCHANDS(R1,R2,TH,F)
  320MOVEX,Y:MOVEX+R1*SIN(TH-PI/F),Y+R1*COS(TH-PI/
F)
  330 PLOT85,X+R1*SIN(TH+PI/F),Y+R1*COS(TH+PI/F)
  340MOVEX+R1*SIN(TH-PI/F),Y+R1*COS(TH-PI/F)
  350DRAWX+R1*SIN(TH+PI/F),Y+R1*COS(TH+PI/F)
  360PLOT85,X+R2*SIN(TH),Y+R2*COS(TH)
  370ENDPROC
  380DEFPROCFACE
  390VDU5
  400R=300:X=640:Y=640:I%=-1
  410FOR TH=0 TO 2*PI STEP PI/30
  420GCOL0,0
  430IF I%=4 THEN GCOL0,3:I%=-1
  440MOVEX+R*SIN(TH),Y+R*COS(TH):DRAWX+(R-64)*SIN(
TH),Y+(R-64)*COS(TH)
  450I%=I%+1
  460NEXT
  470GCOL0,3
  480R=350:X=350:Y=660:I%=1
  490FOR TH=0+PI/6 TO 2*PI STEP PI/6
  500MOVEX+R*SIN(TH),Y+R*COS(TH):PRINTI%;
  510I%=I%+1:NEXT
  520VDU4
  530X=640:Y=640
  540ENDPROC
  550DEFPROCMESS
  560VDU12,7
  570PRINTTAB(2,2)"Sorry but your answer is way ou
t"''''TAB(6)"Please have another try"
  580W=INKEY150
  590ENDPROC
  600DEFPROCLEARN
  610GCOL0,1:PROCHAND
  620HRS=RND(12)-1
  630IF HRS=0 THEN HRS=12
  640IF SEL MINS=0
  650IF SEL=2 MINS=(RND(4)-1)*15
  660IF SEL=3 MINS=(RND(12)-1)*5
  670IF SEL=4 MINS=RND(60)-1
  680GCOL0,2:PROCHAND
  690IFMINS=0 PROCCHIME(HRS)
  700CLS:PRINTTAB(5,1)"What time is it please?"'
  710IF SEL=1 PROCHOUR:GOTO 760
  720IF SEL=2 PROCQUARTER:GOTO 770
  730IFMINS=15 OR MINS=30 OR MINS=45 PROCQUARTER:G
OTO760
  740IF MINS=0 PROCHOUR:GOTO 760 ELSE IF MINS<31 P
RINTTAB(8,4)"Minuite(s) past" ELSE PRINTTAB(8,4)"M
inuite(s)  to"
  750INPUTTAB(5,4)M:VDU7:INPUTTAB(24,4)H
  760IF MINS>30 M=60-M:H=H-1:IF H=0 H=12
  770IF M>60 AND  H<1 OR H>12 PROCMESS:GOTO700
  780IFH=HRS AND M=MINS THEN PROCRIGHT ELSE PROCWR
ONG:GOTO700
  790ENDPROC
  800DEFPROCHAND
  810TH=(PI/30)*MINS
  820PROCHANDS(140,230,TH,90)
  830TH=(PI/6)*HRS+(PI/360)*MINS
  840PROCHANDS(80,170,TH,90)
  850ENDPROC
  860DEFPROCHOUR
  870PRINTTAB(5,4)"It   is          o'clock":M=MINS
:INPUTTAB(15,4)H
  880ENDPROC
  890DEFPROCQUARTER
  900PRINTTAB(5,1)"choose the right answer (1-4)"'
  910PRINTTAB(12)"1. o'clock"'TAB(12)"2. quarter p
ast"'TAB(12)"3. half past"'TAB(12)"4. quarter to";
  920REPEAT:PRINTTAB(34,4)SPC18:INPUTTAB(34,4)M:UN
TIL M>0 AND M<5
  930VDU7
  940CLS:PRINTTAB(5,1)"What time is it please?"'
  950M=(M-1)*15
  960IF M=0 PRINTTAB(5,4);"It   is          o'clock
":INPUTTAB(15,4)H:ENDPROC
  970IF M=15 INPUTTAB(5,4)"quarter past   "H:ENDPR
OC
  980IF M=30 INPUTTAB(5,4)"half past    "H:ENDPROC
  990IF M=45 INPUTTAB(5,4)"quarter to    "H:H=H-1:I
FH=0 H=12:ENDPROC ELSE ENDPROC
 1000DEFPROCRIGHT
 1010PRINTTAB(5,7);"Right!   Right!   Right!";
 1020FOR B=1TO3: FOR A=1TO 240 STEP20
 1030SOUND1,-15,A,1:SOUND2,-15,A+2,1
 1040NEXT:NEXT:ENDPROC
 1050DEFPROCWRONG
 1060SOUND1,-15,20,25
 1070PRINTTAB(5,7);"Wrong!   Wrong!   Wrong!";:W=I
NKEY200
 1080ENDPROC
 1090DEFPROCCHIME(HRS)
 1100CLS:PRINT':IF S%<>1 ENDPROC
 1110 PRINTTAB(4)"*     * ***** ***** ***** *   *
 *"
 1120 PRINTTAB(4)"*     * *       *   *     **  *
 *"
 1130 PRINTTAB(4)"*     * *****   *   ***** * * *
 *"
 1140 PRINTTAB(4)"*     *     *   *   *     *  **"
 1150 PRINTTAB(4)"***** * *****   *   ***** *   *
 *"
 1160FOR I%=1 TO HRS
 1170SOUND1,1,7,4
 1180W=INKEY125
 1190NEXT
 1200ENDPROC
```

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DEALER ENQUIRIES INVITED

Software Reviews

Title	**Tetrapod**
Publisher	**Acornsoft**
Machine	**Model B**
Price	**£9.95 cassette, £11.50 disc**
	40/80

Tetrapod does not boast the most staggeringly colourful display familiar from some current arcade games. It goes rather for some more subtle blue/green mixes. This is symptomatic of the game as a whole. Tetrapod displays an original approach.

The one link with other BBC games of the past is an interesting one, the fact that the programmer's other work for Acornsoft was 'Snooker'. Not surprisingly when you see the Tetrapod "eggs" floating around the screen and consider the number of rebounds being calculated at any one time during the game. Snooker has stood the programmer in good stead.

At first sight and first play, Tetrapod can seem somewhat limited. The player controls a small craft with rotation left and right, thrust and fire. To be honest, the positive feel of the keyboard controls suited me much better than joystick, but the option is there to be taken by stick wizards.

Two (first screen) opposition craft roam the screen, occasionally taking pot shots at your good self. These craft rove about amongst a number of "eggs" knocking them out of the way as they go.

But watch what happens when a shot from your cannon (not the opposition) hits an egg. It is all too easy to do since shots stay "alive" within the screen area, bouncing around until they hit something! On impact, the egg immediately hatches a Tetrapod, a lizard-like creature, swift on its feet and homing incessantly upon the craft (yours or the opposition's) nearest to its hatching point.

When you first play Tetrapod the subtitles of the game take a few moments to sink in. A clue arrives on the second screen with a new opposition creature which is immune to your cannon fire. It can only be dealt with by the lizards themselves and it is your job to release them at the right moment, in the right place.

If the player is being chased by a Tetrapod, then a direct hit will re-encase the little lizard. Rebound shots can also be stopped by further fire. As the screens progress the opposition increases with Killer Bees, Red Devils and Poison Orbs. The Tetrapod eggs are less and less affected by friction, floating uncontrollably around. The answer is to be very selective about what you shoot at and when. Filling the whole screen with cannon fire is suicide, but a necessary release of tension now and then.

Tetrapod uses colours rarely seen on BBC games, and sound which adds emphasis to event during the action. The scenario and nature of the play are original. Smooth movement, homing and rebounds are all masterfully implemented. A great game for any player who relishes a new challenge.

Ratings Table:

SOUNDS	90%
GRAPHICS	80%
DOCUMENTATION	95%
VALUE FOR MONEY	75%
OVERALL	85%

Title	**Fortress**
Publisher	**Amcom**
Machine	**Model B**
Price	**£8.95 cassette**
	£10.39 disc

PACE Amcom's Fortress, the unofficial Zaxon for the BBC, has proved an immensely popular game and for good reason.

The flight of the player-controlled aircraft, shadow depicted on the scarred ground beneath, is fraught with danger.

After taking off and being forced high, it is necessary to get down almost to ground level to shoot out fuel dumps to replenish an ever diminishing supply.

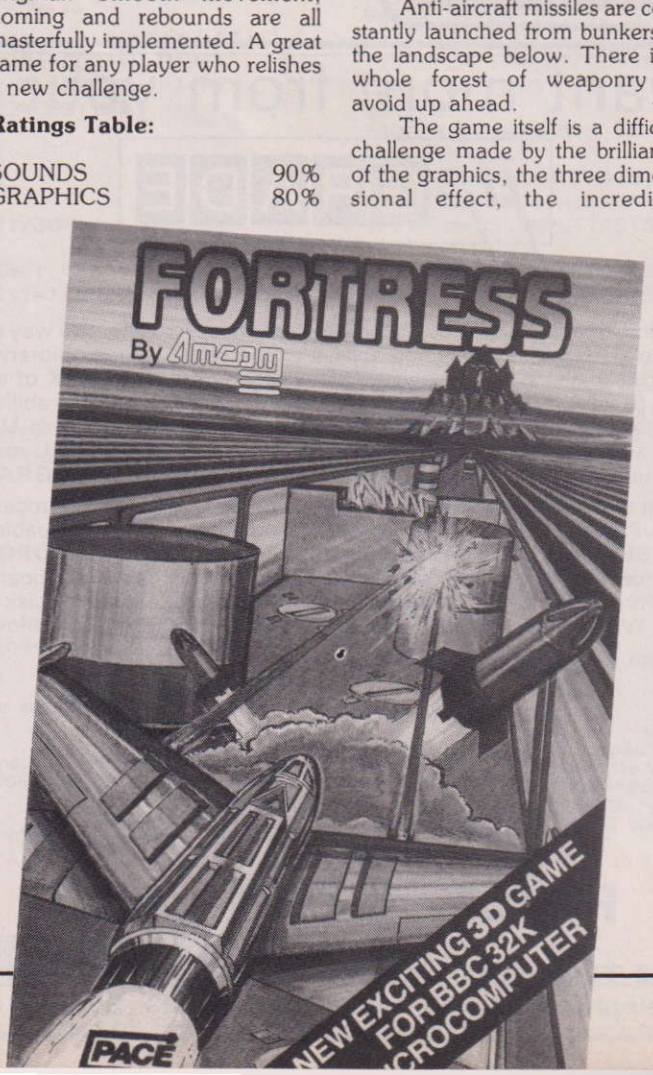
Anti-aircraft missiles are constantly launched from bunkers in the landscape below. There is a whole forest of weaponry to avoid up ahead.

The game itself is a difficult challenge made by the brilliance of the graphics, the three dimensional effect, the incredibly smooth scrolling (considering the amount of furniture being moved around) the thrilling sound effects and, sadly for yours truly, unbeatable explosions.

Fortress has all the necessary trimmings, good instruction sequence, sensible keys and high-scores. But it is the graphics which remain in the mind well after you've finished playing for the night. If you enjoy playing the two-dimensional fly-fast and shoot-quick games then Fortress is the next step up.

Ratings Table:

SOUNDS	80%
GRAPHICS	95%
DOCUMENTATION	80%
VALUE FOR MONEY	80%
OVERALL	85%

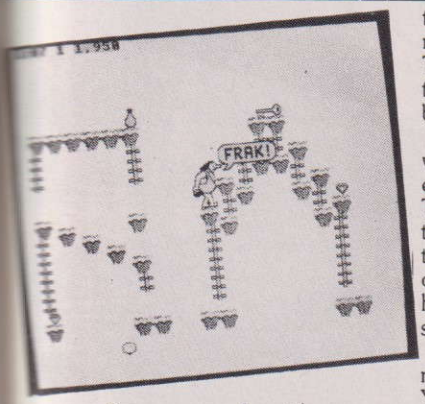


Title	**Frak!**
Publisher	**Aardvark Software**
Machine	**Model B**
Price	**£8.95**

What can you say about such an original game as Frak! other than "go out and see it as quickly as possible". It dived into software charts and it shows just what can be achieved on a BBC. Although not technical perfection, the game has so much original content and humour that it could not miss.

The cartoon characters designed by the teenage Bof are propelled about the weird world of Frak! by Orlando's imaginative programming. The graphics are produced by an advanced sprite handling package written by the programmer. This results in an excellently smooth movement but does have its game playing disadvantages.

It is sometimes a little frustrasting to manoeuvre our caveman hero Trogg (-lodyte?) away from an approaching dagger or balloon (the former come from above, the latter from below) and still find that a life is lost because your sprite has collided with the object rather than the physical appearance of the Trogg sprite on screen. It is just something that you have to get used to.



Trogg roves about the maze, climbing ladders, jumping crevasses and collecting objects. As well as avoiding daggers and balloons, Trog can also "yo-yo" them. His yo-yo can extend to approximately a third of the screen at any position depending on how long the fire key (RETURN) is depressed. It can eliminate balloons and daggers and send nasties shooting sideways out of the game. All this yo-yoing notches up the points.

At the same time the seconds are being counted down in the top left hand corner. The time limit should not prove a problem unless you get really bogged down somewhere along the line. This has to be the first maze type game which works horizontally.

Some of the finer points of keyboard control have to be investigated before an error free run through a screen can be achieved and if in doubt, it is worth taking the plunge.

The origin of the word Frak!, the expletive issued by Trogg each time he comes a cropper, is shrouded in mystery. Aardvark would have us believe that someone was observed using it to disguise less genteel curses. Our information is that it was a favourite word of someone much closer to the company and not just for cursing.

For those who like to go further than just playing the games, Frak! is a goldmine of humorous and apt comments plus the odd piratical tune.

Other than the collision detection already mentioned, the graphic quality of Frak! is something new on the BBC. This is due to imaginative drawing techniques such as the black surround for the maze features. Trogg scuttles along nicely and the scrolling is good enough to become unnoticeable.

The sound is excellent with various ditties accompanying each screen and strange noises as Trogg walks, climbs and yo-yos the nasties. The sound can be turned off and (not documented) on occasion the background tune has disappeared leaving only the sound effects.

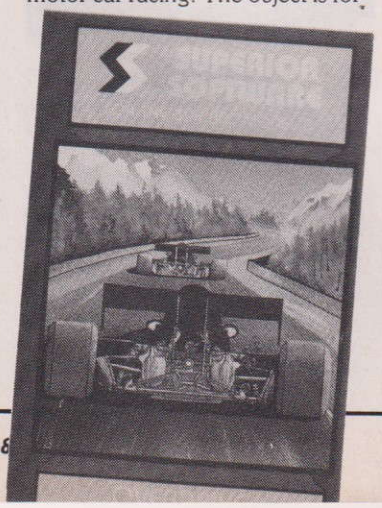
Even the high score table is a new approach to the subject. You select the character you wish to be left as a reminder of your achievement. There are also a couple of nice fill screens which keep interest alive in between games. As screens get harder, strategy becomes more and more important and it helps to have the "freeze" option so that you can sit for a moment pondering a route. The later screens further indicate the revolutionary imagination of the designers. Why not write and tell us about the ones after that?

Ratings Table:

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

Title	**Overdrive**
Publisher	**Superior Software**
Machine	**Model 3**
Price	**£7.95**

Overdrive is an interesting and fast moving game based on motor car racing. The object is for the player to steer his racing car to the left and to the right, accelerating and decelerating by using the 'Z', 'X', ' * ' and '?' keys respectively in an attempt to pass the opposing cars.



During the loading process a screen appears giving information as to which keys should be used. After this a daytime setting appears, this being the first stage of a series of five settings, the remaining four being night, snow, desert and riverside. Each of these screens, by clever use of perspective, takes on a 3-dimensional effect and the straight road disappears into the distance.

All the layouts are similar and give score, time and speed at the top of the screen and directly below this a bonus chart indicating the number of cars passed. A score is awarded relevant to the speed that the player travels and a bonus score allowed for each car overtaken.

To qualify for the following stage the player must have passed a set number of cars in ninety-nine seconds so that he finishes in the top twelve places. His success is indicated on the right hand side of the bonus chart and his failure to reach this target brings the game to a close and at this point the five best scores are shown.

This game has been well put together and the graphics are of a good quality with some excellent sound effects. However, it lacks inventiveness in that the continuous 3-dimensional straight road is rather monotonous and a few bends would add some extra interest.

Ratings Table:

SOUNDS	75%
GRAPHICS	65%
DOCUMENTATION	40%
VALUE FOR MONEY	70%
OVERALL	68%

Title	**Percy Penguin**
Publisher	**Superior Software**
Machine	**Model B**
Price	**£7.95**

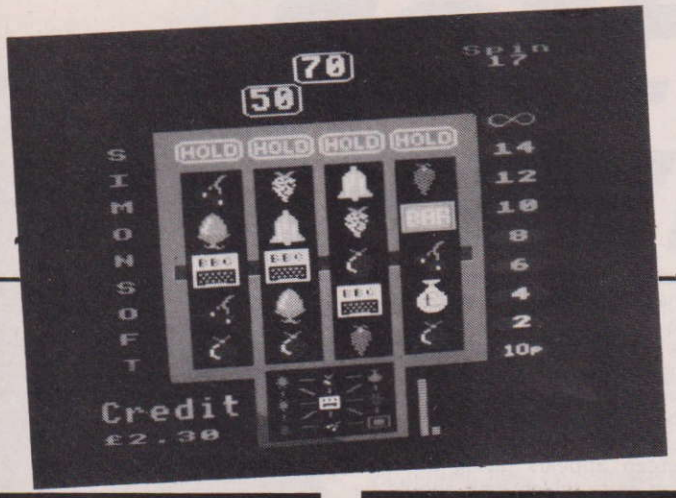
You are Percy in a maze of ice cubes. Also in the maze are the deadly snobees which are out to kill you, so to stay alive you must kill them first. Killing a snobee is done by hurling an ice cube at it, which is achieved by pressing the space bar at the same time as one of the direction keys ("Z" left, "X" right, " * " up and "?" down). For this you score 100 points and additional points are obtained in a number of different ways. Firstly, 10 points for pecking at an ice cube that then disappears. Secondly, 1000 points and an extra life (you start with three), for lining up three of the cubes called diamond cubes which have red and yellow centres as opposed to blue. Thirdly, 10 points for every second under a minute after killing all the snobees on each screen, of which there are eight, with no more than three on the screen at any one time.

The game is interesting, and enjoyable to play with some good graphics, and sound. The only thing that is disappointing is the documentation. Only one of three pages that are repeated while the game is not being played, is devoted to it. On this page there is a brief outline on how to play and what the game is about, but there is no mention that the joystick can be used, or of the bonus score for killing all the snobees on the screen in under a minute. The other two of these three pages are for the top eight scores, anda graphic picture with the title "Percy's home".

Ratings Table:

SOUNDS	70%
GRAPHICS	75%
DOCUMENTATION	40%
VALUE FOR MONEY	70%
OVERALL	73%

CONTINUED OVER



Title	**SuperFruit**
Publisher	**Simonsoft**
Machine	**Model B**
Price	**£5.95**

Superfruit is, yes, a one arm bandit game in which you win or lose money the game has given you in the first place. You start with being given the keys used in the game: "space bar" spins reels, "return" collect wins, "G" all gambles, "1,2,3,4" reel control (nudges, holds, and swap reels), "up/down arrows" change nudge direction. Also on this screen is the option to press "escape" which will load the game straight away or "space bar" which will give several pages of instructions on different aspects of the game. These instructions are on win, gambling, nudges, swap reels and holds.

While the game is loading the screen shows the different combinations of things you require to win, of which the maximum is £4. When it is loaded you are shown the fruit machine and given £2. to start playing with. Each turn costs 20p thus giving you a minimum of 10 turns. When you run out a little tune is played and you are asked "Another £2", to which you then press the "Y" or "N" keys.

This is a very well written game, but I find it difficult to get excited about a game that goes nowhere and achives nothing, and I therefore feel that the time the writer spent on the game could have been more constructively spent on something more stimulating.

Ratings Table:

SOUNDS	70%
GRAPHICS	80%
DOCUMENTATION	70%
VALUE FOR MONEY	50%
OVERALL	70%

Title	**747 Flight Simulator**
Publisher	**DACC Ltd**
Machine	**Electron**
Price	**£9.95**
Title	**767 Flight Simulator**
Publisher	**Flightdeck Software**
Machine	**Electron/BBC (32K)**
Price	**£8.75**

Have you ever seen those films where all the pilots on board a plane are simultaneously taken ill, and they look to you to land the craft safely? Well, even after many hours using each of these, I would still keep very quiet and let someone else fly the thing, it ain't easy!

There is a wealth of difference between the two, and this starts from the booklets which accompany each. The DACC manual has 16 small pages which are crammed full of information and include a full explanation of what the various dials and markers indicate. This is obviously useful, but even more useful would have been some kind of mnemonic alongside each dial. I found that I had crashed before I had located the right page in the book. The Flightdeck manual runs to 18 pages, much larger in size, although the printing is also enlarged. Several diagrams are included, and the person who wrote that a picture was worth a thousand words knew what he was on about. Rather authentic looking maps are included, so that you can choose to crash on either London, Luton or Birmingham. A series of lessons are suggested, and although my first tendency was to skip over them and to get on with it, they are vital for the inexperienced, like myself!

Also included in the Flightdeck pack are two key overlays, one for each micro, and these are absolutely necessary, as a total of 33 keys are used on the Electron, 34 on the Beeb. The overlays are clearly labelled, and make the exercise much more possible. DACC rely on about 20 keys, although the information has to be gleaned from the booklet. Both simulators have a joystick facility built in. The 767 program runs as well on either machine, and the main difference is sound on the BBC. This leads to the big question, which is the better of the two? Well in practically every respect Flightdeck is the high flier! Everything has obviously been so well researched and tightly programmed that the airfields are not only accurately shown, but are also stored in the computer's memory to be the right distance and bearing from each other. So it is feasible to take off from Stansted and land at Birmingham, provided you have enough ability. If you don't, don't despair, for there is even an autopilot option which is invaluable during the early stages. The instrument layout is far better, both in detail and clarity, and I suppose the ultimate test was that both tended to "fly" better on the

Flightdeck simulator, and I enjoyed the experience far more.

Flying the 747 was difficult, with constant references back to the manual, and a feeling of apathy, but flying the 767 made the adrenalin flow.

Ratings Table:

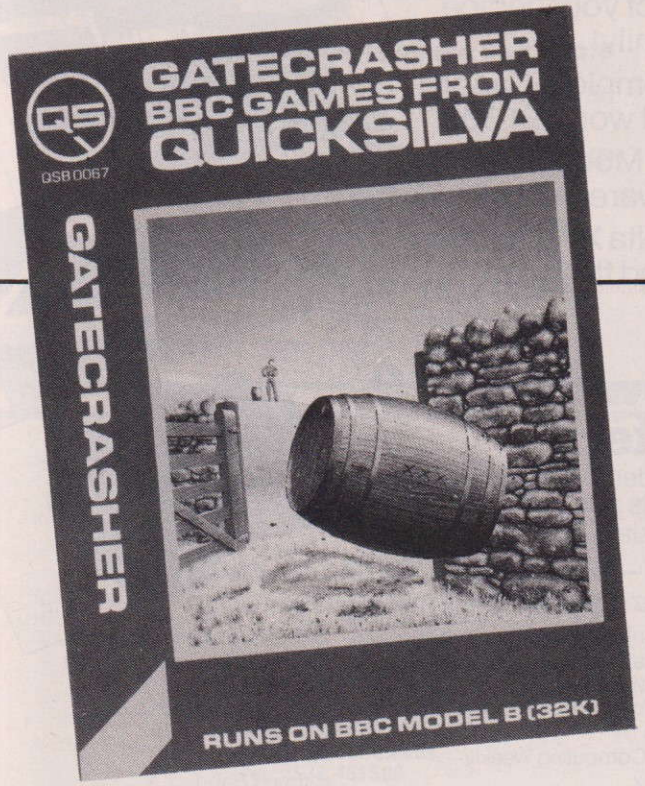
DACC	**747**
SOUNDS	50%
GRAPHICS	65%
DOCUMENTATION	70%
VALUE FOR MONEY	50%
OVERALL	60%

Ratings Table:

Flightdeck	**767**
SOUNDS	50%
GRAPHICS	80%
DOCUMENTATION	100%
VALUE FOR MONEY	90%
OVERALL	85%

Title	**Budget**
Publisher	**Microaid**
Machine	**BBC Model B**
Price	**£6.95**

I must confess at the outset that I've never seen one of the vital roles of the micro in the home as that of keeping check of cheques, and showing me just how early each month I become overdrawn! However, before you nod your head in agreement and turn the page, this is not such an insignificant program as that. It will allow you to produce a kind of a spreadsheet of your accounts,



but in a very simple and user-friendly manner.

Having a disc interface fitted on my machine, I have a dread of watching a program load in and then crash on trying to run with the revised page. Even resetting the page is not always enough, so it was good to see that Microaid have included a routine to take the problem away from peripheral-users. If the page is not set low enough, then the function key is set to reload the program into the correct area of memory (I admit I was actually cheating, and had transferred the program to disc to make my reviewing easier).

The user is then asked to select a period for analysis, from weekly to quarterly. The program prompts for various inputs concerning types of income, and regular monthly outgoings. The categories are already decided, but are very comprehensive in their coverage. After this phase, variable monthly outgoings are given a value, at the end of which the profit or loss is spread around these variables. It is then possible to have as many passes through the next part as needed, with each variable sum being displayed and possibly altered.

The user is given the option to freeze any figures, and then passes continue until all the figures are frozen and Income = Expenditure. Colour is used intelligently throughout to clarify the various stages, and I found it virtually impossible to crash the system. When the final part has been reached, there is an 80 column spreadsheet display which can include a year of analysis and a title for accounts. For interest, I altered the listing to make a system for a fictitious business, and found that even in this capacity, the program was easy to use, accurate and extremely clear throughout. Output can be to the screen only, or also to a printer — a very good addition.

Ratings Table:

SOUNDS	N/A
GRAPHICS	N/A
(use of colour	85%)
DOCUMENTATION	95%
VALUE FOR MONEY	90%
OVERALL	85%

Title	**Gatecrasher**
Publisher	**Quicksilva**
Machine	**BBC Model B**
Price	**£6.95**

For anyone who is heartily sick of zapping ghostlike frogs as they dodge barrels, this will be a most welcome antidote. It requires neither speed nor courage, and it is guaranteed not to numb your fire-button finger, even after a long session. Yet it will frustrate, annoy and hook you very quickly. I found myself coming back to the program time and time again, but still not doing as well as my six-year-old son! That is one of the good features about this tape, a child could sit and play unattended and gradually develop the strategy necessary for success, whereas many arcade games leave children's reflexes far behind.

So what is the revolutionary idea? Well, if I describe it simply by saying that you have to drop a barrel into each of the sectors at the bottom of the screen, it sounds pretty boring, I must agree. However, the way from the top to the bottom is via a series of platforms and chutes. When a barrel is dropped, it travels vertically downwards until it meets a 45° plane, which diverts the movement to either left or right. This continues until it either falls down another chute or meets another slope. Yes, I know it still sounds boring and easy, in which case I suggest you go out and buy it. If you still feel it's boring, then perhaps you're cut out for a lifetime of zapping aliens, but I'm sure most of us relish a different challenge sometimes (why else the growth in Adventures?). Oh, by the way, when you manage to get it right, the rules change with each screen.....

Ratings Table:

SOUNDS	70%
GRAPHICS	70%
DOCUMENTATION	60%
VALUE FOR MONEY	80%
OVERALL	75%

ARCADE ACTION

The climax to the real grand prix seasion is not far away and Sunday Grandstand brings most of us as close as we are ever likely to get to driving at 190 miles per hour around the world's most dangerous race tracks.

The racing car theme seems to have inspired a whole rash of games. Programmers are striving to produce the ultimate motorised sprint for the BBC.

Alligata's Monaco and Superior's Overdrive are about to be overtaken by games from Software Invasion, Acornsoft and with a little luck, Atarisoft's Pole Position.

Pole Position's release has been held up by the recent change in Atari ownership.

Software Invasion's 90% finished game is a cross between Pole Position and Psion's Chequered Flag for the Spectrum. Controls and instruments are displayed at the bottom of the screen and there should be a choice of race tracks. The current one is very reminiscent of Pole Position, as are the rare stray cars which loom up ahead.

Acornsoft's game is being written by Aviator author, Geoffrey Crammond. He is believed to be incorporating various original features such as hills, hazards and pit stops. Given Acorn's current car racing obsession, Geoffrey's attention to detail will be thoroughly tested.

Meanwhile Acornsoft are releasing a dozen games in the run up to Christmas in what seems to be a concerted effort to bury the opposition. Featured amongst these may be the interplanetary game Elite, Labyrinth – a brilliant cybertron like game with great colour mixing and scrolling between rooms (a bit easy if anything) and something called project Bell.

Micro Power have finally converted a whole bunch of games on to disc, using the extra disc space available to them to benefit the buyer. They have come up with some very nice screen pictures and instruction sequences. Superior's new games have brought to an end a rather arid patch. Their Mr Wiz and Wallaby are brilliant and highly original arcade attractions. Superior at their best. Watch out for A&B's own bouncing star from down under in next month's issue. Bouncing baby roos are currently big business at the arcade.

As seen in the national press

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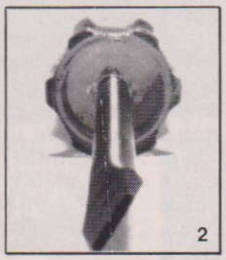

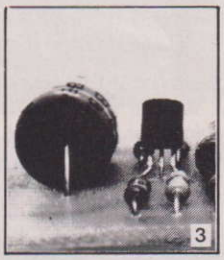

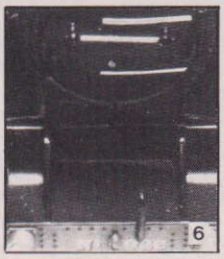

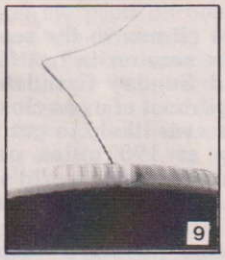

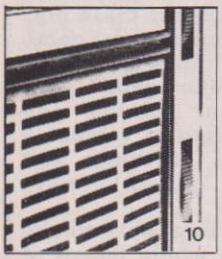

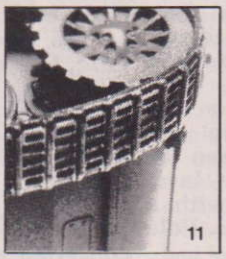

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Just identify the twelve objects pictured opposite....

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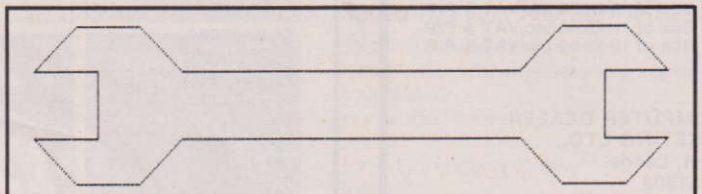
Gridlines

John Sheard

A flexible program that will help school children further their understanding of co-ordinates by creating their own graphics.



More and more primary schools are buying computers (the majority of them BBCs) through the Department of Industry scheme whereby the government contributes half the cost. It will be some time, however, before a significant number of schools possess two or more computers and the present average of one per 200 pupils improved. So, many primary classes are lucky if they have the school's computer for half a day a week, and obviously need to choose which programs they use with care.

Some questions to ask if these circumstances exist, and even if they are more favourable, are:

Will the program help teach or practise something worthwhile?

Can useful preparatory and/or follow-up work be carried out away from the computer?

Can the children work in pairs or small groups?

How long will it take all the children in the class to have a go on the computer?

If appropriate, can any permanent record of the children's work be made — eg with a printer or on tape?

Is the program flexible enough to cater for children of different ages and abilities?

An increasing number of programs are meeting these criteria, but there are still not enough. "Gridlines" was written with them in mind, to provide children with an enjoyable and worthwhile way of developing their understanding of co-ordinates. It has the following features:

1. Much of the work can be carried out away from the computer. Straight-line pictures are drawn on a piece of squared paper marked with a grid (any size from 6×4 to 60×40). The points can then be numbered and their co-ordinates written down before the child goes to the computer to enter them and draw the picture on the screen. During this second stage, the more able children can help those who might be having difficulty.

2. The program itself is simple to operate and very robust. A single keypress is all that is needed whenever the user is given an option, and opportunities are given throughout to correct mistakes.

3. Pictures can be saved on tape, so that the teacher can view them at the end of a session and show them to the class — or to the parents at an open evening!

The program also illustrates how much has to be done to convert a very simple and obvious idea (using the MOVE and PLOT commands to draw pictures on the screen) into a flexible and robust program that meets the criteria listed above.

PROGRAM DESCRIPTION

On running the program, the following options are displayed on top of the grid that will be used:

1. To change the grid's scale (Press S)
2. To draw some pictures on the screen (D)
3. To view some pictures that have already been saved on tape (V)
4. To exit from the program (E)

The default scale of the grid is 5 — ie each of the 24 squares contains 5×5 points that can be used, giving maximum co-ordinates of 30 (horizontally) and 20 (vertically). PROCscale allows any number from 1 to 10 to be entered as the new scale, depending on the range of co-ordinates required. The default value of 5 can be changed by altering the value of "scale" in line 130.

When option 2 is chosen, PROCdrawsetup is called and asks whether the pictures will be saved or not. To save the pictures easily, it is necessary to use a cassette recorder under the control of the computer — ie with a lead ending in a 7 pin DIN plug or a 5 pin plug with separate jack plug. This is in fact the norm, so should not prove a difficulty. If they are to be saved, a file is opened and after each picture has been drawn its co-ordinates are saved onto a tape. (Make sure it's not the same one the program's on!) The recorder is set up at this stage and need not be touched again until the end of the session (very useful in a busy classroom).

Separate graphics and text windows are then defined, with the graphics origin moved accordingly (PROCscreen), and the grid is redrawn (PROC grid). At various stages in the program, G can be pressed to remove the grid (for a clearer view of the picture being drawn) or to restore it. This is effected by PROCgrid change which simply alternates the colour of the grid between 2 (green) and 0 (black) using the VDU 19 command.

DRAWING PICTURES

A picture or pattern can now be drawn on the screen. Each of its points is defined by entering two co-ordinates separated by a comma, eg 6,11 or 25,0 (PROCcoors). A small square is then drawn at that point (PROCpoint), but can be erased by pressing E if a mistake has been made. After the first point has been entered (PROCfirstpoint), PROCnextpoint is repeated until the user decides the picture is finished. Pressing D will cause a line to be drawn from the previous point to the present one (PROCdrawordelete) and PROCafterdraw then offers three options — to move on to the next point (N), to erase the line (E) using PROCdrawordelete with the logical operation and colour set accordingly, or to finish (F). Note that lines do not *have* to be drawn, so pictures with separate sections (eg windows in a house or features on a face) can be built up.

When the picture is finished, PROCfinished is called and, if the pictures are to be saved, PROCsave which asks the children to enter their names (up to a maximum of 16 letters) and a title (up to 12 letters). The co-ordinates are then saved onto tape and another picture can be drawn on the same grid or the program restarted.

No instructions are given in the program regarding the entering of the co-ordinates — an understanding of what they are and which should be entered first is assumed. However PROCcoords as listed is designed to be 100% proof against anything that can be thrown at it! A series of checks ensures that no inappropriate keypress will be acted upon (except BREAK unfortunately, which restarts the program) and no out of range number will be accepted and RETURN will not be affected unless two numbers separated by a comma have been entered. All this does make for a rather long and complicated procedure for what should be a simple operation, so if anyone is very trusting

and has confidence in their children (or is just feeling lazy!) lines 2940 to 3170 can be omitted and the following single line substituted: INPUT X(2), Y(2). This will provide no user-proofing at all, but (useful sometimes) allows points outside the grid and off the screen to be entered and decimal points to be used in the co-ordinates.

3. If the view option is chosen at the start of the program, PROCviewsetup instructs the user on the setting up of the cassette recorder. As with the main section of the program, the recorder must be remote-controlled so need not be touched again once it has been set up. PROCfiledraw is then repeated for as long as it is wanted, drawing pictures whose co-ordinates have been saved on the tape. The file sections of the program have deliberately been kept simple (the same filename is used for each picture) so that any tape of pictures can be played from any starting point to draw pictures on the screen. The grid that each picture was drawn on can be restored in the usual way so that mistakes, if any, can be discussed. Another picture is looked for by pressing P while S returns the user to the start-of-program options.

The only procedures not mentioned so far are PROCrenumberpoints which simply renumbers the co-ordinates for the purposes of drawing as each new point is entered; and the ubiquitous PROCchoice which is used whenever a single keypress is required to proceed. Only the keys listed in the parameter "option" will be acted upon, and VDU 7 provides the beep that sounds when a wrong key is pressed. After four such mistakes a reminder of the keys that can be pressed is printed on the screen.

The following FX calls and VDU commands are used:

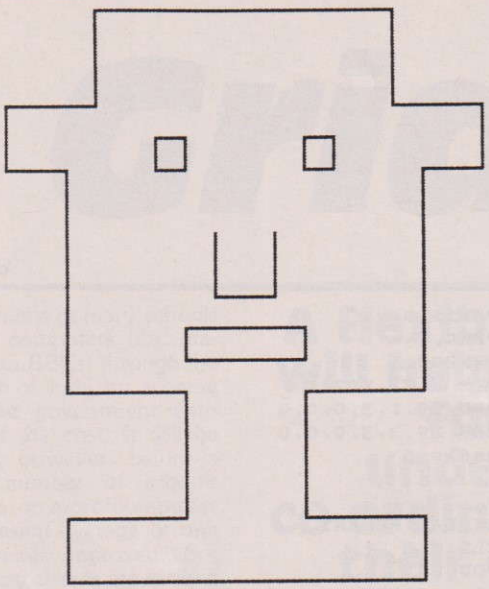
*FX 11,0	disables the auto-repeat
*FX 12	restores it
*FX 4,1	disables the cursor keys
*FX 4,0	restores them
*FX 200,1	disables the ESCAPE key completely
*FX 200,0	restores it
*FX 21,0	flushes the keyboard buffer
*FX 220,32	ensures that the CAPS LOCK is on
VDU 23,1,0;0;0;0;	removes the cursor
VDU 23,1,1;0;0;0;	restores it
VDU 28	sets the text window (line 960)
VDU 24	sets the graphics window (line 970)
VDU 26	restores both windows to the whole screen (line 180)
VDU 21	suppresses output to the screen (used when opening a file)
VDU 6	restores output to the screen
VDU 29	sets the graphics origin (line 980)
VDU 19	is used to set and control the colours of the grid and the picture

(The accompanying illustrations of pictures drawn with the program were printed as they were drawn on a Tandy CGP-115 Color Graphic Printer, reviewed in "A & B Computing" Number 1 and ideal for this kind of program. If any reader has this printer and would like a copy of the simple procedures that enable it to be used with "Gridlines", send an S.A.E. to me at 31 Glen Court, Avenue Road, Wolverhampton. WV3 9JW.)

PROGRAM LISTING

```
10 REM "Gridlines"
20  REM J.A.Sheard
30  REM (C) 1984
40 :
50 MODE 1
60 *KEY10 OLD|M RUN|M
70 *FX11,0
80 *FX4,1
90 *FX200,1
100 DIM X(2),Y(2)
110 VDU 19,1,3,0,0,0
120 VDU 19,3,3,0,0,0
130 scale=5
140 :
150 :
160 REPEAT:REPEAT
170 CLS:CLG
180 VDU 26
190 view=FALSE:tape=FALSE
200 PROCintro
210 UNTIL choice$<>"S"
220 IF view THEN PROCscreen:PROCfiledraw:UNTIL F
ALSE
230 REPEAT
240 CLS:CLG
250 PROCscreen
260 PROCgrid(2)
270 PROCfirstpoint
280 REPEAT
290 PROCrenumberpoints
300 PROCnextpoint
310 UNTIL choice$="Y"
320 PROCfinished
330 UNTIL choice$="S"
340 UNTIL FALSE
350 :
360 :----------------------------------------
--------------
370 :
380 DEFPROCintro
390 COLOUR 1
400 PRINTTAB(12,0)"G R I D L I N E S"
410 PRINTTAB(16,2)"Scale: ";scale
420 VDU 29,76;96;
430 PROCgrid(2)
440 VDU23,1,0;0;0;0;
450 PRINTTAB(4,5)"PRESS - "
460 PRINTTAB(6,8)"S to change the grid's scale"
470 PRINTTAB(6,10)"D to draw some pictures"
480 PRINTTAB(6,12)"V to view pictures saved on t
ape"
490 PRINTTAB(6,14)"E to exit from the program"
500 PROCchoice("SDVE")
510 IF choice$="S" THEN PROCscale
520 IF choice$="D" THEN draw=TRUE:PROCdrawsetup
530 IF choice$="V" THEN view=TRUE:PROCviewsetup
540 IF choice$="E" THEN 3230
550 ENDPROC
560 :
570 :------------------------------
580 :
590 DEFPROCscale
600 PRINTTAB(14,19)"SCALE CHANGE"
610 PRINTTAB(4,24)"How many points wide (from 1
to 10)";TAB(4,26)"do you want each square to be?"
620 VDU 23,1,1;0;0;0;
630 REPEAT:PRINTTAB(35,26)SPC4
640 INPUTTAB(35,26)scale
650 IF scale<1 OR scale>10 THEN VDU 7
660 UNTIL scale>0 AND scale<11
670 ENDPROC
680 :
690 :------------------------------
```

CONTINUED OVER



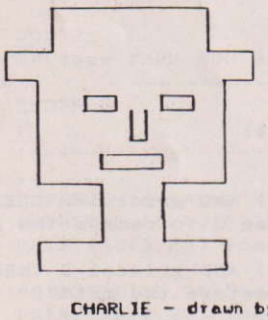
ROBOT drawn by SUBPREET

```
  700 :
  710 DEFPROCdrawsetup
  720 PRINTTAB(17,17)"DRAWING"
  730 PRINTTAB(4,19)"Do you want to save the pictu
res"
  740 PRINTTAB(4,20)"on tape? (Press Y for yes,N f
or no)"
  750 PROCchoice("YN")
  760 IF choice$="Y" THEN tape=TRUE ELSE ENDPROC
  770 PRINTTAB(5,24)"Position a tape in the record
er"
  780 PRINTTAB(4,26)"Press RECORD and PLAY then RE
TURN"
  790 VDU 21
  800 IF tape THEN VDU 21:save=OPENOUT "Gridlines"
:VDU 6
  810 ENDPROC
  820 :
  830 :------------------------------
  840 :
  850 DEFPROCviewsetup
  860 PRINTTAB(16,19)"VIEWING"
  870 PRINTTAB(5,23)"Position a tape in the record
er"
  880 PRINTTAB(13,25)"and press PLAY"
  890 PRINTTAB(9,27)"Then press the SPACE BAR"
  900 REPEAT UNTIL GET=32
  910 ENDPROC
  920 :
  930 :------------------------------
  940 :
  950 DEFPROCscreen
  960 VDU 28,0,31,39,29
  970 VDU 24,0;140;1279;1023;
  980 VDU 29,76;188;
  990 ENDPROC
 1000 :
 1010 :------------------------------
 1020 :
 1030 DEFPROCgrid(colour)
 1040 gridcol=colour
 1050 VDU 23,1,0;0;0;0;
 1060 VDU 19,2,gridcol,0,0,0
 1070 GCOL 1,2
 1080 FOR xline=0 TO 1200 STEP 200
 1090 MOVE xline,0
 1100 PLOT 21,xline,800
 1110 NEXT
 1120 FOR yline=0 TO 800 STEP 200
 1130 MOVE 0,yline
 1140 PLOT 21,1200,yline
 1150 NEXT
 1160 VDU 5
 1170 FOR xnumber=0 TO scale*5 STEP scale
 1180 MOVE xnumber*200/scale-(16*LEN(STR$(xnumber)
)),-24
 1190 PRINT;xnumber
 1200 NEXT
 1210 MOVE 1204-(32*LEN(STR$(scale*6))),-24:PRINT;
scale*6
 1220 FOR ynumber=0 TO scale*4 STEP scale
 1230 MOVE -16-(32*LEN(STR$(ynumber))),ynumber*200
/scale+8
 1240 PRINT;ynumber
 1250 NEXT
 1260 VDU 4
 1270 ENDPROC
 1280 :
 1290 :------------------------------
 1300 :
 1310 DEFPROCfirstpoint
 1320 IF tape BPUT#save,scale
 1330 REPEAT:CLS
 1340 PRINTTAB(10,1)"First point: ";
 1350 PROCcoords(23)
 1360 PROCpoint(2)
 1370 CLS:PRINTTAB(2,0)"Press E for Erase or N for
 Next point"
 1380 PROCchoice("ENG")
 1390 IF choice$="E" THEN PROCpoint(2)
 1400 UNTIL choice$="N"
 1410 IF tape THEN BPUT#save,4:BPUT#save,X(2):BPUT
#save,Y(2)
 1420 PROCpoint(2)
 1430 ENDPROC
 1440 :
 1450 :------------------------------
 1460 :
 1470 DEFPROCnextpoint
 1480 REPEAT:REPEAT:REPEAT:CLS
 1490 PRINTTAB(2,1)"Last point: ";X(1);",";Y(1)
 1500 PRINTTAB(21,1)"Next point: ";
 1510 PROCcoords(33)
 1520 UNTIL X(2)<>X(1) OR Y(2)<>Y(1)
 1530 PROCpoint(2)
 1540 PRINTTAB(2,0)"E for Erase, D for Draw or N f
or Next"
 1550 PROCchoice("EDNG")
 1560 IF choice$="E" THEN PROCpoint(2)
 1570 UNTIL choice$<>"E"
 1580 PROCpoint(1):PROCpoint(2)
 1590 IF tape AND choice$="N" THEN BPUT#save,4:BPU
T#save,X(2):BPUT#save,Y(2)
 1600 IF choice$="D" THEN PROCdrawordelete(1,1):PR
OCafterdraw
 1610 UNTIL choice$<>"E"
 1620 ENDPROC
 1630 :
 1640 :------------------------------
 1650 :
 1660 DEFPROCpoint(number)
 1670 X=X(number)*200/scale
 1680 Y=Y(number)*200/scale
 1690 GCOL4,1
 1700 FOR pointx=X-8 TO X+8 STEP 4
 1710 FOR pointy=Y-8 TO Y+8 STEP 4
 1720 PLOT 69,pointx,pointy
 1730 NEXT:NEXT
 1740 ENDPROC
```

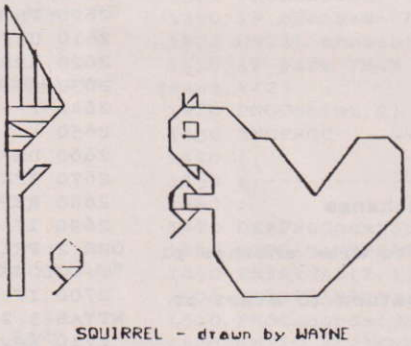
```
 1750 :
 1760 :-----------------------------
 1770 :
 1780 DEFPROCdrawordelete(logic,colour)
 1790 GCOL logic,colour
 1800 MOVE X(1)*200/scale,Y(1)*200/scale
 1810 DRAW X(2)*200/scale,Y(2)*200/scale
 1820 ENDPROC
 1830 :
 1840 :-----------------------------
 1850 :
 1860 DEFPROCafterdraw
 1870 CLS
 1880 PRINTTAB(1)"E for Erase N for Next or F for
finish"
 1890 PROCchoice("ENFG")
 1900 IF choice$="E" THEN PROCdrawordelete(2,2):PR
OCpoint(1)
 1910 IF choice$="F" THEN CLS:PRINTTAB(1,0)"Have y
ou really finished? Press Y or N":PROCchoice("YNG"
)
 1920 IF tape AND choice$<>"E" THEN BPUT#save,5:BP
UT#save,X(2):BPUT#save,Y(2)
 1930 ENDPROC
 1940 :
 1950 :-----------------------------
 1960 :
 1970 DEFPROCrenumberpoints
 1980 X(1)=X(2)
 1990 Y(1)=Y(2)
 2000 PROCpoint(1)
 2010 ENDPROC
 2020 :
 2030 :-----------------------------
 2040 :
 2050 DEFPROCfinished
 2060 IF gridcol=2 THEN PROCgridchange
 2070 IF tape THEN PROCsave
 2080 CLS:PRINTTAB(5,0)"Press P to draw another pi
cture"
 2090 PRINTTAB(2,1)"Press S to return to start of
program";
 2100 PROCchoice("PSG")
 2110 IF NOT tape OR choice$="S" THEN ENDPROC
 2120 CLS:PRINTTAB(3,1)"Press RETURN to open anoth
er file"
 2130 VDU 7,21:save=OPENOUT "Gridlines":VDU 6
 2140 ENDPROC
 2150 :
 2160 :-----------------------------
 2170 :
 2180 DEFPROCsave
 2190 BPUT#save,0
 2200 VDU 23,1,1;0;0;0;
 2210 REPEAT:CLS
 2220 PRINTTAB(0,0)"Enter your name: ";
 2230 INPUT,name$
 2240 UNTIL LEN(name$)>0 AND LEN(name$)<17
 2250 REPEAT:PRINTTAB(0,1)SPC39;
 2260 PRINTTAB(0,1)"Give the picture a title: ";
 2270 INPUT,title$
 2280 UNTIL LEN(title$)>0 AND LEN(title$)<13
 2290 VDU 23,1,0;0;0;0;
 2300 picture$=title$+" drawn by "+name$
 2310 PRINT#save,picture$
 2320 CLS:PRINTTAB(20-LEN(picture$)/2,0)picture$
 2330 PRINTTAB(4,2)"This picture is now being save
d";
 2340 CLOSE #save:VDU 7
 2350 ENDPROC
 2360 :
 2370 :-----------------------------
 2380 :
 2390 DEFPROCfiledraw
 2400 REPEAT
 2410 CLG:CLS
 2420 CLS:PRINTTAB(10,1)"Looking for a picture"
 2430 draw=OPENUP "Gridlines"
 2440 scale=BGET#draw
 2450 PROCgrid(0)
 2460 GCOL1,1
 2470 VDU23,1,0;0;0;0;
 2480 REPEAT
 2490 operation=BGET#draw
 2500 IF operation=0 THEN 2540
 2510 FX=BGET#draw
 2520 FY=BGET#draw
 2530 PLOT operation,FX*200/scale,FY*200/scale
 2540 UNTIL operation=0
 2550 INPUT#draw,picture$
 2560 CLOSE #draw:VDU 7
 2570 CLS:PRINTTAB(20-LEN(picture$)/2,0)picture$
 2580 FOR delay=1 TO 5000:NEXT
 2590 PRINTTAB(1,1)"Press N for next,S to return t
o start";
 2600 PROCchoice("NSG")
 2610 UNTIL choice$="S"
 2620 ENDPROC
 2630 :
 2640 :-----------------------------
 2650 :
 2660 DEFPROCchoice(option$)
 2670 *FX 21,0
 2680 REPEAT
 2690 IF INSTR(option$,"G") AND gridcol=2 THEN COL
OUR 2:PRINTTAB(5,2)"or press G to remove the grid
";:COLOUR 1
 2700 IF INSTR(option$,"G") AND gridcol=0 THEN PRI
NTTAB(5,2)"or press G to restore the grid";
 2710 keypress=0
 2720 REPEAT
 2730 IF keypress>0 THEN VDU 7
 2740 *FX 202,32
 2750 choice$=GET$
 2760 keypress=keypress+1
 2770 IF keypress>3 THEN PRINTTAB(0,1)SPC40;TAB(1,
1)"You must press one of these keys: ";option$;
 2780 UNTIL INSTR(option$,choice$)
 2790 IF choice$="G" THEN PROCgridchange
 2800 UNTIL choice$<>"G"
 2810 ENDPROC
 2820 :
 2830 :-----------------------------
 2840 :
 2850 DEFPROCgridchange
 2860 IF gridcol=2 THEN gridcol=0 ELSE gridcol=2
 2870 VDU 19,2,gridcol,0,0,0
 2880 ENDPROC
 2890 :
 2900 :-----------------------------
 2910 :
 2920  DEFPROCcoords(tab)
 2930 VDU23,1,1;0;0;0;
 2940 C$="":comma=0
 2950 REPEAT:REPEAT:F=0
```

CONTINUED OVER

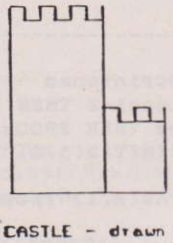
```
 2960 K$=GET$
 2970 IF ASC(K$)<48 OR ASC(K$)>57 THEN F=1
 2980 IF K$="," THEN F=0
 2990 IF C$="" AND K$="," F=1
 3000 IF comma>0 AND K$="," F=1
 3010 IF C$="0" AND K$<>"," THEN F=1
 3020 IF comma=0 AND VAL(RIGHT$((C$+K$),2))>scale*
6 F=1
 3030 IF LEN(C$)>1 AND comma=0 AND K$<>"," F=1
 3040 IF comma>0 AND VAL(MID$((C$+K$),comma+1,2))>
scale*4 F=1
 3050 IF comma>0 AND LEN(C$)-comma>1 F=1
 3060 IF ASC(K$)=13 F=0
 3070 IF comma>0 AND MID$(C$,comma+1,1)="0" AND AS
C(K$)<>13 F=1
 3080 IF ASC(K$)=127 AND C$<>"" F=0 ELSE IF ASC(K$
)=127 F=1
 3090 IF F=1 VDU 7
 3100 UNTIL F=0
 3110 IF ASC(K$)=127 C$=LEFT$(C$,LEN(C$)-1) ELSE I
F ASC(K$)<>13 C$=C$+K$
 3120 IF LEN(C$)<comma THEN comma=0
 3130 IF K$="," THEN comma=LEN(C$)
 3140 PRINTTAB(tab,1)SPC5;TAB(tab,1)C$;
 3150 UNTIL ASC(K$)=13 AND comma>0 AND LEN(C$)>com
ma
 3160  X(2)=VAL(LEFT$(C$,2))
 3170  Y(2)=VAL(MID$(C$,comma+1,2))
 3180 CLS:VDU23,1,0;0;0;0;
 3190 ENDPROC
 3200 :
 3210 :------------------------------
 3220 :
 3230 CLS:CLG
 3240 *FX4,0
 3250 *FX12
 3260 *KEY 10
 3270 *FX200,0
 3280 VDU 23,1,1;0;0;0;
 3290 PRINT'''"Type RUN and press RETURN to restar
t"
 3300 END
```



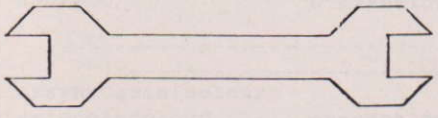
CHARLIE - drawn by SUBPREET



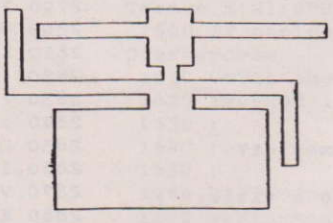
SQUIRREL - drawn by WAYNE



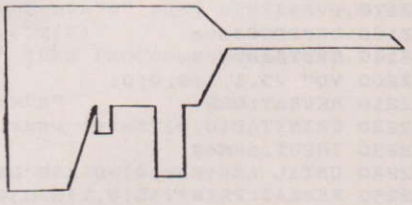
CASTLE - drawn by LISA



SPANNER - drawn by DAVID



ANDY - drawn by DONNA



DRILL - drawn by DAVID

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Typing Tutors

Jon Vogler

Mastering the keyboard is still a must for many computer users. Which Typing Tutor should you try?

What, you may ask, is the point of reviewing all these word-processing programs for businessmen, when our crazy educational system turns out so many women and almost all men who are unable to type?

I well remember times when. having sweated over the draft of an urgent letter, I gnashed my teeth at my typelessness when secretary announced cheerfully "Sorry Mr. Vogler, I am meeting my boy-friend at five; can it wait till tomorrow?" In desperation I joined a hoard of young women at the local secretarial college but found it a humiliating experience. Their fingers seemed joined to the right keys by elastic, whereas mine were arthritic and creaking. I blushed with shame when loudly rebuked by a strident instructor: "Mr. V. you are looking at the keys again!" and all the dollies turned round and giggled.

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No more! All today's trendy executive need do is buy a typing tutor program for his micro and blush in privacy and comfort at home, at less than a third price. As an added bonus daughters and even sons can learn for free and may soon take over the chore altogether in return for pocket money.

The basis of all typing tutors is that, in a series of exercises of increasing difficulty, they:

1) Indicate on the screen which key to hit: either individual letters or as text.

2) Tell you, by sound on the better ones, whether you hit the right one.

3) Analyse your performance for accuracy and speed.

Of the three programs I tested, Kansas's Microtype was very dull; little better than the typing tutor on the Beeb Welcome tape. Although the beauty of screen display and clever analysis of performance does not actually make you type any better; it does reduce the boredom of hours of practice. If you are a solid slogger by temperament, then by all means save a few quid and buy Microtype, you will become just as good a typist just as quickly. You just will not enjoy it much.

All Fingers Go! is an effective teaching package. there are two especially good features: firstly that the correct positions of fingers are shown on the display during all exercises and secondly the choice of brightness of the three elements that make up the screen display: background, keyboard and fingers. However it is spoilt by the lack of a proper instruction book. The glossy book-packaging contains no more than a stapled sheet, with plenty about running the program but scant help in actual typing technique.

The extra £14 for the disc version is unacceptable profiteering, as the only additional production cost is the £3 disc itself: too many software producers are assuming that disc users are wealthier and able to contribute more fo the profits. Disc users unite!

VU-TYPE's handbook, in the best traditions of the BBC, errs if anything the other way. It is so informative it takes a while to find one's way around its generous fifty pages. However once digested it greatly enhances one's understanding of the typist's skill.

VU-TYPE's exercises are varied and ingenious, and draw deeply on collaboration with Pitman's who, of course have been teaching secretarial skills for nearly a hundred and fifty years and know a thing or two about it by now.

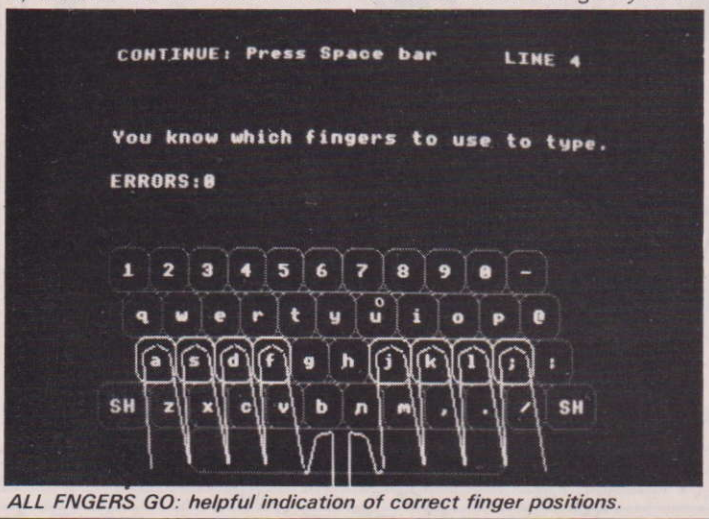
Both display and sound can be varied. Keys can be drawn solid or outline, can bear letters on or not, and the key hit can be made to flash, so that you see where your fingers actually landed in relation to where they were meant to strike. Each key can either click or give out a different musical note with lower case letters a cunning octave higher than capitals, but this can be turned off if musical bystanders become threatening! Choice is also offered to "beep" or not if the wrong key is struck.

VU-TYPE's great disadvantage is that it is not currently available on disc and the promise is "later this year". It takes a painful five minutes to load, certainly not acceptable to a business-person, snatching a few minutes in the lunch-hour. Computer wizards who buy the cassette, defy the copyright and convert it to disc will find that, although it is copyable, there are problems within the program to be solved.

Well done BBC SOFT but let's have VU-TYPE on disc as soon as possible.

BRIEF CONCLUSION

VU-TYPE is by far the best program. If you do not have a disc drive, buy it without hesitation. Disc drive owners may prefer to save loading time by buying "All Fingers Go! but it is less good and the extra price for the disc is extortionate. Microtype is poor value.



ALL FNGERS GO: helpful indication of correct finger positions.

KANSAS MICROTYPE: the screen display is very dull.

MAKER	TITLE	MEDIUM	PRICE
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BBC SOFT	VU-TYPE	Tape	£17.60
National Extension College	All Fingers Go!	Tape or Disc (40 or 80)	£14.95 £28.75

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VideoBase

Alan Rowley

A video tape indexer program that illustrates effective use of disc space. This beginner's guide will help you appreciate the potential of your disc drive for manipulating data.

Disc drives are becoming a fairly common feature on BBC systems these days, but how many people who have them are really exploiting the full potential of their drives? Of course it is very convenient to be able to LOAD and SAVE programs and data files at high speed but if this is all that you are doing with your discs you are not really getting full value from your investment. This article shows you how to use a disc drive for random access filing so that the disc space effectively becomes an extension to the computer memory which can be used as a data store and so opens up the possibility of using your BBC for manipulating vast quantities of data; 800K if your pocket runs to a pair of double sided 80 track drives! The article is illustrated by a Video Tape Indexing program with a storage capacity sufficient to index 1000 recordings distributed between up to 200 tapes, which would themselves cost more than your disc drives!

RANDOM ACCESS

The type of data file that you are probably used to manipulating is called a "sequential" or "serial" file. This is the *only* type of filing possible with a tape system. The major drawback with a sequential file is that any alteration or manipulation of the file requires you to read the whole lot into memory, and after you have finished work on it, to re-write the whole file back to tape or disc. This is not only time consuming, but, more seriously, it means that the size of any file is limited by the computer memory availability.

If you store your data in a "random access" disc file the situation is quite different. You can now pick out the specific file entry that you want and read it, alone, into memory. You can even write an edited version of the item back to the disc in the correct place, so overwriting the original. The amount of data that you can manipulate is now limited only by the disc space.

Discs are, of course, capable of this kind of operation because the read-write head can be directly positioned anywhere on the disc surface but it is not necessary for the programmer to look at the operation in these terms, the DFS looks after the drives, you can consider the file as a list of items, any of which can be selected by moving a pointer through the file.

When you open a file the system automatically sets up the pointer as the pseudo-variable PTR#C%, where C% is the variable chosen by you to hold the channel number associated with the file. Initially PTR#C% has the value zero and points to the top of the file so that you could now access the first entry in the file but you can change the value of PTR#C% and so make it point to any entry that you wish. The actual value held in PTR#C% is the number of bytes from the top of the file that the entry starts at, so if you are going to be able to find a specific item you have to arrange your file in a logical and regular pattern, moreover, you will need to know the length, in bytes of file space, that each stored variable will occupy.

To take the last point first; each disc entry is preceded by an identifier byte which tells the system whether the following variable is an integer, a real number or a string and it is to this identifier byte that the file pointer must be pointing when you access the file. The situation with numbers is quite straight forward. Integers occupy a total of five bytes, one for the identifier and four for the number so if you had a file of integers you could pick out entry N% by setting the pointer to a value of (N%-1)*5, notice N%-1 because the top of the file is at PTR#C%=0. Real numbers are similar except that, since the number itself is stored as five bytes, a total of six bytes of file space are used.

Strings are a little more awkward because they can vary in length and so the identifier byte is followed by a byte containing the string length, the string itself then follows. Locating a specific item in a file of strings would be very complicated if they were all of different lengths and writing an edited version of a string back to the file would be disastrous if it were longer than the original, since it would then corrupt the file entry following it. Both of these

problems are most conveniently solved by padding out all strings with spaces to some predetermined length before writing them to the file and by trapping out the input of any strings which are too long. The file space occupied by each string will then be the same and equal to the length of the string plus two, for the identifier and length bytes.

In practice, of course, you will often want to construct a file consisting of a mixture of variable types. The Video Tape Index uses such a structure and the best way to see how to keep track of the position of the entries is to study the explanation below of the use of the file "DATA" but before I go on to discuss the file structures used in the program we need to look at the way BASIC sets up communication with random access files.

BASIC DIFFERENCES

The BBC user guide deals fairly comprehensively with the use of files but BASIC 1 and BASIC 2 are syntactically different as regards the way they deal with random access. If a file is to be written to it must be OPENOUT and to be read a file must be OPENIN. In BASIC 1 a file which is OPENIN is, in fact, also open for being written to so this is the state in which the file must be for random access. In BASIC 2, however, a random access file must be OPENUP. The Video Tape Index was written on a machine with BASIC 2 so those with BASIC 1 should change all the OPENUPs to OPENIN. In fact OPENUP in BASIC 2 and OPENIN in BASIC 1 use the same token so there is complete compatibility for running programs written in one version of BASIC on machines with the other ROM.

FILE HANDLING

The program uses three files, "DATA", which holds the details of each recorded TV-program, "FORMAT", which stores information on tape usage and "POINTER", the purpose of which will become apparent later. Only the first two are used in random access mode and we will now look at their structures and the parts of the program which access them.

FORMAT

This is the simpler of the two random access files. It consists of 201 integers. The first entry is used to keep track of the number of records in the main "DATA" file and the remaining entries hold the length of each video tape followed by the amount of time already used up on that tape. Figure 1 shows the file structure. To access the number of records we simply set the pointer in "DATA" equal to zero and read or write away, look at line 224 which updates the number of records. To access the time information for any specific tape the pointer must be set to (N%-1) * 10+5, where N% is the tape number. What I have actually done is to set up PROCtimes(n%,a$), line 82, which can be called with n% set to the tape number and will then read or write the timings depending on whether a$="I" or some other letter. Have a look at line 215 for an example where a current value is read, amended and then written back to the disc.

DATA

This file is the main data store for the program and it consists of up to 1000 'records', each of which is 64 bytes in length, subdivided into six data 'fields' some of which hold integers and some of which hold strings. The organisation within each record is shown in Figure 2. It is easy enough to set the pointer to the start of any specific record, we simply give it a value of (N%-1) * 64, where N% is the record number. Finding a specific field within each record is a little more complicated since the fields are of different lengths.

The best way to cope with this is to have a "look-up" table of offsets which can be added to the pointer value for the record start. Figure 2 also shows the relevant offsets and they are stored in the array foffset%, see lines 19 and 20, in such a way that the offset for the Nth field is array element foffset%(N-1). PROCsetpointer (record%,field%), line 72, is really the key to the whole filing system since it will set the pointer in "DATA" to any record and field when called with the appropriate parameters set. Look at it being used in PROCloadrecord(n%), line 88, to select a whole record and at line 167 to write the length of a recording to the disc. For the moment take pt%(N-1) to be equal to N-1, where N is the record number.

The choice of 64 bytes, a sub-multiple of 256, as the record length is not accidental. We have talked so far about accessing the file in terms of moving the pointer, and the DFS then actually moving the disc read-write head to the correct position on the disc. If this were literally what happened, each time you moved the pointer the drives would have to be activated, which would be time consuming and lead to a lot of wear. What actually happens is that, when the file is opened, the system sets up a 256 byte buffer through which it communicates with the file and into which it reads the first 256 bytes from the disc. When you move the pointer, provided that you do not move it further down the file than 256 bytes, the drives will not actually run and you are only communicating with the buffer. If you move outside the buffer the DFS tidies up by writing the current buffer contents to the disc and reading in a new set.

It is a good idea, therefore, to tailor the length of a record so that any one record is entirely contained within a single 256 byte segment of the file so that the discs will not need to be accessed as you move within the record. The best way to ensure this is to make the record length a sub-multiple of 256. In Video Tape Index you will have four records in the buffer at any one time and so ready for rapid access without disc activity.

POINTER

This third file used in the program is a sequential file and it is used to circumvent the main disadvantage of random access disc files

CONTINUED OVER

which arises if you want to move entries from one position in the file to another such as might be the case if you wanted to sort the file or "roll it up" to make a deletion. If we were to *actually* move records about on the disc it would be very slow since we would have to read each record into memory and then write it back into its new position. We avoid this as follows. "POINTER" is read into an array, pt%, at the beginning of the program such that the element pt%(N-1) holds the ordinal number in the file of the record called record N. We can then use the array elements to point to the file position of any record and if we want to change the order in which the records are displayed we only have to re-order the array contents and need not reorganise the disc. Essentially the element numbers of pt% are the ordinal numbers for display of the records, whereas the contents of the array are the ordinal numbers for the records on the disc. You can see examples of the technique in PROCswap, line 246, which interchanges two adjacent records and in the delete routine, line 213.

When the program is RUN you are asked if you are starting a new file. If you are PROCnewfile, line 47, is called and this sets up "POINTER" and writes dummy versions of "DATA" and "FORMAT" onto the disc. This is a useful technique for reserving the necessary disc space for each file and completely prevents any "Can't Extend" errors arising at a later stage.

HOW IT RUNS

The program is menu driven from the REPEAT.....UNTIL loop between lines 22 and 47. The escape key will normally restore the menu at any time during the program, this is organised by the ON ERROR setting at line 21. Care is taken, however, to disable ESCAPE when the files may be being accessed as this could lead to data corruption; *FX200,1 disables the key and *FX200,0 restores it.

An interesting technique, which you might find other uses for, is employed in the routine that allows you to edit the titles of the recordings and the subject information. When a record is being displayed pressing "E" will access the edit facilities and the title will flash. Pressing the space bar will toggle the flashing between the title and subject. When you have selected the field to be edited, by setting it flashing, you should press "RETURN" and a prompt will be given. At the same time the cursors will be separated with the copy cursor automatically being positioned on the old entry. This is all achieved in PROCedit at line 125. The cursor separations and movement of the copy cursor are done by the *FX138,0 calls in PROCrt and PROCup, starting at line 184. This call writes the next parameter into the keyboard buffer and 255 is equivalent to pressing cursor up and 253 is cursor right.

PROGRAM DESCRIPTION

Lines 1 to 12	Calls up a title page and initialises various message strings. Sets up the initial error trapping.
Lines 13 to 16	Provides the options for setting up a new file or working on an existing one.
Lines 17 to 21	Sets up the arrays and calls PROCload to open the files and read the pointers into pt%. Reads the field offsets into the array foffset%. Sets up the main error trapping.
Lines 22 to 41	The main loop for selections from the menu.
Lines 42 to 44	Closes all the files and updates the disc version of the pointers in pt% for future use.
PROCoff	Switches the cursor off.
PROCon	Switches the cursor back on.
PROCnewfile	Sets up a new disc for use in the program. (See above)
FNget	A utility routine which returns the key pressed as a character if the character is in a$.
PROCsetpointer	Sets the file pointer to a chosen field and record.
PROCload	Loads necessary information from the disc and opens the random access files at start up of the program.
PROCtimes	Reads or writes the details of tape length and time already used.
PROCloadrecord	Loads an entire record from the disc file.
PROCprintrecord	Displays any record, loading it from the file first if this is necessary. R% always holds the number of the record currently in memory.
PROCchange	Displays a record and allows choice of editing or moving through the file one record at a time or by jumping to any specified record. Records can also be deleted. Pressing CTRL/C will mark a record as "Cherished". Records so marked cannot be deleted nor will the programs described by them be considered by the routine which searches for items to over-record. A cherished record can be returned to normal by pressing CTRL/H.
FNinc	Used to increase the record number by the routines which scan the file. When the end of the file is reached the scan returns to record 1.
FNdec	Similar to FNinc but used to decrease the record number.
PROCedit	For editing the title or subject. Already described in detail.
PROCeditfield	Calls the routine appropriate to editing the title or the subject information.
PROCintitle	Takes in the title and writes it to the file after padding out to 20 characters if necessary. The flag f% is used to determine whether the cursor separation

is required, as in the case of amending a title, or not, if a new record is being set up.

PROCinsubject Takes in the subject data. Operates in a similar manner to PROCintitle.

PROCintapeno Accepts the tape number for a record. If the tape number has not already been used PROCnewtape is called and the length of the tape requested. For previously used tapes a check is made to see if they are already full.

PROCintime Takes in the length of a recording. Checks that the time is not greater than the space available on the tape.

PROCincounter Accepts the tape counter number at which the recording starts.

PROCnoroom Deals with attempts to overfill a tape by adding too long items.

PROCtapeful Deals with attempts to add anything to a tape already full.

PROCup Separates the cursors and moves the copy cursor up n% lines.

PROCrt Separates the cursors and moves the copy cursor right n% columns.

PROCnewrecord Accepts a completely new entry.

PROCnewtape Adds details of a new tape to the file. Some scrutiny of the tape length is carried out and unlikely tape lengths rejected. You can alter the input trapping to suit your own needs.

PROCdelete Deletes a record from the file by 'rolling up' the pointer array and moving the pointer of the deleted record to the bottom of the active file. Updates the tape time used information.

Prodecr Called by PROCdelete to update the length of file information after a deletion.

FNjump Called by PROCchange to allow you to jump directly from the currently displayed record to any other specified one.

PROCsort Sorts the file into a rational order with all items on the same tape grouped together and arranged in the order that they appear on the tape. A simple bubble sort is used.

PROCfindgap Searches the information on tape usage and prints out the number of any tapes which have empty space of *exactly* a specified length. If there is no tape in this category then the information on the nearest, larger, gap is given so that you can use tape as economically as possible.

PROCreplace Searches the records for candidate programs for over-recording by new items. The details of programs of the correct length or up to five minutes longer are displayed.

PROCpicksearch Accepts a search term of up to 20 characters and lets you choose whether to search the titles or subjects.

PROCsearch Searches the titles or the subjects for a particular character sequence passed in search$. Records which contains the sequence in the correct field are displayed. You have the option to continue the search further down the file for other occurrences of the sequence or to escape to the menu.

PROCsetgap Used to take input of the time searched for by PROCreplace and PROCfindgap.

PROCupdatepointers Writes altered versions of the file "POINTER" back to the disc.

PROCshowtapes Displays the length of each tape and the time left on it. Page mode is used for long lists.

PROCdrive Allows selection of the disc drive for the data disc. The current version is for a double drive system. If you only have one drive you can leave this out and delete the calls at lines 49 and 76.

FNpad Returns any string sent to it padded out to n% characters with spaces. Used to pad the titles and subjects before writing to disc so that we can keep track of the field positions in the file.

PROCheader Displays a title page.

PROCkey Locks or unlocks the disc file "FORMAT" by a direct call to the command line interpreter with the X and Y registers pointing to the command message. "FORMAT" is only unlocked when the program is running. This effectively prevents you accidentally obliterating your data by activating PROCnewfile with a used data disc in the drive. A "File Locked" error will occur and no harm will result.

Data stored in Entry	Length in Bytes	PTR # C1% to Access
Number of records in file	5	0
Length of tape 1 in minutes	5	5
Time unused on tape 1	5	10
Length of tape 2 in minutes	5	15
.....and so on until the entry for the final tape		
Lenth of tape 200	5	1995
Time unused on tape 200	5	2000

Fig 1. Structure of the file "FORMAT".

Data in Field	Type	Length (bytes)	Offset from Record Start
Title	string	22	0
Subject of Recording	string	24	22
Priority*	string	3	46
Tape Number	integer	5	49
Tape Counter at Start	integer	5	54
Length of Recording	integer	5	59

*The priority data is never displayed explicitly but just acts as a flag marking a file as 'cherished' if it contains any character but 'space'.

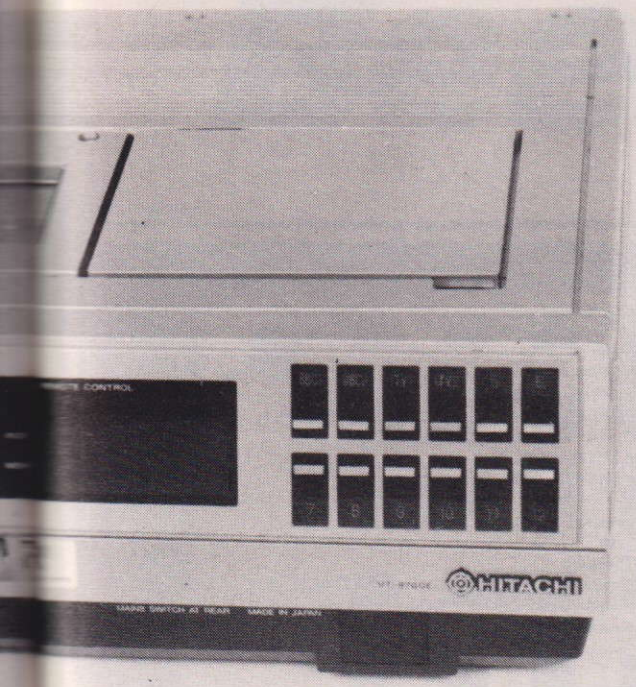
Fig 2. The structure of a record in file "DATA".

CONTINUED OVER

PROGRAM LISTING

```
    1REM*********************
    2REM*VIDEO TAPE INDEXER*
    3REM*By  Alan G. Rowley*
    4REM*  Copyright 1984  *
    5REM*********************
    6*FX200,1
    7*TV0,1
    8MODE5:PROCheader
    9MODE7
   10ON ERROR CLOSE#0:CLS:PRINT"ERROR"':REPORT:E$=INKEY
$(1000):RUN
   11M1$="PRESS 'C' TO CONTINUE TO SEARCH THE FILE":ME$
=" *PRESS 'ESCAPE' TO RESTORE MAIN MENU*"
   12wipe$=STRING$(80," ")+STRING$(3,CHR$(11))
   13REPEAT CLS:PRINTTAB(0,6)"Do you want to:-"''"A. SE
T UP A NEW FILE ?"''"or"''"B. EXAMINE OR WORK ON AN EXI
STING FILE ?"
   14Q$=FNget("AaBb")
   15IFINSTR("Aa",Q$)PROCnewfile
   16UNTIL INSTR("Bb",Q$)
   17DIMpt%(999),fofset%(5)
   18PROCload
   19FORI%=0TO5:READfofset%(I%):NEXT
   20DATA 0,22,46,49,54,59:REM*FIELD OFFSETS*
   21ON ERROR IF ERR=17 THEN 22 ELSE CLS:PRINT"ERROR"''
:REPORT:E$=INKEY$(1000):GOTO22
   22REPEAT CLS:PROCoff:R%=0:*FX200,0
   23FORI%=1TO2:PRINTTAB(15,I%)CHR$(141);CHR$(131);"*ME
NU*":NEXT:*FX15,1
   24PRINT''TAB(4)"1.VIEW/EDIT RECORDS."
   25PRINT'TAB(4)"2.VIEW STATUS OF TAPES."
   26PRINT'TAB(4)"3.MAKE A NEW ENTRY."
   27PRINT'TAB(4)"4.SEARCH TITLES OR SUBJECTS."
   28PRINT'TAB(4)"5.SORT FILE INTO RATIONAL ORDER."
   29PRINT'TAB(4)"6.FIND SPACE OF SPECIFIC LENGTH."
   30PRINT'TAB(4)"7.FIND ITEM TO BE OVER-RECORDED."
   31PRINT''"'E' To END Program  'R' To re-RUN it."
   32PRINT''TAB(6)"Number of Entries Left ";(1000-noe%)

   33Q$=GET$
   34IF noe% AND Q$="1" PROCchange(1)
   35IF Q$="2" PROCshowtapes
   36IF Q$="3" PROCnewrecord
   37IF noe% AND Q$="4" PROCpicksearch
   38IF noe% AND Q$="5" PROCsort
   39IF Q$="6" PROCfindgap
   40IF noe% AND Q$="7" PROCreplace
   41UNTIL INSTR("eErR",Q$)
   42CLOSE#0:PROCkey("L"):IF pointflag% PROCupdatepoint
ers
   43IF INSTR("Rr",Q$) THEN RUN
   44MODE7:END
   45DEFPROCoff:VDU23,1,0;0;0;0;:ENDPROC
   46DEFPROCon:VDU23,1,1;0;0;0;:ENDPROC
   47DEFPROCnewfile
   48LOCALn%,i%,a$
   49PROCdrive("A BLANK"):PROCoff
   50CLS:PRINTTAB(11,10)"*PLEASE WAIT*"
   51C%=OPENOUT"FORMAT"
   52FORi%=0TO400
   53PRINT#C%,n%
   54NEXT
   55CLOSE#C%:PROCkey("L")
   56C%=OPENOUT"POINTER"
   57FORi%=0TO999
   58PRINT#C%,i%
   59NEXT
   60CLOSE#C%
   61C%=OPENOUT"DATA"
   62FORi%=1TO1000
   63PRINT#C%,STRING$(20," "),STRING$(22," ")," ",n%,n%
,n%
   64NEXT
   65CLOSE#C%
   66ENDPROC
   67DEF FNget(a$)
   68LOCAL b$
   69PROCoff
   70REPEAT b$=GET$:UNTIL INSTR(a$,b$)
   71=b$
   72DEFPROCsetpointer(record%,field%)
   73PTR#C%=pt%(record%-1)*64+fofset%(field%-1):*FX200,
1
   74ENDPROC
   75DEFPROCload
   76PROCdrive("THE DATA"):PROCoff:CLS:PROCkey("")
   77C1%=OPENIN"FORMAT":C%=OPENIN"DATA"
   78INPUT#C1%,noe%
   79CP%=OPENIN "POINTER":FORI%=0TO999:INPUT#CP%,pt%(I%
):NEXT
   80CLOSE#CP%:pointflag%=FALSE
   81ENDPROC
   82DEFPROCtimes(n%,a$)
   83*FX200,1
   84PTR#C1%=(n%-1)*10+5
   85IFa$="I" INPUT#C1%,tapelen%,timeused% ELSE PRINT#C
1%,tapelen%,timeused%
   86*FX200,0
   87ENDPROC
   88DEFPROCloadrecord(n%)
   89PROCsetpointer(n%,1)
   90INPUT#C%,tit$,sub$,ch$,tn%,ct%,len%:*FX200,0
   91R%=n%
   92ENDPROC
   93DEFPROCprintrecord(n%)
   94LOCALi%
   95IFn%<>R% PROCloadrecord(n%)
   96CLS:PRINT"Record Number ";n%;:IFch$<>" " PRINT" *C
HERISH*"
   97FORi%=3TO15:PRINTTAB(0,i%);CHR$(157);CHR$(132);TAB
(38,i%)CHR$(156):NEXT
   98PRINTTAB(2,5)"Title:"TAB(14,5);tit$
   99PRINTTAB(2,7)"Subject:"TAB(14,7);sub$
  100PRINTTAB(2,9)"Tape No.:"TAB(14,9);tn%
  101PRINTTAB(2,11)"Counter:"TAB(14,11);ct%
  102PRINTTAB(2,13)"Length:"TAB(14,13);len%;" min."
```




```
  103ENDPROC
  104DEFPROCchange(n%)
  105LOCALa$
  106REPEAT CLS
  107PROCprintrecord(n%)
  108PRINTTAB(0,17)" F-Forward  B-Backward  J-Jump  E-E
dit"''"CTRL/D-Del. CTRL/H-Hazard CTRL/C-Cherish"
  109a$=FNget("EFBJ"+CHR$(4)+CHR$(8)+CHR$(3))
  110PRINTTAB(0,17)wipe$
  111IFa$="F" n%=FNinc(n%)
  112IFa$="B" n%=FNdec(n%)
  113IFa$="E" PROCedit
  114IFa$="J" n%=FNjump
  115IFa$=CHR$(3) ch$="*":PROCsetpointer(n%,3):PRINT#C%
,ch$:*FX200,0
  116IFa$=CHR$(8) ch$=" ":PROCsetpointer(n%,3):PRINT#C%
,ch$:*FX200,0
  117IFa$=CHR$(4)ANDch$=" " PROCdelete(n%):R%=0:IFn%>no
e% n%=1

  118UNTIL FALSE
  119DEF FNinc(n%)
  120n%=n%+1:IFn%>noe% n%=1
  121=n%
  122DEF FNdec(n%)
  123n%=n%-1:IFn%<1 n%=noe%
  124=n%
  125DEFPROCedit
  126LOCALa$,vtab%:vtab%=5
  127PRINTTAB(11,vtab%)CHR$(136);">"
  128REPEAT a$=FNget(" "+CHR$(13))
  129IFa$=" "PRINTTAB(11,vtab%)"  ":vtab%=vtab%+2:IFvta
b%>7 vtab%=5
  130PRINTTAB(11,vtab%)CHR$(136);">"
  131UNTIL a$=CHR$(13):PRINTTAB(11,vtab%)" "
  132PROCeditfield((vtab%-5) DIV 2+1)
  133ENDPROC
  134DEFPROCeditfield(fieldno%)
  135IF fieldno%=1 PROCintitle(1,0,20) ELSE PROCinsubje
ct(1,0,20)
  136ENDPROC
  137DEFPROCintitle(f%,x%,y%)
  138LOCALin$,i%
  139REPEAT PRINTTAB(x%,y%)wipe$:IF f% PROCup(15):PROCr
t(3)
  140PRINTTAB(31)">";CHR$(11):INPUTLINE"Title(20): "in$

  141UNTIL LEN(in$)<21:tit$=FNpad(in$,20)
  142PROCsetpointer(R%,1):PRINT#C%,tit$:*FX200,0
  143ENDPROC
  144DEFPROCinsubject(f%,x%,y%)
  145LOCALin$
  146REPEAT PRINTTAB(x%,y%)wipe$:IF f% PROCup(13):PROCr
t(1)
  147PRINTTAB(35)">";CHR$(11):INPUTLINE"Subject(22): "i
n$
  148UNTIL LEN(in$)<23:sub$=FNpad(in$,22)
  149PROCsetpointer(R%,2):PRINT#C%,sub$:*FX200,0
  150ENDPROC
  151DEFPROCintapeno(x%,y%)
  152LOCALn%
  153REPEAT PRINTTAB(x%,y%)wipe$
  154INPUT"Tape No.(200) "n%
  155UNTILn%>0ANDn%<201
  156PROCtimes(n%,"I")
  157IFtapelen%=0:r%=r%+2:PROCnewtape(n%,x%+2,y%+2)
  158IFtimeused%=tapelen% PROCtapeful(n%)
  159tn%=n%:PROCsetpointer(R%,4):PRINT#C%,tn%:*FX200,0

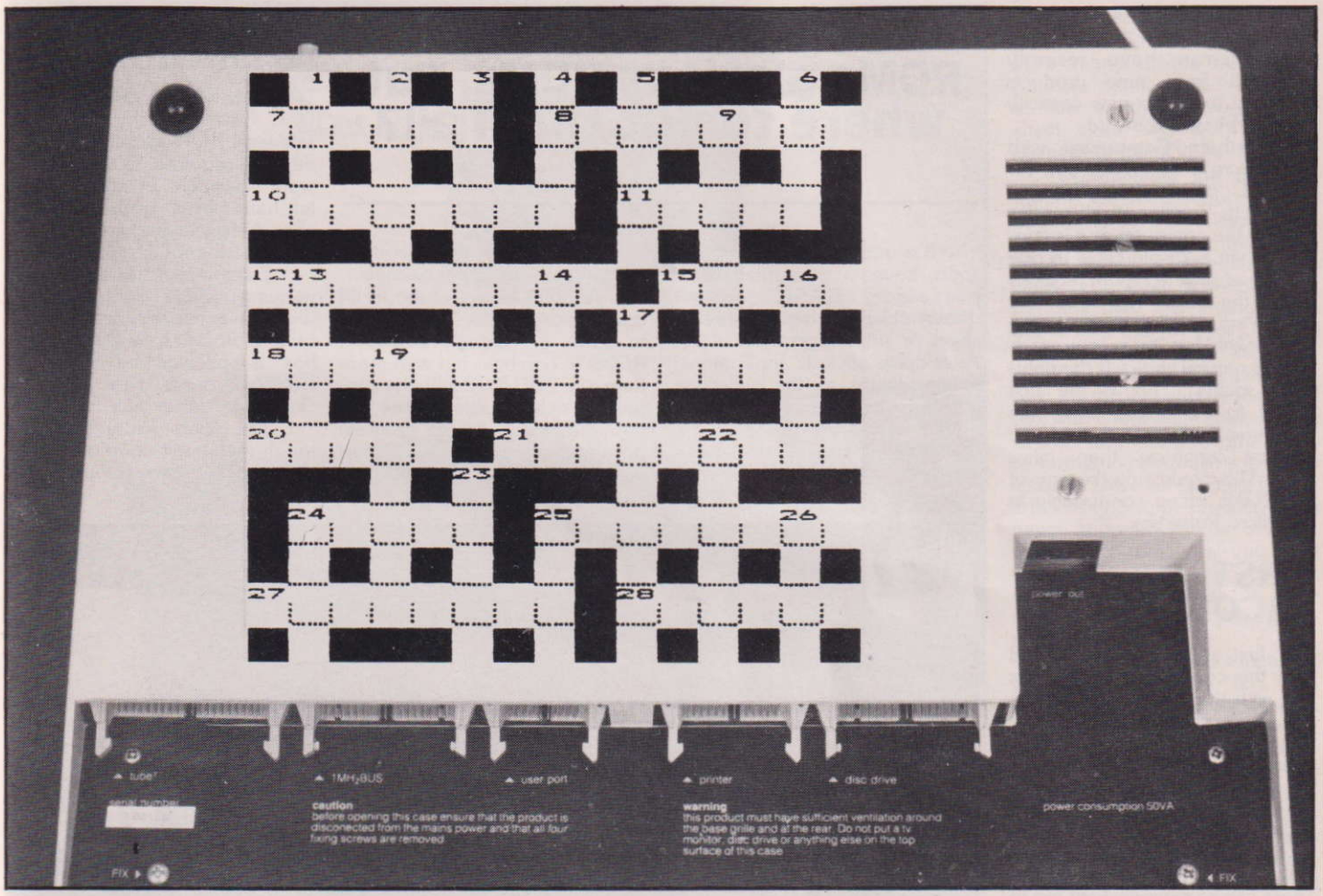
  160ENDPROC
  161DEFPROCintime(x%,y%)
  162LOCALn%
  163REPEAT PRINTTAB(x%,y%)wipe$
  164INPUT"Length of Recording(mins.) "n%
  165UNTILn%>0ANDn%<=tapelen%
  166IFn%+timeused%>tapelen% PROCnoroom ELSE timeused%=
timeused%+n%
  167len%=n%:PROCsetpointer(R%,6):PRINT#C%,len%:*FX200,
0
  168ENDPROC
  169DEFPROCincounter(x%,y%)
  170LOCALn%
  171REPEAT PRINTTAB(x%,y%)wipe$
  172INPUT"Tape Counter No.(9999) "n%
  173UNTILn%>=0ANDn%<10000:ct%=n%
  174PROCsetpointer(R%,5):PRINT#C%,ct%:*FX200,0
  175ENDPROC
  176DEFPROCnoroom
  177CLS:PRINTTAB(2,10)"THERE IS NOT ENOUGH ROOM ON TAP
E ";tn%
  178PRINT''ME$
  179REPEAT UNTIL FALSE
  180DEFPROCtapeful(n%)
  181CLS:PRINTTAB(8,10)"TAPE ";n%;" IS ALREADY FULL"
  182PRINT''ME$
  183REPEAT UNTIL FALSE
  184DEFPROCup(n%)
  185LOCALi%:FORi%=1TOn%:*FX138,0,255
  186NEXT:ENDPROC
  187DEFPROCrt(n%)
  188LOCALi%:FORi%=1TOn%:*FX138,0,253
  189NEXT:ENDPROC
  190DEFPROCnewrecord
  191IFnoe%=1000 ENDPROC
  192PROCon
  193LOCALr%:r%=5
  194R%=noe%+1:CLS
  195PRINT"Record No. ";R%
  196PROCintapeno(0,r%):r%=r%+2
  197PROCintime(0,r%):r%=r%+2
  198PROCintitle(0,0,r%):r%=r%+2
  199PROCinsubject(0,0,r%):r%=r%+2
  200PROCincounter(0,r%)
  201ch$=" "
  202*FX200,1
  203noe%=noe%+1:PTR#C1%=0:PRINT#C1%,noe%
  204PROCtimes(tn%," ")
  205ENDPROC
  206DEFPROCnewtape(n%,x%,y%)
```

CONTINUED OVER

```
  207LOCALw%:timeused%=0
  208REPEAT PRINTTAB(x%,y%)wipe$
  209INPUT"Tape Length(mins.) "w%
  210UNTILw%>59ANDw%<241ANDw% MOD 60=0
  211tapelen%=w%
  212ENDPROC
  213DEFPROCdelete(n%)
  214LOCALi%,temp%
  215PROCtimes(tn%,"I"):timeused%=timeused%-len%:PROCti
mes(tn%," "):*FX200,0
  216IFn%=noe% PROCdecr:ENDPROC
  217temp%=pt%(n%-1)
  218FORi%=n%-1TOnoe%-2
  219pt%(i%)=pt%(i%+1)
  220NEXT:pt%(noe%-1)=temp%:pointflag%=TRUE
  221PROCdecr
  222ENDPROC
  223DEFPROCdecr
  224noe%=noe%-1:PTR#C1%=0:PRINT#C1%,noe%
  225IFnoe%=0 THEN *FX125
  226ENDPROC
  227DEF FNjump
  228LOCALx%:PROCon
  229REPEAT PRINTTAB(0,20)wipe$
  230INPUT"Jump to Record ? "x%
  231UNTILx%>0ANDx%<=noe%
  232=x%
  233DEFPROCsort
  234*FX200,1
  235LOCALi%,flag%,t1%,t2%,c1%,c2%
  236CLS:PRINTTAB(5,10)"*SORTING-PLEASE WAIT A MOMENT*"
  237REPEAT flag%=TRUE
  238FORi%=1TOnoe%-1
  239PROCsetpointer(i%,4):INPUT#C%,t1%,c1%
  240PROCsetpointer(i%+1,4):INPUT#C%,t2%,c2%
  241IFt1%=t2% THEN IF c1%>c2% PROCswap
  242IFt1%>t2% PROCswap
  243NEXT
  244UNTIL flag%
  245ENDPROC
  246DEFPROCswap
  247LOCALtemp%:flag%=FALSE:pointflag%=TRUE
  248temp%=pt%(i%-1)
  249pt%(i%-1)=pt%(i%)
  250pt%(i%)=temp%
  251ENDPROC
  252DEFPROCfindgap
  253PROCsetgap:CLS
  254LOCALi%,best%,x%,flag%,tp%:flag%=TRUE:best%=1000:V
DU14
  255FORi%=1TO200
  256PROCtimes(i%,"I")
  257IFtapelen%=0 OR tapelen%=timeused% THEN 261
  258x%=tapelen%-timeused%
  259IFx%=G% PRINT"Exactly "¦G%¦" minutes on tape "¦i%:
flag%=FALSE
  260IFflag% THEN IF x%>G%ANDx%<best% best%=x%:tp%=i%
  261NEXT
  262IFflag%ANDbest%<1000 PRINTTAB(0,8)"The best space
is "¦best%¦" minutes."''"Tape number ":tp%
  263IFflag%ANDbest%=1000 PRINTTAB(0,8)"SORRY, NO SPACE
 LARGE ENOUGH ON ANY TAPE"
  264PRINT''ME$:VDU15:*FX200,0
  265REPEAT UNTIL FALSE
  266DEFPROCreplace
  267PROCsetgap
  268LOCALtime%,x%,a$,ch$
  269FORi%=1TOnoe%
  270PROCsetpointer(i%,3):INPUT#C%,ch$:PROCsetpointer(i
%,6):INPUT#C%,time%:*FX200,0
  271IFch$=" " x%=time%-G%:IFx%>=0ANDx%<6 PROCprintreco
rd(i%):PRINTTAB(0,20)M1$'ME$:a$=FNget("C")
  272NEXT
  273ENDPROC
  274DEFPROCpicksearch
  275LOCALsearch$,a$:PROCon
  276REPEAT CLS
  277INPUTLINETAB(0,8)"Search Term ?(20) "search$
  278UNTIL LEN(search$)<21
  279PRINT''"PRESS:-"''TAB(8)"1. To Search Titles."''"o
r"''TAB(8)"2. To Search Subjects."
  280a$=FNget("12"):CLS
  281PROCsearch(VAL(a$),search$)
  282ENDPROC
  283DEFPROCsearch(field%,search$)
  284LOCALi%,a$
  285FORi%=1TOnoe%
  286PROCsetpointer(i%,field%):INPUT#C%,a$:*FX200,0
  287IF INSTR(a$,search$) PROCprintrecord(i%):PRINTTAB(
0,17)M1$''ME$:a$=FNget("C")
  288NEXT
  289ENDPROC
  290DEFPROCsetgap
  291REPEAT CLS:PROCon
  292INPUTTAB(0,10)"Time Required in Minutes ?(240) "G%
  293UNTIL G%>0 AND G%<241:PROCoff
  294ENDPROC
  295DEFPROCupdatepointers
  296LOCALi%
  297CP%=OPENOUT"POINTER"
  298FORi%=0TO999:PRINT#CP%,pt%(i%)
  299NEXT
  300CLOSE#0
  301ENDPROC
  302DEFPROCshowtapes
  303LOCALi%:VDU14:@%=3:CLS
  304FORi%=1TO200
  305PROCtimes(i%,"I")
  306IF tapelen% PRINT"Tape ",i%¦"("¦tapelen%¦")  ",tap
elen%-timeused%¦" minutes left."
  307NEXT
  308@%=16:PRINT'ME$:VDU14
  309REPEAT UNTIL FALSE
  310DEFPROCdrive(a$)
  311PROCon:REPEAT CLS
  312PRINTTAB(0,10)"PLEASE LOAD "¦a$¦" DISC AND THEN EN
TER"':INPUT"THE DRIVE NO. "D%
  313UNTIL D%=0 OR D%=1
  314IF D%=0 THEN *DRIVE0
  315IF D%=1 THEN *DRIVE1
  316ENDPROC
  317DEF FNpad(in$,n%)
  318IF LEN(in$)=n% =in$
  319REPEAT
  320in$=in$+" "
  321UNTIL LEN(in$)=n%
  322=in$
  323DEFPROCheader
  324LOCALA$
  325VDU19,2,15,0,0,0,23,1,0;0;0;0;
  326COLOUR131:COLOUR1
  327CLS:PRINTTAB(2,8);"VIDEO TAPE INDEX"
  328PRINTTAB(9,10);"by"
  329PRINTTAB(3,12);"Alan G. Rowley"
  330COLOUR0:PRINT''TAB(5);"Copyright"
  331COLOUR2:PRINT''TAB(1);"(C) February 1984"
  332COLOUR0:PRINT''TAB(3);"B.B.C. MODEL B"''"  O.S. V
ersion 1.2":*FX15,0
  333A$=INKEY$(1000)
  334ENDPROC
  335DEFPROCkey(a$)
  336$&CE0="ACC. FORMAT "+a$
  337X%=&E0:Y%=&C:CALL&FFF7
  338ENDPROC
```

Beebword

Eddie James



CLUES ACROSS

7 Command to look embarrassed (6)
8 True, a bad, messy speed measurement (4,4)
10 It's not positively true (5,3)
11 Variable drinking-place? (5)
12 Drop law-suit being without capital (5,4)
15 A rest can seriously affect the memory (5)
18 Not the first Acorn product that's been delayed? (6,9)
20 Dave's somehow made a copy (5)
21 Being sure about wines, they facilitate connections (4,5)
24 A$ = "CLIVE":B$ = "CURRY":C$ = LEFT$ (B$,3) + RIGHT$(A$,2): PRINT C$ (5)
25 Stupidly slash net — to compare string length? (4,4)
27 Goes from A to B? (8)
28 Database elements wrongly filed before 'S' (6)

CLUES DOWN

1 Moving coil produces mathematical lines (4)
2 Amplitude book (6)
3 If it's 20 it's too big! (5,4)
4 Fit cables without ends (4)
5 DFS commands of stature? (5)
6 With G a note is produced (4)
9 Previously unequalled discs? (7)
13 Making love to Margaret, a Greek character (5)
14 Types and re-orders (5)
16 Abandon a mutant robot without love! (5)
17 Company for whom a foot ailment's often poetical! (9)
19 Statement made by Nero or mad king (2,5)
22 Vent at rear of your micro? (6)
23 Dales spoilt by cables (5)
24 Key submitted by the journalist (4)
25 Pils produces such language! (4)
26 Totals of commercials, about 500 (4)

SOLUTIONS ACROSS

7 COLOUR 8 BAUD RATE 10 MINUSONE 11 LOCAL
12 LOWER CASE 15 BREAK 18 SECOND PROCESSOR
20 SAVED 21 USER PORTS 24 CURVE 25 LESS THAN
27 UPGRADES
28 FIELDS

SOLUTIONS DOWN

1 LOCI 2 VOLUME 3 ERROR CODE 4 ABLE 5 BUILD 6 CTRL
9 RECORDS 13 OMEGA 14 SORTS 16 ABORT 17 ACORNSOFT
19 ON ERROR 22 OUTLET 23 LEADS 24 COPY 25 LISP
26 ADDS

ROM in a Box

Mark Webb

After ROM boards, it is time for ROM boxes. Both the BBC and the Electron have recently benefited from new products designed to create new capacity for ROM based software.

Northern Computers, with their Micro Pulse ROM box for the BBC, have attempted a new approach. The box itself resides outside the computer and is connected via a 28 pin cable to one of the sideways ROM sockets within the BBC. The connector can be squeezed into any of the five sockets but the recommended and natural choice is the right-most socket. This is the first socket to be looked at by the computer on power-up and any resident language then takes over. This could now be any of the ROMs sitting comfortably in the Micro Pulse box.

ROMs glorious ROMs. But where to put them all?

FIRST ENCOUNTER

The first problem encountered with the connection of the box was with the "false ROM" which sits in a chosen socket. The wrong connector had been used, offering a third too many pins. These extras naturally get in the way. This is especially so on earlier issues of the BBC on whose PCBs there are some awkwardly placed resistors. These can be carefully bent out of the way.

Sensibly, the ribbon cable is detachable at the ROM box end and this allows for a bit of adjustment. When the pins do finally push home, the connection is a firm one and no further trouble should be encountered. Unfortunately the early issue board proved so awkward that socket 12 had to be used. This rather defeats the object of the box i.e. ease of access to ROMs, since a 142 socket command has to be entered each time that a new ROM is to be called up.

The Micro Pulse box does not take full advantage of the possible 16 extra ROM sockets, having only seven standard sockets — the same high quality as in the BBC itself — and one zero force socket. This final addition is an excellent feature.

It's odds on that you will soon have a favourite word-processor, BASIC editor, disassembler, perhaps a spreadsheet or printer/graphics utility. After these obvious applications, any additions to the collection can be stored away until required. The zero force socket makes it very easy to choose and access a ROM not permanently installed. It's the equivalent of plugging in a program cartridge.

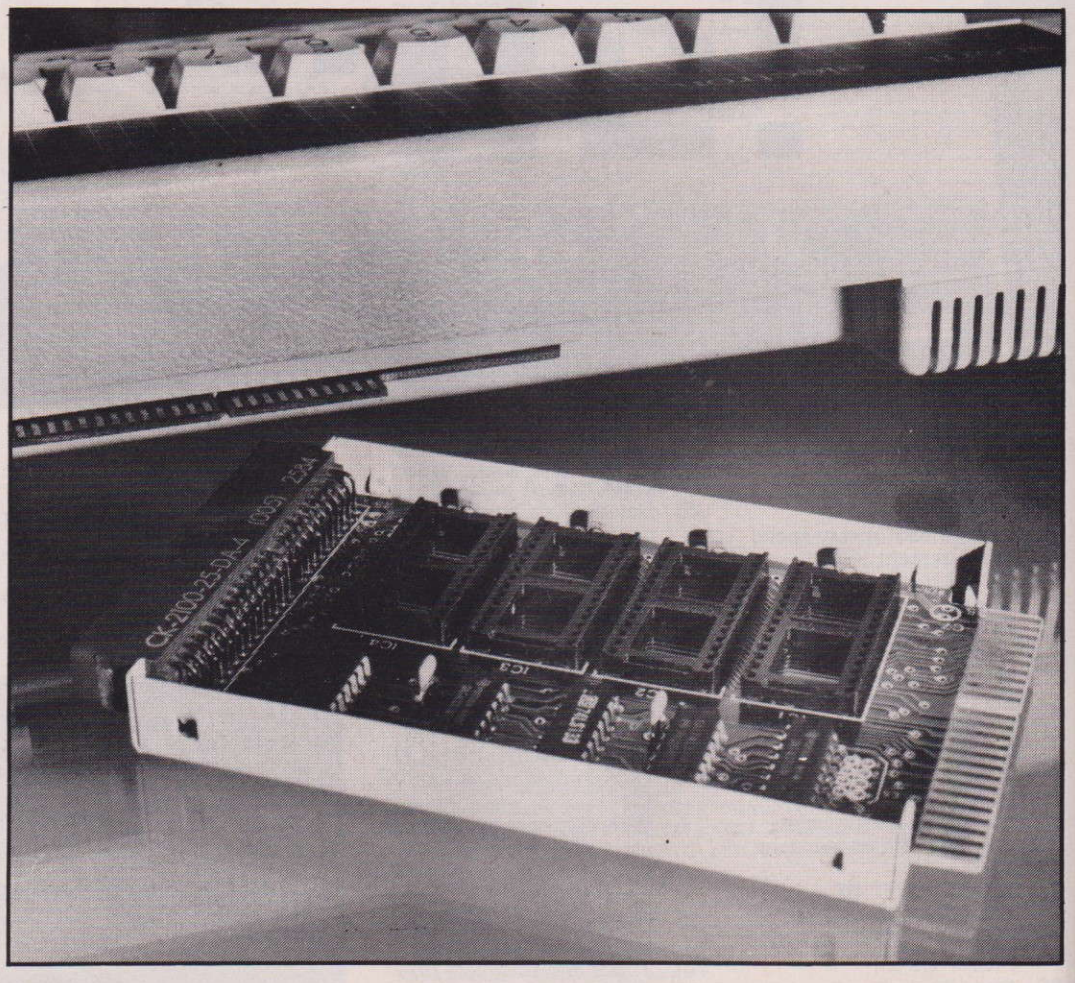
Another aspect of the ROM box is its portability. The possibility arises of having one set of ROMs in one box, but with more than one BBC fitted with the connecting ribbon cable. If one station requires a set of program development aids, or a set of business software, then the box could be "borrowed".

OPERATION

When the box is connected to the BBC board via the right-most sideways ROM socket as intended, the required ROM is hardware selectable. A knob on the left hand corner of the box switches between sockets and the ROMs in them.

Each socket has an accompanying LED (light emitting diode) as a visual indicator of the off and on states. Selection at the box is followed by a CRTL-BREAK and the chosen "language" takes over.

The Micro Pulse box is a tough metal unit done out in the appropriate cream colour with a



Mushroom "can"

Micro pulse open top

plastic lid which pivots into position over the ROM sockets for protection. The plastic used is the brittle type which unfortunately cracks fairly easily.

The box is an excellent concept and a highly practical way of managing ROMs additional to those your machine can handle. Hardware selection means that you will not to able to use the * commands of more than one ROM from within a program, but it also rules out confusion of such commands between like ROMs. The Micro Pulse ROM box is satisfactory on all counts except for the untidy use of an inappropriate component making installation less simple than it should normally be.

MUSHROOMING MICRO

The race to expand the Electron is now reaching the final lap as Acorn and supporting companies put the finishing touches to a variety of additional features, Mode 7, RS423, Centronics, A/D and user ports and now ROM boards.

Newly formed Mushroom Computers (from the Broadway Electronics stable) have come up with a compact, further expandable, four socket ROM board. The thin metal box is about the size of a pack of cards and clips firmly onto the edge connector. Two small retaining screws have to be loosened before the lid can be slid back to install or swap ROMs.

This "sardine can" has space for only four additional ROMs but even this is a great boon for Electron owners who are currently deprived of the use of an extensive range of very useful and "serious" software developed for the BBC.

STRAIGHT SOFTWARE

Mushroom claim that "most legally written BBC ROMs will work straight away with the Electron". This is true of Beebugsoft's EXMON for instance and Computer Concepts Graphics ROM. How many of the other most popular applications, especially in the wordprocessing/spreadsheet class, will work without changes remains to be seen.

Undoubtedly the next few months will see Electron versions of many ROMs appearing, although at least one major software house, Computer Concepts, is not a fan of the Electron. Perhaps they will change their minds now that the Plus One and Mushroom's board are available.

As with their Electron addons, Mushroom supply the ROM box with a rear edge connector of its own so that the computer can be further expanded in a modular fashion. This is an essential feature if flexibility is to be retained. You never know when the one application or peripheral you most want will appear and closing down your options at this early stage could result in disappointment.

Full instructions are included with the Mushroom box and there is a six month guarantee. A ROM card is a very desirable addition to the Electron if you intend to use the computer for some of the more serious programming or business applications. The Mushroom box is a viable alternative to the cartridge system of the Plus One because it is also possible to configure your system for printer/user port and joystick with a range of Mushroom products.

If you choose to do it this way, it could turn out more expensive and you will have an ungainly set of boxes. At the same time it does make it possible to choose fairly exactly the addition you want to make, without taking on extra facilities you might never use.

Both the Micro Pulse and Mushroom boxes are useful additions to their respective computers. The Micro Pulse box is accessible in a way in which a card beneath the lid can never be. The hardware selection means no "noise" from other chips. Mushroom have supplied a no nonsense solution to an inevitable need and have incorporated some sensible features.

Text Master

John R.R. Clarke

Transform your computer into a word processor with this efficient program that will enable you to produce business like documents at home.

After buying an Epson RX-80 printer, I needed a Word Processor. As I did not want to spend £60 or £70 on a professional system, I decided to program my own. I needed a system that would allow me to create pages of text, store them and print them in a number of formats. I wanted to be able to see the document as it was being written, the way it would be printed out.

The program has 15 editing functions and uses a Mode 3 screen displaying 22 lines (out of 60) at a time. I used it for writing up my computer studies project and it is now, of course, being used for this article. It runs on a Model B with a 1.2 OS but provided the cassette bugs of the 0.1 OS are patched it will run on both versions.

Seven printer highlights are provided for the Epson RX-80 but for non Epson owners the VDU sequences on lines 1490 to 1570 can be changed, to suit your printer.

The editing facilities are obtained by pressing the red function keys with or without the shift and/or control key to obtain up to four functions per key. Figure 1 shows a suitable label to fit above the keys naming each function. A description of their purpose follows.

A tab stop can be set by holding the shift key down while pressing 'TAB'. After this 'TAB' will cause the cursor to move to the tab stop. The seven printer highlights are accessed with function keys f(6) and f(7). They each cause a special character to be displayed unique to that function. The characters can be redefined in lines 270 and 280. The 'CAN.MODES' character cancels all of the highlights.

The menu

```
1: TEXT
2: PRINT PAGE
3: LOAD PAGE
4: SAVE PAGE
5: CLEAR PAGE
6: PRINT f(x)
   KEY LABELS
7: EXIT PROGRAM
```

ENTERING THE PROGRAM

In order to fit the available memory the program should be entered with all spaces and REMs removed.

CLEAR LINE	This will clear the current line and return the cursor to the line beginning.
MENU	This returns control to the main menu.
CH. MODE	This will swap back and forth from INSERT/DELETE mode to NORMAL mode. INSERT/DELETE mode causes text after the text cursor to be moved on to make room for more text while it is entered and the DELETE key moves text back to fill up the gap as text is deleted. In the NORMAL mode text is over written by the new text.
COPY LINE	This will cause a line to be copied into a string where it will remain. The 'DISP LINE' function will print this string. When a line is cleared it is copied into this string so accidental pressing of the 'CLEAR LINE' key will not prove fatal.
DISP LINE	See 'COPY LINE' function.
TOP TEXT	This causes the top of the page to be displayed on the screen.
B. OF TEXT	This will cause the bottom of the page to be displayed.
SCR. DOWN	This will scroll the page down one line.
SCROLL UP	This will scroll the page up one line.
CENTER	This will centre the line.
DELETE L	This will delete the current line, by moving all text below it up a line.
INSERT L	This will insert a blank line, by moving all text below the cursor down one line.
SAVE BLOCK	This will save a block of text of n lines, where n is set by pressing one of the keys 1-9 after hitting the 'SAVE BLOCK' key.
LOAD BLOCK	This loads a block of text which has been saved as an ASCII file, either by another program or by the 'SAVE BLOCK' facility.

DESCRIPTION OF PROGRAM

10-40	Initialization
50-150	Menu
160-650	Main loop for interpreting characters input during text entry
660-730	Procedure for centring line
740-850	Procedure for displaying any 22 lines from page
860-980	Inserts or deletes a character at the cursor
990-1060	Scrolls page up
1070-1140	Scrolls page down
1150-1220	Deletes a line and checks shift/control keys for other functions
1230-1280	Inserts a line
1290-1380	Checks shift/control keys for correct printer highlight
1390-1620	Prints page
1630-1730	Prints f(x) key labels
1740-1840	Loads or Saves a page
1850-1950	Loads of Saves an ASCII file

CLEAR LINE	CH. MODE	TOP TEXT	B. OF TEXT	CENTER	DELETE L	ITALICS	CAN. MODES
MENU	COPY LINE	SCR. DOWN	SCROLL UP		INSERT L	UNDER L	EMPHASIZED (= SHIFT
	DISP LINE				LOAD BLOCK	SUBSCRIPT	CONDENCED (= CTRL
					SAVE BLOCK	SUPER SCR.	ENLARGED (= SHIFT & CTRL

Fig. 1

```
   10 DIMA$(60)
   20 FOR A=0 TO 60: A$(A)=STRING$(80," "): NEXT:
B$=A$(0)+" ": A$=B$
   30 MARK=0:MD%=0:PRINTTAB(0,2);
   40 ONERRORGOTO50
   50 B%=POS:C%=VPOS:T%=0:MODE7
   60 PRINTTAB(15,3)"M E N U"''
   70 PRINT"1: TEXT"'"2: PRINT PAGE"'"3: LOAD PAGE
"'"4: SAVE PAGE"'"5: CLEAR PAGE"'"6: PRINT f(x) KE
Y LABELS"'"7: EXIT PROGRAM"'
   80 INPUTM
   90 IFM<1ORM>7THEN50
  100 IFM=3OR M=4THENPROCloadsave
  110 IFM=5THENCLEAR:RUN
  120 IFM=7THENEND
  130 IFM=1THEN160
  140 IFM=2THENPROCprint:GOTO50
  150 IFM=6THENPROClabel:GOTO50
  160 MODE3:PRINTTAB(B%,C%);
  170 *FX4,1
  180 *FX12,8
  190 *KEY0|J
  200 *KEY1|A
  210 *KEY2|B
  220 *KEY3|C
  230 *KEY4|D
  240 *KEY5|E
  250 *KEY6|F
  260 *KEY7|G
  270 VDU23,240,8,16,32,65,130,4,8,16,23,241,0,0,0
,0,0,0,255,255,23,242,0,0,0,0,0,240,144,240,23,243
,240,144,240,0,0,0,0,0,23,244,0,0,255,255,255,0,0,
0,23,247,263,263,263,263,263,263,263,263
  280 VDU23,245,255,255,231,231,231,231,255,255,23
,246,260,260,260,260,260,260,260,260
  290 PROCdisp
  300 IFVPOS=1THENPROCdown:VDU10
  310 IFVPOS=24THENPROCup:VDU11
  320 C%=POS:D%=VPOS:PRINT TAB(6,0);D%-2+MARK;"  "
TAB(20,0);C%;"  "TAB(C%,D%);
  330 A%=GET
  340 IFA%=136THENVDU8:GOTO300
  350 IFA%=137THENVDU9:GOTO300
  360 IFA%=138THENVDU10:GOTO300
  370 IFA%=139THENVDU11:GOTO300
  380 IFA%=13THENVDU13,10:GOTO300
  390 IFA%=2ANDINKEY(-2)=FALSE ANDINKEY(-1)=FALSE
THENMARK=0:PROCdisp:GOTO300
  400 IFA%=2ANDINKEY(-2)=FALSE ANDINKEY(-1)THENPRO
Cdown:GOTO300
  410 IFA%=3ANDINKEY(-2)=FALSE ANDINKEY(-1)=FALSE
THENMARK=38:PROCdisp:GOTO300
  420 IFA%=3ANDINKEY(-2)=FALSE ANDINKEY(-1)THENPRO
Cup:GOTO300
  430 IFA%=4THENPROCcenter:GOTO300
  440 IFA%=5THENPROCdeletel:GOTO300
  450 IFA%=6THENPROCpmode
  460 IFA%=7THENPROCpmod
  470 IFA%=9ANDINKEY(-1):T%=POS
  480 IFA%=9ANDINKEY(-1)=FALSE:PRINTTAB(T%,VPOS);
  490 IFA%=10ANDINKEY(-1)=FALSE ANDINKEY(-2)=FALSE
 THENPRINTTAB(0,VPOS);SPC(80);:VDU11:B$=A$(VPOS-2+
MARK):A$(VPOS-2+MARK)=STRING$(80," ")
  500 IFA%=10AND INKEY(-1) AND INKEY(-2)=FALSE THE
N50
  510 IFA%=1ANDINKEY(-1)ANDINKEY(-2)=FALSE THENB$=
A$(VPOS-2+MARK):GOTO300
  520 IFA%=1ANDINKEY(-1)=FALSE ANDINKEY(-2)THEN A$
(VPOS-2+MARK)=B$:PRINTTAB(0,VPOS);B$;CHR$11;:GOTO3
00
  530 IFA%<>1THEN570
  540 IFMD%=0THENMD%=1ELSEMD%=0
  550 C%=POS:D%=VPOS:PRINT TAB(31,0);:IF MD%=0PRIN
T"NORMAL            ";TAB(C%,D%); ELSEPRINT"INSERT/
DELETE";TAB(C%,D%);
  560 GOTO 300
  570 IF A%<32 THEN 300
  580 IF MD%=1 THEN PROCinsdel: GOTO300
  590 IF A%=127 THEN VDU 8,32,8: A%=32: A$(VPOS+MA
RK-2)=LEFT$(A$(VPOS+MARK-2),POS)+CHR$(A%)+RIGHT$(A
$(VPOS+MARK-2),79-POS): GOTO 300
  600 VDU A%
  610 IF POS=71 THEN VDU 7
  620 VDU 8
  630 A$(VPOS+MARK-2)=LEFT$(A$(VPOS+MARK-2),POS)+C
HR$(A%)+RIGHT$(A$(VPOS+MARK-2),79-POS)
  640 VDU 9
  650 GOTO 300
  660 DEF PROCcenter
  670 H%=0: REPEAT
  680 H%=H%+1: UNTIL MID$(A$(VPOS+MARK-2),H%,1)<>"
 "
  690 I%=81: REPEAT
  700 I%=I%-1: UNTIL MID$(A$(VPOS+MARK-2),I%,1)<>"
 "
  710 A$(VPOS+MARK-2)=STRING$((80-LEN(MID$(A$(VPOS
+MARK-2),H%,I%-H%)))/2," ")+MID$(A$(VPOS+MARK-2),H
%,I%-H%+1): A$(VPOS+MARK-2)=A$(VPOS+MARK-2)+STRING
$(80-LEN(A$(VPOS+MARK-2))," ")
  720 B%=POS: C%=VPOS: PRINT TAB(0,VPOS);A$(VPOS+M
ARK-2);TAB(B%,C%);
  730 ENDPROC
  740 DEF PROCdisp
  750 LOCAL A
  760 B%=POS: C%=VPOS
  770 CLS
  780 PRINT"LINE: ";C%-2+MARK;TAB(12)"COLUMN: ";B%
;TAB(25);"MODE: ";:IF MD%=0 THEN PRINT"NORMAL" ELS
E PRINT"INSERT/DELETE"
  790 PRINT TAB(0,1);STRING$(80,"=")
  800 PRINT TAB(0,24);STRING$(79,"=");TAB(0,2);
  810 FOR A=MARK TO MARK+21
  820 PRINT A$(A);
  830 NEXT
  840 PRINT TAB(B%,C%);
  850 ENDPROC
  860 DEFPROCinsdel
  870 IFA%=127THENVDU8
  880 LIN=VPOS+MARK-2
  890 HPS%=POS
  900 IFA%<>127THENA$=LEFT$(A$(LIN),HPS%)+CHR$(A%)
+RIGHT$(A$(LIN),80-HPS%) ELSE A$=LEFT$(A$(LIN),HPS
%)+MID$(A$(LIN),HPS%+2)
```

CONTINUED OVER

```
  910 IF A%<>127 THEN A$(LIN)=LEFT$(A$,80) ELSE A$
(LIN)=A$+CHR$32
  920 IF A%=127 AND RIGHT$(A$,2)="  " THEN VDU 8
  930 IF RIGHT$(A$,2)="  " THEN B%=POS: C%=VPOS: F
OR LL=VPOS+MARK-2 TO LIN: PRINT TAB(0,VPOS);A$(LL)
;: NEXT: PRINT TAB(B%,C%);CHR$9;: GOTO980
  940 IF A%<>127 THEN A%=ASC(RIGHT$(A$,1)) ELSE A$
(LIN)=LEFT$(A$(LIN),79)+LEFT$(A$(LIN+1),1)
  950 LIN=LIN+1
  960 HPS%=0
  970 GOTO 900
  980 ENDPROC
  990 DEF PROCup
 1000 IF MARK=60-22 THEN ENDPROC
 1010 MARK=MARK+1
 1020 C%=POS:D%=VPOS
 1030 VDU28,0,23,79,2
 1040 PRINTTAB(0,21):VDU26
 1050 PRINT TAB(0,23);A$(MARK+21);TAB(C%,D%);
 1060 ENDPROC
 1070 DEF PROCdown
 1080 IF MARK=0 THEN ENDPROC
 1090 MARK=MARK-1
 1100 C%=POS:D%=VPOS
 1110 VDU28,0,23,79,2
 1120 PRINT TAB(0,0)CHR$11;A$(MARK)
 1130 VDU26,31,C%,D%
 1140 ENDPROC
 1150 DEF PROCdeletel
 1160 IF INKEY(-2) THEN 1850
 1170 IF INKEY(-1) THEN 1230
 1180 FOR A=VPOS+MARK-2 TO 59
 1190 A$(A)=A$(A+1): NEXT
 1200 VDU11
 1210 PROCdisp
 1220 ENDPROC
 1230 VDU10
 1240 FOR A=60 TO VPOS+MARK-1 STEP -1
 1250 A$(A)=A$(A-1): NEXT
 1260 A$(VPOS+MARK-2)=STRING$(80," ")
 1270 PROCdisp
 1280 ENDPROC
 1290 DEF PROCpmode
 1300 IFINKEY(-1)=FALSE ANDINKEY(-2)=FALSE THENA%=
240
 1310 IFINKEY(-1)ANDINKEY(-2)=FALSE THENA%=241
 1320 IF INKEY(-1)=FALSE AND INKEY(-2) THEN A%=242
 1330 IFINKEY(-1)ANDINKEY(-2)THENA%=243
 1340 ENDPROC
 1350 DEF PROCpmod
 1360 IF INKEY(-1)=FALSE AND INKEY(-2)=FALSE THEN
A%=244
 1370 IF INKEY(-1) AND INKEY(-2) THEN A%=247
 1380 ENDPROC
 1390 DEF PROCprint
 1400 CLS:VDU1,27,1,64,1,27,1,56
 1410 VDU1,27,1,71:PRINT'"DO YOU WISH TO HAVE SMA
LLER CHARACTERS  AND WIDE MARGINS (12 CHR'S/INCH)"
'"ANS Y/N":W%=GET:IFCHR$(W%)="Y"ORCHR$(W%)="y":VDU
1,27,1,77,1,27,1,108,1,12
 1420 V%=0
 1430 PRINT'"DO YOU WISH THE SPACES 'UNDER' THE"'
"CONTROLL CODES TO BE DELETED?"'"ANS Y/N":W%=GET:I
FCHR$(W%)="Y"ORCHR$(W%)="y":V%=1
 1440 PRINT''"PRESS SPACE TO BEGIN PRINTING": W%=
GET
 1450 FOR A=0 TO 60
 1460 E%=1:F%=80:REPEAT
 1470 IFMID$(A$(A),E%)=STRING$(81-E%," "):F%=0:GOT
O1610
 1480 U%=ASC(MID$(A$(A),E%,1))
 1490 IFU%=240THENVDU1,27,1,ASC("4"): IFV%=0THENVD
U1,32
 1500 IFV%=0ANDU%=241THENVDU1,32
 1510 IFU%=241THENVDU1,27,1,45,1,1
 1520 IFU%=242THENVDU1,27,1,ASC("S"),1,1
 1530 IFU%=243THENVDU1,27,1,ASC("S"),1,0
 1540 IFU%=245THENVDU1,27,1,69
 1550 IFU%=246THENVDU1,15
 1560 IFU%=247THENVDU1,14
 1570 IFU%=244THENVDU1,27,1,ASC("T"),1,27,1,ASC("F
"),1,27,1,45,1,0,1,27,1,ASC("5"),1,20,1,18
 1580 IF V%=0ANDU%>239ANDU%<248ANDU%<>241THENVDU1,
32
 1590 IFU%>239ANDU%<248:GOTO1610
 1600 VDU 1,U%
 1610 E%=E%+1:UNTILE%>F%:VDU1,13:NEXT
 1620 ENDPROC
 1630 DEF PROClabel
 1640 VDU1,27,1,64,1,15,1,27,1,71,2
 1650 VDU1,27,1,65,1,11
 1660 PRINT "    ";STRING$(104,CHR$223)
 1670 PRINT"    ¦ CLEAR LINE ¦ CH. MODE  ¦ TOP TEX
T   ¦ B. OF TEXT ¦ CENTER     ¦ DELETE L   ¦ ITALI
CS    ¦ CAN. MODES ¦"
 1680 PRINT"    ¦ MENU       ¦ COPY LINE ¦ SCR. DO
WN  ¦ SCROLL UP  ¦            ¦ INSERT L   ¦ UNDER
L    ¦ EMPHASIZED ¦ <= SHIFT"
 1690 PRINT"    ¦            ¦ DISP LINE ¦
    ¦            ¦            ¦ LOAD BLOCK ¦ SUBSC
RIPT  ¦ CONDENCED  ¦ <= CTRL"
 1700 PRINT"    ¦            ¦            ¦
    ¦            ¦            ¦ SAVE BLOCK ¦ SUPER
SCR. ¦ ENLARGED   ¦ <= SHIFT & CTRL"
 1710 PRINT "    ";STRING$(104,CHR$173)
 1720 VDU3
 1730 ENDPROC
 1740 DEF PROCloadsave
 1750 IF M=3:X=OPENUP("PAGE")
 1760 IF M=4:X=OPENOUT("PAGE")
 1770 FOR A=0 TO 60
 1780 IF M=3:INPUT#X,A$(A)
 1790 IF A$(A)="*"AND M=3:A$(A)=STRING$(80," ")
 1800 IF A$(A)=STRING$(80," ")AND M=4:PRINT#X,"*":
GOTO1820
 1810 IF M=4:PRINT#X,A$(A)
 1820 NEXT
 1830 CLOSE#X
 1840 ENDPROC
 1850 IF INKEY(-1) THEN 1880
 1860 *EXEC"BLOCK"
 1870 ENDPROC
 1880 R%=VAL(GET$): IF R%=0 THEN ENDPROC
 1890 C%=POS:D%=VPOS:CLS
 1900 *SPOOL"BLOCK"
 1910 FOR A=MARK+D%-2 TO MARK+D%-2+R%
 1920 PRINT A$(A);: NEXT
 1930 *SPOOL
 1940 PRINT TAB(C%,D%);: PROCdisp
 1950 ENDPROC
```

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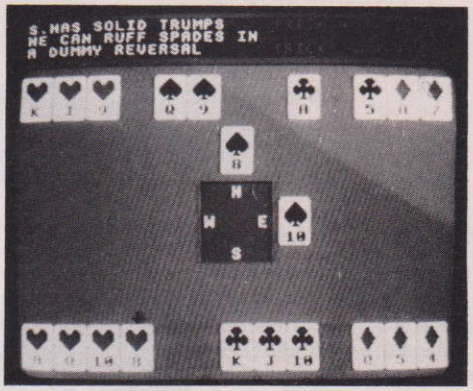

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Dear Editor,
In view of the lack of information in your magazine for FORTH programmers, may I submit the following routine for your scrutiny.

The definition for CODE is borrowed from the FORTH manual (Richard De Grandis-Harrison) and, briefly, creates a dictionary header in which the code field address is set to point to the next free byte. Machine code may then be hand assembled into the dictionary area following the code field pointer.

The routine I present here uses an OSBYTE call with A=&80, to read the analogue to digital converters. It may be used to read other information, but see the User Guide (page 429/430).

Obviously similar routines may be written (or this one generalised) to perform other OSBYTE calls and other O.S. calls.

The advantage of hand assembling this routine is that it may be loaded directly without first loading the assembler.

First, the definition for CODE:

```
: CODE CREATE HERE -2
ALLOT, ;
```

Next my own routine to replace BASIC's ADVAL function:

```
(nl ... ADVAL(nl) )
```

HEX CODE	ADVAL		(create dictionary entry)
86	C,	68 C,	(STX XSAVE)
0B5	C,	0 C,	(LDA low byte nl)
0AA	C,		(TAX)
0A0	C,	OFF C,	(LDY #&FF)
0A9	C,	80 C,	(LDA #&80)
20	C,	OFFF4 ,	(JSR OSBYTE)
8A	C,		(TXA)
0A6	C,	68 C,	(LDX XSAVE)
95	C,	0 C,	(STA comp stack low)
94	C,	1 C,	(STY comp stack high)
4C	C,		(JMP)
6A	+ORIGIN	,	(NEXT)

DECIMAL

I hope this may be of use to any FORTH programmers using joysticks out there. For myself, this is my first attempt at machine code (or assembler), so if you have any constructive comments to make regarding this routine, I would very much welcome them. And how about some articles on LISP?
Yours faithfully,
G.P. Quinney
Wembley
Middlesex

Editor of A&B Computing Number One, Golden Square, London W1R 3AB.

Strongly held opinion? Programming idea? Don't delay; drop us a line and join the Mailsort gang.

Dear Sir,
Although the program "Page Mode Switch" was listed correctly in the July/August edition of *A&B Computing*, a number of typographical errors unfortunately crept into the associated text.

First, as is evident from the program listing, the two OSBYTE calls used are 118 and 129, not 117 and 129 (My fault!). Second, and again evident from the listing, the *FX command used in the definition of the BREAK key should be 14,2, not 14,21. Most important, however, there is confusion between ':' and '¦', presumably because of an inability to print '¦'. The key definition should end with ¦':*FX14,2¦M' and the subsequent statement should read...followed by '¦M' rather than by ':'.

In conclusion, it is worth pointing out that the printed program was written for a cassette based machine. Disk users should, for example, change the value of cona% in line 10 to &A00, and the two 'pokes' in the key definition to ?&220=0:?&221=&0A.
Yours faithfully,
D. Gibbons

Dear Sir,
The problem you are experiencing with regard to inverse graphic print commands is due to the fact that after a VDU5 statement the printed character is exclusive ORed with the existing contents of the screen RAM.

The effect of this is seen if you attempt to print two different characters at the same graphics position. The two characters will appear superimposed, one on top of the other. In fact the square shape of the text character block background is not plotted, only the relevant character bits appear on the screen.

At location &C000 in ROM is a table consisting of the eight bytes for each of the normal ASCII character set. These bytes may be used to produce a redefined "inverted" character set. This is rather expensive in terms of RAM space however. One method is to redefine each character as and when required using VDU 23 commands. This is the method used in the following routine. A procedure is used to convert each character in turn to its inverted version as CHR$ 240.

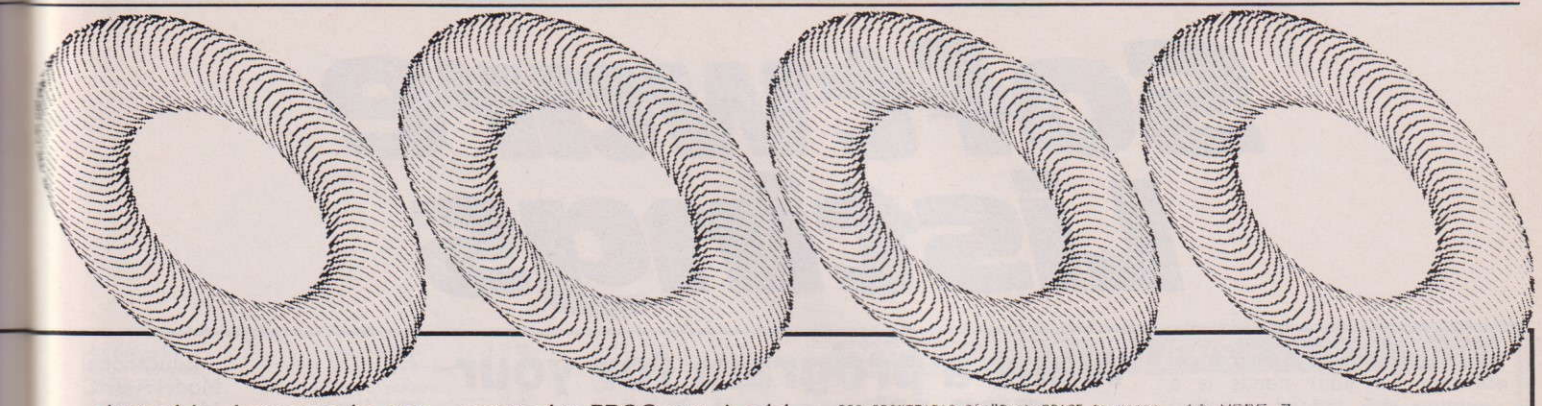
```
 10 MODE4
 20 VDU5
 30 MOVE 600,600
 40 char=GET
 50 PROCinverse
 60 GOTO 40
 70 DEFPROCinverse
 80 ROM=&C000+8*(char-32)
 90 VDU 23,240
100 FOR Q=0 TO 7
110 VDU ?(ROM+Q) EOR 255
120 NEXT Q
130 PRINTCHR$240;
140 ENDPROC
```

The PROC can be tarted up with Local variables and passed parameters as you require, but I think it will satisfy your needs.
Yours faithfully,
B.W. Hall, Bideford, Devon

Dear Editor,
Your readers may be interested to try a surprisingly short program which gives a 3D effect by hidden line supression. This normally involves some complex calculations, but can be easy for regular figures.

In this case a 'doughnut' shape is plotted as a circular spiral in MODE 0. The top of the first loop in the spiral is drawn white and the bottom in black as calculated in line 60. In the next loop the white part is started a little later, just enough so that when the spiral reaches the far side of the 'doughnut' the white part of the loop will be the bottom half, and will have turned through 360° by the time the plot is complete.

A more regular plot can be



obtained by decreasing the step size in line 50 at the expense of some extra time taken. Interesting crinkle-cut effects can be obtained by increasing the step size; and those with a colour monitor might like to try adding 3D jam to their doughnuts!

By the way, a special thank you for your July/August review of word processors which was most helpful.

Dr. D.E. Ray
Carshalton
Surrey

```
  10 theta=0
  20 A%=200:B%=300
  30 MODE0:CLS
  40 PROCcalculate:
 MOVE 640+X,512+Y
  50 FOR theta=0TO
PI*6 STEP PI/290
  60  col=theta*10.
08:IF col>128 THEN c
ol=col-128
  70 PROCcalculate
  80 GCOL3,col
  90 DRAW 640+X,512
+Y
 100 NEXT theta
 110 END
 120 DEF PROCcalcul
ate
 130 X=((A%-B%)*COS
(theta*32))+(B%*COS(
((A%-B%)/B%)*(theta)
))
 140 Y=((A%-B%)*SIN
(theta*32))-(B%*SIN(
((A%-B%)/B%)*(theta)
))
 150 ENDPROC
```

Dear Editor,

I write in response to the plea by Mr. Landsberg at the end of his article on page 55 of the July/August 1984 edition of *A&B Computing*. There he asks for readers to send in any ideas on how to print inverse mode text under control of the graphics cursor, following a VDU 5 command. The enclosed demonstration program illustrates one way in which this can be done.

The heart of the method is contained in PROCprint. A solid block character (char. 240) is first printed in the text foreground colour, followed by a backspace character (line 290). The text character is thus overprinted in the same position in the text background colour, thus producing the desired effect. The only thing to watch is that the string being printed is not too close to the right hand side of the screen, or the backspace will not work.

I trust that this will be of use to Mr. Landsberg, and to your readers.

Yous sincerely,
Robin Newman
(Director of Software)
The Microelectronics Centre
Oundle School

```
  10 REM Inverse Printing after VDU 5
  20 REM R. Newman June 1984
  30 REM B=required background colour
  40 REM F=required foreground colour
  50 :
  60 ON ERROR IF ERR=17 THEN MODE 7:END
:ELSE REPORT:PRINT"at line";ERL:END
  70 MODE 1
  80 B=0:F=3
  90 REM Define char 240 as solid recta
ngle
 100 VDU23,240,255,255,255,255,255,255,
255,255
 110 REPEAT
 120 CLS
 130 PTINTTAB(7,0)"Inverse Text printed
 after VDU 5"
 140 PRINTTAB(0,3)"Type string to be pr
inted"
 150 INPUT""A$
 160 FOR Z=0 TO 400 STEP 100
 170 MOVE Z,Z-300
 180 VDU5
 190 PROCprint(A$,F,B)
 200 VDU4
 210 NEXT
 220 PRINTTAB(0,26)"Push SPACE to repea
t or ESCAPE to end"
 230 REPEATUNTILGET=32
 240 UNTIL FALSE
 250 :
 260 DEF PROCprint(A$,F,B)
 270 LOCAL X
 280 FOR X=1 TO LEN(A$)
 290 GCOL0,F:VDU240,8:GCOL0,B
 300 PRINTMID$(A$,X,1);
 310 NEXT
 320 GCOL0,F
 330 ENDPROC
```

```
Inverse Text printed after VDU 5

Type string to be printed
This is a demonstration

This is a demonstration

This is a demonstration

This is a demonstration

This is a demonstration

Push SPACE to repeat or ESCAPE to end
```

Dear Editor,

You might like to pass on to your readers the example below showing the usefulness of the command *SPOOL.

I recently had a program in which the graphics were being slowed down by the calculation of sines and cosines, and I decided that it would be much faster if the values could be read in from DATA statements. I therefore needed a method by which one program could generate DATA statements which could be added to other programs. The program below is a simplified version of that which I used, and creates DATA statements holding sines and cosines of angles from 36° to 360° in steps of 10°. The DATA statements are written to the file "SINCOS" with line numbers from 8000 to 8090 in steps of 10. Line 50 sets the format for the line numbers to an integer with 4 digits, and line 70 sets the format for the sines and cosines so that they are written as numbers with 5 decimal places.

```
 10 MODE 7
 20 *SPOOL "SINCOS"
 30 l%=8000
 40 FOR i%=36 TO 360 STEP 10
 50 @%=&04
 60 PRINT l%;"DATA ";
 70 @%=&020508
 80 PRINT SIN(i%);",";COS(i%)
 90 l%=l%+10
100 NEXT i%
110 *SPOOL
120 END
```

Those using cassette systems will receive the message "RECORD then RETURN", and can then position the tape accordingly and proceed. With discs no further action is required.

The file "SINCOS" can then be added to a LOADed program by using the command *EXEC. For example, the program below would need the DATA statements created above:

```
200 MODE 7
210 DIM S(10),C(10)
220 FOR i%=1 to 10
230 READ S(i%),C(i%)
240 PRINT S(i%),C(i%)
250 NEXT i%
260 END
```

Once this program has been LOADed, typing *EXEC "SINCOS" will add the data to the end of the program which can then be RUN. This time cassette users will be given no prompting, and must first position the tape at the start of the SPOOLed file, with the PLAY control switched on.

Presumably one could use *SPOOL to write a complete program, but I haven't tried yet!

Yours faithfully
Mary E. Clayton (Mrs)
Leighton Buzzard
Bedfordshire

Software Listings

Want a program for your BBC Micro or Acorn Electron? Look no further than our listings to make your choice.

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 o f 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 — 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	Educational
A	Model A BBC
B	Model B BBC
E	Electron
C	Cassette
D()	Disc (40 or 80)
R	Rom or Eprom

As you are probably aware, new software is surfacing all the time so do not asume 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 dissapointment 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	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
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
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
Amazing Ollie	Ed	Storm	B	C,D	SX	£6.05, £9.95
Anagrams	Do	Cylindrical Software	A,B	C	CS	£3.95
Analyser	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
Answer Back	Do	Kosmos	B,E	C	KM	£10.95
Apollo	Gm	Software Invasion	B	C	IS	£6.95
Append It	Ut	Aztec S/W	B	C	IB	£3.00
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
Android Attack	Gm	Computer Concepts	B	C	GJ	£8.95
Animated Arithmetic	Ed	Ludinski CAL	B	C/D	KA	£6.50/ £7.50
Animator	Ed	Arnold-Wheaton	B	C,D	AW	£9.95, £12.00 + VAT
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
Artisan I	Ut	OIC	B,E	C	OI	£12.75
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 Appplied	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
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
Barset and Barpic	Ed	Longman	B	C,D	LM	£14.50 + VAT
Barrage	Ed	Micro Power	B	C	GK	£7.95
Base 10	Ed	Dial	B	C,D	DL	£4.95, £6,50
BASIC Compiler	Ut	Ack	B	C,D	AC	£14.95, £19.95
BASIC Environment	Ut	Harris	B	D	HM	£14.50
Basic Goodies	Ut	Simonsoft	A,B	C	MS	£5.95
Basic Maths	Ed	Aztec S/W	A,B	C	IB	£3.00
Basic Number Help	Ed	Longman	B	C,D	LM	£9.95, £12.95
Basic Statistics	Bs	Micropak	B	C	MP	£7.95
Battlezone Six	Gm	Kansas	B	C	KA	£9.50
Battlezone 2000	Gm	Lothlorien	B	C	LO	£6.95
Battle Tank	Gm	Superior Software	B	C	SE	£7.95
BBC Artfun	Do	R.H. Electronics	B	C	RH	£9.95
BBC Kaleidoscope	Ed	Dial	B	C	DL	£8.50
BBC Logo	Ed	Dial	B	C,D	DL	£6.50, £8.00
BBC Octuplet	Ed	Dial	B	C	DL	£8.50
Beebart	Ut	Quicksilva	B	C	QS	£14.95
Banner	Do	Micro-Aid	A,B	C	IZ	£2.95
Beamscan	Bs	Beamscan	B	C,D	BS	£40,45
Beat the Bug (Molecule)	Gm	Bridge	B	C	BR	£6.90
Beat the Clock	Ed	Arnold-Wheaton	B	C,D	AW	£15 + VAT
Bed Bugs	Gm	Optima	B	C	OP	£8.95
Bee Base	Ut	GCC	B	E	GL	£45.94
Beeb-Chase	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	Ed	Dial	B	C,D	DL	£4.95, £6.50
BEEP-BEEB	Gm	IJK	B	C	IJ	£3.95
Beep-Beeb (Super Simon)	Gm	IJK Software	B	C	IJ	£4.50
Beebcalc	Bs	Gemini	B	C	GM	£19.95
Beebmon	Ut	Micro Power	A,B	C	GK	£7.95
Beebplot	Bs	Gemini	B	C	GM	£19.95
Beeboids	Gm	Odyssey	A,B	C	OG	£2.75
Beebon Mon	Ut	McKeran	A,B	C	MK	£2.00
Beebsynth	Ut	Clares	A,B	C	CL	£7.95
Beeb-Tote	Gm	Micro Power	B	C	GK	£5.95
Beefeater	Ed	Sulis	B	C	SU	£7.95
Bertie Bear	Ed	Dial	B	C,D	DL	£4.95, £6.50
Besieged	Ed	Sulis	B	C	SU	£9.95
Beyond Basic	Ed	BBC/NEC	A,B	C	KB	£7.25
Billiards	Gm	H and H Software	B	C	HH	£8.50
Birds of Prey	Gm	Romik	B,E	C	RO	£6.99
Bismark	Gm	ASP Software	B,E	C	AS	£6.99
Blagger	Gm	Alligata	B,E	C	SY	£7.95
Blockbuster	Gm	Micro Power	B	C	GK	£7.95
Blockfit	Ed	System	B	D	SY	£46.00
Boat Race	Ed	Pee Bee	B	C,D	PB	£8.50, £11.00
Blackjack/Textpro	Gm /Ut	Software Invasion	B	C	IS	£6.95
Boeing 767	GM	Flightdeck	B	C	FL	£7.67

SOFTWARE SUPPLIERS

Supplier Code

AA Anthony Aspitel Software Systems
56 London Road
Harleston
Norfolk
IP20 9BZ

AB ABC Primary
19 Crumstone Court
Longmeadow Estate
Killingworth
Newcastle Upon Tyne

AC ACK Data
21 Salcombe Drive
Nottingham NG5 8JF

AD Dial Software
72 Downend Road
Downend
Bristol

AG Superior Systems Ltd
178 West Street
Sheffield WS1 4ET

MO Molimerx Ltd
1 Buckhurst Road
Town Hall Square
Bexhill-on-sea
East Sussex

AJ AJ Software
61 Jeddo Road
London WIZ 9ED

AK A.S.K. Ltd
London House
68 Upper Richmond Road
London SW15 2RP

AL Acornsoft Ltd
4a Market Hill
Cambridge CB2 3NJ

AM Microplus Software
6 Litton Way
Leeds

AN Addison-Wesley
53 Bedford Square
London WC1B 3DZ

AO Amcom
23 Hivings Hill
Chesham
Bucks HP5 2PG

AP Processor Applications
22 Mercer Close
Basingstoke
Hants

AS ASP Software
Number One Golden Square
London W1R 3AB

AV A J Vision Service Ltd
61 Jeddo Road
London W12 9ED

AW Arnold-Wheaton Software
Software Publishing Division
Parkside Lane
Leeds LS11 5TD

BB Bug-Byte
Mulberry House
Canning Place
Liverpool L1 8JB

BE Beebugsoft
PO Box 109
High Wycombe
Bucks HP11 2TD

BK BAKsoft
34 Humberstone Road
Cambridge

BM Blue Moon Software Co.
Freepost
Swanley
Kent BR8 7UY

BO Bourne Educational Software
Headbourne Worthy
Winchester
Hants SO23 7SQ

BR Bridge Software
36 Fernwood
Marple Bridge
Stockport
Cheshire SK6 5BE

BS Beamscan
20 Vaughan Avenue
Hendon
London NW4 4HU

BU Busco
16 Colwill Walk
Mainstone
Plymouth

CA Carvells
3/7 Bank Street
Rugby

CR Carswell Computers
Carswell Barn
Faringdon
Oxon SN7 8JN

CD Carsondale Enterprises Ltd
44 Kingsway
Stoke-on-Trent
Staffordshire
ST4 1JH

CG Challenge Games
64 Ferndale Road
London E11

CH Chalksoft Ltd
37 Willowslea Road
Worchester WR3 7QP

CL Clwyd Technics Ltd.,
Microprocessor Centre
Coach House
Kelsterton Road
Flint
Clwyd CH6 5TH

CR Computer Rentals Ltd
CRL House
9 Kings Yard
Carpenters Road
London E15 2HO

CS Cylindrical Software
177 College Road
Moseley
Birmingham B13 9LJ

CS Stable Software
Compton Street
Compton
Nr Winchester
Hants

CT Cottage Software
Heather Cottage
Selly Hill
Whitby
North Yorkshire

CU Level 9 Computing
229 Hughenden Road
High Wycombe
Buckinghamshire HP13 5PG

CONTINUED OVER

SOFTWARE LISTINGS

Title	Type	Manufacturers	Memory		Software Supplier	Price
Bomb Alley	Gm	Software Invasion	B	C	IS	£7.95
Bomber Scramble	Gm	Kansas	B	C	KA	£9.50
Bounce	Gm	Computercat	A,B	C	CC	£4.95
Bouncers	Gm	A&F	B	C	GE	£8.00
Bounty Pirates	Gm	Aztec S/W	A,B	C	IB	£5.50
Boris in the Underworld	Gm	Superior	B	C	SE	£7.95
Boxes/Maze	Ed	Primary	B	C,D	PP	£5.95, £7.95
Brain Teasers	Gm	Dynabyte	A,B	C	DB	£5.95
Break-in	Ed	Highlight	B	C,D	HI	£6.00, £7.00
Break-Up	Gm	Miking S/W	B	C	KC	£3.95
Breakout	Gm	I.J.K. S/W	A,B	C	IJ	£3.95
Breakout	Gm	Bryants S/W	B	C	HW	£3.75
Brick 'em in	Gm	Software For All	B	C	KN	£6.95
Bridge to the East	Gm	Ixion	B	C	IN	£8.05
Bridgeman	Gm	Bridge	B	C	BR	£6.90
Budget	Bs	Micropax	B	C	MP	£7.95
Budget-Multiproduct	Bs	Micropax	B	C	MP	£12.95
Budget-Multiproduct	Bs	Micropax	B	D	MP	£25.00
Bugblaster	Gm	Alligata	B,E	C	SY	£7.95
Bug Bomb	Gm	Virgin Games	B	C	VG	£7.95
Bumble Bee	Gm	Micro Power	B	C	GK	£7.95
Business Game	Ed	Acornsoft	A,B	C	AL	£9.95, £9.20
Bun Fun	Gm	Squirrel Software	A,B	C	SS	£6.50
Caesar the Cat	Es	Mirror	B	C	MR	£6.95
CaLIGNA -	Gm	Golden Challenge	B	C.D	GC	£7.95, 10.00
Canyon	Gm	BBC Pubs	B	C	KB	£10.00
Capitals	Ed	Edsoft	B	C	ES	£5.95
Capitals and Punctuation	Ed	RJE Software	A,B	C	RJ	£4.95
Carbohydrate Metabolism	Ed	Garland Comp.	B	C	JX	£18.24
Careers Analysis	Ed	Arnold-Wheaton	B	D	AW	£155 + VAT
Careers Information	Ed	Arnold-Wheaton	B	D	AW	£45 + VAT
Car Journey	Ed	Heinemann	B	C	HE	£9.25 +VAT
Caplett 1	Ed	Scholar	B	C,D	SC	£7.00, £9.00
Caplett 2	Ed	Scholar	B	C,D	SC	£5.50, £7.50
Carousel	Gm	Acornsoft	B	C	AL	£9.95
Car Race	Gm	Kingfisher	B	C	KF	£6.90
Cashbook Accounts	Bs	Gemini	B	C	GM	£59.95
Cashbook	Do	Micro-Aid	B	C	IZ	£5.95
Cashbook	Do	Micro-aid	A,B	C	IZ	£13.95
Cassette 99	Ed	Ludinski CAL	A,B	C	KA	£5.00
Castaway	Gm	Simonsofy	B	C,D	SI	£8.95
Castle of Riddles	Gm	Acornsoft	B	C	AL	£9.95
Catalog	Bs	Dialog	B	C/D	DG	£19.50
Catalogue	Ut	Baksoft	A,B	C	BK	£4.00
Cat and Mouse	Ed	Kingfisher	A,B	C	KF	£6.90
Cat & Mouse	Gm	Micro Power	A,B	C	GK	£4.95
Catchapple	Ed	Kingfisher	A,B	C	KF	£6.90
Caveman Adventure	Gm	Program Power	B	C	GK	£6.95
Caves of Anoran	Gm	FBC Systems	B	C	FB	£7.00
Cells & Serpants	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	CS	£3.95
Character Orientating	Ut	Cylindrical Software	A,B	C	CS	£3.95
Character Generator	Ut	MP S/W	B	C	JZ	£3.00
Character Generator	Ut	Software for All	B	C	KN	£4.95
Characters	Ut	Computer Concepts	A,B	C	GJ	£6.67
Characters & Envelope 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	Acornoft	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
Children From Space	Ed	A.S.K.	B		AK	£9.95
Childs Play Pack	Ed	Dial	B	C,D	DL	£6.50, £8.00
CHI-Squared	Bs	Micropax	B	C	MP	£7.95
CHI-Squared, contingency tables	Bs	Micropax	B	C	MP	£7.95
Chords	Ed	Aztec	A,B	C	AZ	£6.50
Christmas Carols	Do	Ega Beva	B	C	EB	£9.95
Circle Tutor	Ed	Pee Bee	B	C,D	PB	£9.95, £12.45
Circus	Gm	Digital Fantasia	B	C	NT	£8.95
City Defense	Gm	Bug-BYte	B	C	BB	£7.50
Classification (In)vertebrates	Ed	Scholar	B	C,D	SC	£6.00, £8.00
Claws	Ed	Bryants S/W	A,B	C	HW	£3.75
Clone Ranger	Ut	J.C. Software	B	D	JS	£11.60
Cloze	Ed	GED Software	B	C	GD	£4.50
Cloze Procedure	Ed	Bryants S/W	A,B	C	HW	£4.85
Code Breaker	Gm	Program Power	A,B	C	GK	£4.95
Code-Breaker	Ed	RJE Software	A,B	C	RJ	£4.95
Collectors Catalogue	Do	Acornsoft	B	C	AL	£9.95
Code Race	Ut	Computer Concepts	B	C	GJ	£6.67
Coin Analysis	Bs	Micro-Aid	B	C	IZ	£4.95
Colditz Adventure	Gm	Superior Software	B	C	SE	£7.95
Colossal Adventure	Gm	Level 9 Computing	B	C	CU	£9.90
Colour Snap	Ed	Ega Beva	B	C	EB	£11.95
Comatch	Ed	Clares	A,B	C	CL	£4.95
Commercial Accounts	Bs	Gemini	B	C	GM	£19.95
Commstar	Ut	PACE	B	R	PA	£34.00
Community	Gm	Ixion	B	C	IN	£6.90
Compass	Ed	GED Software	B	C	GD	£4.50
Compendium	Gm	Computercat	B	C	CC	£5.95
Complete Machine Code Tutor	Ed	New Generation	B	C	NG	£14.95
Computr Applications Project	Ed	Addison-Wesley	B	D	AN	£70.00
Connect 4	Gm	Database Software	B	C	NU	£5.90
Conquering Everest	Gm	ASP Software	B,E	C	AS	£6.99
Constellation	Ed	Micro Power	B	C	GK	£6.95
Constellation	Do	Superior	E	C	SE	£7.95
Contours/Places	Ed	Primary	B	C,D	PP	£5.95, £7.95
Co-ordinates	Ed	Primary	B	C,D	PP	£5.95, £7.95
Contract Bridge	Gm	Alligata	B	C	SY	£9.95
Contribution Analysis	BS	Micropax	B	C	MP	£7.95
Cookbook Wizardry	Do	Database Software	B	C	NU	£7.50
Copy Disc	Ut	A.J.	B	C	AJ	£5.95
Corn Cropper	Gm	Cases	A,B,E	C	CE	£6.95
Corporate Climber	Gm	Dynabyte	B,E	C	DB	£7.95
Cosmic Asteroids	Gm	Alligata	B	C	AG	£4.95
Cosmic Combat	Gm	Micro Power	B	C	GK	£6.95
Cosmic Fighters	Gm	Kansas	B	C	KA	£9.50
Cosmic Kidnap	Gm	Superior	B	C	SE	£7.95
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
County (SW/SM)	Ed	Bryants	A,B	C	HW	£4.85
Cowboy Shoot-out	Gm	Micro Power	B	C	GK	£5.95
Cranky	Ed	A.S.K.	B	C	AK	£9.95

Crazy Caves	Gm	Silversoft	B	C	SV	£6.95
Crazy Cut	Gm	R.H. Electronics	B	C	RH	£8.95
Crazy Painter	Gm	Superior Software	B	C	SE	£7.95
Creating a Monster/Word Finder	Ed	Heinemann	B	C	HE	£9.25 + VAT
Creative Graphics	Ut	Acornsoft	B,E	C	AL	£9.95
Cricket	Gm	SJG Soft	B	C	SJ	£7.50
Crime and Detection Quiz	Do	Acornsoft	B,E	C	AL	£12.65
Croaker	Gm	Program Power	B,E	C	GK	£9.95
Crocodiles	Ed	Bryants	A,B	C	HW	£4.85
Crossed Words	Ed	Aztec S/W	A,B	C	IB	£6.50
Crunch	Ed	Oxhey Tutors	B	C	OT	£6.50
C. Rules	Ed	Ed. Soft	B	C	ES	£5.95
Cube Master	Gm	Acornsoft	B	C/AL		£9.95
Curse of the Middle	Gm	Merlin	B	C	MN	£7.95
Curve Stitch Planner	Do	Dial	B	C,D	DL	£4.95, £6.50
Cut 'n' val	Ed	MP Software	B	C,D	MP	£14.50, £17.50
Cybertron Mission	Gm	Micropower	B	C	GK	£7.95
Cylon Attack	Gm	A&F	B	C	GE	£8.00
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	Gnemonica	B	C	GN	£20
Dare Devil Dennis	Gm	Visions	B	C	VI	£7.95
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	AL	£11.90
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
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
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
Disassembler	Ut	Simonsoft	A,B	C	MS	£6.95
Dissassembler	Ut	Micro Power	A,B	C	GK	£5.95
Dissassembler	Ut	Program Direct	A,B	C	NP	£3.00
Dissassembler	Ut	Davansoft	A,B	C	NX	£5.95
Dissassembler	Ut	C J E Microcomputers	A,B	C	NV	£5.00
Disassembler	Ut	A.J.	B	C,D	AJ	£5.95, £7.95
Distances	Ed	Micro-Aid	B	C	IZ	£4.95
Dissembler	Ut	Rainbow S/W	A,B	C	KS	£2.50
Digital X-Word Compiler	Gm	N. Darwood	A,B	C	JB	£6.00

SOFTWARE SUPPLIERS

CX *Contex Computing*
15 Woodlands Close
Cople
Bedford MK44 3UE

DA *Davy Computing Ltd*
Moorcroft House
2 Clarence Lane
Sheffield S3 7UZ

DB *Dynabyte Software*
31 Topcliffe Mews
Wide Lane
Morley
Yorks

DC *D.A.C.C. Ltd*
23 Waverly Road
Hindley
Greater Manchester
WN2 3BN

DD *DDT Software*
Southfield House
11 Liverpool Gardens
Worthing
West Sussex BN11 1RY

DK *DK Tronics*
Unit 2
Shire Hill Industrial Estate
Saffron Walden
Essex CB11 3AX

DG *Dialog*
19 Short's Gardens
London WC2H 9AT

DO *Doctor Soft*
258 Coneygree Road
Peterborough
PE2 8LR

DS *Diamondsoft Ltd*
Cheadle Hulme
Cheadle
Cheshire SK8 5YB

EB *Ebury Software*
National Magazine House
72 Broadwick Street
London W1V 2BP

EG *SESS Ltd*
Central Trading Estate
275-277 Bath Road
Bristol BS4 3EH

EH *Heinemann*
Computers in Education
22 Bedford Square
London

EJ *Logic Systems*
85 Hemingford Road
Cambridge

EL *ECL Software*
29 Richmond Close
Ware
Herts SG12 0EN

ET *Etna Software*
West End House
West End Lane
Marshchapel Lincs

EU *Educare*
139a Sloane Street
London SW1X 9AY

FB *FBC Systems*
10 Castlefields
Main Centre
Derby

FE *Fernleaf Educational*
Fernleaf House
31 Old Road West
Gravesend
Kent DA11 0LH

FL *Flight Deck Software*
25 Halsey Road
Kempston
Beds. MK42 8AP

FM *4MAT Educational Software*
Linden Lea
Rock Park
Barnstaple
Devon EX32 9AQ

FY *Wida Software*
2 Nicholas Gardens
London W5 5HY

GC *Golden Challenge Software*
2-4 Chichester Rents
Chancery Lane
London WC2A 1EG

GD *70 Stoke Road*
Bletchley
Milton Keynes

GE *A&F Software*
83 Hyde Road
Gorton
Manchester M18 7JD

GJ *Computer Concepts*
16 Wayside
Chipperfield
Hertfordshire WD4 9JJ

GK *Micro Power Ltd*
Northwood House
North Street
Leeds LS7 2AA

GM *Gemini*
9 Salterton Road
Exmouth
Devon EX8 2BR

GR *Griffin Software*
285 Ealing Road
Alperton
Wembley
Middlesex
HA0 1HJ

GS *Gaelsett Software*
44 Exeter Close
Stevenage
Herts
SG1 4PW

GY *Huntsman Walk*
Rugeley
Staffs WS15 2SN

HA *Harrison Associates*
Unit 307
16 Brune St
London E1 7NJ

HC *H.C.C.S. Associates*
533 Durham Road
Low Fell
Gateshead
Tyne and Wear NE9 5EY

HE *Heinemann Computers in Education*
Freepost EM17
The Windmill Press
Kingswood
Tadworth
Surrey KT20 6BR

HG *J Hargreaves*
Updown
Pewley Way
Guildford
Surrey

HM *Harris McCutcheon Systems*
40Huntingdon Street
London N1 1HM

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SOFTWARE LISTINGS

Title	Type	Manufacturers	Memory		Software Supplier	Price
Dmove	Ut	FBC Systems	B	C	FB	£12.50
DNA Replication	Ed	Garland Comp.	B	C	JX	£17.65
Dodgy Dealer	Gm	OIC	B	C	OI	£6.50
Dracula Island	Gm	Kansas	B	C	KA	£9.50
Dragon Rider	Gm	Salamander Software	B	C	SA	£7.95
Dragon Quest II	Gm	Bug Byte	B	C	KP	£11.50
Dragon Quest	Gm	Bug Byte	B	C	KP	£11.50
Draughts	Gm	Micro Poer	B	C	GK	£6.95
Draughts/Reversi	Gm	Acornsoft	B,E	C	AL	£9.95, £9.20
Draughts	Gm	Superior	B,E	C	SE	£6.95
Draw	Ut	Micro Power	B,E	C	GK	£9.95
Drawing	Ut	B.B.C.	A,B	C	KB	£10.00
Drawing Pictures and Puzzles	Ed	Ega Beva	B	C	EB	£9.95
Dr. Who: The First Adventure	Gm	BBC Pubs	B	C	KB	£10.00
Dungeon Adventure	Gm	Level 9 Computing	B	C	CU	£9.90
Dynamic Nuclear Magnetic Resonance Spectroscopy	Ed	Microwave	B	C	MW	£3.95
Eagle Empire	Gm	Salamander	B	C	SA	£7.95
Eagle Empire	Gm	Alligata	B	C	SY	£7.95
Early Learning	Ed	B.B.C.	A,B	C	KB	£10.00
Early Numbers	Ed	Bryants S/W	B	C	HW	£4.80
Early Warning	Gm	A&F Software	A,B	C	GE	£6.00
Easycalc	Bs	Zero Software	B	C	AZ	£12.95
Easy Graphics	Ut	Hexagon Software	B	C	HX	£13.50
Easy Times	Ed	Soft Centre	B	C	SN	£6.00
Easywrite	Ed	System Software	B	C	SY	£10.00
Ecological Simulations	Ed	Garland	B	C	JX	£16.50
E.D.G. Graphics Package	Ut	Salamander	B	C,D	SA	£19.95, £24.95
Ed-master	Ed	R. H. Electronics	B	C	RH	£12.95
Educare's 50	Ed	Educare	A,B	C	EU	£7.95
Education (1)	Ed	Microplus	A,B	C	AM	£4.25
Educational (1)	Ed	Golem	A,B,E	CD	OB	£8.00, £10.00
Educational (2)	Ed	Microplus	A,B	C	AM	£5.25
Educational (2)	Ed	Golem	A,B,E	CD	OB	£8.00, £10.00
Education (3)	Ed	Microplus	B	C	AM	£5.25
Edword	Ed	Clwyd Technics	B	R	CL	£38.95
Eiffel Tower	Ed	Chalksoft	B	C	CH	£9.25
Eldorado Gold	Gm	Micro Power	B	C	GK	£6.95
Electric	Ed	Database Software	A,B	C	NU	£5.50
Electricity	Ed	Primary Programs	B	C	PP	£5.95
Electron-Aid	Ut	Dynabyte	E	C	DB	£6.95
Electronic Colouring Book	Do	Addison-Wesley	B,E	C	AN	£9.95
Elem-add and Elem-sub	Ed	Cottage Soft	B	C	CT	£7.50
Empire	Gm	Shards	B,E	C	SH	£6.95
English skills I/II	Ed	Griffin	B,E	C	GR	£11.95
Entrepreneur	Gm	Vulcan	B	C	VC	£7.95
Envelope Generator	Ut	System	B	C	SY	£7.00
Equation Balance	Ed	RJE Software	B	C	RJ	£7.95
Escape From Moonbase Alpha	Gm	Program Power	B,E	C	GK	£7.95
Essential French Verbs	Ed	Carsondale	B	C	CD	£11.50
European Studies	Ed	Aztec S/W	B	C	IB	£6.50
Escape from Pulsar 7	Gm	Digital Fantasia	B	C	NT	£8.95
Exmon	Ut	Beebug	B	CE	BE	£10.00, £23.00
Explorer	Ed	Longman	B	C,D	LM	£9.95, £12.95
Extended Colour Fill Graphics	Ed	Gaelsett Software	B	C	GS	£10.00
Experiments in Artifical Intelligence	Ed	Ganymede Systems	B	C	GY	£9.95
Eye	Ed	Longman	B	C	LM	£14.50
Facemaker	Ed	A.S.K.	B	C	AK	£9.95
Factfile	Ed	Cambridge Micro	B	C,D	CM	£20.08
Factors and Fractions	Ed	Edsoft	B	C,D	ES	£5.95
Fair Share	Ed	Griffin	B,E	C	GR	£9.95
Family Finance	Do	R.H. Electronics	B	C	RH	£12.95
Family Games	Gm	I.J.K. Software	A,B	C	IJ	£4.50
Fantasy Adventure	Gm	Dial	B	C,D	DL	£6.50, £8.00
Fairground	Gm	Superior Software	B	C	SE	£7.95
Fairyland Adventure	Gm	O.K.	B	C	OK	£10.00
Fairytale	Gm	Molimerx	B	C	AJ	£10.06
Fall of Rome	Gm	ASP Software	B	C	AS	£6.99
Feasibility Experiment	Gm	Digital Fantasia	B	C	NT	£10.29
Female Reproductive Cycle	Ed	Garland	B	C	JX	£12.00
Felix and the Fruit Monsters	Gm	Micro Power	B,E	C	GK	£7.95
Felix In The Factory	Gm	Micro Power	B,E	C	GK	£7.95
F For Freddie	Gm	Kansas	B	C	KA	£9.50
Fighter Pilot	Gm	Kansas	B	C	KA	£9.50
File Handler	Ut	Dial	B	C,D	DL	£6.50, £8.00
File Plus	Do	Data tap	B	D	DA	£49.95
Finance Pack	Bs	Dial	B	C,D	DL	£4.95, £6.50
Filer	Bs	Micro Power	A,B,E	C	GK	£8.95
Final Accounts Program	Bs	Gemini	B	C,D	GM	£59.95
Firefight	Ed	Highlight	B	C,D	HI	£6.00, £7.00
First Count	Ed	Scholar	B	C,D	SC	£5.00, £7.50
First Steps in Algebra	Ed	Small School	B	C	SM	£6.95
First Steps with Mister Men	Ed	Mirror	B,E	C	MR	£8.95
Firehawks	Gm	Postern	B	C	PT	£6.95
Fishy Business	Gm	Salamander	B	C	SA	£9.95
Flint's Gold	Gm	Micrograf	B	C,D	MF	£6.95, £9.95
FIZZ BUZZ	Ed	G.E.D. Software	B	C	GD	£4.50
Fizz Buzz	Ed	Bourne	A,B	C	BO	£4.50
Flags	Ed	IJK Software	B	C	IJ	£4.50
Flags	Ed	Micro-Aid	B	C	IZ	£5.95
Flanders	Ed	Focusplan	A,B	C	FP	£5.95
Fletcher's Castle	Ed	Fernleaf	B	C,D	FE	£9.95, £12.95
Flexibase	Dm, Bs	Alligata	B	C	AG	£9.95, £13.95
Flint's Gold	Gm	Micrograf	B	C,D	MF	£6.95, £9.95
Floater	Ed	Cambridge Micro	B	D	CM	£15.00 + 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
French Abroad	Ed	Micro-Aid	B	C	IZ	£7.95
Frenzy	Gm	Persoft	A,B	C	IY	£5.75
Frenzy	Gm	Micro Power	B	C	GK	£7.95
Froggy	Gm	Superior	B	C	SE	£7.95
Frogjump	Gm	Sapphire	B	C	SH	£5.95

Frogger (Machine Code)	Gm	A&F Software	B	C	GE	£8.00
Froglet	Gm	ASP Software	B,E	C	AS	£6.99
Fruit Machine	Gm	Superior Software	B,E	C	SE	£7.95
Fruit Machine	Gm	Bug Byte	B	C	KP	£5.50
Fruit Machine	Gm	Alligata	B,E	C	AG	£5.95
Fruit Machine	Gm	Computersmith	B	C	LC	£5.50
Fruit Machine + Honest Joe	Gm	Beebug	B	C	BE	£7.50
Fruity	Gm	Odyssey	B	C	OG	£3.00
Fun to Learn	Ed	Shards Soft	B	C,D	SH	£6.95, £9.95
Fun Pack	Gm	Sapphire	B	C	SH	£5.95
Fun plot	Ed	Edsoft	B	C	ES	£5.95
Fun Sums	Ed	Kosmos	A,B	C	KM	£4.95
Fun with Numbers	Ed	Golem	B,E	C,D	OB	£8.00, £10.00
Fund With Sorting	Ed	Golem	B,E	C,D	OB	£7.95, £9.95
Fun with Words	Ed	Golem	B,E	C,D	OB	£8.00, £10.00
Fun Games	Gm	B.B.C.	A,B	C	KB	£10.00
Galactic Commander	Gm	Micro Power	B,E	C	GK	£6.95
Galactic Firebird	Gm	Kansas	B	C	KA	£9.50
Galactic Wipeout	Gm	R. H. Electronics	B	C	RH	£8.95
Galaxy Birds	Gm	Superior	B	C	SE	£7.95
Galaxy Wars	Gm	Bug-Byte	B	C	BB	£7.50
Games Compendium B1/2	Gm	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
Game of Logic	Ed	N. Darwood	A,B	C	JB	£8.00
Games of Logic	Gm	Golem	A,B,	C,D	B	£4.95, £6.95
Games of Strategy	Gm	B.B.C.	A,B	C	KB	£10.00
Games Pack II	Gm	Micromail	B	C	OE	£6.75
G.B. Geograph6	Ed	Primasoft	B	C	PR	£6.95
GCE Maths (O) 1/2	Ed	Bryants	A,B	C	HW	£9.50
Genetic Code	Ed	Garland Comp.	B	C	JX	£17.65
Geography Map	Ed	Bryants	B	C	HW	£4.85
Geography France/Spain/Germany/Italy/Belgium/USA/India	Ed	Corona	B	C,D	JY	£6.00, £9.00
German Irregular Verbs	Ed	Carsondale	B	C	CD	£13.80
German Master	Ed	Kosmos	B,E	C	KM	£9.95
Get it Right	Ed	Sulis	B	C	SU	£9.95
Get Set	Ed	Griffin	B,E	C	GR	£9.95
Get the Message	Gm	Dial	B	C,D	DL	£4.95, £6.50
Ghost/Diamonds	Gm	A Lane	A,B	C	OC	£3.00
Ghost Maze	GM	Software for All	B	C	HN	£6.95
Ghouls	Gm	Micro Power	B	C	GK	£7.95
Gideon's Gamble	Gm	Superior Software	B	C	SE	£7.95
Glooper	Gm	Microplus	B	C	AM	£6.95
Glycolysis - TCA Cycle	Ed	Garland	B	C	JX	£15.00
Gnasher	Gm	Superior	B	C	SE	£6.95
Gobbler	Gm	M G B	B	C	MG	£5.45
Golf	Gm	Microplus	B	C	AM	£4.95
Golf	Gm	Computersmith	B	C	LC	£5.50
Golforama	Gm	Dial	B	C,D	DL	£4.95, £6.50
Grand Prix	Gm	Software for All	B	C	HN	£5.95
Grand Prix	Gm	Microplus	A,B	C	AM	£4.25
Granny's Garden	Ed	4MAT	B	C,D	FM	£10.00, £12.00
Graph Capers Senior	Ed	Gem	B	C	GM	£8.50
Graphs	Ed	Bryants	A,B	C	HW	£4.85
Graphics Aid Pack	Ed	Microwave NW	B	C	MW	£8.95
Graphito	Ut	Addison-Wesley	B	C	AN	£21.95 + VAT
Grafix	Ut	Williams	B	D	WI	£10.00
Golf	Gm	Bryants S/W	B	C	HW	£4.88
Golf	Gm	Bug Byte	B	C	BB	£7.00
Golf	Gm	Computersmith	B	C	LC	£5.50
Gomoku	Gm	Micro Power	A,B	C	GK	£3.95
Graphics Package	Ut	Salamander 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

SOFTWARE SUPPLIERS

HN Hutchinson
17-21 Conway Road
London W1P 6JD

HW Bryants (Educational) Software
1 The Hollies
Chalcraft Lane
North Bersted
Bognor Regis PO21 5SX

HX Hexagon Software
17 Straits Road
Gornal
Dudley
West Midlands
DY3 2UR

IB Aztec Software
25 St Mark Road
Deepcar
Sheffield
S30 5TS

IC Ian Copestake
23 Connaught Crescent
Brookwood
Woking
Surrey
GU24 0AN

IF Electronics Applied
4 Dromore Road
Carrickfergus
County Antrim BT38 7PJ

IJ I J K Software
9 King Street
Blackpool
Lancs

IN Ixion Software
10 The Crescent
Lympsham
Weston-Super-Mare
Somerset BS24 0BN

IS Software Invasion
50 Elborough Street
Southfields
London

IU Aardvark Software
15 Queensberry Avenue
Hartlepool
Cleveland TS26 9NW

IV James Hager
7 Basset Street
Camborne
Cornwall TR14 8SW

HS Simon Hessel Software
15 Lytham Court
Cardwell Crescent
Bershire

IX Mayday Software
181 Portland Crescent
Stanmore
Middlesex HA7 1LR

IY Persoft
Freepost
Baildon
Shipley
West Yorkshire BD17 5SX

IZ Micro Aid
25 Fore Street
Praze Camborne
Cornwall TR14 0JX

JL Joe the Lion
213/215 Market Street
Hyde
Cheshire
SK14 1HF

JS J.B. Software
57 Meadow Crescent
Carleton
Poulton-le Fylde
Lancashire
FY6 7QX

JA Hexagon Software
17 Cambridge Grove
Otley

JB N Darwood Ltd
Halfacres
Stroud
Petersfield
Hampshire GU32 3PJ

JC Futura Software
63 Lady Lane
Chelmsford
Essex CM2 OTQ

JS J.C. Software
124 Woodlands Way
Southwater
West Sussex
RH13 7DR

JX Garland Computing
35 Dean Hill
Plymouth PL9 9AF

JY Corona Software
Corona House
21 Tennyson Avenue
London E11 2QN

JZ MP Software & Services
165 Spital Road
Bromborough
Merseyside L62 2AE

KA Kansas City Systems
Unit 3
Sutton Springs Wood
Chesterfield S44 5XF

KB BBC Publications
British Broadcasting Corporation
35 Marylebone High Street
London W1M 4AA

KF Kingfisher Computer Services
Durley Lane
Keynsham
Bristol BS18 2AQ

KH Superior Software
69 Leeds Road
Bramhope
Leeds

KM Kosmos
1 Pilgrims Close
Harlington
Dunstable
Bedfordshire
LU5 6LX

KN Software for All
72 North Street
Romford
Essex

KU Kudusoft
130 Main Street
Tweedmouth
Berwick-upon-Tweed
TD15 2AW

LA Ludinski Computer-Assisted Learning
24 Avondale Avenue
Staines
Middlesex

CONTINUED OVER

SOFTWARE LISTINGS

Title	Type	Manufacturers	Memory		Software Supplier	Price
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	Gm	MP S/W	B	C	JZ	£4.00
Happy Letters	Ed	Bourne	B,E	C,D	BO	£8.97, £10.98
Happy Numbers	Ed	Bourne	B,E	C,D	BO	£8.97, £10.98
Harmony	Ut	Doctor Soft	B	C	DS	£6.95
Heist	Gm	Softspot	B	C	SF	£6.95
Helicopter Rescue/Tunnel/ Roadrace	Gm	A Lane	A,B	C	OC	£4.00
Hell Driver	Gm	Micro Power	B,E	C	GK	£7.95
Hide and Seek	Ed	A.S.K	B	C	AK	£9.95
History Quiz	Do	Acornsoft	B,E	C	AK	£12.65
Hitch Hiker	Gm	Computer Concepts	B	C	GJ	£7.80
Home Accounts	Bs	Harris	B	D	HM	£28.75
Home Accounts	Do	Diamondsoft	B	C	DS	£14.95
Home Accounts	Bs	Gemini	B	C	GM	£19.95
Home Accounts	Do	Persoft	B	C	IY	£12.50
Home Finance	Do	B.B.C.	A,B	C	KB	£10.00
Hooked on Numbers	Ed	Acornsoft	B	C	AL	£9.95
Hoop-La	Ed	Soft Centre	B	C	SN	£6.00
Hopper	Gm	Acornsoft	B,E	C,R	AL	£9.95, £9.20
Horror Castle	Gm	A&F	B	C	GE	£8.00
Horserace	Gm	Dynabyte	B,E	C	DB	£6.95
Hot Cakes	Ed	Private Tutor	B	C,D	PT	£7.95, £8.95
Housekeeper	Ed	Heinemann	B	C	HE	£9.25 + VAT
Howszat	Gm	A&F	B	C	GE	£6.90
Human Blood Groups	Ed	Garland	B	C	JX	£15
Hunchback	Gm	Superior Software	B	C	SE	£7.95
Hydraulics	Ed	Database Software	A,B	C	NU	£5.50
Hyperdrive	Gm	IJK	B	C	IT	£6.50
Identikit	Ed	Stell	B,E	C	ST	£7.95
'...I Do'	Do	Acornsoft	B	C	AL	£12.65
Indentikit/Word Finder	Ed	Heinemann	B	C	HE	£9.25 + VAT
Index	Ut	Microwave NW	B	C	MW	£6.95
Index Numbers-Basket	Bs	Micropax	B	C	MP	£7.95
Index Numbers-Changer	Bs	Micropax	B	C	MP	£7.95
Indexit	Ut	Williams	B	D	WI	£10.00
Inhabitant	Ed	Longman	B	C,D	LM	£9.95, £12.95
Inheritance	Gm	S.W. Hessel S/W	B	C	IW	£5.95
Inheritance	Ed	Garland Comp.	B	C	JX	£34.70
Inkosi	Gm	Chalksoft	B	C	KT	£5.95
Intergalactic Trader	Gm	Micro Power	B,E	C	GK	£8.95
International Special Agent	Gm	O.K.	B	C	OK	£10.00
Intervention commercial	Bs	System	B	C	SY	£345.00
Intervention educational	Ed	System	B	C	SY	£115.00
In the Grip of Ice	Gm	O.K.	B	C	OK	£10.00
Intro	Ed	Clares	A,B	C	CL	£7.95
Introducing Map Skills 1/2	Ed	Cambridge Micro	B	C,D	CM	£13.95, £1.62
Introduction to Microcomputing in Teaching	Ed	Hutchinson	B	C	HN	£17.25
Invaders	Gm	Software Invasion	B	C	IS	£6.95
Invaders	Gm	Superior Software	B	C	SE	£7.95
Invaders	Gm	Software for All	A,B	C	KN	£6.95
Invaders	Gm	Hexagon S/W	A,B	C	JA	£6.00
Invasion	Gm	ASP Software	B,E	C	AS	£6.99
Invisible Man	Ed	Chalksoft	B	C	KT	£5.95
Invoicing	Bs	Acornsoft	B	D	AL	£24.95
Invoices and Statements	Bs	Gemini	B	C	GM	£19.95
Janeplus	Ed	Longman	B	C	LM	£14.50
Jars	Ed	Acornsoft	B	C	AL,	£11.90
JCB Digger	Gm	Acornsoft	B	C	AL	£9.95, £11.50
Jet Power Pack	Gm	Micro Power	B	C	GK	£7.95
Jigsaw Puzzle	Ed	Ega Beva	B	C	EB	£9.95
Jigsaw & Sliding Puzzles	Ed	Golem	B,E	C,D	OB	£7.95, £9.95
Johnny Reb	Gm	Lothlorien	B	C	LO	£6.95
J.R.	Gm	Software for All	B	C	KN	£6.95
Jumbles	Ed	Bryants S/W	B	C	HW	£4.88
Jumbo	Gm	Molimerx	B	C	AJ	£17.25
Jungle Ambush	Gm	Kindsoft	B	C	KU	£6.50
Jungle Journey	Ed	Trekkasoft	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
Laddis	Ut	Silversoft	B	C	SV	£6.95
Labyrinths of La Coshe	Gm	Micro Power	B	C	GK	£7.95
Ladder Maze	Gm	Superior	B	C	SE	£6.95
Landfall	Gm	Virgin Games	B	C	VG	£7.95
Language Tutor	Ed	Rainbow Research	B	C	RR	£5.00
La Princesse (French)	Ed	Aztec S/W	B	C	IB	£6.50
Language-Lab	Ed	M and M Software	A,B	C	MM	£7.50
Landfall & Serpent	Gm	GT Software	B	C	JW	£6.50
Laser Command	Gm	Micro Power	B,E	C	GK	£7.95
Laser Letters	Ed	Shards	B	C,D	SH	£6.95, £9.95
Laser Zone	Gm	Salamander	B	C	SA	£7.95
Las Vegas	Gm	R.H. Electronics	B	C	RH	£8.95
Launching Logic	Ed	Shiva	B	C	SV	£14.95
Learn Addition	Ed	ABC Primary	B	C	AB	£6.50
Learn Subtraction	Ed	ABC Primary	B	C	AB	£6.50
Leap Frog	Gm	IJK Software	B	C	IJ	£7.50
Learning Compendiun I	Ed	Ega Beva	B	C	EB	£11.95
Learning Compendiun 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	Micorpax	B	C	MP	£7.95

Lines and Angles	Ed	4MAT	B	C	FM	£5
Link-4-Plus	Gm	ABC Software	A,B	C	KR	£6.95
Lisp	Ut	Acornsoft	B,E	C,R	AL,	£16.85, £16.10
Lisp	Ut	Aztec	B	C	AZ	£16.85
Logo-Forth	Ut	H.C.C.S.	A,B	E	HC	£59.00
Logo 2	Ut	Computer Concepts	B	C	GJ	£10.00
Longitudinal Waves	Ed	Heinemann	B	C	EH	£12.50
Looking at Graphs	Ed	Heinemann	B	C	HE	£9.25 + VAT
Looking at Scales	Ed	Heinemann	B	C	HE	£9.25 + VAT
Look it up	Ed	GED Software	B	C	GD	£4.50
Look Sharp!	Ed	Mirror	B,E	C	MR	£7.95
Logo Challenge	Ed	Addison-Wesley	B	C,D	AN	£29.95, £37.95
Lorry/Farm	Ed	Primary	B	C,D	PP	£5.95, £7.95
Lords of Time	Gm	Level 9	B	C	CU	£9.90
Lost City	Gm	Superior Software	B	C	SE	£7.95
Lost In Space	Gm	Salamander	B	C	SA	£9.95
Lunar Rescue	Gm	Alligata	B	C	AG	£7.95
L Trap	Gm	Gem	B	C	GM	£8.50
Lunar Lander	Gm	A&F Software	B	C	GE	£6.90
Mach 1	Ut	Gnomonica	B	E	GN	£39.95
Magic Adventure	Gm	Kansas	B	C	KA	£8.50
Mailer	Ut	ASD Ltd	B	C	AS	£5.75
Mailing List	Bs	Gemini	B	C	GM	£19.95
Mailing	Bs	Micro-Aid	A,B	C	IZ	£7.95
Mailing System	Bs	Acornsoft	B	D	AL	£24.95
Map Rally	Ed	Bourne	B,E	CD	BO	£8.97, £10.98
Making Ends Meet	Ed	Cambridge Micro	B	C,D	CM	£15.00 + VAT
Manage	Gm	Cases	B	C	CE	£6.95
Mansion Murders	Gm	Challenge Games	B	C	CG	£6.95
Mapping Skills	Ed	Heinemann	B	C	HE	£9.25 + VAT
Mark Book	Ed	Carvells	A,B	C	CA	£5
Mark Book	Ed	BBC	A,B	C	KB	£15
Martian Attack	Gm	Micropower	B	C		£7.95
Mass	Ut	DDT	B	R	DT	£34.95
Masterbard Hamlet	Ed	Sulis	B	C	SU	£12.95
Master Copier	Ut	Aztec S/W	A,B	C	IB	£6.50
Masterfile	Ut	Beebug	B	CD	BE	£10.00, £19.00
Mastermind	Gm	Micro Power	A,B	C	GK	£3.95
Matchup	Ed	Edsoft	B	C	ES	£5.95
Mathgrid	Ed	Soft Centre	B	C,D	SN	£8.00, £10.00
Maths Invaders	Ed	Stell	B,E	C	ST	£7.95
Mathskills I/II	Ed	Griffin	B,E	C	GR	£11.95
Maths Man	Ed	GED Software	B	C	GD	£4.00
Maths Pack	Ed	Ega Beva	B	C	EB	£11.95
Maths Pack	Ed	Dial	B	C,D	DL	£4.95, £6.50
Maths Topics 1	Ed	Cambridge Micro	B	C,D	CM	£13.95 + VAT
Maths Topics 2	Ed	Cambridge Micro	B	C,D		£15.00 + VAT
Mathspell	Ed	Diamondsoft	B	C	DS	£7.95
Maths Topics 1	Ed	CUP	B	C	UP	£18
Maths Translation	Ed	Corona S/W	B	C	JY	£6.00
Maths Tutors, Graphs	Ed	Salamander	B,E	C	SA	£9.95
Maths Tutors, Vectors	Ed	Salamander	B,E	C	SA	£14.95
Matching	Ed	Clares	A,B	C	CL	£5.95
Maze Invaders	Gm	Micro Power	B	C	GK	£4.95
Maze Man	Gm	C J E Microcomputers	B	C	NV	£6.00
Micro Budget	Do	Micro Power	A,B	C	GK	£6.95
Meditor	Ut	MED	B	C	MD	£9.50
Medmon	Ut	MED	A,B	C	MD	£9.95
Membership Manager	Do	Acornsoft	B	C	AL	£9.95
Memocalc	Bs	Microaid	B	C	IZ	£9.95
Mental Arithmetic Tests	Ed	Small School	B	C	SM	£6.95
Mental Maths and Place Value	Ed	Edsoft	B	C,D	ES	£4.95
Mercy Mission to Mars	Gm	D.A.C.C.	B	C	DC	£5.95
Merlins Castle	Ed	Pumpkin	B	C	PU	£5.00
Meteors	Gm	Acornsoft	B,E	C	AL	£9.95
Metrics (5)	Ed	Chalksoft	B	C	KT	£9.95
Microbial Pop. Dynamics	Ed	Microwave NW	B	C	MW	£7.00
Microbug	Ed	Arnold-Wheaton	B	C,D	SY SW	£15.00 + VAT

SOFTWARE SUPPLIERS

LC *Computersmith*
40 Greenfields Avenue
Bromborough
Wirral
Merseyside L62 6DD

LM *Longman Group*
Longman House
Burnt Mill
Harlow
Essex

LO *Lothlorien*
56a Park Lane
Poynton
Cheshire SK12 1AE

MA *MP Software and Services*
165 Spital Road
Bromborough
Merseyside L62 2AE

MB *Microbyte Software*
Freepost
Newquay TR7 2BR

MD *MED*
640 Melton Road
Thurmaston
Leics

MI *Microgame Simulations*
73 The Broadway
Grantchester
Cambridge
CB3 9NQ

MG *MGB Software Support*
52 Barley Croft
Harlow
Essex

MK *David McKeran*
23 Warwick Drive
East Herrington
Sunderland
Tyne and Wear

MM *M and M Software*
1391 Leek Road
Abbey Hulton
Stoke-on-Trent
Staffs ST2 8BW

MN *Merlin Computer Products*
18 Mansel Street
Swansea SA1 5SG

MO *Micromode*
32 West End Avenue
Gatley
Cheshire

MP *Micropax*
38 Garrick Green
Old Catton
Norwich
NR6 7AN

MS *Musicsoft*
12 Fallowfield
Ampthill
Beds

MW *Microwave NW*
24 Belford Road
Stretford
Manchester M32 0DL

NC *National Extension College*
18 Brooklands Avenue
Cambridge

NG *New Generation Software*
The Brooklands
15 Sunnybank
Lyncombe Vale
Bath BA2 4NA

NO *Number One Systems*
9a Crown Street
St. Ives
Huntingdon
Cambs. PE17 4EB

NP *Program Direct*
37B New Cavendish Street
London W1M 8JR

NR *Foilkade*
Dept PR14
66 Littledean
Yate
Bristol BS17 4UQ

NT *Digital Fantasia*
24 Norbreak Road
Norbreck
Blackpool

NU *Database Software*
97 Defoe Drive
Park Hill
Stoke-on-Trent

NV *CJE Microcomputers*
25 Henry Avenue
Rustington
West Sussex BN16 2PA

NW *Eduquest*
Thames Avenue
Windsor
Berkshire SL4 1QP

NX *Davansoft*
1 Delapoer Drive
Haverfordwest
Dyfed SA61 1HX

OA *Oakleaf Computers Ltd*
121 Dudley Road
Grantham
Lincs

OA *Anirog Computers*
26 Balcombe Gardens
Horley
Surrey

OB *Golem Ltd*
77 Qualitas
Bracknell
Berkshire RG12 4QG

OC *A Lane (Software)*
12/316 Seaside
Eastbourne
East Sussex BN22 7RH

OE *Micromail*
PO Box 34
Leighton Buzzard LU7 8SJ

OG *Odyssey Software*
8 Greenbrook Avenue
Hadley Wood
Barnet
Herts EN4 0LS

OH *Edu-CAL*
28 Ingersoll Road
Shepherds Bush
London W12 7BD

OK *O.K. Products*
65 Rainsborowe Road
Colchester
Essex C02 6JU

OP *Optima Software Ltd*
36 St. Petersgate
Stockport SK1 1HL

OT *Oxhey Tutors*
19 Tudor Walk
Watford
Herts. WD2 4NY

CONTINUED OVER

SOFTWARE LISTINGS

Title	Type	Manufacturers	Memory		Software Supplier	Price
Micro Man	Gm	Pro S/W	B	C	LD	£8.00
Micro Maths	Ed	LCL	A,B	C	KA	£24.50
Micros in Classroom 1-5	Ed	Longman	B	C,D	LM	£20.00 each
Micromon	Ut	Molimerx	B	C,R	MO	£14.00, £28.00 + VAT
Middle Kingdom	Gm	Pro Software	A,B	C		£7.95
Microtext	BS	Acornsoft	B	C	AL	£49.85
Microtype	Ed	Kansas	B	C	KA	£12.50
Micros in Maths Classroom	Ed	Longman	B	C,D	LM	£26.00 + VAT
Million Mazes	Gm	Ludinski	B,E	C	KA	£6.50
Mined Out	Gm	Quicksilva	B	C	QS	£6.95
Miner	Gm	Ixion	B	C	IN	£6.90
Minefield	Gm	Eduquest	A,B	C	NW	£5.95
Minefield	Gm	A&F Software	A,B	C	GE	£6.00
Missile Base	Gm	Acornsoft	B	C	AL,	£9.95
Missile Control	Gm	C J E Microcomputers	B	C	NV	£9.00
Missing Signs	Ed	Acornsoft	A,B	C	AL	£11.90
Missile Strike	Gm	Superior	B	C	SE	£7.95
Missing Length	Ed	Scholar	B	C,D	SC	£6.50, £8.50
Mission Impossible	Gm	Aztec S/W	A,B	C	IB	£6.50
Mitosis	Ed	Garland	B	C	JX	£15
Mixed Games	Gm	I.J.K. S/W	A,B	C	IT	£3.95
MMaths	Ed	Ed. Soft	B	C	ES	£4.95
Model A Invaders	Gm	I.J.K. S/W	A,B	C	IT	£4.95
Model B Invaders	Gm	I.J.K. S/W	B	C	IT	£6.95
Moli-Tool	Ut	Molimerx	B	R	MO	£28.00 + VAT
Moments + Van	Ed	RJE Software	B	C	RJ	£4.95
Monaco	Gm	Alligata	B	C	SY	£7.95
Money Box	Ed	Bryants	A,B	C	HW	£4.85
Moneyplus 1-4	Ed	Fernleaf	B	C,D	FE	£35.95
Monster Maths	Ed	Shards	B	C,D	SH	£6.95, £9.95
Monster Maze	Ed	Kingfisher	A,B	C	KF	£6.90
Monsters	Gm	Acornsoft	B,E	C	AL	£9.95, £9.20
Monsters and Giants	Ed	Longman	B	C,D	LM	£9.95, £12.95
Monster Battles	Gm	Bryants S/W	B	C	HW	£4.80
Moon Mission	Gm	Superior	B	C	SE	£7.95
Moon Raider	Gm	Micro Power	B,E	C	GK	£7.95
Morse Code	Ed	Philip Dodderidge	B	C	PD	£6.50
Morse Code Fun	Ed	Aztec	A,B	C	AZ	£3.00
Moving Molecules	Ed	C.U.P	B	C	CP	£13.95
Mr T's Alphabet Games	Ed	Ebury	B	C	EB	£9.95
Mt T's Measuring Games	Ed	Ebury	B	C	EB	£9.95
Mr T's Money Box	Ed	Ebury	B	C	EB	£9.95
Mr T's Number Games	Ed	Ebury	B	C	EB	£9.95
Mr T's Shape Games	Ed	Ebury	B	C	EB	£9.95
Mr T Tells The Time	Ed	Ebury	B	C	EB	£9.95
Multi-Aid	Ut	Dynabyte	A,B	C	DB	£7.95
Multifile	Bs	Bug Byte	A,B	C	BB	£25.00
Multiforth 83	Ut	Skyware	B	R	SK	£40.00 + VAT
Multiple Choice	Ed	Eduquest	B	C	NW	£25.00
Multiply and Divide	Ed	Cottage Soft	A,B	C	CT	£7.50
Multitest	Ed	System	B	C,D	SY	£14.95
Munchyman	Gm	Micro Power	A,B	C	GK	£5.95
Music Tutor	Ed	Ed. Soft	B	C	ES	£9.95
Music	Do	B.B.C.	A,B	C	KB	£10.00
Music Editor	Ed	System	B	C	SY	£9.00
Music Maker	Gm	Rainbow S/W	A,B	C	KS	£3.50
Music Synthesiser	Ut	Bug-Byte	B	C	BB	£9.50
Music Master	Ed	Merlin	B	C	MN	£6.95
Music Processor	Gm	Quicksilva	A,B	C	QS	£14.95
Music Quiz	Do	Acornsoft	B	C	AL	£12.65
Musictools 1	Ut	Musicsoft	B	C	MS	£5.75
Musical Numbers	Ed	Bryants S/W	B	C	HW	£4.88
Musical Number Box	Gm	Bryants S/W	A,B	C	HW	£3.75
Mutant Invaders	Gm	I.J.K. S/W	A,B	C	IT	£5.95
MX 80 Type 3 Screen Dump	Ut	Software for All	A,B	C	KN	£6.95
My Mathematical Self	Ed	Heinemann	B	C	HE	£9.25 + VAT
Mystery of the Jowa Star	Gm	Shards	B,E	C	SH	£7.95
1914	Ed	Cambridge Micro	B	C,D	CM	£15.00 + VAT
Nominal Ledger	Bs	Micropower	B	C	GK	£7.99
Note Invaders Package	Ed	Chalksoft	B	C	CH	£9.25
Number Balance	Ed	Acornsoft	A,B	C	AL, GA	£11.90
Networks-Basic	Bs	Micropax	B	C	MP	£12.95
Networks-Pert.	Bs	Micropax	B	C	MP	£17.95
Networks-Big Part	Bs	Micropax	B	D	MP	£75.00
Number Bond	Ed	Primary Programs	B	C	PP	£3.95
Number Chaser	ED	A.S.K	B	C	AK	£9.95
Number Fun	Ed	Griffin	B	C	GR	£9.95
Number Lang	Ed	Dial	B	C,D	DL	£4.95, £6.50
Number Puzzler	Ed	A.S.K	B	C	AK	£9.95
Number Gulper	Ed	A.S.K	B	C	AK	£9.95
Number Rally	Ed	Longman	B	C	LM	£9.95
Number Skills 0-20	Ed	Longman	B	C	LM	£9.95
Number Skills 0-999	Ed	Longman	B	C	LM	£9.95
Nursery Rhymes	Ed	Ega Beva	B	C	EB	£9.95
Neanderthal Man	Gm	Alligata	B	C	SY	£7.95
Negadd & Negmin	Ed	Scholar	B	C,D	SC	£7.00, £9.00
Nemesis	Gm	Micro Power	B	C	GK	£7.95
Neutron	Gm	Superior	B	C	SE	£6.95
Night Sky	Do	Bridge	B	C	BR	£9.90
Number	Ed	Edsoft	B	C,D	ES	£4.95
Numberfun	Ed	Griffin	B,E	C	GR	£9.95
Numerology	Ed	Pumpkin	A,B	C	PU	£5.00
Odds on Geography	Ed	Dial	B	C,D	DL	£4.95, £6.50
Odds on Inventors	Ed	Dial	B	C,D	DL	£4.95, £6.50
Odds on Monarchs	Ed	Dial	B	C,D	DL	£4.95, £6.50
Odds on Musicians	Ed	Dial	B	C,D	DL	£4.95, £6.50
Odds on Writers	Ed	Dial	B	C,D	DL	£4.95, £6.50
Oblivion	Gm	Bug-BYte	B	C	BB	£7.50
Old Father Time	Gm	Bug-Byte	B	C	BB	£9.50
Oil	Gm	Computersmith	B	C	LC	£5.50
Ollie Octopus' Sketchpad	Ed	Storm	B	C,D	SX	£6.05, £9.95
Omega Probe	Gm	Optima	B	C	OP	£8.95
One to Nine	Ed	Acornsoft	B	C	AL	£9.95
1-2-3 Snap	Ed	Ega Beva	B	C	EB	£11.95
Open Evening Timetable	Ed	A.J.	B	C,D	AJ	£14.95, £19.95
Optimon	Ut	Optima	B	C	OP	£9.95
Optics	Ed	Hutchinson	B	C	HN	£18.40
Options	Ed	System	B	C	SY	£23.00
Options Timetable	Ed	A.J.	B	C,D	AJ	£14.95, £19.95
Order Processing	Bs	Acornsoft	B	D	AL	£24.95
O.S. Quiz	Ed	Arnold-Wheaton	B	C	AW	£6.00 + VAT
Oscilloscope	Ed	RJE Software	B	C	RJ	£6.95
Othello	Gm	Computer Concepts	A,B,E	C	GJ	£8.95
Othello	Gm	Computercat	B	C	CC	£8.95
Othello	Gm	Sapphire	B	C	SH	£5.95
Paintbox	Ut	Beebug	B	C,D	BE	£10.00, £12.00
Paintbox	Do	Oakleaf	B	C	OA	£9.95
Painter	Gm	A & F	B	C	GE	£8.00
Painting	Ut	BBC	A,B	C	JB	£6.0
Paras	Gm	Lothlorien	B	C	LO	£6.95
Pareto Analysis	B	Micropax	B	C	MP	£7.95

Parity	Ed	N. Darwood	A,B	C	JB	£10.00
Parts of a Sentence	Ed	Scholar	B	C,D	SC	£5.00, £7.00
Pascal	Ed	Chalksoft	B	C	KT	£5.95
Passit Transformations	Ed	Edsoft	B	C	ES	£5.95
Past to Present	Ed	Heinemann	B	C	HE	£9.25 + VAT
Payroll	Bs	Micro-Aid	B	C	IZ	£17.95
Peeko Computer	Bs	Acornsoft	A,B	C	AL	£9.95, £9.20
Peggit	ED	Ed. Soft	B	C	ES	£5.95
Password	Ed	MP Software	B	C,D	MP	£11.00, £14.00
Pengwyn	Gm	Postern	B	C	PT	£6.95
Pansion	Bs	Micro-Aid	B	C	IZ	£4.95
Pentiles	Ed	Silverlind	B	C	SL	£6.95
Percentages	Ed	Scholar	B	C,D	SC	£5.00, £7.00
Percy Penguin	Gm	Superior	B,E	C	SE	£7.95
Perseus and Andromeda	Gm	Digital Fantasia	B	C	NT	£10.29
Personal Accounts	Do	Kansas	B	C	KA	£10.50
Personal Money Management	Do	Acornsoft	B,E	C	AL	£11.90, £11.50
Pettigrews Diary	Gm	Shards	B,E	C	SH	£7.95
Pharoah's Tomb	Gm	A&F Software	B	C	GE	£8.00
Philosopher's Quest	Gm	Acornsoft	B	C	GA	£9.95
Physics	Ed	Micro Power	A,B,E	C	GK	£6.95
Picture Maths	Ed	A J Visions	B	C	AV	£9.95
Picfile	Ed	Cambridge Micro	B	C,D	CM	£20.08
Picture Spell	Ed	GED Software	B	C	GD	£5.00
Pieman	Gm	Musicsoft	B	C	MS	£3.75
Pinball	Gm	Microbyte	B	C	MB	£5.95
Perspective	Ut	Aztec	B	C	AZ	£6.50
Picasso GS	Ut	Odyssey	B	C	OG	£4.50
Picsave	Ut	Hexagon S/W	A,B	C	JA	£6.00
Pick-a-Word	Ed	Ega Beva	B	C	EB	£11.95
Picture Maker	Ut	Acornsoft	B,E	C	AL	£9.95, £9.20
Picture Maths	Ed	A.J.	B	C,D	AJ	£9.95, £12.95
Picture Puzzles	Gm	Ludinski	B,E	C	KA	£6.50
Pirate	Ed	Chalksoft	B	C	CH	£9.25
Planes	Gm	A&F	B	C	GE	£8.00
Planetarium	Ed	Superior	B	C	SE	£7.95
Planet Invaders	Gm	Merlin	B	C	MN	£7.95
Planetfall	Gm	ASP Software	B,E	C	AS	£11.45
Planetoid	Gm	Acornsoft	B	C	AL	£9.95
Play With Words	Ed	Pee Bee	B	C,D	PB	£8.50, £11.00
Plegaron People Eaters	Gm	R. H. Electronics	B	C	RH	£8.95
Plotter	Ed	Dial	B	C,D	DL	£6.50, £8.00
Plunder	Gm	Cases	B	C	CE	£6.95
Population Growth	Ed	C.U.P.	B	C	CP	£13.95
Poker Dice	Gm	Micro Power	B	C	GK	£5.95
Powerboat Race	Gm	Futura S/W	B	C	JC	£7.95
Polar Traveller	Ed	Trekkasoft	B	C,D	TR	£5.50
Polaris	Gm	Bug Byte	B	C	KP	£5.50
Polygon Tutor	Ed	Pee Bee	B	C,D	PB	£7.50, £10.00
Pontoon	Gm	M and M Software	B	C	M	£5
Pool	Gm	Dynabyte	B,E	C	DB	£7.95
Population Growth	Ed	Cambridge Micro	B	C,D	CM	£13.95 + £1.62
Position	Gm	Micro Power	B,E	C	GK	£6.95
Procaid	Ut	Micro Aid	A,B	C	IZ	£3.45
Procflush	Ut	Micro-Aid	A,B	C	IZ	£1.00
Procvar	Ut	Micro-Aid	A,B	C	IZ	£1.95
Proteanse	Gm	D.K. Tronics	B	C	DK	£6.95
Primary Art	Ed	Alligata	B,E	C	SY	£7.95
Primary Time	Ed	Alligata	B,E	C	SY	£7.95
Princess	Gm	Aztec S/W	A,B	C	IB	£6.50
Progo	Ed	Edsoft	B	C,D	ES	£8.95, £10.50
Protractor Tutor	Ed	Pee Bee	B	C,D	PB	£7.80, £10.30
Pub games/Picasso package	Gm	Starsoft	B	C	SR	£9.95
Punc-Man	Ed	Chalksoft	B	C	KT	£7.95
Punction/Word Finder	Ed	Heinemann	B	C	HE	£9.25 + VAT
Punctuation	Ed	Bryants S/W	B	C	HW	£4.88
Purchasing	Bs	Acornsoft	B	D	AC	£24.95
Putting Numbers In Order	Ed	Scholar	B	C,D	SC	£7.00, £9.00

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PD Philip Dodderidge
4 Grange Close
Woodford Green
Essex IG8 9JS

PP Primary Programs
Claypits
Debden Road
Saffron Walden
Essex CB11 3JS

PR Primasoft
2 Spinney Close
Glossop
Derbyshire

PS Psion Ltd
2 Huntsworth Mews
Gloucester Place
London NW1 6DD

PT Postern Ltd
PO Box 2
Andoversford
Cheltenham
Glas, GL54 5SW

PV Private Tutor
29 Holloway Lane
Chesham Bais
Amersham
Bucks

QS Quicksilva Ltd
Palmerston Park House
13 Palmerston Road
Southampton SO1 1LL

QT Qualitysoft
4 James Close
Bridgend
Glamorgan CF32 9SJ

RA Ratco Software
3/177 College Road
Moseley
Birmingham B13 9LJ

RH R. H. Electronics
Chesterton Mill
French's Road
Cambridge CB4 3NP

RJ RJE Software
143 Montague Road
Leytonstone
London E11 3EW

RO Romik Software
272 Argyle Avenue
Slough
SL10 4HE

RR Rainbow Research
288 High Street
Ponders End
Enfield EN3 4HF

RS Redshift
12c Manor Road
Stoke Newington
London N16

SA Salamander Software
17 Norfolk Road
Brighton
East Sussex
BN1 4AA

SC Scholar Soft
Coniseliffe
Woolsington Gdns
Woolsington
Newcastle Upon Tyne
NE13 8AP

SC Screenplay
134 St. Vincent Street
Glasgow

SC Starcade
2 Elworthy Avenue
Liverpool L26 7AA

SE Superior Software
69 Leeds Road
Bramhope
Leeds

SF Softspot
29 South Crescent
Prittlewell
Southend
Essex SS2 6TB

SH Shards Software
189 Eton Road
Ilford
Essex IG1 2UQ

SH Shumwari Associates
12 Marlin Court
Marlow SL7 2AJ

SI Simonsoft
25 Tatham Road
Abingdon
Oxon OX14 1QB

SJ S.J. Grist
127 Waxwell Lane
Pinner
Middlesex

SK Skywave Software
73 Curzon Road
Boscombe
Bournmouth BH1 4PW

SL Silverlind Ltd
156 Newton Rd.,
Burton-on-Trent
Staffordshire DE15 OTR

SM Small School Software
41 Sinah Lane
Hayling Island
Hampshire
PO11 0HJ

SN Soft Centre
Renryle Cottage
Okehurst Lane
Billinghurst
West Sussex RH14 9HR

SO Solar Soft
5 Westmorland Drive
Camberley
Surrey GU15 1EW

SP Sapphire Software
Box 67
Wakefield
Yorkshire

SQ Square Software
12a Uplands Terrace
Swansea
W Glamorgan

SR Starsoft
9 Chatsworth Road
Worsley
Manchester
M28 4NU

SS Squirrel Software
4 Bindloss Avenue
Eccles
Manchester M30 0DV

ST Stell Software
36 Limefield Ave
Whalley
Lancs BB6 9RJ

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SOFTWARE LISTINGS

Title	Type	Manufacturers	Memory		Software Supplier	Price
Pyramid	Ed	Highlight	B	C,D	HI	£6.00, £7.00
Pyramid Painter	Gm	Thor	B	C	TH	£5.95
Questionmaster	Ed	Hutchinson	B	C	HN	£28.75
Q Bert	Gm	Superior Software	B	C	SE	£7.95
Quick Thinking!	Ed	Mirror	B,E	C	MR	£6.95
Railroader	Ed	Stell	B	C	ST	£7.95
Rally A/B	Ed	Longman	B	C,D	LM	£9.95, £12.95
Record Changer	Do	A.J.	B	C,D	AJ	£19.95, £24.95
Record Keeper	Ut	BBC Pubs	B	C	KB	£13.80
Recover	Ut	Baksoft	A,B	C	BK	£6.00
Readability	Ed	Arnold-Wheaton	B	C	AW	£6.00 + VAT
Revenge of Zopr	Gm	Kansas	B	C	KA	£9.50
Reversi	Gm	Microbyte	B	C	MB	£5.95
Reversi	Gm	Superior Software	B,E	C	SE	£6.95
Reversi	Gm	Kansas	B	C	KA	£6.25
Reversi	Gm	Silverlind	B	C	SL	£6.95
Reversi 1	Gm	Micro Power	A,B	C	GK	£5.95
Reversi 2	Gm	Micro Power	B	C	GK	£5.95
Ripple Tank	Ed	RJE Software	B	C	RJ	£7.95
River Adventure	Ed	Pee Bee	B	C,D	PB	£9.50, £12.00
Riverworld Adventure	Gm	O.K.	B	C	OK	£10.00
Road Racer	Gm	Superior Software	B	C	SE	£7.95
Road Runner	Gm	Superior Software	B	C	CH	£7.95
Road Safety	Ed	Bryants	A,B	C	HW	£4.85
Robotic Sums	Ed	GED Software	B	C	GD	£4.50
Robot	Gm	Miking S/W	B	C	KC	£4.95
Rocket Raid	Gm	Acornsoft	B	C	AL	£9.95
Rocky	Gm	Superior	B	C	SE	£7.95
ROM Read	Ut	A.J.	B	C,D	AJ	£8.95, £11.95
Roman Empire	Gm	Lothlorien	B	C	LO	£6.95
Roulette	Gm	Micro Power	A,B	C	GK	£5.95
Row of Four	Gm	Software For All	B	C	KN	£6.95
Royalty Quiz	Do	Acornsoft	B	C	AL	£12.65
Rubble Trouble	Gm	Micro Power	B	C	GK	£7.95
Russian Irregular Verbs	Ed	Carsondale	B	C	CD	£21.00
Russian Text Fill	Ed	Carsondale	B	C	CD	£11.96
Savage Pond	Gm	Starcade	B	C,D	SC	£8.95
Scales and Decimal Estimation	Ed	RJE Software	B	C	RJ	£3.95
Scanning/Word Finder	Ed	Heinemann	B	C	HE	£9.25 + VAT
Science 1	Ed	Shards	B,E	C,D	SH	£6.95, £9.95
Science Pack	Ed	Dial	B	C,D	DL	£4.95, £6.50
Science Fiction Quiz	Do	Acornsoft	B,E	C	AL	£12.65
Sets and Operators	Ed	Shiva	B	C	SV	£14.95
737 Simulator Flight	Gm	Salamander	B.E.	C	SA	£9.95
Scramble	Gm	Bug-Byte	A,B	C	BB	£6.95
Scred	Bs	Stable	B	C	CS	£18
Scribe	Bs	Merlin	B	C	MN	£29.95
Scribe II	Do	Alligata	B,E	C,D	SY	£9.95, £14.95
Sea Cliff Erosion	Ed	Cambridge Micro	B	C,D	CM	£15.00 + VAT
Sea Lord	Gm	Bug-Byte	B	C	BB	£7.50
Sea Wolf	Gm	Optima	B	C	OP	£8.95
Search for the Jewels	Gm	SJG Soft	B	C	SJ	£8.95
Searchbas	Ut	Micro-Aid	A,B	C	IZ	£1.95
Seed Germination	Ed	Garland Comp.	B	C	JX	£18.82
Seige	Gm	Postern	B	C	PT	£6.95
Sentence Maker	Ed	Arnold-Wheaton	B	C	AW	£9.95 + VAT
Sequences	Ed	Chalksoft	B	C	CH	£5.95
737 Flight Simulator	Gm	Salamander	B,E	C	SA	£9.95
Shirley Conran's Magic Garden	Do	Acornsoft	B	C	AL	£9.95
Sheepdog	Ed	Longman	B	C	LM	£9.95, £12.95
Sheepdog Trials	Ed	Bryants S/W	B	C	HW	£4.80
Share Analyser	BS	Synergy	B,E	C,D	SY	£14.95, £19.95
Shoot/Top Shot	Ed	Soft Centre	B	C	SN	£6.00
Shootout	Gm	MP S/W	B	C	JZ	£5.00
Seek	Gm	Micro Power	A,B	C	GK	£6.95
Sentence Sequencing	Ed	Acornsoft	A,B	C	AL	£11.90
Sentence Shaker	Ed	GED Software	B	C	GD	£4.50
747	Gm	Doctor Soft	B	C	DO	£7.95
747	Gm	D.A.C.C.	B	C	DC	£9.95
Shadowfax	Gm	Postern	B	C	PT	£6.95
Shape Generator	Ut	Software for All	B	C	KN	£11.50
Shapes Package	Ed	GED Software	B	C	GD	£8.00
Shape Snap	Ed	Ega Beva	B	C	EB	£11.95
Shop Keeper	Ed	Heinemann	B	C	HE	£9.25 + VAT
Shopping	Ed	GED Software	B	C	GD	£4.50
Shrinking Professor	Gm	A&F	B	C	GE	£8.00
Shuttle	Gm	Molimerx	B	C	MX	£14.95
Shuttle Pilot	Gm	Oakleaf	B	C	OA	£9.95
Signals & Magic	Ed	HRH	B	C,D	HH	£4.80, £6.10
Signs	Ed	Acornsoft	A,B	C	AL	£11.90
Silversoft Index	Do/Bs	Silversoft	B	D	SV	£24.99
Simonsoft Sprites 2	Ut	Simonsoft	B,E	C,D	SI	£12.95
Simple Word Processor	Do	A.J.	B	C,D	AJ	£9.95, £14.95
Simple Queues	BS	Micropax	B	C	MP	£7.95
Simulation Surgery	BS	Micropax	B	C	MP	£12.95
Simulation-Carlton Trucks	Bs	Micropax	B	C	UP	£12.95
6502 Development System	Ut	Acornsoft	B	D	AL	£49.85
Sixers	Gm	O.I.C.	B,E	C	OI	£6.95
Skwosh	Gm	Miking S/W	B	C	KC	£3.95
Sliding Block Puzzles	Gm	Acornsoft	B	C	AL	£9.95
Sliding Block Puzzle	Ed	Ega Beva	B	C	RB	£9.95
Ski Slalom	Gm	R.H. Electronics	B	C	RH	£8.95
Slicker Puzzle	Gm	G.K. Tronics	B	C	DK	£6.95
Snail Trail	Gm	R.H. Electronics	B	C	RH	£4.95
Snake	Gm	Kansas	B	C	KA	£8.50
Snake	Gm	Computer Concepts	B	C	GJ	£6.67
Snake Pit	Gm	Postern	B	C	PT	£6.95
Snapper	Gm	Acornsoft	B,E	C,R	AL	£9.95, £9.20
Snig	Gm	Computercat	B	C	CC	£6.75
Snooker	Gm	Visions	B	C	VI	£8.95
Snooker	Gm	Acornsoft	B	C	AL	£9.95
Snorter	Gm	Beebug	B	C	BE	£7.50
Snowball	Gm	Level 9	B	C	CU	£9.90
Sort Animator	Ed	OIC	B	C	OI	£6.50
Sort M/C	Ut	Micro-Aid	A,B	C	IZ	£1.00
Sortbas	Ut	Micro-Aid	A,B	C	IZ	£1.00
Sortout	Ed	Highlight	B	C,D	HI	£6.00, £7.00
Spacehawks	Gm	Computer Concepts	B	C	GJ	£7.80
Space Adventure	Gm	Virgin Games	B	C	VG	£7.95
Space Cab	Gm	Kansas	B	C	KA	£7.25
Space Fighter	Gm	Superior Software	B	C	SE	£7.95
Space Invaders	Gm	Bug-Byte	B	C	BB	£5.50
Space Pirates	Gm	Bug-Byte	A,B	C	BB	£5.50
S-Pascal	Ut	Acornsoft	B,E	C	AL	£16.85, £16.10
Spacex	Ed	4MAT	B	CD	FM	£8.65, £10.40
Spaceguard	Gm	MP Software	B	C	MP	£6.50
Space Hi-way	Gm	Amcom	B	C	AO	£7.45
Space Kingdom	Gm	Software For All	B	C	KN	£7.95
Space Maze	Gm	Micro Power	B	C	GK	£7.95
Spacefight	Gm	Miking S/W	B	C	KC	£7.95
Space Warp	Gm	Bug Byte	B	C	BB	£11.50
Space Fighter	Gm	MP S/W	B	C	JZ	£8.50
Space Fighter	Gm	Superior S/W	B	C	KH	£7.00
Space Games Pack 1	Gm	Futura S/W	A,B	C	JC	£3.99
Space Games Pack 2	Gm	Futura S/W	A,B	C	JC	£3.99

Space Games Pack 3	Gm	Futura S/W	A,B	C	JC	£4.99
Space Games Pack 4	Gm	Futura S/W	A,B	C	JC	£4.99
Space Jailer	Gm	Micro Power	B	C	GK	£6.95
Space Ranger	Gm	Microbyte	B	C	MB	£7.95
Space Trek	Gm	Program Direct	B	C	NP	£5.99
Space Pirates	Gm	Bug Byte	A,B	C	KP	£8.00
Spanish Tutor A/B	Ed	Kosmos	B,E	C	KM	£9.95
Special Agent	Ed	Heinemann	B	C	HE	£9.25 + VAT
Speechparts	Ed	Bryants S/W	B	C	HW	£4.88
Speed and Light	Ed	Acornsoft	A,B	C	AL	£11.90
Spellcheck (Wordwise)	Ut	Beebug	B	D	BE	£19.00
Spellcheck	Ed	Edsoft	B	C,D	ES	£4.95
Spelling	Ed	Soft Centre	B	C	SN	£6.00
Spell 7+/9+	Ed	Primary	B	C,D	PP	£5.95, £7.95
Spelltest	Ed	Bryants	A,B	C	HW	£4.85
Spellings	Ed	ECL	B	C	EL	£5.99
Spitfire Command	Gm	Superior	B	C	SE	£7.95
Spitfire Flight Simulator	Gm	Alligata	B	C	SY	£7.95
Sphinx Adventure	Gm	Acornsoft	B	C	AL	£9.95, £9.20
Splashdown	Ed	Highlight	B	C,D	HI	£6.00, £7.00
Sploosh	Ed	Highlight	B	C,D	HI	£6.00, £7.00
Spreadsheet	Ed	Contex	B	C	CX	£7.99
Sprites	Ut	Beebug	B	C,D	BE	£10.00, £12.00
Spy	Ut	System	B	C	SY	£24.15
Squash	Gm	Aztec S/W	A,B	C	IB	£5.50
Standards and Variances	Bs	Micropax	B	C	MP	£7.95
Starbattle	Gm	Kudusoft	B	C	KU	£5.50
Star Battle	Gm	Superior	B	C	SE	£7.95
Star Gazer	Ed	Heinemann	B	C	HE	£9.25 + VAT
Starlander	Gm	Kudusoft	A,B	C	KU	£3.50
Star Patrol	Gm	Kudusoft	B	C	KU	£6.50
Starship Command	Gm	Acornsoft	B,E	C,R	AL	£9.95, £9.20
Star Trader	Gm	FBC Systems	B	C	FB	£9.50
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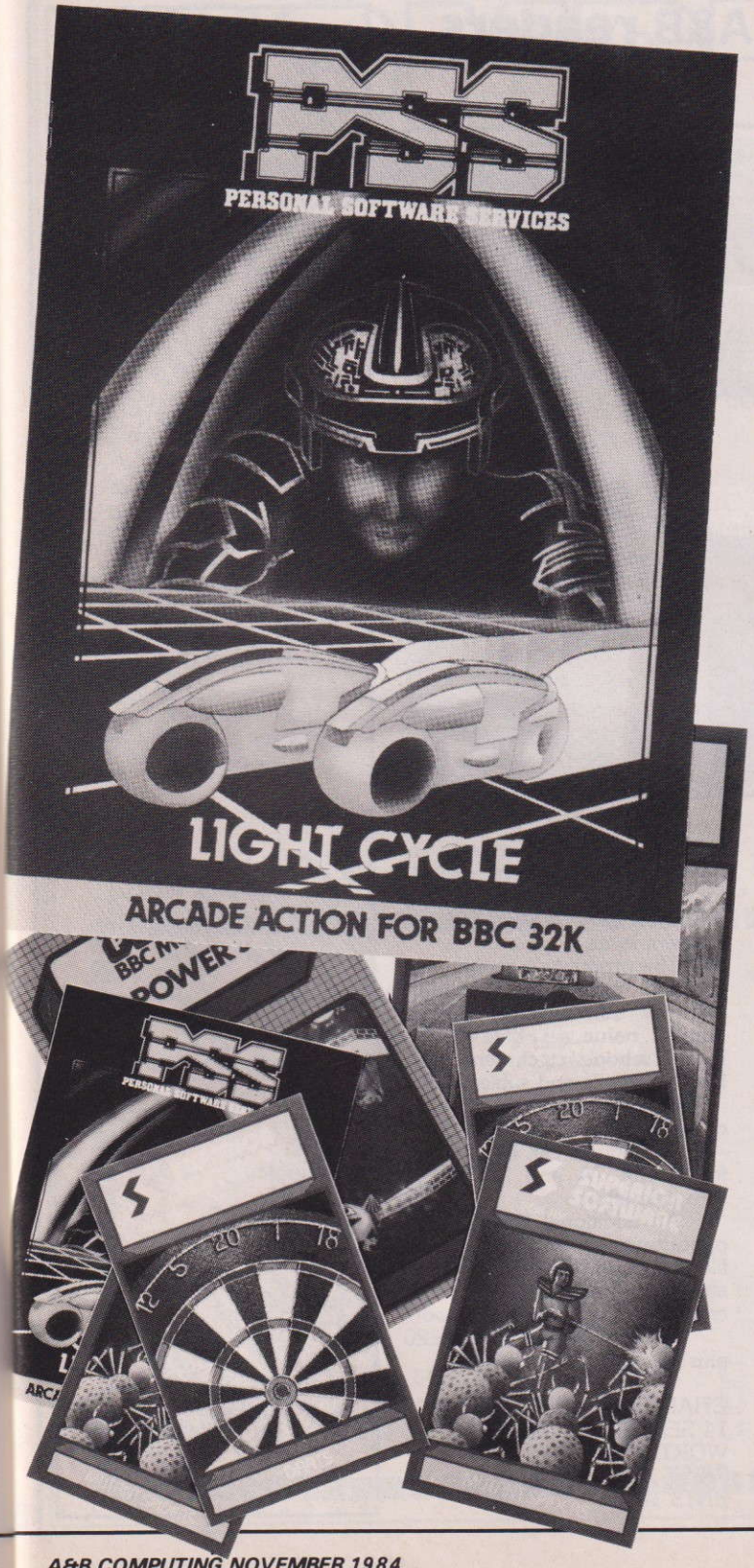

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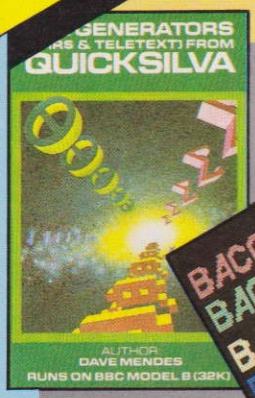

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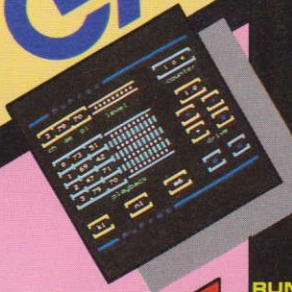

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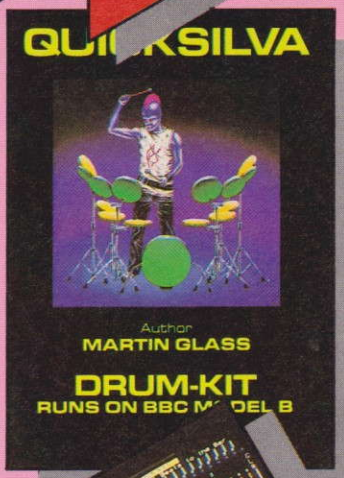

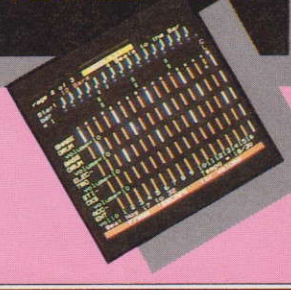

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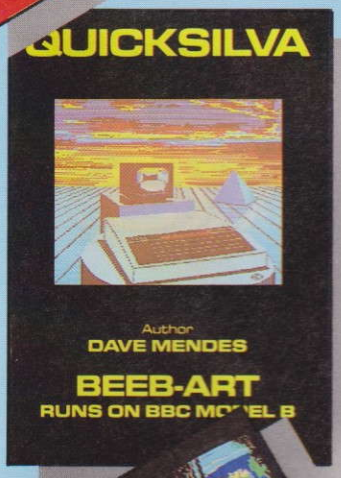

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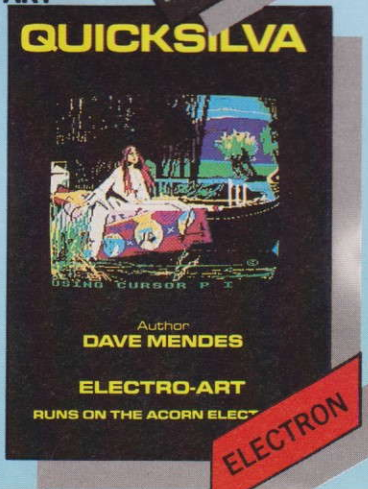

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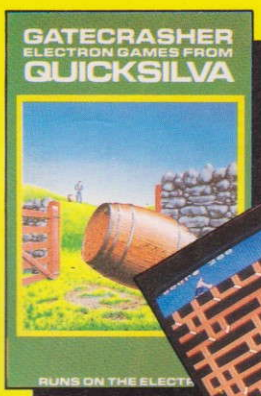

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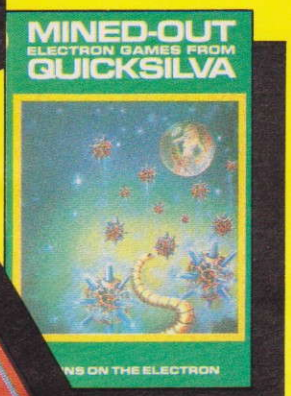

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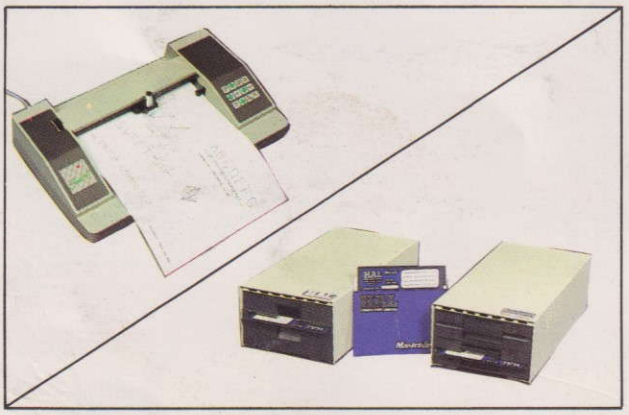

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