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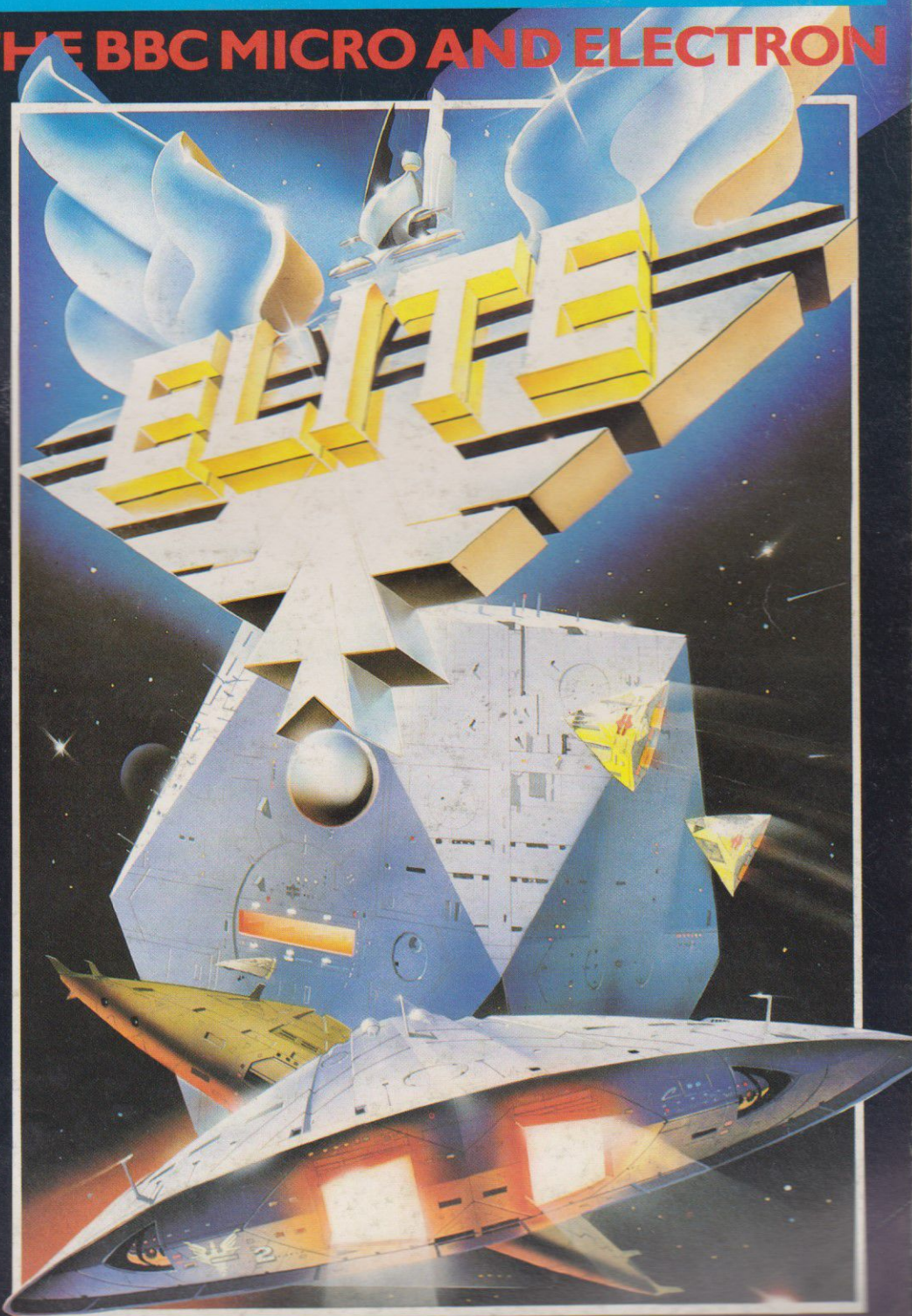
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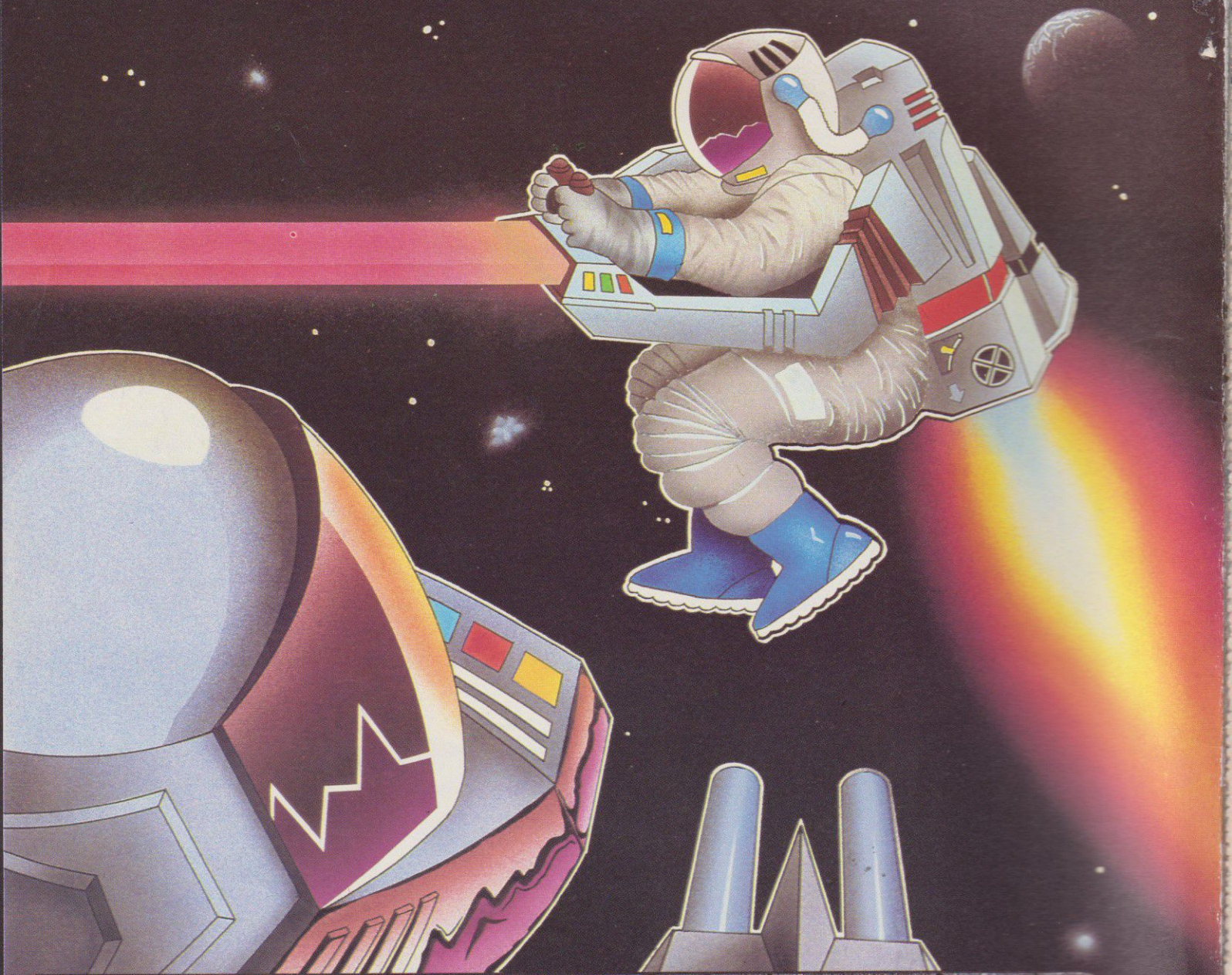
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Just some of PRINTMASTER's commands are listed below:

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

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

*TDUMP copies any text currently on the screen.

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

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

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

```
PRINTMASTER (Epson) 1 02
DEFINE <chr>
FDUMP <fisp>
FONT <country>
GDUMP <cor,op> <<X,Y>> <<gap>>
GPRINT <str> <X,Y> <<cor,op>> <<gap>>
INITIALISE
ITALIC <con/off>
LINEH <lines per inch>
LINESPACE <cap> <<ab inches>>
MARGIN <<left>> <<right+width>>
PAGELEN <<inches+lines>> <<skip>>
PCODE <codes/BASIC>
PROPORTION <con/off>
STYLE <str>
TAB <columns>
TDUMP <<udc width>>
TEXT <<width>> <<shade>> <<height>>
TPRINT <str> <chr> <<X,Y>> <<cor,op>>
ULOAD <fisp>
UNDERLINE <con/off>
USAVE <fisp>
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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.

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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.



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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.

Eleven December 1984

Published by Argus Specialist Publications Ltd., Number One, Golden Square, London W1R 3AB. Tel: 01 437 0626.

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A&B Computing is published monthly on the first Friday of the month preceding cover date. Distributed by: SM Distribution Ltd, 16-18 Trinity Gardens, London SW9 8DX. Telephone: 01-274 8611. Printed in the UK by Garnett Print, Rotherham and London

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Menu

Well, how have you enjoyed your now monthly dose of programs and articles for Acorn addicts? Hopefully it is the enjoyable blend of excellent programs and up to date articles and information which we plan it to be. If it seems otherwise, then please do write in and tell us. We want to know what you want from us.

How business-like is your BBC? Despite the advent of the Z80 second processor and an increasingly good selection of business programs for the standard 32K, there remains a feeling that the BBC is not quite up to the task of bringing new technology into the office.

Following on his look at Z80 software last month, John Vogler's survey of accounting packages for the standard 32K with DFS, should decide the issue either way.

Acorn's Business Computer does little to end the arguments since it packages monitor, double density filing system drives and Winchester, as well as in-built software such as view and Viewsheets. The new styling indicates another market entirely, the desk top, executive area aimed at by Torch and dominated by Apple and IBM.

The ABC family of computers starts with a BBC in a new shell, built in 12" monitor, monochrome or colour, and a keyboard with numeric keypad. The keyboard is separate from the main unit, which houses the monitor, CPU and interfacing.

The various upgrade options are added within the standard shell, such as built-in modem, single and double floppies (640K storage indicating double density and the new filing system). Econet is standard and so is the single floppy.

Next up is the ABC 100 and ABC 110. These add a Z80 and a second floppy disc drive. The 110 has a 10 Megabyte Winchester replacing one of the floppies. The 200 and 210 are non commercial versions "with the speed of a VAX mainframe computer". They are intended for Universities and research establishments where mainframe resources have to be shared.



The ABC 300 and 310 computers are the most interesting developments. The 300 is the first implementation of Digital Research's Concurrent Operating System for the Intel 80286. This chip is an advance on the other 16 bit 8086 and 8088 processors and supports applications written for PC-DOS and CP/M 86.

The 300 range has Desk Top Manager software allowing multitasking, the concurrent use of various applications. The ABC range will be launched in January but was previewed at the Personal Computer World show in order to encourage software developers to transfer their packages into the new "advanced environment".

It is certainly an exciting time for BBC Micro owners who wish

to get involved in computing which can show a return. There are currently almost as many business packages appearing as games.

The new double density disc filing system implemented on the

ABC may well find itself available for the BBC. If not, there are plenty of alternatives. The Opus DDOS is reviewed in this issue and contenders are appearing all the time. Solidisk Technology have their 1770 based double density system for both the BBC and the Electron Plus One waiting in the wings. Acorn's own Plus Three disc interface for the Electron (what happened to Plus Two?) is rumoured to use the same chip.

The Electron also benefits from a new joystick (Atari style) Interface from Power Software. ROM based code enables the user to configure the joystick controls to key combinations.

There's plenty of chance to put your game playing skills to the test in this issue of **A&B**. Bouncer is a top notch arcade game, full colour, fast action and great fun. All you have to do is follow our series, constructing the game as you go along and learning about games programming at the same time.

High Finance brings more subtlety to your BASIC and there's the puzzler, Revsquare.

Adventurers can unite in their appreciation of "Creating Your Own Adventure World", the first of two articles on designing Adventure games. Reviews follow thick and fast with Electron Adventuring and our usual pages packed with software reviews spanning games, education and business.

Finally, watch out for a new musical add-on for Christmas, and for the BBC videodisc interface, a cheap way of controlling videodisc players with an infrared controller.

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Create Your Own Adventure World

Melvyn Wright

Almost anybody with a little programming experience in BASIC can write an adventure game, and many have tried. However, it takes something extra to be able to produce an adventure that will hold the player's interest throughout the game and prevent him from wandering off, vowing never to waste time reloading it. In this two-part article I shall look at some of the features that are necessary in a really good adventure game, and also discuss the details which separate such a game from the vast majority of adventures at present on the market.

TALE OF TWO PARTS

The task of writing an adventure game can be split up into two distinct parts. The first part is the master program which must be provided to handle the actual running of the game. This includes everything from accepting and decoding the player's input, to printing the resulting messages on the screen. The second part is the actual story itself, along with all the puzzles and objects that go with it. These two aspects of an adventure are entirely separate, and it is necessary for both to be up to standard if the adventure is to be playable.

There is no need for the two parts to be written by the same person. Indeed, the person who provides the adventure story need know nothing whatsoever about computing, whilst the programmer is unlikely to be a competent novelist. We are therefore seeing a growing trend in software houses making use of stories provided by separate individuals, or basing their adventures on established books or films. This trend is bound to continue, but it is still necessary to identify the details required in each separate part of the game which prevent it from becoming boring to the player.

First let's have a look at the adventure program itself. It is a relatively simple task to cobble together an adventure master which runs without crashing, but it would probably kill the

In this two part article, Melvyn Wright of EPIC Software explains how to ensure that your own adventure games are both interesting and playable.



associated adventure, no matter how good the story is. What is required is a program that accepts the player's command with the minimum amount of typing, decodes them with the minimum amount of misunderstanding, and displays the results on the screen in a form that is easily understood, and attractive and interesting to look at. Strangely there are only a handful of games currently available which include all of these basic features.

One of the first decisions to make when writing an adventure game is whether or not to include graphics. This argument has been thrashed out many times in virtually every computer magazine under the sun and I do not propose to restart it here. What I will

say is that some people prefer graphic adventures and others prefer text adventures, and until the time comes when the home micro has enough memory to provide lots of high resolution graphics plus reams and reams of description at each location, or until everybody has discs, there will always be this division.

The answer to the problem is this: write the adventure first then see how much memory you have left. If you have enough to include graphics at virtually every location then include them, otherwise pad out the game with longer descriptions. The thing you must not do is to write the graphics first, then build the adventure around them. This is a recipe for disaster as the game

will suffer from a memory problem right from the start and you will constantly be having to prune bits from the storyline to fit it in, leaving you with a very weak adventure.

If you do decide to include graphics, mode 7 provides the ideal facilities. Not only does it use no extra screen RAM but it allows the graphics to be displayed simultaneously with the text, and the graphics are very fast. It is very distracting for the player if the action of the game is constantly being interrupted to slowly draw a picture, which must then disappear before any text can be printed! Fortunately, high resolution pictures are not required for an adventure game so the mode 7 resolution is adequate for the purpose and all eight colours are available plus the special control characters.

The reason that mode 7 is largely ignored by software houses is that it is only provided on the BBC Micro, and most BBC adventures available are conversions of games from other machines. Contrary to popular opinion, there is enough memory available on the BBC Micro to provide a complex adventure with all the features mentioned in this article, plus graphics for 250 locations. The Wheel of Fortune has proved this, but it entails the use of extremely complicated data compression techniques which are beyond the scope of this article.

PRESENTATION

Having made the text/graphics decision, the next thing to consider is the text layout. Here again, Mode 7 provides us with a number of useful facilities to enhance the appearance of the text print-out. Again, most adventure writers do not use these features because they are not available on other computers, or reason that they cannot use them because their compression techniques do not allow it. In my opinion that is the wrong way of approaching the problem. The screen layout should be decided upon first, then the text compression should be designed to provide the required facilities.



There can be no doubt that the use of colour adds significantly to the interest in playing an adventure game, especially when the colour reflects some detail in the message concerned, blue for water, green for forests, etc. As a bare minimum, you should aim to use separate colours for the different types of messages, eg: location descriptions could be in one colour, object in another colour, etc. Furthermore, both upper and lower case letters should be used. It is very tiring to read messages that are printed exclusively in capital letters.

To recap then: the text should be in both upper and lower case, there should be no spelling mistakes or words that are split up at the end of a line and colour should be used imaginatively. This may all sound

obvious but the number of adventures available that include these essential features could be counted on the fingers of one hand, excluding the thumb!

THE HUMAN INTERFACE

Having looked in some detail at the output provided by the master program, it's time to examine the input. The basic requirements here are that the player should be able to communicate with the computer using the minimum amount of effort and in the most natural way possible. Until the hardware and software is available to implement speech recognition on the home micro, this communication will have to be via the keyboard.

Most people hate typing so it is essential that the program accepts commands both in full, and in an abbreviated form. Can you imagine playing an adventure in which you had to type "GO NORTH", "GO SOUTH", "GO EAST" etc. simply to move about? If such a game did exist (and it probably does!) you would give up after five minutes no matter how good the associated story was. So abbreviated commands are essential. Once the player has typed enough of the word to enable the computer to recognise it and differentiate between it and other words in its vocabulary, there should be no need for the player to type any further.

The usual standard applied is that the first four letters are all that the computer looks at, but this should not be followed

slavishly. Very often only three letters are required and occasionally five, especially when the game includes a full language interpreter, where the player may type in a very long string of sentences containing any word in the English language. What is more important is that the computer must select the most likely word from its vocabulary if the player only types a single letter. For example, if the player types "L" the computer should select "LOOK" and not "LISTEN" or "LIGHT". Similarly, "T" should produce "TAKE" and not "THROW" or "TURN" etc.

So much for abbreviations but what about the form that the command should take. There are three formats possible: a simple two word input, ie: "GET LAMP"; a full sentence input, ie: "I WANT TO PICK UP THE LAMP THAT IS ON THE DESK"; and a multi-statement input, ie: "PICK UP THE LAMP AND LIGHT IT". It would appear that the two word command would be the easiest for the player to type in, but our experience with Wheel of Fortune has shown that the full multi-statement input in fact proves to be the easiest format to use.

Firstly, it is usually the case that the player can still type his commands in the form of two words even if the program accepts a full sentence. This is because most command analysers simply split up the sentence into two or more words that they can recognise, and ignore the rest. If this is the case, then a full sentence input is preferable as the player can decide for himself whether to type in just two words, or input a complete sentence if the computer does not understand him.

Paradoxically, the multi-statement interpreter reduces typing even further, as some commands which normally require two words can now be expressed in a single word. Like the full sentence analyser, the multi-statement interpreter still works with two word inputs, but it also understands things like "TAKE LAMP, LIGHT IT" and "GET

CONTINUED OVER



LAMP, MATCHES, KEYS, BOTTLE". Or even more dramatically, "TAKE ALL".

Whilst on the subject of easy command input, do not forget the function keys on both the BBC Micro and the Electron. Unfortunately, memory requirements are such that you may have to use the function key buffer for storing data needed by the program, thereby rendering the keys unuseable. But if this is not the case, they are extremely useful for entering the common commands with a single key press. This is even more useful if you allow the player to set up the keys with his own preferred definitions.

If the player types in a command which the computer does not recognise, or he mis-spells it, he doesn't want to have to retype the complete sentence again when he could easily edit his previous attempt using the BBC's comprehensive editing facilities. Therefore, it is vital that you make the cursor, copy and delete keys available for their normal

functions during command input, and also do not clear unsuccessful commands from the screen until a successful command has been entered. Some programmers have the "clever" idea of using the cursor keys for N, S, E, and W but this is infuriating, especially as these four directions are usually abbreviated to single letters anyway. It means that any false commands have to be completely retyped.

IMPORTANT TOUCHES

The input and output characteristics of the master program are, without doubt, its most important features, and if you get these right you are well on your way to producing a good adventure. But there are various other aspects of this program that can spoil the final game if they are not properly implemented. Every worthwhile adventure must include a facility to enable the player to save his position on tape (or disc) and reload it back in again at a later date.

It is unrealistic to expect an adventurer to start from the beginning again every time he makes a mistake, or performs some non-reversible action.

In addition to this, the save routine should be fast as possible and need never be more than about four blocks long. If your routine is longer than this, or if more than one file has to be saved, then you are doing something wrong. Always arrange your variables so that they are together in memory and stored as single bytes instead of in floating point form. This will save memory anyway, but it will also ensure an efficient save routine. It should be possible for you to get all of your variables into a single page in memory, even in a fairly complex adventure.

Also, ensure that the load routine cannot be started off accidentally, unless it can be absorbed by pressing the escape key. Otherwise the computer will start searching for a file on tape which probably doesn't exist yet. If this cannot be aborted, the player will have to switch off and reload the game — very tedious. To avoid

this, make it mandatory for the player to have to type in the full command, or at least not a single letter abbreviation, to start off the loading process.

Finally, before leaving the subject of the adventure program itself, it is probably worth mentioning the speed at which it runs. Obviously, the faster the better, but do not be discouraged if you do not know how to program in Machine Code. It is perfectly possible to implement the above features in a BASIC program. Of course if it runs far too slowly it will quickly inject boredom into the most exciting adventure plot and there comes a time when Machine Code becomes essential, not only to speed things up, but also because it is the only way of squeezing a long complex adventure into the available RAM.

I have discussed, at some length, the features which we at Epic regard as essential in any adventure game master program. Next month, I shall look at the adventure story itself and how to ensure that its associated puzzles do not make it unplayable.



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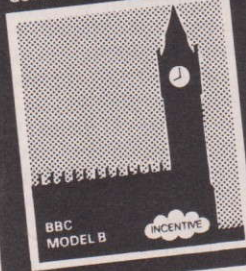
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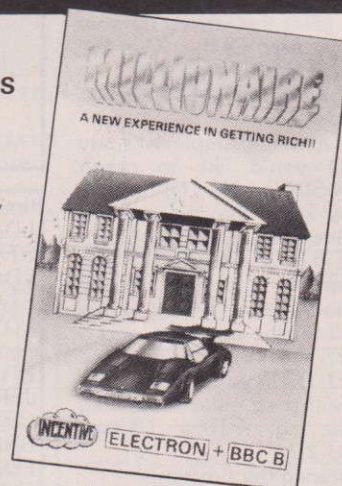
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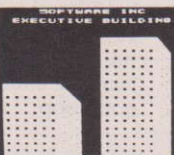
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Graph Plotter

W.A. Schreuder

Depict functions graphically with this educational and interesting program.

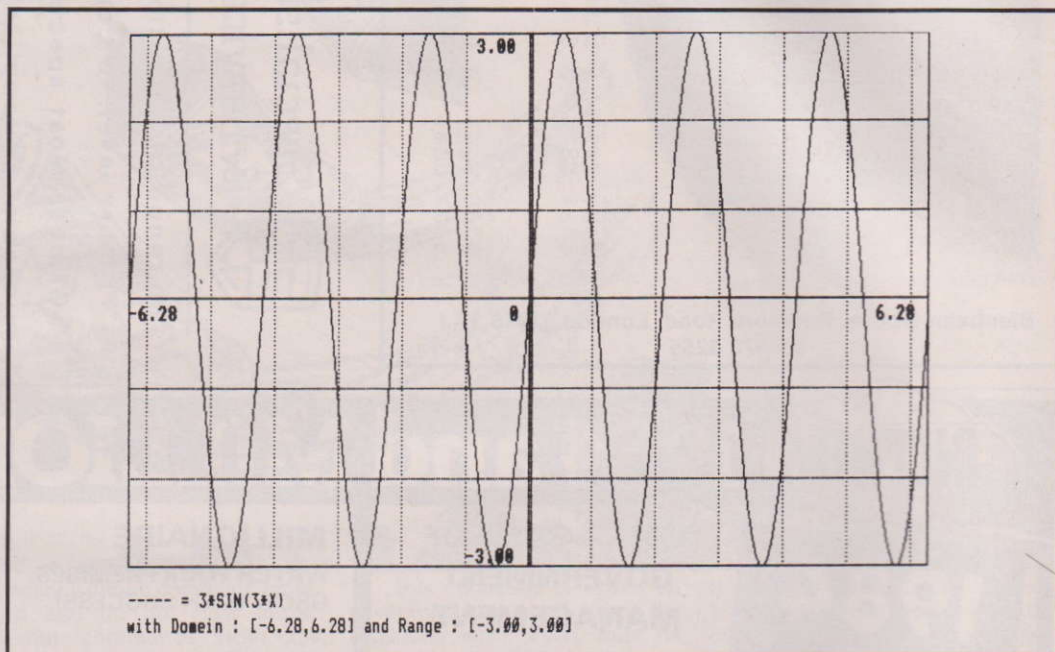
This program is very useful when you want to graph a function. It is about 3.5K long. I shall only give a brief explanation because I think you will find out how the program works by looking through the functions and variables.

When running the program you're asked to answer a number of questions explained as follows:

- (1) The number of functions
— enter the number of functions you want the computer to graph and press return.
- (2) Minimum X-value
— enter the lowest number to be used as the 'X' in the function(s).
- (3) Maximum X-value
— enter the highest number to be used as the 'X' in the function(s).
- (4) Minimum / Maximum Y-value
— as an example let's say that you'd like to graph $3 * \sin(3 * X)$. Of course you know that the smallest value you can get is -3 and the largest value is 3 . If you want the graph to fill the whole screen, then enter -3 for the minimum and 3 for the maximum (see FIG.1). If you'd like a different scale enter something else, e.g. -10 to 10 (see FIG.2).
- (5) Entering the functions
— when entering the functions, make sure that the number of '(' is equal to the number of ')', and use X as the variable.
- (6) White/Black screen
— if you want a white screen and a black graph, enter 'Y', otherwise enter something else. Remember, if you've got a printer, that a screen dump from an almost entirely white screen costs a lot of ink! The routine that does the work is a very short one, here it is:

- (7) Screendump
— the screen dump routine is at &D00 and can be used in other programs too, just do a CALL to &D00. My printer is an EPSON MX80 and the routine works well on this printer. However, it

probably won't work on other printers, so if you want to dump the screen to a different printer you will have to remove my dump routine, which is a modified version from the dump routine in the book



```

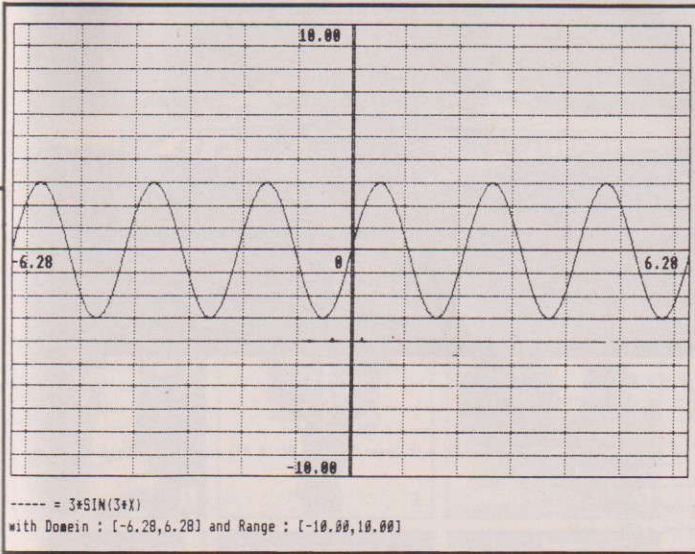
.invert
LDA #&30      ;high byte start address
STA &8F       ;input it in location &8F
LDA #0        ;low byte start address
STA &BE       ;put it in location &8E
LDY #0        ;set counter in Y to 0
.loop
INY           ;increase counter by 1
JSR act       ;goto subroutine which does the inverting
CPY #0        ;255 'inversions' done?
BNE loop      ;no, not yet
LDA &8F       ;yes, check if whole screen
CMP #&80      ;is inverted
BEQ ready     ;yes, whole screen is inverted
LDY #0        ;no, next 255 bytes, set counter to 0
INC &8F       ;increase counter by one
JMP loop      ;goto loop
.act
LDA (&8E),Y   ;put the contents of the two-byte address,
               ;lowbyte = ?&8E + Y and highbyte = ?&8F into the
               ;accumulator
EOR #&FF      ;exclusive — or the contents of the accumulator
               ;with &FF and put the result back into the
               ;accumulator
STA (&8E),Y   ;put the inverted-byte into the location where you
               ;got the original
.ready
RTS

```

'ASSEMBLY LANGUAGE PROGRAMMING for the BBC MICRO' by Ian Birnbaum, and replace it with yours. Should you have any problem in writing your own dump routine, look in the former mentioned book to get an idea how it works or refer to your local BBC dealer.

PROGRAM ON DISC

If you think your fingers will get cramp before you've typed in the program without errors, you can get a working program on tape by crediting my bank account (ABN 57.14.52.957) with #2.50. ABN stands for Algemene Bank Nederland. Don't forget to include your name and address and I'll send your tape within ten days.



HOW IT WORKS

PROCenter __functions

— you are asked for: domain, range, white or black screen, screen dump or not and, finally, for the function(s).

PROCset__screen__up

— scale__x is the scaling factor used for making the underground for drawing the graph(s) on.

PROGRAM STRUCTURE

320-330 The calculation of the positions of the horizontal and vertical axes on the screen.

340-350 Draw underground and border.

710 Const sees to it that for every possible horizontal
position on the screen (680) the accompanying
vertical position is calculated.

1060 This is where the computer jumps to if an error occurs. e.g. division by zero or omission of) or (. The computer aborts on syntax errors but traps errors like too big and division by zero.

1070-1120 Trap the error, skip over the x that caused it,
calculate next x (this is because the computer
doesn't plot points but it draws a line between
two calculated points and if the first one causes
an error and you omit calculating a new position,
then a line will appear where there can't be one.
e.g. TAN(X) would have all its parts connected)
and continue.

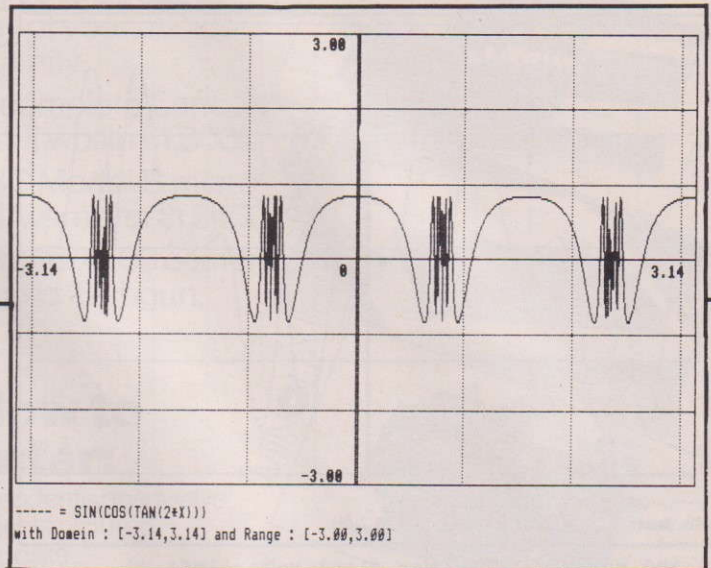
Well, that's all I guess.
Happy Graphing!

PROGRAM LISTING

```

10 REM *****
20 REM * GRAPH PLOTTER V0.5 *
30 REM * ----- *
40 REM * W.A.SCHREUDER *
50 REM * VOSSENLAAN 16 *
55 REM * 9751 GE HAREN (GN) *
60 REM * THE NETHERLANDS *
70 REM * TEL.050-345979 *
80 REM *****
90 FOR IX=0 TO 2 STEP 2:PX=&D00:RESTORE
100 [OPT IX
110 LDA#2:JSR&FFEE:LDA#3:STA&73:LDX#0:JSRL1:LDA#
2:JSR&FFEE:LDX#4:LDA#85:JSR&FFF4:STYL2+1:LDA#84:JS
R&FFF4:STX &75:STY&76

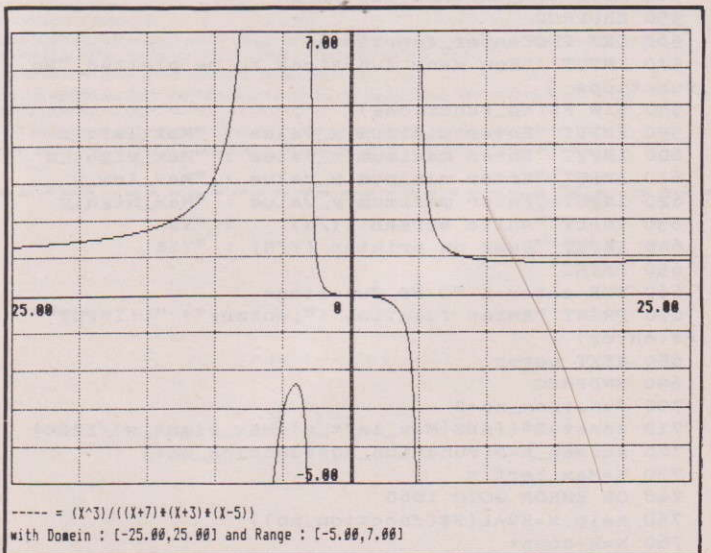
```



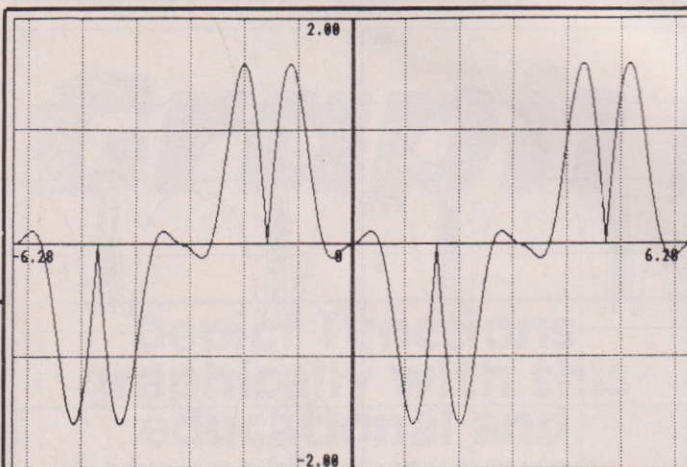
```

120 .L2:CPY#0:BNEL3:LDA#7:STA#73:LDA#3:STA#74:LD
A#40:BNEL4
130 .L3:LDA#11:STA#73:LDA#7:STA#74:LDA#80
140 .L4:STA#70:LDA#32:STA#71:.L9:LDA#70:STA#72:L
DX#74:JSRL1:.L5:LDY#7:.L6:LDA(&75),Y:STA &77,Y
150 DEY:BPLL6:LDY#8:.L7:LDX#7:LDA#1:JSR&FFEE:.L8
:ASL&77,X:RORA:DEX:BPLL8:JSR&FFEE:DEY:BNEL7:LDA&75
:CLC:ADC#8:STA&75:BCCL10
160 INC&76:.L10:DEC&72:BNEL5:LDA#1:JSR&FFEE:LDA#
10:JSR&FFEE:DEC&71:BNEL9:LDA#13:STA&73:LDX#11:JSRL
1:LDA#3:JSR&FFEE:RTS:.L1:LDA#1:JSR&FFEE:LDAL11,X:J
SR&FFEE:INX:CPX&73
170 BNEL1:RTS:.L11:NOP:NOP:NOP:NOP:NOP:NOP:NOP:N
OP:NOP:NOP:NOP:NOP:NOP:NOP:NOP:NOP:NOP:NOP:NOP:N
STA&8F:LDA#0:STA&8E:LDY#0:.loop:INY:JSR act:CPY#0:BNE
loop:LDA&8F:CMP#&80:BEQ ready:LDY#0:INC&8F:JMP 10
op:.act:LDA(&8E),Y:EOR#&FF:STA(&8E),Y
180 .ready RTS:]NEXT I%
190 PX=&DA6
200 FOR I%=1 TO 13
210 READ ?PX
220 PX=PX+1:NEXT I%
230 DATA 27,65,8,27,75,64,1,27,76,128,2,27,50
240 MODE0
250 PROCcenter_functions
260 PROCset_screen_up
270 GOTO 700
280 DEF PROCset_screen_up
290 CLS

```



CONTINUED OVER

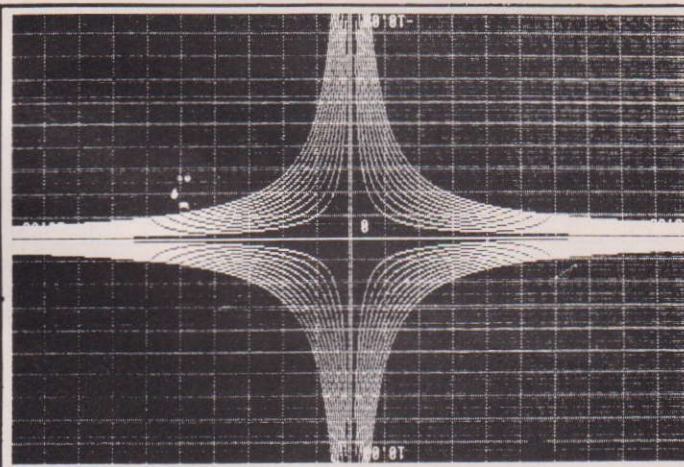


----- = $\text{COS}(3 \times X) + \text{ABS}(\text{TAN}(X)) + \text{SIN}(2 \times X)$
with Domain : [-6.28,6.28] and Range : [-2.00,2.00]

```

300 scale_x=1280/(Max_right_x-Max_left_x)
310 scale_y=1024/(Max_high_y-Max_low_y)
320 Y_ax=ABS(Max_left_x)*(1280/(ABS(Max_left_x)+
Max_right_x))
330 X_ax=ABS(Max_low_y)*(1024/(ABS(Max_low_y)+Ma
x_high_y))
340 IF scale_x<64 THEN h_scale_x=128 ELSE h_sca
e_x=scale_x
350 IF scale_y<51 THEN h_scale_y=102 ELSE h_sca
e_y=scale_y
360 FOR line=Y_ax TO 0 STEP -h_scale_x
370 MOVE line,0
380 PLOT 21,line,1024
390 NEXT line
400 FOR line=Y_ax TO 1280 STEP h_scale_x
410 MOVE line,0
420 PLOT 21,line,1024
430 NEXT line
440 FOR line=X_ax TO 0 STEP -h_scale_y
450 MOVE 0,line
460 PLOT 21,1280,line
470 NEXT line
480 FOR line=X_ax TO 1024 STEP h_scale_y
490 MOVE 0,line
500 PLOT 21,1280,line
510 NEXT line
520 MOVE 0,0:DRAW 0,1023:DRAW 1279,1023:DRAW 127
9,0: DRAW 0,0
530 IF Max_left_x<=0 MOVE Y_ax,0:DRAW Y_ax,1024:MO
VE(Y_ax+4),0:DRAW(Y_ax+4),1024
540 MOVE 0,X_ax:DRAW 1280,X_ax
550 ENDPROC
560 DEF PROCcenter_functions
570 INPUT""How many functions to be plotted "No
_functions
580 DIM F$(No_functions)
590 INPUT"Enter minimum x_value : "Max_left_x
600 INPUT"Enter maximum x_value : "Max_right_x
610 INPUT"Enter minimum y_value : "Max_low_y
620 INPUT"Enter maximum y_value : "Max_high_y
630 INPUT"White screen (Y/N) : "Y$
640 INPUT"Dump on printer (Y/N) : "Y1$
650 PRINT
660 FOR enter=1 TO No_functions
670 PRINT"Enter function (:enter;) "":INPUT""
F$(enter)
680 NEXT enter
690 ENDPROC
700 function_no=0
710 const=2*((ABS(Max_left_x)+Max_right_x)/1280)
720 screen_x=0: function_no=function_no+1
730 X=Max_left_x
740 ON ERROR GOTO 1060
750 help_x=EVAL(F$(function_no))
760 X=X+const
770 calculated_y_value=EVAL(F$(function_no))

```



----- = $\text{ABS}(1/X)$ ----- = $\text{ABS}(4.5/X)+1$
----- = $\text{ABS}(1.5/X)$ ----- = $\text{ABS}(5/X)+1$
----- = $\text{ABS}(2/X)$ ----- = $\text{ABS}(5.5/X)+1$
----- = $\text{ABS}(2.5/X)$ ----- = $\text{ABS}(3/X)+1$
----- = $\text{ABS}(3.5/X)+1$
----- = $\text{ABS}(4/X)+1$
with Domain : [-10.00,10.00] and Range : [-10.00,10.00]

```

780 IF (X_ax+(help_x*scale_y))>1040 OR (X_ax+(he
lp_x*scale_y))<-30 THEN 1090
790 MOVE screen_x,(X_ax+(help_x*scale_y))
800 IF (X_ax+(calculated_y_value*scale_y))>1040
OR (X_ax+(calculated_y_value*scale_y))<-30 THEN 10
90
810 DRAW screen_x+2,(X_ax+(calculated_y_value*sc
ale_y))
820 help_x=calculated_y_value
830 screen_x=screen_x+2
840 IF screen_x<1280 GOTO 760
850 IF function_no<>No_functions GOTO 720
860 @X=&20208
870 VDU5
880 MOVE -50,X_ax-16
890 PRINTMax_left_x
900 MOVE 1130,X_ax-16
910 IF Y_ax<1110 THEN PRINTMax_right_x
920 MOVE Y_ax-32,X_ax-16
930 PRINT"o"
940 MOVE Y_ax-150,1008
950 PRINTMax_high_y
960 MOVE Y_ax-150,32
970 PRINTMax_low_y
980 IF Y$="Y" THEN CALL invert
990 IF Y1$="Y" THEN CALL &D00:VDU2,1,15,13
1000 FOR X=1 TO No_functions
1010 PRINT"----- = "F$(X)
1020 NEXT X
1030 PRINT"with Domein : [":Max_left_x,"":Max_rig
ht_x:"] and Range : [":Max_low_y,"":Max_high_y:"
"]"
1040 VDU1,10,3,4
1050 END
1060 IF (ERR=18 OR ERR=24 OR ERR=22 OR ERR=21 OR
ERR=20) THEN GOTO 1070 ELSE CLS:PRINT"You either p
ressed 'ESCAPE' or you entered a function wrong ":
END
1070 ON ERROR OFF
1080 ON ERROR GOTO 1060
1090 X=X+2*((ABS(Max_left_x)+Max_right_x)/1280):s
creen_x=screen_x+2
1100 IF screen_x>1280 THEN GOTO 850
1110 help_x=EVAL(F$(function_no))
1120 GOTO 770

```


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Just identify the twelve objects pictured opposite...

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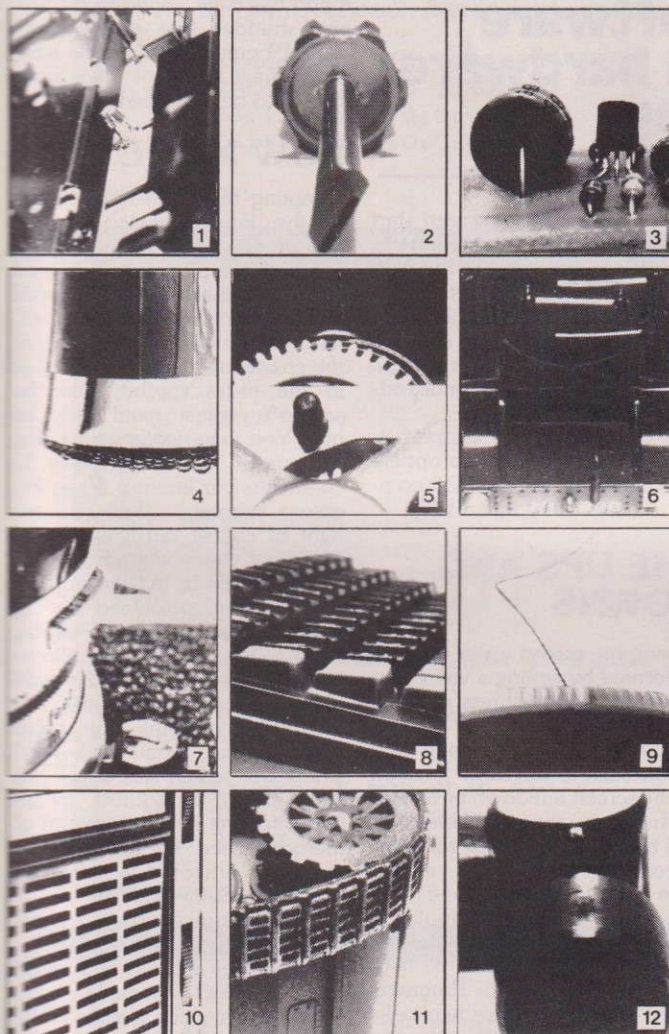
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and write your (one-word) answers in the spaces provided on the coupon. For instance, if you think that number 9 is a record, write 'record' in the space next to 9 on the coupon and so on. Then tell us in up to 20 words why **MAGAZINES MAKE IDEAL HOLIDAY READING**. Complete the coupon in BLOCK LETTERS, and send it to: **DREAM HOLIDAY COMPETITION, Argus Specialist Publications Ltd., No 1 Golden Square, London W1R 3AB**, to reach us no later than 31st December 1984.

Competition rules

- 1 The competition is open to all UK and Eire readers except employees of Argus Specialist Publications Ltd their printers and distributors
- 2 As long as an original coupon from the magazine(s) of your choice is used for each entry there is no limit to the number of entries per person. Photocopied coupons will not be accepted
- 3 All entries must be postmarked before 31st December 1984
- 4 The prizes will be awarded to the first four entrants who identify the twelve objects correctly and whose completed sentence is judged the most apt and original
- 5 No correspondence will be entered into about the competition results: the judges' decision is final
- 6 Winners will be notified by post and the results will be published in a future issue of this magazine



The 12 objects are

1.	2.	3.
4.	5.	6.
7.	8.	9.
10.	11.	12.

Magazines make ideal holiday reading because (up to 20 words)

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Advanced Graphics

Bruce Smith

As promised last month, this month's helping of graphics provides some useful procedures that you can incorporate into your own programs to perform hardware scrolling in any graphics modes moving the screen up, down, left, and right as many times as you want!

The ability to perform a hardware scroll is of paramount importance if fast arcade game type software is to be produced. In hi-resolution modes the screen uses up a massive 20K of memory. Moving these 20480 bytes about would be slow even when performed in machine code and games such as Planetoid and JCB Digger by Acornsoft would not be possible to implement effectively.

For the purposes of demonstration, the four main programs presented here are for use with Mode 2 though they will work equally well in Modes 0 and 1. Mode 2 is used most commonly as it provides the programmer with a full 16 colours although the screen movement is two pixels per time rather than a more steady one pixel per time. The final program demonstrates how these programs can be converted for graphics Modes 4 and 5. Each program is also presented as a procedure with a few lines demonstrating its use. The PROC lines have exclusive line numbers. Thus once they have been tested the first few lines of BASIC can be deleted and the PROC *SPOOLED to tape or disc as an ASCII file. This can then be *EXECuted back into memory into a program whenever required.

BY THE LEFT

The most common scrolling movement will be to move the screen left or right and this is performed by incrementing or decrementing the screen start address register (R12 and R13) respectively (see last month's A&B for details on the CRTC Registers). Programs 1 and 2 perform this scroll respectively.

Let us examine Program 1 as basically the techniques are the same throughout the programs. Before any scrolling can be per-

Incorporate fast action into your software programs with hardware scrolling.

formed the address of the start of screen memory is needed. In hi-res modes this will be &3000. Lines 1100 to 1020 show how this value can be extracted using an OSBYTE &A0 call with the X register containing &50. The address is returned in the processor index registers and is extracted using a USR call and masking off the two unwanted bytes returned by the call. This address is returned in the variable "screen%". Line 1030 simply sets up a FOR...NEXT to repeat the scroll x number of "times%".

The number of pixels the screen is scrolled left is determined in line 1040. In Program 1 this is eight pixels or a byte. If only a single pixel scroll is required this line should read

1040 screen% = screen% + 1.

Lines 1050 and 1060 are checks to ensure that the screen memory stays just where it is. For example continually incrementing "screen%" by eight will eventually cause the variable to exceed &7FFF which is the last byte of screen memory: the BASIC ROM occupies memory from &8000. By subtracting &5000, the screen memory size ie. &8000-&3000, then a screen% value of &8000 will become &3000. Therefore anything moving off the bottom right hand corner will reappear at the top left hand corner. This is called wrap-around.

Similarly adding &500 to a screen% value decremented to &2FFF, which is user memory, will give &7FFF, so that items moving off the top left hand corner of the screen will reappear at the bottom right hand corner of the screen.

Lines 1070 and 1080 determine the values to be written to R12 and R13. The high byte in

scr1% is the current screen start address divided by the number of character bytes per line i.e. 256 * 8 = 2048, the low byte is obtained by using the MOD function. Remember, as we saw last month, the value written to R12 and R13 must be the memory address DIV 8.

The calculated address is then written to the appropriate registers using the VDU23 command (lines 1090 and 1100).

THE UPS AND DOWNS

Moving the screen up or down is performed by writing a value into the screen start address registers that will cause the correct amount of wrap-around to bring the screen back to the same position on the screen but down by a byte. As the hi-res screen consists of 80 * 8 byte characters the value required to do this is simply 80 * 8 = 640. To move the screen up, this value should be added to screen%. To move the screen down, 640 must be subtracted from screen%. Programs 3 and 4 perform these two tasks respectively and these programs

are the same other than this change though an *FX 19 command has been added to cut out any shudder that may occur.

*FX19 simply waits for the start of the next frame of the screen display to be produced.

LOW MODE

Adapting the procedures to run in the low resolution graphic modes 4 and 5 is straightforward. Program 5 is a suitably converted version of the hi-res down scroll presented in Program 4. The differences are as follows. Firstly as the characters per line is half that in the hi-res modes then the screen% adjust need only be half. You may rightly be thinking to yourself "well there's only 32 characters per line not 40 as this geezer suggests". Well you are right of course but it is not the displayed characters per line we are interested in but the number of characters produced by the 6845 in the horizontal display register, R1. Thus the value to be written for a vertical scroll is eight plus or minus 40 * 8 = 160. The second adjustment has taken place in lines 1650 and 1660 where the screen size adjust has been altered to &2800, to account for the smaller amount of memory used by the low res modes which is simply &8000-&5800 = &2800.

These procedures are effective and produce suitable scrolls, however they are still not as effective as their machine code counterparts which work in an instant. But that's another story...

>LIST

```

10 REM *** HARDWARE LEFT SCROLL ***
20 MODE 2
30 PRINT "SCROLLING LEFT"
40 A=GET
50 PROCleft(1000)
60 END
70 :
80 :
1000 DEF PROCleft(times%)
1010 A%=&A0:X%=&50:B%=USR(&FFF4)
1020 screen%=(B% AND &FFFF00)/256
1030 FOR scroll=1 TO times%
1040   screen%=screen%+8

```



```

1050 IF screen% >=&8000 THEN screen%=
screen%-&5000
1060 IF screen%<&3000 THEN screen%=sc
reen%+&5000
1070 scr1%=screen% DIV 2048
1080 scr2%=screen% MOD 2048 DIV 8
1090 VDU 23;12,scr1%;0;0;0
1100 VDU 23;13,scr2%;0;0;0
1110 NEXT
1120 ENDPROC

```

```

>LIST
10 REM *** HARDWARE RIGHT SCROLL ***
20 MODE 2
30 PRINT"SCROLLING RIGHT"
40 A=GET
50 PROCright(1000)
60 END
70 :
80 :
1200 DEF PROCright(times%)
1210 A%=&A0:X%=&50:B%=USR(&FFF4)
1220 screen%=(B% AND &FFFF00)/256
1230 FOR scroll=1 TO times%
1240 screen%=screen%-8
1250 IF screen% >=&8000 THEN screen%=
screen%-&5000
1260 IF screen%<&3000 THEN screen%=sc
reen%+&5000
1270 scr1%=screen% DIV 2048
1280 scr2%=screen% MOD 2048 DIV 8
1290 VDU 23;12,scr1%;0;0;0
1300 VDU 23;13,scr2%;0;0;0
1310 NEXT
1320 ENDPROC

```

```

>LIST
10 REM *** HARDWARE UP SCROLL ***
20 MODE 2
30 PRINT"SCROLLING UP"
40 A=GET
50 PROCup(100)
60 END
70 :
80 :
1400 DEF PROCup(times%)
1410 A%=&A0:X%=&50:B%=USR(&FFF4)
1420 screen%=(B% AND &FFFF00)/256
1430 FOR scroll=1 TO times%
1440 screen%=screen%+640
1450 IF screen% >=&8000 THEN screen%=
screen%-&5000
1460 IF screen%<&3000 THEN screen%=sc
reen%+&5000
1470 scr1%=screen% DIV 2048
1480 scr2%=screen% MOD 2048 DIV 8

```

```

1490 VDU 23;12,scr1%;0;0;0
1500 VDU 23;13,scr2%;0;0;0
1510 *FX19
1520 NEXT
1530 ENDPROC

```

```

>LIST
10 REM *** HARDWARE DOWN SCROLL ***
20 MODE 2
30 PRINT"SCROLLING DOWN"
40 A=GET
50 PROCdown(100)
60 END
70 :
80 :
1600 DEF PROCdown(times%)
1610 A%=&A0:X%=&50:B%=USR(&FFF4)
1620 screen%=(B% AND &FFFF00)/256
1630 FOR scroll=1 TO times%
1640 screen%=screen%-640
1650 IF screen% >=&8000 THEN screen%=
screen%-&5000
1660 IF screen%<&3000 THEN screen%=sc
reen%+&5000
1670 scr1%=screen% DIV 2048
1680 scr2%=screen% MOD 2048 DIV 8
1690 VDU 23;12,scr1%;0;0;0
1700 VDU 23;13,scr2%;0;0;0
1710 *FX19
1720 NEXT
1730 ENDPROC

```

```

>LIST
10 REM *** HARDWARE DOWN SCROLL ***
20 MODE 5
30 PRINT"SCROLLING DOWN"
40 A=GET
50 PROCdown(100)
60 END
70 :
80 :
1600 DEF PROCdown(times%)
1610 A%=&A0:X%=&50:B%=USR(&FFF4)
1620 screen%=(B% AND &FFFF00)/256
1630 FOR scroll=1 TO times%
1640 screen%=screen%-160
1650 IF screen% >=&8000 THEN screen%=
screen%-&2800
1660 IF screen%<&5800 THEN screen%=sc
reen%+&2800
1670 scr1%=screen% DIV 2048
1680 scr2%=screen% MOD 2048 DIV 8
1690 VDU 23;12,scr1%;0;0;0
1700 VDU 23;13,scr2%;0;0;0
1710 *FX19
1720 NEXT
1730 ENDPROC

```


News Me

UPS AND DOWNS

If, after reading last month's Down To Business article, you decided to rush out and buy Acorn's Z80 Second Processor you will already know that the price has gone up by £100 to £399.

Acorn feel that the price rise was justified in order to enable dealers to offer better support to their customers. High demand has stretched the resources of the dealers and Acorn hope that the larger profit margin will enable dealers to expand and improve customer services, an essential part of the Z80 "package".

The good news is that this price increase has been compensated for by a £105 drop in the price of Acorn's Dual Disk Drive as well as a £50 reduction for the Single Disk (100K) Drive which now retails at £199.

CHEAPER COMMUNICATION

A new modem has been developed by Cirket Holdings which is compatible with any RS 232/423 computer, with interface packs available for both the BBC and Electron. The Protek 1200 Modem provides a computer/telephone link which is said to be four times as fast as any of its competitors. The modem, which has full British Telecom approval, is battery powered and completely portable with flexible acoustic link to allow use with nearly all telephones. No adaptation to the phone system is needed, so the modem is suited to business or domestic use. The equipment can be used to transmit signals to databases set up to the 1200/75 Baud International Standard.

The Protek Modem costs £59.95 and is available from most high street computer retail outlets.

Watford Electronics has also launched a new low cost package for the BBC called Modem 84,



consisting of a modem and controlling software on ROM.

The modem is a full duplex system which can send and receive at the same time. It receives data at 1200 Bauds and sends at 75 Bauds, although transmission can be increased to 1200 by operating a mode switch or using software control.

The software comes complete in a sideways ROM and is fully function key driven. The facilities it offers include an optional user function on a function key to allow the addition of routines to do specific tasks and a fast machine code Mode 7 dump in addition to the normal ASCII printout, as well as the ability to save and load pages from disc or tape and fully automatic downloading of Telesoftware with a single function key.

The system is easily installed by plugging in the ROM and connecting the lead from the modem to the computer's RS423 port.

Modem 84 costs £82 and both modem and software can be bought individually, priced £62 and £20 respectively.

EX-STOCK ASSEMBLIES

Scotchflex flat cable/connector assemblies for linking micro-computers to peripheral equipment are to be made available to the home computer market ex-stock. Two BBC compatible versions are available for interfacing with a parallel printer and a disc drive.

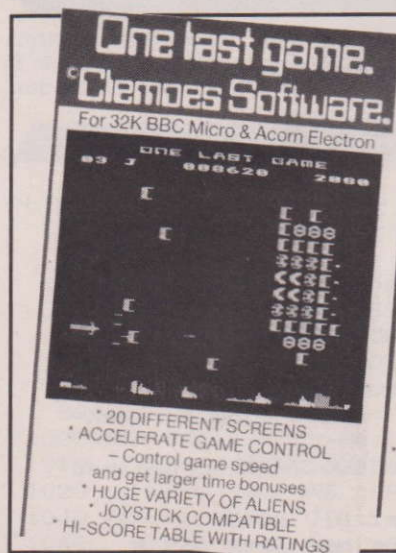
The printer cable (No.HA500P) comprises a 36-way Delta ribbon connector and a 26-way socket linked by a 1250mm length of flat cable. The socket is fitted with built in strain relief.

The disc drive cable (No.HA501D) is terminated at either end with a 34-way card edge connector and a 34-way socket with strain relief.

The cables are supplied by 3M who also make Scotchflex assemblies to customers' own specifications, including double disc drive cables.

ALIEN ACTION

Four new games from Clemoes Software should be in your shops by now. Look out for **One Last Game**, an arcade game involving combat with aliens above moving landscapes which features 20 different screens; **Go**, an old Chinese logic game



WS News

against your computer; **Mayday**, an arcade game in space and **Aabatron**, another arcade game based in the 22nd century on a computer-controlled Earth, overrun by hostile aliens which you've got to destroy.

All cassettes will run on the BBC and Electron and the games can be keyboard or joystick controlled.

recognition of the need to extend robotics into all spheres of education and training.

Up until the present time educational robots worked by specifying the joint to move and by how much. The new package allows movement by simply describing a position in space and the approach angle of the gripper. This is achieved using Carte-

The new Application package includes three additional programs: **Autohome** is a computer controlled home or datum position allowing exact known start position for any programs; **Keyboard control or steering** allows joint selection and movement direct from the keyboard as well as changes in speed and **Towers of Hanoi** allows the use of real discs moved by the robot, not just graphic symbols, to solve the well known mathematical problem.

The company believe that theirs is the first package to introduce the power of spatial co-ordinates into educational robots.

ADAPT TO TELETEXT

Bradley Marshall Ltd have launched a new teletext adaptor for the BBC which gives out a separate picture as well as text to a normal TV including sub-titles, news-flashes etc. The unit can be upgraded to a combined teletext prestel telesoftware adaptor with full ID and auto dialling features, also an optional infra-red remote control is available.

Additional features include mix and telesoftware direct loading, with control software on cassette, chip or disc.

If you're an electronics enthusiast you can buy the adaptor as a build-it-yourself kit, with some of the more difficult modules pre-assembled and tested.

FRENCH ADVENTURE

If you're struggling with French "O" or "A" Levels and are sick of the sight of verbs, nouns and prepositions then you will probably appreciate some light relief in the form of Silversoft's latest language title "French On The Run". This program is an adventure game and is designed to aid revision rather than teach the language.

In the game you are a British pilot in the Second World War and your plane has crashed in France. Eventually you hope to

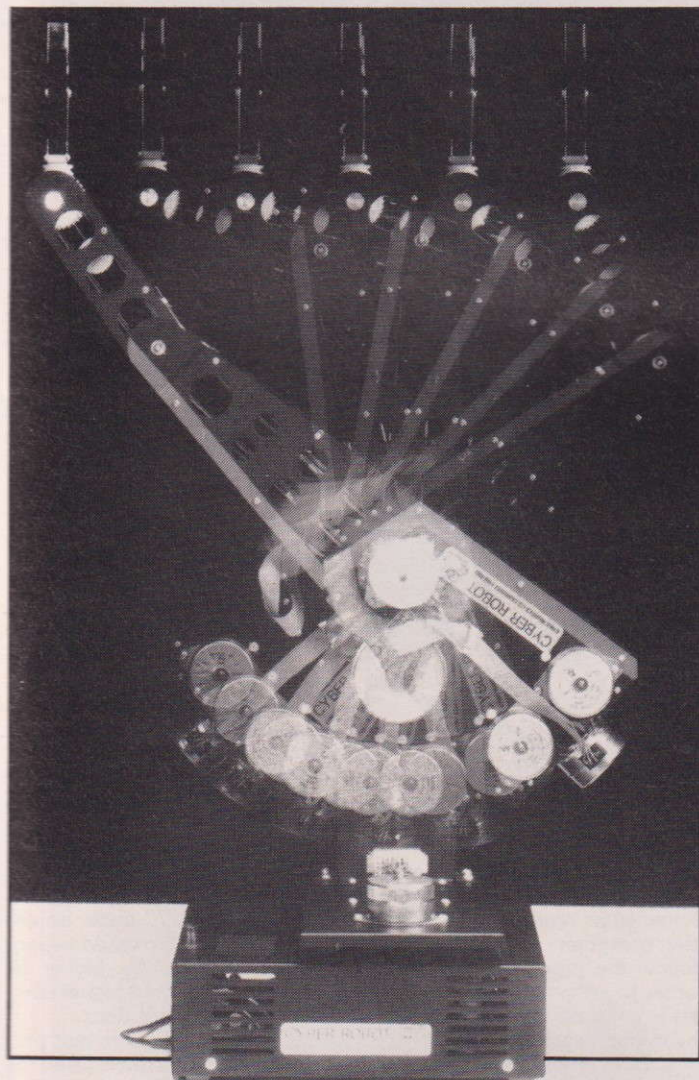
get home but in the meantime you must pass yourself off as French in order to avoid detection by the Germans. You can choose from four levels of difficulty but initially you must start at the beginning and work through all the stages in order to learn the necessary passwords. Levels one to three use language of "O" Level standard while four should provide useful revision for "A" Level students. The programmers researched their use of vocabulary with the help of teachers and pupils as well as the regional Examining Boards so that it is accurate and of real value to students.

In levels one to three your aim is to reach a safe country — Spain, Italy and Switzerland respectively. In order to do this you have to answer a series of question by selecting the correct response from a choice of four. Generally the questions involve you in conversation with another person who must not become suspicious of your true nationality. If you get an answer wrong these people turn out to be either Nazi spies or mercenary characters whom you have to bribe not to report you. As well as the language aspect of the game, the player also has to think about the adventure side, for example you will not be successful in reaching a border unless you get there in a certain time and don't spend all your money too soon.

You have to get every answer right if you are to reach your destination safely, otherwise you are captured again and taken back to the beginning. In this way you go over the same questions but each time the choice and presentation of the answers is different so you learn by your mistakes. Sadly, even when you do finally get there, you are discovered and must start all over again — but on the way you will have learned the password that gets you on to the next level. Finally you reach level four, which has a slightly different structure, and after successfully destroying the enemy headquarters you are helped home.

The game can actually be

CONTINUED OVER



THREE INTO ONE

Cyber Robotics have introduced a new set of Application Software to increase the performance of the Cyber 310 in

sian co-ordinates (x,y,z) which allow a robot to move to a number of points on a straight line and Cylindrical polar co-ordinates (distance, height and an angle) which allow movement in a circle or in a vertical plane under software or user control.

News Me

played by someone with no French knowledge at all by a process of guesswork and elimination. The questions not only test use of the language but also French general knowledge by asking about dates and places.

It is difficult to judge how much the program actually teaches because a good memory is as important as understanding the language in getting to the end of the game successfully, but those who are already studying French will no doubt find it useful and entertaining. It is written in a light-hearted and humorous style and will also appeal to BBC owners who want to justify their purchase by learning from the computer as well as having fun at the same time.

BBC BRAINPOWER

"Now you and your micro can bring out the best in each other", claim Triptych Publishing with regard to Brainpower, a new software range designed for adults who want to put their micros to serious use without necessarily learning to program.

In general the first six titles, of which Project Planner and Forecaster run on the BBC, cover managerial and business skills but with a broad appeal. The software is aimed particularly at small businesses and is designed to provide training and applications for business management without straining financial resources.

Triptych Publishing's objective is to harness the power of the computer to develop the skills and knowledge base of the users in each particular subject, so each title teaches what the subject is, how it is used and the circumstances in which it is most appropriate in order that the findings can be applied to the user's own problems.

Project Planner is designed to help the user plan and organise any kind of work or project in the most efficient way possible. It teaches how to divide



a project into single meaningful components and establish a sequence in which each should be done. Also it shows how to determine the length and importance of every single task and what effect each would have on the whole project should it go wrong or be delayed and which elements are particularly critical to the fulfilment of the plan.

Forecaster's aim is to show how to make predictions about what may happen in the future. It is said to take the guesswork out of forecasting on the basis that tomorrow's events can be predicted on today's facts. It

shows users how to assimilate and express their current knowledge ready for entry into the computer so that they can follow the program's routines in order to arrive at the most logical and accurate extension of the available data.

Both titles consist of three elements; a book containing a detailed explanation of the subject, a Teaching Program which animates and simulates the ideas explained in the text and the main Applications Program. Each costs £19.95 on tape and £24.95 on disc for the complete package.

PRACTITIONERS' PACKAGE

There is no escape from the BBC Micro, or at least Acorn hope there isn't. They've come up with a "Doctor's Package" to automate the many time-consuming administrative tasks necessary in a GP's surgery.

The disc-based system which consists of a Beeb, dual disk-drive, monochrome monitor, spark jet printer and built-in View word processing program costs £1,999. It also includes the first part of a suite of programs to control, for example, repeat prescriptions and patients' record keeping as well as surgery correspondence and documentation. Additional programs under development will handle such tasks as drug usage statistics, automatic patient recall eg for immunisations and financial administration.

Dentists and opticians needn't feel left out because Acorn are developing total packages for them too.

FLEXIBLE FRIEND

Following demand from Japan and Europe, Memorex has introduced a five and a quarter inch, 1.6 Mbyte flexible disc which is completely compatible with eight inch discs of the same capacity.

The new disc, which offers sixty per cent more capacity than the high density diskettes currently available, is a 77 track, double sided unit. The increased capacity was achieved by higher bit density per track and higher coercivity than standard discs.

Memorex's flexible disc products are manufactured using the company's "solid seam" bonding process for its jackets which is said to give better data integrity and protection against foreign particles than is possible using the spot-sealing process.

The new sized discs cost £4.48 and are available from selected distributors nationwide.

WS News



DIMENSIONING A DINOSAUR

Anyone who has recently visited York Museum may well have recognised the Mode 7 display on a lone VDU screen. In a town which boasts the most advanced museum exhibition in the world — the Jorvik

Viking Centre — it is good to see the BBC Micro making a contribution at the Dinosaur exhibition across the road.

South Leeds Information Technology Centre did the programming which is making visitors' heads turn and children's fingers point in amazement. The BBC sits invisibly in a box beneath the

screen but the display is unmistakable. The program demonstrates the various different types of movement and stance seen in both animals of today and in dinosaurs. Apparently the dinosaurs had fully-improved limbs unlike the "crocodiles in a hurry" which are shown to good effect in Teletext separated graphics.

Computer software is beginning to play an important part in display material for all kinds of activities and the BBC, as usual, is finding itself a role.

COMPACT PRINTER

A new thermal printer is now available from Phi Mag Systems Ltd, the company who released the Phloopy data storage system.

The PhiPrint is designed

for use with both the BBC and Electron and costs under £100. It is a 40-column printer with a nine-element dot head providing printing in true descenders, lower case characters and underlining. It also includes versatile character modes and bit image graphics.

Phi Mag hope that its compact styling, quiet operation and low running costs will make it suitable for applications in business, education and research.

BEEB BOARD

If you're finding sticky fingerprints all over your precious BBC keyboard it's obviously time you encouraged your young children to play on the computer themselves. A new pressure-sensitive board has been designed by Touchmaster which aims, among other things, to allow the very young to communicate with the computer through touch and sight.

The Touchmaster has an A4 working surface which is fully linear and does not use any moving switches or similar devices. To operate it you slide an overlay onto the surface, load matching software (called Touchware) into the computer, then touch the overlay with either a finger or stylus in order to produce results on your monitor.

Touchware ranges from educational programs covering shape and colour recognition, memory training, spelling, word and number skills to sophisticated graphics programs allowing the user to draw, paint and construct designs using either free drawing or pre-programmed shapes. There are also board, arcade and adventure games as well as programmer utilities such as graphic editors and sound synthesizer programming. Each program is supplied with instructions and an overlay for the board.

The Touchmaster package includes the board, all accessories necessary for use with the computer and the Touchware multi-paint graphics program. It is available from most computer dealers and costs £149.95.



Beebword

CLUES ACROSS

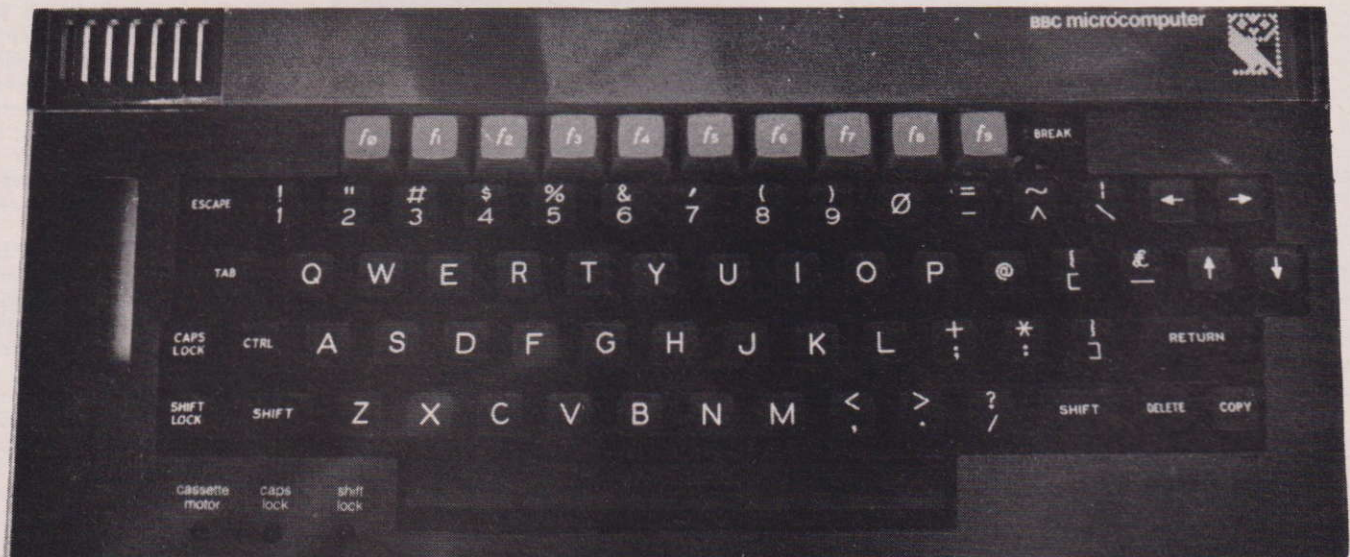
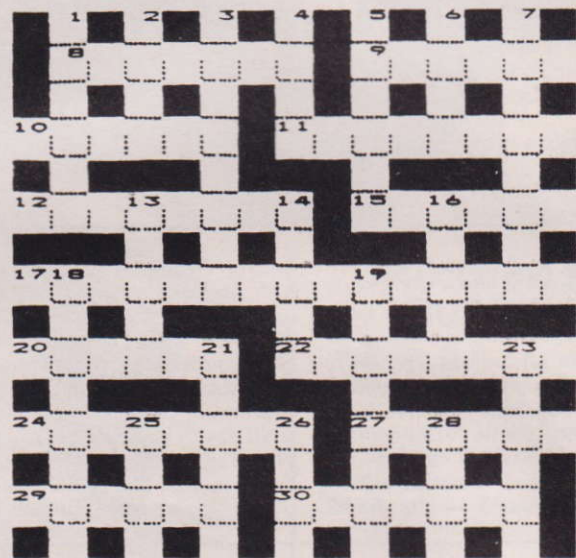
- 8 Extend yourself — create a file! (7)
 9 Automatically runs the program links (6)
 10 America backs best sort of machine code instructions (6)
 11 Sort of bars often associated with printers (8)
 12 Former BBC micro contender, product of northern wine bar? (3,5)
 15 It represents the sound of a percussion instrument (6)
 17 Not easy to solve if toddler's laces come undone (6,2,7)
 20 Two required to assemble the code (6)
 22 Mere burn is fixed by this facility (8)
 24 An error — so don't expect a drink! (3,5)
 27 It's exciting to start up your computer? (4,2)
 29 Marine graphics aid? (6)
 30 A disc could be so great (7)

CLUES DOWN

- 1 It's nil after *FX 210,1 (6)
 2 Makes room for a fresh program at ten? (4)
 3 Possibly sort a few programs (8)
 4 Program interrupt returns lots of money (4)
 5 Sonar experiment includes 100 Atoms Beebs and Electrons (6)
 6 Use the phone to transfer control, basically (4)
 7 Statement: it's in the post! (8)
 13 Yes, British Telecom revolutionised memory (5)
 14 Error message is negative number, we hear (2,3)
 16 It allows communication with Bond's boss after a fashion (5)
 18 A messy glue on a type of port (8)
 19 Mix gin with it, add charge — and blast off! (8)
 21 Power source to zap the alien... (6)

- 23 ...once zapped, the alien allows inter-communication! (6)
 25 Put a value to S, shall we?

- (4)
 26 Lean programmers often use it (4)
 28 Study a statement (4)



SOLUTIONS ACROSS

8 OPENOUT 9 CHAINS 10 SUBSET 11 PARALLEL
 12 NEW BRAIN 15 SYMBOL 17 CASTLE OF RIDDLES
 20 PASSES 22 RENNUNBER 24 NOT LOCAL 27 TURN ON
 29 TURTLE 30 STORAGE

SOLUTIONS DOWN

1 VOLUME 2 NEWS 3 SOFTWARE 4 STOP 5 ACORN'S 6 CALL
 7 ENVELOPE 13 BYTES 14 NO FOR 16 MODEM
 18 ANALOGUE 19 IGNITION 21 SOCKET 23 ECONET
 25 LETS 26 LIST 28 READ

Outstanding Output

Mark Webb

If you are looking for a printer to complement your BBC Micro these days then the choice is overwhelming. Having invested in a microcomputer which can be very versatile in the tasks it performs, it seems only sensible to invest in a similarly versatile printer. Thus, even if you are only doing a bit of do-it-yourself programming at the moment, when the BBC turns into a word processor (probably when the kids start using it for essay writing!), the printer will be able to supply the necessary performance.

VERSATILITY

For professional quality correspondence and report writing the Daisy Wheel is favourite since it produces a solid legible print suitable for impressing clients. The dot-matrix is the home computer favourite because of its price and versatility. Because of the way that the individual dots can be controlled by software, the dot matrix is capable of turning its hand to the reproduction of many different fonts, and even high resolution graphics.

Thermal printing produces wonderfully crisp results but is currently much slower at doing so. This technology (or laser printing which is progressing rapidly) will probably take over but in the meantime manufacturers are doing their level best to exploit those dots.

The two Taxan/Kaga printers, the KP810 and KP910 go some way to challenging the letter quality print of the daisy wheels with their NLQ (Near Letter Quality) print facility. This can be turned on and off with a simple code sent from the BBC, in the same way that any other facility would be turned on or off on an Epson compatible printer. For example: VDU 1,27,1,69 (bold); VDU 1,27,1,40 (NLQ).

The Kaga Electronics printers have the standard character sets well known from other dot matrix printers, including alternative western European characters for countries such as Denmark, Germany and Spain. The NLQ characters however are created with a larger

If you want quality dot matrix printing, why not check out the Kaga / Taxan NLQ printers.



23 x 18 matrix (standard is 11 x 9). This allows for more complexity in the definition of the shapes and a resulting higher quality on the paper. It is also possible to define your own character fonts in standard and NLQ to be held in RAM.

Also, more permanently in ROM, you can have an additional NLQ set. Various sets are already available from Data Efficiency, who distribute the printer range in the UK. These include ornate English styles, Greek and others not catered for by the standard international character sets.

Stand by for Arabic and

documentation and publicity. Currently ROM fonts are priced around the £30 mark but great demand will hopefully knock this down.

NLQ script can be used in standard or enlarged sizes but not in the condensed, emphasised, italic, double strike, superscript, subscript or proportional modes available with the standard set. All facilities are easily accessed with VDU codes and are Epson compatible. The Data Efficiency BBC Micro documentation gives a whole list of regularly used code combinations and explains the principles behind the sequences

needed to enable and disable various operations. There is also a section on sending codes from within Wordwise using the output command.

NLQ

The NLQ script itself is an attractive font, physically printed onto the paper in two separate passes. The first pass prints one part of the design and the second completes the job. The result is a darker print than standard, about double strike shade, and a set of solid looking characters, with smooth circles and curving features. The attraction of any particular script is naturally a matter of taste but NLQ seems to have got it about right. The result is perfect for impressing the reader but not too flowery or confusing to the eye.

An extension to the NLQ two pass facility, is the possibility of an additional graphic printing mode. Routines already written for Epsoms will work perfectly with the KP810 and 910 but using the double pass, 16 dot high density graphics dumps can be achieved.

TWO'S COMPANY

All the range of facilities is available on both the Kaga Electronics printers.

The only difference, for which you pay £100, is the 910's 15.6 inch printable width. This allows for 156 standard characters across the sheet of paper (267 in condensed mode). There is little justification for the home user to spend the extra

Taxan NLQ Tektura font.

>Lorem ipsum dolor sit amet, consectetur adipiscing elit, diam nonummy
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malesuada fringilla quis. Aenean euismod odio vel lectus maecenas
nunc. Quisque porta volutpat erat. Aenean faucibus nibh et justo cursus
id risus. Nunc lacinia accumsan nulla. Aenean malesuada massa mattis
consequat. Aenean lacinia bibendum nulla sed consectetur.

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!"#\$%&'()*+,-./:;<=>?@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

Chinese scripts for the export trade, business correspondence,

CONTINUED OVER

Taxan NLQ Tall font.

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Taxan NLQ Plain font.

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Taxan NLQ Script font.

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cash. He or she is unlikely to ever wish to produce the sort of tabular or report format which could take advantage of the 910. For the business user with large spreadsheets to print out and analyse, the extra width is good value. The only wordprocessor on a standard BBC which can operate over 132 columns, and therefore almost utilise the additional width, is VIEW. The best mode for using 132 columns with VIEW is condensed, enlarged

and cut sheet paper and one original and up to three carbon copies. All this depends on paper thickness but applies to the standard printer papers.

The design of the KPs is uncomplicated and even the most heavy-handed user, like myself, will find setting up a similarly uncomplicated joy. It is much easier than the Epson FX80 for instance. The ribbon comes in a cartridge, very much like a typewriter ribbon. The ribbon is

the manual contains the clearest set of step by step drawings I have yet seen in printer documentation.

The key to the ease with which tractor-fed (pin-fed) paper can be installed are the two adjustable plastic sprockets. Once again excellent help from the manual. The whole setting-up process is problem free except for the unfortunate lack of access to the DIP switches. As usual the factory setting does not match the

Taxan NLQ Shadow font.

>Lorem ipsum dolor sit amet, consectetur adipiscing elit, diam nonummy
eiusmod tempor incididunt ut labore et dolore magna aliquam erat volutpat. Nos
amice et nebevol factum est cond que neg facile efficerd possit duo conteud
notiner si effecerit, et opes vel forunag veling enfugiat nulla priatur.

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!"#\$%&'()*~^ _+;*:?/>.<, àèùòì"£:¿Ññ&PŁđç\$BÆæøø"ÅÖÜäöüÉé¥ø

pica, taking up 133 columns per line. For most uses, listings, screen dumps, graphical output and wordprocessing, the 80 column 810 will suffice.

Both can handle fan folded

hooked onto a roller in the left-hand corner of the front compartment, the cartridge pulled across to the right-hand side and pushed home and the taught ribbon eased into place between the head nose and the ribbon mask. Don't worry about the technical terms,

BBC Micro's method of sending data. The BBC does not issue a line feed with its carriage returns without you issuing the *FX6,0 command every time you power up or reset with Break. The printer really needs to be reset using the DIP switches to generate

its own linefeed.

Since everything has to be taken apart, it is advisable to carry out this operation immediately on receipt of the printer. Switch 3-4 has to be flicked over to "on". At the same time you may wish to enable NLQ at power up, if you wish to use it for most operations and don't fancy issuing software codes every time. It might also be a good idea to enable the input buffer. Once again, very good diagrams and tables in the manual.

ALL IN ALL

Overall it is clear that we are looking at a very reasonably priced (£299 and £399) pair of printers. The 810 is especially good value for the home user who envisages using the BBC for more than play/education and rather expects to get some profit out of it, especially in the form of saved time.

The printers are so easy to set up that no technical knowledge is required nor any manual dexterity! The NLQ mode is an important addition to the range of fonts and you get all the other Epson type features anyway. The Data Efficiency manual will tell you most of what you need to know about using the printers with your BBC and most printer utility software will be available to you. Examples of the NLQ print can be observed in some of the listings in this A&B. See what you think. We were all very disappointed when the 910 we reviewed had to go back and we use printers for all sorts of tasks as well as printing listings. There were not many jobs that it did not make easier than before. On the negative side, the positioning of the DIP switches is much less convenient than on the FX80 and the positioning of the centronics connection in the centre of the back panel did tend to ease paper off line.

All in all the NLQ printers are one up on the current opposition. If you are interested in finding out more then get in touch with Data Efficiency Ltd., Computer Peripherals Division, Maxted Road, Hemel Hempstead, Herts. HP2 7LE. Tel. 0442 60155.

MONITORS – Green / Amber

SANYO – Med. Res.

£76

MTC – High Res.

£108

MWS 800K DRIVE

£399

MWS 400K DRIVE

40/80 TRACK SWITCHABLE

(includes formatting disk and cable)

£267

MONITOR TURNTABLE

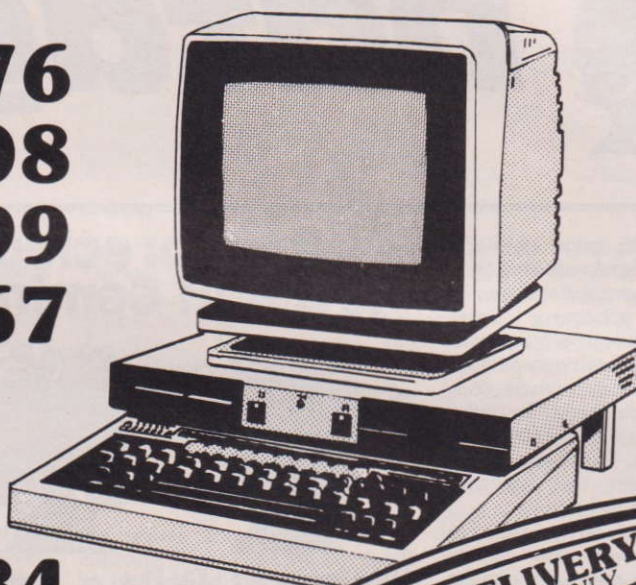
£18

BBC MODEL B

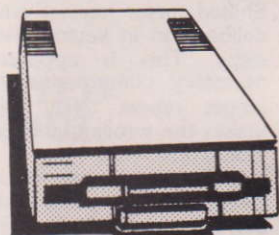
£399

(BBC MODEL B + DFS)

£484

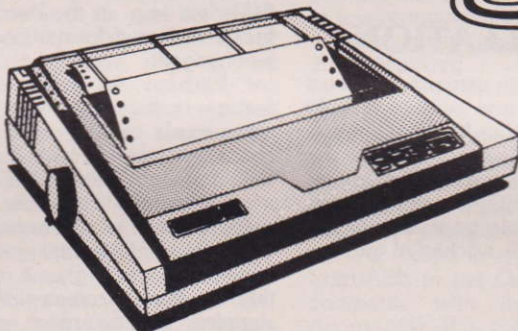


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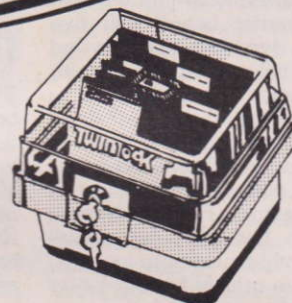
£149

SLIM HEIGHT 5 1/4"
40 TRACK SINGLE
SIDED DRIVE



£199

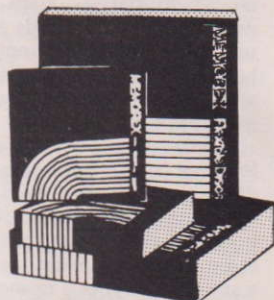
MT80 PRINTER



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HOLDS 80 DISKS **£19.50**

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DISKETTE BOX**



MEMOREX QUALITY DISKETTES

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BOXED IN 10s

£14.20 PER BOX

2D 40 TRACK

..

£18.50

1D 80 TRACK

..

£25.50

2D 80 TRACK

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DataGem



Gordon Taylor

Judging by its price of £130, DataGem is clearly aspiring to be the leader amongst databases for the single processor Beeb. However, although around twice the price of its Beeb competitors, it is not expensive when compared with database for other 8-bit machines with CP/M. Nor is it particularly expensive when compared with the hardware needed to run it.

DataGem is a general-purpose database and can be used to create and use many different datafiles. Part of the reason for its price being higher than its Beeb competitors is apparent when you see what you get — a plug-in carrier board with two ROMs, a demonstration disc and a substantial ring-bound manual. The question is: do these bring corresponding advantages?

To answer this, it helps to understand that DataGem is importantly different from almost all its competitors. Firstly, although DataGem has a couple of full menus with explanatory legends, it is driven mainly by Ctrl-Letter commands — of which there are 16 or so. Almost all of its competitors (e.g. Starbase, DataMinder) are menu-driven.

Secondly, it operates initially much more like an in-memory database and then loads additional records in quantity from the disc(s) in a sequential manner. This is similar to the "continuous processing" mode of View or to the virtual memory operation of Merlin Scribe word processors. Conversely, most of its competitors operate in classic random-access fashion — loading records from the disc(s) one at a time. Moreover, DataGem has no facility for indexing fields — to allow retrieval of a single record from disc in say four seconds. However, by holding up to 250 records at once, it is significantly faster (for comparable datafiles, DFS's and disc drives) at searching the whole datafile or subsets thereof for multiple records meeting the specified criteria.

Another difference is that DataGem has all its routines in machine code in 24K of Sideways ROM. It thus differs from those — e.g. StarBase,

How precious is this jewel in Gemini's crown?



DataMinder and File-Plus — which have a significant number of routines (often in BASIC) on a utilities disc. This helps to make DataGem very fast overall.

INSTALLATION

The DataGem carrier board must be plugged into Sideways ROM Socket IC 52 or IC 88. Although totalling 24K, it is treated by the Machine Operating System as only a 16K ROM — since the 8K ROM is "electronically piggy-backed" and switched in and out as required.

PARAMETERS

DataGem can accommodate unusually large records. At up to 6143 characters, they are over twice the size of even its nearest competitors — File-Plus with 2400 and Merlin with 2560.

Moreover, it compares well also in maximum file size. With a maximum of 5110 records per file, it is the largest of its close competitors and the file can extend over most of four floppy disc surfaces (800K in single density).

In practice, the file size constraint usually operates first. This is recognised and DataGem (in its later versions) can also operate with certain double density and Winchester (hard) disc filing systems (see later). Indeed, the ultimate maximum file size is an enormous 10 MB. These developments however are limited by the absence of Acorn standards in either case — although this could change very soon!

Because of the method of file organization, the datafile length can be extended after first

being set up. However, it should not use more than some 80 per cent of the maximum — in order to leave workspace for sorting and for copying by transferring field data (e.g. in the event that the record card format needs to be changed).

Perhaps its most visible feature is that the record and other cards can be up to 120 characters wide or high (but not both together). Since DataGem uses Mode 7 (like all its competitors), this is accommodated by both scrolling and panning (sideways scrolling) — rather than by discreet screen-size page stepping, as do most of the others. This in turn leads to a typewriter-like presentation of the card. By using the TAB key, the screen shows the whole card centered if it will fit, or acts as a window on the upper-left ("home") corner of the card if it will not. The whole card may of course be traversed — for editing or viewing — by means of the cursor keys.

The field names, or titles, can total up to 3000 characters. For holding the data, DataGem can have up to 62 fields — and these are also ample in length — at up to 120 characters.

As well as its sheer size, DataGem is also very well endowed with features which make the setting up, searching and outputting from a datafile easy and flexible. However, DataGem is not multi-file or relational. According to Gemini, this would need more room both for program (ROM) and for workspace (user RAM). The trade-off was some relational capability versus the searching capabilities, the maths functions and the maximum number of records.

FILE CREATION

While creating the file, the header "Initialisation" is at first flashing all the time — which is very distracting. Luckily, this can be changed — either by simply deleting it or by typing in a non-flashing replacement. Incidentally, this header is not automatically the same as the datafile name — though you may find it convenient to make it so.

I found that there was a distinct tendency to "double entry" — both when stepping around a given record card with the cursor keys and when stepping between cards with the Shifted-cursor keys. Even slight deliberation in keying gives two steps. This is apparently a necessary compromise — any longer repeat delay allegedly makes the scrolling and panning look worse.

The layout of the record card is completely free (within the overall constraints of 120 characters width or height and 3000 characters of field titles plus 6143 characters of field data). This is effected by the paint-a-screen technique — which is in-built (unlike some 8-bit CP/M database packages, which need a separate utility for this).

The fields are referred to as F1, F2 etc. This allows other card formats to be derived from the record format — such as the default and report cards and one or more print formats (see below). Also it allows searches and sorts to be specified in a compact fashion.

Like most other databases for the single-processor Beeb, there is only limited validation of the data entered. DataGem is however significantly better than the majority in having, as well as a string data type, a numeric data type which is limited to numerals and decimal point and also a date data type, which permits only a day-month-year format but allows a two- or four-digit year and a choice of delimiters.

A default record card can be set up. This can both speed data entry (with default field values — e.g. today's date) and help guide the field data entered by example.

A further aid to data entry is a list described as being for User Formulae. In fact, it offers 18 single letters as abbreviations for string, numeric or data data values as well as formulae — of up to 30 characters each. This can considerably speed data entry and reduce the space occupied by the datafile — by avoiding unnecessary repetition. They may even be used for string comparisons. However, the concept has even greater utility when used with the default record card, since the value of such a letter — e.g. the current VAT rate — can be changed at just one point and yet update all the records in a datafile.

PRINTED OUTPUT

A special form of output from DataGem is the report card. It can have its own field titles and layout and is intended for the presentation of derived field values, such as totals and averages. Like all other card formats, it may be differently coloured for easy recognition.

Further cards can be created for output — known as print formats. These can contain any or all of the record files — accompanied by the same or different field names (or titles) — and any variation of layout or size (within the 120 character width or height). For example, the field values can be set in line across, with no field titles in between, so as to fit on a standard paper width. Moreover, while one such print format may be stored along with the datafile, additional printer formats — for alternative output reports — can be created, and stored under their own filenames.

However, creating or editing of such formats can be quite puzzling at first — when certain commands fail to "Take". This is often because the cursor is in an area already occupied by a title or data field. Unfortunately, no explicit prompting for this condition (or many others) appears on screen — due to pressure on space in the (24K) ROM.

For another form of output, the field titles on a print format may be increased — up to the maximum of 3000 characters (provided enough RAM space is set aside for the purpose). This enables a form letter of up to some 500 words to be created within DataGem using the in-built text editor, containing fields whose values are drawn from the current datafile.

Finally on printed output, DataGem can produce spooled files — complete with embedded control codes if need be. These can be merged with longer letters or documents, written in a word processor. For example, a spooled DataGem file can be *EX-ECed into Wordwise, Scribe or View to provide, say, a table within a report. *EXECing (merging) into Scribe requires that the spool file be renamed into the S directory.

The "macro" facility within View allows true mail merging — i.e. the printing of multiple letters, each containing different information drawn from the DataGem file. To produce a suitable file, the first field title in the print format must consist of ASCII 128 Shift-f0 followed by the View "macro" name, with only commas (delimiters) as the titles of up to nine subsequent fields. After being spooled out of DataGem, this file is then READ into a View "macro" document. (If this has a short page length, the four vertical margins may need to be reduced below their default values). The result may then be printed to produce the multiple documents, complete with their merged data fields.

If it becomes necessary to create another datafile, containing one or more existing fields, then you do not need to type all the data in again. Instead, each of the existing fields can be spooled out to a named file and then *EX-ECed back in to the new datafile. This method both affords the maximum flexibility and keeps the individual transfer files to manageable size. Once again, since the header name shown on the screen is not necessarily the datafile name, this should be amended as required.

On the demonstration disc

that comes with DataGem, Gemini provide a utility for transferring datafiles from their simple in-memory database into DataGem. Furthermore, the manual contains a short BASIC program for creating a spool file to transfer data from BASIC or from other databases.

SEARCHING

As noted above, DataGem is unusual in not allowing any fields to be defined as index fields — which would give rapid access to single record in say three to four seconds. This makes DataGem possibly less suitable for use e.g. in answering telephone enquiries — although it does have a "Go To Record" command. However, thanks to holding up to 250 records in memory at one time and then accessing the remainder sequentially in large blocks, it offers much faster searching of the whole datafile for potentially multiple "hits".

As noted in my review of StarBASE in the October issue, compared with the standard Acorn 0.90 DFS, the search process can be further speeded by using as "fast" DFS, such as the Watford 1.3 or the Acorn 1.2, incorporated in the DNFS used for the Second Processors. However, caution must be exercised in choosing the DFS since a powerful and complex program like DataGem needs careful checking (and possibly modification) for compatibility and DataGem is stated to be compatible with only certain DFS's (see below).

The search criteria are entered in a dialogue line at the bottom of the screen, with the record card (or part of it) displayed above it. The type and number of any field on the whole card can be displayed at the top of the screen by positioning the cursor on it.

The available search criteria are very powerful — including substrings (or part-fields) through the use of explicit single or multiple wild cards for single and multiple characters, logical operators and Boolean combination operators. Moreover, the search criterion can be up to 36

characters in length and can be edited (to avoid the need for re-entering it from scratch in the event of a mistake).

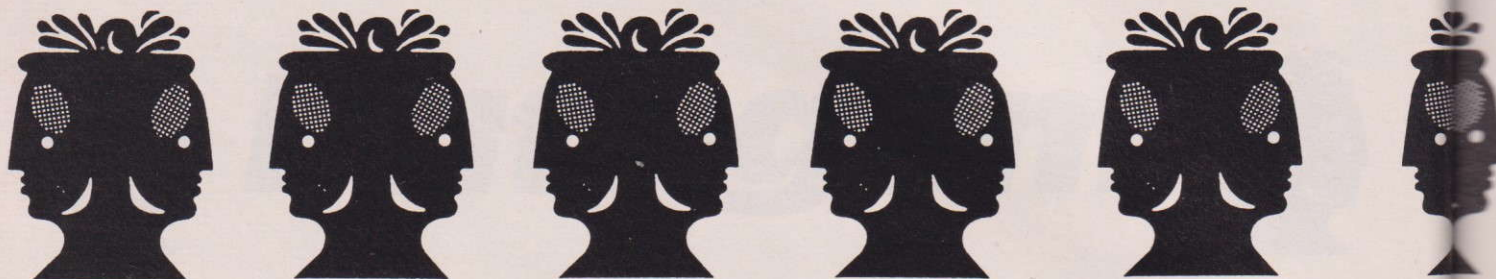
Searches are applied between "levels" — with the source file being on one level (initially level 0 — the whole datafile) and the destination file on another chosen level — of eight available. Although the name "level" implies a fixed hierarchy, the relationships are purely what the user decides and they are more accurately describe as subsets. The availability of up to eight levels of subsets means that it is possible to apply complex search criteria in stages — so that the effect of each stage may be viewed and reviewed separately. Moreover, this allows selections to be "undone" by switching back to the previous level.

As well as allowing searching for the presence or absence of the criterion in the current level, another option also adds those records from the main datafile which meet it. Also any two levels (which may themselves be the results of searches) can be combined — so as to find the total records, the records which are the same, or the records which differ, in the specified criterion.

Provided the field or fields in question are known, the method of file handling used by DataGem means that the search is further speeded by being limited to that/those field(s). However, if the field is unknown, it is possible to use a wild card in place of the field number — although the search will then take correspondingly longer. When searching, DataGem displays a string of dots, with an arrow indicating progress, and changes them to squares to mark the "hits".

A considerable convenience with DataGem (compared with, say, StarBASE) is that the up-to-eight levels or subsets are automatically saved with the datafile — as also are the level you were last on and the last search criterion. However, there is no provision for saving the complete search history for each level.

CONTINUED OVER



SORTING

In order to retain the advantage in speed of loading of sequential access (to the datafile) normally used by DataGem, it is necessary to be careful in the use of sorting. This is because, if the datafile was re-saved after sorting, it could only be re-loaded by random access (which is much slower). Hence the recommended practice is to sort the level or subset and use it to produce e.g. an ordered printout or spooled file, then press Break to erase the sorted order before closing the file and to retain the original fast-loading, sequential order. This works for datafiles/subsets containing up to the maximum number (5110) of records.

Sorting may be in either ascending or descending order and sorting on string fields can be chosen to be with or without taking account of case.

Although DataGem can only sort datafiles or subsets thereof on one field at once, this is done to the full depth of the field, which may be of up to 120, 15 or eight characters — of the string, numeric or date data types respectively. Moreover, leading spaces are ignored and so do not cause an out-of-order sort. Furthermore, though not especially fast (at about 15 minutes for 1000 15-character files), the type of sort has been chosen to allow successive sorting on more than one field — provided that you start with the least significant field. This approach (of a single field sort which may be used successively) enables large subsets to be sorted (to full field depth) within a workspace of reasonable size. If necessary, DataGem will use multiple passes to carry out a sort.

CALCULATIONS

The mathematical operators available are limited to the four standard functions (+, -, *, /) and unary minus. However, these may be combined with the logical operators to compute e.g. the maximum or minimum value

for a particular field as well as its average value and variance (although only the formulae for the first and third are given in the manual). The primary functions are within DataGem itself and independent of the BASIC ROM — which therefore need not even be installed in the machine.

DataGem datafiles also contain certain variables and values which are available for use in calculations — both within records and across records. These include variables such as the current record number in the datafile (as N), the current level or subset (as L), the current record number in the current level (as R) and the total number of records in the current level (as O). In addition, the values of any numeric field (as Fn), the total value of any numeric field in the current level (as Tn) and the values of the day, month, and year components of any date field (as Dn, Mn and Yn), are available.

Calculations may also be done on individual record cards in a spreadsheet-like fashion. DataGem records can be large and may then be viewed by scrolling and panning. Formulae may be entered separately — on the User Formulae card — and DataGem may be toggled between the Formulae and Derived (value) modes. Calculation of the record card(s) defaults to "off" — but can be initiated by a "Force Calculation" option. This "spreadsheet-like" operation is particularly convenient when using only the screen display in an interactive fashion but the card format or sheet can also be output to a printer or spool file.

SECURITY

At present, DataGem contains no provision for password protection. However, the datafiles are encrypted and cannot be read simply by using *LIST, *TYPE or *DUMP — as for most other Beeb databases. Nor is it possible to access the ROM routines e.g. from BASIC so as to decrypt the datafiles. Instead, only the files produced from within DataGem

for spooling e.g. into word processors (and, to a lesser extent, those used for field transfer) are readily readable.

Gemini plan to offer protection in a future upgrade of DataGem.

ROBUSTNESS AND COMPATIBILITY

DataGem can accept discs loaded into the wrong drives and drives specified in the wrong order. This is important when the datafile may be on from one to four surfaces.

DataGem is compatible with the Acorn 0.90 DFS, the Watford 1.3 DFS, the Pace Amcom DFS, the Pace WFS (Winchester Filing System) and the Microware WFS. It will also work with multiple filing systems — such as the Acorn Econet in combination with a DFS — albeit at a penalty in the number of records held in memory.

However, such compatibility has only been achieved by dealing with various "features" in such software — usually at a penalty in the performance of DataGem. For example, compatibility with the Acorn 0.90 DFS requires that any datafile be padded out to its full size before copying, in order to prevent the wrong catalogue being copied under certain circumstances. This adds a small overhead to the sort procedure.

DataGem version two (which will be available very shortly and as an exchange for earlier versions) will also be compatible with the Watford 1.1 and 1.2 DFS's, the Pace Amcom B DFS and the Opus Double Density DFS.

EXPERIENCE IN USE

In use, DataGem is quite well endowed with interlocks (to prevent overwriting or futile actions) but — due to pressure on space even in 24K of ROM — it produces very few prompts. Thus, while it does not allow files or data to overwrite each other (see above)

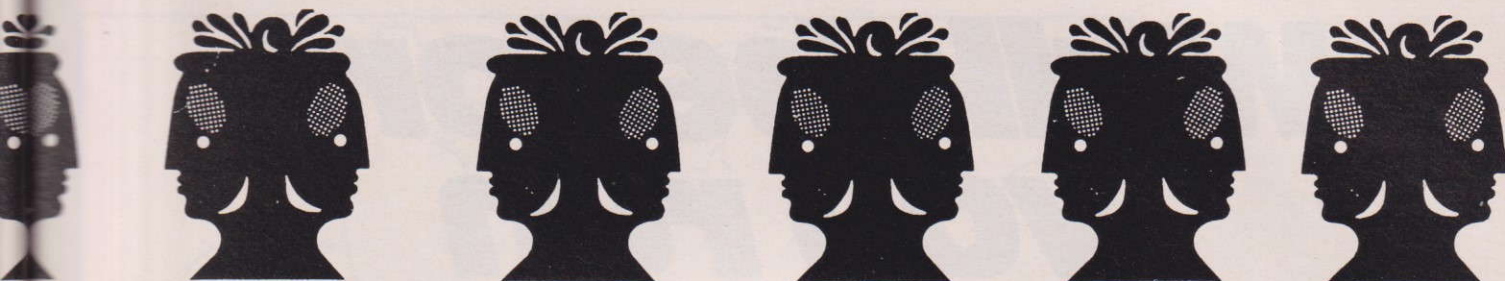
or less than two records to be sorted or less than one record to be browsed or printed, you have to keep an eye on the top line to understand these conditions. As well as the cursor co-ordinates, this shows the type and number of any field title or data that it is currently on, the current level, whether DataGem is in Formula or Derived Mode, the record number in the current level, the number of records in the current level and the maximum number of records for which there is space in the current datafile.

Further interlocks prevent you from e.g. exiting to BASIC until after you have closed the current datafile. When errors do occur, the messages are at least strings rather than numbers but are still somewhat cryptic — even though they are fully explained in the manual.

Notwithstanding the two menus, DataGem is primarily "command driven" (in that there are no explanatory legends accompanying the command letter lists when these are shown at the bottom of the screen). This is simply because the choices are so numerous — i.e. at least 13 in "Set-Up" mode and at least 16 in "Browse" mode (See Fig. 1). This contrasts with most other databases for the single processor Beeb, which are primarily or wholly "menu-driven" and have typically 12 or so menus — each with around five choices and short explanatory legends.

Such "command driving" has very real advantages for users who are more familiar with the program. They can achieve the desired result in less time and with fewer keystrokes than with a menu-driven database. In the case of DataGem, the advantages are increased by the sheer number of features of the database.

However, the designers have "raised the threshold" for achieving familiarity by some inconsistencies between the same commands issued in the two modes and even in the editors. This is all the more surprising since there appear to be enough letters in the alphabet for all the commands (typically Ctrl-Letter) to be unique. The explanation of-



ferred by Gemini is the desire to have the letters suggest their function — even with some ambiguities.

Despite the "command-driven" nature of DataGem, there is at present only a very limited provision for the creation of "command files". These are sequences of keystrokes which may be entered into the function key buffer (which is not otherwise used by DataGem). While easy enough for a few keystrokes, this buffer is notoriously difficult to use for more because of its small size — only 256 bytes or characters — (which encourages the use of very cryptic abbreviations) and the impossibility of editing it. Furthermore, although the contents of this buffer can be saved (with *SAVE filename OBOO OBFF, as in the Beeb User Guide, p 502) and hence re-loaded, this is not documented in the present DataGem manual.

MANUAL

A demonstration disc is provided to help you through the early stages of familiarisation with the program. However, its value is somewhat reduced since the manual does not tell you which file you should be using at any particular stage. Also the field numbers and data values in the demonstration files often differ from those given in the manual — which seems odd.

Such considerations are all the more important as the DataGem manual is of daunting size — at 184 pages — compared with e.g. 39 for Starbase, 73 for File-Plus and 94 for DataMinder. Furthermore, although broken down into many sections, the pages are not numbered but have non-sequential reference codes instead. Also, despite the profusion of features and the length of the manual, there is no index — so you can spend a lot of time turning pages!

Against this, the binder and pages are of good quality, the pages are properly typeset and have plenty of white space, and there are many cross-references in the text. There is also a quick-reference card. However, there is still considerable scope for im-

provement. The present manual is not easy to work with and you may well not be able to find and use all of DataGem's many features.

PLANNED DEVELOPMENTS

As noted in their introductory leaflet for DataGem, Gemini intend to offer "a range of attractively priced application masks". These are the record and print formats, together with default cards and example data, which will be customized to particular database applications, and should start becoming available from October. A "Mask Generator" program may also be offered.

They also intend to offer a "Program Generator" — similar to the utilities available for other "command driven" databases. This enables files of commands (and presumably search criteria etc.) to be written within Wordwise or BASIC and then spooled out. One or other of such files can then be EXECed into DataGem (perhaps by choosing between programmed function keys) — in order to carry out procedures which are required repeatedly — whether regularly (e.g. weekly, monthly) or irregularly. Effectively, such command files provide a "shell", making a relatively complex database simple to operate for a special purpose — simpler even than a menu-driven database.

Mention has also been made by Gemini of a range of simple utilities, written in BASIC, to convert datafiles produced by other databases. Those mentioned have included Acorn Record Keeper, Clares Betabase, Gemini Stock Control, GCC Starbase and Psion VuFile.

Any major upgrade of DataGem itself and a "definitive 3-D graphics/statistics" package "to interface with DataGem files" will involve additional ROMs of 8 or 16K.

Other plans for DataGem include releasing a revised manual, starting seminars for dealers, recruiting consultants and forming a User Group with its own quarterly magazine.

CONCLUSIONS

The advantages of DataGem over other single-processor Beeb databases released so far have been detailed above. More fundamental is the fact that DataGem is quite different in its rapid access but index-less search characteristics and in its "command-driven" control. As well as the different (often faster) performance, this means that DataGem requires a lot of commitment for the user — not least because of the sheer number of features. It is not helped by the lack of explicit prompts (due to understandable pressure on ROM space) — nor by the present manual — which is overlarge and somewhat difficult to use.

However, the availability of

User Formulae and the prospects of customised application masks and a "command file" Program Generator that DataGem has considerable further potential. This is important in a database, since user needs almost invariably grow with time.

In short, DataGem should not be your first database. You should have experienced the limitations of lesser databases first — in order to provide the motivation for learning and exploiting its many powerful features. Also it is probably more suitable for users who will make regular — rather than only occasional — use of it.

DataGem is currently available from dealers or direct from: Gemini Marketing Ltd., 18a Littleham Road, Exmouth, Devon EXB2 9G. Tel (0395) 265165.

Fig. 1 DATAGEM MENUS AND COMMANDS

MENU 1		SET-UP MODE COMMANDS	
ESC	To Set Up Mode	ESC	To Menu 1
A	BASIC	TAB	Centre Card
B	Re-Mask File	Ctrl-A	Allocate Title RAM
C	Close File	Ctrl-C	Change Screen Colours
D	Create File	Ctrl-D	Manipulate Field Data
E	Convert File	Ctrl-E	Edit Titles or Data
F	Use File (Menu 2)	Ctrl-F	Add New Field
*	Command Line	Ctrl-H	Change Header
		Ctrl-I	Centre Card
		Ctrl-P	Print Field Analysis
		Ctrl-S	Change Size of Card
		Ctrl-T	Manipulate Field Title
		Ctrl-Del	Delete Field
		*	Command Line
MENU 2		BROWSE MODE COMMANDS	
ESC	To Browse Mode	ESC	To Menu 2
A	Add Records	TAB	Centre Card
B	Sort Records	Cursor	Traverse Card
C	Close File (Menu 1)	Shift-Curs	View Adjacent Records
D	Delete Records	Func.Keys	Combined Operations
E	Retrieve (Undelete)	Ctrl-A	Add Record
F	Force Calculations	Ctrl-B	Batch Edit
G	Default Card	Ctrl-C	Change Screen Colours
H	Report Card	Ctrl-D	Manipulate Field Data
I	Load Quantity	Ctrl-E	Edit Titles or Data
J	User Formulae	Ctrl-F	Formula/Derived Toggle
K	Field Transfer	Ctrl-G	Go To Record
L	Change Level	Ctrl-H	Change Header
M	Save Format	Ctrl-I	Centre Card
N	Load Format	Ctrl-N	Numeric Field Parameters
O	To Search Menu	Ctrl-P	To Print Menu
P	To Print Menu	Ctrl-S	Change Size of Card
*	Command Line	Ctrl-T	Manipulate Field Title
		CTRL-V	Valuate Card
		*	Command Line

Walk before you run

Richard Ives

If you have been following this series, you may think that you are getting to be quite a little hacker on your computer. But don't get too cocky, because there is a whole important area which we haven't yet explored. This is the area of graphics, on which subject I intend to devote a few words this month, and in the next issue, if the editor allows.

The first micro-computer I owned didn't have any facilities for drawing. With the BBC and Electron we can easily produce a dazzling array of lines and shapes on the screen in a variety of colours (including flashing ones). On my first machine I didn't even have any colour (how things have improved in four short years!), if I wanted to draw a graph or picture of any sort my only choice was to do it with PRINT TAB statements (which I told you about in this series a couple of issues ago). However, although it is limited, PRINT TAB can be used to create excellent graphics, and this month we'll consider how to use it and a few other features.

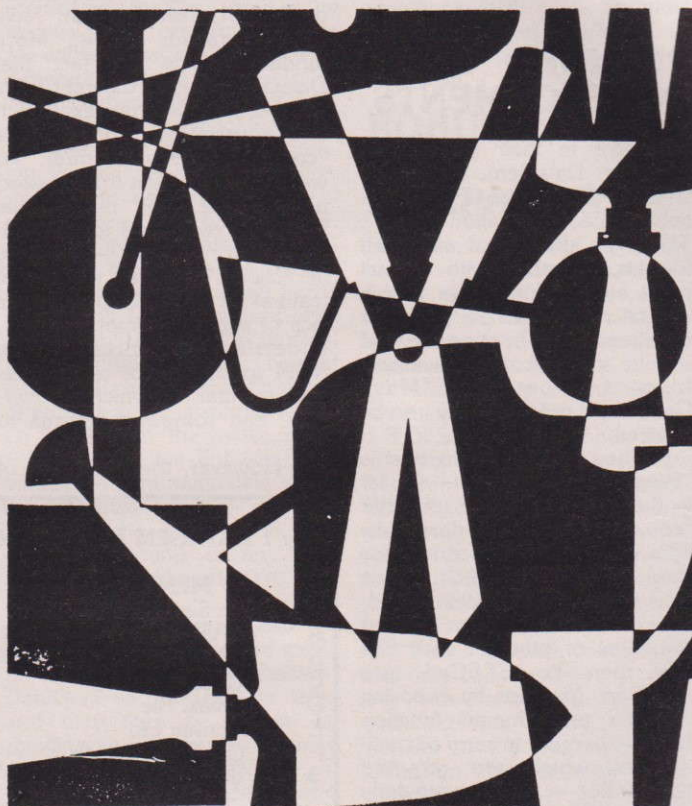
DRAWING A BAR GRAPH

To start off simply; suppose we want to draw a bar graph. We will see later how this may be done more easily, but for the moment suppose that we want to do it just using PRINT statements (if you think you know how to do it more easily then have a go before next month). We will draw a couple of axes first (no, not those things you see a lot of in "Mad Max II"). This bit of program should do the trick.

```
5 MODE 6
10 FOR I = 1 To 39
20 PRINTTAB(1,24)“-.”
30 NEXT
40 FOR I = 1 To 23
50 PRINTTAB(1,I)“I”
60 NEXT
```

Line 5 clears the screen and ensures we are in a mode of the right size for this program segment to work. We then use two loops first to print a series of dashes along the bottom of the

Create simple characters and bring them to life.



screen, and then the letter 'I' to represent the vertical axis. Think about the loops used here and why those values have been used (Try rewriting this program segment to work in Mode 2.)

Now we can create our histogram. To plot ten bars of random length the following lines will do:

```
70 FOR I = 3 To 39 STEP 4
80 FOR J = 3 To RND(20)
90 PRINT TAB(I,25-J)“*”
100 NEXT
110 NEXT
```

Notice the loop within a loop; the outer 'I' loop (lines 70 to 110) positions the bars along the horizontal axis, and the inner 'J' loop (lines 80 to 100) prints a number of asterisks which depends on the value determined by RND(20). The asterisks aren't very pretty; we might like to create our own characters and

make a kind of pictogram: we are coming to this in a moment.

Although this technique is adequate for simple bar charts, we can't draw a line graph in this way. Let's leave that particular problem for a moment (well, alright then, a month or two) and learn now how to define our own characters. Type:

NEW

in order to remove the program we have been using from the memory.

CREATING A SHAPE

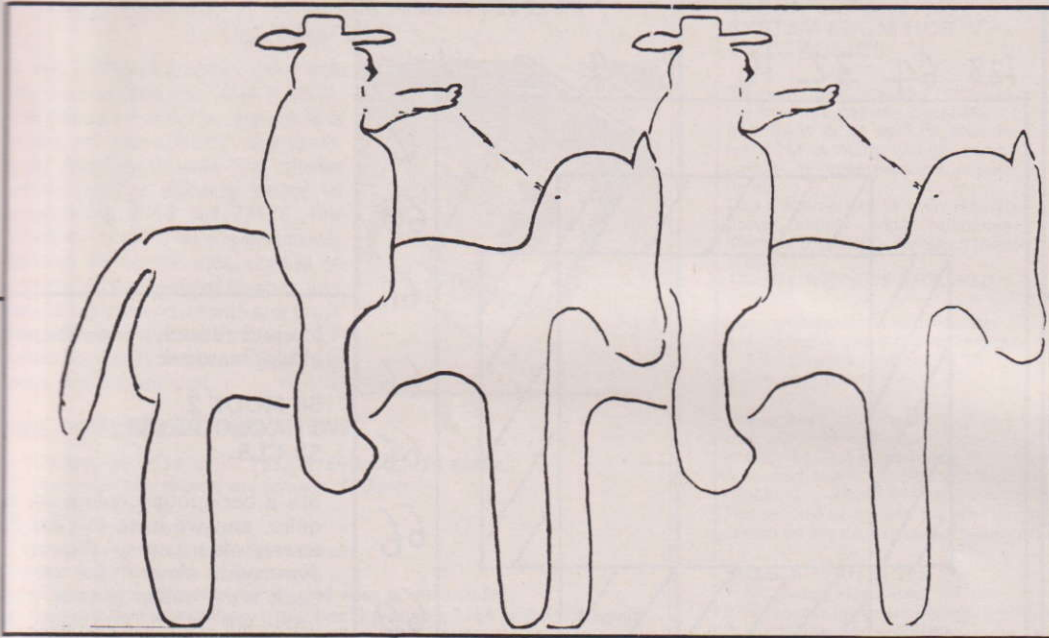
The standard characters available on the BBC or Electron keyboard are rather limited. Some home computers provide you with a ready-made set of useful

characters, such as playing card symbols. Acorn doesn't do this, but the user does have complete freedom to define his/her own characters. Thus, we are no longer limited to the alphabet, the numbers and whatever other special characters are available. We can tell the computer what shape we want a particular character code to represent and it will obediently produce that character on demand — until we turn it off. (However, we can always save the definition of the characters in a piece of program, so that's not a problem). The character will be very small, as we only have one character space to work in at the moment, but if we use a large character mode, say Mode 5, it should be just about big enough to see.

HORSES FOR COURSES

Let's now think about making up a shape of our own to draw. Let's get away from graphs now, what would be fun? I always try and err on the side of simplicity in these articles (the computer is bad enough to deal with, without having to cope with complicated ideas in the text) so let's draw a simple matchstick figure; a matchstick horse and rider.

Each of the characters, whether they are already defined or made up by use, are laid out on a tiny 8x8 grid. That is, the small square into which each character fits consists of 64 even more tiny squares. If you have good eyesight and you look very closely at a character on a high resolution monitor, you can see these little squares. They are called pixels, and can be turned on or off as we please. (They can also be on or off in a different colour.) So when you look at a character you are really seeing a particular on-off arrangement of 64 pixels. All we have to do is to tell the computer which pixels we want on and which we want off and our character is defined. Of course, we have to represent this in numbers, as we'll see in a minute, but the first thing to do is to draw out our character on an enlarged 8x8 grid. Let's do it free-hand first like this:



Oh dear, my secret is out now, and you all know I'm useless at drawing! But in any case this is no use, as my line passes through the middle of some pixels, and we can't light up half a pixel; it has to be either on or off. So we must redraw our picture in little blocks (it's like building with two-dimensional Lego) so that each pixel can be either on or off, like this:

this figure by eight numbers, one for each row. (By the way, to get one confusing thing clear: when I say 'row' I mean the horizontal line, and when I say 'column', I mean the vertical.) To do this we give each column a place value.

Pause for a minute to explain that: think about when we write any number, say 4321. The 1 just means 1, but the 2 doesn't stand for 2, it stands for 20, and

vertical columns has a place value. They don't increase in powers of ten like the numbers we are used to (1,10,100,1000...) but in powers of two: 1, 2, 4, 8, 26, 32, 64, 128. So the rightmost column is the 'units column' the next the 'twos' column, the next the 'fours' column and so on. To decide the number needed to define each of the rows, we add together the place values represented by the squares which are lit up on any row.

Now we have them, what do we do with them? We tell the computer which character we want to be that shape. I explained about ASCII codes in a previous article, but just to recap... each character is represented in the computer by a number in the range 0 to 255. For example, capital 'A' by 65, and so on. We can refer to any character by giving the computer the number, thus either:

```
PRINT CHR$(67)
or
VDU 67
```

will cause the letter 'C' to be PRINTed. On the Electron, characters 128 through 255 are initially undefined and we can do what we like with them. However, characters 224 through 255 are the ones that are generally used for user-defined graphics. (We can define others, or even all those from 32 through 255, although not all at once, unless we do some jiggery-pokery with the memory). This is true on the BBC, too, apart from Mode 7, where all characters are defined and cannot be redefined. So if you are using a Beeb for character definition, make sure that you are not in Mode 7.

VDU COMMANDS

The command for defining characters is VDU 23. VDU statements do a variety of esoteric things; VDU followed by a number between 0 and 31 generates ASCII Control codes (special codes giving the computer instructions). VDU codes 32 through 126 generate the ASCII character set, VDU 127 has the same effect as the delete key, codes 128 through 223 are normally undefined, and, as I mentioned, of these 224 through 255 are immediately available for our use. So the statement:

```
10 VDU 23,224,16,24,19,127,253,84,68,68
```

will define character 224 as our little horse. Let's PRINT it to see (type RUN first):

```
PRINT CHR$(224)
```

Now we've got it, let's play around with it. Print a line:

```
50 MODE 5
60 FOR I=1 TO 10
70 PRINT CHR$(224);
130 NEXT
RUN
```

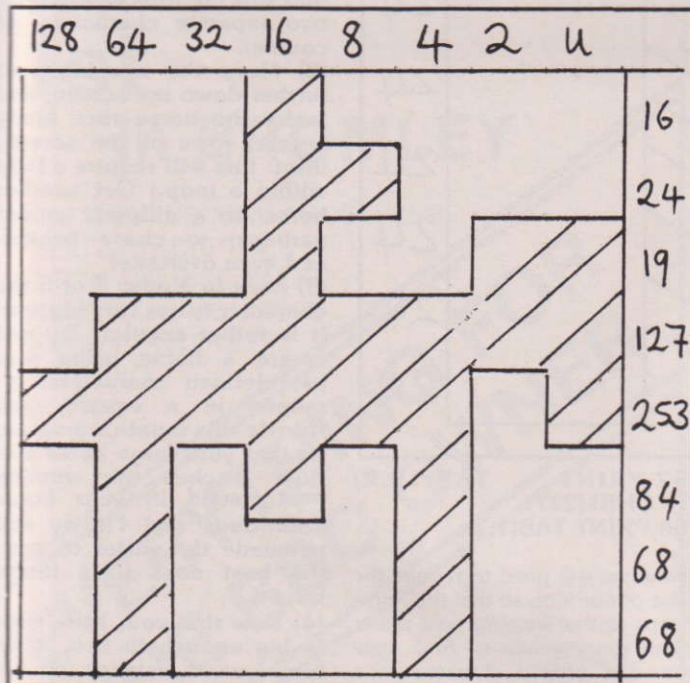
That looks fun...if we could delete the character shortly after we PRINTed it, it would look as if it was moving. To do this, we can move back a character (one of those control codes: VDU 8, does this) and then PRINT a blank in that position. Add:

```
90 VDU 8
95 PRINT " ";
```

and try RUNNING this revised program. Oops! That deletes our horse too quickly, before we've had time to see it. We need a statement to make the computer wait for a bit before deleting. If you remember the stuff we did in this column a few months ago on getting information into the computer you will recall that INKEY is suitable for this, so add:

```
80 DUMMY=INKEY(10)
```

CONTINUED OVER



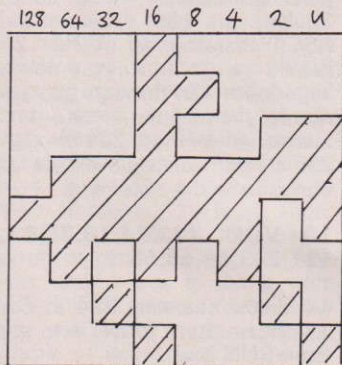
EXPLAINING IT TO THE COMPUTER

O.K., we now need to turn this into something the computer can understand — numbers. This is where we have to do a bit of maths. It is possible to represent

the 3 stands for 300 and the 4 for 4000. We could play a game where I said 'I'm thinking of a number with a 6 in the 5th place, a 9 in the second place and zeros everywhere else', and you'd have to decide what number I meant. And of course, you'd instantly come up with 60090.

On our 8x8 grid each of the

That should slow it down a bit. See if it does. Our horse moves, but rather woodenly. That is because it has stiff legs. If we were to make another horse character, but with the legs in a running position, and then PRINT one character after the other, as is done in cartoon animation, it should look better. If we draw another horse on an 8x8 grid:



calculate the correct numbers, which will be the same as last time, except the last two with the legs in their new position, when the numbers will be 34 and 17. Now put these in a VDU statement to define another character:

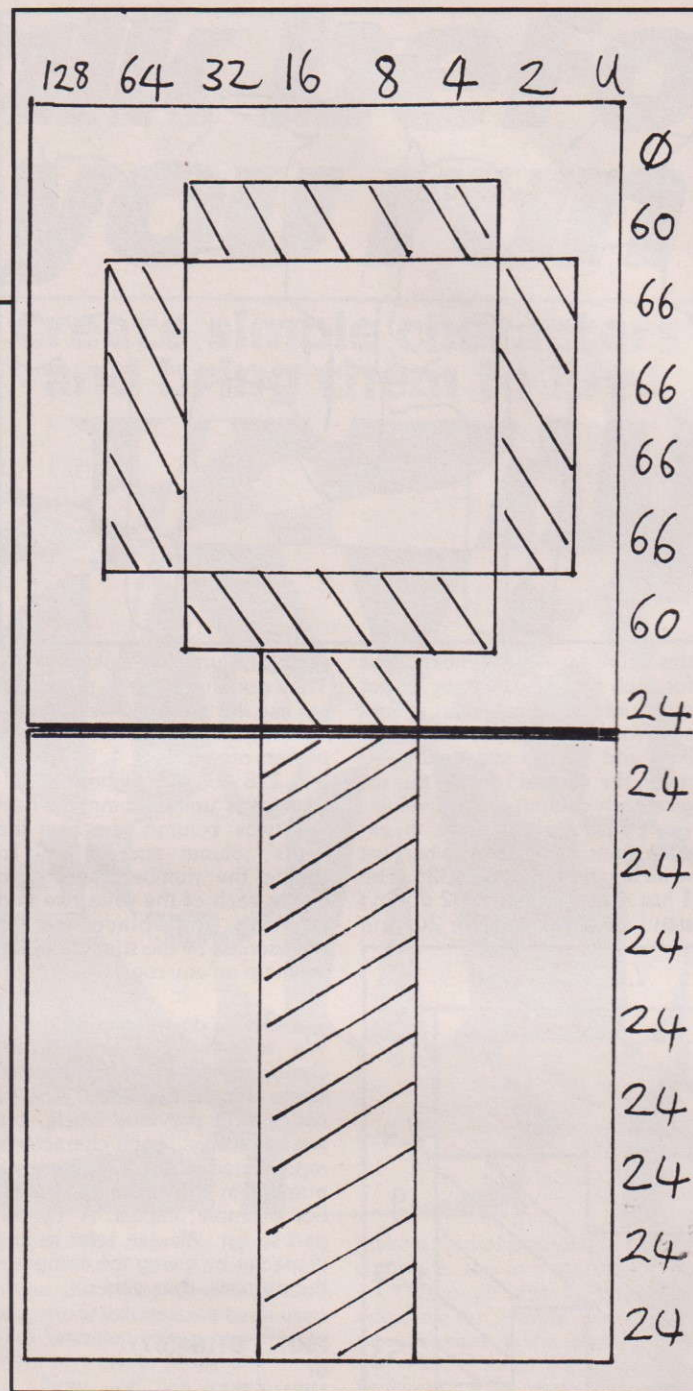
```
20 VDU 23,225,16,24,19,
127,253,84,34,17
```

and PRINT this new character inside our loop (deleting that as well after a suitable, slightly longer pause):

```
100 PRINT CHR$(225)
110 DUMMY=INKEY(20)
120 VDU 8
125 PRINT " ";
```

RUNNING A RACE

How about putting in a winning post? We'll use two characters for this, PRINTing them one below the other so as to make it big enough to see. The top character can be the round ring on the top of a winning post, and the lower character can be the post itself. So the two characters together will look like this:



Now work out the numbers: 0,60,66,66,66,66,60,24 and put them in a VDU statement:

```
30 VDU 23,226,0,60,66,
66,66,66,60,24
```

Now the post is simple, so put that in a VDU statement as well:

```
40 VDU 23,227,24,24,
24,24,24,24,24,24
```

Now PRINT it at an appropriate point on the screen so that the horse can race towards it, and start the horse a bit lower down:

```
55 PRINT TAB(19,1)
CHR$(226)
```

```
57 PRINT TAB(19,2)
CHR$(227)
58 PRINT TAB(1,2);
```

Now we will need to reduce the size of our loop so that the horse stops at the winning post rather than running into it. And since our last printed character is a blank, we must add a standing horse at the appropriate place after it has finished running:

```
60 FOR I=1 TO 8
140 PRINT TAB(18,2)
CHR$(224)
```

Now how about some colour — a green background for the grass, and as we can't get green in

Mode 5 (directly), we change to Mode 2 instead:

```
50 MODE 2
51 COLOUR 130
52 CLS
```

(It's a background colour we require, and we have to clear the screen after issuing the colour command.) And if we want a black horse rather than a white one we can change the foreground colour, too:

```
59 COLOUR 0
```

It is still a bit crude, but perhaps you can see the possibilities. O.K., then here are some exercises you can try in order to extend this program.

EXERCISES

(1) Create a waggon for your horse to pull. Perhaps one that tips up (this would need two separate characters, of course).

(2) Move the winning post further down the screen, and make the horse race along several rows of the screen. (hint: this will require a loop within a loop.) Get another horse (in a different colour perhaps) to chase behind, and even overtake!

(3) Even in Modes 2 or 5 the character is not very big, and it is rather angular. Try and create a horse using four user-defined characters, arranged in a square, and rewrite this month's program so that your large horse and rider reaches the winning post. (send in your horse definitions and I'll try and persuade the editor to print the best ones in a future issue.)

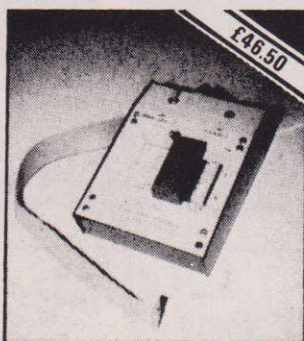
(4) Now that your little rider is big enough to see, make him have a mishap on his ride: let him fall off. You'll have to create two more separate sets of characters to represent the horse and rider on their own.

(5) Going back to the beginning of this article, create some nice pictogram characters to use in a bar chart instead of boring old asterisks.

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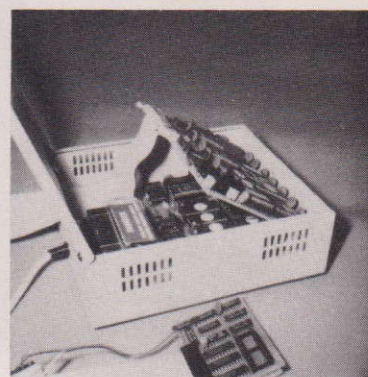
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B.B.C.

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ELECTRON

CASSETTE

Questions Answers

Bruce Smith

My thanks to John Peters of Eastbourne for providing this months instalment of undocumented error messages. John has found the answers to the two outstanding messages. He points out that the 'Key in use' error (ERR 250) occurs when a function key tries to redefine itself using a line such as.

*** KEY 0 * KEY 0
"SOMETHING ELSE" IM EXTRA**

John points out also that there must be more text after the definition so that the key is still in use when the computer tries to redefine it.

It is believed that the 'No Filing System' error is only in the 0.1 OS and is generated when typing *NET or *ROM. Perhaps if anyone still uses the 0.1 OS they could try it out and let me know.

Well I think that just about covers all the available error messages... unless you know otherwise!

Q: Following last issues tip on tweaking down the sound on the Beeb by adjusting the volume preset. I have received a letter from John Zachar in Brackley who requested a solution to a similar problem but using either BASIC or the Operating System.

A: If you are using home grown programs then 'turning' the sound volume down is quite simple as all it requires is an adjustment to the amplitude or loudness parameter. The amplitude parameter is the second on specified in the SOUND command, for example the amplitude of the command.

SOUND 1, -15, 100, 200

is -15. The amplitude of a sound may take any value between -15 and 4 inclusive. A value of -15 is the loudest. -7 is half volume and 0 is silence.

If all the SOUND commands in your program use a maximum amplitude value of -15 just edit a new lower and more pleasing amplitude value in.

On the otherhand if the sound is being produced by a

Our specialist in solving the stickiest Beeb problems tackles your questions

commercial piece of software that you cannot get at, because it is protected there is no simple way out. The easiest solution would be to turn the sound off completely using *FX210,1. This call is the Read/Write sound Suppression status call. All the time the location the call writes to contains 0 the sound output is enabled. By writing any other value to it disables the sound completely. Executing this call before loading your protected software should be music to your ears!

Q: Tina Evans of Islington remembers reading somewhere that there are several *FX calls that operate directly on the BELL character (CTRL-G), but cannot find any reference to them in the User Guide. Can A&B help?

A: We certainly can! In fact the four calls you are seeking are,

*** FX 211
* FX 212
* FX 213
* FX 214**

The first of the three, *FX211, can be used to determine which sound channel is used by CTRL-G. The normal default value is channel 3, however an interesting white noise bell can be implemented with *FX211,0.

*FX212 accesses the bell SOUND information, which basically allows you to determine either the amplitude of the ENVELOPE number to be used by the BELL, the actual value to be written should be the amplitude or ENVELOPE value minus 1, multiplied by eight.

*FX213 determines the frequency or pitch of the BELL character, *FX213,200 gives a high pitch Bell while *FX213,10 a low pitch sound.

Finally *FX 214 can be used to adjust the BELL duration.

*FX214,1 will be the quickest of beeps. While *FX254 produces a CTRL-G lasting a good 12 seconds. If your really game for a laugh try *FX214,255!

Q: C.J. Hill of Tyne & Wear writes, "I have successfully used the screen dump program from the Jan/Feb issue of A&B. However being a novice in this area I fail to understand why programs written in MODE 7 cannot be dumped. Further is it possible to obtain a program to perform this function?"

A: An interesting question! The basic reason a teletext screen cannot be dumped to a printer directly from screen in the normal way is because it is organised in a totally different manner. Many of the more popular printers these days, such as Star and Epson, have the capability of performing bit image graphics. Using some suitable software each pixel of screen memory is read off the screen and turned into a binary number which determines which of the eight pins on the head of the dot matrix printer head are fired. This conversion is really quite simple because the graphics mode being dumped is also a bit mapped display. The conversion process is required because the printer head works across the screen in rows of eight bytes therefore a column of eight bits from eight bytes stacked on top of each other are printed one at a time.

The teletext screen is organised in a completely different manner, and it is in fact controlled by a special chip - IC5 on the PCB an SAA5050 Teletext Character generator. Each character on the Teletext screen is formed using a 2*3 pixel block, and it is not possible to read these off the screen and dump in the normal way. However Teletext dumps are certainly possible providing the

printer being used as a definable character set or graphics characters. The software is more complex also because control characters must be interpreted correctly to produce double height characters and so forth.

Q: Andrew Robert of Romford has recently acquired a Disc Drive and Interface and has some problems, I'll let him explain... 'I have recently purchased a single disc drive and Acorn DFS interface. While I have been able to load and save my programs correctly with no problems I am unable to construct a !BOOT correctly so that it will automatically chain a particular BASIC program when I perform a SHIFT-BREAK. Can you please advise me?'

A: There could be several reasons why your !BOOT file is not working correctly, your letter is a little vague as to how far you actually 'get' so I'll go through the whole process which is not too difficult.

Firstly we shall assume your BASIC program is called GUM and that it is saved on disc. If it is not already there place the disc containing GUM in the disc drive and type,

* BUILD !BOOT

The drive should now whirl and a four figure line number should appear looking like this,

0001

Now type

CHAIN "GUM" RETURN

line number 0002 should now appear. We have actually finished or !BOOT file so now press ESCAPE. Once again the disc should whirl and then the prompt reappear. What we must do now is to tell the disc that it contains a !BOOT file, to do this type,

* OPT 4,3

once again the disc should whirl and the !BOOT file is complete. Typing SHIFT-BREAK should now LOAD and RUN the GUM !BOOT (ouch).

YES!



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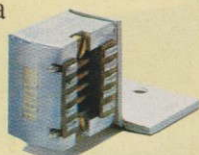
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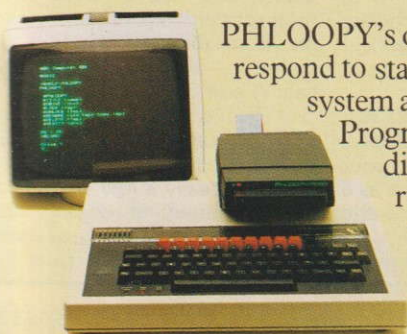
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A&B



On - line

Robin Wilkinson

Never has the concept of the workstation on-line to remote computer services been so near as it is today.

And the Beeb, with its ability to control communication speeds, its Mode 78 teletext and proliferation of modems and terminal communications software, is growing into the home/professional terminal for on-line systems.

Most microcomputers have perhaps just one or two comms packages to support modem walking around the networks — but as the recent A&B feature on hardware illustrated, the Beeb is particularly well catered for.

But once you have purchased your modem, what services are there available and at what cost? And in general communications does the RS423 limit the Beeb comms facilities?

Hooking up a modem to any computer gives a set of options for its use:

- ★ Accessing remote computer services
- ★ Electronic mail/messaging/information databases
- ★ File transfer
- ★ Formulating D.I.Y. databases accessed by other uses
- ★ Information broking
- ★ Bulletin boards
- ★ Distance learning

EXPLOSION

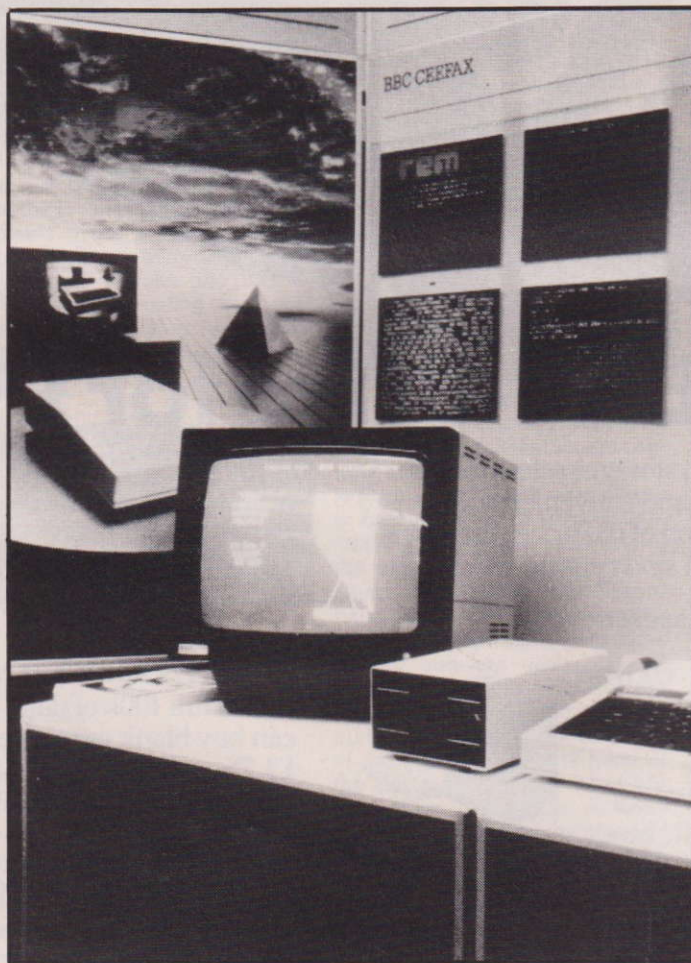
The relaxation of BT's monopoly on the telephone network will do much in the next year to increase the range of publicly accessible databases.

There have always been databases, particularly in the higher education area, to access. These and others were up until the last two years really for the experimentalists amongst us. Not only that, the cost of modems in 1982 for example typically averaged around £250 — today they start as low as £50.

The emergence of VANS — value added network services — will do much to spur the evolving on-line work station. And a new wave of telecommunication services will emerge for the home micro user.

Already there are a vast range of viewdata services which

The BBC Micro and remote computer services. Make the connection.



are easy to use and log-on to — an important element in databasing which should not be underestimated.

These services include Prestel — BT's own public viewdata service — which includes a special microcomputing section and private services, often with key-word search and computing processing abilities.

For example, with your Beeb you can check on a company's latest credit rating through a service operated by British Mercantile Credit, or if you're with

Midland, your own bank account.

You can check on the latest movements in the financial market — there are a number of competing systems to choose from operated by Citiservice, Reuters, Financial Times and others.

Many of these viewdata services offer a wide degree of local call access points so that your telephone bill does not come as a nasty shock at the end of the quarter.

And because they are an

RCS (remote computer service) aimed at home/professional users, they normally incur charges which are either based on a subscription, payable annually or computer access time and storage fees, or a combination of both.

The computing service on Prestel, which is currently dominated by the brave Micronet 800 service, is worth some investigation. It is the beginning of things to come.

Micronet has some 12,000 subscribers, many of them (probably 70%) BBC owners. It offers an electronic news magazine (a type of teletext A&B Computing), multi-player on-line games, although limited in their interactive capabilities and most excitingly:

- a) Telsoftware
- b) National Bulletin-board type services
- c) Teleshopping

Users of Micronet are able to download software into their Bees after selecting programs from brief descriptions on the system. A number of major BBC software houses have supported this venture but there are some notable absentees at this stage offering their main product lines — one being Acornsoft! Electronic distribution of software has its piracy problems too!

However, there is an ever growing range offered and free programs too.

So, with your modem, you can dial up Prestel any time of the day or night and perhaps find just the program you want.

UNIQUE

The truly unique service Prestel can offer in its microcomputing section, however, is a nationally available bulletin board where users can leave their own messages and talk on-line to people from different parts of the country — all at a local telephone call. A sort of on-line CB.

This is where the fun and entertainment of modems really does come into its own. Thus far, Prestel is really a low technology service aimed at coping with thousands of simultaneous users. It sacrifices interaction —



although it does have electronic mail, telex — for a mass market service.

There are other straightforward ASCII on-line services available in the U.K. However, they will normally require a user to have an account with BT's

Packet Switch Stream network — PSS for short.

A PSS account — costing a basic £20 a year — is really a passport along the highways and by-ways to many hundreds of services both in the U.K. and overseas.

Using PSS I have dialed BT Gold — a business messaging service and the subject of some controversy with hackers of the Get To Know Your Micro series.

I have even looked in on CompuServe — a giant American database. And there are others available like the World Reporter, a current affairs and news service, Dialog's Knowledge Index, another American database which has been shipped — electronically that is — to the U.K., aimed at microcomputer users.

The big advantage of PSS is that there are a number of local call points in the U.K. and can be cheaper than dialling databases over normal public telephone network.

PSS charge you for the amount of data you transmit along the lines — calling US databases, for example, can cost about one fifth of what it would be on normal transatlantic call rates.

These pure ASCII databases — as opposed to viewdata — are able to offer more on-line computing facilities. You can have your own file storage areas and depending on the type of modem and software you have — transfer files with error correction protocols to overcome

telephone line interference.

The first exponents of modems and the home micro were the bulletin boards. The U.K. currently has around 40. They are great fun and a source of very good information — as users tend to be computing freaks — but limited in the number of simultaneous callers they can cope with.

With more and more modems available for different micros in the U.K. we will probably see a shift to some commercial bulletin boards — a type of hybrid between one-man/single user amateur systems and the full-blown professional ones.

Of course a modem — particularly if it has auto-answer facility can be great fun and of great use. You can allow anyone to dial you — providing the baud rates of the modems are compatible — and dump a file on your system; or even build your own database for friends, or colleagues to dial into. Or you can establish your own viewdata database. Packages for this are recommended by the Council for Educational Technology at Hatfield.

WHERE TO GO

Listed below are telephone numbers to dial for further information about some of these systems. You should also try your local library which may have a directory of on-line systems.

- ★ Prestel Microcomputing — 01 583 9811
- ★ Micronet 800 — 01-278 3134
- ★ Knowledge Index — 0865 730969
- ★ BT Gold — 01 403 6777
- ★ PSS — 01 920 0661
- ★ World Reporter — 09327 85566
- ★ CompuServe — 01 01 614 457 8650
- ★ LASER (librarians) — 01 636 4684

A number of these services will also contain information about other databases. So, if you happen to know anybody into bulletin boards or on-line services, try them too. Like software and hardware — there is nothing to beat personal recommendation.

800 (C) 800c
WORLD'S LARGEST MICRO DATABASE

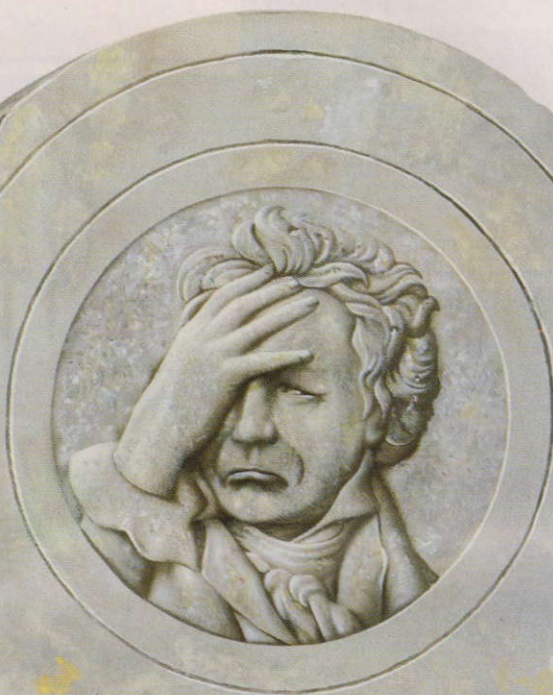
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MORE WHAT'S NEW
GOTO #

Roll over B



R.I.P.

LUDWIG VAN
BEETHOVEN

1770 - 1827

AVAILABLE ON



&



Beethoven.

If you can play the comb and paper this is the music program for you.

The new Music System from Island Logic. That's what it's called. And what it actually does, in musical terms, basically, in a word, is everything.

You don't need any musical ability. The program is designed for the man in the street (the one carrying the BBC B micro).

And you don't need to be able to read music.

In fact all you need is one fully operative finger, one eye and one ear (two or more may be an advantage but are not essential).

You can create noises with the program (sounds of your own creation).

Or you can recreate the sounds of conventional instruments. Wind, strings, percussion and so on.

Or you can take tunes from the Song & Sound Library on the program and murder them in the name of art.

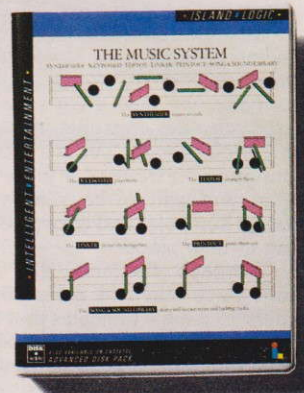
Then with these sounds you can build tunes before your very eyes - or ears.

Adding, taking away, juggling, jiggling, twisting the sounds, wowing the next door neighbours.

The program will even print out your compositions in proper music-manuscript form. And you don't need any knowledge of music to do it.

To Ludwig the prospect of music composition by the masses must make him turn in his grave.

But to us the prospect is heartening. Mr Beethoven, as you decompose, we compose.



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

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



Concept Keyboard

E.D. Thomas

Some time ago, I was travelling through one of London's British Rail Terminals and called in at a fast food outlet. I was interested to note that the conventional till with its rows of numeric buttons had disappeared and been replaced by a touch-sensitive pad. All the cashier had to do was, for example, press the areas indicating the words "coffee" and "cheeseburger" — both illustrated by a simple drawing — and the correct price appeared on the till display. The operator had no worries about changing prices, because they were easily amended in the program. What a simple but effective idea!

Ever since I started using computers in the infant department, I've been amazed at the way youngsters have coped with the QWERTY keyboard, but are we being fair to them? Most adults, who are not trained typists, have difficulty in finding their way around it. In our preschool handbook, we stress to parents the need to avoid the use of capital letters because our reading scheme uses lower case letters only in the early stages. Normally, we take great care to introduce new concepts in well-structured stages, yet we place youngsters in front of a piece of equipment with 74 keys, all with strange symbols, and expect learning to take place.

Perhaps the fact that so many have taken to using computers so readily indicates that we often underestimate their ability and if they are capable of using a QWERTY keyboard, they are probably able to follow a far more difficult program than the basic structured reinforcement material being presented to them. But for those children with poor psychomotor control or basic learning difficulties, are we to deny them the opportunities offered by the micro? If we can remove the problems associated with the QWERTY keyboard, then both groups should be able to press on at a greater speed.

PRESSING ON

The ideas suggested by the pressure-pad till have now been developed as an alternative to the QWERTY keyboard. (N.B. I'm

Star Micro Terminals' alternative to QWERTY.



not suggesting that this was the origin of the idea, merely my first contact.) Probably the best known one to-date is the CONCEPT keyboard, produced by Star Microterminals. This is linked to the computer through the User Port. It is constructed of a wipe-clean, scratch and chemical resistant polycarbonate surface mounted in an aluminium case.

Unlike the normal typewriter-like form of keyboard, the CONCEPT does not have permanently labelled keys. Instead it is a touch-sensitive pad, divided into 16 x 8 (128) "keys". Any key, or group of keys, can be assigned by the user to any character, word, function, shape, etc. At the present time, A4 and A3 versions are available. The latter, which is approximately 50% more expensive, is in fact a better model, as it is sensitive over the whole area, whereas the A4 suffers from dead areas where the squares cross. This can cause minor irritation, especially if several "keys" have been

designated to the same function. (Star Microterminals' News Sheet No.1 — September 1984 — announced several improvements to the A4-128. It is now sensitive over the entire matrix area, has an improved case and overlay retaining clips and incorporates a Shift facility allowing you to double the number of outputs available from the keyboard.)

CONCEPT comes with a tape or disc of five programs, together with the necessary overlays. The latter are simply sheets of paper, A3 or A4 — depending on model, which "label" the keyboard. If only the SPACE BAR is required to operate the program, as in ALPHA, then the whole pad has been programmed to that effect; if a few numbers or letters are required as in ABACUS or JIGSAW, then appropriately sized areas, suitably positioned, are programmed. So, all the unnecessary clutter of the normal keyboard is removed.

Some software houses pro-

duce programs which have a CONCEPT option — please see list at the end of the article of those known to the writer. Unfortunately, these are few in number at this time, but hopefully the advantages offered by CONCEPT will be appreciated and more will include the option in future. The advantages extend beyond the use with children who have problems with the normal keyboard, because it can be programmed to work in the same way as the function keys, thus saving time in typing in quite complicated and/or lengthy instructions, e.g. QUEST, the A.U.C.B.E.'s database program.

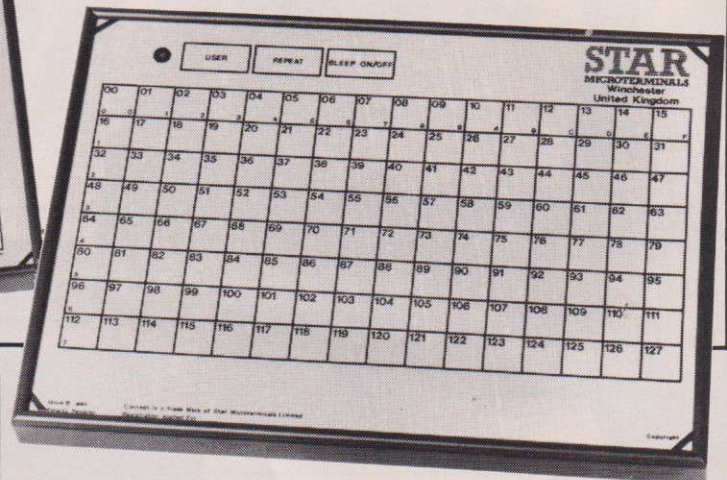
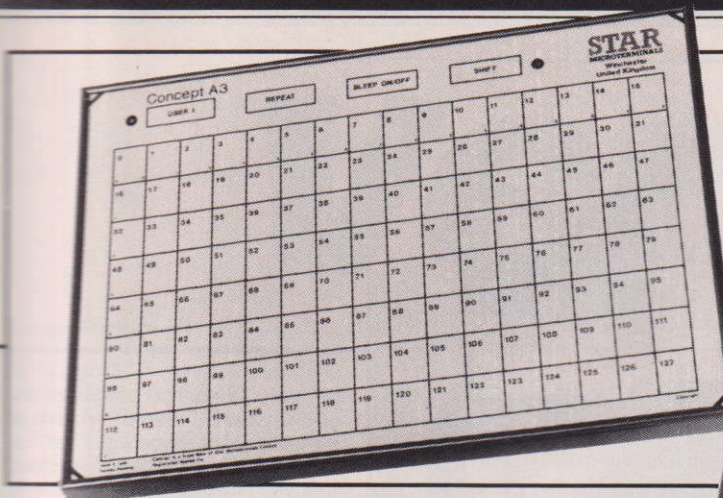
ADAPTION

The alternative, of course, is for the teacher to decide which programs are suitable for use with his/her class, then to design an overlay to suit the requirements of the program. This makes life for the children much easier, but as M.A.Doyle writes in the user guide, "The possibilities are endless — all it takes is time — a lot of time". Unfortunately, there's more to it than merely sketching out a new overlay — the program has to be adapted to accept commands from CONCEPT.

Before starting to convert any program, it is necessary to run it using the normal keyboard, in order to list the commands required and to decide on the best design for the overlay — which keys are pressed most frequently; is it best to leave a row or column of spaces between the "live" areas? Several "dummy" runs might be needed before reaching a satisfactory design — is it suited to the user; is it easily adapted to different groups; does it require pictures and letters/numbers, so that the program can be used at various stages, or is it better to have separate sheets which work the same "keys".

When a "working model" has been achieved, the program can be converted to run on the CONCEPT. There are two methods:

- a) that suggested in the User Guide;
- b) that provided by the STARSET program produced by



- 1 Instructions.
- 2 Create a new layout.
- 3 Catalogue of layouts.
- 4 Edit a previously defined layout.
- 5 Convert a layout into the interface program.
- 6 Exit from the program.

Select an option from 1 to 6.

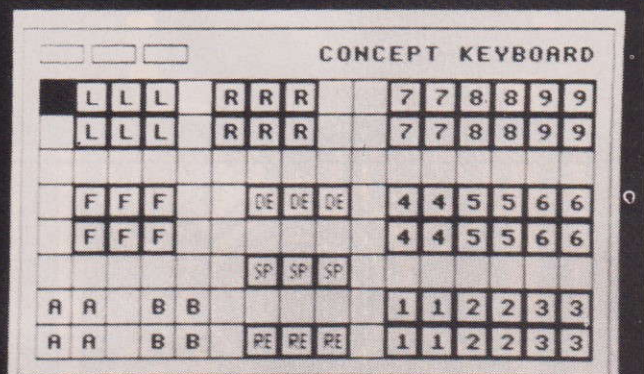
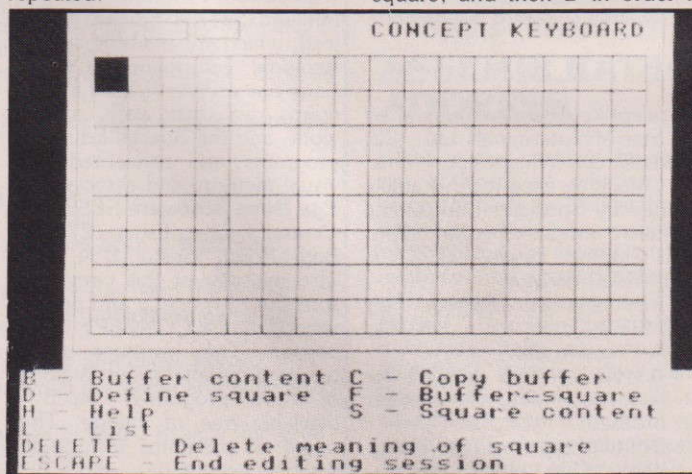
A.U.C.B.E. The first method involves the user in adapting the original program, which is achieved by adding a procedure to the program to enable CONCEPT to communicate with the computer. This is clearly explained using several examples in the User Guide, and anyone with a little programming experience shouldn't find it too difficult to succeed — if the original program is listable, has space, and the user is not too ambitious to start with!

I believe most users will find the STARSET program, which allows them to create new overlays or edit previously constructed overlays without having to adapt the original program, by far the easier method (as long as no "memory shifting" has taken place in the program — if it has it will interfere with the running of the interface file).

Another advantage is that the finished product of the STARSET program is a machine code interface file that sits in the computer memory, which allows it to be controlled by either the CONCEPT or QWERTY keyboards.

As with all A.U.C.B.E. programs, STARSET is superbly documented, so that the user can follow the step by step instructions for the first few attempts, but will soon find it second nature! The menu gives the following options:

If option 2 is selected — Creating a new Overlay — a screen replica of CONCEPT will appear, as below. The arrow keys are used to move the cursor square to the area which is to be defined. Pressing the letter D will cause the computer to ask for the definition, which is then typed in. This area can be made larger by moving the cursor to the next square and pressing C, which will COPY the same definition in that square, and may be repeated on as many squares as required in order to create the size pad desired. Once the area is large enough, the cursor square can be moved to the next square to be defined, and the procedure repeated.



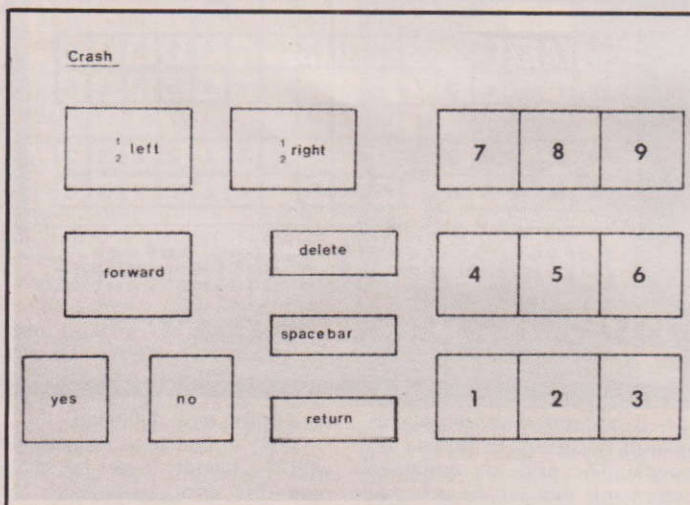
If at any time, it is considered necessary to amend the overlay, or add an additional command, this can be achieved very simply by moving the cursor to the square which needs to be redefined, pressing the DELETE key (if the square is already defined) which will "clear" the square, and then D in order to

type in the new definition.

Once the user is satisfied with the layout, it can be saved onto disc using, if desired, the same name as the original program. This is possible as it is stored in directory L of the disc. When the OVERLAY program is saved, the program automatically returns to the main menu. The next stage is to change the overlay into an INTERFACE file, which will sit in the computer memory and allow the use of both normal and concept keyboards. Again, this can be given the same name, as it is stored in directory 1.

Having produced the necessary overlay and interface file, the program can now be run. If we take as an example the CRASH program from the Micro Primer Pack, keyboard and overlay for which are illustrated above, the user takes the following action:

CONTINUED OVER



Switch off machine — on again.
Type in LOAD "CRASH"
*RUN I. CRASH
RUN

The advertising for the CONCEPT keyboard states that it is the alternative to QWERTY. It's certainly a very promising alternative, and the enthusiast will find the time — lots of time — to convert programs for use with CONCEPT. Unfortunately, at this point in time, many teachers are still trying to come to grips with the basics of the new technology, and most schools trying to find the money for the second micro or a disc drive. If it is to become the alternative, then the manufacturers have to persuade more software producers to include a concept option in their programs, and I would like

to think that the COI will come up with a supplementary offer for primary schools — as they did for secondary — and that CONCEPT keyboard would be included.

DETAILS

Concept keyboard manufactured by Star Microterminals Ltd., 22, Hyde Street, Winchester, Hants. Machine used for this article loaned by Specialist Educational Software and Services Ltd., Central Trading Estate, 257-277, Bath Road, Bristol.

Price (as quoted by S.E.S.S.)

A4 version £65 + VAT.

A3 version £95 + VAT (or less, depending on number ordered).

Both prices include Handbook, User Guide and in-

troductory tape or disc of five programs plus overlays.
Lead for BBC £8.

★ Since this article was written an A3 version with 256 pads has been announced at £149. A2 versions with 128 and 256 pads should be available in December — special offer price of £159 and £179 respectively on first 500 orders!

STARSET is available with new purchases of Concept Keyboard, or from A.U.C.B.E., Endymion Road, Hatfield, Herts for present owners. Price to schools £8.

SOFTWARE

The following publishers produce software which can be controlled by the CONCEPT keyboard.

MEP — Blue Files Nos. 35 & 36 (Firs School Programs and West Midland Special Education Project), which are available through Regional Information Centres. Four out of five of the Firs Programs deal with early number work, and the Special Education programs are concerned with visual memory and association.

Ega Beva Software SESS Ltd., Central Trading Estate, 275-277 Bath Road, Bristol BS4 3EH. The majority of this company's software for nursery and primary schools has a CONCEPT option version. They produce an interesting cassette-based catalogue of their programs, which is available free of charge. Their range of programs include the sample cassette/disc, and a suite

of early language programs for young deaf children developed at the Partially Hearing Unit of Thorpe St. William Primary School, Norwich.

ESM Duke Street, Wisbech, Cambs PE13 2AE are publishing several language programs which have been developed by MEP — PREREADING, EARLY READING and SENTENCE BUILDER.

LTS Haydon House, Alcester Road, Studley, Warwicks produce MATHS TALK, HARLEQUIN and CONCEPT KEYPAD JUNIOR PACK. These programs have been developed in co-operation with MEP.

Page Educational Software 17, Pagefield Cres., Clitheroe, Lancs have STORIES SUITE, which is a collection of programs to facilitate early reading and sentence construction through free story and poem writing, and early foreign language work for the reading age range 4 — 12.

Nucleus 20, Buckingham Road, Swindon, Wilts. (Unable to obtain review copies of these programs — they look expensive!)

POSTSCRIPT

We would be interested to hear of any other software produced for the CONCEPT keyboard and will publish details in a future edition if there is sufficient information forthcoming — look out for reviews of some of the above software in our EDSOFT pages over the next few editions. Please write to the Editor with details of:

- commercially produced software;
- work undertaken by teachers who have spent 'lots of time' on producing programs which run on CONCEPT or adaptations and would be prepared to share their knowledge with others. N.B. because of copyright laws it will, of course, only be possible for details of the STARSET FILES or CONCEPT PROCEDURES plus overlays to be made available for any adapted programs.

Verify

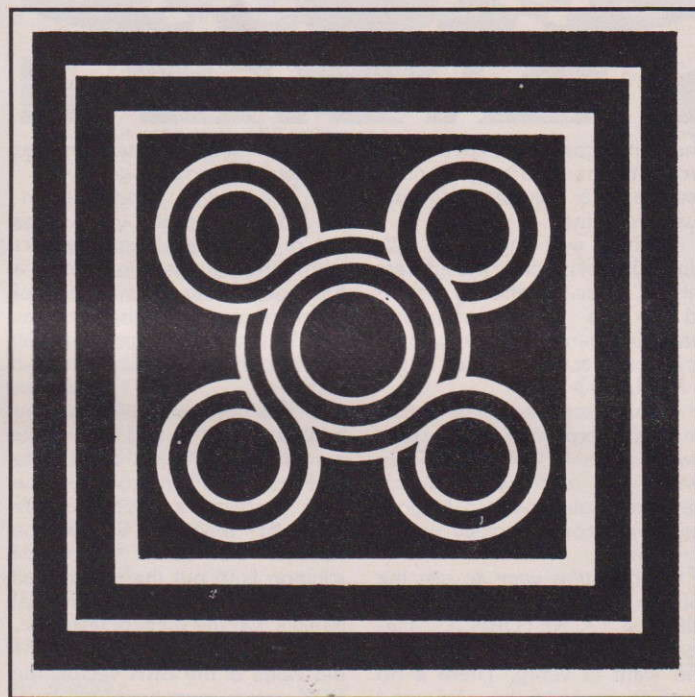
Shingo Sugiura

Although Beeb Basic is incredibly comprehensive, it lacks a useful command found on most of the other inferior micros; a verify facility. It is in fact a very easy command to implement and it is difficult to see why Acorn omitted to include it in their superb Basic, but instead of quibbling I decided to write my own utility that can sit in the machine until it's needed, in which case it can be invoked as if it was a standard Beeb Basic command, i.e. no CALLs or star commands.

At first the method may not be immediately obvious but in fact there is a very easy way to implement this because of the way the Beeb handles errors. Like many of the operating system routines, the errors are handled via vectors. The BRK vector, &202 and &203, can be altered to point to user supplied routines (this process is often

referred to as intercepting the BRK vector). In my utility program, the BRK vector is altered to point to a routine which checks the error number (lines 280, 290) and if it's not 4 i.e. "Mistake", it indirections through the old value of the vector. However, if the cause of the error was a "Mistake" then the routine checks the buffer with the command, i.e. "VERIFY" (lines 310-370). If this does not agree, again, the error is passed over to the normal error handling routine. Assuming that a match is found, the routine then goes on to see if there is a filename enclosed in inverted commas (lines 390-400). If all these conditions are met, the actual verifying starts (line 530). Although the program is liberally commented, for the sake of inexperienced assembly language programmers, I will go through the actual verify routine thoroughly.

A facility to check that the information in memory has been successfully saved.



PROGRAM DETAILS

530	Places a carriage return at the end of the filename.
540-550	The two zero page locations, &70 and &71 are used as pointers which point to the memory location which is to be compared with the program saved on tape (or disc). These are set up to point the current value of PAGE which is found by "peek"ing &18. Of course, for "good" programming fanatics, this is a sin. It may be replaced by an osbyte call.
560-570	Loads accumulator with &40 and the registers are pointed to the control block.
580	Equivalent to CALL osfind. "Osfind" calls with the accumulator set to &40 opens a file for input only.
590	If the accumulator is zero, it means that the file could not be opened (in the case of disc system this usually means that there is no such file).
600	Store the file handle number in zero page location &72.
610-620	Load a byte from current file, specified by the file handle number contained in &72.
630	Check if the end of the file has been reached (C is set when this happens).
640-650	Check with program if they're not the same, generate error.
660-670	Increment pointer.
680	Go back to beginning of loop.
690-730	No such file error.
740-770	Routine called when a file has been successfully verified.
780-810	Routine called when an error has been found; i.e. when the program in memory does not match with the saved file.
820-850	Routine which closes the file and warm starts.
860-890	Routine to skip spaces when the command is being checked.
900-920	Missing " error. Generated by BRK. Exactly the same as the missing " error in Basic.

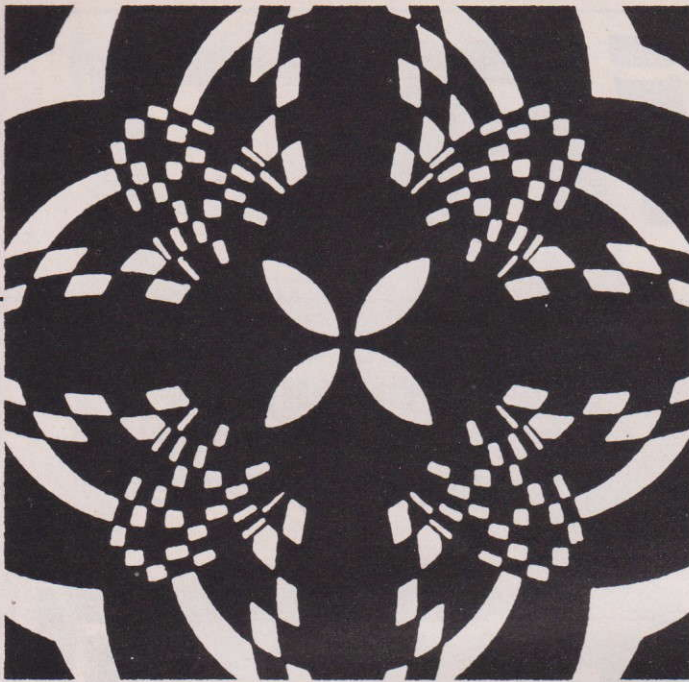
When you have typed in the listing, save it before you run it. This is vitally important since running this program without knowing what's going on can be disastrous, probably fatal!

ASSEMBLY ADDRESS

When you've checked the listing, run it. You'll be asked for the assembly address. This is the address at which you want the verify utility to be assembled. This might confuse people not familiar with assembly language so let me explain. The routine occupies just over one page and must be assembled in a suitable place. The choice largely depends on what filing system is in use. If you are using the disc system the only decent place to put the utility is in

page &A, the cassette work space, but if you use cassette the choice isn't so easy. Since the routine occupies more than one page of memory, it can not be placed in the usual place, page &D. If you did, the routine would overwrite your Basic program! The only possible but not the ideal place to put the utility is page &B, however you will lose the use of the function keys and some user defined characters. If you really want the use of function keys and the user defined characters, you can place the code in page &D AFTER setting page to &F00. This can be done by typing PAGE=&F00 <RETURN>. Don't forget though, that if you press BREAK, you must manually reset page to this address to edit your program.

CONTINUED OVER



The same goes for experienced programmers who may want to use the area suggested for their own programs.

When you input the address, do not precede the address with '&' since it is already assumed to be in hexadecimal (base16), therefore if you wanted to input &A00, type 'A00' <RETURN>.

The assembled code can be saved (as explained by the program) and *RUN when you switch your machine on. In this way the routine will sit in your machine inconspicuously until it is needed.

When you want to use the routine, simply type 'VERIFY filename' <RETURN>, filename being the name of the file you want to verify. There is no need to precede the command with a star. Don't forget that if you press BREAK, the BRK vectors will be restored and the routine will no longer function. It must be initialised by CALLing

the execution address (same as the assembly address).

The routine is primarily intended for cassette users since you're very unlikely to get errors with discs (unless you have a habit of leaving discs on top of the monitor or using the floppy as a coffee mat) but the program will work perfectly well for disc systems.

This program shows you how easy it is to add new Basic commands. It is just as easy to add more than one routine. The only problem is finding a safe area of memory where the routines can reside. The best solution is to put the routines all on one EPROM like commercial toolkits. On the point of firmware, because this routine reserves the old value of the BRK vector, the BRK vector must have the usual values before the routine is run (CALLed). Problems can occur if a commercial utility firmware such as 'Toolkit' changes the BRK vector.

PROGRAM LISTING

```

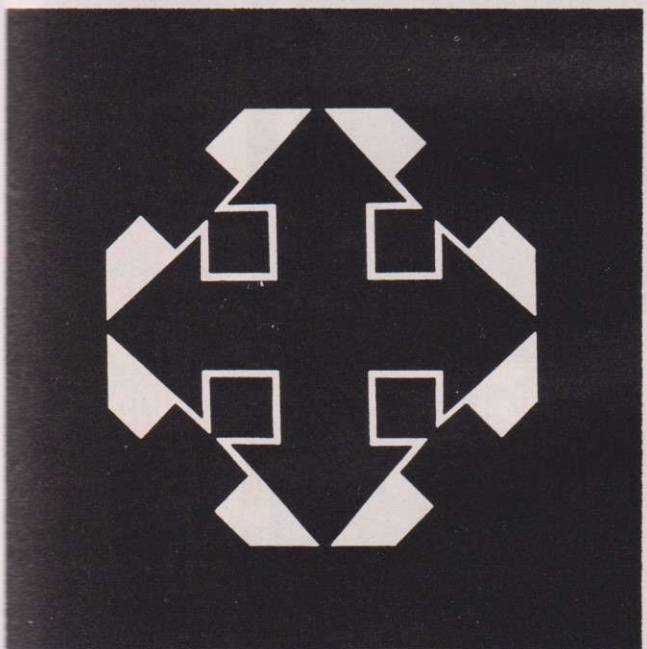
10 REM Verify Utility
20 REM By Shingo Sugiyura
30 REM Copyright (C) 1984
40
50 MODE7
60 PROCassemble
70 END
80 DEFPROCassemble
90 warm=&8AF3:warm1=&8A96
100 basic=&8000:buff=&700:file_name=&50
110 cswrch=&FFEE:osfind=&FFCE:osbget=&FFD7:osnew
120 PRINT"Input address to which code is to"
130 PRINT"be assembled. Hex is assumed and do not"
140 PRINT"prefix the address with '&'"

```

```

150 INPUT"Address="code$
160 FOR pass=0 TO 2 STEP2:PX=EVAL("&"+code$)
170 [OPT pass
180 LDA &202:STA error \Sto
re original error
190 LDA &203:STA error+1 \han
dling routine address
200 LDA #FNlo(start):STA &202 \Int
ercept BRK Vector
210 LDA #FNhi(start):STA &203 \Dit
to
220 LDA #7:JSR oswrch \Bee
p
230 LDX #0
240 .begin LDA title,X:JSR oswrch \Pri
nt message
250 INX:CPX #27:BNE begin
260 JMP osnew1 \New
line and back to Basic
270 .start
280 LDY #0:LDA (&FD),Y \Loa
d error number
290 CMP #4:BEQ p_verify \Pos
sible "VERIFY"
300 JMP (error) \Nor
mal error handling
310 .p_verify LDX #&FF:LDY #&FF \Pos
sible "VERIFY"
320 JSR skip_space \Str
ip spaces
330 DEY
340 .syntax INY:INX
350 LDA buff,Y:CMP data,X \Com
pare with buffer
360 BEQ syntax
370 CPX #6:BEQ cont2 \End
of command?
380 JMP (error) \Nor
mal error handling
390 .cont2
400 DEY:JSR skip_space \Ski
p spaces
410 CMP #ASC"":BEQ cont3 \Spe
ech marks?
420 JMP (error) \Nor
mal error handling
430 .cont3
440 LDX #&FF
450 .name INX:INY
460 LDA buff,Y:CMP #13 \Ret
urn?
470 BNE cont
480 JMP miscomma \Mis
sing "
490 .cont
500 CMP #ASC"":BEQ verify \Spe
ech marks?
510 STA file_name,X \Cop
y file_name
520 BNE name
530 .verify LDA#&D:STA file_name,X \Pla
ce cr at end of filename
540 LDA#0:STA &70 \Poi
nt to PAGE
550 LDA &18:STA &71 \Dit
to
560 LDA #&40

```

```

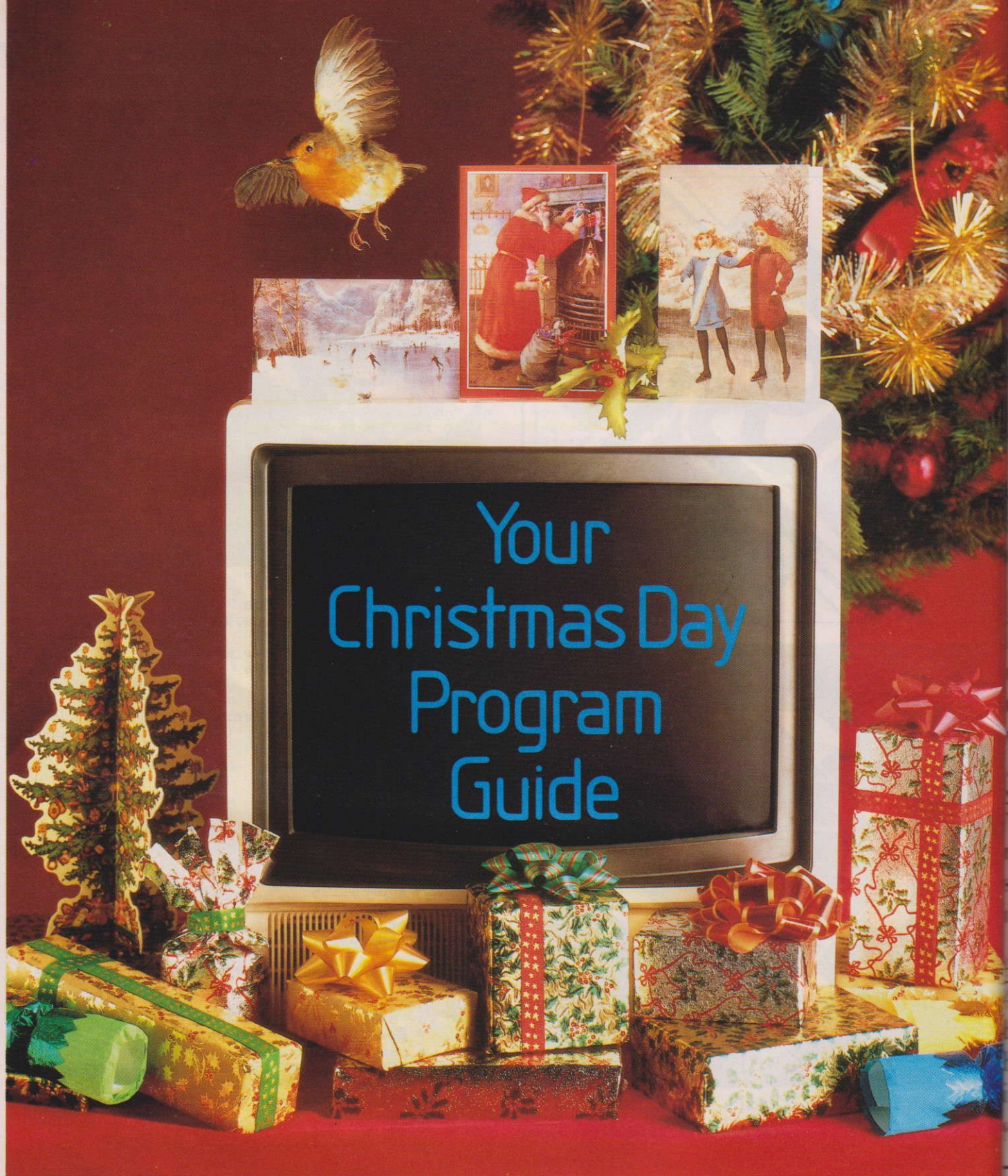
570 LDX#FNlo(file_name):LDY#FNhi(file_name) \Poi
nt to control block
580 JSR osfind \Ope
m file for input only
590 BEQ no_file \No
such file!
600 STA &72
610 .loop LDY&72
620 JSR osbget \Get
a byte
630 BCS verified
640 LDY #0: CMP (&70),Y \Che
ck with program
650 BNE verify_error \Sam
e?
660 LDA &70:CLC:ADC#1:STA &70 \Inc
rement pointer

```

```

670 LDA &71:ADC#0:STA &71 \Dit
to
680 JMP loop
690 .no_file LDX#0
700 .file_mes LDA f_mes,X:JSR oswrch \Pri
nt "no such file"
710 INX:CPX#12:BNE file_mes
720 JSR osnewl:BIT basic:BPL PX+5 \New
line
730 JMP warm:JMP warm1 \War
m start
740 .verified LDX#0
750 .print_ok LDA ok,X:JSR oswrch \Pri
nt "file verified"
760 INX:CPX#13:BNE print_ok
770 JSR osnewl:JMP close \New
line then close file
780 .verify_error LDX #0
790 .error_mes LDA e_mes,X:JSR oswrch \Pri
nt "verify error"
800 INX:CPX#12:BNE error_mes
810 JSR osnewl:JMP close \New
line then close file
820 .close
830 LDA#0:LDY &72:JSR osfind
840 BIT basic:BPL PX+5 \Whi
ch Basic?
850 JMP warm:JMP warm1 \War
m start
860 .skip_space INY
870 LDA buff,Y: CMP#&20 \Is
it a space?
880 BEQ skip_space \If
it is, skip it
890 RTS \Ret
urn from subroutine
900 .miscomma BRK \Gen
erate error
910 OPT FNequb(9) \Err
or number
920 OPT FNequs("Missing ""+CHR$0) \Err
or message
930 .data OPT FNequs("VERIFY")
940 .ok OPT FNequs("File verified")
950 .f_mes OPT FNequs("No such file")
960 .e_mes OPT FNequs("Verify error")
970 .title OPT FNequs(CHR$12+"Verify utility ope
rational")
980 .error OPT FNequb(0):OPT FNequb(0)
990 ]NEXT
1000 PRINT""To save code, type:"
1010 PRINT""*SAVE"+CHR$34+"VERIFY"+CHR$34+code$+"
";PX
1020 PRINT""then <RETURN>."
1030 PRINT""To initialise this utility, either"
1040 PRINT"CALL &";code$;" or *RUN"+CHR$34+"VERIF
Y"+CHR$34+","
1050 PRINT""then use as a normal command"
1060 PRINT""i.e. VERIFY filename <RETURN>."
1070 ENDPROC
1080 DEFFNlo(number)=number MOD 256
1090 DEFFNhi(number)=number DIV 256
1100 DEFFNequs(string$)
1110 $PX=string$:PX=PX+LEN(string$)
1120 =0
1130 DEFFNequb(number)
1140 ?PX=number:PX=PX+1:=0

```

Acornsoft announce tidings of great joy for both BBC Micro and Electron owners: eight brand new programs for Christmas.

Each one makes an ideal stocking filler.

They're all available at your local Acorn stockist. (To find out where that is, simply call 01-200 0200.) Or you can send off for our

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

Alternatively, however, you could always take a chance and drop a line to Father Christmas.

ACORN
Software for the BBC Micro and Electron

9.00 Firebug

A fast moving arcade-type game in which you are a fireman, trying to rescue some oil drums and take them to the safety of a water tank. Your opponent is the firebug who runs around lighting fires which move slowly towards the drums and fire extinguishers, destroying them if contact is made.

10.00 Maze

A gripping graphics game where you enter a top secret installation with the aim of stealing secrets from a rival company. The security system, however, has many levels each consisting of a maze of corridors patrolled by armed robot guards. Complete with full colour 3-D graphics, sound effects and a high score table.

12.00 Elite

A superb 3-dimensional graphics game that's light years ahead of any other. You are a space trader who roams the universe, making your living from buying and selling cargo in your Cobra space craft. On your travels, you will encounter aggressors who are eager to put an end to your dealings. Be warned, only the fittest will survive.

1.00 Crazy Tracer

A crazy adventure in which you guide a paint roller round the edge of a maze of rectangles, while avoiding the monsters which are trying to stop you by crushing the roller. Beware – as the game progresses, so the number of monsters chasing you will increase.

3.00 Go

Go is a board game for two players which originated in China 3000 years ago and is now more popular than Chess in the Far East. It requires strategic insight, intuition and a strong, calculating mind. If you wish, you can also challenge the computer at differing degrees of difficulty. A velly good game indeed.

4.00 Watch Your Weight

At last, a weight-loss program designed especially for you. With it, your computer becomes an expert wholly conversant with and sympathetic to your needs, and will help you choose an appropriate and individual weight-loss plan. The program also includes a calorie counter and a series of apposite menu suggestions to help stimulate your imagination when you just can't think what to eat.

5.00 The Complete Cocktail Maker

With everything from a Black Russian to a Betsy Ross, this program contains data sufficient to concoct a staggering 320 different cocktails.

6.00 Paul Daniels' Magic Show

Amuse and amaze your friends with your astounding feats of magic. This program contains ten tricks to be performed by or with your BBC Micro/Electron. Hurry though – it's bound to disappear fast.

Random Access

Dave Carlos

There will be a large number of readers who are currently thinking of buying a disc drive and a disc interface. Some may be hoping that Father Christmas will be stocking up with them, others may have started pulling their hair out waiting for cassettes to load. So for all of these people, and the old man at the North Pole, I thought a little advice on which style and configuration of drive to consider might be useful. Please remember that the comments made are purely personal and you may get different advice from other sources; what I can assure you of is that much of this advice is based on personal, sometimes bitter, experience.

WHY BUY A DISC DRIVE?

This section should be subtitled "Arguments to convince the non-computer fanatic", anyone who uses cassette filing already knows most of these by heart!

Disc drives offer fast access to large programs and eliminate all the time that you used to spend twiddling your thumbs whilst the program loaded. More seriously, they give one the chance to use the random access filing system that the BBC supports, which means that databases can be created which are larger than the memory available inside the machine. On the smallest capacity drive (100K), I use a program which can hold over 1000 names and addresses whereas, without discs, I would be limited to only about 200. This doesn't mean that they are only for serious use however. If you are interested in developing programs for pleasure or sale they are a great boon. I remember producing my first commercial program, using cassettes. It took me six weeks and at the end there were about 15 cassettes in differing stages of completion.

Now I use two discs per new program, one as a working copy and one backup in case of disasters. Within a matter of seconds every new version or slight change can be saved, always before testing, and then

This month we consider the important and difficult decision of which disc drive to choose.



retrieved if anything should go wrong. I couldn't afford that luxury when using cassettes, each save operation meant at least four minutes whereas the amendments made might have only taken two. You will therefore find that your working time can become more productive.

There are a couple of problems however: before you can use a disc drive you need to add a disc interface comprising some 10 integrated circuits and an Eprom based DFS which is likely to cost about £100. Secondly the disc interface needs its own working space in user memory. This means that the games and other programs which worked fine on a

cassette based system can cause difficulties when transferring them to disc based systems. For this reason it is worth checking that your favourite piece of software will run on discs without too much trouble or that the supplier will provide a disc version (some will even offer part exchange on these programs). If this fails, last month's column should give you a little help on disc relocation and possible routines to use.

The variety of disc interfaces available is growing day by day, there must be more than five currently on the market. Please don't get confused between a disc filing system (DFS) chip and a disc interface. The interface is a

package of about 10 integrated circuits which have to be present to provide the hardware to operate the drives. The DFS is the software which allows you to tell the computer how to use the drives. Usually they may be bought together, but there is a problem currently with the supply of one of the chips in the interface. The standard 'floppy disc controller' for the BBC system is the Intel 8271 but this is becoming rarer by the day.

For this reason some suppliers are selling only the DFS chip rather than the whole interface. My advice on this is *don't* buy an interface from anyone without an 8271 floppy disc controller, you are unlikely to be able to find one for sale and until you do your interface and therefore drives are unusable. The only exception to this is if you decided to buy a Double Density interface. There are a number of these available now and they offer twice as much storage on each floppy disc you use. What they can't offer, in some cases, is full compatibility with the normal density system and in particular with some well protected commercial disc based software. If you are only going to use discs on one machine then they could save you money, but if you ever want to send a disc to someone else then you could be in difficulties. I need compatibility, so I use a standard interface and DFS rom.

DISC DRIVES

Recently the new 3 inch and 3.5 inch drives have become available for the BBC computer and so choice of which drive to buy has become more difficult. The only assistance that I can give is to suggest that, before buying any of the slightly unusual systems or drives, you check that the software you want to buy is available for that system or is very easy to transfer from cassette to the new media. I fully understand that this may seem to suggest that you should stick to the old style (5.25 inch) drives but until (as is the case with video tapes now) all programs are available on all



systems, it would be irresponsible to give any other advice at this time.

Once you have selected the type of drive, you have then to decide on the configuration you wish to buy. This may be decided for you by economic factors and you end up buying the single sided single drive, but even so it is worth asking if you can add to your drive at a later date in order to make it either a dual or a double sided one. If this is possible, and some manufacturers make this a feature of their products, it

will prevent your having to sell one drive secondhand, at a fraction of its new cost, in order to upgrade to a dual or double sided one. I know from bitter experience that this is quite likely to happen sooner or later. It took me just a week to decide that a single drive was not what I needed; unfortunately it took me a few months to sell it and get a double. If your money will stretch to it, I would recommend the purchase of a dual drive unit (single or double sided), especially for more serious users since

making backup copies on a single drive is very time consuming and error prone indeed.

A final item to check when comparing prices is the inclusion or not of a manual and formatting disc. These are essential to the use of the drive and you must have them, unless the DFS has a built in formatter. Don't think that you can buy the original Acorn version for a song; it is likely to cost you about £30. You only get it free if you buy Acorn disc drives not with the interface. For this reason most suppliers include

these items in the price, but you do need to check carefully.

Next month I hope to feature some of your problems and include a few words about the different DFS chips now available. Keep sending your disc problems of any kind to:

Dave Carlos (Random Access),
A & B Computing,
1 Golden Square,
London W1R 3AB.

Happy data writing till next month.

Reversal

Trevor Truran

In this new puzzle a six by six grid of squares is nearly filled with 35 reversible counters. The bottom left corner square is empty.

At the start of play all the counters are showing their RED side uppermost and your task is to turn them all over so that every counter shows its YELLOW back and the same corner square is empty.

To make all this possible you make moves and captures. The move is that of a knight in chess — two squares in a straight line followed by one at right angles.

Each move is made so that the counter doing the jumping lands in the empty square, so your first move is a choice of B3 or C2. As the counter lands so it is turned over to show the opposite colour. The capture is similar to that of Reversi, or as it is now widely known, Othello. Any counters of the other colour lying between the one which has just landed and another of the same colour are turned over.

In this puzzle, captures are only made horizontally and vertically not diagonally.

HOW MANY MOVES?

The problem is can you solve it — and in how few moves?

As a target you could rate your efforts as follows:

More than 300 — you've upset the computer, it was only DIM'ed for 300!

100 to 300 — You've upset those who think the human race is Nature's last word!

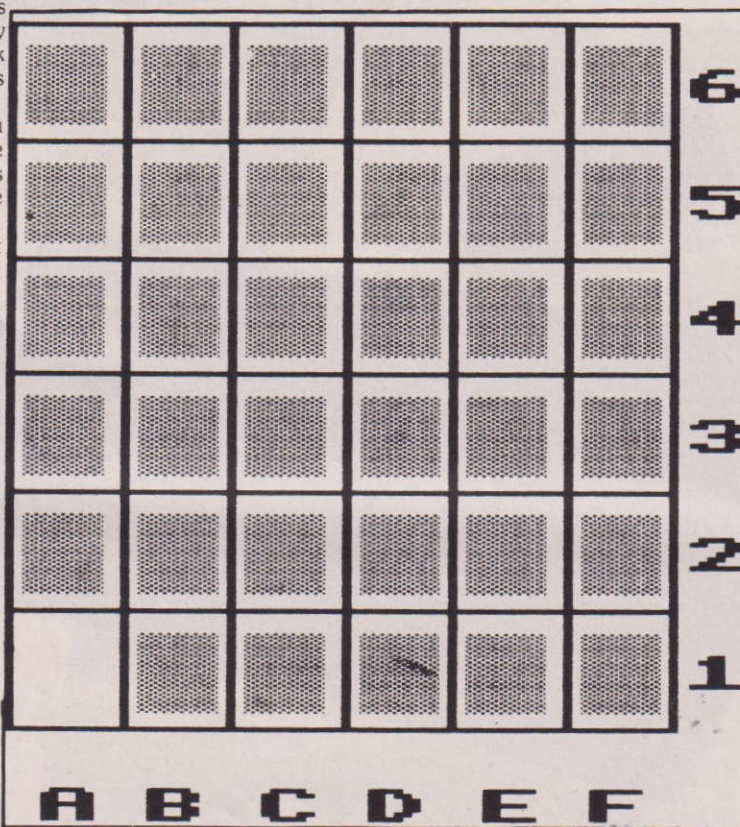
50 to 100 — not bad. Not good either.

20 — that equals the best known. Less than 20 — quick, write in and tell us how!

When running the program INPUT each move by entering the column letter (A to F) and then row number (1 to 6). Input has been chosen so that you can delete a wrong choice of key press before you press RETURN.

The program will inform you if your move is illegal; make the move if it is not; carry out any

Pit your mental agility against this puzzle of the VDU.



PROGRAM NOTES

The program runs in Mode 5.

The error routine called by line 140 is simply there in case ESCAPE is pressed accidentally when aiming at the digit 1 next door. You will be asked if you really meant it and if not be returned to an input of your next move.

PROCGRID simply draws the 6 by 6 slab of squares and lines 210 to 260 set up the initial captures which result and check whether the problem has been solved or not.

When you are successful you will be given a list of the moves made. Interested readers will be able to adapt the program to give a large variety of similar problems. The basic idea is to set up some pattern of counters on the grid and reverse it. For example, the central 16 squares could be filled with red counters and the outer border yellow. How few moves do you need to turn that central square into all yellow? (Of course, the bottom left corner square must start empty). layout of counters. These lines can be altered if you wish to make up your own problems.

The main loop runs from line 280 to 440.

An input is requested for each move, first the column (line\$) and next the row (row%). Lines 300 and 330 check that these are within the permitted limits.

Line 340 converts these input values into P% and Q%, the grid reference of the square from which the counter is being moved.

PROCHECK, called by line 350, ensures that the counter being moved is a knight's move away from the empty square, whose grid reference is given by empx%, empty%.

If the move is not valid then PROCError is called which prints a message on the screen and blows you a friendly raspberry before inviting another move input.

Line 370 calls PROCmove which checks the colour of the counter being moved, rubs it out of the square it was in, switches to the opposite colour and draws it in what was the empty square.

Line 380 calls PROC SWITCH. This long procedure checks the lines radiating away from the square the counter has just moved into and searches for counters of the opposite colour before another of the same colour. If a legal capturing situation has arisen then the counters in that line are switched over to the other colour.

Line 390 updates the grid reference of the new empty square and lines 400 to 420 add the last move made to the solution array.

Line 430 calls PROCcheck which first tests for the bottom left square being empty and, if so, checks that every other square is yellow. If it is then check% returns a value of 35 which will terminate the main loop at line 440.

Line 450 is only there to give you time to realise just what you have done before the screen is cleared and the solution displayed. Those with printers could add a print option to PROCsolved.


```

100 REM***REVERSASQUARE***
110 REM***BY Trevor Truran***
120 REM***COPYRIGHT RESERVED FEB 1984***
130 DIM sol$(300)
140 ON ERROR GOTO 1240
150 MODE5
160 VDU24,0;0;900;850;:VDU28,0,5,19,0
170 VDU5
180 @1=00001
190 PROCGRID
200 VDU4
210 FOR X%=116 TO 616 STEP 100
220 FOR Y%=116 TO 616 STEP 100
230 PROCBOX(X%,Y%,1)
240 NEXT Y%
250 NEXT X%
260 PROCBOX(116,116,0)
270 empX%=116:empY%=116:turn%=0
280 REPEAT
290 FLAG%=0
300 REPEAT:CLS:INPUT TAB(0,2)"Column (A-F)",line$
310 UNTIL ASC(line$)>64 AND ASC(line$)<71
320 REPEAT:CLS:INPUT TAB(0,2)"Row (1 to 6)",row%
330 UNTIL row%>0 AND row%<7
340 P%=116+(100*(10-(75-ASC(line$)))):Q%=116+(100*(row%-1))
350 CLS:PROCcheck(P%,Q%)
360 IF FLAG%=1 THEN 290
370 PROCmove(P%,Q%)
380 PROCswitch
390 empX%=P%:empY%=Q%
400 row$=STR$(row%)
410 turn%=turn%+1
420 sol$(turn%)=line$+row$
430 PROCcheck
440 UNTIL check%=35
450 PROCpause(100)
460 MODE7:PROCsolved
470 INPUT TAB(0,23)"Another try..",A$
480 IF LEFT$(A$,1)="Y" THEN CLEAR:RUN
490 END
500 DEFPROC solved
510 PRINTTAB(0,5)CHR$141;CHR$131;"You have solved";
520 PRINT" it in...";turn%;" moves."
530 PRINTTAB(0,6)CHR$141;CHR$131;"You have solved";
540 PRINT" it in...";turn%;" moves."
550 PRINT:PRINT
560 FOR t%=1 TO turn%:PRINTsol$(t%);" ";:NEXT
570 ENDPROC
580 DEFPROC GRID
590 FORA%=100 TO 700 STEP 100
600 MOVE A%,100:DRAWA%,700:MOVE100,A%:DRAW700,A%
610 NEXT
620 A$="ABCDEF":FORN%=1 TO 6:MOVE120+100*(N%-1),50
630 PRINTMID$(A$,N%,1):MOVE720,160+100*(N%-1):PRINTN%
640 NEXT
650 ENDPROC
660 DEFPROC BOX(X%,Y%,col%)
670 GCOL0,col%:MOVE X%,Y%:MOVE X%+64,Y%
680 PLOT85,X%+64,Y%+64:MOVEX%,Y%+64:PLOT85,X%,Y%
690 ENDPROC
700 DEFPROC CHECK(P%,Q%)
710 IF ABS(P%-empX%)=200 AND ABS(Q%-empY%)=100 THEN ENDPROC
720 IF ABS(P%-empX%)=100 AND ABS(Q%-empY%)=200 THEN ENDPROC
730 PROCerror:ENDPROC
740 DEFPROC error
750 FLAG%=1
760 CLS:PRINTTAB(0,2)"No such move."
770 SOUND1,-15,20,20:SOUND2,-15,40,20:PROCpause(50)
780 CLS:ENDPROC
790 DEFPROC pause(T)
800 finishtime=TIME+T
810 REPEAT:UNTIL TIME=finishtime:ENDPROC
820 DEFPROC move(P%,Q%)
830 col%=POINT(P%,Q%)
840 IF col%=1 THEN col%=2 ELSE col%=1
850 PROCBOX(P%,Q%,0)
860 PROCBOX(empX%,empY%,col%):ENDPROC
870 DEFPROC switch
880 LOCAL N%,X%,Y%
890 N%=1
900 X%=empX%+100*N%:Y%=empY%
910 IF POINT(X%,Y%)=0 THEN 950
920 IF POINT(X%,Y%)=col% THEN 940
930 N%=N%+1:GOTO900
940 FOR J%=1 TO N%:PROCBOX(empX%+100*J%,empY%,col%):NEXT
950 N%=1
960 X%=empX%-100*N%:Y%=empY%
970 IF POINT(X%,Y%)=0 THEN 1010
980 IF POINT(X%,Y%)=col% THEN 1000
990 N%=N%+1:GOTO960
1000 FOR J%=1 TO N%:PROCBOX(empX%-100*J%,empY%,col%):NEXT
1010 N%=1
1020 X%=empX%:Y%=empY%+100*N%
1030 IF POINT(X%,Y%)=0 THEN 1070
1040 IF POINT(X%,Y%)=col% THEN 1060
1050 N%=N%+1:GOTO1020
1060 FOR J%=1 TO N%:PROCBOX(empX%+100*J%,empY%,col%):NEXT
1070 N%=1
1080 X%=empX%:Y%=empY%-100*N%
1090 IF POINT(X%,Y%)=0 THEN 1130
1100 IF POINT(X%,Y%)=col% THEN 1120
1110 N%=N%+1:GOTO1080
1120 FOR J%=1 TO N%:PROCBOX(empX%+100*J%,empY%):NEXT
1130 ENDPROC
1140 DEFPROC check
1150 IF POINT(120,120)<>0 THEN check%=0:ENDPROC
1160 check%=0
1170 LOCAL X%,Y%
1180 FOR X%=120 TO 620 STEP 100
1190 FOR Y%=120 TO 620 STEP 100
1200 IF POINT(X%,Y%)=2 THEN check%=check%+1
1210 NEXT Y%
1220 NEXT X%
1230 ENDPROC
1240 REM MAKE SURE IF ESCAPE PRESSED
1250 IF ERR=17 THEN CLS:PRINTTAB(0,2)"Are you sure?"
1260 A$=GET$: IF A$<>"Y" THEN 280
1270 MODE7:END

```


Beeb Lab

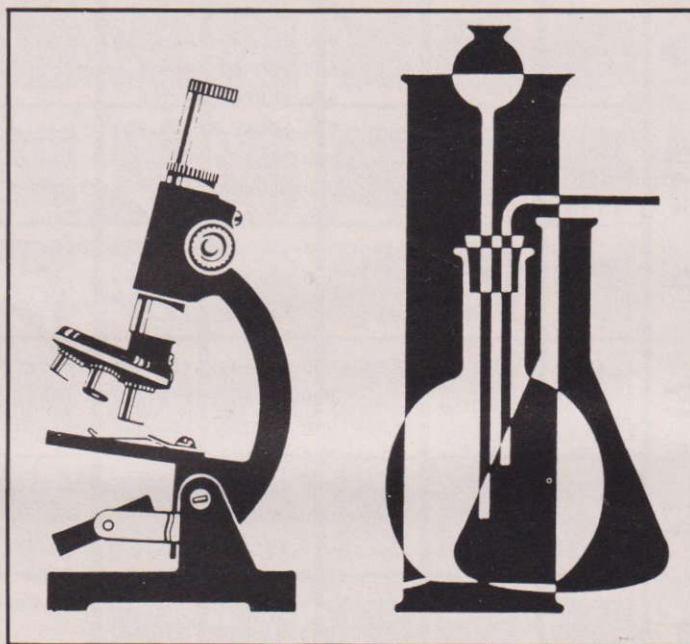
Alan Rowley

The BBC Model B is well equipped to be employed in the science laboratory, having a number of built in interfaces for communication with the outside world.

In this particular article I want to concentrate on the analogue to digital converter, a.d.c., which essentially allows the computer to measure voltages enabling you to use your machine to replace a volt meter or similar potentiometric display such as a chart recorder. Of course you can do much more than just display the voltage readings; once they are in the computer memory all sorts of possibilities open up for example integration, differentiation, statistical processing, scaling and all without having to type in the numbers! In this article, however, I just want to introduce you to the principles and pitfalls of using the a.d.c. and, by way of illustration, to describe the use of the computer to simulate a chart recorder and a large, digital, voltage display meter, but first let us look at the a.d.c. itself.

There are in fact four a.d.c. channels on the BBC and connections are made at the D-plug on the back of the Model B; if you use joysticks or paddles you have been using the a.d.c., perhaps without realising it. A joystick or a scientific instrument, such as a chromatograph, provides a continuously varying voltage, an analogue signal, which is useless to the digitally minded computer. Hence the need for the a.d.c. which compares the analogue voltage with an internal reference voltage, V_{ref} , and then sends a number to the computer, which is proportional to the ratio of the input voltage of V_{ref} . The precision of the conversion will depend on the converter used, the one in the BBC is essentially capable of 10 bits resolution. This means that an input voltage equal to V_{ref} will return 1023 to the computer, the total range being 0 to 1023. Actually the BBC converter returns a sixteen bit value, that is the total range is 0 to around 65,200 but only ten bits are reliable, the remainder are reserved for future expansion when better con-

A look at data collection in the science laboratory using the BBC and specifically its analogue to digital converter.



verters may be installed. For practical purposes the only thing to be remembered is that the raw values returned should always be divided by 64 and rounded down to an integer to mask off the unreliable bits. The description in the "User Guide", where 12 bits precision is claimed, is rather optimistic, I suggest you stick to 10 bits.

The significance of all this in practice is that the voltage range from 0 to V_{ref} is represented to the computer in discreet steps from 0 to 1023 and, since V_{ref} is 1.8 volts, then the precision of the converter is 1.8 divided by 1024, or 1.75 millivolts. It should also be fairly obvious that any voltage to be measured will have to be between 0 and 1.8 volts and so it may well be necessary to add an amplifier or a potential divider between any instrument and the computer. Voltages below 0 volts will merely convert

to zero, irrespective of their true value, and similarly any voltage above 1.8 volts will return 1023. A more important point, however, is that voltages more negative than about -0.3 volts or greater than +5 volts will almost certainly destroy the a.d.c. chip, so be careful.

TIMING

As I have already said, the BBC has four a.d.c. channels and conversion on all four channels starts as soon as you switch on, the values being tucked away in memory. Each channel takes about 10 milliseconds to actually complete the process of conversion and the resulting value is then stored before the process begins on the next channel. After all four channels have converted the first channel converts again and the updated value is stored. When you read the value of an

a.d.c. channel with the BASIC function `ADVAL(n)`, where n is the channel number, what you actually get is the current stored value for that channel, and so the value could be almost 40 milliseconds old if the channel was just in the process of updating when you took the reading. For games paddles this is not a problem but if you are trying to read a scientific instrument as a function of time the error could be crucial, fortunately the benevolent Acorn have provided a solution. The operating system call `*FX17,n` will interrupt the normal conversion sequence and force the a.d.c. to immediately start a conversion on channel n . In this manner you can time a reading to within 10 milliseconds, the time taken for the actual conversion process. The sequence would therefore be, to take readings at specified time intervals:

1. Initiate conversion on required channel.
2. Read value returned and then set timer to zero.
3. Wait for time interval to expire and then goto line 1.

We have to be a little careful here however, since, as the actual conversion will take about 10 milliseconds, it is possible that we could be taking our reading before the conversion is complete, in which case we will get some "old" value, which was read from the channel on the last conversion round. What we need to be able to do is to wait until we are sure that the conversion which we have just forced is complete and then take our reading. Again facilities are provided to do this, via an `OSBYTE` call which enables you to read the memory location which contains information about the most recent a.d.c. channel to have converted. The `*FX17,n` call resets this location to zero and it remains zero until the conversion is complete when it will be changed to contain the value n , the number of the channel which most recently finished converting. We can thus modify the above sequence to:

1. Initiate conversion on required channel.
2. Check to see if conversion is complete, if yes take the

reading and set the timer to zero, otherwise goto 2.

3. Wait for time interval to expire and then goto line 1.

The memory location in question is &2BE and it is read by OSBYTE &80, the value being returned in the Y register. You can, of course, read the location directly with an indirection operator if you are feeling sinful, and indeed it is not a bad idea if you are working from BASIC, since extracting values passed back from OSBYTE calls needs some rather cumbersome coding, but from ASSEMBLY language things are much simpler. Indeed I think that the actual coding for the sequence above is clearer in ASSEMBLER and so I have illustrated it in this way in Listing 1. Do not be intimidated if you are not familiar with the Assembler, the outline is quite straightforward. Also you do have the bonus of speed, although this is not strictly necessary for most applications, BBC BASIC is remarkably fast.

The relevant code is shown in PROCassemble beginning at line 50 of Listing 1. Line 55 is just a label so that we can call the routine produced by the name "read", lines 56 to 61 are merely to preserve the current status of the processor when the routine is entered so that we can restore everything when it is complete, this is done in lines 78 to 83 before we return to BASIC at line 84. The business part of the code is between lines 62 and 77. Lines 62 to 64 initiate the conversion on channel chan%, these three lines are the equivalent of #FX17,chan%. Lines 65 to 70 are a conditional loop which checks for completion of the conversion, OSBYTE is called with the accumulator set to &80 and the X register as zero. This is the protocol which returns the number of the last channel to convert in the Y register. At lines 69 to 70 the value of the Y register is compared with the number of the channel in use and execution only continues if they are the same, meaning that conversion is complete, otherwise we loop back to line 65 and check for completion of the conversion again. Lines 73 to 77 read the

a.d.c. channel and store the value returned in two convenient locations on zero page, &70 and &71, from where we can easily retrieve them from BASIC. The timing of the readings is not done within the assembler routine, it is more simply done from BASIC.

READINGS AS A FUNCTION OF TIME

The program in Listing 1 makes the computer operate like a chart recorder, displaying the a.d.c. input graphically as a function of time, but before we go on to look at it in detail we should consider two further points about taking readings as a function of time.

The first of these is concerned with the fact that when we use the computer to read an analogue signal we are not able to carry out analogue to digital

conversions continuously, as we have already seen the conversion itself takes a finite time and we cannot take another reading until the current conversion is complete. In practice we will also want to do something with the reading we have taken, to plot it or display it in some way perhaps. So the a.d.c. is only sampling the analogue signal at discreet time intervals. The question is "how short do these intervals need to be to ensure that we get a faithful representation of the analogue source?". Too slow a sampling rate could well miss some of the faster peaks in an oscillating signal, they would have been and gone between samples.

The full answer to this question requires complex mathematics but, luckily, there is a simple rule of the thumb which says that it is necessary to sample at least twice the rate of the fastest component of the analogue

signal, for example a sampling rate of four samples per second is equivalent to a frequency response of two cycles per second. This is the sampling rate that I have set in the chart recorder program since this is equivalent performance to that of most laboratory chart recorders. The timing is done using TIME, which reads in 100ths of a second, and the time interval is set in line 7 of Listing 1 by the variable time%, to the sample interval in 100ths of a second. You can reduce this to 10, giving 10 samples per second but do not go further or you will run foul of the next point that we must consider. If you have a second processor you can go to 20 samples per second; a chart recorder with a frequency response of 10 cycles per second would cost you a lot more than the second processor and the BBC so you have a very good

CONTINUED OVER





argument for buying one!

The next problem to be aware of is that if you try to be too ambitious about your sampling rate, or about what you do with the results, you might distort the timing of your program. Look again at Listing 1 and in particular at PROCdisplay, lines 25 to 42. There is no ENDPROC since the escape key is the only way out.

At line 31 we wait to take a reading until the time is correct and then, at line 31, actually takes the reading and reset the timer to zero. There are then several operations which go on up to line 41. the point is plotted on the screen amongst other things, before we go back to line 31 to wait for the right time again. If we take too long away from line 31, when we come back to see if the time for another reading has come we may be too late and, although the reading will still be made, the time base will be wrong. The best way to check that all is well is to print out the actual time that the reading is taken, this is done at line 32. The line can be removed once you are sure that things are working correctly, in which case the value printed out should always be equal to the value set in line 7 for time%, if it is larger you will have to speed up or shorten what you do between samples.

This article is intended to be

only an introduction to the use of the a.d.c. and to show the most obvious way of using it in the laboratory, faster sampling rates are possible but this takes us into the realm of using events and interrupts which are best left until the basic principles are clear and for most laboratory applications, such as displaying gas chromatograms, are quite unnecessary.

CHART RECORDER PROGRAM – Listing 1

HOW IT RUNS

The main program runs down to line 19, the remainder being functions and procedures. Line 6 reserves space for the machine code produced when PROCassemble is called at line 8. The channel in use and the sampling rate are both set at line 7 and you can alter them to suit your applications. Line 9 sets up the error trapping so that pressing the escape key will take you out of the display sequence at any time. Lines 10 to 17 display a title page and then wait for either 'E' or the space bar. The former ends the program whereas the latter starts the chart recorder display by selecting MODE 0 and then calling PROCdisplay.

FUNCTIONS AND PROCEDURES

FNget

A utility routine that waits for any key press contained in the string passed as a\$ and then returns the character corresponding to the key. This is the main display routine. The local variables are declared and the background colour changed to blue, at line 26. The main routine is all contained within the infinite REPEAT...UNTIL loop which runs from line 29 to line 42. The loop is exited with the escape key. The FOR...NEXT loop between lines 30 and 41 carries out the plotting of the result on the screen, increasing the horizontal co-ordinates by two graphics points for each reading. Lines 31 to 34 actually take the reading, checking that the time is correct. The aggregate time is also updated and printed at line 34. The reading is tucked away on zero page by the assembler routine and is retrieved, converted to an ordinary decimal number, masked off to 10 bits and finally scaled to fit on the display screen at line 35. Lines 36 to 39 do the actual plotting. First any previous points on the screen are removed by overwriting with background colour, PLOT7, at line 37. This enables the screen display to wrap round, the plot re-appearing at the left of the screen when the right hand margin is passed. The points are plotted and joined up at line 38, the conditional ensures that the first point does not have a spurious line drawn to it from an off screen point. Line 40 tests the 'H' key, which if pressed, allows the display to be temporarily frozen.

PROCdisplay

FNhold

This stops the display until the space bar is pressed, with suitable messages. The total time in hold is recorded and passed back to the main program so that the correct aggregate time is shown when the display is restarted.

PROCassemble

This has been fully described in the article.

DIGITAL DISPLAY — Listing 2

HOW IT RUNS

Down to line 12 is an initialisation sequence. The channel number and the precision of the readings are set at line 6. The program works by taking 50 readings from the a.d.c. and using the average value. This minimises noise. If you want you can vary prec% to increase the response time at the expense of precision or vice versa. Line 7 reserves space for the machine code and sets up the arrays used in the program. The string array last\$ contains the current values of the digits on the screen so that they can be compared with the next reading and only the ones which have changed

are updated. This saves time and stops the display continually flickering. The array number\$ stores the strings of graphics characters and control codes which are used to print the large numbers on the screen. PRINT number\$(n) will be all that is then required to display a large, calculator display style, representation and no cursor and at line 11 the units chosen are printed on the display, nicely centred.

The actual readings are taken within the REPEAT...UNTIL loop between lines 13 to 20. The loop is left with the escape key which just re-runs the programs as set up in the error trapping at line 5. There is no timing of the readings in this program, they are just left to be taken as quickly as possible. The normal rate is about 5 per second.

PROCEDURES

PROCwipe

A utility used to erase an existing number on the display by overprinting with spaces. There can be up to 5 number positions and the one to be wiped is chosen by the parameter passed as n%. This sets up the graphics required for the large numbers. Lines 30 to 33 define a series of strings of control characters by concatenation. These are used for repeated cursor movements. At line 29 a solid block character is defined by VDU 23. The numbers are made up of a selection of seven bars, as on a calculator display, these are defined in lines 35 to 41 and then the correct bars are concatenated into the elements of the string array, number\$, at lines 42 to 51. The decimal point is also set up, in line 34, as point\$.

PROCprintno

This procedure does the actual printing of a number passed as n. Any leading zeros are stripped at line 55 and then n is converted into a string by STR\$. The value of @ was set up at line 6 so that STR\$ observes the number printing format requested. The resulting string is examined a character at a time in the loop between lines 56 and 60. A check is made at line 57 to see if the character has changed, if it has not execution jumps to the next pass around the loop, otherwise the existing character is wiped and the new one substituted with the appropriate element of the array last\$ being updated.

PROCassemble PROCsetscale

This is exactly the same as in Listing 1. Provides a title page and allows you to set some of the parameters. The value which will be taken as 100% reading on the a.d.c. is input at line 105, for example entering 1.8 will make the display show voltages directly or 100 will give readings of percent of full scale deflection. This lets you scale the display to your application. You can also enter the units to be shown on the display, at line 108. This is optional and can be let out by pressing RETURN with no entry.



PROGRAM LISTING 1

```

1 REM*****
2 REM* LABORATORY 'CHART RECORDER' PROGRAM *
3 REM*   by Alan G. Rowley (C) June 1984   *
4 REM*****
5 MODE7
6 DIM code% 49
7 chan%=1:time%=25
8 PROCassemble(chan%)
9 ON ERROR MODE7:IF ERR=17 THEN 10 ELSE REPORT:END
10 CLS:VDU23,1,0;0;0;0;0;
11 PRINTTAB(0,2)"CHART RECORDER DISPLAY-";100DIVtime
   %;" Samples/second"
12 PRINTTAB(10)"by Alan G. Rowley"
13 PRINT"Press:-"'"SPACE BAR' to begin display."
   "'E' to END program."
14 PRINT""Display of the data can be temporarily
   'frozen' by pressing 'H'. To re-start press the 'SPACE
   BAR'."
15 PRINTTAB(0,22)"THIS MENU IS RE-DISPLAYED AT ANY T
   IME WHEN THE 'ESCAPE' KEY IS PRESSED"
16 A$=FNget(" eE")
17 IF A$=" " MODE0:PROCdisplay
18 MODE7
19 END
20 DEF FNget(a$)
21 LOCALb$
22 *FX15,1
23 REPEAT b$=GET$:UNTIL INSTR(a$,b$)
24 =b$
25 DEFPROCdisplay
26 VDU23,1,0;0;0;0;0;19,0,4;0;
27 LOCALi%,j%,t%,p%,n%
28 t%=time%-1:TIME=0
29 REPEAT
30 FORi%=0TO1278 STEP 2
31 REPEAT UNTIL TIME>t%
32 PRINTTAB(78,0)TIME:REM*REMOVE WHEN WORKING OK*
33 CALL read:TIME=0:t=t+time%
34 PRINTTAB(0,0);INT(t/100);".s"
35 n%=((?&70+?&71*256)DIV64)*960/1023
36 j%=i%+80:IFj%>1280 j%=j%-1280
37 MOVEj%,0:PLOT7,j%,960
38 IF i%<>0 MOVEi%-2,p%:DRAW i%,n%
39 p%=n%
40 IF INKEY(-85) t=t+FNhold
41 NEXT
42 UNTIL FALSE
43 DEF FNhold
44 LOCALa$
45 TIME=0
46 PRINTTAB(70,0)"*HOLD*"
47 a$=FNget(" ")
48 PRINTTAB(70,0)" "
49 =TIME
50 DEFPROCassemble(chan%)
51 P%=code%

```

CONTINUED OVER


```

52 osbyte=&FFF4
53 I
54 OPT 2
55 .read

```

```

56 PHP          \SAVE ALL REGISTERS
57 PHA
58 TXA
59 PHA
60 TYA
61 PHA
62 LDA #17
63 LDX #chan%
64 JSR osbyte    \START A/D CONVERSION
65 .check
66 LDX #0
67 LDA #&80
68 JSR osbyte    \CHECK FOR COMPLETION
69 CPY #chan%
70 BNE check     \IF CONVERSION IS COMPLETE
71              \GO ON AND READ VALUE, OTHERWISE
72              \RETURN TO CHECK AGAIN
73 LDA #&80
74 LDX #chan%
75 JSR osbyte    \READ CHANNEL
76 STX &70       \STORE VALUE ON PAGE ZERO
77 STY &71
78 PLA
79 TAY
80 PLA
81 TAX
82 PLA
83 PLP
84 RTS          \RETURN TO BASIC
85 J
86 ENDPROC

```

PROGRAM LISTING 2

```

1 REM*****
2 REM* LABORATORY DIGITAL DISPLAY PROGRAM *
3 REM* by Alan G. Rowley (c) June 1984 *
4 REM*****
5 ON ERROR IF ERR=17 THEN RUN ELSE MODE7:REPORT:END
6 chan%=1:prec%=50:@%=&0102040A
7 DIM code% 49,last$(4),number$(9)
8 MODE7:PROCsetscale
9 PROCassemble(chan%)
10 MODE4:VDU23,1,0;0;0;0;19,0,4,0,0,0,0
11 PRINTTAB((40-LEN(UNIT$))DIV2,30)UNIT$
12 PROCsetup
13 REPEAT
14 total%=0
15 FORi%=1TOprec%
16 CALL read
17 total%=total%+(?&70+?&71*256)DIV64
18 NEXT
19 PROCprintno((total%DIVprec%)*MAX/1023)
20 UNTIL FALSE
21 DEFPROCwipe(n%)
22 LOCALi%=n%:n%=8*n%
23 FORi%=10TO24
24 PRINTTAB(n%,i%) STRING$(8," ")
25 NEXT
26 ENDPROC
27 DEFPROCsetup

```

```

28 LOCALi%
29 VDU23,240,255,255,255,255,255,255,255
30 FORi%=1TO6:vert$=vert$+CHR$(240)+CHR$(10)+CHR$(8)
: NEXT
31 horiz$=STRING$(4,CHR$(240))
32 up$=STRING$(7,CHR$(11)):back$=STRING$(6,CHR$(8))
33 down$=STRING$(7,CHR$(10)):right$=STRING$(6,CHR$(9))
))
34 point$=STRING$(12,CHR$(10))+STRING$(2,CHR$(9)):FOR
Ri%=1TO3:point$=point$+STRING$(3,CHR$(240))+STRING$(3,C
HR$(8))+CHR$(10):NEXT
35 bar1$=STRING$(2,CHR$(9))+horiz$+back$
36 bar2$=right$+CHR$(10)+vert$+back$+up$
37 bar3$=CHR$(9)+CHR$(10)+vert$+CHR$(8)+up$
38 bar4$=down$+STRING$(2,CHR$(9))+horiz$+back$+up$
39 bar5$=down$+CHR$(9)+CHR$(10)+vert$+CHR$(8)+up$+up
$
40 bar6$=down$+right$+CHR$(10)+vert$+back$+up$+up$
41 bar7$=down$+down$+STRING$(2,CHR$(9))+horiz$+up$+u
p$+back$
42 number$(1)=bar2$+bar6$
43 number$(2)=bar1$+bar2$+bar4$+bar5$+bar7$
44 number$(3)=number$(1)+bar1$+bar4$+bar7$
45 number$(4)=bar3$+bar2$+bar4$+bar6$
46 number$(5)=bar1$+bar4$+bar3$+bar6$+bar7$
47 number$(6)=bar1$+bar3$+bar4$+bar5$+bar6$+bar7$
48 number$(7)=number$(1)+bar1$
49 number$(8)=number$(6)+bar2$+bar1$
50 number$(9)=number$(5)+bar2$
51 number$(0)=number$(1)+bar1$+bar3$+bar5$+bar7$
52 ENDPROC
53 DEFPROCprintno(n)
54 LOCAL t$,n$,i%

```

```

55 IF LEFT$(STR$(n),1)="" n$=MID$(STR$(n),2,5) ELSE
n$=LEFT$(STR$(n),5)
56 FORi%=1TO5
57 t$=MID$(n$,i%,1):IF t$=last$(i%-1) THEN 60 ELSE 1
ast$(i%-1)=t$
58 PROCwipe(i%-1)
59 IF t$="." PRINTTAB((i%-1)*8,10)point$ ELSE PRINT
AB((i%-1)*8,10)number$(VAL(t$))
60 NEXT
61 ENDPROC
62 DEFPROCassemble(chan%)
63 REM*****
64 REM* EXACTLY SAME CODE AS IN THE *
65 REM* CHART RECORDER LISTING *
66 REM*****
67 ENDPROC
68 DEFPROCsetscale
100 LOCALwipe$:wipe$=STRING$(200,"")+STRING$(2,CHR$(
11))
101 REPEAT
102 PRINTTAB(6,0)"DIGITAL LABORATORY DISPLAY"TAB(19
,1)"by"TAB(13,2)"Alan G. Rowley"
103 REPEAT
104 PRINTTAB(0,5)wipe$
105 INPUTTAB(0,5)"Please enter the value which you wa
nt to be displayed when the A/D is at its maximum re
ading(range 0.1 to 9999) "MAX
106 UNTIL MAX>=.1 AND MAX<=9999
107 REPEAT
108 PRINTTAB(0,10)wipe$:INPUTTAB(0,10)"Enter the unit
s in use, just press the 'RETURN' key to leave blank,
maximum length 20 Char. "UNIT$
109 UNTIL LEN(UNIT$)<21
110 ENDPROC

```


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High Finance

Jonathan Evans

The BBC micro has, of course, excellent capabilities for animated graphics, which are exploited in most of the games written for it. The machine is, however, also exceptionally well suited to the programming of text based strategy/simulation games, which seem to be comparatively neglected (I am not including the popular but rather stereotyped adventure games in this category). BBC Basic is a good language for strategy games because it is much easier to write and edit the fairly complex structures involved with the aid of procedures. Also, the use of Mode 7 provides plenty of memory space whilst still allowing presentation to be enhanced by special features such as coloured and double height text.

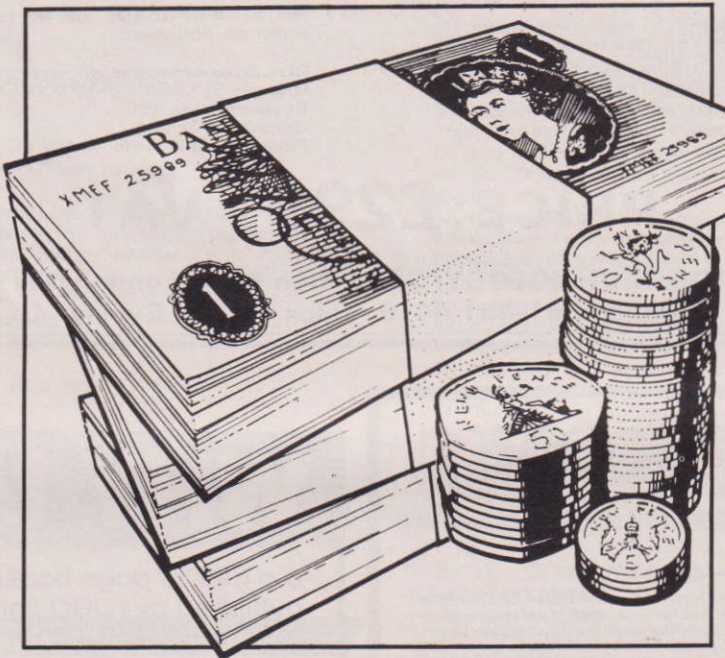
In programming terms it is essential to have a clearly planned and carefully structured program, and even so you will need to allow considerable time for testing the program to eliminate errors which can occur in the various branches. The main problem, however, lies not in the coding of the program but in planning the game itself to have the right degree of complexity. Since such games require decision making, there should be some rational basis for the choices made. If this is too transparent, the game is easily solved and soon discarded.

Now, it is quite easy to make the game *arbitrarily* difficult, by either introducing a lot of random events which can in no way be foreseen or controlled, or else by providing a lot of choices whose effectiveness can only be discovered by a laborious process of trial and error. I have played games written like this and personally found them frustrating and boring. How, then, should one proceed?

The answer is to make the rationality of choices partially apparent, but with sufficient complexity in the game to make it difficult to master. If a number of different strategies, all of which have some reasonable basis to them, can be tried, so much the better.

The necessary complexity requires either a very large program, or else non-arbitrary use of

Test your financial acumen with this exciting strategy game. Do you spend or save to make money?



random elements. What I mean by the latter is that the player is able knowingly to make more or less risky choices. In view of the need to keep program code within magazine length, I have chosen this latter approach in the present game.

MAKE MONEY

The game involves investment decisions to try to maximise the growth of a capital sum over a period of years. It can be played by a single player or up to six in competition with one another. At the start of each round (a different year) each player makes two sets of decisions. The first are money raising decisions. Money can be placed in the player's deposit account either by borrowing (up to a credit limit), or by selling assets acquired from previous rounds of play.

Following these decisions,

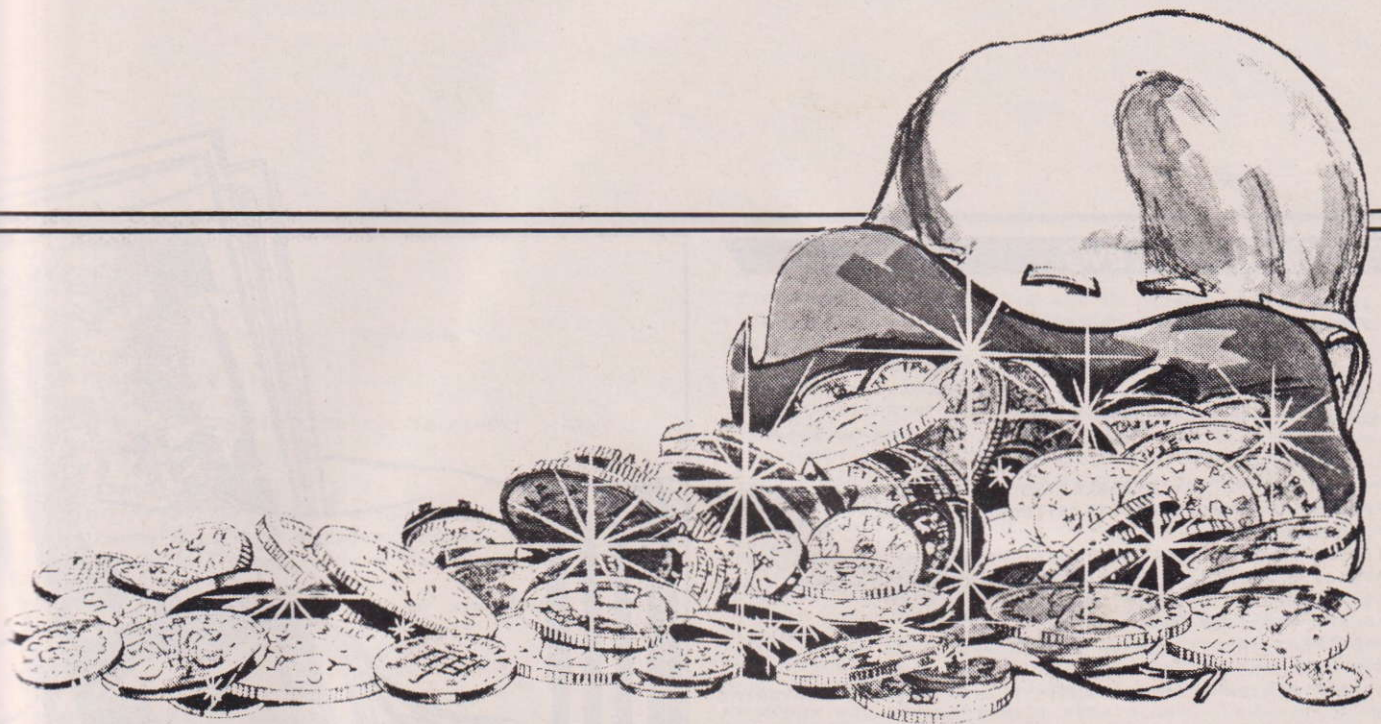
the player is then given the opportunity to buy either property or stocks and shares, or to leave money on deposit. In fact, the available cash can be distributed between these three locations in any way that the player chooses. Leaving money on deposit is a no risk option, in that it will accrue interest at a rate specified at the start of each year. Property and stock investments return income which is generally lower than the bank deposit rate, but the value of these assets may also change. In this respect property investment is the medium risk and stocks and shares the higher risk option. On average, both will increase in value, but they might also lose value. The size of potential losses and gains is considerably large for stock and shares.

The pay-off structure of these options is sufficiently complex to require a fair amount of

play to work out. However, there are other factors which affect choice of strategy. In the first place while interest rates are specified and fixed in advance for each year (loan interest is always two percent higher than the return on deposits) they vary considerably from year to year. Obviously this affects the relative value of borrowing or leaving money on deposit. Choices are also dependent on the state of play in a multi-player game. When behind, particularly towards the end of a game, one may need to make riskier choices to catch up, while a leading player may choose more conservatively.

In a multi-player game it is better if players do not see the choices made by other players, especially in the closing stages (otherwise a player following another can maintain a lead simply by matching the decisions of the other). If playing a solo game it is probably more interesting to play against one or two dummy players to whom you assign a fixed strategy. For example, you can have a passive investor who leaves all of his money on deposit throughout the game, or a wild speculator who borrows to his credit limit on every turn and invests everything in the stockmarket (this can easily lead to bankruptcy, but the program allows for this). Incidentally, the game also allows handicapping by altering the initial capital allowance of each player. For example, you can try to beat a passive investor over ten years giving him a £5000 start, and so on.

The game is, of course, far too simple to be taken seriously as a simulation of real world economic events. Because the program uses well under half the available memory space in Mode 7, it should run on a Model A with only 16K available. Alternatively, Model B owners might wish to expand the game to include more investment options, or to introduce taxation, which is ignored at present. However, even as it stands, I believe you will find it complex enough as a game to maintain your interest for quite a number of plays.



PROGRAM STRUCTURE

- 10-120** Initialising statements such as dimensioning arrays. Disabling the escape key is essential in view of the use of numeric inputs.
- 130-300** Sets up the start of a game by requesting number and names of players, the length of the game in 'years' and offering change in initial capital allowances.
- 320-540** This FOR loop runs the main game over the number of years specified. A nested FOR loop (lines 430-510) handles the decision making for each player in each year.
- 540-600** The main program ends by printing the final results and offering another game.
- 610-720** **FNstock**. This function (called by PROChistory) returns the percentage change of value in stocks and shares in a given year. Five qualitatively different sorts of year are chosen randomly (with appropriate reports placed in the variable MESSAGE\$). The precise value returned also varies randomly within a given range under each type of year.
- 740-760** **PROChheader**. Sets initial heading which is then preserved in a text window (line 120) throughout the game.
- 780-850** **PROCnewpage**. This frequently called procedure clears the screen by scrolling it with blank lines following a press of the spacebar. If desired, lines 838-840 can be replaced with a simple CLS to speed up the play.
- 870-1020** **PROCchange**. Handles alteration of players' initial allowances if required. Note the insertion of UNTIL TRUE in line 920, closing the REPEAT loop prior to ending the procedure. In BBC Basic it is essential to close all loops and end all procedures correctly to avoid mysterious 'crashes'.
- 1040-1120** **PROCaccounts**. Prints the current state of a player's accounts.
- 1140-1370** **PROCraise**. Handles the money raising decisions for each player. The variable loan% is used to flag whether a player has taken a loan on a particular turn, in which case he or she is not offered the chance to repay it on the same turn (at line 1410).
- 1390-1730** **PROCinvest**. Handles the investment decisions for

- 1620-1730** **PROCrepay**. This procedure is called only if a player decides to repay some of his loan on a particular turn.
- 1750-2100** **PROChistory**. Computes changes to deposit and loan accounts and income from property and stocks and shares. Also computes changes in capital value of the assets held. The procedure then displays all the 'history' of the year in question in a series of screen 'pages'.
- 2120-2380** **PROCproperty**, **PROCstocks**. These two procedures are really part of PROChistory (called at line 2090). They were separated owing to the author's prejudice against long procedures!
- 2400-2450** **PROCassets**. Computes nett assets for each player at the end of each year and checks for bankruptcy (flagged in the array BUST%).
- 2470-2660** **PROCresults**. Prints out the final results at the end of each game.
- 2680-2770** **PROCbust**. Called at the start of each year only if one or more players has gone bust. In the unlikely event of all players going bust the game is restarted by the inelegant autorun at line 2760. There is no other easy way to tie up all the structures for a restart at this point.
- 2790-2810** **ON ERROR** routine. Type this in early, since it clears the text window and mends the escape key in the event of an error.

CONVERSION FOR THE ELECTRON

Unfortunately the Electron does not have Mode 7 and there is no way to simulate the multi-coloured text in a program of this length. Electron owners will have to make do with a two colour display in Mode 6. This will require removal of CHR\$ codes in the PRINT statements. The main

problem is that credit balances are printed in yellow and debits in red. Hence, when removing the code for red (CHR\$129) alter the line to make sure that a minus sign is printed. For example, a minus sign should be inserted before LOAN% in line 1090 and removed before the second ASSET% in line 1110. This adjustment is also recommended for BBC owners using a monochrome TV or monitor!

CONTINUED OVER

PROGRAM LISTING

```

10REM MONEY GAME
20REM BY JONATHAN EVANS
30REM APRIL 1984
40REM
50ON ERROR GOTO 2790
60MODE7:X=RND(-TIME)
70*TV255
80*FX220,0
90REM:ESCAPE KEY DISABLED:ESCAPE ACTION BY CONTROL @
100DIM LOAN%(6),DEPOSIT%(6),PROP%(6),STOCK%(6),ASSET%
(6),NAME$(6)
110DIM LOANL%(6),DEPOSITL%(6),PROPL%(6),STOCKL%(6),DE
PINT%(6),LOANINT%(6),PROPINT%(6),STOCKINT%(6),BUST%(6)
120PROCheader:VDU20,0,24,39,2
130REM START OF GAME
140REPEAT:INPUT"Number of players (1-6) ";NP%:UNTIL
NP%>0 AND NP%<7
150FOR PLAYER=1 TO NP%:BUST%(PLAYER)=0:NEXT PLAYER:NB
%=0
160REPEAT:INPUT"Number of years (1-20) ";NY%:UNTIL N
Y%>0 AND NY%<21
170FOR I%=1 TO NP%
180LOAN%(I%)=0:DEPOSIT%(I%)=10000:PROP%(I%)=0:STOCK%(
I%)=0:NEXT I%
190FOR PLAYER = 1 TO NP%
200PRINT"Enter name of player ";PLAYER
210INPUT N$:IF LEN(N$)>10 THEN N$=LEFT$(N$,10)
220NAME$(PLAYER)=N$:NEXT PLAYER
230PROCnewpage
240PRINT"Each player has been allocated an""initial
capital allowance of £10,000."
250*FX15,1
260PRINT"Do you wish to change any player's""allowa
nce (Y/N) ?":REPEAT:G$=GET$:UNTIL G$="Y" OR G$="N"
270IF G$="Y" PROCchange
280FOR PLAYER=1 TO NP%:ASSET%(PLAYER)=DEPOSIT%(PLAYER)
):NEXT PLAYER
290PRINT"Press <SPACE> to start game"
300*FX15,1
310REPEAT UNTIL GET=32
320FOR YEAR=1985 TO 1985+NY%-1
330CLS:IF NB%=0 PROCbust:PROCnewpage
340PRINT"At the start of ";YEAR;" the nett ""assets
of each player are as follows:"
350FOR PLAYER=1 TO NP%
360IF BUST%(PLAYER)=1 THEN 390
370PRINTNAME$(PLAYER); TAB(20);
380PRINT CHR$131;"£";ASSET%(PLAYER)
390NEXT PLAYER
400DI%=3+RND(9):LI%=DI%+2
410PRINT""Bank interest rates for ";YEAR;"are ";DI%
;"% for deposit accounts and";LI%;"% for loan accounts
."
420PROCnewpage
430 FOR PLAYER=1 TO NP%:loan%=FALSE
440IF BUST%(PLAYER)=1 THEN 510
450 PROCaccounts
460PROCraise
470PROCinvest
480PROCaccounts
490PRINT"This completes the financial decision""mak
ing for ";NAME$(PLAYER);" for ";YEAR
500PROCnewpage

```



```

510NEXT PLAYER
520PROChistory
530PROCassets
540NEXT YEAR
550PROCresults
560PRINT"Another game (Y/N) ?":REPEAT:G$=GET$:UNTIL
G$="Y" OR G$="N"
570IF G$="Y" AND NP%=1 THEN CLS
580 IF G$="Y" THEN 130
590MODE7:*FX220,27
600END
610DEF FNstock
620ON RND(5) GOTO 630,650,670,690,710
630MESSAGE$= "This was a year of steady trading where
a slow but sustained growth in the economy led to
growing confidence in the City."
640=4+RND(4)
650MESSAGE$="A good year in the City following
discovery of new oil fields and faster than expected i
ndustrial growth."
660=8+RND(8)
670MESSAGE$="A very quiet year in the City with
little overall movement in share prices."
680=-2+RND(4)
690MESSAGE$="A massive stock market boom took place
this year, with unexpected discovery of new natural
resources and severe setbacks to major competing na
tions."
700=30+RND(15)
710MESSAGE$="The economy slumped badly this year as
the value of the pound declined sharply and unemployem
t figures soared. The stock market suffered a ma
jor depression."
720=-20-RND(15)
730:
740DEF PROCheader
750CLS:FOR I=1 TO 2:VDU141,132,157,134:PRINT SPC10;"M
ONEY GAME":NEXT I
760ENDPROC
770:

```



```

780DEF PROCnewpage
790LOCAL I,J,K:K=70
800PRINT"Press <SPACE> to continue"
810*FX15,1
820REPEAT UNTIL GET=32
830VDU31,0,24
840FOR I=1 TO 23:PRINT:FOR J=1 TO K:NEXT J:NEXT I
850VDU30:ENDPROC
860:
870DEF PROCchange
880PRINT"Players initial allowances may be""altered
in the range £5,000 to £15,000.""Enter amount for eac
h player without""pound sign or commas."
890REPEAT
900INPUT"Enter name of player or type END ""N$
910IF LEN(N$)>15 THEN N$=LEFT$(N$,15)
920IF N$="END" UNTIL TRUE:ENDPROC
930PL=0
940FOR I=1 TO NP%
950IF N$=NAME$(I) THEN PL=I
960NEXT I
970IF PL=0 THEN VDU7:PRINT"No such player.":UNTIL FA
LSE
980REPEAT:PRINT"Enter allowance for ";NAME$(PL)
990INPUT"AS%
1000UNTIL AS%>=5000 AND AS%<=15000
1010DEPOSIT$(PL)=AS%
1020UNTIL FALSE
1030:
1040DEF PROCaccounts:@%=0
1050PRINT"NAME$(PLAYER);""s accounts""stand as follow
s:"SPC12;"I"
1060PRINT"DEPOSIT ACCOUNT"TAB(20);CHR#131,DEPOSIT$(PLA
YER)
1070PRINT"PROPERTY"TAB(20);CHR#131,PROP$(PLAYER)
1080PRINT"STOCKS AND SHARES"TAB(20);CHR#131,STOCK$(PLA
YER)
1090PRINT"LOAN ACCOUNT"TAB(20);CHR#129,LOAN$(PLAYER)
1100PRINT"NETT ASSETS"TAB(20);
1110IF ASSET$(PLAYER)>0 PRINT CHR#131, ASSET$(PLAYER)
ELSE PRINT CHR#129,-ASSET$(PLAYER)
1120ENDPROC
1130:
1140DEF PROCraise
1150PRINT"You may raise money by borrowing up to""an
amount equal to your nett assets, ""or by selling prop
erty and/or stocks""and shares. All cash raised will b
e ""placed in your deposit account pending"
1160PRINT"your investment decisions."
1170*FX15,1
1180PRINT"Do you wish to raise cash in ";YEAR;"(Y/N)
?":REPEAT:G$=GET$:UNTIL G$="Y" OR G$="N"
1190IF G$="N" PROCnewpage:ENDPROC ELSE CLS:PROCaccount
s
1200BORROW%=ASSET$(PLAYER)-LOAN$(PLAYER)
1210REPEAT
1220 IF BORROW%<=0 THEN PRINT"You have insufficient c
redit to borrow.":GOTO 1270 ELSE PRINT"How many pounds
do you wish to borrow""(0 to ";BORROW%;")"
1230INPUT B$:UNTIL B%>=0 AND B%<=BORROW%
1240IF B%>0 THEN loan%=TRUE
1250LOAN$(PLAYER)=LOAN$(PLAYER)+B%
1260DEPOSIT$(PLAYER)=DEPOSIT$(PLAYER)+B%
1270IF PROP$(PLAYER)=0 GOTO 1320
1280PROCnewpage:PROCaccounts
1290REPEAT:PRINT"How many pounds worth of property do
""you wish to sell (0 to ";PROP$(PLAYER);")"

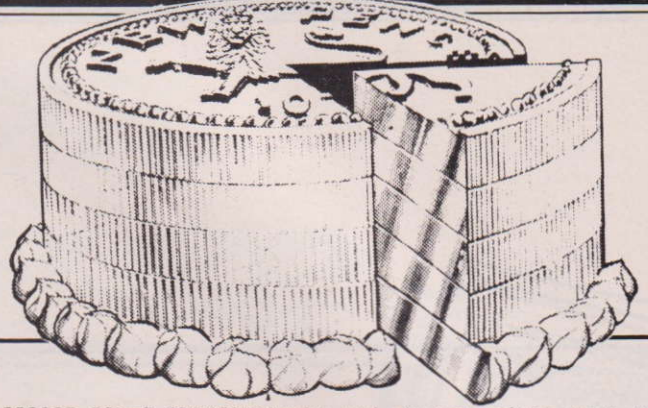
```

```

1300INPUT P$:UNTIL P%>=0 AND P%<=PROP$(PLAYER)
1310PROP$(PLAYER)=PROP$(PLAYER)-P$:DEPOSIT$(PLAYER)=DE
POSIT$(PLAYER)+P%
1320IF STOCK$(PLAYER)=0 THEN PROCnewpage:ENDPROC
1330PROCnewpage:PROCaccounts
1340REPEAT:PRINT"How many pounds worth of stocks and"
"shares do you wish to sell (0 to ";STOCK$(PLAYER);")"
1350INPUT S$:UNTIL S%>=0 AND S%<=STOCK$(PLAYER)
1360STOCK$(PLAYER)=STOCK$(PLAYER)-S$:DEPOSIT$(PLAYER)=
DEPOSIT$(PLAYER)+S%
1370PROCnewpage:ENDPROC
1380:
1390DEF PROCinvest
1400PROCaccounts
1410IF LOAN$(PLAYER)>0 AND NOT loan% PROCrepay
1420PRINT"You may invest in property and/or ""stocks
and shares up to the amount""of cash held in your dep
osit account""which will be automatically debited.""A
ny money not invested will remain on"
1430PRINT"deposit and earn ";DI%;"" interest in ";YEAR
;"."
1440*FX15,1
1450G$="Y"
1460PRINT"Do you wish to change your investments""in
";YEAR;" (Y/N) ?":REPEAT:G$=GET$:UNTIL G$="Y" OR G$="N"
1470IF G$="N" PROCnewpage:ENDPROC ELSE CLS:PROCaccount
s
1480DEP%=DEPOSIT$(PLAYER)
1490REPEAT:PRINT"How many pounds worth of property do
""you wish to buy (0 to ";DEP%;")"
1500INPUT P$:UNTIL P%>=0 AND P%<=DEP%
1510DEPOSIT$(PLAYER)=DEPOSIT$(PLAYER)-P%
1520PROP$(PLAYER)=PROP$(PLAYER)+P%
1530PROCnewpage
1540 DEP%=DEPOSIT$(PLAYER):IF DEP%=0 ENDPROC
1550PROCaccounts
1560 REPEAT:PRINT"How many pounds worth of stocks and
""shares do you wish to buy ""(0 to ";DEP%;")"
1570INPUT S$:UNTIL S%>=0 AND S%<=DEP%
1580DEPOSIT$(PLAYER)=DEPOSIT$(PLAYER)-S%
1590STOCK$(PLAYER)=STOCK$(PLAYER)+S%
1600PROCnewpage:ENDPROC
1610:
1620DEF PROCrepay
1630 L%=LOAN$(PLAYER):IF L%=0 OR DEPOSIT$(PLAYER)=0 EN
DPROC
1640PRINT"Do you wish to repay any of your loan"
1650PRINT"(Y/N) ?":REPEAT:G$=GET$:UNTIL G$="Y" OR G$="
N"
1660IF G$="N" PROCnewpage:PROCaccounts:ENDPROC
1670 IF L%<DEPOSIT$(PLAYER) THEN LR%=L% ELSE LR%=DEPOS
IT$(PLAYER)
1680 PRINT"How many pounds do you wish to repay""(0
to ";LR%;") ?"
1690REPEAT:INPUT P$:UNTIL P%>0 AND P%<=L%
1700DEPOSIT$(PLAYER)=DEPOSIT$(PLAYER)-P%
1710LOAN$(PLAYER)=LOAN$(PLAYER)-P%
1720PROCnewpage:PROCaccounts
1730ENDPROC
1740:
1750DEF PROChistory
1760REM COMPUTE INTEREST FOR EACH PLAYER
1770FOR PLAYER = 1 TO NP%:IF BUST$(PLAYER)=1 THEN 1800
1780DEPINT$(PLAYER)=DEPOSIT$(PLAYER)*DI%/100

```

CONTINUED OVER



```

1790LOANINT%(PLAYER)=LOAN%(PLAYER)*(DI%+2)/100
1800NEXT PLAYER
1810REM COMPUTE INTEREST FROM PROPERTY AND STOCKS FOR
EACH PLAYER
1820PRI%=RND(2)+2;SI%=RND(3)+1
1830FOR PLAYER=1 TO NP%;IF BUST%(PLAYER)=1 THEN 1860
1840 PROPINT%(PLAYER)=PROP%(PLAYER)*PRI%/100
1850STOCKINT%(PLAYER)=STOCK%(PLAYER)*SI%/100
1860NEXT PLAYER
1870REM COMPUTE CHANGES IN PROPERTY AND STOCK VALUES
1880PC%=RND(20)-6;SC%=FNstock
1890FOR PLAYER=1 TO NP%;IF BUST%(PLAYER)=1 THEN 1930
1900PR%=PROP%(PLAYER);ST%=STOCK%(PLAYER);PROPL%(PLAYER)
)=PR%;STOCKL%(PLAYER)=ST%
1910PROP%(PLAYER)=PR%*(1+PC%/100)
1920STOCK%(PLAYER)=ST%*(1+SC%/100)
1930NEXT PLAYER
1940PRINT" In ";YEAR;" the banks paid ";DI%" interest
" "on deposit accounts and charged ";DI%+2;" " interest
t on loan accounts. Property " " investments yielded a ne
t income " " of ";PRI%;" " and stocks and shares " " a divi
dend of ";SI%;" " .
1950PRINT" The resulting cash flow for each player " " w
as as follows: "
1960PRINT" Name      Deposit  Property Stocks Loan "
1970FOR PLAYER=1 TO NP%;IF BUST%(PLAYER)=1 THEN 1990
1980PRINT NAME$(PLAYER);TAB(10);CHR$131;DEPINT%(PLAYER)
TAB(20);CHR$131;PROPIINT%(PLAYER);TAB(29);CHR$131;STOCKI
NT%(PLAYER);TAB(34);CHR$129;LOANINT%(PLAYER)
1990NEXT PLAYER
2000PROCnewpage
2010PRINT" The changes in bank balances for each " " pla
yer during ";YEAR;" were as follows: "
2020PRINT" Name      Deposit      Loan "
2030PRINT"      Start  End      Start  End "
2040FOR PLAYER=1 TO NP%;IF BUST%(PLAYER)=1 THEN 2070
2050DEPOSITL%(PLAYER)=DEPOSIT%(PLAYER);LOANL%(PLAYER)=
LOAN%(PLAYER);DEPOSIT%(PLAYER)=DEPOSITL%(PLAYER)+DEPINT
%(PLAYER)+PROPIINT%(PLAYER)+STOCKINT%(PLAYER);LOAN%(PLA
YER)=LOANL%(PLAYER)+LOANINT%(PLAYER)
2060PRINT NAME$(PLAYER);TAB(10);CHR$131;DEPOSITL%(PLA
YER);TAB(17);CHR$131;DEPOSIT%(PLAYER);TAB(26);CHR$129;LOA
NL%(PLAYER);TAB(33);CHR$129;LOAN%(PLAYER)
2070NEXT PLAYER
2080PROCnewpage
2090PROCproperty;PROCstocks
2100ENDPROC
2110:
2120DEF PROCproperty
2130PRINT" During ";YEAR;" the value of property "
2140IF PC%=0 PRINT" was unchanged "
2150IF PC%>0 PRINT" rose by ";PC%;" " .
2160IF PC%<0 PRINT" fell by ";-PC%;" " .
2170PRINT" The value of each player's property " " holdi
ngs changed as follows: "
2180 PRINT" Name      Start      End "
2190FOR PLAYER=1 TO NP%;IF BUST%(PLAYER)=1 THEN 2210
2200PRINT NAME$(PLAYER);TAB(12);CHR$131;PROPL%(PLAYER)
TAB(25);CHR$131;PROP%(PLAYER)
2210NEXT PLAYER
2220PROCnewpage
2230ENDPROC
2240:
2250DEF PROCstocks
2260PRINT" STOCK MARKET REPORT FOR ";YEAR
2270PRINT" MESSAGE#

```

```

2280IF SC%=0 PRINT" Stocks and shares values were unch
anged. "
2290IF SC%>0 PRINT" Stocks and shares values rose " " by
";SC%;" " .
2300IF SC%<0 PRINT" Stocks and shares values fell " " by
";-SC%;" " .
2310PROCnewpage
2320PRINT" The value of each player's stocks and " " sha
res changed as follows: "
2330PRINT" Name      Start      End "
2340FOR PLAYER=1 TO NP%;IF BUST%(PLAYER)=1 THEN 2360
2350PRINT NAME$(PLAYER);TAB(12);CHR$131;STOCKL%(PLAYER)
TAB(25);CHR$131;STOCK%(PLAYER)
2360NEXT PLAYER
2370PROCnewpage
2380ENDPROC
2390:
2400DEF PROCassets
2410FOR PLAYER=1 TO NP%;IF BUST%(PLAYER)=1 THEN 2440
2420ASSET%(PLAYER)=DEPOSIT%(PLAYER)+PROP%(PLAYER)+STOC
K%(PLAYER)-LOAN%(PLAYER)
2430IF ASSET%(PLAYER)<0 AND BUST%(PLAYER)=0 THEN BUST%
(PLAYER)=1;NB%=NB%+1
2440NEXT PLAYER
2450ENDPROC
2460:
2470DEF PROCresults
2480PRINT" After ";NY%;" years, the final accounts " " o
f each player have been calculated " " as follows "
2490FOR PLAYER=1 TO NP%
2500PROCnewpage
2510PROCaccounts
2520NEXT PLAYER
2530IF NP%=1 THEN ENDPROC
2540A%=ASSET%(1);NW=1
2550FOR PLAYER=2 TO NP%
2560IF ASSET%(PLAYER)>A% THEN A%=ASSET%(PLAYER);NW=PLA
YER
2570NEXT PLAYER
2580PROCnewpage
2590PRINT" The final nett assets of each player " " are
as follows: "
2600FOR PLAYER=1 TO NP%
2610PRINTNAME$(PLAYER);TAB(20);
2620IF ASSET%(PLAYER)>0 THEN PRINT CHR$131;" " ;ASSET%
(PLAYER) ELSE PRINT CHR$129;" " ;-ASSET%(PLAYER)
2630NEXT PLAYER
2640PRINT " " CHR$136;CHR$134NAME$(NW);" is the winner! "
2650PROCnewpage
2660ENDPROC
2670:
2680DEF PROCbust
2690PRINT" The following players are bust and may " " ta
ke no further part in the game: "
2700FOR PLAYER=1 TO NP%
2710IF BUST%(PLAYER)=1 THEN PRINT NAME$(PLAYER)
2720NEXT PLAYER
2730 IF NB%=NP% THEN PRINT" All players are now bust "
"so the game is over. " ELSE ENDPROC
2740PRINT" Another game (Y/N) ? "
2750REPEAT;G$=GET$:UNTIL G$="Y" OR G$="N"
2760IF G$="Y" THEN RUN ELSE CLS:END
2770ENDPROC
2780:
2790REM ERROR ROUTINE
2800MODE7:FX220,27
2810REPORT:PRINT" AT LINE ";ERL:END

```


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

SOLIDISK HAS SOMETHING TO OFFER.

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

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

THE DISK DRIVE:

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

SOLIDISK DUAL DENSITY DISK FILING SYSTEM.

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

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

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

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

Solidisk engineers won't stop there.

But let's first answer some more immediate questions.

1 — SINGLE OR DOUBLE DENSITY?

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

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

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

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

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

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

2 — INSTALLATION:

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

3 — BASIC DISK SYSTEM COMMANDS AND UTILITIES:

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

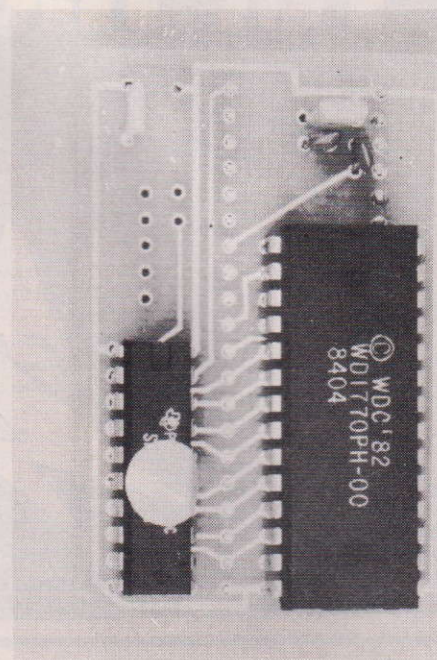
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Optional extra:

- DFDC instead of DDFS: £10.00.



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

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

The net result is exceptional response and user-friendliness.

Outstanding speed too.

As shown in the benchmark test on the opposite page.

CUT THE COST OF RUNNING YOUR MACHINE

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

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

4 — OUTSTANDING PERFORMANCE:

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

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

For example:

B10 DEFFNB1:REM Save a 16k program.

B10 T% = TIME

B20 *SAVE A 8000 + 4000

B30 = TIME - T%

Full listings are included in the User Manual.

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

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

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

With Wordwise:

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

With Scribe:

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

With Beebug's Masterfile:

Sort records 1 to 20 in PEOPLE sample database, the database is presorted on field 2 then the program is asked to sort on field 1, the time is then taken: 56.23 sec. (127.86 sec. with AC.90 DFS). These timings are improved even further in double density mode.

The figures speak for themselves.

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

Solidisk engineers won't stop there.

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

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- Quadruple FDC drivers (8271, 8272, WD 1770, WD 2793).
- RAM Disk facilities for Solidisk Sideways RAM.

6 — SOLIDISK DFDC:

THE ONLY SYSTEM TO ADD DOUBLE DENSITY AND KEEP COMPATIBILITY.

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

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

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



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

7 — PRICES (including P and P and VAT)

STL DDFS (disk chip upgrade for BBC B)	£39.95
STL DFDC for those who have Acorn DFS	£49.95
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Software Reviews

Title Meteor Mission
Publisher Acornsoft
Machine Model B
Price £9.95 cassette,
£11.50 disc

The release of Meteor Mission is likely to be overshadowed somewhat by the "super games" like Elite which Acornsoft give the full treatment. It's not at all a bad game however. A bit conventional I suppose but fun to play.

The mother ship cruises across the top of the screen waiting for you to release your lander for the hazardous journey to the planet surface. The route is blocked by small and large meteors (very much like those from the original ZX81 Meteors), other alien craft and bombs, all of which are fatal.

On the surface awaiting the ship are six humanoids, three either side. When the airborne hazards have been negotiated, the lander has to accurately drop onto one of the two landing pads, using the thrusters if necessary. Thrust is automatic on the way up, but you do get a laser with which you can shoot meteors and other objects getting between you and the mother ship. Basically the controls are left, right and release/thrust/fire — all one key (or the fire button). There are 200 points for getting a humanoid, 300 for getting back to the mothership and bonuses for shooting meteors.

The crash sequence is a little disappointing since it is used quite a lot! A quick flicker and the standard white noise reminiscent of lander programs everywhere. When "Game Over" appears, there follows the inevitable Roll of Honour.

Sound is not utilised as well as it might be in this game and the graphics are not sensational. The bombs and comets are colourful but the meteors are not solids (easier to move around). The pink surface and light blue ship add to a sickly looking screen. It is the actual playability of the game if anything that merits a look at Meteor Mission. Control of the lander is instant and all movement very smooth. Perhaps it is just that the game is a classic and always fun. A fair addition to

the Acornsoft range in that case but nothing to set the micro world on fire.

Ratings Table:

SOUNDS	50%
GRAPHICS	70%
DOCUMENTATION	90%
VALUE FOR MONEY	70%
OVERALL	60%

Title Droгна
Publisher Acornsoft
Machine Model B
Price £9.95, £11.50

Droгна? Ring a bell? See the television series? The adventure game tackled by various personalities on early evening BBC 2? Well the name is about the only element which has transferred directly from the series to the software.

In the television game the final obstacle for the two remaining adventurers was a maze, across which they had to make their faltering way, trying to outguess an invisible opponent. Within the game itself there was a puzzle connected with the use of an alien currency — Droгна.

These two elements have come together in this program, a simple but fascinating game. Each Droгна is one of five different shapes and colour. They are laid out at random to create the playing board. The two opponents have their bases at the top and bottom of the screen and progress outwards from these by moving onto valid Droгна. A legal move is one onto a droгна the same shape or the same colour as that displayed. The symbols change at random.

Each player continues the "span" of his/her move until no further progress can be made or for other tactical reason. The character currently able to move indicates this by turning its head from side to side. The aim of each player is to win the game by reaching a points total of 900. Three sets of booty are available half way up the sides of the playing area. The first to be collected is worth 100, the second 200 and the third 600.

This is where Droгна demands tactical play. The 600 point diamond is always going to be required to win. Players can rob each other of "swag" that each is carrying, and of "store"

—swag they have placed in their base — so that a number of alternatives are available to each player at every move. A good tactic is to drop lower value swag near to home base before going for the 600 pointer, since "store" becomes safe when another "swag" is deposited with it.

If all this sounds a little complicated then don't worry: it becomes quite clear as you play and the Acornsoft documentation does an excellent job explaining the subtleties of the game.

It should be made clear that this is not an arcade game, but a tactical thinking game. If you are not in the mood, the colours and shapes of the Droгна board can weave some misleading patterns and the superb winning move you had thought out a moment ago has disappeared into thin air. Like all such games, it can be frustrating but more often than not satisfying.

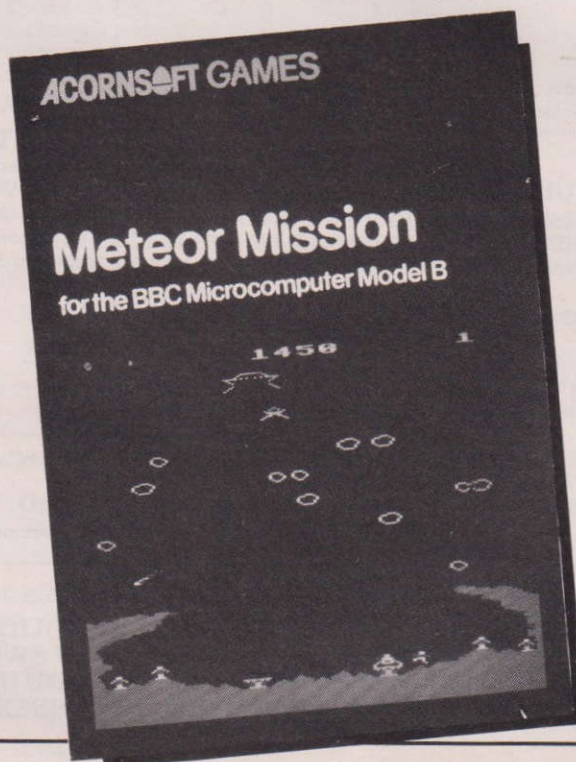
The game is two player and could prove a winner with the family at Christmas. Whether it will hold attention into the new year only time will tell. Will we get Droгна playing clubs springing up all over the country? It certainly has addictive qualities and is very well presented on screen.

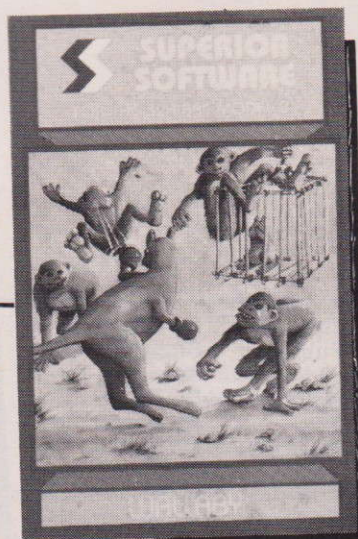
Ratings Table:

SOUNDS	60%
GRAPHICS	80%
DOCUMENTATION	90%
VALUE FOR MONEY	76%
OVERALL	80%

Title Joy Rom
Publisher Wizard Development
Machine BBC Model B
Price £17.50

Many of the commercial style games for the BBC micro do not allow joystick control and some of you may be thinking that the constant keyboard bashing will damage it for ever. This ROM — imaginatively named the 'JOY ROM' — aims to solve all your problems by allowing you to run games which do not support joystick control to be used with the standard Acorn analogue





joysticks or Atari sticks (in the latter case, The Wizard Interface must be purchased separately).

Being on ROM, it can be called up immediately by typing *JS <RETURN>. Then you can follow the on-screen instructions from there; or so the little leaflet leads you to expect. Unfortunately, you have to be rather experienced to get even to this stage because the instructions on fitting and using this ROM are very ambiguous and downright misleading in places.

The instructions casually tell you that LINKS33 needs moving from WEST to EAST to enable the JOY ROM to work in IC100 or IC101. I'm sure that inexperienced users would be rather confused already. Some of you might have realised that this is necessary because Joy Rom is a 4K ROM instead of the normal 8K type. You might also know that this change means both IC100 and IC101 can only accept 4K ROM/EPROMs which effectively means that one of the sockets can not be used. The instructions fails to tell you this.

Worse still, the actual software isn't much better either. There is no way of setting the sensitivity and there is no protection against BREAK. Also, as far as I can tell, it only caters for games using negative INKEY. To top it all, I have a sneaking suspicion that this ROM will not work on a sideways ROM board. Definitely not recommended.

Ratings Table:

SOUNDS	N/A
GRAPHICS	N/A
DOCUMENTATION	30%
VALUE FOR MONEY	30%
OVERALL	30%

Title	Spitfire Command
Publisher	Superior Software
Machine	BBC Model B
Price	£7.95

The year is 1940 and the forces of the Luftwaffe are preparing to clear way for the invasion of Britain. They underestimate the resolve of the RAF pilots who,

although heavily outnumbered, made every aircraft count in their flight for liberty... Heart warming stuff, isn't it.

You are one of the 'few' and the task is to shoot down the enemy fighters before they can attack and to prevent them from dropping saboteurs by parachute. Well, you are in fact given an out-of-the-cockpit view and must line up the enemy fighters in your sights and blast them into a million pieces. You have to watch your damage points (which go down every time you're shot at or a parachutist manages to escape) because when it goes down to zero, you've had it.

The idea is a bit (very) old and the graphics are nothing to write home about (in fact, there isn't a single multi-coloured character in sight) and the usual features such as sound on/off option and a freeze option are missing. For those who still enjoy mindless blast-em-out-of-the-sky games rather than the new wave of impossible-to-control games which requires 11 fingers, it may be worth adding to your software collection. For others however, forget it.

Ratings Table:

SOUNDS	70%
GRAPHICS	60%
DOCUMENTATION	70%
VALUE FOR MONEY	65%
OVERALL	66%

Title	Wallaby
Publisher	Superior Software
Machine	BBC Model B
Price	£7.95

In this game, you play the part of a boxing wallaby who has to rescue the baby wallaby from its cage. The wallaby is killed on contact with the monkeys who kidnapped the baby or the apple cores thrown by these vicious mammals. Of course, wallaby is not without defences. He can punch the marauding monkeys and he can leap over them with one swift bound.

At this point, you may be bursting into sweat thinking:

could this be an... an original game? Well, regular arcade goers would not recognise this game because it's a conversion of an Atari VCS game! Still, don't let that put you off. The original has been improved out of recognition with the use of multi-coloured graphics, nice animation and sounds, but what happened to all the extra features we have come to expect?

True enough, the obligatory hall of fame feature is included but where is the sound on/off option or the freeze option? And if you press some of the function keys when you enter your name in the hall of fame, you get some very interesting effects: such as a BAD MODE error! I must confess that the game itself is fairly addictive and will prove to be challenging for the first few goes but I'm not so sure of its long term appeal.

Ratings Table:

SOUNDS	70%
GRAPHICS	75%
DOCUMENTATION	60%
VALUE FOR MONEY	70%
OVERALL	69%

Title	Dune Rider
Publisher	Micro Power
Machine	Model B
Price	£7.95

A galactic courier riding across the desert, shooting the enemy to save the planet. This is the scenario of Dune Rider, a recent release from Micro Power. Right from the loading sequence this game shows more class than most on the market. The instructions scroll steadily up the screen whilst the cassette keeps running, setting the scene and listing the control keys. These can be changed to whatever the player fancies, or joysticks can be used.

Having tried both, I found joysticks easier.

The game starts with a little figure running towards a four wheel buggy, the dune rider. As he disappears on-board the ground scrolls horizontally from right to left, giving the impression of movement in the opposite direction. The dune rider can be moved horizontally in either direction or made to jump off the desert surface. The aim of the game is to shoot alien ships in the sky whilst avoiding obstacles on the ground. There are seven different alien ships altogether, although only two types appear initially. The others appear later in the game as the score progresses. There are two different obstacles on the ground, lava pits and radioactive rocks. Lava pits have to be jumped over, the rocks have to be shot first to make them safe to jump over. At least that is what the instructions said. I found that shooting at them made no difference, jumping over them was sufficient.

The alien ships move about the sky in two ways. Some stay in the same place horizontally and merely move up and down, whilst the others also move horizontally giving an overall diagonal movement. Whatever the movement, the ships still spend their time dropping bombs at you. When an alien tanker is hit it drops a fuel cannister which has to be caught to top up the ever decreasing fuel supply on the dune rider.

The program gave no trouble loading, and the initial displays are very good. The horizontally scrolling graphics are excellent, and response to the controls is good. When using joysticks the fire button fires bullets both horizontally and vertically, but as yet I have found no use for the horizontal firing. The explosion sequences, particularly when the dune rider gets hit, are very good, as is the suspension which move up and down as the level of the terrain changes. The sound effects are acceptable being a good partner to the graphics without being overwhelming. They can be disabled and re-enabled from within the program.

CONTINUED OVER

The game starts with only alien scouts and the occasional tanker to aim at. Scouts only earn 10 points so scoring is fairly slow. The tanker is worth 120 points with a bonus for catching the fuel pod as it falls, so for a good score this is really necessary. The third type of alien, the orbiter worth 20 points, appears once 1000 points have been scored. This took me so long I was beginning to think they didn't exist. When the other four aliens appear I haven't found out yet, as I have only managed to score 1970 points. Perhaps at 2000?? The obligatory three lives are given, but no mention is made of earning extra lives at a particular scoring level.

My only criticism of the game is that I found it too difficult. Having to concentrate on the alien ships and avoid their bombs whilst avoiding the lava pits and rocks is not easy. Some of the lava pits are difficult to see and controlling the jumping is tricky. I frequently found myself jumping too early and landing on the obstacle. There is no facility for setting the level of difficulty so you have to take it as it comes. If the starting level had been a little easier, and the other alien ships introduced earlier it would have been better still. When the third alien ship comes in at 1000 points the game speeds up noticeably and it quickly goes from hard to near impossible.

Overall this is a very good game with excellent graphics and sound. It contains all the refinements such as sound disable and re-enable, pause and continue in mid screen, and on-screen scoring. It is only a one player game, but there is a high score table for those who wish to compete against each other. Perhaps if I get better I might find out where the other aliens have got to. In the meantime the planet looks doomed.

Ratings Table:

SOUNDS	75%
GRAPHICS	90%
DOCUMENTATION	50%
VALUE FOR MONEY	80%
OVERALL	85%

Title Mr Wiz
Publisher Superior Software
Machine Model B/
Electron
Price £7.95

Mr. Wiz is a magician who spends his time running round an orchard eating the cherries and avoiding the Gremlins. Unlike the Pac-Man style of chase with a pre-defined maze, Mr. Wiz can go anywhere in the orchard but his pursuers can only move on the paths existing at the start of each screen, or along the path created by Mr. Wiz as he moves.

The programs, consisting of a number of sections of BASIC and machine code, loaded faultlessly. The playing instructions were clear, but only appeared during loading and could not be referred to while playing.

Mr. Wiz responds to the standard Z,X,?, * to control his movement, and the space bar to throw his crystal ball at the pursuer. He can also be controlled by a joystick. The aim of the game is to eat all the cherries in the orchard while avoiding the Gremlins who emanate from a mushroom at the centre of the orchard. The Gremlins can be killed either by being hit by a thrown crystal ball, or by being squashed by a falling apple. The apples, scattered around the orchard, fall toward the bottom of the screen when the grass under them is removed as Mr. Wiz passes by. They fall as far as the next patch of grass killing everything in their path, including Mr. Wiz if he still happens to be there.

Points are scored for each cherry eaten, with a bonus of 1000 points for eating the mushroom home of the Gremlins. However this makes the Gremlins very angry and they no longer stick to the paths but home in on you straight across the grass. In view of the limited size of the orchard, 18x12, this is not to be recommended if there are many cherries left to be eaten. As each screen is cleared it is replaced by a different orchard, but still with the same aim. Three lives are available with an additional life gained for every 10000 points scored.

The game is simple to play, but to build up a good score requires a certain amount of strategy which only comes with practise. Character movement is very smooth and keyboard response good. I found proportional joysticks difficult to use, but perhaps the switched variety would be better. Sound effects accompanying the eating of the cherries and the killing of the Gremlins are quite acceptable, but there is a tune which plays continuously while the game is running. This soon becomes irritating and can only be turned off by disabling the sound channel before the game is loaded, but this also removes the acceptable sound effects.

Overall I found the game enjoyable. It was very easy to play but with plenty of scope for improvement. Good graphics coupled with a different screen layout for each orchard (at least up to screen five which is as far as I got), gives an interesting variation as the game progresses. Annoying features were the inability to selectively disable the sound track, no pause feature and no variation in the starting level of difficulty. The game may get more difficult with each screen, but at the lower levels this was not obvious.

Ratings Table:

SOUNDS	50%
GRAPHICS	80%
DOCUMENTATION	80%
VALUE FOR MONEY	75%
OVERALL	80%



Title Nifty Lifty
Publisher Visions
Machine Model B
Price £6.95

Enjoy the ultimate in shopping experience — take all you can carry away with you. Except for the one slight hitch that befalls all such ventures, you can certainly keep what you can take. It's just that you have to avoid being crushed by the lifts as you wander from floor to floor. Unfair you say — not so, say the management who in their magnanimity allow you the freedom of the store. They say the rewards are there for those that deserve them and as they give away so much of their stock to you they might as well have a little fun while you have yours.

The screen is divided into rows and there are a number of lifts travelling up and down. You start from the bottom floor and must get to the other side of the floor to get to the next floor where you must cross back to get to the next floor and so on, until you get to the top when you will go onto a screen with more lifts to contend with. The concept is devastatingly simple but in practice it turns out to be both challenging and extremely addictive. The cute characters are incredibly well defined and well animated. The "Entertainer" played constantly in the background boosts up the enjoyment of this already enjoyable game a considerable amount. The game becomes more and more difficult until you lose all your three lives.

"Nifty Lifty" lacks some of the professional touches found on games by Acornsoft and Micro Power in that it does not have a high score table and you can not freeze a game but it is so incredibly addictive you're forced to have "Just-one-more-go". Recommended.

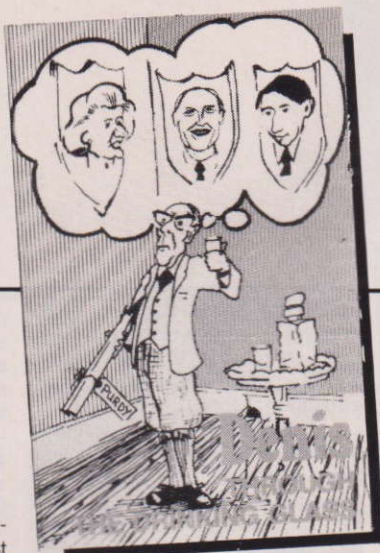
Ratings Table:

SOUNDS	100%
GRAPHICS	100%
DOCUMENTATION	70%
VALUE FOR MONEY	70%
OVERALL	85%

Title Denis Through
The Drinking
Glass
Publisher Applications
Software
Specialities
Machine Model B
Price £5.50

This is a text only adventure, orthodox in construction but most unorthodox in content. You play the role of Denis Thatcher, whose first objective is to escape the clutches of Maggie and find the hidden booze at No. 10 to sustain you on your travels to the eventual sanctuary of the Gravediggers Arms. On the way you will encounter many contemporary political figures such as Keith Joseph, Ken Livingstone and Arthur Scargill. It is great fun, provided you have the right sort of anti-establishment, Private Eye type sense of humour. Playing this made me reflect on the conservatism shown by the major software companies in marketing games. Not only are "new" arcade games usually variations in all too familiar themes, but adventure games still, in the main, seem to involve dwarfs, elves and lamp carrying. Why, oh why, when the whole range of subjects available to novelists and dramatists could be used?

Don't expect a masterpiece of coding like Snowball or Twin Kingdom Valley though. The game structure is very simple since it is a conversion of a program written originally for the Spectrum using The Quill. This also accounts for the tangled web of GOTOS and GOSUBS which make cheating your way through this adventure harder than playing it straight, but at least reminds you why you paid the extra for the BBC micro in the first place. The game also has a feature which I normally dislike in adventures — "killing" you (just ending the game in this case) without warning, for example when you move into some new locations without carrying the requisite object. I find it forgivable here because the save/load routine is very fast, and these and other premature ends are usually accompanied by some witty Sun newspaper headline about Denis's misfortune.



The adventure is surprisingly difficult to solve because of its unorthodox nature — you do have to think in a different sort of way. I must admit that I got stuck on the first task of finding the flask from which you must drink to get past the first ten moves. Being short of time for the review, I rang the author in desperation who was very helpful. Thereafter, you must take a drink about every ten moves to avoid sobering up — a joke which wears rather thin after a while. One of the better features, however, is that HELP produces different messages in different locations, often terse and rude but usually providing an important clue. Incidentally, the descriptions and messages are all in verse — as poetry it ranks alongside Rupert Bear stories, but fits well with the general atmosphere of the thing. A final word of warning — there are some naughty bits. I had to send my eleven year old daughter from the room to try the word obviously required in one situation. Result — another embarrassing exposure in the Sun!

Ratings Table:

SOUNDS	N/A
GRAPHICS	N/A
DOCUMENTATION	80%
VALUE FOR MONEY	90%
OVERALL	85%

Title Drum Kit
Publisher Quicksilva
Machine Model B
Price £7.95

Drum Kit is software for all those BBC owners who have already wired up their micros to external speakers, hi-fis, even the P.A. when it's on hire, and grabbed anything and everything which

might turn the Beeb into a musical instrument.

It is an unfortunate fact that, apart from the educational and theoretical, the BBC does not pack much of a musical punch. None of the micros do. MSX may offer Yamaha synth add-ons but that is a new area entirely. The BBC can also use MIDI to control or digitally record from MIDI equipped synthesisers and drum machines. Acorn have got something up their sleeves this Christmas along the lines of a cheap keyboard and interface for the BBC.

Drum Kit is an attempt to simulate some of the hardware in software. All four voices are employed and BBC sound software well exploited. The display is well thought out. Even if the colours are not to your taste, they are at least contrasting. Sixteen beats of each voice are displayed in each page.

Drum Kit starts up in demo mode and from here there are two types of editing. Firstly you can switch the buttons (notes, beats) of each voice (called Snare, Bass, Electro, Sticks) on and off. All buttons can be cleared if you foul up. Movement of the cursor is through the cursor keys. Return turns on and off. Space moves to the next page (1-16, 17-32 etc). Escape takes you to the second area of editing.

This is the "Values" page. Here a number of boxes represent increasing and decreasing the values of tempo, beats to the bar, number of bars and Start Bar. Put the cursor in the box and use Return to change value. This sort of editing is very friendly and encourages experimenting with various combinations. The Start Bar marks the area of memory in which the rhythm section is to reside. This combines with the save facility to allow the construction of complex structures in sections. A saved file is defined by the Start Bar, number of bars and bar length. The four voices and accents are stored, no other subtleties such as volume, tempo or bar segregation.

Values also sets the metronome on and off. It uses the fourth voice and plays a background beat on the first beat

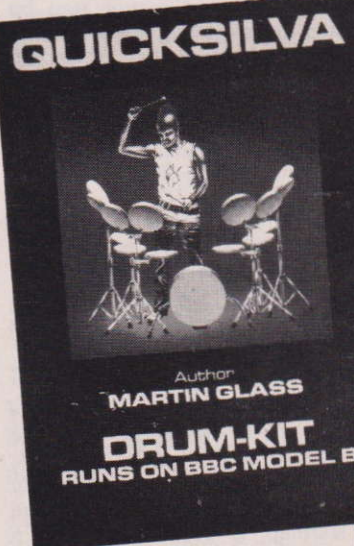
of every bar. The metronome is useful in conjunction with the "T" tap key. This enables real time input, for practice or for inspirational editing!

Envelope editing and saving is an entirely separate function, accessed through the volume page of "Values". It is a conventional Envelope editor.

Drum Kit tries very hard to supply the features needed by a practising percussionist but, largely because of the limitations of the BBC, falls well short. The sounds are not the most realistic obtainable. I have heard better attempts at snare and bass. It sounds as though the author went for the option of producing "acceptable" electronic sounds rather than try for realism. If you can forget the sound and just need something to fiddle with, to experiment with rhythms, then Drum Kit will suffice. Don't imagine that this, or any other music utility, can take the place of the real thing, skin, or silicon.

Ratings Table:

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



CONTINUED OVER



Title Star Seeker
Publisher Mirrorsoft
Machine Model B
Price £9.95 cassette,
£12.95 disc

There are a number of programs around for the BBC and Electron at the moment to aid the watcher of the night sky. From a hobby and an educational point of view, the computer can be a great help in this area. Star Seeker is available only on the BBC and goes further than any of the programs so far, as far as the information stored, graphical representation and documentation to explain what you are seeing are concerned.

The documentation takes you through the program options (and there are many) step by step, from loading the programs, specifying your location (longitude and latitude) and time (+ or - from GMT) to getting a close-up of a certain part of the night sky or getting information on one of over 300 stars in the Stardata file.

Anyone who is taking up the hobby of star gazing from scratch will find a fair amount of introductory information and explanation of terms. With a good book from the library, Star Seeker could prove an effective way to cut your teeth.

First thing with a star map is to specify direction of view (N,S,E,W,O), the latter is Overhead. You can also specify more precisely in degrees. The starmap is constructed and a number of options listed in a

menu. L lists constellations spotted, C constructs a constellation map, with names and the option to print out the plot (so you can take it outside with your binoculars and do it for real). I gives information on any plotted star. The star is chosen with cursor keys and Copy. Information includes the accurate position of the star in the sky, its brightness, the name of the constellation, its distance in light years from earth and the times at which the star rises and sets.

U updates the position of the stars in the sky at hourly intervals (caused by the rotation of the Earth). S stops the option. D allows access to another viewing direction, T another time of night, N a new date or location and E a quick exit from the program.

The documentation relates what you can see on screen to the real night sky and offers a number of ideas on how to use Starseeker to gain information on what you have seen or to plan your watching in advance.

A second program, Solar System, provides information on the Sun and Moon. Options one to nine provide information on brightness, position in the sky, rising and setting and so on. Option 10 deals with sunrise and sunset. Option 11, the same for the moon. Options 13 and 14 show positions and other information on Hailey's Comet in relation to other bodies. Scaling can be changed and orbital motions followed. It is all very comprehensive and impressive. The graphical plots take place in a central window with information displayed to either side. The print

option for Epson RX and FX80 printers is very welcome indeed and increases the program's already considerable worth as an educational tool.

Star Seeker is certainly worth a look if you already take your astronomy seriously or if you are looking for a new hobby for the winter. I would also recommend it as a resource for the family (it is a part of the home discovery series after all) or the school. Both programs are written by Dr Paul Phillips of the London Planetarium and if you don't fancy a trip to London, Star Seeker will bring the computer equivalent into your home.

Ratings Table:

SOUNDS	N/A
GRAPHICS	95%
DOCUMENTATION	90%
VALUE FOR MONEY	90%
OVERALL	90%

Title The Lair
Publisher Utopia Software
Machine BBC B
Price £4.95

If adventure is your thing then this program is probably not for you. On a scale of one to ten for 'Memorable Adventures that I have seen' this one wouldn't even appear. You guessed I don't like it. Well done.

The basis of the game seems good enough but there is a great gap between what is said on the single sheet of instructions and the actual game. There are 200 chambers in The Lair, sounds good, this is a role playing adventure, shades of The Valley, great, then things start to slip. You have only about eight commands, all accessed by pressing single keys; there are no graphics to speak of and the room descriptions take about one line each, not what one expects at all in today's computer programs. You have the choice of four roles all with differing strength to magic ratios, the aim is to collect gold and increase your strength, but it is so boring that I never got very far at all.

It is said that there are some deadly traps and one way passages in the lair but the only sort of interest that I found was

the actual combat. Unlike The Valley there is no skill element even here, for each part of the combat proceeds unseen as you press the space bar. You have an opportunity to bribe each creature but if you fail they take all your money anyway.

Then the combat that ensues is based on relative strength and a random component. I have honestly played more interesting board games, even on my own! I cannot see anything to praise in this game apart from its speedy response — well if the program does nothing you can't expect it to take long can you! — and its number of locations. Definitely a tape to leave on the shelf. You have probably typed in better programs from this magazine.

Ratings Table:

SOUNDS	0%
GRAPHICS	20%
DOCUMENTATION	40%
VALUE FOR MONEY	0%
OVERALL	0%

Title Frantic Fingers
Publisher Power Software
Machine Model B
Price £2.95

This clever and useful utility is a program which writes a program which writes a program! When you *RUN the program supplied it gives you a choice of two options (ESCAPE returns to this menu), one of which permits redefinition of up to 10 keys, and the other conversion of key presses of joystick functions. When you have chosen your options the program then saves a file to tape under a name which you can choose. The saved file is itself a machine code patch which is the *RUN prior to loading the arcade game whose controls you wish to redefine. Thus you have the versatility to create very simply as many patches — under different filenames — as you may need.

When the patch is *RUN, the third program within a program is created — the small interrupt routine which plays the necessary tricks with your operating system (it doesn't matter if the patch is then overwritten



DR. GLENN WILSON

The Dating Game

for the BBC Microcomputer and Acorn Electron



when the game loads). Although the final routine is not relocatable my research indicates that it has been intelligently placed in the printer buffer — at addresses hex 880 to 8BF. Although commercial machine code programs regularly pinch 'unofficial' areas of memory anywhere from &900 upwards (including those produced by Acornsoft!), only the most virulent are likely to disturb this patch.

This excellent utility should not really be necessary. In my view all arcade games should offer options for joysticks and redefinition of keys (and also freeze game and sound off options). Software writers please note!

Ratings Table:

SOUNDS	N/A
GRAPHICS	N/A
DOCUMENTATION	75%
VALUE FOR MONEY	90%
OVERALL	90%

Title	SAS
Publisher	Commander
Machine	Comsoft
Price	Model B
	£4.95

Are any social scientists investigating the effects of violence in computer games? Zapping aliens in space seems pretty abstract and stylised, but do you really want your kids playing the role of SAS soldiers gunning terrorists down in the streets? It's only the role playing that bothers me with this one — there is certainly no disturbing realism in the graphics. Indeed your SAS hero shuffles across the screen with a mincing stride which belies his macho image.

The instructions present a lot of pious twaddle about having a public duty to protect the innocent in society from the increasing threat of terrorists, and the misquotation from the 23rd Psalm which remains on screen while the main game loads epitomises the general tastelessness of the thing. The true spirit of the game is to be found in the REM statements for anyone brave enough to list the

Basic section of the program. The message begins "Welcome pirates...", wishes that anyone copying the program should "rot in HELL" and ends with a dedication to a friend whose reaction to all games is "But I want to kill!".

Technically the game is fairly mediocre by current standards, though it is cheap for BBC software. The SAS officer is animated by the ZX keys and fires with Return. Movement is horizontal only and there is no joystick option. The static scenery of street scenes is very nicely drawn (three different scenes) but the use of animation and sound is extremely limited. What you have to do is line yourself up with terrorists who appear in random locations and shoot them. You have to avoid the bullets they fire at you and also avoid shooting hostages who are sometimes held in front of the terrorists. On higher screens you have to deal with more terrorists and bullets. Definitely not to my taste.

Ratings Table:

SOUNDS	40%
GRAPHICS	50%
DOCUMENTATION	60%
VALUE FOR MONEY	55%
OVERALL	50%

Title	The Dating Game
Publisher	Acornsoft
Machine	Model B/
Price	Electron
	£12.95

It is difficult not to approach this software with a good deal of scepticism and, after spending an evening playing it, I can't honestly say it will change your life or even "help you understand yourself and your relationships", as promised by the accompanying documentation. It does however provide a great deal of entertainment and amusement.

The package comes with a booklet and two cassettes divided into five programs covering different aspects of relationships. Each section consists of a series of questions and multiple-choice answers which the user selects confidentially. The computer

stores the answers and produces an analysis at the end. Most of the sections can be played either alone or with a group of people for comparison results.

The sections are: (1) The Dating Game, which allows you to assess your compatibility with a current or prospective partner or, if you're feeling really daring, allows a group of people to answer the questions and let the computer decide who should be with whom; (2) General Compatibility, which is similar to (1) except it assesses the compatibility of people who might spend a lot of time together without being physically involved, eg flatmates, business colleagues etc; (3) Love Style, which tells you what kind of lover you are and displays the results as positions on three different scales under the headings "fanciful versus practical", "serious versus playful" and "cool versus passionate"; (4) Preferred Relationship, which reveals the kind of relationship you want and your role in it, again showing the results on a scale in the areas "giving versus taking", "committed versus free", "boss versus slave" and "quiet versus exciting" and finally (5) Dating Skills, which examines your social skills in dating and mating and aims to assess your overall level of sophistication.

Even if you can take all this seriously there are several obvious drawbacks to the package. Once you've played the games and perhaps tried them with a few friends there can be little further use for the software. By their nature the answers to the ques-

tions are very limited — a ready made reply must be chosen from a maximum of six, when none of the options may actually reflect the user's true response. If you're considering a prospective lover rather than someone you already know you have to either guess their responses or invite them to play the game themselves which is hardly practical or subtle. The most entertaining part of the game is trying to cheat and see which answers your partner is choosing without them knowing, and it's probably the only way The Dating Game will teach you anything you didn't know already!

Ratings Table:

SOUNDS	N/A
GRAPHICS	N/A
DOCUMENTATION	95%
VALUE FOR MONEY	55%
OVERALL	65%

Title	The BBC Micro Toolbox
Publisher	BBC Publications
Machine	Model B
Price	£21.00

This is a release from earlier this year, full of utility programs to assist in the writing, testing and debugging of your own BASIC programs.

Some of the routines are embedded within BASIC programs. The intention is that you extract the routine from the pro-

CONTINUED OVER

gram to use in your own. For example, there is a BASIC program that demonstrates the two main ways of plotting a circle, and then fills it with the new horizontal fill command (PLOT 77,x,y). All three parts are separate procedures easily separated, or rewritten for personal use.

Included with the package are nine machine code utilities providing a wealth of programming genius. The programs vary in length from &100 to &300 bytes, and so are easily locatable below PAGE. These are also co-resident, i.e. they can exist in memory at the same time as the BASIC program you are working on.

Cross Referencer is the first of these utilities. It enables the user to obtain a list of all the lines in which a specified string or command appears. You have the option of either listing out just the line numbers or the line numbers plus the program line.

Packer is next on the list. It will test the length of each of your program's lines and crunch them together if possible. It calculates the number of bytes on the line, then calculates the number on the second and, if below the maximum, makes the two lines into one. This rule continues until the end of the program. It will not act on lines beginning with DEF or REM.

For REMs there is REM stripper. References to lines within the program are changed to "live" lines. It looks for the REM BASIC token and therefore will not remove comments in assembler. Space Remover is of the same ilk. Another shrinker. The idea is to actually remove all the unwanted spaces between the text which, under normal circumstances, make the program readable. One thing I found about using this program was that it encourages the correct use of BASIC, since if you use certain lazy shortcuts, especially with regard to variables, you end up with a syntax error because of using the space remover. For example:

IF A = SPAC E = 8

where A, SPAC and E are all variables. This line becomes:

IF A = SPAC = 8

This results in an error. A THEN is needed. The utility tokenises the keywords (identified and marked in position). For example:

IF A = X THEN PRINT TAB(8); "Hello"

After passing through the cruncher, the line appears on the screen as:

IF A=XTHENPRINTTAB(8); "Hello"

which is exactly the same as the previous line except that no spaces are visible. But in essence they are still there, thus maintaining the correct grammar. If you were to copy this line for some reason, the line would take on an entirely different meaning where two variables would be made equal to each other, A and XTHENPRINTTAB(8)!

Replacer allows one word to be swapped with another anywhere in the program. Good for changing variable and procedure names.

Resequencer will allow you to move a block of code around a program to save having to retype it again. This is achieved by the single command line, detailing the lines to be copied, and then the destination line number.

Spacer puts the spaces back in to give a neat and readable appearance to your listings (for submission to A&B). To avoid syntax errors the program is written to look at the keyboard "tokens" and ignore some of them. One of these codes to be ignored is that Keyword PROC, since to put a space around this would cause an error. The call could not be executed. Nor are spaces inserted at the start or end of lines (since these take up valuable memory in BBC BASIC). The reverse of Packer reads lines, encounters colons and invents new lines.

Variable dump is also very useful if you are writing programs for publication. It sends all the used variables in your program to

the screen and, if you wish, printer.

All the above utilities are written in assembler, listings of which are in the manual along with detailed explanations and step by step "how to use" sections. Amongst the other BASIC programs on the cassette are Character Generator, Graphics Dump and Disassembler. The latter provides a clear and readable memory dump and shows absolute addresses, so you can tell exactly where the next pointer is.

Other programs include a large number of sorting routines, a RAM test program, a procedure for writing the character set sideways, a speech chip number generator and a double size characters routine for use in any mode.

All the programs are very well written but some might be considered just "stocking fillers". There are plenty of similar utilities around and the user will have to decide on how much use he or she will make out of such an expensive package.

Title	Mini Office
Publisher	Database Publications
Machine	BBC B
Price	£5.95
	cassette, £7.95
	disc

This has to be one of the very best value for money packages that I have ever seen. The idea behind this collection was that they should be very simple business programs that could be used, by small businessmen and women, to discover if the full versions could be of use in their work. What happened was that the programmers assigned to the project got so involved that they ended up producing very respectable working versions of the programs instead.

So for your £6 you actually get three business programs, a word processor, a data base and a spreadsheet with graphics. The wordprocessor is the weakest of the three I feel. There is the option of 20 to 40 characters per line, which means that output on an 80 column printer is not as



you see on screen. A novel idea is that the 20 column output can be printed, on the Epson Bit Image range, as screen dumps and therefore emerge exactly as you see it on screen. Another innovation is the 'words per minute' count that you can be given as you type text into the machine. There are other options which mean that this can actually be used as a simple text editor besides just a demonstration.

The database program is much better and although it has a low limit on the amount of data per record it is likely to be of use to anyone who wants to computerise a small card file system. The program can search the database using either the full and exact string or parts of the strings or in the case of numeric fields, using equality, less than, more than or numbers between two specified values. This really is a vast range of options and with the multi-field sorting routine it is a better program than at least one I have used priced at £20.

The final set of programs comprise the spreadsheet package and once again these have features to shame many full priced 'business' programs. There is a continual update option so that any change in values is put into immediate effect. The formulae can contain most of BASIC's arithmetical operators and are very simple to program. Labels are also easy to set up and there are special keys which will insert a line at any point. After you have prepared the sheet you can then save and load up the graphics program. This allows you to prepare graphs of any of the rows that you have saved. There are a number of options and there is a printer dump, for Epson compatible printers.



As you can tell this is an impressive suite of programs and not only because of the price. I cannot believe that anyone will be disappointed in this package and there must be a number of users of other programs who wish that it had been released before they made some expensive mistakes. The only thing that I would like is a set of function keystrips but you can always make your own!

Ratings Table:

SOUNDS	N/A
GRAPHICS	N/A
DOCUMENTATION	80%
VALUE FOR MONEY	100%
OVERALL	100%

Title	Elite
Publisher	Acornsoft
Machine	Model B/ Electron
Price	£14.96 cassette, £17.95 disc, £12.95 Electron

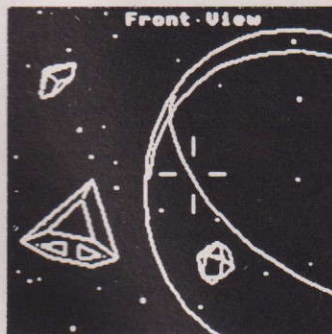
As I spin uncontrollably towards Diso, my cargo of exotic liqueurs and wine already lost, scooped up into the hold of a pirate ship, the sound of lasers on the hull of my Cobra Mk II ringing in my ears, I know that another attempt to join the Elite will be over in a matter of seconds.

Elite, Acornsoft's brand new space fantasy simulation can, and will, take its players into the fantasy world of deep space, the world brought to us by countless science fiction writers, and now by two Cambridge undergraduates from Jesus College. Elite is flexible enough a game to allow the player to live out a number of roles within its solar systems and galaxies. Be a trader, the quiet life, a pirate, a bounty hunter, a miner, or as likely, a combination of all of these. If you wish, you can even become a hermit on some lonely asteroid. That however would be a waste of your considerable investment in buying Elite.

The justification for paying at least £12.95 (the Electron monochrome version) for Elite, is that this game will plunge you into another world. Three lesser games for the same price could

not hope to compete with the comprehensive challenge to the player's tactical, trading and space fighting skills presented by Elite. You might well hone your laser aim with Vortex and test your financial acumen with Planetfall, but Elite offers the chance to combine the lot.

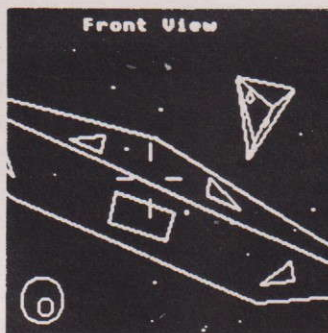
The package includes a bulky flight manual, with a training section for new pilots, guidelines to the sort of political systems, alien life forms, industrial and agricultural economies the trader will encounter. As in the game itself, there are humorous elements in the planet descriptions owing much to the authors' acquaintance with the Hitchhiker's Guide To The Galaxy. The owner of Elite also gets a handy reference guide to the keyboard functions and the other space ships which he will encounter. There is a poster with some of these same ships and a detailed "Observer's Guide" in the manual. Space ship spotting is an important part of the trader's skill.



Finally, the game is accompanied by a book called The Dark Wheel. It is based on the game (rather than the more usual reverse situation) and picks up on many of the details, distances, prices, ship performances, which form the world of Elite. The story is a powerful one, the revenge of a father's death, and helps push the player's imagination over the boundaries of keyboard and monitor into the dark void and whirling stars of the game.

Elite was written using the BBC Assembler, the final code being generated from a number of source files. This method has resulted in some very impressive 3D graphics, a split screen, and

the storage (in tokenised form no doubt) of a considerable amount of information. The space craft and Coriolis stations are conveniently geometric shapes and are drawn using a hidden line algorithm in the two colour mode window. Beneath the window and in four colours, the status window provides information on ship position in relation to other craft in the area, compass heading and readouts on energy banks (which supply the all important protective shields, fuel, lasers and so on). Your initial Cobra Mk II is supplied with one forward laser and three missiles. Part of the skill in playing Elite is trading successfully enough to be able to afford various items of equipment for your ship. Docking computer, scoop, mining, beam or military lasers, front and rear, anti missile device and intergalactic drive are just some of the possibilities. The latter is necessary to reach the other seven galaxies. This seems to be necessary if you wish to become "Elite".



Your initial status is "Harmless" progressing to "Most Harmless" (another Hitchhiker reference) and on to the top of the range, Deadly and Elite itself.

Acornsoft are running a competition with a £100 prize each month up to March, when there will be a final. So far no-one, either the programmers themselves, or those at Acornsoft, knows of anyone who has achieved Elite status. The top end of Dangerous seems to be the current high score. A challenge indeed.

The function key plays an important role in the playing of the game, accessing various sources of information on market prices, available goods on the space station with which you are currently docked (you don't actually visit any planets), an inventory, personal status (including your standing in the eyes of the police!), plus local and galactic navigation charts. Within the galaxy it is possible to pinpoint any star and get information about it. Your local chart shows the solar systems to which you can travel with you seven light year range.

When you have made your choice, your ship goes into Hyperspace (Witch space as it is sometimes called). Space skips or jumps can then be made (providing no other ships are in the area) towards the target planet. Once in orbit, docking has to be achieved with the Coriolis station for trading to take place. Be warned, market prices fluctuate and some illegal goods, narcotics and slaves, will have the police Vipers down on you in an instant. Pirates will also prefer the more valuable cargoes so it pays to take it easy and play it safe until you can build up some reasonable defensive capability.

CONTINUED OVER

Every player will find his or her own niche within the world of deadly Thargoids (their fear glands surgically removed), of radioactive cargos, of heavily armed Boas (all ships are named after snakes), of gripping the joystick in an attempt to target your already armed missile on a pirate Mamba, reaching for the M key at the same time, and the feeling of elation as the credits you have earned as bounty are flashed up on the screen. And still you must do your best not to relax, as the rear viewscanner reveals a yet more deadly foe.

Elite is not a game without fault. For instance, stars do not travel through transparent planets, not even in space fantasies. Programmers can only do so much. The Elite package recognises this and provides the compensating factors of imagination. You are much too busy trying to match the revolution of your Cobra with that of the space station to worry about details. The differences between cassette and disc versions on the BBC are not matters of importance, frills like quick graphic scenes inside the space station, although there is disc accessing for launch from docking and for Hyperspace.

As well as game functions the keyboard also allows access, when frozen with Copy, to various game playing subtleties, key response, sound on and off and so on. There is even a Bitstick option for those lucky enough to have access to the graphics joystick. You can save your status to disc or tape, Adventure style.

Well, the escape capsule ejected safely and my insurance has provided another Cobra. Time for another mission, another attempt to achieve Elite status. It seems a long way off. I may never make it. But that doesn't stop me trying. It's worth it.

Ratings Table:

SOUNDS	90%
GRAPHICS	90%
DOCUMENTATION	100%
VALUE FOR MONEY	80%
OVERALL	95%



Title	Electronic Colouring Book
Publisher	Addison-Wesley
Machine	Model B/Electron
Price	£9.95

The electronic colouring book is a very attractive package indeed and to some extent a useful tool for drawing and colouring screen pictures on your Beeb or Electron. The tape contains the control program and 18 examples of what can be achieved. These picture files include stunning pictures of snakes, a butterfly, fruit, racing car and so on. The packaging uses one of these drawings. Kimono.

First and foremost, Electronic Colouring Book, as the name suggests, demonstrates what can be achieved by colour mixing the palette of BBC and Electron, and by changing the logical assignation of the available eight static colours.

The screen displays a blank white background sketching sheet and a menu of colours along the right hand edge. The bottom option is DRAW. The cursor can be moved with joystick or cursor keys to make the choice of current colour or DRAW. This

final option proved difficult with the joysticks I used since the calibration did not allow the cursor to stretch into the extreme bottom right hand corner. Cursor keys will suffice anyhow. To fill an area, all you have to do is hit P or fire. The fill routine uses the new PLOT commands from BASIC 2 and are impressively fast.

Drawing involves fixing the cursor with F or fire, moving to the end point and fixing again. Each stage can be deleted by going back to the DRAW symbol. Paint can be deleted with D and the whole screen cleared with C if you have really made a mess. When you have finished a drawing or you want to go to bed, the drawing can be saved to cassette as two files. You are only prompted for one but the picture is saved as drawing and colour in separate parts. When loading back in, the drawing file is read first and then the colour if you wish.

When you have got the colour sorted out, there remain a couple of very interesting options still open. E allows you to experiment with the basic colour settings, so that you can choose from your own palette. The numbers one to eight instan-

taneously change one of the basic colours. This facility is great fun. You can tap away on the keys stimulating all kinds of colour combination. And if you hit upon something you like, it can be saved. R restores the original colouring, so don't worry. B swaps background colour (white to black). This gives a sort of negative effect, since all the black lines drawn go white and the colour mixes are similarly effected. Great fun.

Now we encounter the one major problem with the Electronic Colouring Book. In all the very good documentation, I expected to find information about how to *SAVE a screen, or some means of retrieving files from outside the program, or a built-in printer routine (not difficult to implement one would have thought). I searched in vain. Unless you are a dab hand at screen photography, you will have to lead your unbelieving friends or relatives to the computer, or else break into program to send it off to your own routine, which is difficult to do, and Addison-Wesley would disapprove strongly.

It may be illogical but the best way to currently make use of computer graphics is through hard copy, and the lack of print facilities spoils the excitement a bit. To be able to draw complex pictures and then not use them in other programs is also frustrating.

The above criticism of the program does not take away the fact that the Electronic Colouring Book is a friendly utility, with which it is easy to get impressive looking results. This should appeal to children and those of us adults without a grain of artistic talent. The artist who came up with the example pictures certainly has that talent and they are almost worth the price of the cassette themselves. The one thing that seems to keep people glued to a computer screen for any length of time is colour graphics and this program allows the user to produce some very nice examples. A shame that the facilities are not there for showing them off to a wider audience. I'm sure that a child who had created something with the Book would like to take it home to Mum.

ROM Report

Trevor Attewell

If you have a long document or listing to print, it is handy to have a print buffer which will hold the complete text and send it to the printer automatically while you get on with something more productive, using the computer normally. The Buffer & Backup ROM provides this facility, though you also need some separate RAM in a ROM extension board of appropriate design — a number of these are available. The command *BUFFER looks for RAM in the paged-ROM area, and, if present, it is cleared and a printer driver routine is copied into it. This happens automatically on a cold start, after which *BUFFER serves to clear the RAM of text. It must also be issued if you have overwritten the RAM, for example by using it for data storage.

At switch-on the message "Print buffer in page N : XXXX bytes free" appears, where N is the location of the RAM, and XXXX is IDFF for an 8k RAM, the remaining 513 bytes being taken up by the printer driver routine. *HELP BUFFER also produces the message. To use the buffer *FX5,3 is issued to select the printer routine. After this call anything sent to the printer, eg from WORDWISE or by "LIST" (after CTRL B), goes into the buffer. Transmission from the buffer to the printer (Centronics only) also commences if the printer is on line. If the text is too long for the buffer the surplus is transferred as space becomes available, ie at printer speed.

Once buffer input has ceased, the computer can be used as normal while the printer chunters on — all *FX5 calls are intercepted until the buffer has emptied. The manual doesn't mention a nasty trap — *BUFFER temporarily annexes three pages of memory from &2000 if the printer is enabled (whether on-line or not), corrupting everything in this area. This is easily done, for example by clearing the buffer after a false start on a listing. It can also happen on issuing *BUFFER in WORDWISE menu mode, depending on the length of the text and the cursor position. The alternative is given of pressing BREAK with

Beeb ROMs scrutinised: Watford Electronics Buffer and Back Up ROM.

under their 'star' command headings. *ROM is, in fact, a normal OS command (equivalent to *FX141) which enters the ROM filing system. Following it with *CAT (or *.) produces a

```

AS          Dim 01 Len 01 "
"
ANS         Dim 01 Len 01 "N"
F           000A
G           0
GS          Dim 01 Len 01 "N"
IS          Dim 02 Len 02 "E1"
K           0003
L           Dim 01 Len 01 "E"
MS          Dim 19 Len 01 "4"
P           0
TS          Dim 30 Len 00 ""
Tempno      0001
V           0004
W           0003
X           0003
Y           0004
Z           -1
al          0
a           0034
an          -1
am          -1
comp( 0007, 004B)
comp$( 004B)
change      0_

```

any key except SHIFT or CTRL. This seems safe (though its side-effects are a nuisance), but a sensible precaution is never to clear the buffer unless the text in memory has been saved or can be discarded!

BACK TO BASIC(S)

The remaining contents of this ROM are somewhat miscellaneous, and best considered

list of five BASIC files held in this ROM, of which the first two are !BOOT and MENU. After a SHIFT/SPACE/BREAK !BOOT chains MENU, which offers a

CONTINUED OVER

ROM Filing System

(C) Watford Electronics 1984

- 1) Examine the contents of a ROM
- 2) Backup tape programs
- 3) Generate a tape from disc
- 4) Return to BASIC

Please enter choice

choice of the remaining three files or return to BASIC (more accurately to command mode).

The first file is ROMLOOK, which copies the content of a selected ROM into memory from &3000 upward, and then displays it in hex and ASCII. Leading zeros are suppressed in hex bytes, but not replaced by spaces, giving a very untidy display. There is no provision for backtracking or jumping forward, and the most likely application is in copying ROMs, for which permission is necessary.

MENU-AL LABOUR!

The second file is D-TAPE, which transfers disc files to tape with the optional addition of a menu as the first tape file. The menu requires a data file (MENUDAT) to follow it, and D-TAPE generates this. If the menu is subsequently CHAINED, it will chain a selected program, though you will either

have to wait while it wades through unwanted ones on the way or skip them manually.

Files to be transferred can be taken from more than one disc, and a catalogue of these (FLIST) is built up on each. The program DISKMNU must also be transferred to the first disc (confusingly under the name MENU), making these extra files, so that a disc already containing more than 28 files cannot be used if a menu is required. DISKMNU can also be used with its data file MENUDAT to give an auto-boot menu option on discs.

A few improvements in this routine would be welcome — for example, it always produce the prompt 'Change disc' when the current one has been dealt with, even if only one was used, and the only way out is to ESCAPE. The program must be run twice, once to set up the files and again to load the tape, and when the Menu is finally used the required program is chained into a small text window, necessitating an ESCAPE (if the program permits) followed by RUN.

The third 'star' command is *VAR, which lists the variables in a BASIC program. It does no list FN/PROCs or resident integer variables, but does cope with general integers. Real variables are printed normally unless they are whole numbers, in which case they appear in hex, which is a little disconcerting. Strings are listed as Dim, length and current content, while array dimensions are also in hex, including leading zeros. The display is not paged, and disables paging if you have previously enabled it, so CTRL/SHIFT must be held down to stop scrolling.

Finally, *TCOPY allows a tape to be backed-up onto disc. Hobbit or another tape. This is a standard utility which worked perfectly well on tape and disc, and should do so equally well on a Hobbit, though I was not able to test this. There is no facility for selecting the files to be transferred, so any skipping must be done manually.

Data CRC errors can be over-ridden or not as required, and file names are truncated, if

necessary, before transfer to disc. The manual suggests the consecutive use of D-TAPE and *TCOPY to back up a disc on a single drive, rather than 'frequent disc-swapping'. Just someone's little joke.....I hope?

CONCLUSION

Without doubt the print buffer facility provides the main reason for buying this chip, as long as you are prepared to invest in the necessary extra RAM — as a guide this review fitted into an 8k RAM leaving 450 bytes free. The other utilities may or may not be useful, depending upon the contents of any other ROMs that you may be thinking of purchasing, or have already installed. The manual covers the necessary ground, though it makes few concessions to the beginner, who might appreciate a little more explanation with the old example here and there. However, if you frequently handle quantities of text you might well be more enthusiastic about this ROM than I am.

Competition

This month's competition offers the chance to win an amazing new game from Complete Microcomputer Services called Lingo — the game that makes fun of the English Language.

Lingo is a word game for four players. The computer "deals" each player twelve random words from a large database and then displays a pool of terminations, articles and conjunctions.

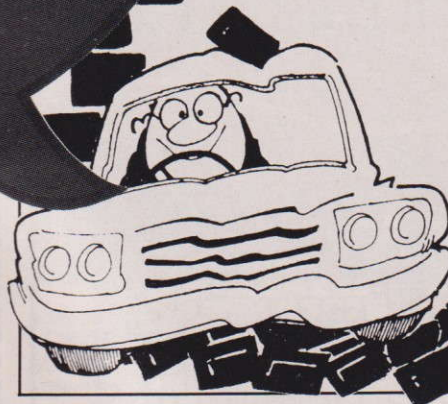
call
piece
often
star

must
be
act
mad

is
city
still
either

* *	an	as	from	*	-s	-ed	-est
the	in	with	if	,	-es	-ied	-iest
to	it	not	this	?	-ies	-ly	-n
and	for	at	that	!	-ing	-ily	-en
of	by	but	re-	-	-ll	-er	-n't
a	on	or	un-	-	-ve	-ier	* *

LINGO



tions. The players then make up surrealistic, bizarre or amazing sentences which must be meaningful and grammatical, using as many of the words as possible. The computer awards marks for intricacy and ingenuity.

Lingo is based on an idea by Alan Wakeman, who, before writing and publishing a number of English language textbooks, was an English teacher in schools and a Director of the International Language Centre in London.

The game has already attracted a great deal of interest within literary circles and negotiations are under way with BBC 2 and Channel 4 to turn it into a television panel game.

HOW TO WIN

All you have to do is create an "extraordinary, surrealistic or just plain silly" expression using the following words combined with any from the pool of common words and terminations. The only limitation is your imagination:

If you don't feel these words inspire you to produce a really sensational sentence then you may choose from one of the following additional "deals":

radio	across	list
age	next	keep
rather	river	art
even	more	are
walk	know	night
rain	do	lemon
they	laugh	above
begin	whose	use

Fifteen lucky winners will receive a copy of Lingo along with a few "goodies" including Lingo rock, shelf wobblers and

window stickers.

Please complete the entry form and send it to us at our Golden Square address, marking

the envelope "Lingo" competition. All entries must be received by Friday 21 December. The winners will be notified once the competition has closed and the results will be published in a future issue of **A&B Computing**. 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.

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 Complete Microcomputer Services or anyone connected with the competition.

Electron Adventuring

Giuseppe de Benedictis

When the Electron was launched over a year ago, the cynics in the home computer world thought that complex adventures would be impossible with the specification announced. Already the BBC micro had been accused of being short of memory with only about 28K in Mode 7. Along came the Electron as a young pretender with a maximum of only 21K available to BASIC! However, the ingenuity and perseverance of programmers came through and now there are many adventures on the market for the Electron.

O.K., so what do I think adventures should have? Well, since this is an article on the Electron, its facilities and capabilities must be taken into account. Ideally, though, an adventure should have an interesting storyline, one that invites the traveller to move forward, to surge from one location to another. The most effective way to do this is to create an atmosphere, a feeling of belonging to the adventure and this can only be done by good descriptions or displays of the locations. We've already arrived at one of the current great arguments of the adventure world... text or graphic descriptions? I will immediately state my preference. Text only. With the Electron, lack of memory has already dictated this choice to many adventure programmers with the notable exception of one (more later). I find that the views conjured up by my own imagination far surpass any cartoon-quality picture provided by a computer, however good the graphics.

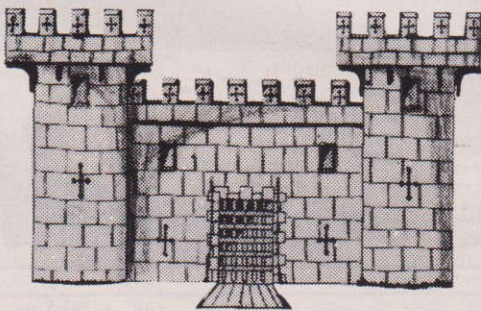
A major factor in enjoying any computer game is the ease with which "contact" can be made. With adventures, more and more emphasis is being placed on speech interpreters, i.e. the ability to input complex sentences using nouns, verbs, adverbs, adjectives etc. Whilst it's important to be able to communicate effectively with the computer, surely it's extravagant with such as the Electron to have complex software taking up valuable RAM which could be used for more rooms, more puzzles, more copious descriptions. The old

Our adventure games expert explains what he looks for in a good program and reviews some of the titles available for the Electron to see if they meet his expectations.

EPIC
Software

EPIC

adventures



**The Quest for
The Holy Grail**

FOR THE ACORN ELECTRON

The Quest for The Holy Grail

Acorn
Electron

verb/noun format has been in use for years now and whilst dated must surely rank as number one for the Electron as long as there is as extensive and well-chosen a vocabulary as available memory allows.

What is important, in fact essential, is to be able to move

easily. North, South, East, West, Up and Down, with their appropriate abbreviations are perfectly sufficient. The addition of the four half compass points are not necessary even for the most complex of adventures. Again though some software houses commit a cardinal sin —

their programs allow only GO NORTH and not N, RUN WEST and not W. Why?

THRILL

Maybe we should give some thought as to why we enjoy adventures (apart from being masochistic). The thrill of solving a problem or puzzle and hence opening up a new avenue into a hitherto undiscovered tunnel or room leading into the unknown beats all the zapping and thumping from the arcade game variety. But funnily enough puzzles as true puzzles are few and far between in adventures. It is common to find that you need a red key to open a red door or a sword to kill a dragon, but how many codes to break or pieces of lateral thinking have you seen? Worse than this though is the illogical puzzle. What's the point of a barrier to your progress being removed by luck or by happening to be at the right place at the right time? This leads me to the current fad of independent movement and actions of characters. Whilst it's good to have characters that can give you help providing you treat them nicely (by presents, compliments or just by being pleasant), I have my doubts about random movement and random interference. After all, however realistic an adventure it is, it becomes frustrating when in successive games the same actions may produce different results for no good reason.

Having poured forth on features of playing an adventure, I'll finish this part with a few points. Firstly, I believe that a fast save-game facility is essential. Secondly, I believe that breaking into the program should be as difficult as the programmer knows how to make it. Thirdly, software houses should make hint sheets available.

With this, the adventures themselves.

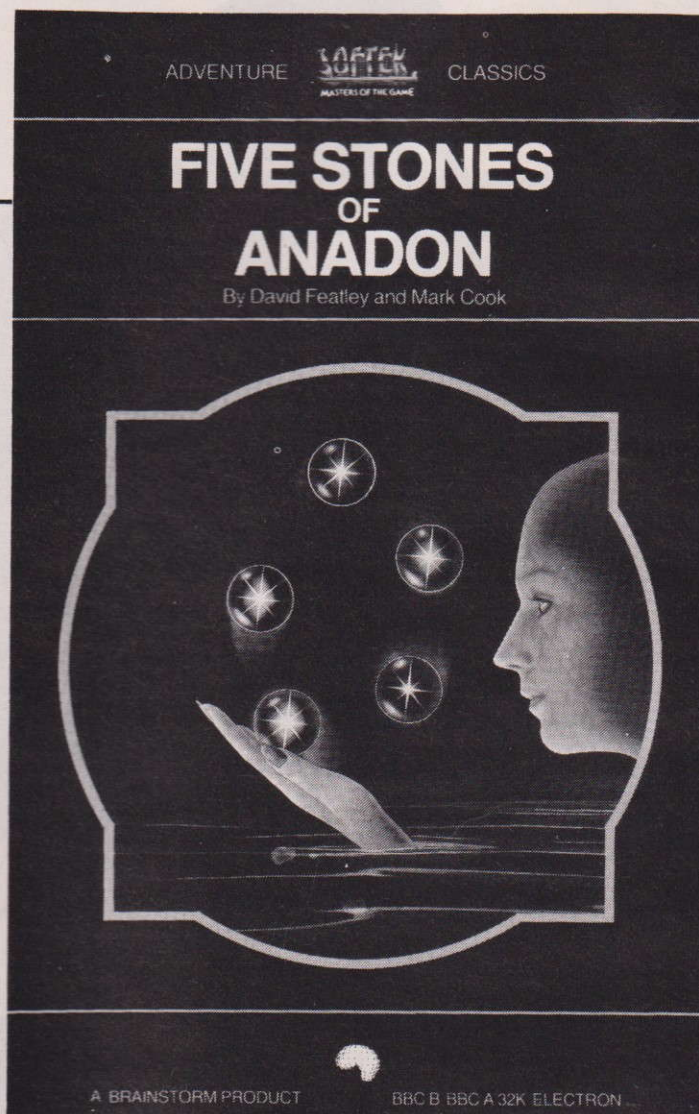
NINE GOOD TITLES

In preparation for this article I looked at some nine titles. More have been written but availability

of the software and a wish to look at these carefully led to this selection. All adventures discussed here were played on an Electron and not a BBC. (Obvious you may think but a mistake made by many software houses.) The adventures are in the classic tradition, that is in the Crowther and Woods mould, moving through rooms, collecting objects and treasures and solving puzzles. There is no representative of the Atic-Atac variety.

It seems appropriate to start with Classic Adventure from Melbourne House. This is a version of the mainframe adventure that started it all with 140 rooms and many of the original puzzles. The programmer has kept to the rules that I approve of. He has made movement simple and quick. The range of exploration is wide before tough barriers are reached, but when they are arrived at be prepared for some brain-hurts unless you've done the original (or Level 9's version on some other computer). I don't think that I'd be giving much away if I warned the over-confident that not all solutions to the puzzles are the same as the original! My main criticism of this adventure is that some part of the original atmosphere has been lost. In order to keep the puzzles, the adventure's textual description has been severely cut. The Electron's lack of available memory has led to this sad deficiency. This apart, a good adventure to have in your collection and one that will keep you going for weeks.

It is important to stimulate the imagination of the adventurer. This begins with the title and so I'm a little bothered when I see "Adventure" as a title from a major software house. Micro Power's marketers had better buck their ideas up for their next adventure. Not only have they produced an adventure with an unimaginative title, but they have made it such that it's virtually impossible to play! Having loaded the adventure the first barrier to success is not a dragon, a locked door or even a boulder in a cavern entrance, but the fact that no simple compass direction is acceptable (sorry, west is O.K.).



The compulsory inputs are GO NORTH, WALK EAST, RUN SOUTH no less. Onto the better aspects of the game. The rooms are quite well described and there are interesting puzzles, some based on tales from the Arabian Nights. Apparently there are over 100 locations but I'll be honest and say that I've only visited about 70. The reason for this (and also the reason why I probably won't be going back to "Adventure") is that there is no save-game facility. This adventure is not for beginners and as such you're going to die many times before the solution is arrived at. No save-game makes this very frustrating... in fact past my pain threshold!

A popular "trick" of the software house trade is to write software for the BBC 32K that needs no conversion for the Electron. Hence three machines (BBC B, BBC A 32K, Electron) are

catered for at once. This is what Softek have done with their first two offerings from the Adventure Classics series, "The Eye of Zolton" and the "Five Stones of Anadon".

The adventures share similar features. Both are written in BASIC by the same authors. Movement is easily achieved with N,S,E,W,U and D. The function keys have been set up well with the ten most common verbs available and easily used. A good, reasonably quick save-game facility is provided in both adventures. In fact it is obvious that the same skeleton has been used for both adventures, though of course the rooms, their descriptions, the objects and the puzzles are different.

"The Eye of Zolton" has the honour of being the only adventure that I looked at that had a cryptic code to solve! There were several nice features to the game

including interaction with an old man, the use of several magic objects and an old favourite, the post of beans (no more hints).

The second adventure, "Five Stones of Anadon", I found more enjoyable. The object of this adventure is to collect five stones to make a ring. The stones remain visible whilst the Wizard of Anadon is strong enough to help you, but once weakened further the stones become invisible. A nice touch here is that the stones may still be collected even if invisible and so the game may still be finished. I liked this adventure because the verbs and nouns allowed actually fitted well with the descriptions of the rooms, meaning that natural choices for verb/noun combinations were usually understood. Well done Softek.

These two adventures from Softek were certainly not large (about 70-80 rooms), but there were enough puzzles in both to maintain a fair amount of interest. It'll admit that I solved "The Eye of Zolton" by breaking into the BASIC code, whilst finishing "Five Stones of Anadon" through sheer perseverance.

RAPID DEVELOPMENT

Adventures have been developing rapidly over the last two or three years. It is important that software houses that deal only in adventures move forward. One such software house is Epic. Epic write software exclusively for Acorn machines and so believe that they can use the Acorn machines' facilities more effectively than other more generally orientated software houses, such as Level 9. There is no doubt that Epic have produced a series of very good adventures.

To date Epic has produced four adventures, "Castle Frankenstein", "The Quest for the Holy Grail", "The Kingdom of Klein" and "The Wheel of Fortune". I have looked at three of them and have been impressed by the thought and willingness to

CONTINUED OVER

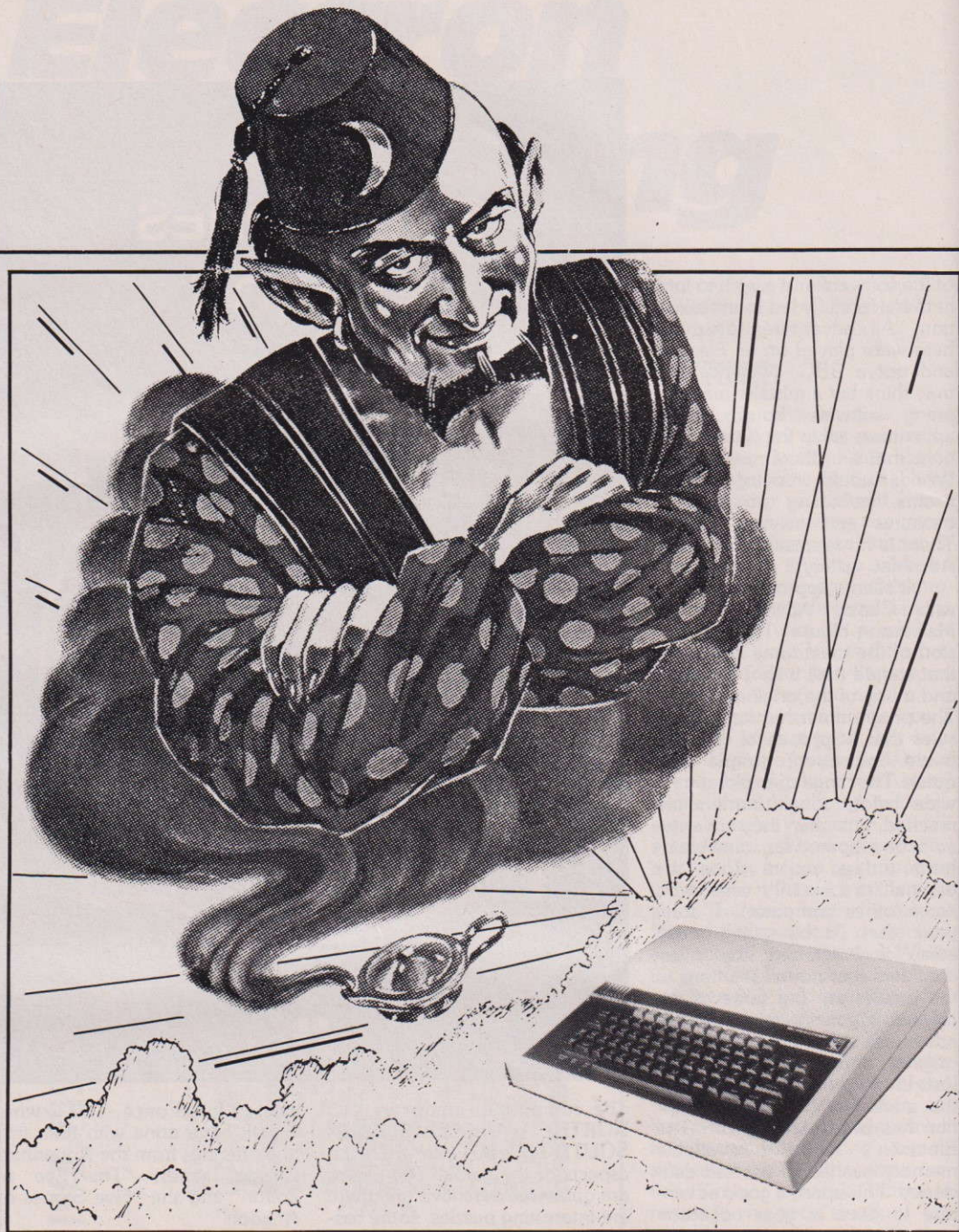
improve that Epic has shown. Each of the adventures has over 220 locations, all capable of understanding full sentence input. Each has the fastest save-game that I've ever seen on an adventure of any size and the vocabulary has been well-chosen to allow several verbs and nouns to be understood to carry out the same actions.

I began by looking at "Castle Frankenstein". This is set near the Castle where the Monster was thought to have died. The aim is to find and destroy the Monster after going through the likes of sulphur pits, experiments rooms, exploring graveyards and the Castle's secret passages. Movement is simplicity itself with many locations being visited before a definitive stop is put to progress. I found the puzzles well thought out and logical. With the help of the hint sheet that had been thoughtfully provided I finally managed to solve this adventure. It had been fun and I looked forward to the second in the series, "The Quest for the Holy Grail".

"The Quest for the Holy Grail" is set in King Arthur's time at Camelot. King Arthur has decided that you must show your worthiness and return the Holy Grail to Camelot. Not an easy task. This excellent adventure involves fighting multi-coloured knights, exploring the most superb castle complete with the requisite secret passageways, locked doors and towers and also an encounter with a fair maiden. Throw in an island, a flaxen-haired beauty and this makes for the most enjoyable adventure that I've played to date.

BLOCKBUSTER

The final adventure that I've played from Epic is their latest blockbuster, "Wheel of Fortune". There is no doubt that this is one of the most advanced Electron adventures. Though there are no graphics (there are in the BBC version) there are sentence-decoding, multi-sentence input, "intelligent" characters and the usual Epic fast save-game facility.



But what sets this adventure apart from the others is that whilst it has 250 locations there are still these features and more available. The function keys may be set up to take up to ten commonly used sentences and input of "C" or "CONTINUE" allows rapid movement in a straight line. It is the little extras that show the time and thought that have gone into these adventures.

However in the long run the most important thing about the adventure is the content. There's no doubt that "Wheel of Fortune" does not have the most descriptive of rooms, but this is almost completely made up for by the deviousness and ingenuity of the

puzzles that must be solved. The game is set up such that it has several phases, each of which seems to have to be solved almost totally before the next phase may be finished successfully. There are encounters with beggars and policemen as well as the popular snakes and dwarfs and all in all this is a thoroughly enjoyable experience. My only concern was that in successfully (or so I thought) negotiating each phase and carefully choosing my objects so that all those of value were carried from one phase to the next, I reached the last stage and was told that I'd left a lot of treasure lying around! I'm stuck.

Epic do provide a "hints"

service and I suspect that I'll be onto them soon.

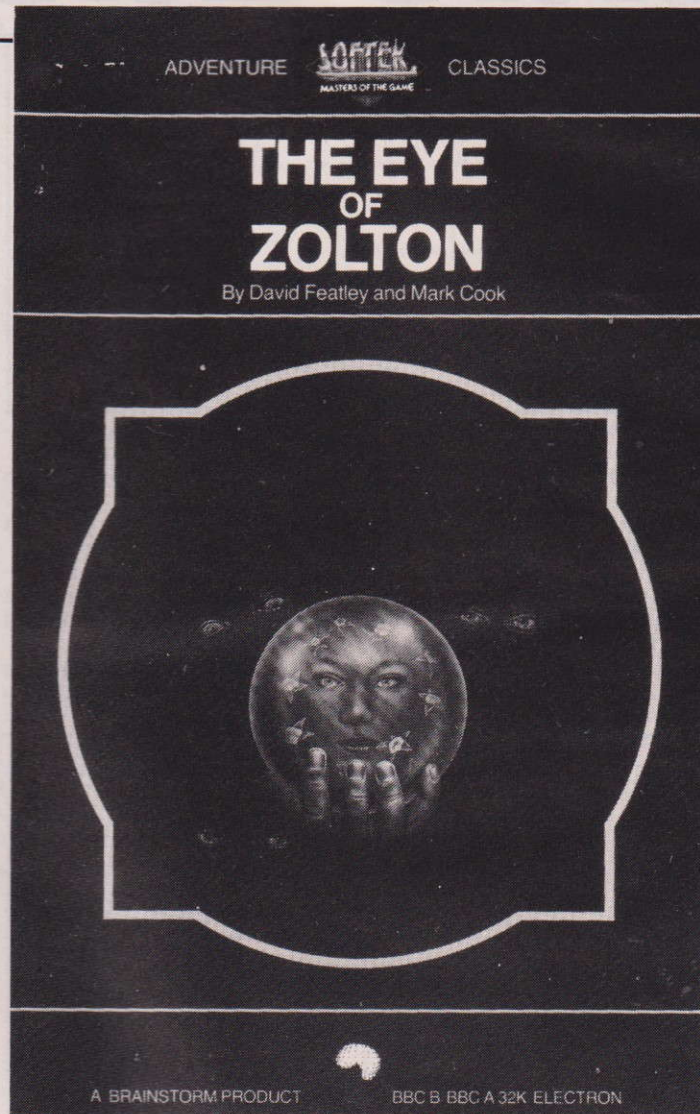
In looking at many adventures it's inevitable that some do not come up to the standard. This is the case with "Suicide Island" from Dollarsoft. This is an adventure in two parts totalling 64K of program in all. The object is to collect treasure (and that's all I know!). The response was very slow, the descriptions were boring and the vocabulary was very limited (I only discovered about four verbs outside of the compass points). There was no save-game feature and the only god-send was unintentional on the part of the programmer (I think) and that was that I managed to find the

code to get to the second part of the adventure using only one, yes one, object. I must be honest and say that I gave up very quickly on the second part when I realised that it was to the same standard as the first part. I think that the scope provided in having two parts of 32K each deserved much better than this effort and it goes to prove that the old saying "Give them enough rope and they'll hang themselves" applies in computing too.

GRAPHICS

Along with the Epic adventures, the single Electron adventure offering from Bug-Byte stands out above the rest. This to my knowledge is the only adventure with graphics on the market (though I believe that "Hulk" from Adventure International is about to burst on the scene).

The scenario for the adventure, called "Twin Kingdom Valley" is a standard one. There are many woods, forests and deserts to get lost in. There is an excellent castle and a whole set of underground passages. For you experienced Electron adventurers there is nothing new... yet. Every room has a full screen picture associated with it and with about 175 locations I would say that there are probably about 100 different views. This in itself is quite an achievement. It is true that the descriptions are not very good, usually being about 8 or 10 words, but to add the diversity there are many good and bad characters randomly wandering around sometimes picking up



weapons. So beware.

I've noticed many questions

and pleas for help in the computer magazines on this adven-

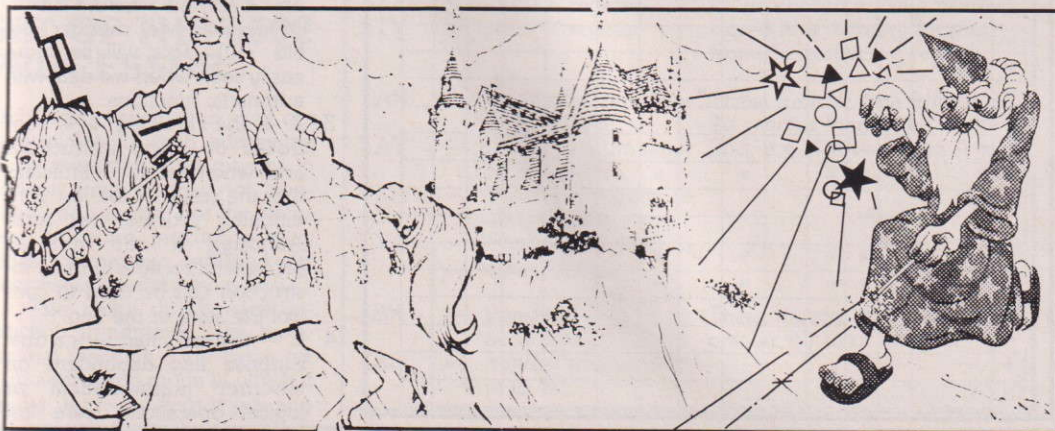
ture and I'm proud to say that I finished this one... with no help (and I didn't need the sick giant for anything!).

Even though this adventure broke some of my rules, I did enjoy playing it. I was kept up several nights by the persistence of the dragon and the stubbornness of the witch, but in the end brute force won through. I would have preferred that none of the half-compass points had been allowed as input and also that the fulcrum of the whole adventure hadn't leant on getting one particular sequence of events exactly right, but then who am I to criticise Bug-Byte for having produced an excellent piece of software (how did they manage that super-fast colour-fill routine?).

In writing about these nine adventures I have not tried to relate the story or say very much about the technical aspects of the programming involved. I have tried to offer a feel for the games and how I enjoyed playing them against my set of criteria. One criticism that I have of all these adventures is that all substantial documentation (when it's there!) is within the software. Though costs would be higher, I would like to see the practice of including short descriptive manuals for scene-setting, thus allowing reference at any time including whilst playing.

What of the future? It is a possibility that techniques employed on the Spectrum, such as landscaping, could be used on the Electron. A very exciting prospect is software cartridges, already in use by Acornsoft and hopefully to be taken up by software houses. Of course, the Plus 1 unit is necessary for this and the success of software cartridge will necessarily depend on the success of the Plus 1. On the software house front it would be good to see Level 9 enter the fray of Electron adventures and provide a battle royal with Epic so making the Electron user the ultimate winner.

Whichever way software and hardware develop there is no doubt that the complex adventure on the Electron is alive and kicking.



Machine Code Made Easy

Steve Willis

In the first two articles in this series I concentrated on the general operation of the 6502 processor. Now is the time to look at its actual explicit commands and their functions. This will lead to some examples which you can try and will introduce you to the BBC ASSEMBLER.

At this time I intend to deal with "pure" machine code as opposed to machine operating calls such as OSBYTE. The use of these calls is of great importance to efficient programming but you will understand their significance better with a background of machine code programming. Thus we will reserve an investigation of the calls until a later article.

THE PROCESSOR IS A SIMPLETON!

At the outset of this look at the processor you must appreciate one thing — it is stupid, with no more brain power than a young child. Consider a child who can do no more than add, subtract or compare two numbers or put a number in the box which he/she is told. This processor has the same mental age!

However, its power lies in its ability to do this again and again, without error and at great speed. Its disadvantage is that it cannot make any decisions of its own — in fact it does exactly as it is told without question. Thus any "mistakes" in the sequence that your program are YOURS.

FUNCTIONS OF THE PROCESSOR

All the instructions available on the 6502 can be grouped in various "functional" categories. We will look at these functional groups and their basic operation, then we will consider each instruction. First here is a list of the groups:

1. DATA HANDLING — moving numbers, inside or outside the processor, from one place to another.
2. COUNTING — add (or subtract) 1 to (or from) the contents of a given memory location.

Fig 1 The Flag (Status Register)

* The whole register may be set to a user value by the command PLP which would load it from the top stack entry. This device method has its uses. Seven bits of this 8-bit register are used. The associated commands are: N — no controlling commands, machine set only.*

V — CLV clear overflow Flag, cannot be set by user.*

B — no controlling commands, machine set on BRK command.

D — SED — set decimal mode (Flag=1).

CLD — set binary mode (Flag=0).

I — SEI — set interrupt disable (Flag=1).

CLI — set interrupt enable (Flag=0).

Z — no control directly (LDA#0 would set Z to 1 though).

C — SEC — set carry to 1 — for mathematical use.

CLC — set carry to 0 — for mathematical use.

3. COMPARISON — comparing two whole bytes, for an exact match.
 4. BRANCHING — the rerouting of the sequence of instruction execution either conditionally or unconditionally.
 5. LOGIC — comparing two numbers, bit by bit, to give a predetermined result. This is a combination of mathematical and comparative operations using a system called BOOLEAN ALGEBRA.
 6. ADDITION — add two numbers together.
 7. SUBTRACTION — subtract one number from another.
 8. HOUSEKEEPING — instructions which set up parts of the processors ready for one of the above functions.
- Unlike many processors the 6502 has no specific instructions for Input or Output. Instead it

relies on the computer designer to set up his own hardware selection of I/O systems.

THE STATUS REGISTER

Some of these functions cause the setting of "flags" to note the occurrence of an "event". These flags are stored in the "status" or "flag" register, as it is jointly known, within the processor. This register is like a panel of judges at a sports event where each judge marks on a facet of the performance.

Although an eight-bit register (see figure 1) with seven-bits in use, only four are directly accessible by instructions controlling their contents. A fifth flag, the D flag (decimal flag) is controlled by the programmer to indicate to the processor which mode (binary or decimal) is to be used for a mathematical function and may be set/reset by the programmer directly.

The five flags that we will be interested in are N V Z C and D. It is these which are used in decision making for governing the conditional changes in program execution. The "events" notes by these are:

1. N — the sign flag — whenever N is 1 it indicates that the value of the last data transfer or data processing instruction was a negative number.
2. V — the overflow flag — this flag is set as a result of an arithmetical operation that has caused the sign bit (bit 7) in the result to be corrupted by an overflow from bit 6 (remember we number the bits 7-0). This will be more easily seen when we deal with arithmetic functions.
3. Z — the zero flag — is controlled by many instructions and when set to 1 indicates that the result of the last conditioning process was zero. Although it can not be set/reset directly a dummy instruction can be used to control the state of the flag.
4. C — the carry flag — is a dual purpose flag dependent on whether mathematical or logical operations were last

MNE	FLAGS					ADDRESSING																MODES			
	N	V	D	Z	C	IMP	ABS	ZERO	INDEXED	ABS,X	ABS,Y	ZERO,X	ZERO,Y	INDEX,X	INDEX,Y	REL	IND	ACC							
ADC	N	V		Z	C		40	45	49	70	79	75		61	71										
AND	N						20	25	29	30	39	35		21	31										
ASL	N			Z	C		0E	06		1E		16											04		
BCC																							80		
BCS								80																	
BEQ																							F0		
BIT	#	0					2C	24																	
BN1																							30		
BNE																							00		
BPL																							10		
BRK	#	0					06																		
BVC																							50		
BVS																							70		
CLC							#C	18																	
CLD							#C	08																	
CLI							#1	56																	
CLV	#	1						68																	
CMP	N			Z	C		CC	CD	CF	DD	DF	DD		E1	D1										
CPX	N			Z	C		EC	ED	E1																
CPY	N			Z	C		CC	CD	CF																
DEC	N						CE	CD		DE		DD													
DEX	N																								
DEY	N																								
EOP	N						40	45	49	50	59	55		61	51										
INC	N						EE	ED		FE		FD													
INP	N																								
INX	N																								
INX	N																								
JMP																							6C		
JSP																									

executed. It can be set or reset directly and its different uses will be seen later.

THE REGISTERS AND THE MEMORY

In order to remind you of where we can put data, consider the block diagram of figure 2. The processor itself contains A (the accumulator) and X & Y (two 8-bit registers). In general the memory areas open for us to use are from &71 to &8F (in the zero page), from &E00 to &7BFF (&1900 to &7BFF for disc users) and from &A00 to &CFF.

Please note that the other areas of RAM can be accessed but the user should beware as the result of accessing some locations can be disastrous. The user who wishes to delve deeper and understands what he is doing would be well advised to purchase "THE ADVANCED USER GUIDE for the BBC Micro" by BRAY, DICKENS & HOLMES from the Cambridge Microcomputer Centre. It is quite expensive but well worth the money; all we need now is a disassembled listing of the OS and BASIC ROMS showing subroutines!

Figure 2 also shows PCL & PCH (the two program counter 8-bit registers), P (the status register) and S (the stack pointer — see later) which will be affected by nearly every instruction that is executed.

THE INSTRUCTION SET OF THE 6502 PROCESSOR

Each instruction may or may not be available in each addressing mode mentioned last month, in addition it may or may not "condition" one or more of the status flags. Also an instruction may consist of one, two or three bytes (successive memory locations).

The chart shows each instruction mnemonic, its hexadecimal machine code value for each addressing mode in which it can be used, the flags it sets and

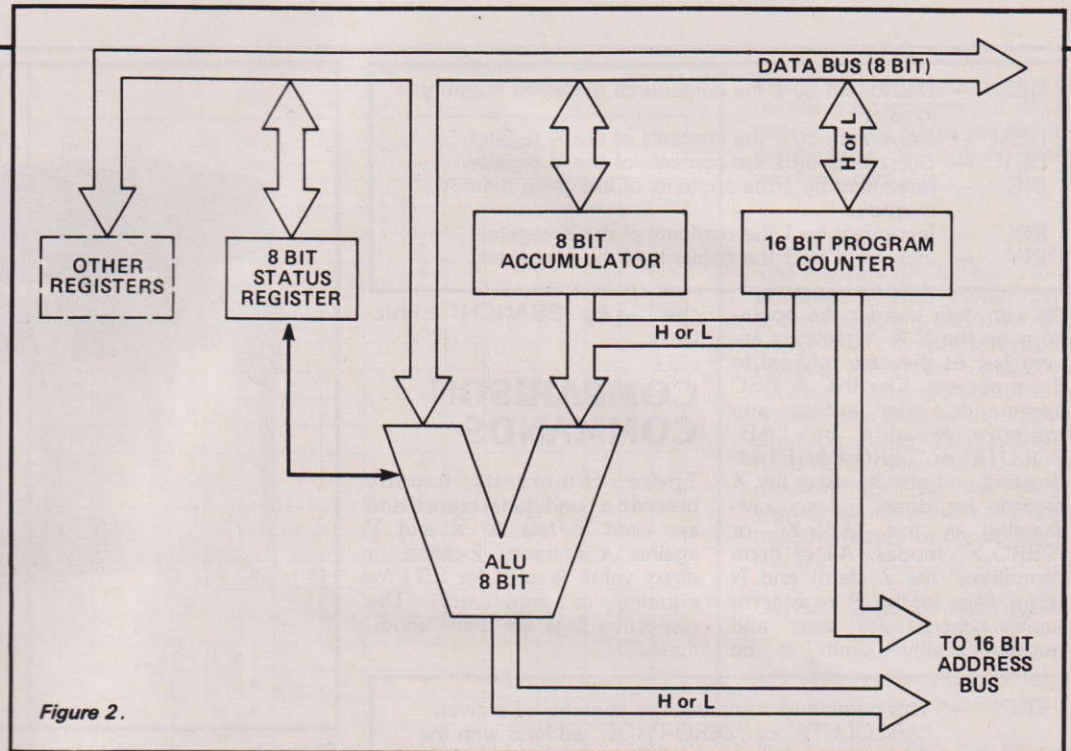


Figure 2.

the number of bytes required. However when using the Assembler you will only need to know the mnemonics and the

available addressing modes for each instruction (the axes of the chart).

So to the instructions and

their uses, we will look at these in a logical manner. I will then give a summary of the instructions in their functional groups.

First we will examine "DATA TRANSFER" either internal to the processor chip or involving external memory locations (see Table).

In all of these commands the contents of the "source" of the data is left unchanged — except where LDA, LDX or LDY are used in the "IMMEDIATE" addressing mode when the value to be loaded is given as part of the instruction e.g. load A with the value 67 would be LDA 67. In all cases the previous contents of the 'destination' is overwritten. As may be expected the transfer commands (Txx) are internal to the processor and are executed very quickly.

COUNTING COMMANDS

Given that we may wish to count up or down from a previously loaded number there is a series of "COUNT" commands:

CONTINUED OVER

DATA TRANSFER COMMANDS

LDA	— load accumulator	Dependent on the address mode chosen a value can be loaded directly or from a memory location to the respective register.
LDX	— load X register	
LDY	— load Y register	
STA	— store accumulator	Dependent on the address mode chosen a value can be stored in a memory location from the respective register.
STX	— store X register	
STY	— store Y register	
TAX	— transfer accumulator to X register	These transfer data from the 1st register mentioned to the 2nd. e.g. TAX — from A to X.
TAY	— transfer accumulator to Y register	
TXA	— transfer X register to accumulator	
TYA	— transfer Y register to accumulator	
TSX	— transfer S into accumulator	These transfer the stack pointer (S) to or from A.
TXS	— transfer accumulator into S	

- DEC — Decrement by 1 the contents of the given memory location.
- DEX — Decrement by 1 the contents of the X register.
- DEY — Decrement by 1 the contents of the Y register.
- INC — Increment by 1 the contents of the given memory location.
- INX — Increment by 1 the contents of the X register.
- INY — Increment by 1 the contents of the Y register.

As with data transfer the operations on the X & Y registers are very fast as they are internal to the processor. The INC & DEC commands may access any memory location by "ABSOLUTE" or "ZERO-PAGE" addressing and also by using the X register for offset indexed addressing in the "ABS,X" or "ZERO,X" modes. All of them "condition" the Z (zero) and N (sign) flags in the P register to enable checks for zero and negative/positive limits to be

checked by "BRANCH" instructions.

COMPARISON COMMANDS

These commands usually precede a conditional branch and are used to test A, X and Y against a memory location or direct value (except for BIT) for equality or sign/carry. The respective flags are then "conditioned".

- BIT — This command compares the contents of a given "ABSOLUTE" or "ZERO-PAGE" address with the accumulator and sets the Z flag = 1 if they are the same otherwise Z = 0. In addition the N & V flags are loaded with the two highest bits from the memory location respectively.
- CMP — compares with the accumulator
- CPX — compares with the X register
- CPY — compares with the Y register

The comparison is made using a value given or from a given memory location.

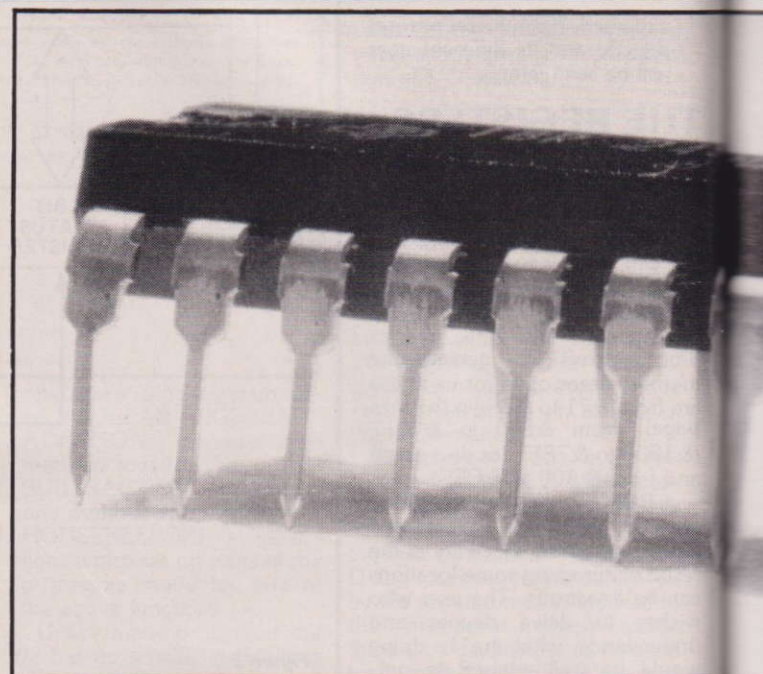
LOGICAL OPERATIONS

Apart from carrying out mathematical operations we can compare two numbers, or memory locations, BIT by BIT. These operations carried out using the accumulator as the comparator

and the storage place for the result. In most cases they involve a comparison with another number, or memory location, but may only operate on the accumulator alone as we will see.

Now think of the possible options for the result of a two number (two bit) comparison. We could say the following are all the options available:

NUMBER A	NUMBER B	RESULT
0	0	0
0	0	1
0	1	0
0	1	1
1	0	0
1	0	1
1	1	0
1	1	1



Thus there are eight possible result combinations for the four possible combinations of two binary numbers. However the usual need would be to answer one of the following questions:

A	B	R
0	0	0
0	1	0
1	0	0
1	1	1

ORA

compare the accumulator bit by bit with the given number/location contents and store the bit results in the accumulator according to the table:

A	B	R
0	0	0
0	1	1
1	0	1
1	1	1

EOR

compare the accumulator bit by bit with the given number/location contents and store the bit results in the accumulator according to the table:

A	B	R
0	0	0
0	1	1
1	0	1
1	1	0

- Are there trains in both sections? — i.e. if A = 1 and B = 1 then R = 1, else R = 0.
- Is there a train in either section? — i.e. if either or both of A and B = 1 then R = 1, else R = 0.
- Is there only one train present? — i.e. If (A = 1 and B = 0) or (A = 0 and B = 1) then R = 1, else R = 0.

These then equate directly to AND (A and B must be 1 for R to equal 1), OR (A or B or both = 1 makes R = 1). EOR (if only one of A or B = 1 then R = 1). The machine code commands are:

AND
compare the accumulator bit by bit with the given number/location contents and store the bit results in the accumulator according to the table:

ADDITION & SUBTRACTION

The 6502 processor has a powerful system for handling decimal arithmetic which can lead to pro-



blems for the unwary. In particular it is capable of addition and subtraction in two distinct modes — binary and decimal. It is up to the user to define the mode in which a particular sum is to be performed.

It is in the execution of these sums that the Decimal flag in the status register comes into its own. For it is the state of this flag that tells the processor which arithmetic mode to operate in. The Carry flag is also important to us now as it is our "scrap paper" to write down any "carry" is caused by our arithmetic.

Therefore in this group I include not only the commands that define arithmetic operations, but also those that control the decimal and carry flags:

ADC ADD the contents of the defined address (or immediate number) to the accumulator with the contents of the carry flag.

SBC SUBTRACT the contents of the defined address (or immediate number) from the accumulator with the contents of the borrow (carry) flag.

CLC Clear the carry flag to 0.

MNE	INST	N	V	B	D	I	Z	C	ADDRESSING MODES												
									IMP	ABS	ZERO	IMMED	ABS,X	ABS,Y	ZERO,X	ZERO,Y	(IND,X)	(IND,Y)	REL	IND	ACC
LDA	N	I								A0	A5	A9	B0	B9	B5		A1	B1			
LDI	N	I								A6	A6	A2		BE		B6					
LDY	N	I								AC	AA	A0	BC		BA						
LSR										4E	46		5E		56						4A
NOP									EA												
ORA	N	I								00	05	09	10	19	15		01	11			
PHA									4B												
PHP									0B												
PLA	N	I							AB												
PLP	N <td>V<td>B<td>D<td>I<td>Z<td>C</td><td></td><td>2B</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></td></td></td></td></td>	V <td>B<td>D<td>I<td>Z<td>C</td><td></td><td>2B</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></td></td></td></td>	B <td>D<td>I<td>Z<td>C</td><td></td><td>2B</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></td></td></td>	D <td>I<td>Z<td>C</td><td></td><td>2B</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></td></td>	I <td>Z<td>C</td><td></td><td>2B</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></td>	Z <td>C</td> <td></td> <td>2B</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>	C		2B												
ROL	N	I								2E	26		3E		36						2A
ROR	N	I								4E	46		7E		76						6A
RTI	N	V	B	D	I	Z	C		40												
RTS									60												
SBC	N	I								E0	E5	E9	F0	F9	F5		E1	F1			
SEC									7B												
SED									FB												
SEI									7B												
STA										B0	B5		90	99	95		B1	91			
STB										8E	86						96				
STX										8C	84					94					
TAX	N	I							AA												
TAI	N	I							AB												
TSX	N	I							BA												
TXA	N	I							BA												
TXB									9A												
TXC	N	I							9B												
BYTES PER INSTRUCTION										1	3	2	2	3	3	2	2	2	2	3	1

CLD Clear decimal flag (to 0) — set to binary mode.
SEC Set the carry flag to 1.
SED Set decimal flag (to 1) — set to decimal mode.

As you can see the extent of arithmetic commands is not exactly extensive. However we will have to look very closely at them in future.

HOUSEKEEPING COMMANDS

The remaining commands are primarily for controlling the processor status and for storing/retrieving processor information when temporary jumps are made. The major commands in this section are those known as PUSH and PULL (these relate directly to the POKE & PEEK commands of the Z80 processor

which is probably more widely known). The other commands are explained briefly below.

STACK COMMANDS

The PUSH & PULL are user commands to store and retrieve data which you wish to save temporarily in a reserved workspace called the user "STACK". In the BBC microcomputer the stack is in page &01 of the memory.

PHA copy the contents of the accumulator onto the top of the stack.
PHP copy the contents of the status register onto the top of the stack.
PLA move the top entry from the stack into the accumulator.
PLP move the top entry from the stack into the status register.

These are very important commands and represent fast, flexible storage of the status register and accumulator. We will be seeing much of them later.

THE REST

The Interrupt flag indicates to the processor when it should halt its present program and dive off to carry out a predetermined routine. We can "mask" or "enable" interrupts but, if we enable them then we must have a predetermined "INTERRUPT ROUTINE". However there are different types of interrupt and we will examine them fully later, the commands for controlling the flag are:

CLI Clear the interrupt flag (to 0) — enable interrupts.
SEI Set the interrupt flag — disable interrupts.

The overflow flag can be reset when we wish but we cannot set it:

CLV Clear overflow flag to 0.

The last commands are:

BRK This causes a sequence like an interrupt, but it moves to the address given by memory locations FFFF FFFE.
NOP This is a NO OPERATION command — it can be used to fill space where we think we may wish to add later or as a very short time delay (notably one microsecond!).

Well there we have it, the full instruction set and I am afraid that there we must leave it, otherwise this alone could turn into the whole month's magazine! Now we are over the worst and can start to play with machine code and the BBC Assembler. I will try and demonstrate each group of commands and explain them fully. If you have problems or queries please write and let me know.



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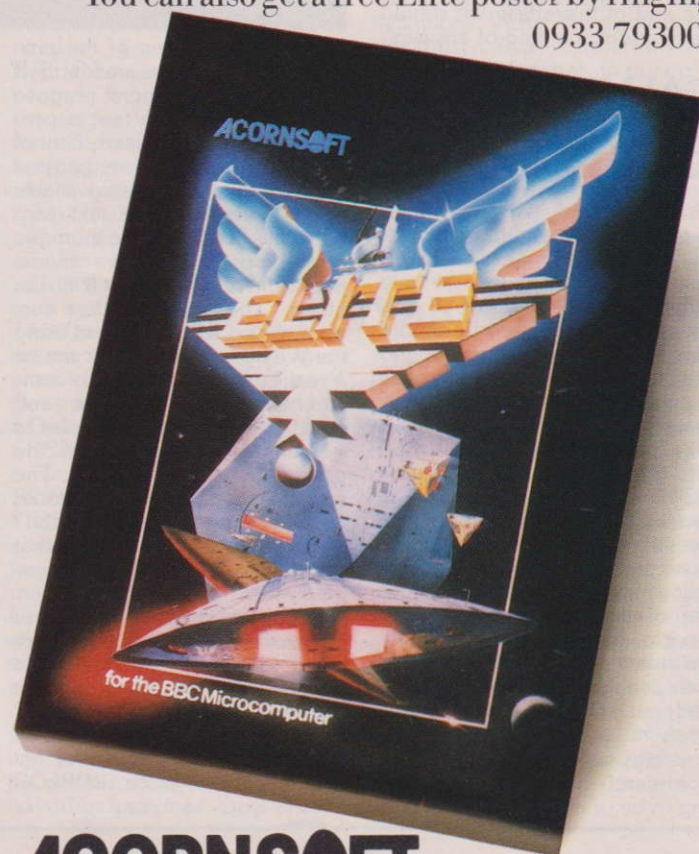


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ACORNSOFT

Addcomm

Dave Carlos

If you're looking at all the recent releases of sideways ROMs to add a little more power to your BBC, then ADDCOMM is likely to be on your list of possible purchases. A couple of this ROM's features make it stand out from the rest of the crowd. Firstly its commands don't have those fancy stars (asterisks, to you and me) in front. All the commands that it supports are used in exactly the same way that you use BASIC keywords. Its other outstanding feature is its total of forty commands which are split up into four main sections. It claims to be a graphics ROM, a logo ROM, a toolkit ROM and a general purpose ROM, so much so that it negates the need to buy several different chips, according to its publisher.

Can any ROM really cover all those commands? Is it easier to use than all the others? Would it be a good purchase as a first or even only extension ROM?

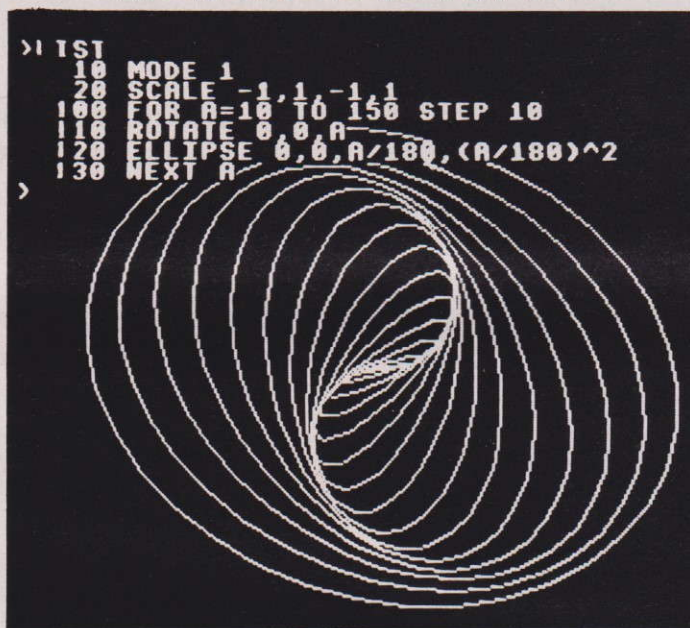
These are the questions that I have at the back of my mind as I review this piece of software. By the end of this article we should be nearer some kind of answers.

CALLING UP YOUR COMMANDS

There is certainly a difference between this ROM and the others in the way that its routines are called or used. Don't think that the only difference is the absence of stars though, they are used to denote calls to the operating system and anything following a star is sent as a parameter to such a call. This means that it is not possible to put an expression needing evaluation into a call to a normal, sideways ROM. By extending BASIC, in the way that this ROM does, it's possible to have any kind of expression, function or variable following the call and therefore the commands are much more flexible. It also means that multi statement lines are acceptable with ordinary BASIC commands and ADDCOMM's commands freely mixed.

Having said all that, the commands have to be worth using to be of any value and it is at

ADDCOM sets out to extend BBC BASIC. How well does it fare?



this stage that some of the problems and difficulties are found. If we consider the general purpose commands first they are a very strange collection indeed. One of the most useful commands is SETWIN which makes available up to seven separate text windows, all of which have a unique cursor position which can be moved independently of all the others. The actual window currently being accessed is set using the WIN commands. This can be a real boon for those with complex screens to organise and could even give the impression of a multi-tasking machine if the program is written carefully. The syntax is identical to the VDU 28 command which, whilst it can't be called friendly, does mean that it should be familiar to most programmers.

The most useless group of commands, in my opinion, are those which start with the word POP. There are three of these and they all act upon the BASIC stack to get you out of a situation that you should never have got into in the first place. POPFOR allows you to jump out of

FOR/NEXT loops without leaving a return address on the stack, POPGOS has the same action in relation to GOSUBs and PROPREP when using REPEAT/UNTIL loops. In all these cases the only reason that anyone might want a command such as this is if their program has got completely out of hand and they are programming completely blind. Any programmer who writes with any structure at all is unlikely to want or need such commands. I can't think of an occasion when I have ever thought I needed such a command and I doubt that they have any use at all, even the examples in the manual are contrived. One has the message 'A silly example' following it!

Another strange addition is the LGOTO command, which is provided because 'structured programmers never use GOTO'. This command allows you to label lines, all labels must begin with a lower case letter, and then jump to them by name, eg LGOTO label. Once again I can't say that I have ever felt a great need for such a structure and I would be grateful for a program-

ming example where such a statement provides the only, or even the best, solution. This emphasises one of the deficiencies of the 72 page manual provided. Although it is written to the same format as the User Guide, the program examples given in the text are so short as to be almost frivolous. Very few indeed explain the use of the command in any real way and most are simple contrivances to show how the command works, not how it could, or should, be used.

The final general purpose commands are SORT, OPT and ADDCOMM. The last two are included to give the user control over certain of the ROM's features. OPT allows you to specify such things as which page the ROM uses as private workspace and which settings are used by certain plotting commands etc. ADDCOMM is used to turn the ROM off. SORT is a fast sort routine for single dimension string arrays and will return the array elements specified in alphabetical order. It strikes me as a pity that a useful routine such as this is so restricted, why couldn't it deal with numeric arrays also?

GRAPHICS COMMANDS

The graphics section of this ROM also has some rather strange quirks, take SCALE as an example. In other graphics ROMs, SCALE allows the normal DRAW, MOVE and PLOT commands to work on a scaled basis, ie you don't need to modify the program to work on the scaled screen, this is done automatically. With this ROM there are special commands to use the scaled screen: SMOVE, SDRAW and SPLOT. The normal commands work on the whole screen and ignore the scaling completely which I find less than useful although some users might appreciate the ability to use two sets of commands. The translation and rotational commands (TRANS & ROTATE) are also fixed to the scaled screen giving, in all two overlaid graphic screen command sets. The final command in this series is UNSCALE which can be used to return the


```

>LIST
10 MODE 1
20 SCALE -1.5,1.5,-1.5,1.5
30 FOR A=0 TO 180 STEP 3
40 ROTATE 0,0,A
50 PROCsine_wave
60 NEXT A
70 END
80 DEFPROC sine_wave
90 SMOVE -1,0
100 FOR X=-1 TO 1 STEP 0.2
110 SDRAW X,SIN(X*PI)
120 NEXT X
130 ENDPROC
>GREPL:PROC sine_wave:PROCW
50
80 DEF
COMPACT
130
>LIST
10 MODE 1: SCALE -1.5,1.5,-1.5,1.5: F
OR A=0 TO 180 STEP 3: ROTATE 0,0,A: PROC
W: NEXT A: END
80 DEFPROCW: SMOVE -1,0: FOR X=-1 TO
1 STEP 0.2: SDRAW X,SIN(X*PI): NEXT X: E
NDPROC
>

```

normal screen co-ordinates of the scaled screen cursor, so that you can use the POINT routine of BASIC etc.

There are two drawing commands, CIRCLE and ELLIPSE, which give fairly fast response. This is a little cheeky though because the ellipse routine can be used for circles, a circle is a special type of ellipse after all, and so one of these is rather redundant and probably included for simplicity.

The use of these commands is rather more complex than need be. When you need to draw a cir-

The final pair of commands, CFILL and FILL, allow you to use mixtures of the colours available in the current screen mode, when filling already drawn shapes. This allows you much greater control over the variety of shades and patterns on the screen than you would otherwise have. The FILL command works from the specified point in every direction and stops when a boundary byte is reached. This algorithm is good but it does need an amount of variable space to use as a stack and can give 'No Room' errors if memory is tight.

```

>LIST
10 MODE 1
20 SCALE -1,1,-1,1
30 C=1
40 FOR X=0.1 TO 1 STEP 0.1
50 GCOL 0,C
60 ELLIPSE 0,0,X,1-X,0,360,60,85
70 C=(C+1) MOD 3 +1
80 NEXT
90 CFILL 1,2,2,1
100 FILL -1,-1
>

```

cle the major consideration is do you want it to be filled or in outline only? This ROM gives you the chance to use every possible plotting code that the machine can support. This means that it has maximum flexibility but the syntax becomes unwieldy. For example, to plot a filled circle in the centre of the screen you might type the following:

(CIRCLE 640,512,200,0,360,10,85)

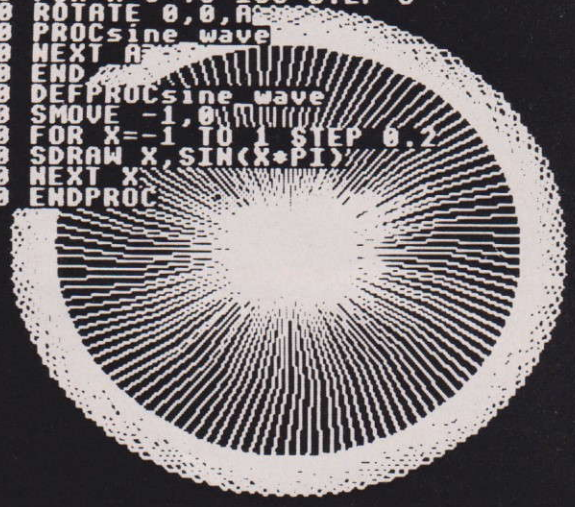
The numbers specify, respectively, the x co-ordinate, y co-ordinate, radius, start angle, end angle, angle increment and the plot code. Flexible it is but simple it ain't!

Two of the 'Logo Graphics' routines, LCIRCLE, LELLIPSE, are extensions of the commands listed above but they plot in relation to the logo cursor instead of the normal graphics one. The turtle movement commands are LMOVE, ANGLE, ADVANCE and TURN. LMOVE is used to position the Logo cursor before other commands, ANGLE sets the direction in degrees, ADVANCE is similar to 'Forward' in normal LOGO syntax and TURN is used to give a new direction to the plotting. Unfortunately a number of the ideas upon which LOGO are based are completely ignored by this system. Turtle

```

>LIST
10 MODE 1
20 SCALE -1.5,1.5,-1.5,1.5
30 FOR A=0 TO 180 STEP 3
40 ROTATE 0,0,A
50 PROCsine_wave
60 NEXT A
70 END
80 DEFPROC sine_wave
90 SMOVE -1,0
100 FOR X=-1 TO 1 STEP 0.2
110 SDRAW X,SIN(X*PI)
120 NEXT X
130 ENDPROC
>

```



graphic commands are meant to relate to the movement of a body, or turtle, and hence the use of Left Turn and Right Turn. Using this ROM you have to be aware of 'standard mathematical angle measurement', ie angles are measured in degrees anticlockwise from a three o'clock position.

I cannot believe that this is what Pappert and his team had in mind when they developed LOGO as a language for children. Add to this the fact that there are no procedure building commands and you have a complete travesty of a LOGO language. You could use BASIC Procedures, of course, but then you need a good knowledge of BASIC too and that is not expected by a 'real' LOGO language, this just gives simple turtle movement commands and nothing more. The other commands can be used either within type of trail that the turtle leaves, again using internal PLOT code numbers and LPOS which is used to tell you where the cursor is on a scaled screen.

The final set of commands are used to provide a BASIC programmer's toolkit and some of these are the most useful in the ROM. FIND, GREPL and SREPL are used to find, globally replace and selectively replace certain strings within a program. FIND will highlight the found characters with a colour change in any mode. All these commands can be used either within literal strings ie those starting and ending with '"', or outside them so this means that you will need two passes to replace both. I regard this as a fairly sensible precaution and it is very easy to use. LVAR gives a list of all, or just certain, variable names which have been defined by the pro-

gram already. MEM gives a display of the program length, variable space used and the memory left both in hex and decimal forms. This can be very useful in program development, especially when used with COMPACT which will concatenate lines so that your program takes up less room and KILLREM which does exactly what its name suggests.

The final commands that the ROM supports are GOODPROG, used to repair a 'Bad program' error, CHAR a character defining aid and FKEYS which allows you to list, and therefore alter more easily, all your function key definitions. VERIFY is another of the most valuable additions to BASIC and one that, in my opinion, should have been written into the BBC specification. It allows you to check a copy of a program on tape or disc against the same program whilst it is still in memory, a great boon for those with unreliable cassette recorders.

VARIABLE

As you may have realised from the detailed comments above, there is much in this ROM that is not too well thought out and much that is valuable and needed. I cannot see it replacing, in the real sense of the word, any of the more specialised ROMs in my collection. I can see it being useful to those who want a few of the utilities but don't want to go to the expense of buying a ROM extension board, or to those on a very limited budget, but there are no commands that are better implemented in this ROM than the more specialist ones and a good number of the commands seem to be more like window dressing than useful utilities.

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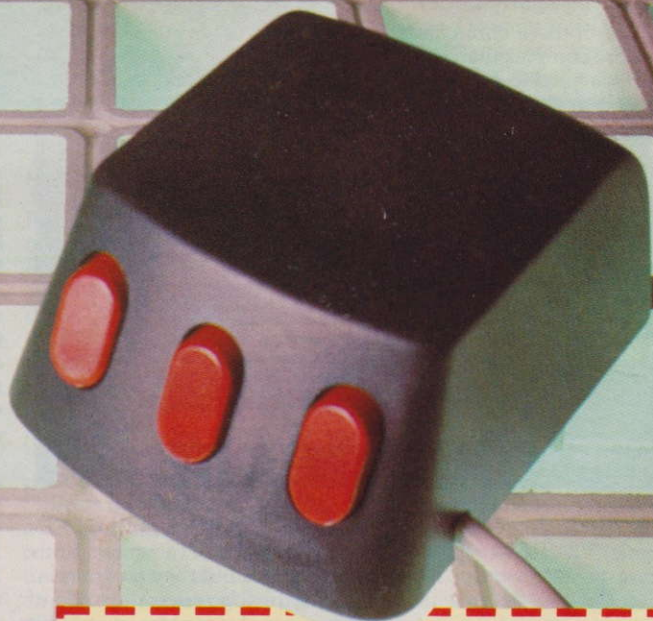
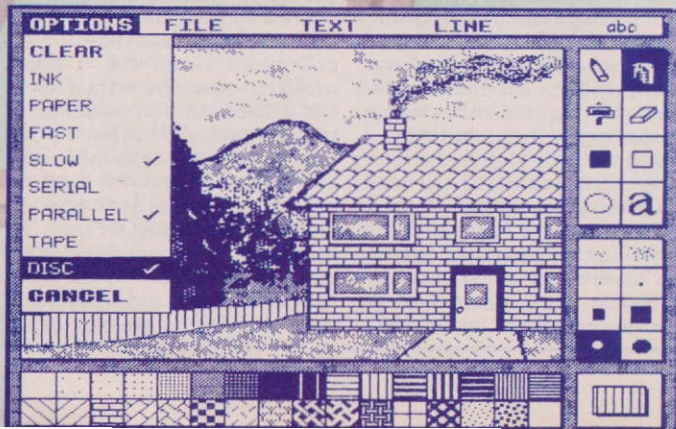
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Opus DDOS

Tony Self

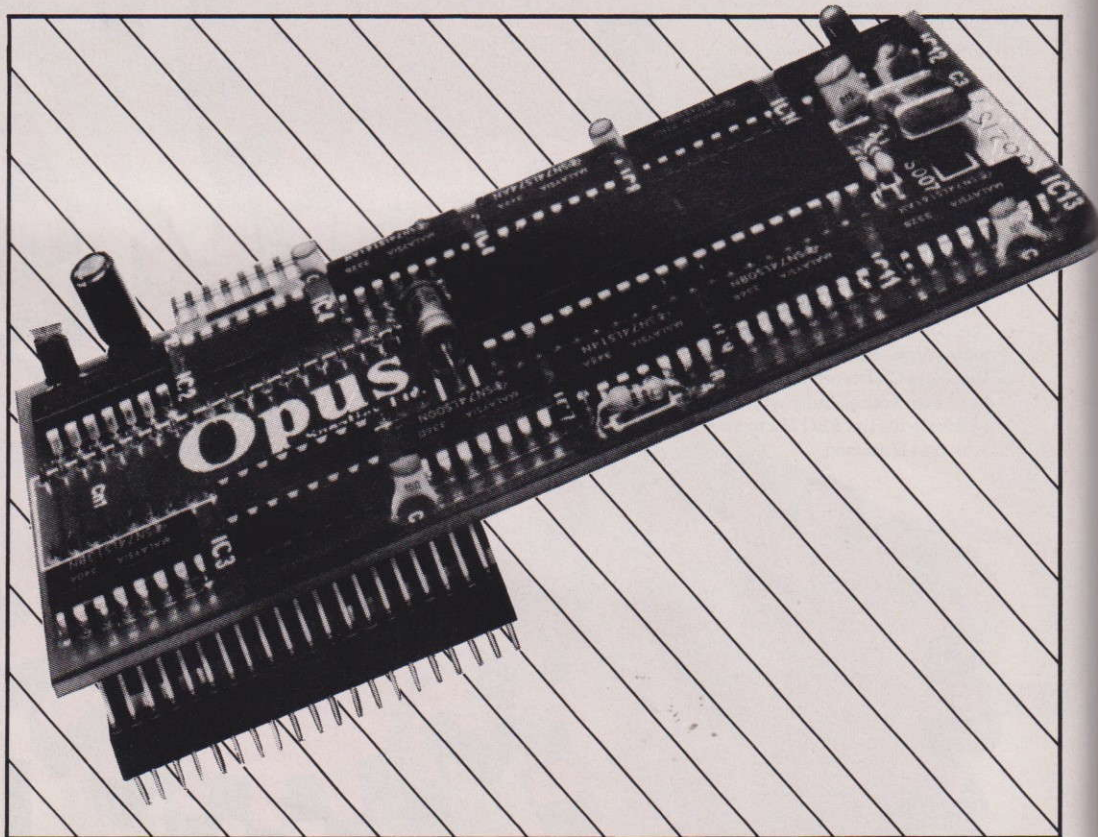
When Acorn designed the BBC Micro one of their biggest mistakes was their choice of Disc Filing System. It has three major drawbacks. Firstly they chose to use an 8271 disc controller chip, which is outdated and only capable of supporting single density discs. Secondly the DFS only allows a maximum of 31 files on a disc irrespective of how much space they take up. Lastly the DFS takes another 2.75K of user memory, restricting further the memory available for your own programs, without the use of downloading routines.

Shortly after the issue of the Acorn DFS a number of companies set about writing their own DFSs to improve on Acorn's. The most well known being Watford's and Amcon's Kenda DFS. More recently a number of double density systems have appeared on the market, which not only replace the DFS ROM, but also the 8271. When preparing replacement disc filing systems for the BBC Micro, the software writer's main problem in adding the improvements to the system, is to maintain compatibility with the original Acorn DFS. In this review I will be looking at the offering from Opus Supplies Limited.

THE HARDWARE

The Opus DDOS kit comes in an unobtrusive corrugated cardboard box, measuring 2"x5"x8". Most of the volume is taken up by the packing of expanded polystyrene (this should travel well). In the centre cut out of the packing is the disc controller board (DCB), which uses the Western Digital 2791 disc controller chip, and a polybag containing the rest of the chip set. The board measures about 2"x5" and stands on legs of just under an inch long which sit in a 40 pin DIL socket. The provisional manual I was originally supplied with carries an appendix which gives clear instructions on how to fit the unit. As I have an issue 3 board I had to make the necessary modifications to IC27. This is also covered in the appendix. Having done this, the rest was relatively easy, just a matter

The latest in double density systems, a DFS alternative for disc users.



of inserting the rest of the chip set and plugging in the board. The provisional manual did cause a bit of confusion here as it tells you to insert chips into IC sockets 81 & 82 which OPUS did not supply in their kit. I initially assumed that these were not required and soldered on. My assumption was proved correct when I received the finished manual, which also contained some useful diagrams. The other problem I had was with my APTL sideways ROM Board. I had been told that their system was compatible, but the legs on the disc controller board were too short and it would not fit with ROMs fitted in the left side of the ROM board, and only then with a bit of a squeeze.

Fitting an extra socket on the end of the legs raises the DCB high enough to stop fouling of the ROM board. I would recommend using an extra socket anyway as the legs of the DCB are rather large and will make the on-board socket unuseable if you should wish to revert to inserting a single chip in the future. Those of you who already have a single density DFS will have to replace three of the chips for those supplied on an EPROM, which should be placed in one of the highest priority sockets. Having fitted the EPROM I held my breath and switched on. I was most relieved to be greeted with

**BBC Computer 32K
OPUS DDOS 3.11 BASIC**

THE SOFTWARE

DDOS is supplied on a 16k EPROM, which the writer tells me is virtually fully utilised. Opus claim that the software is compatible with Acorn DFS, The Tube, Sideways RAM, Disc Doc-

tor, Wordwise and View, to name but a few. However they say that there are a couple of bugs when using View, but that these are in View not in DDOS. Is this Acorn not complying with their own standards again? Perhaps the revised version of View (to be released shortly) will overcome these bugs.

The software covers all the standard Acorn DFS commands with additions to the filing system commands and the utilities to cope with the double density operations. Table 1 shows a print out of the *HELP DDOS and *HELP UTIL commands. The extra built in utilities include a *FORMAT command, which allows you to format your discs

>*HELP DDOS
OPUS DDOS 3.11

```

4080      <argument>
ACCESS    <afsp> (L)
BACKUP    <src drv> <dest drv>
COMPACT   (<drv>)
COPY      <src drv> <dest drv> <afsp>
DELETE    <fsp>
DENSITY   <argument>
DESTROY   <afsp>
DIR        (<dir>)
DRIVE     (<drv>)
ENABLE
INFO      <afsp>
LIB        (<dir>)
MCPY      <src drv> <dest drv>
RENAME    <old fsp> <new fsp>
SROM      <Hex no.>
STAT      (<drv>)
TAPEDISK  <fsp>
TITLE     <title>
WIPE      <afsp>
XCAT      (<drv>)

```

EXMON 1.0a
OS 1.20
>
>
>
>*HELP UTILS
OPUS DDOS 3.11

```

BUILD     <fsp>
DISC
DUMP      <fsp>
FORMAT
LIST      <fsp>
TYPE      <fsp>
VERIFY    (<drv>)
VOLGEN    (<drv>)

```

EXMON 1.0a
OS 1.20

either 40 or 80 track and either single or double density, a *VERIFY command for checking your discs, a command called *VOLGEN (short for VOLUME GENERator) which I will cover later and an interesting command called *FDCSTAT. This is used for reporting bugs in DDOS back to Opus. They are obviously not convinced that the system is bug free. The idea is that if you have problems with the system and you haven't completely crashed your machine you enter *FDCSTAT, which will return the status of the Floppy Disc Controller. The response you get will be something like "WD 2791 status: 0". You then phone up

Opus, tell them what went wrong and give them the status information. I haven't had to use this yet!

The additional filing system commands, apart from two, are required to handle the double density system. The exceptions are *TAPEDISK and *SROM.

*TAPEDISK aids easy transfer of tape files to disc, though only one file at a time. Fortunately, for those of you who have Disc Doctor installed, DDOS only recognises *TAPEDISK, so if you want to transfer more than one file you can still use *TAPEDISK. *SROM is used to specify a sideways ROM and then allow you to *SAVE it to disc.

THE DOUBLE DENSITY SYSTEM

There are two commands which allow you to set the mode of operation. *4080 takes an argument of either ON, OFF or AUTO. The default state is OFF. If you are using a 40 track drive you won't need the command. The purpose of the command is to allow an 8 track drive to read 40 track discs. *4080 ON or *4080 AUTO will enable this function. *DENSITY similarly takes the arguments SINGLE, DOUBLE or AUTO. In practise I haven't found any situation where I have wanted to use this command. Once *4080 is set to AUTO, when using an 80 track drive, the format of the discs being used is completely transparent to the user.

Without going into technicalities, a double density system allows you to squeeze more bytes per square inch on to your discs. The normal format for a single density, 40 track is 40 tracks with 10 sectors each holding 256 bytes (i.e. $40 * 10 * 256 = 100k$ bytes). Out of this the Acorn DFS allocates two sectors for the catalogue, so the actual space available to the user is 99.5K. The Opus DDOS gives you an extra eight sectors per track, increasing the formatted space to 180K (i.e. $40 * 18 * 256$). Again space is required for a catalogue and DDOS takes 18 sectors, (i.e. one track). This is to allow for up to 248 files against the maximum allowed by ACORN of 31. The user is therefore left with actual storage space of 175.5K.

The extra files are obtained by having up to eight separate catalogues — OPUS call these volumes. These volumes are accessed by letter so the first volume on drive 0 is accessed by the command *DRIVE 0A and the last by *DRIVE 0H. The standard *CAT command will then display the appropriate catalogue. DDOS also has an additional command *XCAT which will display all the volumes' catalogues on the current drive. One small gripe here is that *X-

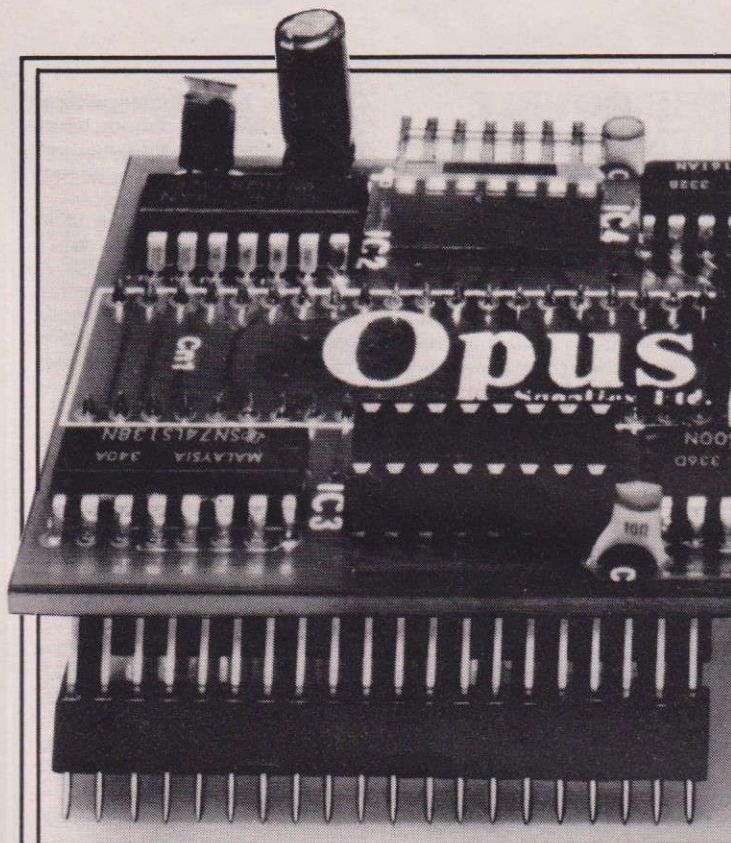
CAT does not automatically put the micro into paged mode which is obviously necessary when you might have 248 files to look through.

I mentioned earlier a utility program called by *VOLGEN. This is used to allocate space to the available volumes. After formatting a disc in double density, space is allocated to only three or five volumes as follows: 40 track vols A & B 72K, vol C 31K; 80 track vols A - D 72K, vol E - 67K. *VOLGEN gives you the option to alter these default states.

There are two drawbacks here. First you can only sensibly use the utility with blank discs as the operation resets all the data pointers and clears the catalogues. Secondly the way the utility works is a little confusing, especially as no explanation is given in the manual. Each volume can only be allocated complete tracks (i.e. blocks of $4\frac{1}{2}K$) however the program apparently expects space to be allocated in 1K blocks. This means, for example, that if you try to allocate 49K to a volume the program responds by allocating only 45K (i.e. 10 tracks), but try to allocate 50K and the response is 49K (i.e. 11 tracks). There is also a maximum amount of space which can be allocated to a volume, which the manual says is 255, but in fact is only 252 (i.e. 56 tracks at $4\frac{1}{2}K$ per track). Why OPUS have made this restriction I don't know, but it does mean that you can't have data files much bigger than are available on a single density 80 track drive, which is a shame. This method of increasing the number of files available seems to work well and at the same time remains compatible with the Acorn DFS. However some careful planning is required if you are going to use the space effectively in an organised way.

A command which aids with the organisation is *STAT which reports the space allocated to the existing volumes together with the unutilised space available. I would have liked to have seen a further option of allocating space dynamically by

CONTINUED OVER



just having vol A available initially. Volume B would then automatically be made available on reaching 31 files or 252K on vol. A or could be forced open by a separate command which at the same time would stop any further allocation of space to vol. A.

USING THE SYSTEM

The first thing I tried was to format a few discs with the various options and then save some programs. I used the built in *TAPEDISK command for this and experienced no problems, except when trying to save on a 40 track disc. However, entering the command 4080 AUTO overcame this problem. I was then able to load back programs without having to worry what track size or density the disc was. All the standard DFS commands worked, again with no problems regarding track size or density except for *BACKUP. This command will not allow backing up of

discs from one density to another, however a separate command, *MCOPY is provided which will backup files between single and double density, providing the destination disc has at least the same capacity as the original. Another thing which is not made clear in the manual is that *COPY will copy individual files between densities.

COMPATIBILITY

One of the main aspects of the system which OPUS emphasises in marketing their product is compatibility. Certainly in its standard operation it is fully compatible with the Acorn DFS, but how does it operate when configured with other hardware and software.

Firstly, Disc Doctor, probably one of the most popular utility ROMs for the disc user. Here I did not experience any real problems, certainly none which crashed the machine. However there are limitations when using it with double density discs. This is because Disc Doctor is only ex-

pecting to find 10 sectors per track and not 18. Therefore the disc editing facilities, such as *DZAP and *RECOVER, are unable to access sectors 10-17.

I have also used DDOS with various other sideways ROMs without experiencing any difficulties. For instance the file handling in Wordwise, *MERGE and *CHECK in Beebug's Toolkit and the disassemble spooling command in Beebug's EXMON.

The DDOS ROM also incorporates the necessary Tube Software to run a second processor, so obviating the necessity to install Acorn DNFS in a sideways ROM socket as well as DDOS. I only had access to a 6502 second processor for a couple of days but in that short time I did not experience any problems with the use of DDOS.

The only area where I experienced problems was with protected software. Opus told me that the system was compatible with Acornsoft discs and I was able to run JCB digger without any problems although it did take some 12-13 seconds to load. However, Acornsoft have recently changed their protection and this apparently caused problems. Also Micro Power have recently brought out their best selling games on disc, but these cannot be read by DDOS. Rumour has it that they are being particularly awkward and that their protection makes direct calls to the 8271 registers, rather than using the OSWORD 7F call, which DDOS supports. I was also unable to boot Amcom's Fortress. I understand that Opus have been having discussions with Acorn and that Acorn have agreed to support the major double density interfaces that are in the market, providing that it does not lessen the protection of their discs. Also Acorn themselves are soon going to have to opt for a

new disc controller, as supplies of the 8271 dry up, and rumour has it that they have already decided on the WD1770 which is software compatible with the WD2791. However I recently met one of the team from Acornsoft who hotly denied all these rumours.

VERDICT

Overall I was very impressed with the system. Its compatibility with the Acorn DFS makes it easy for existing users to upgrade their systems to double density without the fear of their discs not being usable. Looking at the economics, this is a cheap way of increasing the capacity of a disc system, even if you only have a single 40 track drive. And for new users the interface is only about £25 more than the standard Acorn DFS.

I was disappointed with the manual. It is good as far as it goes, with clear concise instructions for each command and a good appendix on fitting. But where are the details on the errors and error numbers and where is the information on the available OSWORD calls? A little more effort here would not have gone amiss.

The only real problem at the moment is compatibility with commercial protected software, but the prospects here look encouraging.

For the serious programmer, who's not really into zapping aliens from the cockpit of a Spitfire, the facilities afforded by DDOS are a boon and I would recommend the purchase. However if you are into games it is probably worth waiting a while to make sure Opus can resolve the protection problem. Also we hope to be reviewing Opus's main rival in the double density stakes, the UDM DDOS, in the very near future.

	ACORN	DDOS
formatted capacity of single 80 track	199.5K	355.5K
maximum file size	199.5K	252K
maximum no. of files	31	248
sectors per track	10	18
cost incl. VAT	£108	£129.95

"dialog...

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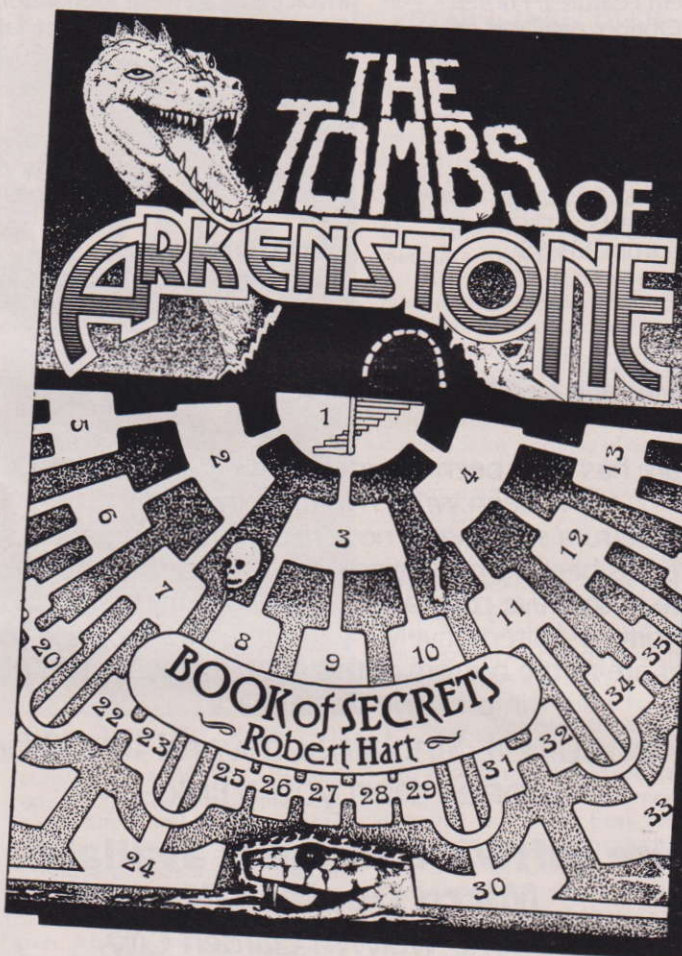
Title Tombs of Arkenstone
Publisher Arnold-Wheaton Software
Machine BBC 'B'
Price £17.25 incl. VAT for cassette or disc

"TOMBS OF ARKENSTONE — an educational adventure at four levels of difficulty that has proved compulsive for both pupils and teachers alike. Use your powers of deduction to negotiate the 'Tombs', then baffle your friends by devising your own fiendish scenarios!"

This was the advert which caught my eye many months ago. Does the program live up to it, or is it written with the usual advertiser's licence? I've heard of adults becoming obsessed with adventure programs; personally, until the arrival of GRANNY'S GARDEN with its graphics, I found the text only — 'Where next?' — type of adventure programs very frustrating and dismissed them as being frivolous. It was with some disappointment, therefore, I read in the User Guide that the program is a text only adventure program. "All the magic and excitement of the adventure comes through words and numbers". Well, the review's got to be written so let's finish reading the User Guide, and not be cynical!

Impressive! Details of program operation, general description and background to story, using the program at home and school, linking the program across the curriculum, ideas and plans for making your own adventures. Very impressive!

On to the story book. The evil Dragonlord, Asgarn, has stolen the Elfin Ring, which is used to control the journeys of the sun from day to night. Without the ring, the land of Arken will remain in darkness; Asgarn and his Dragons and Serpents will rule. Three young and inexperienced Adventurers are sent to regain the Ring. They must trap Asgarn in the Tombs of Arkenstone, where he hides, guarded by his monsters. The 42 page book sets the scene superbly — yes, the magic and excitement are there!



— and illustrates the conventions of the adventure program. Few children will fail to become totally engrossed in the story and will be straining at the leash to start the program.

But wait, there's more. 'A Book of Secrets' explains how the children can become part of the story — "Can we read it during lunchtime, please?" — and goes on to tell how to get started on the computer.

After the brief introduction, the user group (it can be played by a single player who makes all the decisions him/herself, but I think the interaction among the users is often more important than with the computer) decides

on the level of difficulty — don't be too clever, start with one!

The screen shows the number of the cavern the group's in — corresponds to the plan which the Hunter has to keep, those that tunnels lead to and some clues — 'There's gold nearby', and invites the group to MOVE, VIEW or BLOCK — good use of function keys here. All this is attractively presented in coloured print on a black background. If the users wish to see what's in a cavern linked to the one they're in, f3 is pressed for VIEW, followed by the number of the cavern, and the information is displayed on the screen — 'There's a Diamond

Dragon in Cavern...', together with details of magic power used and amount left.

Will the Hunter, Warrior and Magician succeed? There's always help from the Elf at the touch of f6 — the HELP key! As the children gain experience with the adventure, they can keep the score of their 'experience points' and work their way through the grades from Apprentice to Arkenmage.

Well, I hate to admit it, we didn't have time to miss the graphics! We were too involved in reading the screen for clues, planning our moves, working out our strategy, writing our own descriptive stories, and creating our own artistic impressions and, of course, there's still 'MAKE YOUR OWN ADVENTURE' to look forward to!

This is a separate program, which opens up infinite creative possibilities and involves children in writing their own adventures based on the TOMBS structure. This can be set in any time period, any location, with their own monsters and clues, and can be changed and refined until they are happy with it. Beware Ian Whittington, SAQQARA here we come!

TOMBS OF ARKENSTONE is an excellent program in its own right, but the freedom and flexibility offered by MAKE YOUR OWN ADVENTURE ensures it'll be a must for primary schools where the creative role of computers is appreciated, and even if it isn't — yet! It may seem a little expensive for home users, but if you want something which will keep the little darlings engrossed from this Christmas to next, then it must be good value. I hope Arnold-Wheaton will consider including several copies of the story book — and a cassette version of the story for group work! — in the final package.

Ratings Table:

EDUCATIONAL VALUE	95%
SOUNDS	N/A
GRAPHICS	N/A
DOCUMENTATION	90%
VALUE FOR MONEY	90%
OVERALL	90+ %

Title Tesselations
Publisher Cambridge
Machine Micro
Price Model B
 £25.00 + VAT

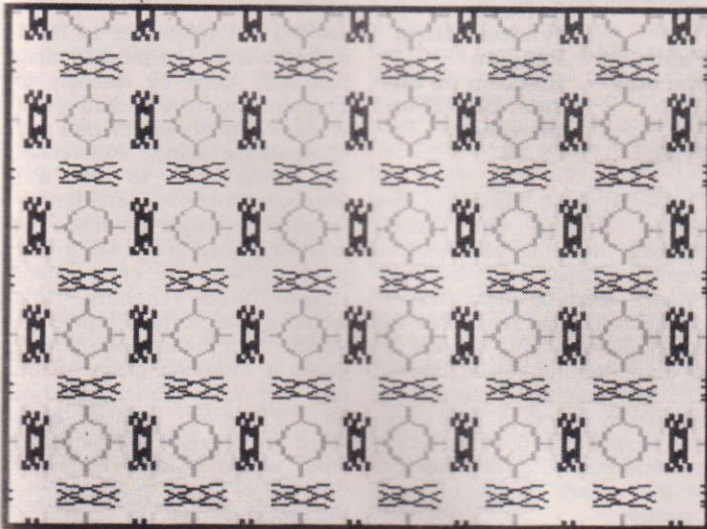
Tesselations is an extraordinary program, a first in the home computer league. Its educational content goes from the mathematics classroom into the art and design department and beyond. The program is flexible enough to attract all sorts of users and friendly enough in terms of operation not to disappoint them.

To quote the manual, "Tesselations can be used to generate tiles which always fit

single letter (T for tessellate, R for rotate, L for library and so on).

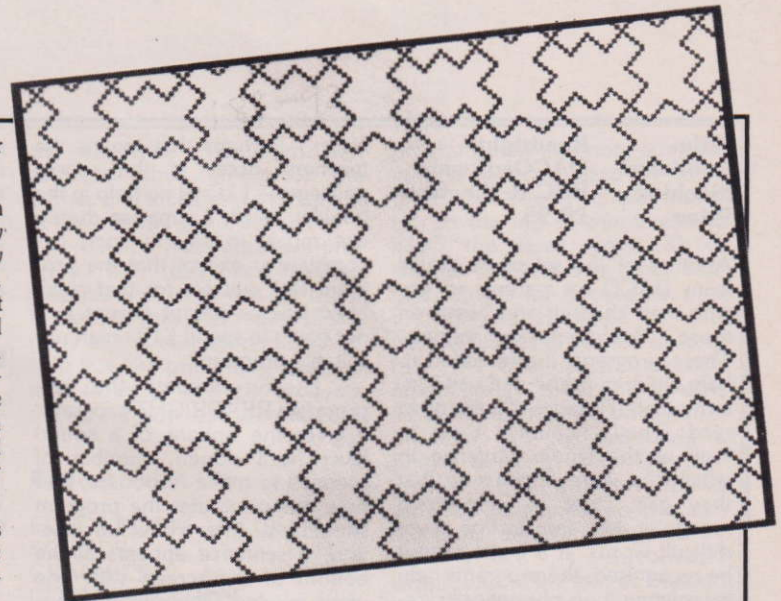
It's a form of menu for each part of the program but a very economic and efficient one, easy to learn and quick to implement. I had my doubts about it at first and wondered why the good old function keys had not been used. No key strips needed: all the information is on screen and the excellent manual takes you through every stage as if you had just seen your first computer keyboard.

There are four main routes out from the main menu. The library accesses all disc informa-



together so that they can be tessellated across the plane of the screen." The program Tesselations can produce, for instance, any pattern from the Islamic, Chinese, Celtic or Japanese cultures, or any other come to that. Consider the pattern on your lounge or bedroom wall. Tesselations can reproduce it and any other such interlocking pattern.

The program employs a new form of "human interface" designed by Fred Daly of Homer-ton college. Four keys, the cursor left and right, Return and Space Bar do the lion's share of all the choosing and actioning which goes on during any session with Tesselations. The bottom of the screen presents the user with choices, each represented by a



tion, catalogues, saves and recalls library files. The drawing route allows you to create your own pattern on a single tile. Drawing allows you to change the colour and shape of the tile edges, to draw within the tile and to erase the current drawing. Drawing within the tile encompasses all seventeen groups of plane patterns. These involve rotation, reflection and glide reflection symmetry. If you don't relate to the mathematical terms then this program will explain them in a highly visual manner.

The tessellation route does all the work, the 6502 number crunching away until the screen is full of your original tiles. You may not be able to make out the original pattern so there is a facili-

ty to overlay the tile outlines. The scaling can be changed in the range of 0.2 to 1 of the original size and continually experimented with, recalculated and displayed.

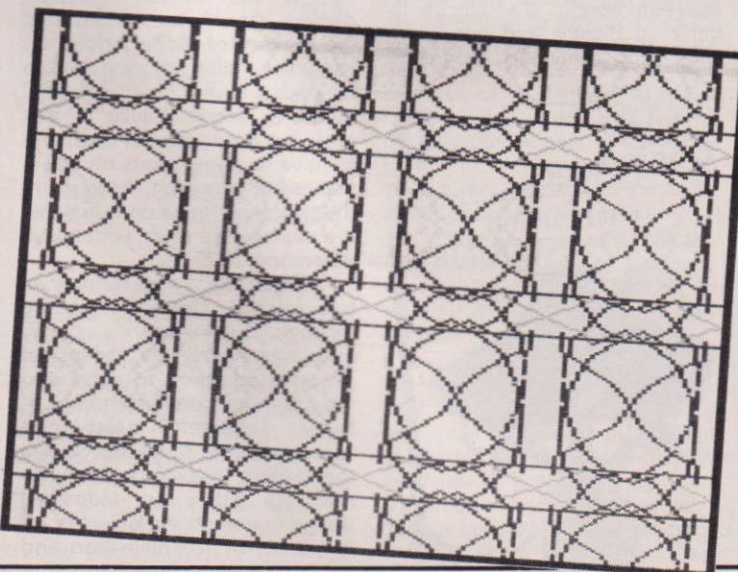
The frame option presents the choice of rotating, side stretching and corner stretching your tile shape. A correct description of the shape, eg Square, Rectangle, 60% Rhombus is displayed.

The printer option can be called upon by getting back to the main choices and hitting Copy. It has been tested with Epson MXs, Walters, Integrex colour — very impressive, and Epson RX-80. When tried with an Epson FX-80, another popular option with the BBC, it did not perform.

Tesselations is a very special program for many reasons. It packs more performance into an educational program than any other BBC program so far. Its applications are very wide ranging, from crystallographers to home economists. It is very easy to use despite the considerable flexibility and number of options.

Ratings Table:

EDUCATIONAL VALUE	95%
SOUNDS	90%
GRAPHICS	100%
DOCUMENTATION	90%
VALUE FOR MONEY	85%
OVERALL	95%



CONTINUED OVER

Title
Publisher
Machine
Price

Readright
DACOsoftware
BBC & Electron
£9.95

Another of the set of programs from DACO for parents to use with their children and based on those developed for schools. These programs are intended to help children in the early and intermediate(?) stages of learning to read. They encourage them to look at the whole sentence in which the word appears so that they gain clues to help them recognise less familiar or more difficult words. If a word cannot be recognised, the programs help by splitting it up phonetically, re-joins it and show the word in its context again. Faster reading is encouraged as the number of seconds allowed to read a word is variable and can be reduced to improve the speed of reading. All these are very creditable aims.

The TEST program enables the parent to start the child 'at the correct program level'. After an introduction, single words appear on the screen in clear yellow double-height lettering, and all the parent has to do is press X if the word is read incorrectly, or any other key if correct. Depending on how well the reader performs, up to 67 words appear on the screen in succession. The program finishes when it has decided on which READRIGHT program and at which level the child should begin. It took me some time to sort out how the system worked — sometimes 'it' decided after just one error; sometimes after nine. If the incorrect test word was the last for say READRIGHT 1, then the screen shows that little John should begin on READRIGHT 1 LEVEL 12, while if he was wrong with a number of the test words for READRIGHT 2, it might indicate four levels to work from. Nowhere could I find any advice to the parent on what to do after that. Should they plough on with the next level automatically or retest?

I played the part of a bright Charlie and got them all right. The screen indicated 'See User

Notes'. Perhaps that means the teachers' notes in the school package — I found no help in the booklet. Well, I suppose there's not much to say in such circumstances except that the program isn't suitable for that child! How does a parent ensure he's not going to spend £10 on an unsuitable program?

Having loaded the appropriate READRIGHT program, it gives the options of a sound level (well done!), number of seconds to make responses, and how many minutes the program should last. After a brief introduction, a sentence appears at the bottom of the screen with one word missing. The correct 'missing word' is selected from a series of words which appear in the middle of the screen. If the correct word is chosen, a bright face and stars appear and the word drops into place; if the wrong word is selected, it is driven off the screen and the correct word appears, is split phonetically and is joined up again to drop into the sentence; if the correct word is not chosen within the time allowed then the word flashes and the same sentence appears.

I liked the idea of varying the time to improve reading speed, but during a trial of the levels in READRIGHT 3 one of the sentences was repeated four times — and not because I got the word wrong! Most children would find that degree of random selection boring. It's difficult to think up dozens and dozens of 'interesting' sentences, but I can't

see this package attracting many children to the process of learning to read. Perhaps a few lessons could be learnt from STORYLINE — if the sentences linked together to give the start of a story, they might have more child-appeal.

Ratings Table:

EDUCATIONAL VALUE	50%
SOUNDS	30%
GRAPHICS	40%
DOCUMENTATION	50%
VALUE FOR MONEY	40%
OVERALL	40%

Title
Publisher
Machine
Price

Penguin Study Software
(Various titles)
Penguin
Electron on one
side, BBC B on
the other
£9.95

I received three titles from this series, Romeo and Juliet, Macbeth and the Merchant of Venice. These were, by coincidence, three of Shakespeare's plays which I had read while still at school with, I must confess, little enthusiasm or indeed interest. The fact that these three tapes completely rekindled my interest, and proved to be both fascinating and informative, gives a measure of the superb quality of these cassettes.

At the outset, Electron owners should be warned that the absence of Mode 7 does not allow the entire program data to be loaded at one time, and BBC machines score heavily in that area. It is a long tape to load, and to have to reload parts on cue is somewhat annoying. Apart from this problem, the various features are available on each, with minor differences in display.

There are a vast number of interrelated themes running through Shakespeare's plays, and examiners are adept at phrasing questions to delve into the students understanding of these delicately intertwined aspects. These tapes encourage the student to explore these, by selecting either an individual theme (a person, an object or an emotion) or a combination and



seeking out references to these from the text. The programming has been done by teachers of English, who have packed a vast amount of important themes and ideas are highlighted. References are made back to the text (Penguin, naturally!), and further suggestions might be made or searching questions phrased. For private study, to complement school-based teaching, this would appear to be a superb investment for the English student, giving a thorough grasp of the play in a much shorter period of time. However, perhaps even more importantly, this series of tapes would awaken the most dormant of minds to re-examine the works of the Great Bard. I cannot recommend them too highly.

Ratings Table:

SOUNDS	n/a
GRAPHICS	100%
DOCUMENTATION	100%
EDUCATIONAL VALUE	100%
VALUE FOR MONEY	100%
OVERALL	100%

Title
Publisher
Machine
Price

Podd
ASK/Acornsoft
BBC B &
Electron
£9.95

Now I have to admit that this program has me fascinated. Aimed at 5 to 11 year olds, although I would say that the upper limit is a little high, it gives you a little



figure who can follow commands. You have to tell him what you would like him to do and he takes the appropriate action on screen. Your first task, and the first option available, is to find the list of words that he can respond to, for nowhere are you given a full list. So that I don't spoil the fun, I shall simply say that he/she can make a number of facial movements, some physical movements and some spacial movements (around the screen). This gives a fascinating start to the program as you try to find the words to use. As each word is expected to be typed at the keyboard, I would expect a younger child to need an adult present, but then that is true of most educational software at this age and is probably the best policy at all ages.

The second option enables you to string together movements into a sequence which Podd will then perform; this too can be quite fascinating if you choose an interesting group of words. Overall this package is likely to fascinate and educate 5 to 7 year olds but above that age the only real interest will be the spelling of some of the words. It is likely to expand the vocabulary of many young children and if yours are anything like mine, they will go around imitating Podd's actions!

Ratings Table:

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

Title	Squeeze
Publisher	ASK/Acornsoft
Machine	BBC B & Electron
Price	£9.95

This is one of the new releases from the educational specialist ASK. It is based on the idea of fitting pentomino shapes (ie shapes made of 5 squares, a domino is made of two!) into a grid. You can either play against the computer, who plays a fairly mean game, or another human being. Each player is allocated one of the many possible pentomino

shapes and they may place their shape anywhere on the screen. This is where the strategy comes into play, if you position your piece carefully you can find a position that will leave you the possibility of placing another shape whilst, at the same time, denying your opponent space for his shape. The game ends when there is no more room for any of the shapes on the screen. The winner is the player with the most shapes on the grid.

There are three levels of play, each of these allowing a different type of shape movement. On level one you just move up/down and left and right, on two you can also turn the shape around and on three you can flip the shape over two. As these are the three rotational planes that we learn about in geometry we have some educational content. Although the game can be played by the ages suggested (5 to 12) it is probably most 'educational' for the older ones, and possibly even those up to 15. It is also one of the few games that I could see being played by adults as the strategy element can be very involving, especially on the bigger grids and higher levels. Although it is like board games that I have played previously this is a good computer implementation and it really adds to the enjoyment.

Ratings Table:

SOUNDS	50%
GRAPHICS	70%
DOCUMENTATION	80%
VALUE FOR MONEY	80%
OVERALL	80%

Title	Bunsen
Publisher	Scholar Soft
Machine	BBC Model B
Price	£4.95

This program is in three parts. The first allows the user to select the named parts of the bunsen burner from a list and the parts, with labels, are drawn on the screen. The second part draws a diagram of the bunsen burner and the user is asked to name the parts. If the answer is incorrect there is no opportunity for a second chance. The number of correct answers is given at the end of

the sequence. The third part simulates the lighting of the burner and includes a description at the bottom of the screen.

While it is an attractive program with colourful, realistic graphics and large text, to use it to teach pupils the names of the parts of the bunsen and how to light it is like using a sledgehammer to crack a nut. Adequate documentation was provided.

Ratings Table:

EDUCATIONAL VALUE	10%
SOUNDS	N/A
GRAPHICS	90%
DOCUMENTATION	80%
VALUE FOR MONEY	75%
OVERALL	15%

Title	Storyline
Publisher	DACOssoftware
Machine	BBC A & B, Electron
Price	£7.95

STORYLINE is one of four language programs for parents to use with their children in the home and is based on programs developed for use in schools. This one helps children compose their own stories, and could be helpful for those who would not normally write stories, because of lack of motivation, lack of confidence, or are put off by poor handwriting. Words and phrases are combined to produce stories, some of which might be 'nonsense' stories. This in itself can act as a stimulus to some children, but given a little time they should be able to put some of the unusual combinations to good effect and will gain a useful insight into sentence structure.

The program has two levels, with the vocabulary in level one set at a more restricted level. At the start of the program, the user is asked if a printer is being used, followed by a request to select the level required. After these choices have been made, a word or phrase appears at the bottom of the screen. This is printed in clear mode 7 double height letters on a red background, which I think is far better for the group of children likely to be using this

program than the more complex graphic lettering used in some programs. The child may move this to the top of the screen to begin the story (press X) or change it (press any other key) and repeats the procedure until the story is complete or until he/she wishes to see the story so far — the print scrolls automatically as the text window fills up — or make a print out of the story so far, assuming a printer is being used! The programs have predetermined sentence structures, so the correct punctuation is always put in, and there is automatic wraparound at the end of lines, so no words are split up. On model B the story may be up to about 400 words, while model A will allow about half that.

All controls are single letters, so the program is very simple to operate. This disabling of the ESCAPE key to prevent accidental exit, the partial disabling of the BREAK key so that although the user exits from the program it can be re-RUN, together with the 'Are you sure?' warning, which comes up if the user decides to start a new story, are very helpful touches, and show what can be done to assist the smooth use of micros by children.

The instruction leaflet is a clear guide to the use of the program, and most users will welcome the helpful instructions which enable parents — perhaps the children will work it out first! — to change the vocabulary in the program.

I'd like to see an option for saving the stories. This would be very useful, particularly if a printer isn't available, so that parents and children can review the progress being made and the variety in the stories produced. If it were possible to revise the stories, then this would give them an introduction to the word-processor.

Parents wishing to find a language program for children having difficulty with writing for the reasons mentioned earlier, should find this a useful alternative, and I'll certainly be using it with those who are not keen on

CONTINUED OVER

putting pen to paper. However, several teachers I asked to try it out in the normal classroom situation found the 'structured situation' too restrictive — like many programs, its success depends on the imagination of the users!

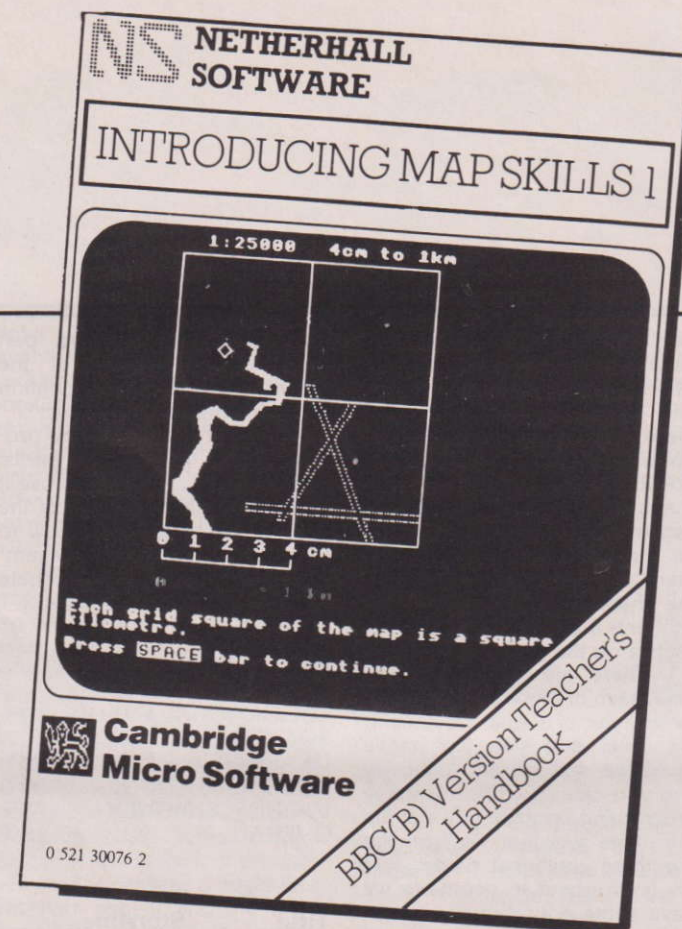
Ratings Table:

EDUCATIONAL VALUE	65%
SOUNDS	(bleeps!)
GRAPHICS	75%
DOCUMENTATION	80%
VALUE FOR MONEY	60%
OVERALL	70%

A version of the above program, slightly modified, is available for schools in THE STORY PROGRAMS. This suite of four programs — the above (level 1 and 2 become STORY 1 & 2) plus two more from WORDGRAM (STORY 3 & 4), is available on two cassettes or disc at £14.50. It is accompanied by very comprehensive documentation — instructions for running programs, details of printout facility, outline of stories, teaching uses and strategies, details of how to change the vocabulary in the stories, and a list of all the vocabulary in the programs. WORDGRAM was reviewed in our November edition.

Title	Introducing Map Skills 1&2 : Watts in your Home : Balance your Diet : Moving Molecules
Publisher	Netherhall Software
Machine	BBC B Disc
Price	£13.95 + VAT

You are likely to have heard the name Netherhall software before as this is the school that produced a number of the programs in the BBC's 'Welcome' package. They have also contributed software to the MEP packages that are supplied to schools and it is really to those in educational establishments that this group of



programs is likely to appeal. Whilst the home user might be able to use certain of the packages I really doubt that they would be able to get value for money from them.

The 'Balance your Diet' program is meant to be used in Health Education or possible Home Economics teaching. The idea is that you type in code representing your diet for a day and you are given a read out of the amounts and ratios of protein, fat, carbohydrate and fibre that the food contained. As you are also asked for your age and sex this is then related to a norm and the resultant over or under consumption is noted. The program is well error trapped and fairly interesting although I do find the input a little tedious as there are a great many codes to be searched through. A good workmanlike, if slightly staid, program.

'Watts in your Home' is a very similar program but this time you input the type of appliances that you have and how long they are in use for and the program will give readout of the cost and the ratios of the various fuel types that you have used. There is the opportunity to input two lists of uses and then compare the costs of the two. This means that heating a room by using different fuels can be compared and it is

possible to see the value of fuel conservation. As with some of the other programs there are a number of pupils worksheet specimens provided and you are allowed to copy these for use with the program. There is little doubt that a package such as this can make understanding fuel consumption much easier than by the pen/paper method.

The most fascinating program in this collection, for me at least, is the 'Moving Molecules' disc. The programs demonstrate, using the BBC's extensive graphic commands, how pressure and temperature changes affect the behaviour of gases, liquids and solids. One program shows the phase changes of molecules at different temperatures, another diffusion in gases and liquids and the final ones with variations in pressure, temperature and volume. All of the programs rely on a display of the molecules at the various stages selected and this is a very good visual representation indeed. I have to admit that I have put this program on just to watch the molecules move! I really believe that this program will help a vast number of children to visualise the 'kinetic theory' in a manner that would not be possible using static pictures and would recommend its use in most 13-18 physics syllabuses.

The programs about map skills also use the graphics to very good effect, in fact I'm prepared to say that these are the best graphical and educational programs that I have seen. The first disc covers two areas, grid references and scales with the second covering the use of compass points and bearings. Both packages contain well planned worksheets to accompany the programs and these are reproducible for classes using them. The grid references section is to a large extent a moving teaching aid with full descriptive notes. There are practice examples and, unusually for a number of educational programs, there is a full explanation available if you got the answer wrong.

I particularly like the program about scales which can display the same, admittedly simple, map in four different scale sizes. There are also sections on the representative fraction and others which allow you to enlarge or reduce the map at will. The Compass based disc requires much more input from the user and is both a teaching and a testing package.

The final part of this section is a game called 'Yacht Race' in which you can sail your yacht, in competition against another student if you so desire, around an irregular course. The direction, as compass points or bearings, and distance have to be input and the winner is the first to cross the line to the sound of the cannon. In all another excellent package.

There is no doubt that these are all packages of serious software and what they lack in immediate appeal, as far as the casual observer is concerned, they make up for in soundness of conception and teaching quality. If you are interested in using computers across the curriculum you could do much worse than to try these packages.

Ratings Table:

SOUNDS	79%
GRAPHICS	100%
DOCUMENTATION	95%
VALUE FOR MONEY	90%
OVERALL	90%

A&B

COMPUTING

FOR THE USER OF THE BBC MICRO

A&B Computing, now a monthly publication, is entirely dedicated to users of the BBC Micro and Acorn Electron.

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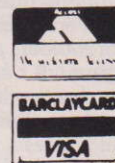
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Down to Business

Jon Vogler

SCOPE OF THIS REVIEW

Hitherto the BBC Micro has not been regarded as suitable for serious business use. What little business software was available had limited capability. During the past few months however, significant new sets of business software have hit the market; this review considers them as sets and does not study any single task, such as payroll or purchase ledger, in detail. It is aimed at the small business that wants to computerise one or two tasks now, using software to which further functions can be added later. Last month we discussed two Z80 second processors that would upgrade the BBC to a modest business machine and a review of ACCOUNTANT, part of the Acorn Z80 package, appears in this issue. To assess how good is the new software that does not need a Z80, it has been compared with one of the most successful packages that does.

The survey covers seven different sets, with a price range between £40 and £900. They cover, between them, the whole range of business functions: buying things, stocking things, selling things, paying people, keeping track of the money involved in these activities and, finally, producing a set of accounts to satisfy all those interfering outsiders: the auditors, the VAT man, the tax man, the shareholders and others who imagine a harassed business man has nothing better to do all day long than produce neat tables of figures.

In what follows, figures in brackets refer to the line numbers in the main table.

FOUR BASIC QUESTIONS

The buyer can tell serious, professional business software, from programs which are really only suitable for simple house-keeping or club accounts, by asking:

— How many discs are involved? (2). One might be tempted to think that a set of software with several discs was superior, but in fact, for discs

How businesslike is your BBC. Jon Vogler brings you a comprehensive account.

ACORNSOFT I Product Entry	
Reorder Level	150
Reorder Quantity	100
Quantity On Hand	245
Quantity on Order	0
Quantity Allocated	100
Average Cost	£

ACORN's superb screen layout is no substitute for functionality

that have to be shuffled in and out by a tired business man, during a book-keeping session at the end of a working day, the fewer the better. SAGE's achievement, of getting virtually all basic accounting functions other than payroll onto one single disc, is notable!

— What limits the file size? (3) If it is the computer's memory, as for example, most of Gemini's cheaper range (which I have called "Small Business"), then the number of customers or stock items or anything else that is kept on a file will be severely limited and the program will constantly fail by running out of memory. If however the program uses "random access disc files" then the number of employees or transactions will be limited only by the number and capacity of discs on your computer. (With previous ar-

ticles in this series, I have ignored tape cassette systems as being too slow for business use.)

— Are the different activities integrated? (4). This means: will you have to enter, to carry out one activity, data already entered while engaged in another or will it automatically be available. For example, if you produce an invoice to send to a customer, will the production of that invoice automatically debit that customers account with you

or reduce the number of items in your stock!

— Does it operate standard double entry book-keeping practice with a nominal ledger (5). If not, as with the ACORNSOFT and SOFTWARE FOR ALL Series, it may be quite adequate for producing invoices, statements and other basic commercial documents, but it will not produce a set of accounts that will satisfy an auditor or the tax man.

HOW CAPABLE?

Answers to HOW MANY ENTRIES? (6-10) are based on the maximum system that the software will support. Files on 40 track, or single or single-sided disc drives, may be smaller than this.

Under WILL IT PRODUCE? (sections 11-31) I have listed some of the main outputs one might require. Some programs produce other reports as well; many produced the reports shown but in a less than adequate fashion, for example the Gemini (Small Business) mailing list is very awkward because you cannot make the printer pause to adjust the labels in mid print.

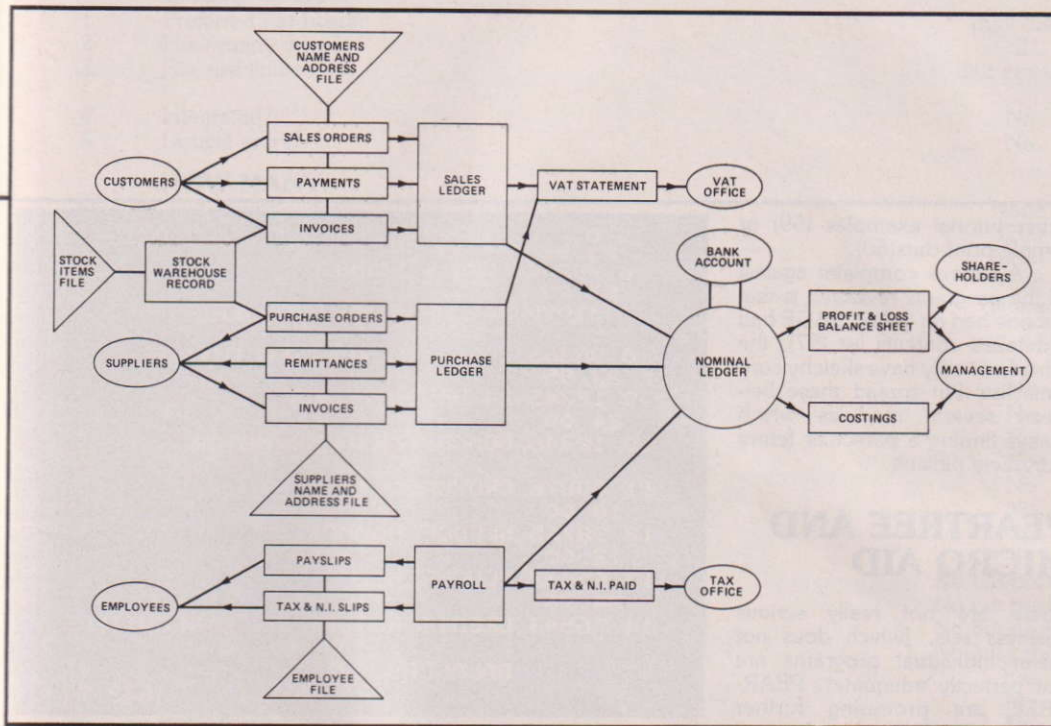
There are some surprising gaps in some of the program sets: At first glance ACORNSOFT MIRLE appears comprehensive, as it comprises no less than seven separate glossy packages. It is in fact marred by lack of a central nominal ledger to pull them all together and produce a set of accounts (11,12,13) The absence of a payroll module (17) is equally surprising. The SOFTWARE FOR ALL set is even less complete. Surprising too that the otherwise very comprehensive GEMINI PROFESSIONAL and

MEMO TO FINANCE DIRECTOR

To carry out some commercial functions (but not produce full accounts) at low cost, buy SOFTWARE FOR ALL or MICRO-AID if they do the functions you need?

For an (almost) full range of business functions buy GEMINI's INTEGRATED ACCOUNTING package if there is no prospect you will need a second processor for other tasks.

If future need for a second processor justifies the extra cost, buy SAGE for maximum flexibility and accounting power.



FEATURING: EASE OF USE

Certain features make the system much easier to use. Availability of tailor-made stationary, (37) often in multi-part sets, can save a great deal of grief in trying to adapt an invoice format designed in the days of ledger clerks on high-stools with copper plate hand-writing!

It was pleasant to see that all the systems use menus (38) but only the better ones offered sufficiently clear screen prompts that the program could be run without reference to the handbook. MLC have still not realised that business users have monochrome video screens (39); much of their coloured display was unreadable at normal brightness. My accountant showed marked lack of enthusiasm when I talked about computer accounting for my own business on the grounds that "I like to see plenty of explanation in the accounts; it helps to get the tax man to accept them". Those words should be written up in letters of fire over the door of every software house. Most allowed enough space on the invoice (41) but only the first 25 characters or so was transferred to statements, day books etc.

Features to speed up the laborious book-keeping process are very welcome. Surprisingly the cheaper programs: MICROAID and SOFTWARE FOR ALL, allowed you to insert the date and there after accept it by default on as many subsequent entries as you wish (44). Automatic incrementing of the invoice number is also a time saving feature. All the better programs enable the user to set up a file of customers, suppliers, stock items etc., allocate a code to each and recall all appropriate details just by entering the code (45). ACORNSOFT, GEMINI (Professional), and SAGE all took this a stage further and used the name and address files to generate mailing lists (24). The most elementary value of a computer is that it does the arithmetic for you yet some programs, for ex-

SAGE sets cannot produce purchase orders (25), let alone calculate stock reorder levels (R O Ls) and economic order quantities (E O Qs) (28) or carry out job costing (30).

These techniques and practices are fundamental to good business management. Every wise boss knows that, if he allows his employees to purchase materials without a rigid purchase order system, they may

- not obtain price estimates or quotes in advance,
- duplicate purchases made by other staff members,
- not take advantage of trade

and bulk discounts and possibly even — purchase items for their own use on his account!

Elsewhere in this journal I have expressed my horror of accounting packages that do not produce job costs (30). Three sets could be made to do so to a limited degree, by careful choice of nominal ledger codes. For this reason it is essential that the user can define these himself (33), and this also ensures accounts appropriate to his style and type of business. Only SAGE and GEMINI (Small Business) use the

abundance of information in the system to produce cost-code budgets (31) and compare actual expenditure with them.

I have said it before and shall say it many times again: let us have business software designed by practising business men to produce profits and not just by accountants to record losses!

Small business men who are exempt from VAT will know the frustration of repeat nil answers to VAT queries, yet none but GEMINI's Small Business set allow the user to eradicate VAT altogether (32). It is things like this that make people prefer manual systems, despite all that computers have to offer!

That it should be possible to vary invoices and vary the prices at which stock is quoted (34). SOFTWARE FOR ALL offer an intelligent dual selling price and separate cost price for each stock item and SAGE is even more flexible. An appalling short coming of the ACORNSOFT series is that there is no way you can add postage and packing, transport, discounts etc to an invoice: it can only be priced at a fixed value for that product (35). The best programs give the user the chance to allocate his use of disc space (36), for example the newspaper distributor who buys from perhaps only six or a dozen companies but sells to two or three hundred need not waste disc space on hundreds of supplier accounts which he will never use.

SALES LEDGER/INVOICING : INVOICE HEADER
LAST SEQUENCE NUMBER : 1 -0000

I(nvoice)/C(redit note): INVOICE
CUSTOMER NUMBER : 1

RICHMOND MACHINE TOOL CO
48 THE RAILWAY SIDINGS
EAST DURHAM
NORTHUMBRIA

ND1 7GD

ORDER NUMBER : 989

TAX POINT : 040984

DUE DATE : 041084

SETTLEMENT DISCOUNT: 0.00

SETTLEMENT DATE :

SAME DELIVERY ADDRESS? (Y/N) _

**GEMINI (Professional): a superb piece of software:
the invoicing module**

CONTINUED OVER

ample, GEMINI (Small Business), required you to total up a batch of invoices yourself (46). SAGE repeatedly and fervently urged thier users to use manually produced "batch control sheets" and do the manual totalling and then use this as a cost check but they allow you to be slovenly and ignore their advice if you prefer.

Much care has been devoted to entry routines and to achieving a balance between rapid entry, (for example no need to confirm with the return key) and giving the operator a chance to check that data is correct before committing it to entry (47).

Several of the sets were very clever of catching errors (48) and SAGE produced detailed instructions on correcting errors that had been inadvertently entered (49). GEMINI (PRO) in particular pay careful attention to security: offering copious advice on backing up discs (50), screen warnings when discs are nearly full (52) and a pass word so that unauthorised persons cannot study your most intimate secrets (51) although there is little agreement which programs need it: MICROAID and SOFTWARE FOR ALL also provided passwords; SAGE surprisingly offer it only on the payroll package.

The handbook to any piece of business software is critically important. Several authors apologised that they could not teach accounting principles in a short document, but the more expensive programs took some trouble to indicate the difference between good and sloppy practice (53). Almost all authors had taken care to write in simple language (55); I was delighted to find no "computereese" anywhere. Accounting language has to be used but business men are used to it and many authors took trouble to explain as they went along. A pity that neither ACORNSOFT nor GEMINI (Professional) provide screen pictures in their handbooks (56), these not only make the learner's task easier but relieve the monotony of endless text. Nor do ACORNSOFT take the trouble to give

either tutorial examples (59) or sample print-outs(60).

A serious complaint against all the programs reviewed is that not one had an index. SAGE had a detailed contents list (57); the others not only have sketchy contents lists but spread these between several modules which makes finding a particular feture extremely difficult.

PEARTREE AND MICRO AID

There are not really serious business sets, (which does not mean individual programs are not perfectly adequate). PEARTREE are promising further modules by December 1st and MICROAID say they will be providing integration.

GEMINI (SMALL BUSINESS)

These were the first business programs for the BBC Micro, so their sales have probably been better than their quality justifies. In some cases, for example, invoicing, the computer does little more than act as a typewriter. Two of the programs, (stock control and mailist), have been upgraded to use random access filing but the lack of integration, and the small file capacity makes them now appear rather pedestrian in contrast to what has become available, in particular from GEMINI themselves. For the tiny business, not seeking to produce a complete set of accounts but just to computerise one or two functions, they may still be adequate and are modestly priced.

```

5 D      0102WASHERS
23.97    54.98
6 76244  PLUG & SOCKET
87.09
7 31098  SET OF RING SPANNERS
108.00
8 98365  200m. GALVANISED WIRE
23.95
9 12345  24 BRUSH HEADS
24.00
10 12346 MONOBLOCK PUMP MOTOR
250.00
11 09876 CROWBAR
10.00
12 98765 SLEDGE HAMMER
12.00
13 65432 PLUGWRENCH
34.76
14 76543 CREDIT RETURN OF WIRECUTTERS
10.50
BALANCES C/D
301.15    632.90
    
```

MICRO-AID: a rather confused screen layout in the stock control module

ACORNSOFT MIRLE

These are the biggest disappointment. To pay a total of £175 for a set which, at the end of the day, will not produce a set of accounts, and are individually too inflexible to adapt to many businesses, does not represent value for money. Many people will be attracted to the apparently low price of £25 per module: until they realize each module does very little: for example you actually need three to cover the sales process.

The seven modules repeat one another interminably: over half the text is repeated in all seven handbooks and the same is true of many of the disc programs: for example the product update procedure appears on the stock control, invoicing, and

order processing modules, and an almost identical one on the purchasing module. Purchasers of the complete set do not receive value for money and ACORNSOFT should recognise this and offer a substantially reduced package price for the person who buys all seven.

On the credit side, you can integrate all seven or almost any combination. As might have been predicted from ACORNSOFT, screen presentation is superior to any of the other packages but that is no substitute for functionality.

GEMINI (PROFESSIONAL) INTEGRATED ACCOUNTING SET

This is the newest and most exciting. To have achieved a substantial degree of integration, very rapid file access and respectably large file sizes, without the use of a second processor, is a fine achievement. As one would expect from GEMINI, the individual modules are eminently professional and for the first time present the single processor BBC as a viable small business computer. A "Try before you buy" arrangement will be announced shortly. GEMINI have at last

Posting details.

Do you want to post each item individually? (Y/N) Y

B/C	Details	V	Nett	VAT
(1)	Report on combustion of a	0	10.00	0.00
0	Set of Photographs	0	6.00	0.00
0		1	0.00	0.00
0	Packing & Carriage	0	1.00	0.00

SAGE: professional and very flexible

SOFTWARE HOUSE

MLC PEARTREE

MICRO AID

BASIC SPEC

1	Preferred hardware?	dual discs	single disc
2	How many discs?	2	3
3	File size limited by:	disc capacity	disc capacity
4	Integrated?	No	No but promised
5	Double entry?	No	No
HOW MANY:			
6	— Account codes?	None	2250
7	— Customers or suppliers?	3200	525
8	— Stock items	3200	None
9	— Employees?	None	100
10	— Transactions?	None	2250
WILL IT PRODUCE:			
11	Profit & Loss a/c?	No	Yes
12	Balancesheet?	No	No
13	Notes to the accounts?	No	No
14	VAT statement?	No	No
15	Bank reconciliation?	No	Yes
16	Audit trails or daybooks	No	Yes
17	PAYE & Nat Ins?	No	Yes
18	Pay advice?	No	Yes
19	P60/P45 etc?	No	No
20	Invoices?	No but promised	No
21	Credit notes?	No but promised	No
22	Statements?	No but promised	Yes
23	Aged debtors list?	No but promised	Yes
24	Mail list (customer & suppliers)?	Yes	Yes
25	Purchase orders?	No	No
26	Remittance advice?	No	Yes
27	Stock reports?	Yes	No
28	R O Ls or E O Qs?	No	No
29	Stock usage data?	No	No
30	Job costings?	No	Limited
31	Budgets?	No	No
FLEXIBILITY: Can user:			
32	— Ignore VAT if exempt?	No VAT function	No VAT function
33	— Define nominal codes?	No	Yes
34	— Multiple stock prices?	Yes	None
35	— Freely write invoices?	No	None
36	— Advance plan disc use?	No	No
EASE OF USE:			
37	Stationery available?	No	Yes
38	Menu driven?	Yes	Yes
39	Pleasant mono display?	No — coloured	No — coloured
40	Good screen prompts?	No	No
41	Item description length?	20	28
42	Easy print routines?	Yes but rigid	Yes but rigid
43	Worked examples?	No	Some
SPEED:			
44	Auto entry of date?	None	Yes
45	Names entered from files?	No	No
46	Calculates batch totals?	No	No
47	Slick entry routines?	No	No
ACCURACY & SECURITY:			
48	Errors caught?	No	Some
50	Advice on data backup?	No	Superficial
51	Security password?	No	Yes
52	Warn before disc full?	No	Yes
HANDBOOK			
53	Teaches good accounting?	No	No
54	Clear layout?	No	No
55	Free from jargon?	Yes	Yes
56	Uses screen pictures?	No	No
57	Detailed contents list?	No	No
58	Error messages explained?	No	No
59	Practice examples?	No	No
60	Sample reports?	No	No

CONTINUED OVER

released their 24K ROM database "DATAGEM" and in the accounts handbook state that these "combine powerfully". Unfortunately they give no inkling how this is done in either handbook!

SAGE

SAVE has the payroll separate at £195+VAT and all the rest together as SAGE PLUS for £695+VAT. For both together you pay £795+VAT. Leave out invoicing and stock control and you get SAGE ACCOUNTS at £375+VAT. SAGE offer an attractive "try before you buy" scheme, but of course you cannot take advantage of this unless you have a Z80 second processor.

I liked SAGE enormously save for its major defect: lack of job costing. I found it much easier to use and more flexible than ACORN's ACCOUNTANT.

WHAT YOU GET FOR THE PRICE

GEMINI have produced a superb product. Have they priced themselves out of the market with a total of £500? There are three alternatives for the serious businessperson?:

- buy ACORN'S attractive package of a Z80 second processor with ACCOUNTANT. This costs only £300 (a £100 price increase has since been announced — Ed.), but leaves out many important functions, such as invoicing, payroll and stock control. However possession of the second processor opens up the whole range of professional CP/M software.
- buy GCC (Cambridge) Ltd's offer of a Z80 with SAGE ACCOUNTS for £430. However to add invoicing, payroll and stock control will increase the total to £914: a lot to pay, even when you get a second processor.
- forget about the BBC for business use and buy a

* S A L E S I N V O I C E *					
Invoice to :- RICHMOND MACHINE TOOL CO 40 THE RAILWAY SIDINGS EAST DURHAM NORTHUMBRIA ND1 7GD			NORTHUMBRIA FASTENERS LTD WEAR TRADING ESTATE CASTLE ROAD NEWCASTLE TYNE & WEAR TD4 7YS 0973 456221 002 345 986		
Delivery Address :- WATERSIDE WAREHOUSE RIVER ST FELLING NEWCASTLE ND5 4RQ					
CUSTOMER NUMBER : 0001 ORDER NUMBER :			OUR REF : 1 -0002 TAX POINT : 04/09/84		
ITEM	DESCRIPTION	PRICE	QTY	VAT DISC	VALUE
4030	BRASS HEX HEAD BOLTS	0.16	5000	1 20.00	640.00
4027	STEEL WASHERS	0.02	10000	1 10.00	180.00
4017	STAINLESS STEEL NUTS	0.05	7000	1 10.00	315.00
POST & PACKING	AS PER YOUR TELEPHONE CALL TO OUR MR ROBERTS 27/08/84			0	10.00
SUB TOTAL :					1145.00
VAT TOTAL :					153.23
TOTAL :					1298.23
INVOICE DUE ON 041084					
A SETTLEMENT DISCOUNT OF 114.50 MAY BE DEDUCTED IF PAID BEFORE 041084					

— GEMINI (Professional) Printed sales invoice: businesslike but no flexibility of layout

serious small business machine, such as the Apricot (256 Kbytes of memory) or the ACORN business machine, which should appear before this review does.

It is easy to complain about these prices but:

- I pay my accountant four

hundred pounds every year, and expend much sweat myself, to produce accounts. If software can save substantially on this it is worth it and it is rare that cheap options represent good business investment.

- These purchases are tax deductible which can make

them look very much more attractive.

- Both GEMINI (Professional) and SAGE represent superb examples of the programmer's art and the companies deserve to be paid well for them. How many customers will have the cash to do so is another matter!

THE SETS THEMSELVES

GEMINI (SMALL BUSINESS)

SOFTWARE FOR ALL

ACORNSOFT MIRLE

GEMINI (PROFESSIONAL)

SAGE

dual discs 5	single disc only 4	dual discs 7	dual discs 5	Z80 + dual disc 2
memory (except mail & stock)	disc capacity	disc capacity	disc capacity	disc capacity
No	only stock & inv	Yes	Yes	Yes
No	No	No	Yes	Yes
90	None	None	143	9999
220	400	No limit	610	9999
220	100	No limit	1980	9999
40	None	None	198	999
No limit	750	No limit	650	About 3700
Yes	No	No	Yes	Yes
Yes	No	No	Yes	Yes
Yes	No	No	Yes	No
Yes	Yes	Yes	Yes	Yes
Yes	No	No	Yes	Yes
Yes but tedious	Yes	Yes	Yes	Yes
Yes	No	No	Yes	Yes
Yes	No	No	Yes	Yes
Yes	No	No	Yes	Yes
Yes	Yes	Yes	Yes	Yes
No	Yes	Yes	Yes	Yes
Yes	Yes	Yes	Yes	Yes
No	Yes	Yes	Yes	Yes
Yes but poor	No	Yes	Yes	Yes
No	No	Yes	No	No
No	Yes	Yes	Yes	No
Yes	Yes	Yes	Yes	Yes
No	No	No	No	No
No	No	No	Yes	Yes
No	No	No	Limited	Limited
Yes	No	No	No	Yes
Yes	No	No	No	No
No	None	None	Yes	Yes
2	3	2	2	2
Yes	Yes	No	Yes	Yes
No	No	Yes	Yes	Yes
No	No	No	Yes	Yes
Yes	Yes	Yes	Yes	Yes
Yes	Yes	Excellent	Excellent	80 column
No	No	Excellent	Excellent	Excellent
23	32	30	24	25
Yes but rigid	Yes but rigid	Yes but rigid	Yes and flexible	
Yes	No	No	No	Yes
No	Yes	No	No	Yes
Yes	Yes	Yes	Yes	Yes
No	Yes	No	Yes	Yes
No	Fair	No tedious	Excellent	Excellent
Some	Yes	Yes	Yes	Yes
Yes	Yes	Yes	Yes	Yes
No	No	Yes	Yes	Yes
No	Yes	No	Nom ledger only	Payroll only
No	No	No	Yes	Yes
No	No	No	A little	Yes
No	Yes	Yes	Yes	Excellent
Yes	Yes	Yes	Yes	Yes
No	Yes	No	No	Yes
Inadequate	Inadequate	Inadequate	Barely adequate	Detailed
No	No	Yes	No	No
No	No	No	No	Yes
No	Yes	No	Yes	Yes

Bouncer

Margaret Stanger

Bouncer is the result of several months work which started, simply enough, as a desire to produce an arcade style game with multiple screens, smooth movement, high score table and all the other attributes that are expected in a game of that type.

The final program fits the specification, but producing it highlighted several problems I had not previously encountered. Some of these problems had solutions already widely known and were easily solved by a search through articles in various books and magazines. Other problems were not so amenable to solution, and procedures to deal with them had to be devised. Over all this activity hung the bugbear of the BBC micro; lack of memory space.

In this series of articles I hope to show how the program evolved and how the various problems were solved. Each instalment will contain a part of the program which will be self-contained and can be debugged and tested on its own. At the end of the series you will hopefully have gained some insight into games programming and also have a BBC micro version of the Arcade Game "Kangaroo".

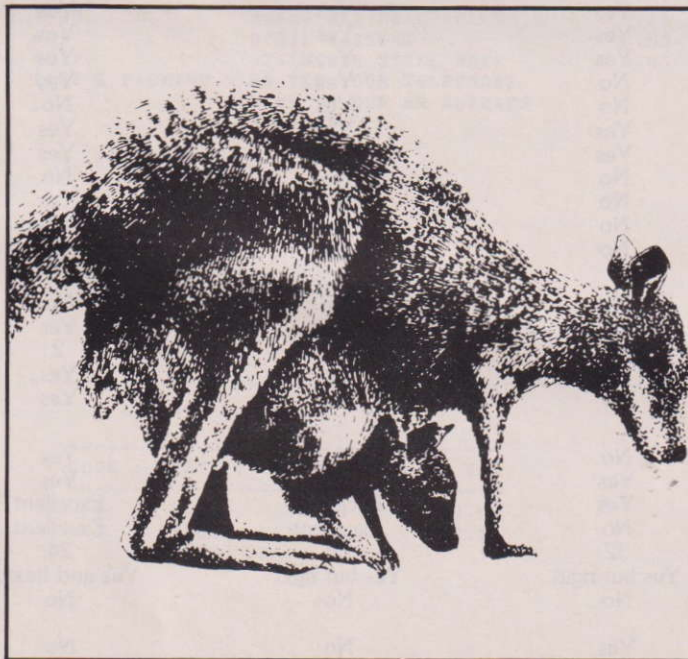
COME ON KANGA

For those not familiar with the game the following brief account is included. The aim of the game is relatively simple. A small baby kangaroo has been imprisoned in a tree top jail by some particularly unpleasant monkeys. Mum has to climb up the tree to rescue him. This sounds easy but since the monkeys are doing their best to stop her by throwing apples and apple cores it is, in fact, quite tricky.

If you succeed, the monkeys re-kidnap the poor thing and Mum has to negotiate a more difficult route. This process is repeated through several screens which increase in difficulty. Various bonus points can be collected by Mum as the game progresses.

Purists will of course complain of trivial errors like

In creating this professional arcade game for the BBC several interesting problems arose. The scene is set in the first part of our series on how the program evolved.



kangaroos don't live in trees, monkeys don't eat apples etc. I can only answer that what's good enough for the arcades must suffice for the Beeb!

CONSIDERATIONS

During the game several moving objects have to be dealt with, kangaroos, monkeys, fruit etc. To do this in BASIC would be very slow, so machine code movement routines were necessary. After some consideration it was decided to write the whole program in machine code (with the exception of the high

score table).

In theory using BASIC for the main program and machine code routines for the movement should give an acceptable game but IF — THEN structures in BASIC are not very fast and the number of branches is not necessarily constant and would probably lead to uneven movement.

On the face of it, the task of writing a full length machine code program would not be too daunting a task on a machine equipped with as good an assembler as the BBC micro. However, the entire program is quite long and

the complete assembly program is too big to fit into memory.

All is not lost though. By dividing the program into four sections and assembling them and *SAVEing them individually it is possible to pack the program into the available space. (The reason for this apparent "quart into a pint pot" miracle is that the assembler mnemonics are stored as ASCII by the computer; thus for example the assembler version of "Load the Accumulator", LDA, would require three bytes. When assembled this would be stored as &A9 i.e. one byte.)

COMING SHORTLY

The four consecutive monthly articles will contain the listings for each section, together with source programs for LOADING and SAVEing the main program.

This article will show you how to set the scene and contains the data for the various sheets of the game.

Article 2 will deal with the method of creating the sprites, and will include routines for POKEing them in front of the scenery.

Article 3 contains the movement routines, use of joystick or keyboard in machine code and the concept of "patrols".

Article 4 includes the scores, the rescue, the interaction of the kangaroo and the missiles. The final piecing together of the program and the addition of the High Score table will be dealt with and a complete set of instructions for the game will be given.

SETTING THE SCENE

The source program is listed below, to be typed in at PAGE &5000 to allow space for the machine code and data to be stored from &22F0 to &27FF.

Remember to set PAGE=&5000 and type in NEW (RETURN) before typing in the program.

NOTE: If you omit the NEW the computer will "hang up" after



the first line of program.

Don't panic if you forget to set PAGE before you start typing, the situation can still be saved by following the instructions below. Type in the following:-

```
SAVE "SOURCE1"
PAGE = &5000
*LOAD "SOURCE1" 5000
SAVE "SOURCE1"
```

NOTE: This will not work if you have RUN the program.

When you have typed in SOURCE1 and saved it, RUN the program to save the data and user-defined characters.

The second program TEST1 is at PAGE&1900 to leave space for more machine code later.

Before typing in TEST1, set PAGE = &1900 (RETURN), NEW (RETURN). Again, omitting the NEW will cause the machine to hang up.

The data for the tree is stored from &23E4 to &25FF, with a byte for each "PRINTTAB" position from row 3 to row 30.

All the information is in one byte, as follows:-

Bit 7 background colour (0

Bits 4-6 foreground colour
Bits 0-3 add this code to 240 to give the user defined characters.

SOURCE1

VARIABLES

A% item of tree data
B% item of screen data
P% program pointer
X% loop variable

MAIN PROGRAM

Line 20 Accesses initialisation and assembly.
30 Reads data for tree display.
40 Reads data for four different screens.
50 Saves user defined characters.
60 Saves machine code and data.

DATA

Lines
80-130 treetop and jail
140-200 branch 3
210-270 branch 2

280-340 branch 1
350-410 screen 1
420-480 screen 2
490-550 screen 3
560-620 screen 4

PROCEDURES

PROCIN User defined characters.
830 PROCAS defines OSWRCH (operating system read/write character) the equivalent of a BASIC VDU. For example VDU7 becomes LDA #7:JSR OSWRCH in machine code.

970 CEN. This routine copies the data for the middle branch a row at a time, backwards. The first line of data is put in lines 1 and 2 of branch space.

Line 3.
Line 4.
Line 5.
Line 6.
Puts low byte for screen 1 in &80.
Puts high byte for screens 1 and 2 in &81.
Puts low byte for screen 3 in &80.
Puts low byte for screen 2 in &80.

The program counter is set, and I have opted to print the assembly, and ignore errors on the first pass. The OPTION can be changed to suppress the assembled listing after the program is known to be correct.

840 The equivalent of VDU31,0,3 (i.e. PRINTTAB(0,3)).
850 Puts the low byte of the location of the first item of tree data in &70, and the high byte in &71.
860 Puts tree data in &80, and bit 7 in &82.
870 Puts bits 4 to 6 in &81.
880 Puts bits 0-3 in &80.
890 Foreground colour.
900 Background colour.
910 User defined character.
920 Next item of data.
930 Compare for end of tree.
940 SCREEN checks for level number, and branches for the four different levels in the least two significant bits of the contents of &D8E. If, at the fourth level, the data starts at &2780 so the low byte (&80) is put in &80.
950 Puts high byte (&27) in &81.
960 Copies the 120 items of data in branch 1 and branch 3.

GET RID OF THOSE BUGS

If there is an "Out of Data" error at lines 30 or 40, check the data lists carefully for missing commas. The commas are the only way the computer can tell where one item of data ends and the next one starts. A missing comma will fool the machine into thinking there aren't enough items. Similarly an extra comma (i.e. two commas together) may give a "No such variable" error message.

When the machine code is assembled, the first pass picks up syntax errors, and the second pass other errors, and it is useful to have the assembler listing to ensure that the code is correctly assembled. The printed assembly will be something like:-

2357 AD 8E SCREEN LDA &D8E

Reading from left to right, the significance of the symbols is as follows:-

1. Location of first byte of instruction.
2. Op code.
3. Low byte or amount branched.
4. High byte if any.
5. Source code.

Two passes are necessary to assemble the code. During the

CONTINUED OVER

first pass the addresses of subroutines will not have been defined and so, on the first pass, if jumping or branching, the location of the first byte of the instruction is shown instead of the subroutine address. Of course after the second pass, the correct subroutine addresses should be shown.

TEST 1

VARIABLES

A	ASCII of key pressed.
LEVEL	The level reached. This will be stored in &D8E in the final game.
X%	Loop variable.

LABELS

SCREEN &2357
TREE &22F0

MAIN PROGRAM

```

20      Load machine code
      and data.
30      Load User defined
      characters.
40      Selects mode, ac-
      cesses initialisation
      routine.
50      CALLS TREE to
      display the tree, and
      waits for a key to be
      pressed.
60      CALLS SCREEN for
      each level.
70      Prints four lines of
      green background for
      the treetop.
      Eventually the scores
      and status will be
      displayed here.
80      CALLS TREE for
      each level, with a
      pause between each
      one.

```

PROCEDURES

PROCIN	
100	Defines labels.
110	Prints each user defined character for checking.
120	Waits for key to be pressed, clears the screen.

GETTING GOING

After typing in SOURCE 1 and saving it, the program should be RUN to *SAVE the data and user-defined characters. TEST1 should then be typed in (with PAGE set to &1900). On running TEST1, a display of the user-defined characters should appear across the screen. Pressing any key will display the tree. Further key presses will display each screen in turn.

Obviously only a general guide on how to debug this program (or any other for that matter!) can be given, but I have listed below some of the more likely faults.

The user defined characters should be:

238,239 message
240 blank
241 block
244 ladder
245,252 vines, sides of jail
246,247 roof

The rest are mainly foliage.

If all these are missing, check the lines that LOAD and SAVE "VDU".

If only some are missing they could be defined with 9 or 7 bytes instead of 8 in SOURCE1.

In general if the message "at line 50" or a selection of error messages appears, the routine that is CALLED is either missing, not assembled correctly, not SAVED or not LOADED properly.

If the machine hangs up or some memory is overwritten check that each routine has its RTS in the correct place.

If an extra colon is included during assembly, the instruction numbers and labels could be out of step. If a colon is omitted, an instruction could be ignored.

Missshapen tree branches generally point to an error in the data in SOURCE1. Check this section carefully for an extra item.

While testing SCREEN, if only the middle branch looks odd, check the machine code from CEN in SOURCE1.

The scenery should now be in place and next month we will see how to define the sprites and put them on the screen.



PROGRAM LISTING 1

```

10REBOUNCE SOURCE1 BY M.STANGER
20PROCIN: PROCAS
30FORX% = 0T0539: READA% : ? (&2E4+X%) = A%: NEXT
40FORX% = 0T0&1FF: READB% : ? (&2600+X%) = B%: NEXT
50*SAVE "VDU"0C6F 0CFF 801F
60*SAVE "MC1"22F0 27FF 801F
70VDU7: END
80DATA&AA,&21,&21,&21,&21,&21,&21,&21,&21,&21,&
21,&AD,&AD,&21,&21,&21,&21,&21,&AB,&AD
90DATA&AF,&AA,&AB,&AA,&AD,&21,&21,&21,&2B,&2D,&
AB,&1D,&1D,&AA,&21,&21,&21,&AB,&AF,&11
100DATA&A9,&86,0,0,0,&2A,&2D,&2B,0,&66,&61,&61,&
61,&61,&61,&61,&E7,&A9,&11
110DATA&11,0,0,0,0,0,0,0,0,&7C,0,0,0,0,0,&75
,&11,&11
120DATA&11,0,0,0,0,0,0,0,0,&7C,0,0,0,0,0,0,&75
,&11,&11
130DATA&11,&1D,&1D,&1D,&1D,&1D,&1D,&1D,&1D,&1D,&
1D,&1D,&1D,&1D,&1D,&34,&11,&11,&11
140DATA&11,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,&34,&87
,&11,&11
150DATA&11,0,0,0,0,0,0,0,0,0,0,0,0,0,0,&34,0,&
11,&11
160DATA&11,0,0,0,0,0,0,0,0,0,0,0,0,0,&34,0,&
11,&11
170DATA&11,0,0,0,0,0,0,0,0,0,0,0,0,0,0,&34,0,&
11,&11
180DATA&11,0,0,0,0,0,0,0,0,0,0,0,0,0,&34,0,&
11,&11
190DATA&11,0,0,0,0,0,0,0,0,0,0,0,0,0,&34,0,&
11,&11
200DATA&11,&11,&34,&1D,&1D,&1D,&1D,&1D,&1D,&1D,&
1D,&1D,&1D,&1D,&1D,&1D,&1D,&11,&11
210DATA&11,&86,&34,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
,&11,&11
220DATA&11,0,&34,0,0,0,0,0,0,0,0,0,0,0,0,0,0,&
11,&11
230DATA&11,0,&34,0,0,0,0,0,0,0,0,0,0,0,0,0,0,&
11,&11
240DATA&11,0,&34,0,0,0,0,0,0,0,0,0,0,0,0,0,0,&
11,&11
250DATA&11,0,&34,0,0,0,0,0,0,0,0,0,0,0,0,0,0,&
11,&11
260DATA&11,0,&34,0,0,0,0,0,0,0,0,0,0,0,0,0,0,&
11,&11
270DATA&11,&1D,&1D,&1D,&1D,&1D,&1D,&1D,&1D,&1D,&
1D,&1D,&1D,&1D,&1D,&34,&11,&11,&11

```



```

280DATA&11,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,&34,&87
,&11,&11
290DATA&11,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,&34,0,&
11,&11
300DATA&11,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,&34,0,&
11,&11
310DATA&11,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,&34,0,&
11,&11
320DATA&11,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,&34,0,&
11,&11
330DATA&11,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,&34,0,&
11,&11
340DATA&11,&1D,&1D,&1D,&1D,&1D,&1D,&1D,&1D,&1D,&1D,&
1D,&1D,&1D,&1D,&1D,&1D,&1D,&11,&11
350DATA&11,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,&34,0,&
11,&11
360DATA&11,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,&34,0,&
11,&11
370DATA&11,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,&34,0,&
11,&11
380DATA&11,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,&34,0,&
11,&11
390DATA&11,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,&34,0,&
11,&11
400DATA&11,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,&34,0,&
11,&11
410DATA0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
420DATA&11,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,&34,&87
,&11,&11
430DATA&11,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,&34,0,&
11,&11
440DATA&11,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,&1A,&1D,&1B,&
34,0,&11,&11
450DATA&11,0,0,0,0,0,0,0,0,0,0,0,0,&1A,&1D,&1B,&1E,0,0
,&34,0,&11,&11
460DATA&11,0,0,0,0,0,0,0,&1A,&1D,&1B,&1E,0,0,&7C,0
,0,&34,0,&11,&11
470DATA&11,0,0,0,&1A,&1D,&1B,&1E,0,0,&7C,0,0,&7C
,0,0,&34,0,&11,&11
480DATA0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
490DATA&11,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,&34,&87
,&11,&11
500DATA&11,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,&34,0,&
11,&11
510DATA&11,0,0,0,0,0,0,0,0,0,0,0,0,&1B,&34,&1B,0,&
34,0,&11,&11
520DATA&11,0,0,0,0,0,0,0,0,0,0,0,0,&1A,&1B,&34,0,0,&
34,0,&11,&11
530DATA&11,0,0,0,&1A,&1D,&1B,0,0,0,&1A,&1B,0,&34
,0,0,&34,0,&11,&11
540DATA&11,0,0,&1A,&1B,0,&1A,&1B,0,&1A,&1B,0,0,&
34,0,0,&34,0,&11,&11
550DATA0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
560DATA&11,0,0,0,0,0,0,0,&7C,0,&75,0,0,0,0,0,0,&34
,0,&11,&11
570DATA&11,0,0,0,0,0,0,0,&7C,0,&75,0,0,0,0,0,0,&34
,0,&11,&11
580DATA&11,&1B,&1B,&34,&1B,&1B,&34,&1D,&1B,&75,0
,0,0,0,0,&34,0,&11,&11
590DATA&11,0,0,0,&34,&7C,&75,&34,0,&1B,&1B,&34,&1B
,&1B,&34,&1B,0,&34,0,&11,&11
600DATA&11,0,0,&34,&7C,&75,&34,0,0,0,&34,&7C,&75
,&34,0,0,&34,0,&11,&11
610DATA&11,0,0,&34,&7C,&75,&34,0,0,0,&34,&7C,&75
,&34,0,0,&34,0,&11,&11
620DATA0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
630DEFPROCIN VDU23,240,0,0,0,0,0,0,0,0,0,0,0,0,0,0
640VDU23,241,255,255,255,255,255,255,255,255,255

```

```

650VDU23,242,255,129,129,129,129,129,129,129,129,129,129,129,129
660VDU23,243,255,24,24,24,24,24,24,255
670VDU23,244,255,129,129,129,255,129,129,129
680VDU23,245,64,64,64,64,64,64,64,64
690VDU23,246,3,7,15,31,63,127,255,255
700VDU23,247,128,192,224,240,248,252,254,254
710VDU23,248,60,126,255,255,255,255,126,60
720VDU23,249,255,255,126,126,126,126,60,60
730VDU23,250,255,255,255,127,127,63,63,30
740VDU23,251,255,255,255,254,254,252,252,120
750VDU23,252,2,2,2,2,2,2,2,2
760VDU23,253,255,255,255,255,255,255,126,56
770VDU23,254,255,255,255,255,126,126,60,60
780VDU23,255,60,60,126,126,126,255,255,255
790VDU23,238,0,139,218,218,170,170,138,139
800VDU23,239,0,162,182,182,170,170,162,162
810ENDPROC
820DEFFPROCAS
8300SWRCH=&FFEE:FORPASS=1T03STEP2:P%=&22F0:[OPTP
ASS
840.TREE LDA#31:JSROSWRCH:LDA#0:JSROSWRCH:LDA#3:
JSROSWRCH
850LDA#&E4:STA#70:LDA#&23:STA#71
860.BEG LDY#0:CLC:LDA(&70),Y:STA#80:AND#128:STA#
82
870LDA#80:AND#112:STA#81
880LDA#80:AND#15:STA#80
890LDA#17:JSROSWRCH:LSR#81:LSR#81:LSR#81:LSR#81:
LDA#81:JSROSWRCH
900LDA#17:JSROSWRCH:ROL#82:LDA#82:ADC#128:JSROSW
RCH
910LDA#80:ADC#240:JSROSWRCH
920CLC:LDA#70:ADC#1:STA#70:LDA#71:ADC#0:STA#71
930CMP#&26:BNEBEG:RTS
940.SCREEN LDA#DBE:AND#3:CMP#1:BEQ01:CMP#2:BEQ02
:CMP#3:BEQ03:.Q4 LDA#&80:STA#80
950.Q43 LDA#&27:STA#81
960.TRA LDY#119:LDX#119:.Q5 LDA(&80),Y:STA#245C,
X:STA#2574,X:DEX:DEY:BNEQ5
970.CEN LDX#19:LDY#0:.C1 LDA#2471,X:STA#24E4,Y:S
TA#24FA,Y:INX:DEX:BNEC1
980LDX#19:LDY#0:.C2 LDA#2485,X:STA#250E,Y:INX:DE
X:BNEC2
990LDX#19:LDY#0:.C3 LDA#2499,X:STA#2522,Y:INX:DE
X:BNEC3
1000LDX#19:LDY#0:.C4 LDA#24AD,X:STA#2536,Y:INX:DE
X:BNEC4
1010LDX#19:LDY#0:.C5 LDA#24C1,X:STA#254A,Y:INX:DE
X:BNEC5:RTS
1020.Q1 LDA#0:STA#80
1030.Q12:LDA#&26:STA#81:JMPTRA
1040.Q3 LDA#0:STA#80:JMPQ43
1050.Q2 LDA#&80:STA#80:JMPQ12
1060:1:NEXT:ENDPROC

```

PROGRAM LISTING 2

```

10REBOUNCE TEST1 BY M.STANGER
20*LO."MC1"
30*LO."VDU"
40MODE2:PROCIN
50CALL TREE:A=GET
60FORLEVEL=1TO4:??&DBE=LEVEL:CLS:CALLSCREEN
70COLOUR130:PRINTSTRING$(80," "):COLOUR128
80CALL TREE:A=GET:NEXT:END
90DEFPROCIN
100TREE=&22F0:SCREEN=&2357
110FORX%=238TO255:PRINTCHR$X%:NEXT
120A=GET:CLS:ENDPROC

```


Software Listings

Finding and choosing the correct software for your needs is a daunting task indeed, whether you are looking for a word processing package or for a new game to test your alien destroying, treasure seeking, path-finding talents!

Often you can be put off even looking through the pages of advertisements which tempt you with vivid descriptions of the amazing graphics and sound effects of the game being offered, you sit there with pen poised above cheque book and your eye catches the small print that tells you that the game will run on just about every available machine except the one sitting beside you!

But BBC and Electron owners need despair no longer

Want a program for your BBC Micro or Acorn Electron? Look no further than our listings to make your choice.

— help is at hand in the following pages. We have put together as comprehensive a list as possible of the software available for these machines. In order to fit in as many as possible we have had to use codes in some columns. The title of the software, whether it is for the BBC or the Electron, the company which produces it, the

form in which it is available, the supplier code and price; all are given for each piece of software listed. The codes used are:

Code	Explanation
Gm	Game
Bs	Business
Ut	Programming utility
Do	Domestic

Ed
A
B
E
C
D()
R

Educational
Model A BBC
Model B BBC
Electron
Cassette
Disc (40 or 80)
Rom or Eprom

As you are probably aware, new software is surfacing all the time so do not assume that there is no such item as the one you are looking for, if it is not included in the following list. Remember that much BBC software is being converted for the Electron and to avoid disappointment it is best to wait for a specifically written program. If you are aware of a piece of software that is not listed here, whether you are a user or a producer, feel free to let us know.

SOFTWARE LISTINGS

Title	Type	Manufacturers	Memory	Software Supplier	Price
ABC	Ed	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	Case	B,E	C	CE £6.95
A Cluster of Curves	Ed	Chaddington	B,E	C,D	CN £10.00
Action of the Heart	Ed	Gariatu 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,D,L	£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
All aboard	Ed	Arnold-Wheaton	B	C	AW £9.95 + VAT
Alligatacalc	Do	Alligata	B	C	SY £9.95
Alpha Graph	Ed	Arnold-Wheaton	B	C,D	AW £15.00 + VAT
Alien Dropout	Gm	Superior Software	B,E	C	SE £7.95
All Fingers Go	Ed	NEC	B	C	NC £14.95
Alpha	Ed	Golem	B	C	OB £8.05
Alphachopper	Ed	Sulis	B	C	SU £9.95
Alphabet	Ed	J B Software	B	C	JS £4.95
Alphabeta	Bs	H and H Software	B	C	HH £28.50
Amazing Ollie	Ed	Storm	B	C,D	SX £6.05, £9.95
Anagrams	Do	Cylindrical Software	A,B	C	CY £3.95
Analysar	Bs	Number One Systems	B	C,D	NO £33/45
Angles and Parallel Lines	Ed	Scholar	B	C,D	SC £5.50, £7.50
Angles and Triangles	Ed	Scholar	B	C,D	SC £5.50, £7.50
Angle Tutor	Ed	Pee Bee	B	C,D	PB £9.95, £12.45
Android Attack	Gm	Computer Concepts	B	C	GJ £7.80
Anagram	Ed	Ed.Soft	B	C	ES £4.95
Angles Navigate	Ed	Primary Programs	B	C	PP £5.95
Angle(4)	Ed	Chalksoft	B	C	KT £6.95
Angle Turner	Ed	Arnold-Wheaton	B	C,D	AW £15 + VAT
Anglezap	Gm	Gem	B	DC	GM £7.50
Animal/Vegetable/Mineral	Ed	Bourne	B,E	C	BO £8.97, £10.98
Animal, Vegetable, Mineral	Ed	Arnold-Wheton	B	C,D	AW £15 + VAT
Answer Back	Do	Kosmos	B,E	C	KM £10.95
Android Attack	Gm	Computer Concepts	B	C	GJ £8.95
Animated Arithmetic	Ed	Ludinski CAL	B	C/ D	KA £6.50/ £7.50
Animator	Ut	Screenplay	B	C	SC £11.95
Animator	Ed	Arnold-Wheaton	B	C,D	AW £9.95, £12.00 + VAT
Apollo	Gm	Software Invasion	B	C	IS £6.95
Append It	Ut	Aztec S/W	B	C	IB £3.00
Apocalypse	Gm	Red Shift	B	C	RS £9.95
Arcadians	Gm	Acornsoft	B,E	C	AL £9.95, £9.20
Arcade Action	Gm	Acornsoft	B	C	GA £11.90
Arcade 1	Gm	Odyssey	B	C	OG £3.00
Arcade Games	Gm	Ganymede Systems	B	C	GY £9.95
Area of Rectangles	Ed	Scholar	B	C,D	SC £5.00, £7.00
Area of Triangles	Ed	Scholar	B	C,D	SC £7.00, £9.00
Area Radar Controller	Gm	Software For All	B	C	KN £6.95
Arithmetic Plus 1-4	Ed	Fernleaf	B	C,D	FE £35.95
Arrow of Death (1)	Gm	Digital Fantasia	B	C	JT £6.95
Arrow of Death (2)	Gm	Digital Fantasia	B	C	NT £8.95
Artisan I	Ut	OIC	B,E	C	OI £12.75
Asteroid Storm	Gm	Micro Power	B,E	C	GK £7.95

Asteroids/Frog	Gm	Aardvark Software	B	C	IU	£4.00
Asteroid Belt	Gm	Electronics Applied	B	C	IF	£11.50
Asteroid Belt	Gm	Computer Concepts	B	C	GJ	£7.80
Asteroid Miner	Gm	Optima	B	C	OP	£8.95
Astro Navigator	Gm	Micro Power	B	C	GK	£6.95
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 Ocruplet	Ed	Dial	B	C	DL	£8.50
BCPL Calculations	Ut	Acornsoft	B	D	AL	£9.95, £11.50
Beebart	Ut	Quicksilver	B	C	QS	£14.95
Banner	Do	Micro-Aid	A,B	C	IZ	£2.95
Beamscon	Bs	Beamscon	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-BEEP	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
Beebeater	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
Binary Numbers	Ed	Chaddington	B,E	C,D	CN	£10.00
Birds of Prey	Gm	Romik	B,E	C	RO	£6.99
Bismark	Gm	ASP Software	B,E	C	AS	£6.99

SOFTWARE SUPPLIERS

Supplier Code		BK	BAKsoft
			34 Humberstone Road Cambridge
AA	Anthony Aspitel Software Systems 56 London Road Harleston Norfolk IP20 9BZ	BM	Blue Moon Software Co. Freepost Swanley Kent BR8 7UY
AB	ABC Primary 19 Crumstone Court Longmeadow Estate Killingworth Newcastle Upon Tyne	BO	Bourne Educational Software Headbourne Worthy Winchester Hants SO23 7SQ
AC	ACK Data 21 Salcombe Drive Nottingham NG5 8JF	BR	Bridge Software 36 Fernwood Marple Bridge Stockport Cheshire SK6 5BE
AD	Dial Software 72 Downend Road Downend Bristol	BS	Beamscon 20 Vaughan Avenue Hendon London NW4 4HU
AG	Superior Systems Ltd 178 West Street Sheffield WS1 4ET	BU	Busco 16 Colwill Walk Mainstone Plymouth
MO	Molimerx Ltd 1 Buckhurst Road Town Hall Square Bexhill-on-sea East Sussex	CA	Carvells 3/7 Bank Street Rugby
AJ	AJ Software 61 Jeddo Road London W1Z 9ED	CR	Carswell Computers Carswell Barn Faringdon Oxon SN7 8JN
AK	A.S.K. Ltd London House 68 Upper Richmond Road London SW15 2RP	CD	Carsondale Enterprises Ltd 44 Kingsway Stoke-on-Trent Staffordshire ST4 1JH
AL	Acornsoft Ltd 4a Market Hill Cambridge CB2 3NJ	CG	Challenge Games 64 Ferndale Road London E11
AM	Microplus Software 6 Litton Way Leeds	CH	Chalksoft Ltd 37 Willowslea Road Worcester WR3 7QP
AN	Addison-Wesley 53 Bedford Square London WC1B 3DZ	CL	Cluyd Technics Ltd., Microprocessor Centre Coach House Kelsterton Road Flint Cluyd CH6 5TH
AO	Amcom 23 Hivings Hill Chesham Bucks HP5 2PG	CM	Comsoft 7 Roman Drive Leeds West Yorkshire LS8 2DR
AP	Processor Applications 22 Mercer Close Basingstoke Hants	CN	Chaddington Software 14 Selkirk Close Worthing BN13 1PR
AS	ASP Software Number One Golden Square London W1R 3AB	CO	Computer Rentals Ltd CRL House 9 Kings Yard Carpenters Road London E15 2HO
AT	ATM King's Chambers Queen Street Derby DE1 3DA	CY	Cylindrical Software 177 College Road Moseley Birmingham B13 9LJ
AV	A J Vision Service Ltd 61 Jeddo Road London W1Z 9ED	CS	Stable Software Compton Street Compton Nr Winchester Hants
AW	Arnold-Wheaton Software Software Publishing Division Parkside Lane Leeds LS11 5TD	CT	Cottage Software Heather Cottage Selly Hill Whitby North Yorkshire
BB	Bug-Byte Mulberry House Canning Place Liverpool L1 8JB		
BE	Beebugsoft PO Box 109 High Wycombe Bucks HP11 2TD		

CONTINUED OVER

SOFTWARE LISTINGS

Title	Type	Manufacturers	Memory	Software Supplier	Price
Blogger	Gm	Alligata	B,E C	SY	£7.95
Blockbuster	Gm	Micro Power	B C	GK	£7.95
Blockfit	Ed	System	B D	SY	£46.00
Blue Dragon	Gm	MP	B,E C,D	MP	£7.48, £10.50
Boat Race	Ed	Pee Bee	B C,D	PB	£8.50, £11.00
Blackjack/ Textpro	Gm	Software Invasion	B C	IS	£6.95
Boeing 767	Gm	Flightdeck	B C	FL	£7.67
Bomb Alley	Gm	Software Invasion	B C	IS	£7.95
Bomber Scramble	Gm	Kansas	B C	KA	£9.50
Bounce	Gm	Computercat	A,B C	CC	£4.95
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	Do	Micro-Aid	B C,D,F	IZ	£9.95, £11.70
Budget	Bs	Micropax	B C	MP	£7.95
Budget-Multiproduct	Bs	Micropax	B C	MP	£12.95
Budget-Multiproduct	Bs	Micropax	B D	MP	£25.00
Bugblaster	Gm	Alligata	B,E C	SY	£7.95
Bug Bomb	Gm	Virgin Games	B C	VG	£7.95
Bumble Bee	Gm	Micro Power	B C	GK	£7.95
Business Game	Ed	Acornsoft	A,B C	AL	£9.95, £9.20
Bun Fun	Gm	Squirrel Software	A,B C	SS	£6.50
Caesar the Cat	Es	Mirror	B C	MR	£6.95
CaLIGNA -	Gm	Golden Challenge	B C,D	GC	£7.95, 10.00
Canyon	Gm	BBC Pubs	B C	KB	£10.00
Capitals	Ed	Edsoft	B C	ES	£5.95
Capitals and Punctuation	Ed	RJE Software	A,B C	RJ	£4.95
Carbohydrate Metabolism	Ed	Garland Comp.	B C	JX	£18.24
Careers Analysis	Ed	Arnold-Wheaton	B D	AW	£155 + VAT
Careers Information	Ed	Arnold-Wheaton	B D	AW	£45 + VAT
Car Journey	Ed	Heinemann	B C	HE	£9.25, + VAT
Caplett 1	Ed	Scholar	B C,D	SC	£7.00, £9.00
Caplett 2	Ed	Scholar	B C,D	SC	£5.50, £7.50
Carousel	Gm	Acornsoft	B C	AL	£9.95
Car Race	Gm	Kingfisher	B C	KF	£6.90
Cashbook Accounts	Bs	Gemini	B C	GM	£59.95
Cashbook	Do	Micro-Aid	B C	IZ	£5.95
Cashbook	Do	Micro-aid	A,B C	IZ	£13.95
Cassette 99	Ed	Ludinski CAL	A,B 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	DG	£19.50
Catalogue	Ut	Baksoft	A,B C	BK	£4.00
Cat and Mouse	Ed	Kingfisher	A,B C	KF	£6.90
Cat & Mouse	Gm	Micro Power	A,B C	GK	£4.95
Catchapple	Ed	Kingfisher	A,B C	KF	£6.90
Caveman Adventure	Gm	Program Power	B C	GK	£6.95
Caves of Anoran	Gm	FBC Systems	B C	FB	£7.00
Cells & Serpents	Gm	ASP Software	B,E C	AS	£6.99
Cells & Serpent	Gm	Hexagon S/W	A,B C	JA	£5.00
Centibug	Gm	Superior	B,E C	SE	£7.95
Central Heating	Ed	Heinemann	B C	HE	£9.25, + VAT
Cesil	Ed	Dial	B C,D	DL	£6.50, £8.00
CESCIL	Ed	Eduquest	A,B C	NW	£19.95
Cesil Interpreter	Ed	Computersmith	B C	LC	£15.00
Challenger	Gm	Joe the Liar	B C	JL	£7.45
Character Shapemaker	Ut	Square	B C	SQ	£7.00
Chargen	Ut	Busco	A,B C	BU	£3.95
Chargen and Demo	Ut	Rainbow Research	B C	RR	£8.50
Character Builder	Ut	Davensoft	A,B C	NX	£4.95
Character Definer	Ut	A.J.	B C,D	AJ	£9.95
Character Enlarger	Ut	Cylindrical Software	A,B C	CY	£3.95
Character Orientating	Ut	Cylindrical Software	A,B C	CY	£3.95
Character Generator	Ut	MP S/W	B C	JZ	£3.00
Character Generator	Ut	Software for All	B C	KN	£4.95
Characters	Ut	Computer Concepts	A,B C	GJ	£6.67
Characters & Envelope Definer	Ut	Electronics Applied	B C	IF	£5.50
Chard	Ut	System	B C	SY	£9.00
Chargen	Ut	Odyssey	A,B C	OG	£4.50
Chemical Analysis	Ed	Acornsoft	B C	AL	£13.80
Chemical Collisions	Ed	Cambridge Micro	B D	CM	£15.00, + VAT
Chemical Simulations	Ed	Acornsoft	B C	AL	£13.80
Chemical Structures	Ed	Acornsoft	B C	AL	£13.80
Chemistry	Ed	Micro Power	B,E C	GK	£6.95
Chess	Gm	Micro Power	A,B C	GK	£5.95
Chess	Gm	Micro Power	B,E C	GK	£7.95
Chess	Gm	Acornsoft	B,E C	AL	£9.95
Chess	Gm	Bug Byte	B C	EA	£11.50
Chess	Gm	Superior	B,E C	SE	£7.95
Children From Space	Ed	A.S.K.	B C	AK	£9.95
Childs Play Pack	Ed	Dial	B C,D	DL	£6.50, £8.00
CHI-Squared	Bs	Micropax	B C	MP	£7.95
CHI-Squared, contingency tables	Bs	Micropax	B C	MP	£7.95
Chords	Ed	Aztec	A,B C	AZ	£6.50
Christmas Carols	Do	Ega Beva	B C	EB	£9.95
Circle Tutor	Ed	Pee Bee	B C,D	PB	£9.95, £12.45
Circus	Gm	Digital Fantasia	B C	NT	£8.95
City Defense	Gm	Bug-BYTE	B C	BB	£7.50
Classification (In)vertebrates	Ed	Scholar	B C,D	SC	£6.00, £8.00
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
Combination Business Pack 1	Bs	Gemini	B C,D	GM	£159.00
Combination Business Pack 2	Bs	Gemini	B C,D	GM	£79.95
Combination Business Pack 3	Bs	Gemini	E C	GM	£79.95
Combination Home Pack 1	Do	Gemini	B,E C,D	GM	£79.95
Commercial Accounts	Bs	Gemini	B C	GM	£19.95
Commstar	Ut	PACE	B R	PA	£34.00
Community	Gm	Ixion	B C	IN	£6.90
Compass	Ed	GED Software	B C	GD	£4.50
Compendium	Gm	Computercat	B C	CC	£5.95
Complete Machine Code Tutor	Ed	New Generation	B C	NG	£14.95
Comput Applications Project	Ed	Addison-Wesley	B D	AN	£70.00
Connect 4	Gm	Database Software	B C	NU	£5.90
Conquering Everest	Gm	ASP Software	B,E C	AS	£6.99
Constellation	Ed	Micro Power	B C	GK	£6.95
Constellation	Do	Superior	E C	SE	£7.95
Contours/ Places	Ed	Primary	B C,D	PP	£5.95, £7.95

Co-ordinates	Ed	Primary	B	C,D	PP	£5.95, £7.95
Contract Bridge	Gm	Alligata	B	C	SY	£9.95
Contribution Analysis	BS	Micropax	B	C	MP	£7.95
Cookbook Wizardry	Do	Database Software	B	C	NU	£7.50
Copy Disc	Ut	A.J.	B	C	AJ	£5.95
Crn 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
Crossword	Ed	GSN	B	C,D	GS	£11.50, £12.50
Crunch	Ed	Oxhey Tutors	B	C	OT	£6.50
C. Rules	Gm	Ed. Soft	B	C	ES	£5.95
Cube Master	Ed	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	Gnomonica	B	C	GN	£20
Dare Devil Dennis	Gm	Visions	B	C	VI	£7.95
Darts	Gm	Superior	B	C	SE	£6.95
Database	Ut	Computercat	B	C	CC	£12.95
Database	BS	Gemini	B	C	GM	£19.95
Data-Quiz	Ut	Bryants S/W	B	C	HW	£4.88
Database	Ut	R. H. Electronics	B	C	RH	£12.95
Database	BS	Acornsoft	B	C	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
Decay	Ed	GSN	B	D	GS	£15.00
Defchr	Ut	Micro-Aid	A,B	C	IZ	£2.95
Demon Decorator	Gm	Micro Power	B	C	GK	£6.95
Demon Knight	Gm	ASP Software	B,E	C	AS	£6.99
Density and Circuit	Ed	Acornsoft	A,B	C	AL	£11.90
Descender	Gm	FBC Systems	B	C	FB	£7.50
Desert Trek	Ed	TrekkaSoft	B	C,D	TR	£5.50
Design	Ut	Beebug	B	C,D	BE	£10.00, £19.00
Desk Diary	BS	Acornsoft	A,B,E	C	AL	£9.95
Desperate Dan	Gm	Thor	B	C	TH	£5.95
Detective	Gm	ASP Software	B,E	C	AS	£6.99
Detective	Gm	Computersmith	B	C	LC	£5.50
Determination of Electrostatic	Ed	GSN	B	C,D	GS	£14.00, £15.00
Devil's Causeway	Gm	Anirog Computers	A,B	C	OA	£6.00
DFM Database	BS	Dialog	B	C/D	DG	£24.00

SOFTWARE SUPPLIERS

CU	Level 9 Computing 229 Hughenden Road High Wycombe Buckinghamshire HP13 5PG	FB	FBC Systems 10 Castlefields Main Centre Derby
CX	Contex Computing 15 Woodlands Close Cople Bedford MK44 3UE	FE	Fernleaf Educational Fernleaf House 31 Old Road West Gravesend Kent DA11 0LH
DA	Davy Computing Ltd Moorcroft House 2 Clarence Lane Sheffield S3 7UZ	FL	Flight Deck Software 25 Halsey Road Kempston Beds. MK42 8AP
DB	Dynabyte Software 31 Topcliffe Mews Wide Lane Morley Yorks	FM	4MAT Educational Software Linden Lea Rock Park Barnstaple Devon EX32 9AQ
DC	D.A.C.C. Ltd 23 Waverly Road Hindley Greater Manchester WN2 3BN	FY	Wida Software 2 Nicholas Gardens London W5 5HY
DD	DDT Software Southfield House 11 Liverpool Gardens Worthing West Sussex BN11 1RY	GC	Golden Challenge Software 2-4 Chichester Rents Chancery Lane London WC2A 1EG
DK	DK Tronics Unit 2 Shire Hill Industrial Estate Saffron Walden Essex CB11 3AX	GD	70 Stoke Road Bletchley Milton Keynes
DG	Dialog 19 Short's Gardens London WC2H 9AT	GE	A&F Software 83 Hyde Road Gorton Manchester M18 7JD
DO	Doctor Soft 258 Coneygree Road Peterborough PE2 8LR	GJ	Computer Concepts 16 Wayside Chipperfield Hertfordshire WD4 9JJ
DS	Diamondsoft Ltd Cheadle Hulme Cheadle Cheshire SK8 5YB	GK	Micro Power Ltd Northwood House North Street Leeds LS7 2AA
DY	Dynatech Microsoft Rue du Commerce Bouet St. Peter Port Guernsey C.I.	GM	Gemini 9 Salterton Road Exmouth Devon EX8 2BR
EB	Ebury Software National Magazine House 72 Broadwick Street London W1V 2BP	GN	Gnomonica 2 Stable Cottages Pleystowe, Rusper Rd Capel, Dorking Surrey RH5 5HE
EG	SESS Ltd Central Trading Estate 275-277 Bath Road Bristol BS4 3EH	GR	Griffin Software 285 Ealing Road Alperton Wembley Middlesex HA0 1HJ
EH	Heinemann Computers in Education 22 Bedford Square London	GS	Gaelsett Software 44 Exeter Close Stevenage Herts SG1 4PW
EJ	Logic Systems 85 Hemingford Road Cambridge	GY	Huntsman Walk Rugeley Staffs WS15 2SN
EL	ECL Software 29 Richmond Close Ware Herts SG12 0EN	HA	Harrison Associates Unit 307 16 Brune St London E1 7NJ
ET	Etna Software West End House West End Lane Marshchapel Lincs	HC	H.C.C.S. Associates 533 Durham Road Low Fell Gateshead Tyne and Wear NE9 5EY
EU	Educare 139a Sloane Street London SW1X 9AY		

CONTINUED OVER

SOFTWARE LISTINGS

Title	Type	Manufacturers	Memory	Software Supplier	Price
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
Disassembler	Ut	Micro Power	A,B C	GK	£5.95
Disassembler	Ut	Program Direct	A,B C	NP	£3.00
Disassembler	Ut	Davansoft	A,B C	NX	£5.95
Disassembler	Ut	C J E	A,B C	NV	£5.00
Disassembler	Ut	Microcomputers 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
Dmon	Ut	Alligata	D, E	AG	£7.95
Dmove	Ut	FBC Systems	B C	FB	£11.95, £19.95
DNA Replication	Ed	Garland Comp.	B C	JX	£12.50
Dodgy Dealer	Gm	OIC	B C	OI	£17.65
Dracula Island	Gm	Kansas	B C	KA	£6.50
Dragon Rider	Gm	Salamander	B C	SA	£9.50
Dragon Quest II	Gm	Bug Byte	B C	KP	£7.95
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
Drilla Killa	Gm	Vampire Soft	B C,D	VA	£6.90, £7.90
Droga	Gm	Acornsoft	B C,D	AL	£9.95, £11.50
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 Junior	Bs	Harrison	B D	HA	£
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	Clywd Technics	B R	CL	£38.95
Eiffel Tower	Ed	Chalksoft	B C	CH	£9.25
Einstein's Quanta Simulation	Ed	GSN	B C,D	GS	£14.00, £15.00
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
Examiner	Ed	Acornsoft	B C	AL	£9.95
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 Artificial 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.	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
Frak	Gm	Aardvark	B	C	AR	£8.95
French Abroad	Ed	Micro-Aid	B	C	IZ	£7.95
Frenzy	Gm	Persoft	A,B	C	IY	£5.75
Frenzy	Gm	Micro Power	B	C	GK	£7.95
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	RE	£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
Gamemaker	Ut	Holly	E	C	HO	£12.99
Game of Logic	Ed	N. Darwood	A,B	C	JB	£8.00
Games of Logic	Gm	Golem	A,B	C,D	B	£4.95, £6.95
Games of Strategy	Gm	B.B.C.	A,B	C	KB	£10.00
Games Pack II	Gm	Micromail	B	C	OE	£6.75
Gateway to Karos	Gm	Acornsoft	B	C	AL	£9.95
G.B. Geography	Ed	Primasoft	B	C	PR	£6.95
GCE Maths (O) 1/2	Ed	Bryants	A,B	C	HW	£9.50
Genetic Code	Ed	Garland Comp.	B	C	JX	£17.65
Geography Map	Ed	Bryants	B	C	HW	£4.85
Geography						
France/Spain/Germany/Italy/Belgium/USA/India	Ed	Corona	B	C,D	JY	£6.00, £9.00
German Irregular Verbs	Ed	Carsondale	B	C	CD	£13.80
German Master	Ed	Kosmos	B,E	C	KM	£9.95
Get it Right	Ed	Sulis	B	C	SU	£9.95
Get Set	Ed	Griffin	B,E	C	GR	£9.95

SOFTWARE SUPPLIERS

HE	Heinemann Computers in Education Freepost EM17 The Windmill Press Kingswood Tadworth Surrey KT20 6BR	IV	James Hager 7 Basset Street Camborne Cornwall TR14 8SW
HG	J Hargreaves Updown Pewley Way Guildford Surrey	HS	Simon Hessel Software 15 Lytham Court Cardwell Crescent Bershire
HH	H&H Software 53 Holloway Runcorn Cheshire WA7 4TJ	IX	Mayday Software 181 Portland Crescent Stanmore Middlesex HA7 1LR
HM	Harris McCutcheon Systems 40 Huntingdon Street London N1 1HM	IY	Persoft Freepost Baildon Shipley West Yorkshire BD17 5SX
HN	Hutchinson 17-21 Conway Road London W1P 6JD	IZ	Micro Aid 25 Fore Street Praze Camborne Cornwall TR14 0JX
HO	Holly Computers PO Box 17 Bingley W. Yorkshire BD16 3JQ	JL	Joe the Lion 213/215 Market Street Hyde Cheshire SK14 1HF
HW	Bryants (Educational) Software 1 The Hollies Chalcroft Lane North Bersted Bognor Regis PO21 5SX	JS	J.B. Software 57 Meadow Crescent Carleton Poulton-le Fylde Lancashire FY6 7QX
HX	Hexagon Software 17 Straits Road Gornal Dudley West Midlands DY3 2UR	JA	Hexagon Software 17 Cambridge Grove Otley
HY	Honeyfold Software Standfast House Bath Place, High St. Barnet London EN5 1ED	JB	N Darwood Ltd Halfacres Stroud Petersfield Hampshire GU32 3PJ
IB	Aztec Software 25 St Mark Road Deepcar Sheffield S30 5TS	JC	Futura Software 63 Lady Lane Chelmsford Essex CM2 0TQ
IC	Ian Copestake 23 Connaught Crescent Brookwood Woking Surrey GU24 0AN	JS	J.C. Software 124 Woodlands Way Southwater West Sussex RH13 7DR
IF	Electronics Applied 4 Dromore Road Carrickfergus County Antrim BT38 7PJ	JX	Garland Computing 35 Dean Hill Plymouth PL9 9AF
IJ	I J K Software 9 King Street Blackpool Lancs	JY	Corona Software Corona House 21 Tennyson Avenue London E11 2QN
IN	Ixon Software 10 The Crescent Lympham Weston-Super-Mare Somerset BS24 0BN	JZ	MP Software & Services 165 Spital Road Bromborough Merseyside L62 2AE
IS	Software Invasion 50 Elborough Street Southfields London	KA	Kansas City Systems Unit 3 Sutton Springs Wood Chesterfield S44 5XF
IU	Aardvark Software 15 Queensberry Avenue Hartlepool Cleveland TS26 9NW	KB	BBC Publications British Broadcasting Corporation 35 Marylebone High Street London W1M 4AA
		KF	Kingfisher Computer Services Durley Lane Keynsham Bristol BS18 2AQ

CONTINUED OVER

SOFTWARE LISTINGS

Title	Type	Manufacturers	Memory	Software Supplier	Price	
Get the Message	Gm	Dial	B C,D	DL	£4.95, £6.50	
Ghost/Diamonds	Gm	A Lane	A,B	C	OC	£3.00
Ghost Maze	GM	Software for All	B	C	HN	£6.95
Ghouls	Gm	Micro Power	B	C	GK	£7.95
Gideon's Gamble	Gm	Superior Software	B	C	SE	£7.95
Glooper	Gm	Microplus	B	C	AM	£6.95
Glycolysis - TCA Cycle	Ed	Garland	B	C	JX	£15.00
Gnasher	Gm	Superior	B	C	SE	£6.95
Gobbler	Gm	M G B	B	C	MG	£5.45
Golf	Gm	Microplus	B	C	AM	£4.95
Golf	Gm	Computersmith	B	C	LC	£5.50
Golforama	Gm	Dial	B	C,D	DL	£4.95, £6.50
Grand Prix	Gm	Software for All	B	C	HN	£5.95
Grand Prix	Gm	Microplus	A,B	C	AM	£4.25
Granny's Garden	Ed	4MAT	B	C,D	FM	£10.00, £12.00
Graph Capers Senior	Ed	Gem	B	C	GM	£8.50
Graphs	Ed	Bryants	A,B	C	HW	£4.85
Graphics Aid Pack	Ed	Microwave NW	B	C	MW	£8.95
Graphito	Ut	Addison-Wesley	B	C	AN	£21.95 + VAT
Grafix	Ut	Williams	B	D	WI	£10.00
Golf	Gm	Bryants S/W	B	C	HW	£4.88
Golf	Gm	Bug Byte	B	C	BB	£7.00
Golf	Gm	Computersmith	B	C	LC	£5.50
Gomoku	Gm	Micro Power	A,B	C	GK	£3.95
Graphics Package	Ut	Salamander	B	C	NZ	£24.95
Graph and Charts Pack	Bs	Acornsoft	B,E	C	AL	£9.95, £9.20
Graphics Pack	Ut	Bug-Byte	B	C	BB	£9.50
Graphs (Arithmetical)	Ed	Bryants	B	C	HW	£4.85
Great Britain Ltd	Gm	Hessel	B	C	HS	£5.95
Greater and Smaller	Ed	Scholar	B	C,D	SC	£6.50, £8.50
Grig Blitz	Gm	Computercat	B	C	CC	£5.95
Group Statistics	Bs	Micropax	B	C	MP	£7.95
Guardian	Gm	Alligata	E	C	SY	£7.95
Guided Discovery	Ed	Etna Software	B	C	ET	£9.95
Gunsmoke	Gm	Software Invasion	B	C	IS	£7.95
Guzzler	Gm	Computersmith	B	C	LC	£5.50
Handwriting 1/2	Ed	Chalksoft	B	C	CH	£9.95
Hangdroid	Gm	Micromode	B	C	MO	£4.00
Hangman	Ed	Micro Aid	B	C	IZ	£7.95
Hangman Player	Ed	Square	A,B	C	SQ	£7.00
Hangman	Gm	Micro Aid	B	C	IZ	£7.95
Hangman	Gm	Aztec S/W	A,B	C	IB	£5.50
Hangman	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
Headway	Ed	GSN	B	C,D	GS	£200.00
Heist	Gm	Softspot	B	C	SF	£6.95
Helicopter Rescue/Tunnel/Henry IV Part 1	Gm	A Lane	A,B	C	OC	£4.00
Roadrace	Ed	Penguin	B,E	C	PE	£5.95
Hell Driver	Gm	Micro Power	B,E	C	GK	£7.95
Hi-Bouncer	Gm	Mirrorsoft	B	C,D	MR	£6.95, £9.95
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
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
Howzat	Gm	A&F	B	C	GE	£6.90
Human Blood Groups	Ed	Garland	B	C	JX	£15
Hunchback	Gm	Superior Software	B	C	SE	£7.95
Hydraulics	Ed	Database Software	A,B	C	NU	£5.50
Hyperdrive	Gm	IJK	B	C	IT	£6.50
Identikit	Ed	Stell	B,E	C	ST	£7.95
'... I Do'	Do	Acornsoft	B	C	AL	£12.65
Identikit/Word Finder	Ed	Heinemann	B	C	HE	£9.25 + VAT
Index	Ut	Microwave NW	B	C	MW	£6.95
Index Numbers-Basket	Bs	Micropax	B	C	MP	£7.95
Index Numbers-Changer	Bs	Micropax	B	C	MP	£7.95
Indexit	Ut	Williams	B	D	WI	£10.00
Inhabitant	Ed	Longman	B	C,D	LM	£9.95, £12.95
Inheritance	Gm	S.W. Hessel S/W	B	C	IW	£5.95
Inheritance	Ed	Garland Comp.	B	C	JX	£34.70
Inkosi	Gm	Chalksoft	B	C	KT	£5.95
Intergalactic Trader	Gm	Micro Power	B,E	C	GK	£8.95
International Special Agent	Gm	O.K.	B	C	OK	£10.00
Intervention commercial	Bs	System	B	C	SY	£345.00
Intervention educational	Ed	System	B	C	SY	£115.00
In the Grip of Ice	Gm	O.K.	B	C	OK	£10.00
Intro	Ed	Clares	A,B	C	CL	£7.95
Introducing Map Skills 1/2	Ed	Cambridge Micro	B	C,D	CM	£13.95, £1.62
Introduction to Microcomputing in Teaching	Ed	Hutchinson	B	C	HN	£17.25
Invaders	Gm	Software Invasion	B	C	IS	£6.95
Invaders	Gm	Superior Software	B	C	SE	£7.95
Invaders	Gm	Software for All	A,B	C	KN	£6.95
Invaders	Gm	Hexagon S/W	A,B	C	JA	£6.00
Invasion	Gm	ASP Software	B,E	C	AS	£6.99
Invisible Man	Ed	Chalksoft	B	C	KT	£5.95
Invoicing	Bs	Acornsoft	B	D	AL	£24.95
Invoices and Statements	Bs	Gemini	B	C	GM	£19.95
Janeplus	Ed	Longman	B	C	LM	£14.50
Jars	Ed	Acornsoft	B	C	AL	£11.90
JCB Digger	Gm	Acornsoft	B	C	AL	£9.95, £11.50
Jet Power Pack	Gm	Micro Power	B	C	GK	£7.95
Jigsaw Puzzle	Ed	Ega Beva	B	C	EB	£9.95
Jigsaw & Sliding Puzzles	Ed	Golem	B,E	C,D	OB	£7.95, £9.95
Johnny Reb	Gm	Lothlorien	B	C	LO	£6.95
J.R.	Gm	Software for All	B	C	KN	£6.95
Julius Caesar	Ed	Penguin	B,E	C	PE	£5.95
Jumbles	Ed	Bryants S/W	B	C	HW	£4.88
Jumbo	Gm	Molimerx	B	C	AJ	£17.25
Jungle Ambush	Gm	Kindsoft	B	C	KU	£6.50
Jungle Journey	Ed	Treksoft	B	C	TR	£5.50
Junior Maths	Ed	Aztec	A,B	C	AZ	£3.00
Junior Maths Pack	Ed	Micro Power	B	C	GK	£6.95
Junior Word Splits	Ed	Sulis	B	C	SU	£9.95
Just a Mot	Ed	Sulis	B	C	SU	£9.95
Kamikaze	Gm	A&F	E	C	GE	£7.90
Keeping Myself Alive	Ed	Heinemann	B	C	HE	£9.25 + VAT
Katakombs	Gm	Golem	B	C,D	OB	£5.95, £7.95
Keyrecog	Ed	Ed. Soft	B	C	ES	£4.95
Kidney	Ed	Garland	B	C	JX	£12
Kingdom of Hamil	Gm	Acornsoft	B	C	AL	£9.95
Killer Gorilla	Gm	Micro Power	B,E	C	GK	£7.95
Knowledge Quest	Ed	Pee Bee	B	C,D	PB	£10.95, £14.45
Konexion	Gm	M and M Software	A,B	C	MM	£5

Kopffäger	Ed	Cambridge Micro	B	D	CM	£15.00 + VAT
Kremlin	Gm	Doctor Soft	B	C	DO	£6.95
Kubla Khan	Gm	Blue Moon	B	C	BM	£8.95
L	Ed	ATM	B	D	AT	£10.00
Labdis	Ut	Silversoft	B	C	SV	£6.95
Labyrinths of La Coshe	Gm	Micro Power	B	C	GK	£7.95
Ladder Maze	Gm	Superior	B	C	SE	£6.95
Landfall	Gm	Virgin Games	B	C	VG	£7.95
Language Tutor	Ed	Rainbow Research	B	C	RR	£5.00
La Princesse (French)	Ed	Aztec S/W	B	C	IB	£6.50
Language-Lab	Ed	M and M Software	A,B	C	MM	£7.50
Landfall & Serpent	Gm	GT Software	B	C	JW	£6.50
Laser Command	Gm	Micro Power	B,E	C	GK	£7.95
Laser Letters	Ed	Shards	B	C,D	SH	£6.95, £9.95
Laser Zone	Gm	Salamander	B	C	SA	£7.95
Las Vegas	Gm	R.H. Electronics	B	C	RH	£8.95
Launching Logic	Ed	Shiva	B	C	SV	£14.95
Learn Addition	Ed	ABC Primary	B	C	AB	£6.50
Learn Subtraction	Ed	ABC Primary	B	C	AB	£6.50
Leap Frog	Gm	IJK Software	B	C	IJ	£7.50
Learning Compendium I	Ed	Ega Beva	B	C	EB	£11.95
Learning Compendium II	Ed	Ega Beva	B	C	EB	£9.95
Ledger	Bs	Micro Aid	B	C	IZ	£7.95
Legion	Gm	Software Projects	B	C	SW	£7.95
Letters	Ed	Chalksoft	B	C	CH	£6.95
Let's Count	Ed	A.S.K	B	C	AK	£9.95
Letterbugs	Ed	Highlight	B	C,D	HI	£6.00, £7.00
Librarian/Word Finder	Ed	Heinemann	B	C	HE	£9.25 + VAT
Library Classification	Ut	Aztec	A,B	C	AZ	£6.50
Library Dewey Classification	Ed	Aztec S/W	B	C	IB	£6.50
Life	Gm	Ixon	A,B	C	IN	£4.75
Life Plus	Gm	Mayday	A,B	C	IX	£4.49
Lift	Ed	Cambridge Micro	B	D	CM	£15.00 + VAT
Lift off with Numbers	Ed	Shiva	B	C	SV	£14.95
Lightpen Colourgraphic	Ut	R.H. Electronics	B	C	RH	£9.95
Linear Programming	Bs	Micropax	B	C	MP	£12.95
Linear Regression, Correlation	BS	Micropax	B	C	MP	£7.95
Lines and Angles	Ed	4MAT	B	C	FM	£5
Link-4-Plus	Gm	ABC Software	A,B	C	KR	£6.95
Lisp	Ut	Acornsoft	B,E	C,R	AL	£16.85, £16.10
Lisp	Ut	Aztec	B	C	AZ	£16.85
LISP Demonstrations	Ut	Acornsoft	B	C,D	AL	£9.95, £11.50
Logo-Forth	Ut	H.C.C.S.	A,B	E	HC	£59.00
Logo 2	Ut	Computer Concepts	B	C	GJ	£10.00
Longitudinal Waves	Ed	Heinemann	B	C	EH	£12.50
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
Macbeth	Ed	Penguin	B,E	C	PE	£5.95
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

SOFTWARE SUPPLIERS

KH	Superior Software 69 Leeds Road Bramhope Leeds	MS	Musicaoft 12 Fallowfield Amphill Beds
KM	Kosmos 1 Pilgrims Close Harlington Dunstable Bedfordshire LU5 6LX	MW	Microwave NW 24 Belford Road Stretford Manchester M32 0DL
KN	Software for All 72 North Street Romford Essex	NC	National Extension College 18 Brooklands Avenue Cambridge
KU	Kudusoft 130 Main Street Tweedmouth Berwick-upon-Tweed TD15 2AW	NG	New Generation Software The Brooklands 15 Sunnybank Lyncombe Vale Bath BA2 4NA
LA	Ludinski Computer-Assisted Learning 24 Avondale Avenue Staines Middlesex	NO	Number One Systems 9a Crown Street St. Ives Huntingdon Cambs. PE17 4EB
LC	Computersmith 40 Greenfields Avenue Bromborough Wirral Merseyside L62 6DD	NP	Program Direct 37B New Cavendish Street London W1M 8JR
LM	Longman Group Longman House Burnt Mill Harlow Essex	NR	Folkade Dept PR14 66 Littledean Yate Bristol BS17 4UQ
LO	Lothlorien 56a Park Lane Poynton Cheshire SK12 1AE	NT	Digital Fantasia 24 Norbreck Road Norbreck Blackpool
MA	MP Software and Services 165 Spital Road Bromborough Merseyside L62 2AE	NU	Database Software 97 Defoe Drive Park Hill Stoke-on-Trent
MB	Microbyte Software Freepost Neuquay TR7 2BR	NV	CJE Microcomputers 25 Henry Avenue Rustington West Sussex BN16 2PA
MD	MED 640 Melton Road Thurmaston Leics	NW	Eduquest Thames Avenue Windsor Berkshire SL4 1QP
MI	Microgame Simulations 73 The Broadway Grantham Cambridge CB3 9NQ	NX	Davansoft 1 Delapoe Drive Haverfordwest Dyfed SA61 1HX
MG	MGB Software Support 52 Barley Croft Harlow Essex	OA	Oakleaf Computers Ltd 121 Dudley Road Grantham Lincs
MK	David McKeran 23 Warwick Drive East Herrington Sunderland Tyne and Wear	OB	Anirog Computers 26 Balcombe Gardens Horley Surrey
MM	M and M Software 1391 Leek Road Abbey Hulton Stoke-on-Trent Staffs ST2 8BW	OC	Golem Ltd 77 Qualitas Bracknell Berkshire RG12 4QG
MN	Merlin Computer Products 18 Mansel Street Swansea SA1 5SG	OE	A Lane (Software) 12/316 Seaside Eastbourne East Sussex BN22 7RH
MO	Micromode 32 West End Avenue Gatley Cheshire	OG	Micromail PO Box 34 Leighton Buzzard LU7 8SJ
			Odyssey Software 8 Greenbrook Avenue Hadley Wood Barnet Herts EN4 0LS

CONTINUED OVER

SOFTWARE LISTINGS

Title	Type	Manufacturer	Memory	Software Supplier	Price
Mark Book	Ed	Carvells	A,B C	CA	£5
Mark Book	Ed	BBC	A,B C	KB	£15
Martian Attack	Gm	Micropower	B C		£7.95
Mass	Ut	DDT	B R	DT	£34.95
Masterbard Hamlet	Ed	Sulis	B C	SU	£12.95
Master Copier	Ut	Aztec S/W	A,B C	IB	£6.50
Masterfile	Ut	Beebug	B CD	BE	£10.00, £19.00
Mastermind	Gm	Micro Power	A,B C	GK	£3.95
Matchup	Ed	Edsoft	B C	ES	£5.95
Mathgrid	Ed	Soft Centre	B C,D	SN	£8.00, £10.00
Maths Invaders	Ed	Stell	B,E C	ST	£7.95
Mathskills 1/II	Ed	Griffin	B,E C	GR	£11.95
Maths Man	Ed	GED Software	B C	GD	£4.00
Maths Pack	Ed	Ega Beva	B C	EB	£11.95
Maths Pack	Ed	Dial	B C,D	DL	£4.95, £6.50
Maths Topics 1	Ed	Cambridge Micro	B C,D	CM	£13.95 + VAT
Maths Topics 2	Ed	Cambridge Micro	B C,D		£15.00 + VAT
Mathspell	Ed	Diamondsoft	B C	DS	£7.95
Maths Topics 1	Ed	CUP	B C	UP	£18
Maths Translation	Ed	Corona S/W	B C	JY	£6.00
Maths Tutors, Graphs	Ed	Salamander	B,E C	SA	£9.95
Maths Tutors, Vectors	Ed	Salamander	B,E C	SA	£14.95
Matching	Ed	Clares	A,B C	CL	£5.95
Matrices	Ed	Chaddington	B,E C,D	CN	£10.00
Maze Invaders	Gm	Micro Power	B C	GK	£4.95
Maze Man	Gm	C J E	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
Merchant of Venice	Ed	Penguin	B,E C	PE	£5.95
Mercy Mission to Mars	Gm	D.A.C.C.	B C	DC	£5.95
Merlins Castle	Ed	Pumpkin	B C	PU	£5.00
Meteor Mission	Gm	Acornsoft	B C,D	AL	£9.95, £11.50
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	£15.00 + VAT
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
Milikan's Oil Drop	Ed	GSN	B C,D	GS	£14.00, £15.00
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
Minfield	Gm	Eduquest	A,B C	NW	£5.95
Minfield	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	B C	NV	£9.00
Missile Control	Gm	Microcomputers	B C	GM	£9.95
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
Mr 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
Mr Wiz	Gm	Superior	B,E C	SE	£7.95
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
Multiple Choice Maths O 1/2	Ed	Chaddington	B,E C,D	CN	£12.00
Multiple Slit Interference	Ed	GSN	B C,D	GS	£14.00, £15.00
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
Mutant Spiders	Gm	Superior	B C	SE	£6.95
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
1984	Gm	Incentive	B C	IV	£6.95
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	£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 Gulp	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
Password	Ed	MP	B	C,D	MP	£11.00, £14.00
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
Peniles	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

SOFTWARE SUPPLIERS

OK	O.K. Products 65 Rainsborowe Road Colchester Essex CO2 6JU	SA	Salamander Software 17 Norfolk Road Brighton East Sussex BN1 4AA
OP	Optima Software Ltd 36 St. Petersgate Stockport SK1 1HL	SC	Scholar Soft Coniscliffe Woolington Gdns Woolington Newcastle Upon Tyne NE13 8AP
OT	Oxhey Tutors 19 Tudor Walk Watford Herts. WD2 4NY	SC	Screenplay 134 St. Vincent Street Glasgow
PD	Philip Dodderidge 4 Grange Close Woodford Green Essex IG8 9JS	SC	Starcade 2 Elworthy Avenue Liverpool L26 7AA
PI	Pica Software 4 Beech Court Pocklington Yorks YO4 2NG	SE	Superior Software 69 Leeds Road Bramhope Leeds
PR	Primasoft 2 Spinney Close Glossop Derbyshire	SF	Softspot 29 South Crescent Prittlewell Southend Essex SS2 6TB
PS	Psion Ltd 2 Huntsworth Mews Gloucester Place London NW1 6DD	SH	Shards Software 189 Eton Road Ilford Essex IG1 2UQ
PT	Postern Ltd PO Box 2 Andoversford Cheltenham Glas. GL54 5SW	SH	Shumwari Associates 12 Marlin Court Marlow SL7 2AJ
PV	Private Tutor 29 Holloway Lane Chesham Bais Amersham Bucks	SI	Simonsoft 25 Tatham Road Abingdon Oxon OX14 1QB
QS	Quicksilver Ltd Palmerston Park House 13 Palmerston Road Southampton SO1 1LL	SJ	S.J. Grist 127 Waxwell Lane Pinner Middlesex
QT	Qualitysoft 4 James Close Bridgend Glamorgan CF32 9SJ	SK	Skywave Software 73 Curzon Road Boscombe Bournemouth BH1 4PW
PP	Primary Programs Claypits Debden Road Saffron Walden Essex CB11 3JS	SL	Silverlind Ltd 156 Newton Rd., Burton-on-Trent Staffordshire DE15 0TR
RA	Ratco Software 3/177 College Road Moseley Birmingham B13 9LJ	SM	Small School Software 41 Sinah Lane Hayling Island Hampshire PO11 0HJ
RH	R. H. Electronics Chesterton Mill French's Road Cambridge CB4 3NP	SN	Soft Centre Renrlye Cottage Okehurst Lane Billinghurst West Sussex RH14 9HR
RJ	RJE Software 143 Montague Road Leytonstone London E11 3EW	SO	Solar Soft 5 Westmorland Drive Camberley Surrey GU15 1EW
RO	Romik Software 272 Argyle Avenue Slough SL10 4HE	SP	Sapphire Software Box 67 Wakefield Yorkshire
RR	Rainbow Research 288 High Street Ponders End Enfield EN3 4HF	SQ	Square Software 12a Uplands Terrace Swansea W Glamorgan
RS	Redshift 12c Manor Road Stoke Newington London N16	SR	Starsoft 9 Chatsworth Road Worsley Manchester M28 4NU

CONTINUED OVER

SOFTWARE LISTINGS

Title	Type	Manufacturers	Memory	Software Supplier	Price
Pharaoh's Tomb	Gm	A&F Software	B C	GE	£8.00
Philosopher's Quest	Gm	Acornsoft	B C	GA	£9.95
Physics	Ed	Micro Power	A,B,E C	GK	£6.95
Picture Maths	Ed	A J Visions	B C	AV	£9.95
Picfile	Ed	Cambridge Micro	B C,D	CM	£20.08
Picture Spell	Ed	GED Software	B C	GD	£5.00
Pieman	Gm	Musicsoft	B C	MS	£3.75
Pinball	Gm	Microbyte	B C	MB	£5.95
Perspective	Ut	Aztec	B C	AZ	£6.50
Picasso GS	Ut	Odyssey	B C	OG	£4.50
Picsave	Ut	Hexagon S/W	A,B C	JA	£6.00
Pick-a-Word	Ed	Ega Beva	B C	EB	£11.95
Picture Maker	Ut	Acornsoft	B,E C	AL	£9.95
Picture Maths	Ed	A.J.	B C,D	AJ	£9.95
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
Planet of Colourful Sound	Ed	Honeyfold	B C,D	HO	£9.95
Planetoid	Gm	Acornsoft	B C	AL	£9.95
Playbox	Gm	Comsoft	B,E C,D	CM	£6.50
Play With Words	Ed	Pee Bee	B C,D	PB	£8.50
Plegaron People Eaters	Gm	R. H. Electronics	B C	RH	£8.95
Plotter	Ed	Dial	B C,D	DL	£6.50
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	Gm	Trekkssoft	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
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
Position	Gm	Micro Power	B,E C	GK	£6.95
Procaid	Ut	Micro Aid	A,B C	IZ	£3.45
Proclush	Ut	Micro-Aid	A,B C	IZ	£1.00
Procar	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
Protractor Tutor	Ed	Pee Bee	B C,D	PB	£7.80
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
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
Pyramid	Ed	Highlight	B C,D	HI	£6.00
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
Record Changer	Do	A.J.	B C,D	AJ	£12.95
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
Readability	Ed	GSN	B C,D	GS	£8.00
Report	Ed	GSN	B D	GS	£38.50
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
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
Roman Empire	Gm	Lothloriep	B C	LO	£6.95
Romeo and Juliet	Ed	Penguin	B,E C	PE	£5.95
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
School Text	Ed	GSN	B C,D	GS	£14.00
Science 1	Ed	Shards	B,E C,D	SH	£15.00
Science Pack	Ed	Dial	B C,D	DL	£6.95
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
Scrd	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
Sea Cliff Erosion	Ed	Cambridge Micro	B C,D	CM	£15.00
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
Sheepdog Trials	Ed	Bryants S/W	B C	HW	£4.80
Share Analyser	BS	Synergy	B,E C,D	SY	£14.95
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	Spellcheck (Wordwise)	Ut	Beebug	B	D	BE	£19.00
Sentence Shaker	Ed	GED Software	B	C	GD	£4.50	Spellcheck	Ed	Edsoft	B	C,D	ES	£4.95
747	Gm	Doctor Soft	B	C	DO	£7.95	Spelling	Ed	Soft Centre	B	C	SN	£6.00
747	Gm	D.A.C.C.	B	C	DC	£9.95	Spell 7 + /9 +	Ed	Primary	B	C,D	PP	£5.95,
Shadowfax	Gm	Postern	B	C	PT	£6.95							£7.95
Shape Generator	Ut	Software for All	B	C	KN	£11.50	Spelltest	Ed	Bryants	A,B	C	HW	£4.85
Shapes Package	Ed	GED Software	B	C	GD	£8.00	Spellings	Ed	ECL	B	C	EL	£5.99
Shape Snap	Ed	Ega Beva	B	C	EB	£11.95	Spitfire Command	Gm	Superior	B	C	SE	£7.95
Shop Keeper	Ed	Heinemann	B	C	HE	£9.25 + VAT	Spitfire Flight Simulator	Gm	Alligata	B	C	SY	£7.95
							Sphinx Adventure	Gm	Acornsoft	B,E	C	AL	£9.95,
Shopping	Ed	GED Software	B	C	GD	£4.50							£9.20
Shrinking Professor	Gm	A&F	B	C	GE	£8.00	Splashdown	Ed	Highlight	B	C,D	HI	£6.00,
Shuttle	Gm	Molimerx	B	C	MX	£14.95							£7.00
Shuttle Pilot	Gm	Oakleaf	B	C	OA	£9.95	Sploosh	Ed	Highlight	B	C,D	HI	£6.00,
Signals & Magic	Ed	HRH	B	C,D	HH	£4.80,							£7.00
						£6.10	Spreadsheet	Ed	Contex	B	C	CX	£7.99
Signs	Ed	Acornsoft	A,B	C	AL	£11.90	Sprites	Ut	Beebug	B	C,D	BE	£10.00,
Silversoft Index	Do/												£12.00
	Bs	Silversoft	B	D	SV	£24.99	Spy	Ut	System	B	C	SY	£24.15
Simonsoft Sprites 2	Ut	Simonsoft	B,E	C,D	SI	£12.95	Squash	Gm	Aztec S/W	A,B	C	IB	£5.50
Simple Word Processor	Do	A.J.	B	C,D	AJ	£9.95,	Staircase Stampede	Gm	Comsoft	B	C,D	CM	£7.50,
						£14.95							£9.50
Simple Queues	BS	Micropax	B	C	MP	£7.95	Standards and Variances	Bs	Micropax	B	C	MP	£7.95
Simulation Surgery	BS	Micropax	B	C	MP	£12.95	Starbattle	Gm	Kudusoft	B	C	KU	£5.50
Simulation-Carlton Trucks	Bs	Micropax	B	C	UP	£12.95	Star Battle	Gm	Superior	B	C	SE	£7.95
6502 Development System	Ut	Acornsoft	B	D	AL	£49.85	Star Gazer	Ed	Heinemann	B	C	HE	£9.25 +
Sixers	Gm	O.I.C.	B,E	C	OI	£6.95							VAT
Skwosh	Gm	Miking S/W	B	C	KC	£3.95	Starlander	Gm	Kudusoft	A,B	C	KU	£3.50
Sliding Block Puzzles	Gm	Acornsoft	B	C	AL	£9.95	Star Patrol	Gm	Kudusoft	B	C	KU	£6.50
Sliding Block Puzzle	Ed	Ega Beva	B	C	RB	£9.95	Starship Command	Gm	Acornsoft	B,E	C,R	AL	£9.95,
Ski Slalom	Gm	R.H. Electronics	B	C	RH	£8.95							£9.20
Slicker Puzzle	Gm	G.K. Tronics	B	C	DK	£6.95	Star Seeker	Do	Mirrorsoft	B	C,D	MR	£9.95,
Snail Trail	Gm	R.H. Electronics	B	C	RH	£4.95							£12.95
Snake	Gm	Kansas	B	C	KA	£8.50	Star Trader	Gm	FBC Systems	B	C	FB	£9.50
Snake	Gm	Computer Concepts	B	C	GJ	£6.67	Star Striker	Gm	Superior	B	C	SE	£7.95
Snake Pit	Gm	Postern	B	C	PT	£6.95	Starfighter	Gm	FBC Systems	B	C	FB	£7.50
Snapper	Gm	Acornsoft	B,E	C,R	AL	£9.95,	Star Trek Adventure	Gm	Superior Software	B	C	SE	£7.95
						£9.20	Star Trek	Gm	Micro Power	A,B	C	GK	£5.95
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							
Soundplan	Ut	ME & P Products	A,B	C	KK	£10.00							
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	C,D	AL	£16.85,							
						£19.90							
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 Journey	Ed	Honeyfold	B,E	C,D	HO	£9.95,							
						£11.95							
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							
Spellbound (lrg/hrq)	Ed	GSN	B	C,D	GS	£14.00,							
						£15.00							

SOFTWARE SUPPLIERS

SS	Squirrel Software 4 Bindloss Avenue Eccles Manchester M30 0DV	TH	Thor Erskine Industrial Estate Liverpool Merseyside L6 1AP
ST	Stell Software 36 Limefield Ave Whalley Lancs BB6 9RJ	UP	Cambridge University Press Edinburgh Building Shaftesbury Road Cambridge
SU	John Wiley and Sons Ltd Distribution Centre Shripney Road Bognor Regis West Sussex PO22 9SA	VA	Vampire Software PO Box MT15 Shadwell Leeds LS17 8DW
SV	Silversoft London House 271-273 King St. London W6 9LZ	VC	Vulcan Computing 32 Guildford Road 32 Guildford Road Farnham Surrey GU9 9QB
SW	Software Projects Bear Brand Complex Allerton Road Woolton Liverpool Merseyside L25 7SF	VI	Visions Software 1 Felgate Mews Studland Street London W6
SX	Storm Winchester House Wootton Grove Sherborne Dorset	VG	Virgin Games 61/63 Portobello Road London W11 3DD
SY	Synergy Software 7 St. Andrews Close Slip End Luton LU1 4DE	VN	Vine Micros Marshborough Sandwich Kent CT13 0PG
SY	System Software 12 Collegiate Crescent Sheffield S10 2BA	WI	5 Belmont Avenue Edmonton London N9 7JL
TE	Technical Education 112 City Road London EC1	YH	Yorke House Software 33 West Street Oundle Peterborough PE8 4EJ

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SOFTWARE LISTINGS

Title	Type	Manufacturers	Memory	Software Supplier	Price
Star Maze	Gm	Database Software	B C	NU	£7.50
Star Patrol	Gm	Kudusoft	B C	KU	£6.50
Startrek / Candy Floss	Gm	I.J.K.S / W	A,B C	IT	£5.95
Star Trek	Gm	Hexagon S / W	A,B C	JA	£5.50
Starpark	Ed	Micro-Aid	B C	IZ	£9.95
Starter Word Splits	Ed	Sulis	B C	SU	£9.95
Stats 1	Bs	ME & P Products	A,B C	KK	£15.00
Statistics 1 / 2	Ed	Chaddington	B,E C,D	CN	£10.00
Stock	Ed	System	B C,D	SY	£14.95
Stock Car	Gm	Micro Power	B C	GK	£7.95
Stock Control	Bs	Acornsoft	B D	AL	£24.95
Stock Control	Bs	Gemini	B C	GM	£19.95
Stock Control, classification	BS	Micropax	B C	MP	£7.95
Stock Control-EOQ	BS	Micropax	B C	MP	£7.95
Stock Control-Roq and Rol	Bs	Micropax	B C	MP	£7.95
Stockmarket	Gm	Micro-Aid	B C	IZ	£4.95
Stockmarket	Gm	ASP Software	B,E C	AS	£6.99
Story	Ed	HRH	B C,D	HH	£5.65, £6.95
Story A — Spanish Gold	Ed	Chalksoft	B C	CH	£7.95
Storybuilder	Ed	Bryants S / W	B C	HW	£4.85
Stock Valuation	Bs	Micropax	B C	MP	£7.95
Story	Ed	H&H	B,C,D (40,80)	HH	£7.50, £9.50, £10.50
Stranded	Gm	Superior	B,E C	SE	£7.95
Subkiller	Gm	D.K. Tronics	B C	DK	£6.95
Submarines	Gm	GED Software	B C	GD	£4.00
Suffixes	Ed	Golem	B C	OB	£8.05
Sum Fun	Ed	GSN	B C	GS	£8.00, £9.00
Summit (hrg/lrg)	Ed	GSN	B C,D	GS	£8.50, £9.50
Super Fruit	Gm	Simonsoft	B,E C,D	SI	£5.95
Super Fruits	Gm	D.K. Tronics	B C	DK	£6.95
Super Invaders	Gm	Acornsoft	B C	AL	£9.95
Superlife	Ed	Golem	B,E CD	OB	£4.95, £6.95
Supersquare	Ed	GSN	B C,D	GS	£8.50, £9.50
Superplot	Ut	Beebug	B C	BE	£10.00
Super Spell	Ed	Aztec	A,B C	AZ	£5.50
Supergolf	Gm	Squirrel Software	B C	SS	£7.50
Super Hangman	Gm	I.J.K. S / W	B C	IT	£3.95
Survival	Ed	System	B C	SY	£14.95
Survivor	Gm	MP Software	B,E C,D	MP	£7.48, £10.50
Swamp Monsters	Gm	M P Software	B C	JZ	£6.50
Swamp Monsters	Gm	M P Software	B C	JZ	£6.50
Swordmaster	Gm	Micrograf	B,E C,D	MF	£7.95, £10.95
Tables Test	Ed	Bryants S / W	B C	HW	£4.88
Tables	Ed	Bryants	A,B C	HW	£4.85
Tables	Ed	ECL	B C	EL	£5.99
Table Sums	Ed	Griffin	B C	GR	£9.95
Tabel Adventures	Ed	A.S.K	B C	AK	£9.95
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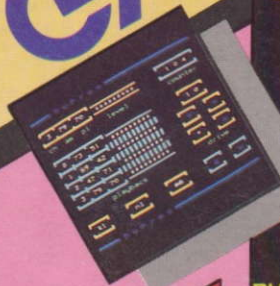
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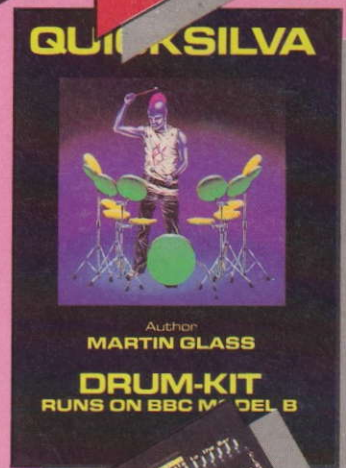


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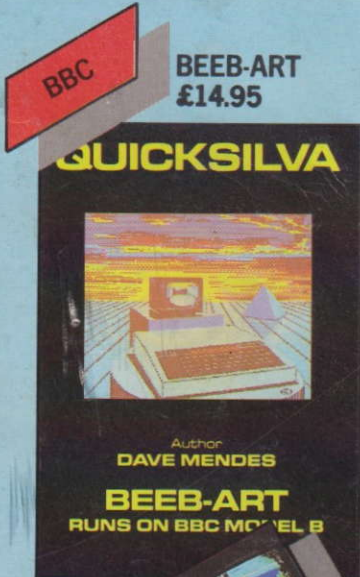
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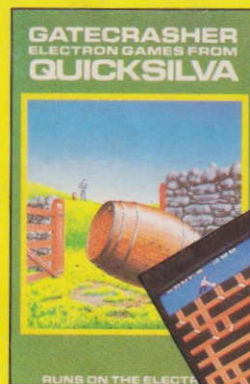
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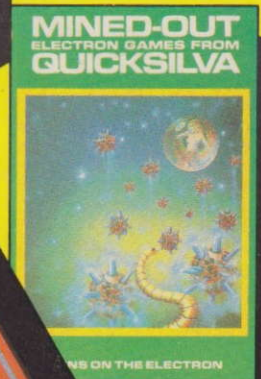
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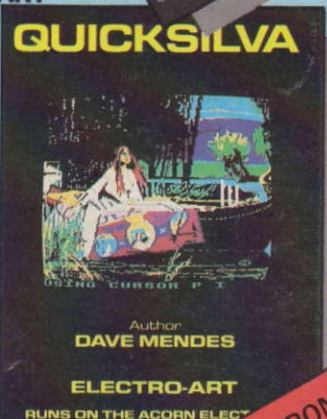
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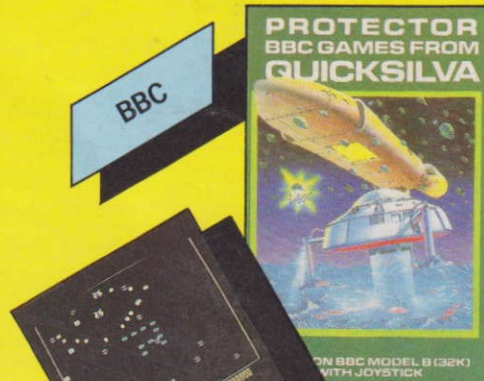
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