

# FOR THE BBC MICRO & MASTER SERIES

# REFRAN

**FILE HANDLING FOR ALL**

Nick Williams and David Spencer commence a major series of articles on the considerable topic of file handling in BASIC.

The ability to store data for subsequent access and manipulation is one of the most important and commonplace functions of a computer system, and learning how to write programs to achieve this is often a major milestone for anyone developing their programming skills. Indeed, we think that this subject is too difficult to master, and this series of articles will start right from the beginning, so no one should feel that they are excluded.

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Whenever you are going to create a data file, one of the first things you need to do is to decide what fields each record will contain. It is worth spending some time on this, as it will save a lot of trouble later on. We will create a file to contain the following information about each person:

So let's take an example. We will create a file to contain the following information about each person:

NAME, ADDRESS, PHONE, BIRTHDAY, DATE, SEX, HEIGHT, WEIGHT, HAIR, EYES, COMPLEXION, OCCUPATION, INTERESTS, HOBBIES, SPORTS, MUSIC, BOOKS, FILMS, TV, GAMES, TOYS, CLOTHING, JEWELLERY, ACCESSORIES, etc.

CREATING A DATA FILE

100 MODE 3  
110 ON ERROR GOTO 220  
120 PRINT TAB(10); "CREATE DATA FILE"  
130 INPUT "NAME"; NAME  
140 INPUT "ADDRESS"; ADDRESS  
150 INPUT "PHONE"; PHONE  
160 INPUT "BIRTHDAY"; BIRTHDAY  
170 INPUT "DATE"; DATE  
180 INPUT "SEX"; SEX  
190 INPUT "HEIGHT"; HEIGHT  
200 INPUT "WEIGHT"; WEIGHT  
210 INPUT "HAIR"; HAIR  
220 INPUT "EYES"; EYES  
230 INPUT "COMPLEXION"; COMPLEXION  
240 INPUT "OCCUPATION"; OCCUPATION  
250 INPUT "INTERESTS"; INTERESTS  
260 INPUT "HOBBIES"; HOBBIES  
270 INPUT "SPORTS"; SPORTS  
280 INPUT "MUSIC"; MUSIC  
290 INPUT "BOOKS"; BOOKS  
300 INPUT "FILMS"; FILMS  
310 INPUT "TV"; TV  
320 INPUT "GAMES"; GAMES  
330 INPUT "TOYS"; TOYS  
340 INPUT "CLOTHING"; CLOTHING  
350 INPUT "JEWELLERY"; JEWELLERY  
360 INPUT "ACCESSORIES"; ACCESSORIES  
370 PRINT "FILE CREATED SUCCESSFULLY"  
380 GOTO 100

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## Address Address

Telephone Number Phones  
Birthday Dates  
Since we will need to refer to these pieces of information (or fields) within any program, we will use names or addresses as variable names for the first four fields, but for brevity the names and dates for the last two fields are treated as strings.

CREATING A DATA FILE

We are now ready to write a simple program to create a file containing this information:

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110 INPUT "Address"; ADDRESS  
120 INPUT "Phone"; PHONE  
130 INPUT "Birthday"; BIRTHDAY  
140 INPUT "Date"; DATE  
150 INPUT "Sex"; SEX  
160 INPUT "Height"; HEIGHT  
170 INPUT "Weight"; WEIGHT  
180 INPUT "Hair"; HAIR  
190 INPUT "Eyes"; EYES  
200 INPUT "Complexion"; COMPLEXION  
210 INPUT "Occupation"; OCCUPATION  
220 INPUT "Interests"; INTERESTS  
230 INPUT "Hobbies"; HOBBIES  
240 INPUT "Sports"; SPORTS  
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330 INPUT "Accessories"; ACCESSORIES  
340 PRINT "File Created Successfully"  
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# Multi-Column Page Printer

● FILE HANDLING FOR ALL  
● DISC SPOOLER UTILITY  
● CAR PARK GAME  
● EXTENDED VECTORS

## FEATURES

Boxed in the Carpark	
Multi-Column Printing	
File Handling for All	
Now C Here (Part 3)	
BEEBUG Mini-Wimp	
BEEBUG Education	
Disc Spooler Utility	
First Course -	
Character Control (Part 3)	
The Master Pages -	
Vectoring Around	
Referencing the Master 128	
Master Hints	
Debugging DATA Statements	
Workshop -	
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### MASTER

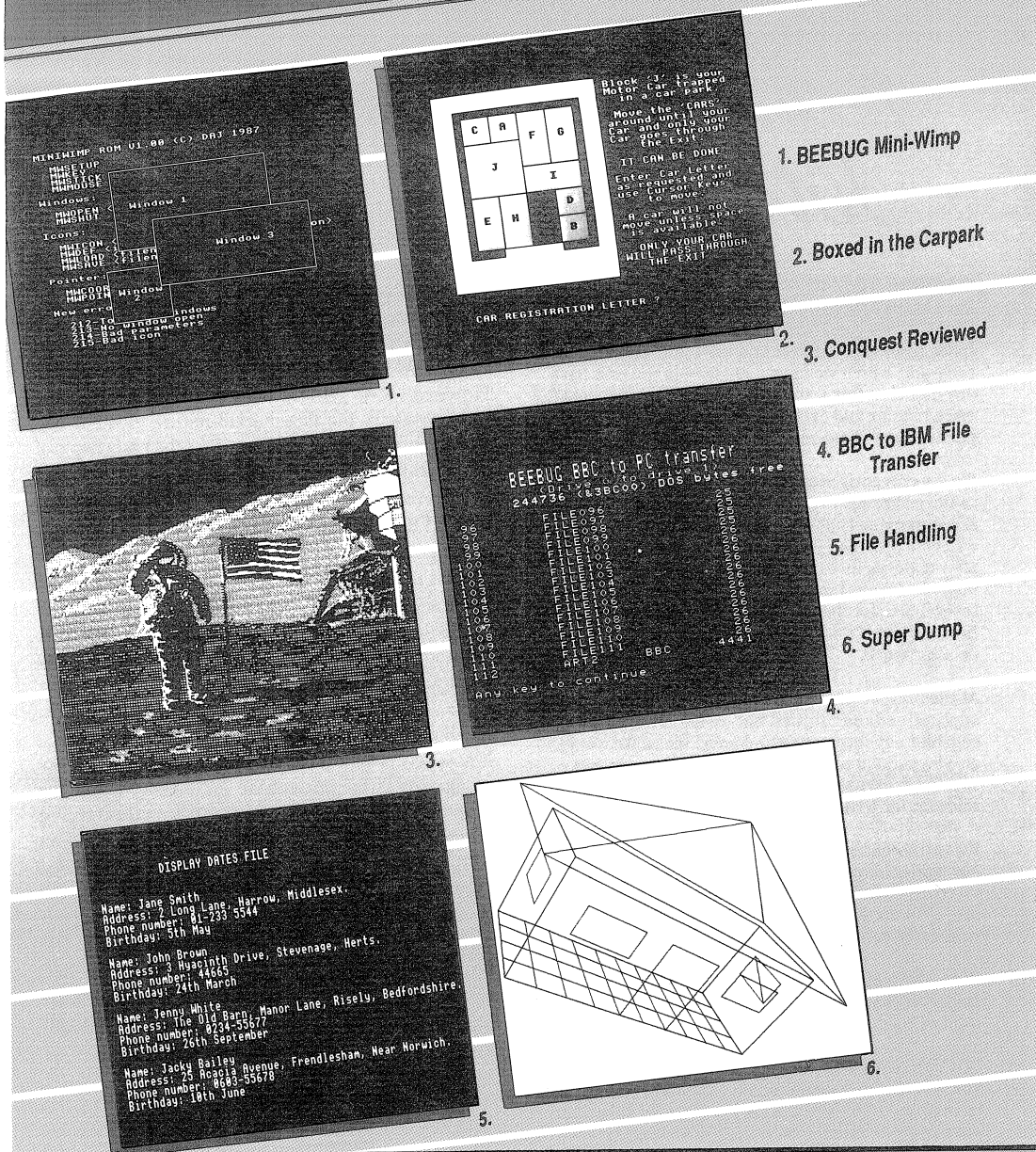
	Talking to Edit
	Edit Search and
	Replace
	Overview Problems

## PROGRAM INFORMATION

All programs listed in BEEBUG magazine are produced direct from working programs. They are listed in LISTO1 format with a line length of 40. However, you do not need to enter the space after the line number when typing in programs, as this is only included to aid readability. The line length of 40 will help in checking programs listed on a 40 column screen.

Programs are checked against all standard Acorn systems (model B, B+, Master, Compact and Electron; Basic I and Basic II; ADFS, DFS and Cassette filing systems; and the Tube). We hope that the classification symbols for programs, and also reviews, will clarify matters with regard to compatibility. The complete set of icons is given





below. These show clearly the valid combinations of machine (version of Basic) and filing system for each item, and Tube compatibility. A single line through a symbol indicates partial working (normally just a few changes will be needed); a cross shows total incompatibility. Reviews do not distinguish between Basic I and II.

### Computer System

Master (Basic IV)



Compact (Basic VI)



Model B (Basic II)



Model B (Basic I)



Electron



### Filing System

ADFS



DFS



Cassette



### Tube Compatibility

Tube



# Editor's Jottings

## CONTRIBUTING TO BEEBUG

Most of the articles and programs which we publish in BEEBUG are contributed by BEEBUG members. Indeed, many of the best and most interesting programs which we have published in the past have originated in this way. We also have a small band of more regular and experienced contributors, particularly where reviews are concerned.

We are currently seeking new material for publication in the magazine. Programs with or without accompanying explanation, short or long; all are welcome provided you believe that what you have to offer matches up to the standard of previously published material. If you have ideas for a series of several articles then we would urge you to contact us first to discuss this before undertaking too much detailed work.

At the present time we are particularly keen to receive applications and utilities, but we are always willing to consider any interesting and novel ideas. We would also be pleased to hear from any member who has specific expertise or experience which would be relevant for writing reviews.

Potential contributors are recommended to send for our leaflet *Notes of Guidance for Contributors*, available on receipt of an A5 SAE. Remember that we do pay promptly for all material published, and we have now raised our maximum rate of payment to £50 per page.

Please help us to continue to make BEEBUG the magazine that you and all other BBC micro owners will want to read.

## VOLUME 6 INDEX

You will find included with this issue a complete index to volume 6 of BEEBUG. This has been organised to provide the maximum help when searching for a previous article. With six complete volumes, our computerised bibliography Magscan makes even more sense, and can greatly speed up finding all references to a particular subject. If you have not been keeping up-to-date with the monthly Magscan updates on the magazine discs, a complete volume 6 bibliography is being included on the magazine disc for this month at no extra charge. See inside back cover for details.

## News News News N

### SHOW CANCELLED

As speculated in the last BEEBUG, the Acorn User show, due to take place at the end of July, has been postponed until an 'unspecified date'. The reason for this sudden change is rather unclear, with neither Redwood Publishing, publishers of Acorn User, or Acorn, sponsors of the show, saying very much. However, it is widely believed that Acorn were unhappy with the flea-market nature of the show, something which has increased over the past couple of years, and would rather see a much more up-market affair complete with seminars and lectures. It is thought that Acorn User are working on such a show, but it is very unlikely that it will occur this year. While Acorn's point is probably valid, one can't help thinking that a show with lots of bargain stalls will attract more people than a more formal gathering. It remains to be seen whether another organiser, such as Database Publications, steps in to fill the gap.

### ACORN PRICE INCREASES

It now seems almost certain that Acorn will announce an increase in the price of the Archimedes within the next few days. It is rumoured that this increase will be around 15%, putting about £150 on the price of an A310 with colour monitor. The price rise is attributed to increasing costs worldwide of certain integrated circuits used in the Archimedes. In particular, the price of dynamic RAM chips has increased substantially. It is not clear if the price of the Master will also rise, although any further increase in chip prices will make this almost inevitable. BEEBUG will continue to supply machines at the old price while stocks last.

### SEEING DOUBLE IN VIEW

Tubelink has just released a package that allows two documents to be edited in the View wordprocessor at the same time. The package, appropriately called Double View is 32K long, and is currently available for the Master and Compact as either two 16K ROMs or as a ROM image on disc to be loaded into sideways RAM. A model B and B+ version is promised shortly. Double View works in conjunction with your existing copy of

# News News News News News News News News N

View. The disc sells for £39.95 and the ROMs for £49.95. As well as letting you work on two documents simultaneously, Double View also offers many other improvements to View. A complete on-screen help system using pull-down menus is provided, and it is possible to cut text from a document into a clip-board, and then paste it into another document. Facilities are also provided for faster saving of part documents, and for the easy importing of spreadsheets from Viewsheets. Double View is available from Tubelink, PO Box 641, London NW9 8TF, or credit card orders on 01-205 9393.

## ARCHIE PIPEDREAM

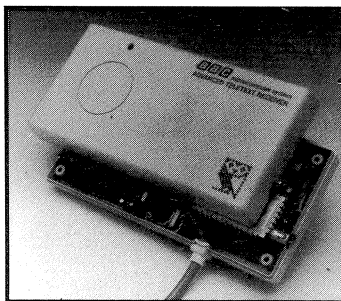
Still on the subject of word processors, Colton Software have just released a version of their Pipedream combined word processor and spreadsheet for the Archimedes. Pipedream will be best known to Beeb users in the form of View Professional (reviewed in BEEBUG Vol.6 No.4), which is almost identical, although the software is also available for the IBM PC and compatibles, and is supplied as standard on the Cambridge Computer Z88. The idea of Pipedream is that of a word processor that includes the layout and functions of a spreadsheet, with some database features thrown in for good measure. The Archimedes version of Pipedream cost £113.85 including VAT, and can be obtained from Colton Software Ltd., Highcroft, The Avenue, Madingley, Cambridge CB3 8AR, or phone (0954) 210928.

## ON-SITE REPAIRS

Acorn have signed an agreement with Granada Microcare to provide on-site maintenance for Archimedes systems. Granada, who are well proven in the field of computer leasing and on-site backup, promise an eight hour response to all calls, with a replacement machine being left if an immediate repair is not possible. The service contracts, which are available for the basic computer, mono or colour monitor, and any accessories, for periods from one to five years, cover all repair costs, including parts. The price of cover ranges from £94 per annum for a 300 series Archimedes to over £700 for a 440 with colour

monitor over 5 years. This scheme, which should prove very attractive to business users, can be handled through BEEBUG, who will arrange cover as soon as your payment and machine details are received.

## TELETEXT FROM GIS



General Information Systems, the company that brought us the Red Box home security system, has struck again, this time with a teletext

adaptor for the model B and Master 128. The GIS teletext receiver comes in a very smart looking box which is the same cream colour as the computer's case and carries the BBC logo and owl. The adaptor is powered from the computer, the only connections being a lead to the user port, and a socket for a TV aerial lead. The GIS system is fully approved by the BBC, replacing the old Acorn teletext adaptor, and comes with the latest version of BBC Soft's ATS ROM. Like the rival from Morley, the GIS unit has a built-in microprocessor, but unlike the Morley system, full control of all the primitive operations is still possible. The complete system costs £149 inclusive, and can be obtained direct from GIS, Croxton Park, Croxton, Cambridgeshire PE19 4SY.

## WORDWISE PLUS 2

Wordwise Plus 2, IFEL's enhanced version of Wordwise Plus, which was reviewed in BEEBUG Vol.6 No.7, has been reduced in price to just £32.95. Additionally, for a limited period, IFEL are supplying free with each Wordwise Plus 2 a fast sorting package. Existing Wordwise Plus 2 users can buy the sorting software for a nominal price by contacting IFEL. IFEL are at 36 Upland Drive, Plymouth, Devon PL6 6BD, or telephone (07555) 7286.

ⓑ



# ConQuest

*Roger Burg reports on Watford Electronics' latest enhancements to the Quest Mouse package.*

<b>Product</b>	<b>ConQuest</b>
<b>Supplier</b>	<b>Watford Electronics</b> Jessa House, 250 High St, Watford, Herts, WD1 2AU. Tel. (0923) 37774
<b>Price</b>	<b>£33.35 inc. VAT</b>

Watford Electronics has released ConQuest, an add-on to its excellent mode 1 graphics package Quest Paint, reviewed in BEEBUG Vol.6 No.7. The package contains a manual, a couple of information sheets and the new ROM. It also needs the mouse and ROM from Quest Paint. Once installed, seven extra drawing features become available from within Quest. Five of these features use the Acorn Graphics ROM directly.

If you have a standard BBC model B you will need an Acorn Graphics ROM in addition to the Quest and ConQuest ROMs. A disc system is also essential. Bearing in mind the number of ROMs which need to be resident inside the machine, some kind of ROM expansion board will also be needed. It is also recommended that more memory be fitted in the form of sideways RAM if ConQuest is to be used to its full potential. Fortunately the Master meets all these requirements as supplied.

Once installed, ConQuest gives the entire Quest system greater compatibility with different shadow and sideways RAM boards. On its own, it provides a font editor. You can enter the enhanced package either from Quest Paint, as before, or from ConQuest's font editor using the command \*FONTEDIT or \*WFONTEDIT (in the event of any ROM command clashes).

## THE FONT DESIGNER

The new font designer is a first class utility. Font editors flatter a mouse more than most programs, and the precision and snappy

responsiveness of this one are ideal. It has all the features which I can think of, except the ability to display a line of text, and it has a couple of new features which I haven't seen before. One of them adds or removes a complete row or column of pixels. This avoids the most befuddling and time-wasting job of balancing a font's proportions. Only the option to design Quest's brushes rather than its fonts, is less than idiot-proof.

But Quest's fonts are defined in 16 by 16 pixel grids, and spacing of characters like "i"s or "w"s is fixed in steps of 16 pixels. As the font editor necessarily adopts these restrictions, its output on screen is never more than tolerable.

## NEW GRAPHICS FACILITIES

From the font editor, either \*(W)PAINT or the Paint icon lead into Quest Paint. An extra "I/O" menu now presents the additional RAM and filing facilities, and further "Global FX" options are included as descriptive mouse-pointers. Five of these are called from Acorn's Graphics ROM: the ellipses, solid or filled option, arcs, sectors and segments. These are important facilities, and as I bemoaned the lack of rotatable ellipses in the earlier review, I must applaud them here! Acorn's Graphics ROM is slower than Quest and cannot use all its options of protected and cycled colours, but this is a small price to pay.

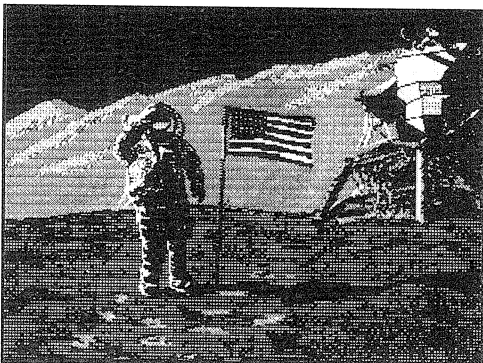
The two new features which ConQuest provides operate on the image in the cut-and-paste window. This can be read from sideways RAM or from the screen, and it is copied back to a new position, at any angle or distorted to any four-sided shape. Both are easy to use.

The implementation of the rotation is exemplary. One button press establishes the centre of the destination window, which is outlined on the screen, varying its angle of rotation smoothly according to the horizontal position of the mouse pointer. A second press can remove the point to reposition it, or begin plotting the image slowly and thoroughly.

The distortion option is similar except that drawing the initial four-sided figure is more prone to errors, and pressing the quit button undoes all the points, not just the most recent one. However, ConQuest plots the paste image

to fit the new shape equally thoroughly and fairly accurately in any four sided figure.

ConQuest does not cope with all quadrilateral distortions. However it was not intended to foreshorten "COKE" as it appears wrapped round the side of a can, nor draw a chess board receding in perspective. But both routines open up possibilities for experiment, and even if the results have to be modified by hand or rejected, Quest will do either.



#### THE MANUAL ON USING EXTRA RAM

If you're thinking of buying ConQuest to let Quest make use of extra RAM, or if you have more than one filing system already installed, then go to your dealer and check the manual first. It is precise and readable and describes the few incompatibility problems well. In short, the Graphics ROM, if used with ADFS, takes a little too much memory on a BBC B, and there is a problem with level three file servers. The manual also explains how to avoid problems which may arise between the Quest system and other resident firmware. Apart from these exceptions, Watford Electronics claim that the Quest system works happily on most combinations of hardware.

To ensure that ConQuest can use just about any proprietary RAM extension, a customised RAM driver routine of up to 64 bytes can be placed in memory at location &140 to select write access to your particular RAM board. While maximum compatibility is always welcome, it would not be unreasonable to expect a little more support in this respect.

The typestyle of a manual seldom causes comment, but the improvement over the Quest

manual's typeface is outstanding. It was difficult to maintain confidence in a graphics package whose manual is graphically weak.

#### CONCLUSIONS

Unless you have a Master, you will need to purchase the Acorn's Graphics ROM in order to run ConQuest, and if you want to use its full potential, you will be advised to install extra RAM in your machine.

When using the package you will find that Quest's button presses do not provide all the options required, and ConQuest's extra functions slightly increase the complexity of this, a small consideration, but a nuisance when you are doing something tricky or important.

The font designer, however good, is but a small bonus in Quest. If you cannot design a dozen good letters straight onto the screen you won't need to design 127 bad ones in the editor. But if you have other applications - perhaps you want to design NLQ letters for your own printer utility - you won't do better than with this package.

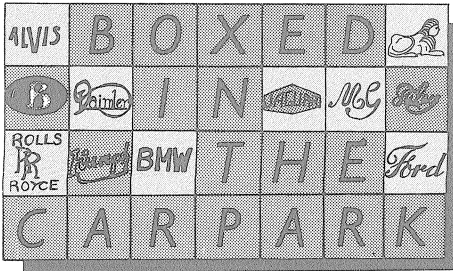
The new graphics features are useful: rotated ellipses for example, and the window transformation, both have great imaginative potential. To say that they add little to Quest must be understood as a compliment to one of the best graphics programs about, and not a slight on ConQuest.

Quest was not written with perspective in mind. You have to work hard at it to convey depth, and this is not seriously improved by the new features. It is also intended as a mode 1 designer, and apparently writes straight to the screen, which probably accounts for its speed and reduces the code, but consequently it will not use spooled files, second processors or other screen modes. So ConQuest does not do everything! But then as an add-on it only costs £33.35, and if you use mode 1 graphics seriously, and need those useful rotated ellipses - treat yourself.

#### NOTE

*Please note that ConQuest does not work with very early versions of Quest. Should you have any compatibility problems, Watford Electronics will update your existing Quest ROM to the latest version for a small handling charge.*

ⓑ



*This is one of those maddeningly simple yet frustrating games that rapidly becomes addictive. In this case G.N.Steeper's version is based on an original game over 40 years old.*

This program is an implementation on a moving-block type of puzzle that came into my possession over 40 years ago, well before the days of the microcomputer. The original was made from cardboard, but I made a more durable copy from perspex. This has stood the test of time and came to light again just recently when I was tidying up. I decided to have a go at producing a computer version of the puzzle, and the following listing is the result.

In outline, the object of the game is to 'shuffle' cars around in a carpark so that you may extricate your own vehicle (parking problems are clearly not new). In the original puzzle, the other vehicles were labelled Rover, Austin, Hillman, Riley and the like, which now arouses a touch of nostalgia for these old marques. The puzzle, though, is just as tantalising.

Type the program in and save it. When run, the program is quite self-explanatory, as the operating instructions are always in view. Do take special care to get the spacing right when typing in lines 1020 to 1070 as any error here spoils the presentation of the instructions. Moving cars around the carpark is no more complicated than entering the car's registration letter (in upper case) followed by the cursor key to indicate the direction of movement. When you have given the puzzle a fair trial and begin to doubt your ability to solve it, just press Escape and the solution will be revealed. Pressing Shift-Escape will exit from the program. Have fun.

```

10' REM Program CarPark
20 REM Version B1.0
30 REM Author G.N.Steeper
40 REM BEEBUG May 1988
50 REM Program subject to copyright
60 :
100 finish=FALSE:error=FALSE
110 ON ERROR PROCerror: IF finish THEN
END
120 IF NOT error MODE 1: PROCmenu
130 error=FALSE
140 REPEAT
150 *FX4,1
160 IF J%≠468 PROCEND
170 IF Solve=1 READ M$:IF M$="X" PROCEN
ND
180 IF Solve=1 READ Action
190 IF Solve<>1 REPEAT:PRINT TAB(2,29)
"CAR REGISTRATION LETTER ? ";M$=GET$:U
NTIL M$>="A" OR M$<="J"
200 PRINTTAB(28,29) M$;
210 IF M$="A" X%=AX%:Y%=AY%:W=a:D=b:x=
c:y=e:PROCmove:AX%=X%:AY%=Y%
220 IF M$="B" X%=BX%:Y%=BY%:W=a:D=b:x=
c:y=e:PROCmove:BX%=X%:BY%=Y%
230 IF M$="C" X%=CX%:Y%=CY%:W=a:D=b:x=
c:y=e:PROCmove:CX%=X%:CY%=Y%
240 IF M$="D" X%=DX%:Y%=DY%:W=a:D=b:x=
c:y=e:PROCmove:DX%=X%:DY%=Y%
250 IF M$="E" X%=EX%:Y%=EY%:W=a:D=B:x=
c:y=E:PROCmove:EX%=X%:EY%=Y%
260 IF M$="F" X%=FX%:Y%=FY%:W=a:D=B:x=
c:y=E:PROCmove:FX%=X%:FY%=Y%
270 IF M$="G" X%=GX%:Y%=GY%:W=a:D=B:x=
c:y=E:PROCmove:GX%=X%:GY%=Y%
280 IF M$="H" X%=HX%:Y%=HY%:W=a:D=B:x=
c:y=E:PROCmove:HX%=X%:HY%=Y%
290 IF M$="I" X%=IX%:Y%=IY%:W=A:D=b:x=
C:y=e:PROCmove:IX%=X%:IY%=Y%
300 IF M$="J" X%=JX%:Y%=JY%:W=A:D=B:x=
C:y=E:PROCmove:JX%=X%:JY%=Y%
310 UNTIL FALSE
320 :
1000 DEF PROCmenu
1010 VDU28,23,28,39,1
1020 PRINT"Block 'J' is yourMotor Car t
rapped in a car park."
1030 PRINT"" Move the 'CARS' around unt
il yourCar and only yourCar goes through
the Exit."
1040 PRINT"" IT CAN BE DONE"
1050 PRINT""Enter Car Letter as request
ed and use Cursor Keys to move."
1060 PRINT"" A car will not move unles
s space is available."

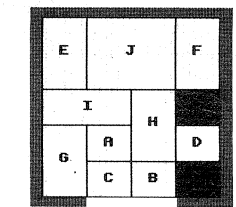
```



```

1070 PRINT" ONLY YOUR CAR WILL PASS
THROUGH THE EXIT"
1080 VDU26
1090 PROCSetup
1100 Solve=0
1110 ENDPROC
1120 :
1130 DEF PROCmove
1140 PROCcheck
1150 PROCclear
1160 IF Solve<>1 Action=GET
1170 IF Action=139 AND GOU=0 PROCdraw(0
,M$,X%,Y%,W,D,x,y):Y%=Y%+108:PROCdraw(2
,M$,X%,Y%,W,D,x,y):ENDPROC
1180 IF Action=138 AND GOD=0 PROCdraw(0
,M$,X%,Y%,W,D,x,y):Y%=Y%-108:PROCdraw(2
,M$,X%,Y%,W,D,x,y):ENDPROC
1190 IF Action=137 AND GOR=0 PROCdraw(0
,M$,X%,Y%,W,D,x,y):X%=X%+120:PROCdraw(2
,M$,X%,Y%,W,D,x,y):ENDPROC
1200 IF Action=136 AND GOL=0 PROCdraw(0
,M$,X%,Y%,W,D,x,y):X%=X%-120:PROCdraw(2
,M$,X%,Y%,W,D,x,y)
1210 ENDPROC
1220 :
1230 DEFPROCcheck
1240 f=16:g=50:h=150
1250 U1=POINT(X%+g,Y%+f):U2=POINT(X%+h,
Y%+f):IF U1=0 AND U2=0 Col=0
1260 D1=POINT(X%+g,Y%-D-g):D2=POINT(X%+
h,Y%-D-f):IF D1=0 AND D2=0 Col=0
1270 L1=POINT(X%-f,Y%-g):L2=POINT(X%-f,
Y%-h):IF L1=0 AND L2=0 Col=0
1280 R1=POINT(X%+W+f,Y%-g):R2=POINT(X%+
W+f,Y%-h):IF R1=0 AND R2=0 Col=0
1290 ENDPROC
1300 :
1310 DEFPROCdraw(Col,S$,X%,Y%,W,D,x,y)
1320 GCOL0,Col
1330 MOVE X%,Y%
1340 PLOT 69,X%+W,Y%
1350 PLOT 85,X%,Y%-D
1360 PLOT 85,X%+W,Y%-D
1370 VDU5:MOVEX%+x,Y%-y:GCOL0,0:PRINTS$
:VDU4
1380 ENDPROC
1390 :
1400 DEF PROCerror
1410 IF ERR=17 AND INKEY-1 THEN CLS:PRI
NT"Escape pressed at line ";ERL':finish
=TRUE
1420 IF ERR=17 AND NOT(INKEY-1) THEN So
lve=1:PROCSetup:PRINTTAB(2,29)"SOLUTION
COMING UP"SPC(15):VDU7:MELA=INKEY(300):V
DU7:error=TRUE

```



Block 'I' is your Motor Car trapped in a car park.

Move the CARS around until your Car and only your Car goes through the Exit.

IT CAN BE DONE

Enter Car Letter as requested and use Cursor Keys to move.

A car will not move unless space is available.

ONLY YOUR CAR WILL PASS THROUGH THE EXIT

CAR REGISTRATION LETTER ?

```

1430 IF ERR<>17 THEN CLS:REPORT:PRINT ;
" at line ";ERL':finish=TRUE
1440 ENDPROC
1450 :
1460 DEFFPROCSetup
1470 PROCdraw(3,"",0,1000,700,800,0,0)
1480 PROCdraw(1,"",84,932,544,600,0,0)
1490 PROCdraw(0,"",116,904,480,540,0,0)
1500 PROCdraw(3,"",236,360,240,28,0,0)
1510 A=232:a=112:B=208:b=100
1520 C=104:c=40:E=80:e=32
1530 EX%=120:EY%=900
1540 PROCdraw(2,"E",EX%,EY%,a,B,c,E)
1550 JX%=240:JY%=900
1560 PROCdraw(2,"J",JX%,JY%,a,B,b,E)
1570 FX%=480:FY%=900
1580 PROCdraw(2,"F",FX%,FY%,a,B,c,E)
1590 GX%=120:GY%=684
1600 PROCdraw(2,"G",GX%,GY%,a,B,c,E)
1610 IX%=240:IY%=684
1620 PROCdraw(2,"I",IX%,IY%,a,b,C,e)
1630 HX%=480:HY%=684
1640 PROCdraw(2,"H",HX%,HY%,a,B,c,E)
1650 AX%=240:AY%=576
1660 PROCdraw(2,"A",AX%,AY%,a,b,c,e)
1670 BX%=360:BY%=576
1680 PROCdraw(2,"B",BX%,BY%,a,b,c,e)
1690 CX%=120:CY%=468
1700 PROCdraw(2,"C",CX%,CY%,a,b,c,e)
1710 DX%=480:DY%=468
1720 PROCdraw(2,"D",DX%,DY%,a,b,c,e)
1730 ENDPROC
1740 :
1750 DEFFPROCclear
1760 GOU=1:GOD=1:GOL=1:GOR=1
1770 IF W=a AND U1=0 GOU=0
1780 IF W=A AND U1=0 AND U2=0 GOU=0
1790 IF W=a AND D1=0 GOD=0

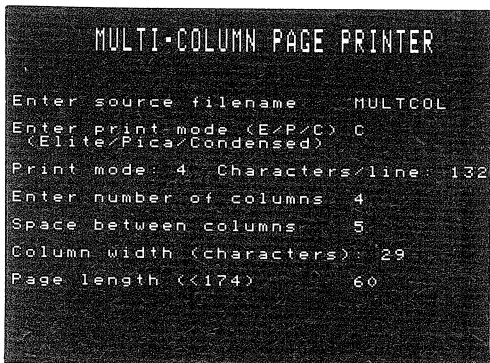
```

*Continued on page 29*

# MULTI-COLUMN PRINTING MULTI-COLUMN PRINTING MULTI-COLUMN PRINTING

*Documents printed in neat columns look really good, yet this simple layout can often be difficult to achieve. Jan Stuurman provides a versatile utility to do just that, and it may be used with almost any text file, whatever its source.*

The utility presented in this article formats any (spooled) text file into columns, and prints the result using an Epson FX-80 or compatible printer. Start by typing in the program, taking extra care with the assembler sections, and save it.



When you run the program, it will ask for the name of the source (text) file to be formatted. The program then offers a choice of three print modes: 80 characters per line (cpl) Elite, 96 cpl Pica, or 132 cpl Condensed. You must then specify the number of columns, the space between them (in characters) and the number of lines per page to be printed. All text lines output are left-justified, and are split at word boundaries except when the word is longer than the width of the column. A Return in the text signals the end of a line, while the '[' character may be used to indicate the end of a column, and similarly the ']' character to mark the end of a page, although these two special characters can be changed if desired by altering

lines 3570 and 3580. When the program has finished printing a page it will beep and wait for the space bar to be pressed, allowing the paper to be changed if printing on individual sheets. If you just want to print continuous sheets without having to press space each time then remove line 180 from the listing.

The only Epson-specific code is the setting of the print mode in line 150, and the re-setting of the printer in line 200. The print mode is selected in lines 2070-2120. It would not be difficult to change the program to work with any other printer that supports the print modes used, but which uses different codes to select them.

Almost any text file may be processed by this utility, whether originated through a word processor, text editor or any other means. Just make sure that the text is in pure ASCII format first (i.e. spool the text out from a word processor such as Wordwise, or remove any formatting commands as in View), and away you go.

```

10 REM Program MultCol
20 REM Version B1.0
30 REM Author Jan Stuurman
40 REM BEEBUG May 1988
50 REM Program subject to copyright
60 :
100 MODE7:HIMEM=PAGE+61400
110 ON ERROR GOTO900
120 PROCtitle
130 PROCinput
140 PROCassem
150 VDU2,1,27,1,33,1,pmode%,3
160 VDU28,0,24,39,22
170 REPEAT CLS:VDU2:CALL prtpage:VDU1,
13,3,7:*FX15,1
180 IF ?eofflg=0 PRINTTAB(4)CHR$133"Pr
ess <SPACE> to continue...":IF GET=32
190 UNTIL ?eofflg=&FF
200 CLOSE#S$:VDU2,1,27,1,64,3,26
210 END
220 :
900 ON ERROR OFF
910 CLOSE#0:VDU3
920 REPORT:PRINT" at line ";ERL
930 END

```

```

940 :
1000 DEFPROCtitle
1010 FOR I=0 TO 1:PRINTTAB(3,I)CHR$141C
HR$129CHR$157CHR$131"MULTI-COLUMN PAGE P
RINTER "CHR$156:NEXT
1020 ENDPROC
1030 :
2000 DEFPROCinput LOCALI%
2010 VDU28,0,24,39,5:REPEAT CLS
2020 PRINTCHR$130"Enter source filename
";TAB(25)CHR$131;
2030 INPUT"sf$:S%=OPENINSf$
2040 IF S%=0 VDU7:PRINTTAB(10)CHR$129"N
O SUCH FILE":I%=INKEY250
2050 UNTIL S%<>0
2060 VDU28,0,24,39,7
2070 REPEAT CLS:PRINTCHR$130"Enter prin
t mode (E/P/C)"
2080 PRINTCHR$130" (Elite/Pica/Condense
d)";TAB(25,0)CHR$131;
2090 P%=GET AND &5F
2100 UNTIL P%=69 OR P%=80 OR P%=67:PRIN
T CHR$P%':pmode%--(P%=80)-4*(P%=67)
2110 mlin%=80-16*(P%=80)-52*(P%=67)
2120 PRINT'CHR$134"Print mode:"CHR$133;
pmode%;TAB(15)CHR$134"Characters/line:"
CHR$133;mlin%
2130 VDU28,0,24,39,12
2140 REPEAT CLS:PRINT CHR$130"Enter num
ber of columns";TAB(25)CHR$131;
2150 INPUT"ncol%
2160 UNTIL ncol%>0ANDncol%<=mlin%
2170 VDU28,0,24,39,14
2180 REPEAT CLS:PRINTCHR$130"Space betw
een columns";TAB(25)CHR$131;
2190 INPUT"cspc%
2200 UNTIL cspc%>0 AND cspc%<=mlin%/(nc
ol%-1)
2210 cwid%=(mlin%-(ncol%-1)*cspc%)/ncol
%
2220 PRINT'CHR$134"Column width (charac
ters)":"CHR$133;cwid%
2230 mpage%=(&7C00-HIMEM)/mlin%
2240 VDU28,0,24,39,18
2250 REPEAT CLS:PRINTCHR$130"Page lengt
h (<";mpage%;")";TAB(25)CHR$131;
2260 INPUT"plen%
2270 UNTIL plen%>0ANDplen%<=mpage%
2280 ENDPROC
2290 :
3000 DEFPROCassem
3010 base=&70:lbase=&72
3020 bufptr=&74: ?&74=0

```

```

3030 eofflg=&75: ?&75=0
3040 eopflg=&76:eocflg=&77:eolflg=&78
3050 col=&79:lin=&7A
3060 off=&7B: ?&7B=cwid%+cspc%
3070 buffer=&67B
3080 osbget=&FFD7:oswrch=&FFEE
3090 :
3100 FOR pass=0 TO 2 STEP 2:P%=&900
3110 [OPTpass
3120 .prtpage LDA #0:STA eopflg
3130 LDA #HIMEM MOD256:
STA base:STA lbase
3140 LDA #HIMEM DIV256:
STA base+1:STA lbase+1
3150 JSR clearpage
3160 LDA #ncol%:STA col
3170 .columnloop LDA #0:STA eocflg
3180 LDA base:STA lbase:
LDA base+1:STA lbase+1
3190 LDA #plen%:STA lin
3200 .lineloo LDA #0:STA eolflg
3210 JSR makeline
3220 .chkeol LDA eolflg:BNE chkeoc
3230 JSR bufferreset
3240 .chkeoc LDA eocflg:BNE chkeop
3250 CLC:LDA lbase:ADC #mlin%:STA lbase
3260 BCC nocarry:INC lbase+1
3270 .nocarry DEC lin:BNE lineloo
3280 .chkeop LDA eopflg:BNE print
3290 CLC:LDA base:ADC off:STA base
3300 BCC noc:INC base+1
3310 .noc DEC col:BNE columnloop
3320 .print
3330 LDA #HIMEM MOD256:STA base
3340 LDA #HIMEM DIV256:STA base+1
3350 LDX #plen%
3360 .prloop1 LDY #0
3370 .prloop2 LDA #1:JSR oswrch
3380 LDA (base),Y:JSR oswrch
3390 INY:CPY #mlin%:BNE prloop2
3400 CLC:LDA base:ADC #mlin%:STA base
3410 BCC pnoc:INC base+1
3420 .pnoc DEX:BNE prloop1
3430 RTS
3440 :
3450 .clearpage
3460 LDX #plen%
3470 .cloop1 LDY #0:LDA #&20
3480 .cloop2 STA (lbase),Y
3490 INY:CPY #mlin%:BNE cloop2
3500 CLC:LDA lbase:ADC #mlin%:STA lbase
3510 BCC cnoc:INC lbase+1

```

*Continued on page 64*





*Mike Williams and David Spencer commence a major series of articles on the considerable topic of file handling in Basic.*

The ability to store data for subsequent access and manipulation is one of the most important and commonplace functions of a computer system, and learning how to write programs to achieve this is often a major milestone for anyone developing their programming skills. Indeed, we feel sure that there are many Basic programmers who even now still feel that this subject is too daunting to be mastered. This series of articles will start right from the beginning, so no one should feel that they are excluded.

But these articles are not aimed just at the beginner. The series will develop a general understanding of file structures and file handling techniques which we hope will prove equally useful to experienced programmers.

### CARD INDEX FILES

This month we will start from scratch by defining some useful terms, and learning some basic techniques. The simplest form of file is probably one based on the familiar card index. Such a file consists of a number of *records* (or cards), one for each entry in the file, while each record is divided into several separate pieces of information called *fields*. In a card index, and indeed in most files, every record in a given file follows exactly the same format.

Whenever you are going to create a data file, one of the first things you need to do is to sit down and decide just what fields each record is going to contain. It is worth spending some time on this, whatever type of file organisation is going to be used, as changing the file structure (that is the organisation of the file) at a later stage can be difficult if not impossible.

So let's take an example. We will create a file to contain the names and addresses of friends with details of their birthdays. Fairly obviously we need to store the following information about each person in the file:

FIELD	VARIABLE NAME
Name	Name\$
Address	Address\$
Telephone Number	Phone\$
Birthday	Date\$

Since we will need to refer to these pieces of information (or fields) within any program we will use **Name\$** and **Address\$** as variable names for the first two items, but for brevity **Phone\$** and **Date\$** for the last two respectively. All four fields are here treated as strings.

### BASIC I

Users of Basic I should note that any occurrence of **OPENUP** in programs listed in this series should be replaced by **OPENIN**. This is discussed in more detail in this first article.

### CREATING A DATA FILE

We are now ready to write a simple program to create a file containing this information. The file handling instructions needed will be explained using this example.

#### Program: CREATE

```

100 MODE 3
110 ON ERROR GOTO 220
120 PRINTTAB(10,1)"CREATE DATES FILE"
130 VDU28,0,24,79,3
140 F=OPENOUT("DATES")
150 REPEAT
160 INPUTLINE"Name: " Name$
170 INPUTLINE"Address: " Address$
180 INPUTLINE"Phone number: " Phone$
190 INPUTLINE"Birthday: " Date$
200 PRINT#F,Name$,Address$,Phone$,Date$
210 UNTIL FALSE
220 IF ERR=17 THEN PRINT""File DATES C
reated OK"
230 IF ERR<>17 THEN REPORT:PRINT" at li
ne ";ERR
240 CLOSE#F:VDU26
250 END
    
```

The program selects mode 3 and displays a title at the top of the screen before defining a text window. This will contain the dialogue which ensues as we enter the data, without corrupting or losing our main heading.

The first file related instruction is in line 140. Before a file can be used it must be *opened* ready for use. In this instance (line 140) we use OPENOUT (for output from computer to disc), specifying the name by which the file is to be known (DATES). OPENOUT checks to see if a file of the name specified already exists, and if so deletes it, before creating and opening a file ready for our use. Because of this, OPENOUT should only be used when you want to create a new file.

```

DISPLAY DATES FILE

Name: Jane Smith
Address: 2 Long Lane, Harrow, Middlesex.
Phone number: 01-233 5544
Birthday: 5th May

Name: John Brown
Address: 3 Hyacinth Drive, Stevenage, Herts.
Phone number: 44665
Birthday: 24th March

Name: Jenny White
Address: The Old Barn, Manor Lane, Risely, Bedfordshire.
Phone number: 0234-55677
Birthday: 26th September

Name: Jacky Bailey
Address: 25 Acacia Avenue, Frenclisham, Near Norwich.
Phone number: 0603-55678
Birthday: 10th June

```

When a file is opened, Basic links it to the program via a *channel*, and the number of this channel (called a *channel number* or *handle*) is returned by OPENOUT, and in our program assigned to the variable F. Any variable could be used here, but from now on all references to the file must use the file handle rather than the file name.

The REPEAT-UNTIL loop (lines 150 to 210) prompts for the input of data for each record and writes it to the file. The use of INPUTLINE means that data typed in may contain commas, quotes and the like. The PRINT# instruction in line 200 is the one which actually sends a complete record to the file. This uses a modified form of the normal PRINT statement. The difference is the reference to the channel number. We could have written each piece of data (field) to the file individually, but there is no real advantage in doing that. It also helps, for the future, to think even now in terms of reading and writing complete records.

In any case, the PRINT#F does not actually send data directly to the disc. Instead, the DFS (or ADFS) reserves part of its private memory as a *buffer*, and places the data in this. When the buffer is full the filing system copies its contents to the disc. Therefore, depending on just how much data you enter for each record, you may or may not hear the disc drive operate.

We must have some way of terminating the REPEAT-UNTIL loop. One solution is to use some special character or characters to be entered in response to the Name prompt, but unless we were to alter the program substantially we would still have to continue and enter dummy information (or just press Return) for the other fields as well. In this short program we have used Escape to get out of the loop, and as we have used no procedures or functions there are no problems. Once all the records have been entered, the program must close the file using a CLOSE instruction (referencing again just the channel number). It is also worth pointing out that CLOSE#0 will close all open files, and is useful in immediate mode for closing any files accidentally left open. The VDU26 at the end of the program simply restores the text window to full screen size.

## READING A DATA FILE

Having created our data file, the obvious thing to do is to write another short program which will allow us to display or print the contents of our file. Here is the program to do it.

```

Program: DISPLAY
100 MODE 3
110 PRINTTAB(10,1)"DISPLAY DATES FILE"
120 VDU28,0,24,79,3
130 F=OPENIN("DATES")
140 REPEAT
150 INPUT#F,Name$,Address$,Phone$,Date$
160 PRINT"Name: ";Name$
170 PRINT"Address: ";Address$
180 PRINT"Phone number: ";Phone$
190 PRINT"Birthday: ";Date$
200 UNTIL EOF#F
210 CLOSE#F:VDU26
220 END

```

As you can see, the program we need to read and display the records in the file is very similar to the one we used to create it in the first place. We must open the file before we can read any records from it. This time we use OPENIN - input from file (OPENOUT would delete the existing file and create a new empty file). We have a similar REPEAT-UNTIL loop, but we must now read each record from the file before we can display its contents on the screen. Reading data from a file uses a variation on INPUT just as writing to a file uses a variation on PRINT, again referencing the channel number.

The major difference concerns the way in which the REPEAT-UNTIL loop is terminated. We do not know how many records there are, so we must just read in records until we reach the end of the file. Fortunately there is a special function in Basic to help us with this, the keyword EOF. This references the channel number, as do all file handling instructions, and returns a value of TRUE or FALSE depending upon whether the end of the file has been reached or not. Once all the records have been read and displayed the file is closed.

### SIMPLE FILE UPDATING

So far so good, and if all this is new to you then we hope that you have been pleasantly surprised at how easy file handling can be. Let's proceed further. The two programs we have written so far are fine, but there is one major drawback. There is no way we can add additional records to an existing file. Every time we run the first program the existing file will be deleted and a new one created. We will now produce another program which allows an existing file to have further records added to it. Here it is.

#### Program:UPDATE

```
100 MODE 3
110 PRINTTAB(10,1)"UPDATE DATES FILE"
120 VDU28,0,24,79,3
130 F=OPENUP("DATES")
140 REPEAT
150 INPUT#F,Name$,Address$,Phone$,Date$
160 UNTIL EOF#F
170 ON ERROR GOTO 250
```

```
180 REPEAT
190 INPUTLINE"Name: " Name$
200 INPUTLINE"Address: " Address$
210 INPUTLINE"Phone number: " Phone$
220 INPUTLINE"Birthday: " Date$
230 PRINT#F,Name$,Address$,Phone$,Date$
240 UNTIL FALSE
250 IF ERR=17 THEN PRINT"File DATES Up
dated OK"
260 IF ERR<>17 THEN REPORT:PRINT" at li
ne ";ERR
270 CLOSE#F:VDU26
280 END
```

As you can see, this program is largely just an amalgamation of our previous two programs. In order to add new records to our existing file, we need to find the end of that file. Because we do not know how many records already exist, the only way to do this is to start at the beginning of the file and read through all the records until we get to the end (this is like the second program but without displaying the record contents), and then continue with the equivalent of the first program to add additional records as required.

You can think of this process in terms of a pointer. When a file is opened, a pointer is placed at the beginning of the file. As records are added to a file (or read from a file) the pointer is moved forward through the file. Depending upon whether we are reading or writing, the pointer will indicate either the start of the next record to be read, or the position to start writing the next record. The concept of a pointer is important in file handling, and in future articles we will look at ways of controlling its position more directly.

### OPENING FILES

You should be able to follow our latest program without too much difficulty. The one important difference is that the file is opened using OPENUP - open file for updating (not OPENIN or OPENOUT). Now much confusion seems to surround these three statements so we will try and clarify matters once and for all. According to the various user guides the three file opening instructions perform the following functions:



**OPENOUT** - Open for output to file only.

If the file does not exist, a new one is created. If a file with the same name exists it is deleted first and a new one created.

**OPENIN** - Open for input from file only.

If the file does not exist a zero channel number is returned.

**OPENUP** - Open a file for input and output.

If the file does not exist a zero channel number is returned. The one real source of confusion is that OPENUP does not exist in Basic I, but the action of OPENIN in Basic I is identical to OPENUP in Basic II. As a result, Basic I users should always replace OPENUP with OPENIN (in our third program for example).

When you want to create a new data file use OPENOUT, but as any existing file with the same name will be automatically deleted it may be worth checking first. For example, in our first program we might replace line 140 with:

```
140 IF FNcheck("DATES") THEN F=OPENOUT
("DATES") ELSE VDU26:END
1000 DEF FNcheck(filename$)
1010 LOCAL ans$,flag%,F:flag%=FALSE
1020 F=OPENIN(filename$)
1030 IF F=0 THEN flag%=TRUE ELSE INPUT"
File already exists - replace (Y/N): " a
ns$:flag%=(ans$="Y"):CLOSE#F
1040 =flag%
```

This function is quite useful and so it has been written for use with any file name which can be specified as a parameter. What the function does is to attempt to open the specified file for input from disc. If the file already exists a non-zero channel number will be allocated. This is detected by the function and the user is asked whether or not this file should be replaced. The variable flag% is set TRUE or FALSE as a result. If, when OPENIN is called, a channel number of zero is obtained, then no file of that name exists.

When accessing an existing file, we have a choice of either OPENIN or OPENUP. often, you can use OPENUP all the time for this

purpose, but you should be aware of OPENIN as its more limiting functions can actually prove useful on occasion. Basic I users should use OPENIN whenever OPENUP is specified in Basic II - there is no choice here anyway.

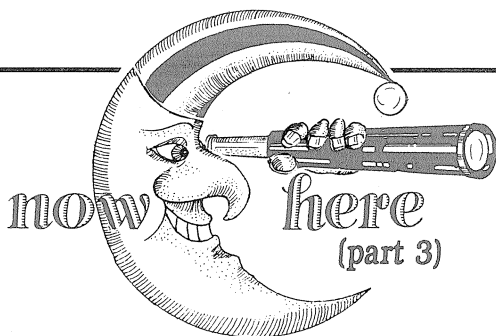
Again, some precautions are still advisable, and you are recommended to include an extra line to check that any file you try to access does exist (you might just have the wrong disc inserted for example). Simply check that the channel number is non zero. In the second and third programs we could add:

```
135 IF F=0 THEN PRINT"File not found":
VDU26:END
```

We have now reached the point where we have three simple but complete file handling programs, one to create a file, one to display the contents of the file, and a third to update the file by adding new records to it. There are, if you think about it though, two rather obvious omissions in what we have so far achieved. There is no facility to remove a record from the file, nor is there any means of changing or modifying the contents of any record in the file, either to correct any mistake we may have made on entering the data, or just because the data has changed (change of address for example).

Unfortunately, neither of these requirements is as easy to implement as the functions we have already programmed. We need to be able to locate any record that we may wish to change, and to ensure that any amended data is written back to the file so as to replace the original record. Record deletion is no easier, because even if we determine a way to blank out any record we will be left with 'holes' in our data file which may well trip up the Display or Update programs.

We'll tackle both of these problems in the next issue of BEEBUG, where we will also begin to examine how we can make all our file handling much more general so that our programs are not tied to a particular data file as here. For now, happy filing. B



*Last month's article touched on C's array handling facilities and illustrated some of the concepts with a "timerick-processor". This month, as promised, we take a look at file handling with more about arrays.*

Just about the only drawback with the BEEBUG C package is the lack of an editor. This is OK if you have a text or word processor, but is a bit limiting if you don't. I have designed a simple line editor that works much like the Basic editor, and embodies the concepts I want to cover this month. It is, however, quite lengthy and we'll have to cover it in two chunks, part this month and part next. The major part, which is quite long itself, appears at the end of the article.

## FILES

All input and output between a C program and the real world is done via *streams*. The keyboard is an *input stream*, the VDU screen and printer *output streams*. Other streams such as files are easily established and used much as with BBC Basic. Let's open a file:

```
stream_in = fopen("c.welcome", "r");
```

This is not a million miles from:

```
A=OPENIN("file")
```

Of course that's not the whole story. `stream_in` is a user-defined variable of type `FILE`. `fopen` is a standard function supplied with C. Its arguments are two strings - the first is the filename, the second the access mode. This may be one of "r" (read), "w" (write), or "a" (append), with or without a trailing "+" which signifies *update*, allowing read and write operations (similar to `OPENUP` in Basic II). The function returns a value which is used throughout the program to specify the stream. If the open is unsuccessful (e.g. file not found, catalogue full, etc.), a value of `NULL` is returned.

Naturally enough there are functions for reading from and writing to these streams. These are not part of the language as such, but are supplied in the standard library. Here is a short program to copy a file to the end of another file:

```
/** C.FAPPEND **/
/** Copies MYFILE to the end of OUTFILE **/
#include <stdio>
#include <string>
main()
{
    FILE *in, *out;
    int c;
    char infile [] = "MYFILE";
    char outfile[] = "OUTFILE";
    /* open both files */
    if((in=fopen(infile,"r")) &
        (out=fopen(outfile,"a"))){
        /* if successful, do the copy */
        while((c=fgetc(in)) != EOF)
            fputc(c,out);
        fclose(in);
        fclose(out);
    }
    else
        printf("It's all gone wrong!"); }
```

Here we have defined two pointers `*in` and `*out`, for use as file streams. We have also defined and initialised two character arrays, `infile` and `outfile` - the compiler calculates the appropriate size for the array from the initial strings. An integer `c` is used to hold the characters read because the EOF (End Of File) value is -1, and a variable of type `char` can never be negative.

The files are opened during the evaluation of the `if` condition. If the output file exists the file pointer is set to the end of the file. A null value returned by either occurrence of `fopen()` (they are connected by '&', the logical AND) causes the program to terminate via the `else` statement, otherwise the copy proceeds with the `while` loop. If the output file doesn't exist it will be created. Copying stops when the function `fgetc(in)` returns EOF, and the files are closed.

We have used three other file access functions; `fgetc(stream)` to read the next character, `fputc(integer, stream)` to write it and

`fclose(stream)`. There are others which will handle strings and formatted input and output, but let's walk before we run!

## MORE ABOUT ARRAYS

Last month's article dealt with the basic ideas about arrays and pointers. This month's project demands an extension of these ideas.

As we said, an array of variable-length strings is best held as a single character array with an array of pointers to the beginning of each string. For our editor, we must be able to insert text. This can be done by adding new lines to the end of the text array, but we need more information about each string in the array - we must identify the next and previous strings so that we can control the sequence of lines. To preserve the analogy with the Basic line editor, we will also number the lines (in tens, arbitrarily). The information we require about each line in our text file is:

- a pointer to this line in the text array;
- the line's "number";
- a pointer to the information about the previous line;
- a pointer to the information about the next line.

Thankfully, there is an alternative to the rather ghastly idea of processing four separate arrays. It's called a structure, an important and useful concept in C not found at all in Basic.

A structure is a group of variables which may be manipulated as a whole. The only operations allowed on a structure are getting its address (with '&') and accessing one of its members (with '->' - of which more later). This is quite enough though. Here is our structure for the array of controlling pointers:

```
struct txtcontrol{
char *ptext; /* pointer to text array */
int linenum; /* the line's "number" */
struct txtcontrol *prev;
struct txtcontrol *next;
};
```

The structure's name is `txtcontrol`; it consists of a character pointer (to identify the start of a line in the text array), the line's number, and two pointers *to the structure itself* (this is perfectly legal and very useful). To declare our array of

control data we simply write, somewhere after the definition of the structure:

```
struct txtcontrol info[1000];
```

or we could simply have written `info[1000]` between the final `}` and `;` of the structure definition. The structure definition itself does not reserve any variable space, it simply creates a new variable type (called `txtcontrol` in our example). The declaration of `info` gives us an array of variables, each of which has the defined structure.

Loading the text array from a file is fairly straightforward - open the file using `fopen()`, copy data to a text array using `fgetc()`, replace each newline `\n` with the standard C string terminator `\0` and call `insert()` to update our control array and copy the line to the text table proper. Each line points to, and is pointed to by, its neighbours. Writing the array to a file, and editing it in store, are only a little more complex.

## DRIVING THE EDITOR

We need now to start defining our "language" - the commands or 'verbs' we will recognise and act on. Firstly a general format must be laid down. We will be accepting a line from the keyboard consisting of an editor command and (possibly) data. Using `getstring()` to obtain this line will save reinventing the wheel.

For ease of programming, I have assumed that the command and the data will be separated by a space or comma, and have written a function called `split()` which divides the entered command line into two parts - pre-separator and post-separator. This enables commands of the form:

**LOAD file**

to be handled easily. Some commands may require more than one "argument" - think of the `LIST` command in Basic. Here again, `split()` can be used to separate the arguments. So our general syntax will be formalised as:

**VERB[<separator>arg[<separator>arg...]]**

Here, the square brackets indicate optional components of the command. A separator is either a space or a comma.

If we now turn to the insertion of lines and think of Basic, you can see that a line may be thought of as a *numeric command*! Hence if the

"verb" is numeric, the remaining text is to be inserted at a place appropriate to the numeric value of the "verb" - remembering that the line numbers do not form part of the source code. If `split()` finds that the first part of a line is numeric it returns TRUE.

Finally, we turn to the vocabulary. If our editor is to resemble Basic, we should be able to LOAD a file, SAVE a file, LIST selected lines, insert and delete lines, and (because this editor is itself a program) QUIT. Later on, we can add a few bells and whistles such as AUTO, RENUMBER, DELETE, partial SAVE and an automatic compilation-on-exit.

Each of the above commands can be written as a separate function, called from `main()`. All `main` will need to do is examine the entered line and identify which function to call. For the sake of brevity, `main()` will only recognise commands typed in full in upper case and will not output any error messages. A library function `strncmp(string1, string2, num)` is used, which compares the first `num` characters in each string and returns zero ("FALSE") if they match. To use this in an if statement which requires a TRUE in the case of a match, I have used the 'NOT' qualifier '!' (as in `!=`, 'not equal') before each function call.

I've already touched on LOADING a program. If you examine the code, you'll see that the named file is copied into a temporary text array, character by character. Whenever a return character is found, `\0` is substituted and the function `insert()` is called. Here we see structure manipulation for the first time. The function has a pointer, `ptr`, which is of type `struct txtcontrol`. This can be set to point to any element in `info` thus:

```
struct txtcontrol *ptr, *ptr1; ... ptr =
&info[n];
```

and from then on, using `ptr` in a statement will be identical in effect to using `info[n]` (until `n` is changed!). By incrementing or decrementing `ptr` we can access the next or previous element. These two statement groups are equivalent as far as `ptr1` is concerned:

```
{
n++;
```

```
ptr1 = &info[n];
}
```

```
{
ptr++;
ptr1 = ptr;
}
```

Members of a structure are identified thus:

```
old_line = info[n].linenum;
```

so using our pointer we could say:

```
old_line = *ptr.linenum;
```

A short form of this last format exists and is used in preference:

```
old_line = ptr->linenum;
```

The operator `->` consists of a hyphen followed by the 'greater than' symbol. The operation can be nested thus:

```
old_line = ptr->next->linenum
```

if `ptr->next` is a pointer to the structure of which `linenum` is a member.

Now you should be able to follow the code in the largest function, `insert()`. The incoming line number may lie outside the current range - before the first line or after the last. It may also replace the first or last line. Under these conditions only, the variables `firstpointer` and `firstline`, or `lastpointer` and `lastline` will need to be updated.

To insert a line, we scan the control data array until the right position is found. Then we must link our new line to its *previous* and *next* neighbours. If we are replacing an existing line, the old line must be unlinked and the new one joined up in its place. If the new data is a zero length string we are deleting a line, so the previous and next lines are linked together. Finally, the text is copied into the text array proper.

Turning to the LIST function, we can see how the command line is split once again to give the start and finish line numbers. These are converted from string format to numeric format by `atoi()`, a home-produced version of the library function `atoi()` - "ASCII to integer". The control array is scanned for the first specified line. You cannot just run through `info` by incrementing a subscript if lines have been inserted or deleted, so we re-initialise our

pointer (in the third portion of the for statement) by setting it first to `firstpointer` and subsequently to `ptr->next`. We then print succeeding lines until the second line number is exceeded. Piece of cake really, isn't it?

The SAVE function essentially LISTs the text to a file, and the code is correspondingly similar, except that newline characters (`\n`) replace nulls (`\0`). A partial SAVE would be disgustingly easy to implement - if you remember how `split()` works (returning TRUE if the first portion is numeric), the start and finish lines should precede the filename thus:

```
SAVE 10,300 progpt1
SAVE 310,700 progpt2
```

Well, that just about wraps it up for now. Next month we'll add some extra facilities to our editor, and look into the BEEBUG C compilation and linking processes.

C you around!

#### NOTE:

For those who do not have access to a C compiler, a fully compiled version of the editor will be included on the magazine disc when part 4 of this series is published in the next issue.

```
/* elementary line editor */
/* BY D MCSWEENEY (C) 1988 */
/* Beebug C series, part 3 */

#include <stdio>
#include <string>
#define TEXTMAX 8000
#define LINEMAX 500

/* *** external variables *** */
struct txtcontrol{
    char *ptext;
    struct txtcontrol *prev;
    int linenum;
    struct txtcontrol *next;
} info[LINEMAX];
struct txtcontrol *firstpointer, *lastpointer;
int firstline, lastline;
FILE *in, *out;
char text[TEXTMAX], *pfree;
int inc = 10;
int lineno;
int nfs; /* next free subscript in info */
```

```
char p1[6], p2[6];
/* MAIN */
main(){
    char command[5], line[74];
    char inline[80];
    int result, n;
    initialise();
    do{
        lineno = 0;
        printf("? ");
        getstring(inline, 80);
        if(split(inline, command, line))
            lineno=atoj(command);
        if(lineno > 0)
            insert(lineno, line);
        if(!strcmp(command, "LOAD", 4))
            progload(line);
        if(!strcmp(command, "SAVE", 4))
            progsave(line);
        if(!strcmp(command, "LIST", 4)){
            split(line, p1, p2);
            editcheck(p1, p2);
            proglis(atoj(p1), atoj(p2));
        }
    } while(!strcmp(command, "QUIT", 4));
    printf("That's yer lot!");
}
```

```
/* the final version of getstring */
getstring(str, max)
char str[];
int max;
{
    int n=0;
    int a;
    while((a=getchar()) != '\n' && max-- > 0){
        if(a == '\b')
            if(n > 0)
                n--;
            else
                n = 0;
        else
            str[n++] = a;
    }
    for(; n<max; n++)
        str[n] = '\0';
    return(n);
}
```

```
/* SPLIT */
/* separate command/line no from
the rest of the input line
return TRUE if part1 numeric */
split(string, part1, part2)
```

*Continued on page 62*



# THE BEEBUG MINI WIMP (pt I)

*If you want to be able to use windows, icons and pointers, but can't afford to buy an Archimedes, then this short series from David James is right up your street.*

I have always admired the sophistication of graphics achieved by packages such as the AMX mouse and BEEBUG's Icon Master; however, these all cost money, so I set about writing my own mode 4 window system in the form of a sideways ROM image. In this, the first of three articles, I will present the ROM image which is used to manipulate the windows and icons on the screen. Subsequent articles will provide a screen-based icon designer, which is itself an example of the use of the Mini-Wimp, and we will discuss other examples of the use and application of the Mini-Wimp star commands.

The ROM image for the Mini-Wimp is just over 2.5K long, with the rest of the sideways RAM bank being used as workspace by the program. The Mini-Wimp will work well on both a model B or a Master, but in the case of a model B, at least 16K of sideways RAM is needed. The Mini-Wimp provides three basic functions: Window handling; a pointer system; and an icon plotter, and it makes use of an AMX mouse if fitted.

## ENTERING THE PROGRAM

Because of the length of the original source code, we are for once publishing the Mini-Wimp in the form of a hex dump. However, the source code will be on the BEEBUG monthly disc, or you can send in an A5 SAE to get a printed listing. Entering the hex dump is made easy by the loading and error checking program in listing 1, which should be entered and saved first. Before running the loader for the first time, any file on the disc called

MWROM should be deleted. When run, the loader presents the current address at the top left, which will initially be 8000. Each line of the dump should then be entered, pressing Return at the end of each line. It is not necessary to enter the spaces between the groups of characters, although these will do no harm, and both the address at the start of each line and the blank lines should be omitted. So for example, the first two lines could be entered as:

```
0000004C2B8082154AA7<Return>
```

```
004D494E4957494DCD70<Return>
```

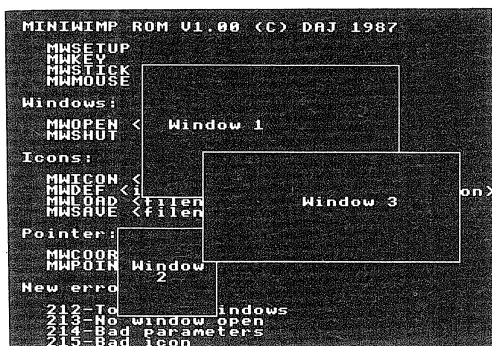
As each line is entered, the loader checks both its length and contents, and if there is any error it will beep, print a message and prompt for the line again. If Escape or Break is pressed at any point during entry, the file will be saved up to the current line, and when the loader is next run it will detect this and start at where you left off. Once all the hex dump has been entered, the loader returns to Basic, and the file MWROM contains the final ROM image.

```
10 REM Hex Dump Loader
20 REM By David Spencer
30 :
40 ON ERROR GOTO 410
50 *KEY10 CLOSE#X%|M*KEY 10|M
60 READ name$,st%,end%
70 DIM B%(9)
80 X%=OPENUP name$:IFX%=0 X%=OPENOUT
name$
90 PTR#X%=EXT#X%
100 S%=(EXT#X%+st%)AND &FFF8
110 REPEAT:REPEAT:REPEAT
120 PRINT;~S%;";":INPUT "" H$
130 L$="":FORF%=1TOLENH$
140 IFMID$(H$,F%,1)<>" " L$=L$+MID$(H$,F%,1)
150 NEXT
160 IF LEN L$<>20 VDU7:PRINT"Wrong length - Repeat line"
170 UNTIL LEN(L$)=20
180 C%=S%
190 FOR E%=0 TO 9
200 B%=EVAL("&"+MID$(L$,E%*2+1,2))
210 C%=FNcrc(C%,B%):B%(E%)=B%
220 NEXT
230 IF C% VDU7:PRINT"Checksum error - Repeat line"
240 UNTIL C%=0
250 FORF%=0TO7:BPUT#X%,B%(F%):NEXT
```

```

260 S%=S%+8
270 UNTILS%=end%
280 CLOSE#X%:*KEY 10
290 END
300 :
310 DEF FNcrc(S%,A%)
320 LOCAL F%,T%
330 S%=S%EOR A%*256
340 FORF%=1TO8
350 T%=0
360 IFS%>&7FFF S%=S%EOR&810:T%=1
370 S%=(S%*2+T%) AND &FFFF
380 NEXT
390 =S%
400 :
410 IF ERR=17 THEN CLOSE#X%:PRINT:END
420 REPORT:PRINT" at line ";ERL
430 END
440 DATA "MWROM",&8000,&8B00

```



## USING THE ROM

The Mini-Wimp ROM image should be loaded in using \*SRLOAD on a Master, or your normal loader on a model B, and then initialised by Control-Break. Typing \*HELP will list the ROM's title, while \*HELP MW will list the new star commands now available. The commands offered by the Mini-Wimp are listed below.

\*MWSETUP sets up the system and must be issued once and for all before any of the other commands.

\*MWKEY selects keyboard control of the pointer.

\*MWSTICK selects a joystick controlled pointer.

\*MWMOUSE causes the pointer commands to be passed to the AMX Super

ROM, which must be installed in a higher priority socket.

\*MWOPEN <left x, bottom y, right x, top y> opens a window on the screen. The parameters are specified in character terms with the origin (0,0) being at the top left of the screen. This is the same as when setting up text windows with VDU28. The screen under the new window is saved in sideways RAM, the window border drawn, and the background cleared. You can open a maximum of three windows at a time, and each window can be up to 30 characters wide, (or 31 if one side touches the edge of the screen).

\*MWSHUT closes the last window opened, restoring the background to its former state.

\*MWICON <0 to 63> prints 1 of the 64 possible icons at the text cursor position. Each icon consists of four characters which are printed in a 2 by 2 square. The Mini-Wimp stores these definitions in memory between &5000 and &57FF. Therefore, before using icons, HIMEM should be set to &5000. The Mini-Wimp prints the icons by redefining characters 150-153.

\*MWDEF followed by an icon number and 32 further parameters define one of the 64 icons. The data is in the same form as it would be to define a normal character. This command is very cumbersome, and a complete icon designer and editor using the Mini-Wimp will be published next month.

\*MWSAVE <filename> <start icon> <end icon> saves to the named file all the icons between the given start and end numbers. For example, \*MWSAVE ICONS 40 45 will save icons 40,41,42,43,44 and 45 to a file called ICONS.

\*MWLOAD <filename> <start icon> performs the opposite to \*MWSAVE. The first parameter is the filename, and the second is the number of the first icon to be read in. The number of icons read depends on the length of the file. For example, \*MWLOAD ICONS 1, where ICONS is the file from above, will load in icons 1 to 6.

\*MWPOINTER causes a pointer to appear on the screen. This can then be moved

around by using the cursor keys, the joystick, or an AMX mouse, depending on the option selected by \*MWKEY etc. The command exits when Copy, the joystick fire button, or a mouse button is pressed, and returns the pointer's character position in the Basic variables X% and Y%. When controlling the pointer from the keyboard, there are two speeds at which the pointer moves. You can toggle between these speeds by pressing the Caps Lock key.

## TESTING THE ROM

Once the ROM image has been loaded, it can be tested as follows: Type MODE 4 followed by COLOUR 129:COLOUR 0:CLS, which will select the correct mode and reverse the colours. Now type \*MWSETUP to initialise all the ROM's workspace. Then fill the screen with text, using for example \*HELP. A sample window can be opened by typing \*MWOPEN

10,20,30,10, which should clear the middle of the screen. Finally, this window can be closed using \*MWSHUT.

## TECHNICAL DETAILS

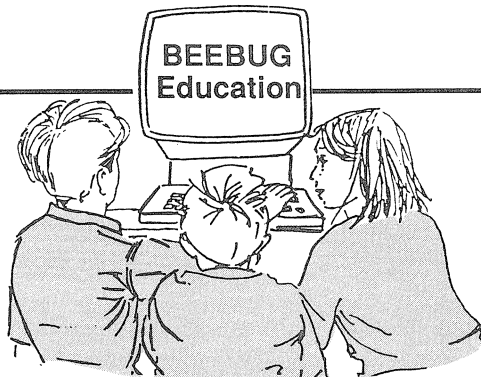
The Mini-Wimp uses memory from &70 to &8F as general workspace, and also memory from &5000 to &57FF for the icons. This icon area is just below mode 4 screen memory. Characters 150 to 153 are re-defined each time an icon is plotted, and therefore shouldn't be used elsewhere. Although the program was written for a model B with sideways RAM, it runs just as well on the Master 128 and Compact provided that shadow RAM is not used, due to the way screen memory is accessed directly.

*Next month we bring you an icon designer, which not only designs icons for the Mini-Wimp, but also uses the Mini-Wimp system itself.*

8000:0000 004C 2B80 8215 4AA7	8100:FFA9 0820 EEEF 20EE 36FD	8200:16A5 84C9 20B0 10A5 1538
8008:004D 494E 4957 494D CD70	8108:FFA9 9820 EEEF A999 C484	8208:86C9 20B0 0AA5 8438 84EF
8010:5020 524F 4D00 2843 40DF	8110:20EE FFA9 0B20 EEEF BF19	8210:E586 9003 4C1C 82A2 A88F
8018:2920 3139 3837 2044 3CC7	8118:4CA2 8086 77A2 008A 971C	8218:034C EE87 A683 CAA4 7C88
8020:6176 6964 204A 616D 934A	8120:4820 3981 B010 8578 14F7	8220:8688 A585 38E5 8318 C578
8028:6573 0008 C904 F009 85E9	8128:68AA A578 9DFB 8AE8 3B67	8228:6903 8573 A584 38E5 7724
8030:C909 D003 4C0E 8828 9A0A	8130:E477 D0EB 1860 6838 423E	8230:8618 6903 8574 A583 2DCB
8038:6048 9848 8A48 B1F2 C705	8138:6020 B181 A200 B1F2 40CE	8238:D003 E8C6 73A5 85C9 0DEA
8040:29DF C94D D055 C8B1 3A71	8140:C920 F020 C92C F01C B110	8240:27D0 02C6 73A5 86D0 D22E
8048:F229 DFC9 57D0 4CC8 9FC5	8148:C9D0 F018 C930 9012 7464	8248:03C8 C674 A584 C91F 4841
8050:A200 8478 A478 BD53 809A	8150:C93A B00E 38E9 3095 DD59	8250:D002 C674 A573 C921 2603
8058:8AC9 20F0 1D85 77B1 6E7E	8158:8DE8 C8E0 04F0 034C 9E05	8258:B0BD 0A0A 0A85 7320 A9FB
8060:F229 DFC5 77D0 05C8 69AF	8160:3E81 3860 C88A F0FA 6E67	8260:E783 A687 E003 D005 B492
8068:E84C 5680 8A29 F818 4762	8168:E003 F01D E002 F00D AE24	8268:A201 4CEE 87E6 878A 5AA0
8070:6908 AAC9 60F0 244C 3BF8	8170:A58D 858F A900 858D DCD6	8270:A204 182A CAD0 FBAA 0213
8078:5480 B1F2 C9D0 F007 21C0	8178:858E 4C89 81A5 8E85 6ED5	8278:A57B 9D2B 8BE8 A57D 8758
8080:C920 F003 4C9B 808A 9784	8180:8FA5 8D85 8EA9 0085 8FE6	8280:9D2B 8BE8 A57F 9D2B 1D41
8088:29F8 186A 6AAA BDB3 A7F8	8188:8DA9 00A6 8DF0 0818 3DBD	8288:8BE8 A581 9D2B 8BE8 F2D1
8090:8A85 77BD B48A 8578 8170	8190:6964 B0CE CAD0 F8A6 76DE	8290:A579 9D2B 8BE8 A57A 1C12
8098:6C77 0068 AA68 A868 211B	8198:8EF0 0818 690A B0C2 7827	8298:9D2B 8BE8 A575 9D2B 7E56
80A0:2860 68AA 68A8 6828 3F73	81A0:CAD0 F8A6 8FF0 0818 2F15	82A0:8BE8 A576 9D2B 8BE8 5708
80A8:A900 60A2 0120 1B81 EB6E	81A8:6901 B0B6 CAD0 F818 2FFD	82A8:A573 9D2B 8BE8 A574 C4B2
80B0:B009 A200 BDFB 8AC9 92CE	81B0:60B1 F2C9 20D0 04C8 C8E9	82B0:9D2B 8BAA A000 B175 A1EB
80B8:4090 05A2 044C EE87 AB03	81B8:4CB1 8160 A204 201B 80C7	82B8:9179 C8C4 73D0 F7A9 20D1
80C0:8575 A900 8576 A005 2CA9	81C0:81B0 54A5 8385 7BA5 5CC5	82C0:4018 6575 8575 A901 91BE
80C8:0675 2676 88D0 F9A9 BD2B	81C8:8485 7DA5 8585 7FA5 314B	82C8:6576 8576 A573 F00E 159B
80D0:5065 7685 76A2 96A0 C57B	81D0:8685 81A2 00BD FB8A E818	82D0:1865 7985 79A9 0065 786F
80D8:00A9 1720 EEEF 8A20 2212	81D8:8583 E8BD FB8A 8584 6F43	82D8:7A85 7A18 9002 E67A 5B15
80E0:EEFF B175 20EE FFC8 F923	81E0:E8BD FB8A 8585 E8BD BCF6	82E0:CAD0 D1A9 1D20 EEEF 5B21
80E8:9829 07D0 F5E8 E09A 0A60	81E8:FB8A 8586 A583 C928 B762	82E8:A900 20EE FF20 EEEF 070D
80F0:D0E7 A996 20EE FFA9 0CDC	81F0:B025 A585 C928 B01F 080F	82F0:20EE FF20 EEEF A912 2CF1
80F8:9720 EEEF A90A 20EE BD9D	81F8:A585 38E5 83C9 1FB0 6AEF	82F8:20EE FFA9 0020 EEEF E23D

8300:20EE FFA5 8385 81A9 A35F	84B8:FF8A 2910 D00A A046 7CC3	8670:48A5 7A48 A000 B179 55A6
8308:0085 8220 CF83 A581 45B1	84C0:A2FF CAD0 FD88 D0F8 6817	8678:9175 C8C4 73D0 F7A9 0BC2
8310:38E9 0485 7BA5 82E9 757B	84C8:A913 20F4 FF20 3685 076E	
8318:0085 7CA9 1F38 E584 121D	84D0:A670 A471 20E7 8320 19D9	8680:4018 6575 8575 A901 433F
8320:8581 A900 8582 20CF 4E6D	84D8:0485 2054 8590 D120 4F10	8688:6576 8576 A573 F00E C71A
8328:83A5 8138 E904 857D 3EBA	84E0:3685 A000 A900 9960 C8BA	8690:1865 7985 79A9 0065 AAEE
8330:A582 E900 857E A585 2B3C	84E8:04C8 C008 D0F8 A670 04D5	8698:7A85 7A18 9002 E67A 8994
8338:8581 E681 A900 8582 9B8D	84F0:8E60 04A4 718C 6404 55AD	86A0:CAD0 D168 857A 6885 A4F9
8340:20CF 83A5 8185 7FA5 FA71	84F8:A90F A201 A000 20F4 98E2	86A8:79A6 87F0 21A9 1C20 857B
8348:8285 80A9 2038 E586 C8B7		86B0:EEFF A583 20EE FFA5 C082
8350:8581 A900 8582 20CF CA0C	8500:FF4C A280 A575 48A5 E2AE	86B8:8420 EEFF A585 20EE 4D22
8358:83A5 7B8D FF89 A57C F3FE	8508:7648 A000 B175 99EB E397	86C0:FFA5 8620 EEFF A91E CF07
8360:8D00 8AA5 7D8D 017A 7711	8510:8A19 CB8A 59DB 8A91 9F00	86C8:20EE FF4C A280 A91A 2FD4
8368:A57E 8D02 8AA9 048D A962	8518:75C8 C008 D0D0 A938 4A11	86D0:20EE FF4C A280 A900 3879
8370:FE89 20D9 83A5 818D 30AE	8520:1865 7585 75A9 0165 E70F	86D8:8572 4CA2 80A9 FF85 CDC7
8378:018A A582 8D02 8AA9 A368	8528:7685 76C0 10D0 D068 A1DE	86E0:724C A280 A980 8572 05DF
	8530:8576 6885 7560 A000 5731	86E8:4CA2 80A2 2120 1B81 9754
	8538:B9EB 8A91 75C8 C008 F644	86F0:9005 A203 4CEE 87A2 E2C3
	8540:D0D0 A938 1865 7585 CB4B	86F8:00BD FB8A C940 9005 FA51
	8548:75A9 0165 7685 76C0 5CD1	
	8550:10D0 E560 20C9 85E0 64FC	8700:A204 4CEE 8785 75A9 E897
	8558:FFD0 06A5 70F0 02C6 E339	8708:0085 7620 DD87 A000 8992
	8560:7020 E285 E0FF D008 0686	8710:B9FC 8A91 75C8 C020 OFEC
	8568:8A50 9C27 F002 E670 73A2	8718:DDF6 4CA2 8020 B181 DE68
	8570:2097 85E0 FFD0 06A5 0203	8720:A200 A900 9D00 01E8 4E4A
	8578:71F0 02C6 7120 B085 62EE	8728:E012 D0F8 A200 B1F2 9CD3
		8730:9D20 01E8 C8C9 0DF0 F070
	8580:E0FF D008 A571 C91E 8B2F	8738:0BC9 20D0 F1CA A90D 07A1
	8588:F002 E671 20FB 85E0 2CA5	8740:9D20 0160 A203 4CEE 49A1
	8590:FFF0 0218 6038 60A5 C4EE	8748:8720 1D87 A201 201B AE66
	8598:72F0 05A9 C64C 1586 9A02	8750:8190 05A2 034C EE87 FAFA
	85A0:A980 A202 20F4 FFA2 B449	8758:A200 BDFB 8A85 75A9 9AFC
	85A8:00C0 C090 02A2 FF60 5CFF	8760:0085 7620 DD87 A575 78E2
	85B0:A572 F005 A9D6 4C15 1B75	8768:8D02 01A5 768D 0301 C42E
	85B8:86A9 80A2 0220 F4FF 57F3	8770:A920 8D00 01A9 018D B320
	85C0:A200 C041 B002 A2FF 3531	8778:0101 A9FF A200 A001 2BC3
	85C8:60A5 72F0 05A9 E64C 3C09	
	85D0:1586 A980 A201 20F4 99CE	8780:20DD FF4C A280 201D 76AE
	85D8:FFA2 00C0 C090 02A2 5DB0	8788:87A2 0220 1B81 9005 5FD0
	85E0:FF60 A572 F005 A986 53B0	8790:A203 4CEE 87A2 00BD CB1E
	85E8:4C15 86A9 80A2 0120 558A	8798:FB8A 8575 A900 8576 BCEE
	85F0:F4FF A200 C041 B002 8028	87A0:20DD 87A5 758D 0A01 4219
	85F8:A2FF 60A5 72F0 05A9 6466	87A8:A576 8D0B 01A2 01BD 11BB
		87B0:FB8A 8575 E675 A900 95E5
	8600:964C 1586 A980 A200 5DA4	87B8:8576 20DD 87A5 758D 855B
	8608:20F4 FF8A A200 2903 C013	87C0:0E01 A576 8D0F 01A9 C7AB
	8610:F002 A2FF 60AA A981 5258	87C8:20BD 0001 A901 8D01 1C3F
	8618:A0FF 4CF4 FFA6 87D0 204A	87D0:01A2 00A0 01A9 0020 C277
	8620:05A2 024C EE87 C687 2A0A	87D8:DDFF 4CA2 80A2 0506 B349
	8628:CA8A A204 182A CAD0 4C64	87E0:7526 76CA D0F9 A576 816A
	8630:FBAA BD2B 8B85 83E8 F960	87E8:1869 5085 7660 A900 221D
	8638:BD2B 8B85 84E8 BD2B 8A8E	87F0:1869 14CA D0FB AAA0 3B75
	8640:8B85 85E8 BD2B 8B85 4FF9	87F8:00BD EF89 9900 01E8 20BA
	8648:8E88 BD2B 8B85 79E8 49C1	
	8650:BD2B 8B85 7AE8 BD2B 972E	8800:C8C0 14D0 F468 AA68 D36F
	8658:8B85 75E8 BD2B 8B85 7A93	8808:A868 284C 0001 4898 DB9F
	8660:76E8 BD2B 8B85 73E8 16DC	8810:488A 4820 B181 C90D FD15
	8668:BD2B 8B85 74AA A579 7CF4	8818:F02B 29DF C94D D032 1C31
8380:058D FE89 20D9 83A5 6B3C		
8388:7F8D FF89 A580 8D00 FB23		
8390:8A20 D983 A57D 8D01 3AA6		
8398:8AA5 7E8D 028A 20D9 615A		
83A0:83A5 788D FF89 A57C 4FCB		
83A8:8D00 8A20 D983 A91C DF00		
83B0:20EE FFA5 8320 EEFF 2660		
83B8:A584 20EE FFA5 8520 EC29		
83C0:EEFF A586 20EE FFA9 EE86		
83C8:0C20 EEFF 4CA2 80A2 825B		
83D0:0506 8126 82CA D0F9 73C7		
83D8:60A2 00BD FD89 20EE D921		
83E0:FFE8 E006 D0F5 60A9 FBE3		
83E8:0085 75A9 5885 7698 687D		
83F0:F010 A940 1865 7585 0046		
83F8:75A9 0165 7685 7688 E7A2		
8400:D0F0 8AA8 F010 A908 6B3A		
8408:1865 7585 75A9 0065 6EB6		
8410:7685 7688 D0F0 60A9 AB36		
8418:0085 8385 86A9 2785 18D3		
8420:85A9 1F85 84A9 FF85 EFF0		
8428:72A9 0085 8785 7085 4A92		
8430:71A9 8B85 79A9 8B85 3038		
8438:74AC A280 A202 201B 1241		
8440:8190 05A2 034C EE87 05F4		
8448:A200 BDFB 8AC9 28B0 F6C5		
8450:F285 70E8 BDFB 8AC9 1371		
8458:1FB0 E885 714C A280 ACB0		
8460:8677 8478 A004 B177 7949		
8468:9900 0188 10F8 A200 0472		
8470:A001 4CF7 FFA5 72C9 4AE5		
8478:8D0D 2BA2 EEA0 8920 DFCC		
8480:6084 A2F3 A089 2060 2083		
8488:84A2 F8A0 8920 6084 598D		
8490:A200 A001 A940 20F1 D12C		
8498:FFAD 0401 8570 AD05 688B		
84A0:0185 714C E284 A670 F746		
84A8:A471 20E7 8320 0485 B5D1		
84B0:A9CA A200 A0FF 20F4 BC23		

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## Evaluating Educational Software by Mark K. Sealey

How do you decide which software to buy for your pupils or students? It is likely that you will rely to some extent on reviews in magazines like BEEBUG. But when an interesting product which hasn't yet been reviewed comes your way, how do you decide? How do you interpret the review itself anyway? This month BEEBUG Education draws on the strongest points from the many schemes and checklists offered in recent years to provide a guide to choosing educational software.

### BROAD CRITERIA

To start with, ask yourself what the program or package does. If this could be done better without the computer (for instance with pencil and paper), stop here and save your money. Although it is true that children are particularly motivated by the interactive nature of the computer, there is more and more evidence that they are also to some extent confused, by some screen conventions for example, and that this occurs on more occasions than we perhaps like to admit.

### EQUIPMENT

Next, if you have decided to continue, check that you have and can use the equipment configuration required: most publishers make it very clear which disc format (40 or 80T, single or double-sided and so on) is required. But there are so many different Acorn computer systems that it is easy to overlook the fact that the software you have your eye on might not run on the Econet, or may require a second processor, or sideways RAM.

### DOCUMENTATION

Many people would put the quality of any documentation high on their list of priorities when evaluating software. If there is no support when things go wrong or behave unpredictably, you are very unlikely to be able

to make anything like the most out of what you have bought. Certain publishers (whose products tend to get reviewed more frequently in these pages) make a virtue out of clear, well-presented, attractive documentation; often this will have a teacher's ideas book and details of relevant resources to be used alongside the package. A technical appendix and booklists, as well as some mention of the Educational considerations underlying the software, are other good signs.

### WHAT ARE THESE EDUCATIONAL CONSIDERATIONS?

This is not too difficult a question to answer. The most important thing is that the approach of the suite or program is child-centred, and likely both to appeal to the user and to work interactively. It is now accepted that we do not learn by listening, or even just watching, but by doing. The more the software involves the user the better.

To this end, it is helpful to know whether the software in question has actually been trialled by teachers and children. This fact certainly makes a difference to professional reviewers in their assessments. Is it clear that children have liked it and teachers found it easy to use? Does the overall personality of the package leave you with a positive feeling, one of having achieved something (assuming that you have the chance to try the suite out)? You would also be looking closely at the pace and grading of the program. Does it allow children to fit its use to their concentration spans? Are the sound, graphics and animation of a gimmicky type that will intrude after several sessions, or do they really add something to the presentation?

In certain cases it will be appropriate to ask if there are images, language or 'scenes' in the package which are offensive because of racist, sexist or class bias. Such images will almost always patronise the children and are to be avoided.

You may decide that the software will be too difficult or too easy for a particular age or ability range. This might be because of the language it uses, or it may lack a clear aim altogether. If not, is the purpose compatible with your own priorities in the learning situation? These may concern sharing, co-operation, ways of recording and so on.



Adventure games, for instance, often invite the users to work together in solving a particular problem. If you don't believe in this practice, the package may not suit.

It is helpful to examine just how the software fits into your existing curriculum. Does the package aim to introduce new material, test it, reinforce it, extend it or allow experimentation and/or investigation within it? Generally the latter is to be preferred because there will probably be greater scope for interaction.

It is also important that the program or programs leave the user in control. Again, research has shown that the better software does not lead pupils thoughtlessly along a predetermined path, but affords them choices and options to promote learning at their own pace.

Whatever the style and rationale behind the piece of software, it is vital that it enables the teacher to intervene and help the pupils, and that it is not so dense that, for example, time is wasted in learning a batch of unnecessary codes or spurious passwords. Does the suite permit adequate preparation and encourage time off the computer? Is it easy to link with other work under way and to plan follow-up activities?

### EASE OF USE

It is imperative that the design and cueing systems (the prompts, error messages and input routines) are easy to follow. However good the original idea, there is always someone who will misunderstand an instruction, or forget for example that Escape interrupts the action. The better these pupils are catered for, the happier their experience of using the software is likely to be. In the cases where the overall layout (system of menus and sub-menus or icons) is simple and uncluttered, it is likely that thought has gone into planning the rest of the package. Try crashing it and see if the program can cope. How much is left after Break (and then Shift-Break or Ctrl-Break) have been pressed?

### ROBUSTNESS

This aspect of a program is similar to the preceding. Bear in mind that it may not only be you, the specialist software user, who will want to work with the package. How well are errors trapped? How good is the feedback for

'unconventional' responses? Users who are not familiar with microcomputers must find the dialogue with the screen as helpful as any specialist's instructions. Another good sign is the way in which menus work. If an option is no longer relevant (because of an earlier choice, say, not to attach a printer), it might well be featured less prominently in the list, or better - disappear altogether. It should certainly be possible to return to the menu at any time to re-select and confirm choices.

There is a whole host of other similar points to watch. Is input permitted in both upper and lower case? If not, does the program turn off the Caps Lock? Does it disable Break? Does it, for instance, allow screen dumps (check that they work with your printer) to be interrupted by Escape or something similar? Check carefully how discs and files are organised. Ask yourself how easy it is to erase unwanted data, for instance, from within the program. Many non-specialist users will not want to learn the vaguaries of \*DELETE <fsp> or \*WIPE <fasp> and the rest. Is there provision for backing up data conveniently - perhaps also from within the suite? Is the product itself protected so that you cannot (legally or easily) make your own working copy?

### FLEXIBILITY

It is arguable that the most successful educational software is that which allows teachers and students the greatest degree of choice in how they use it. For example, an adventure or simulation which has both its own scenario and allows you to create one of your own is preferable. So is one which permits saving of the game half way through, or where a secondary file can be opened, so that the pupil's 'moves' can be studied and/or diagnosed afterwards. These have more flexibility than software with a single unalterable route which must be taken each time.

### CONCLUSIONS

Clearly not all the questions above will be appropriate to every piece of educational software. But these are the ones I have found the most helpful in evaluating software for pupils and students of all ages. We hope that you will write to BEEBUG Education with your own experiences and ideas too. B

# DISC SPOOLER UTILITY

*Ever wished that your printer output could be redirected straight into a file on disc or tape? Derek Floyd has the answer with this compact and versatile machine code utility.*

There are many programs which direct their output towards the printer or screen, but not to disc (or tape). In most situations this is all that is required. However, I have found several situations when I would have liked to divert the output from the printer, and send it to a disc file instead. The utility presented here will enable you to do just that.

## DATABASES AND SPREADSHEETS

Databases and spreadsheets serve as a perfect example of this. There are always provisions to send output to a printer but they allow comparatively little control over the format of the output. The output can now be spooled to disc or tape, and can then be loaded back into a word processor or text editor, and altered or even incorporated into another document.

## ALTERING AND RELOCATING MACHINE CODE

Another example can be found in the use of a disassembler. Altering and relocating a machine code program is simple enough providing that you have the source code (the original assembly language program). If you no longer have the source code, the machine code will need to be disassembled, typed in again, altered, and finally re-assembled. The majority of disassemblers allow disassembled code to be displayed on the screen or sent to the printer, but usually there is no provision to send the output to a file. Diverting the printer output to a file will save having to type in all the assembly language instructions again.

## DIVERTING THE PRINTER OUTPUT

All the ingredients to redirect the printer output are available in the BBC's Operating System. Firstly, there is an FX call to direct the printer output in one of four directions.

- \*FX 5,0 Nowhere, a useful dump during testing.
- \*FX 5,1 The parallel printer driver, the default.
- \*FX 5,2 The serial printer driver.
- \*FX 5,3 A user defined printer driver.
- \*FX 5,4 Network printer.

There is also a user defined printer driver vector, or jump address, that can be used to point to the new driver, wherever we decide to put it. The following listing simply assembles a new machine code driver and saves it to disc. Once the driver has been loaded, entering \*FX5,3 will divert the printer output to a specified file.

## ENTERING THE PROGRAM

Enter the program paying particular attention to the assembler part, especially if you are not familiar with assembly language. Ensure that you save the program before you run it to avoid corruption in case of error.

## USING THE PROGRAM

The program generates a short machine-code utility and automatically saves it to disc as 'DISCSPL'. The following information will then be displayed on the screen.

```
Disc Spooler saved as 'DISCSPL'
It will operate from PAGE &900
Syntax: DISCSPL <afsp>
File can be closed by 'CLOSE # channel'
Spooler is activated by '*FX 5,3'
Spooler is de-activated by:
    '*FX 5,1' for parallel printers or
    '*FX 5,2' for serial printers.
```

To load the printer driver into memory and specify the file to which all output is to be diverted use the following star command:

```
*DISCSPL <filename>
```

The utility will generate an error if you do not

specify a filename. Make sure that the single space between the command and the filename is not omitted. If the file is successfully opened then this is announced together with the file channel (or handle) number in hexadecimal:

```
Spool file opened channel &11
```

Once a spool file has been opened, it may be activated with \*FX5,3. From this point onward any output scheduled for the printer will be spooled to disc. The driver is de-activated by executing either \*FX5,1 or \*FX5,2 to restore your normal driver. Finally, the file should be closed with the command CLOSE#<channel>.

## RECOVERING OUTPUT

The resultant file will be in a standard ASCII format and may be loaded into most popular word processors (e.g. Wordwise, View, etc.). If the file contains Basic or assembly language instructions then they will need line numbers. The easiest method of giving them line numbers is to load the file into a word processor and insert the word 'AUTO' before the first instruction. When you save the file from the word processor make sure that you spool the text out rather than just saving it (for View, save the file without rulers or embedded commands). If you then \*EXEC the file from within Basic, line numbers will be provided automatically. Should you wish to do more elaborate things with the file it will be necessary to write your own program to read the file in, one line at a time, and deal with it accordingly. The following program demonstrates how to read in a file. In this example the file is simply sent to the printer but the program could be altered to direct the contents into another file, perhaps using a different format.

```
10 REM SPOOLER
20 REM D.R. Floyd
30 REM May 1988
40 :
100 CLS:VDU2
110 C%=OPENIN("filenme")
120 REPEAT
130 B%=BGET#C%:VDU1,B%
140 UNTIL EOF#C%
150 VDU3:CLOSE#C%
```

## PROGRAM DESCRIPTION

The program is well structured so it should be easy to follow for those people familiar with assembly language. However, the listing is in such a style that errors should be easy to detect by anyone. The code can be segregated into three distinct blocks.

**Lines 1160-1500.** This routine initialises the spooler, setting the vectors to point to the new driver called 'spool'. The channel number is displayed using a short routine to avoid the different addresses in Basic I and II.

**Lines 1510-1660.** This is the new driver, which is not a printer driver at all, but simply sends characters to the disc buffer.

**Lines 1670-1730.** This is the display routine, which writes messages to the VDU screen. The message is pointed to by the zero-page address &80, and is displayed until either a &0D or &00 is found. The message is completed by a Carriage Return only if the terminator is &0D. The three messages are inserted into the assembled code using Basic indirection operators.

The last three Basic procedures can be considered as house keeping, and do not affect the utility itself. The final machine code utility just fits into one page of memory.

## USING THE SPOOLER ON A CASSETTE SYSTEM

This utility works on tape as well as disc with a small number of alterations. Firstly, line 1090 should be changed to read &D00 so that the utility assembles and operates in an area not normally used by a cassette machine. Similarly, both occurrences of the number &900 in lines 1930 and 2020 should be changed to &D00.

Secondly, the utility may be run using \*/DISCSPL <filenme>. The command \*/ is read by the system as \*RUN. This presents a problem, because the program looks for the space after DISCSPL to check that a filename follows. So, the numbers in lines 1180 and 1210

should be increased by one to &0709 and &070A to allow for the extra character in the command.

The only problems that may arise are when another program uses the same workspace, namely &70 to &82 and &900 to &9FF (&D00 to &DFF for tape). Now any printer output can be redirected to a file quickly and efficiently.

```

10 REM Program    DISC SPOOLER
20 REM Version    B1.57
30 REM Author     D.R. FLOYD
40 REM BEEBUG     May 1988
50 REM Program    Subject to copyright
60 :
100 ON ERROR PROCError: END
110 MODE 7
120 PROCtitle
130 PROCinitialise
140 PROCassemble
150 PROCautosave
160 PROCinstructions
170 END
180 :
1000 DEF PROCinitialise
1010 osfind% = &FFCE
1020 osput% = &FFD4
1030 osnl% = &FFEE7
1040 oswrch% = &FFEE
1050 osbyte% = &FFF4
1060 oscli% = &FFF7
1070 filename% = &0070
1080 handle% = &0082
1090 code% = &0900
1100 ENDPROC
1110 :
1120 DEF PROCassemble
1130 FOR I%=0 TO 2 STEP 2
1140 P%=code%
1150 [ OPT I%
1160 .setup
1170 LDA #code% DIV 256
1180 STA &81:LDA &0708:CMP #&20
1190 BNE prompt:LDX #&0
1200 .floop
1210 LDA &0709,X:STA filename%,X
1220 INX:CMP #&0D:BNE floop
1230 .open
1240 LDX #filename% MOD 256
1250 LDY #filename% DIV 256
1260 LDA #&80:JSR osfind%
1270 STA handle%:BEQ cantopen
1280 .vectors

```

```

1290 LDA #spool MOD 256:STA &222
1300 LDA #spool DIV 256:STA &223
1310 LDA #message MOD 256:STA &80
1320 JSR display:LDA handle%
1330 LSR A:LSR A:LSR A:LSR A
1340 JSR print:LDA handle%:JSR print
1350 JSR osnl%
1360 RTS
1370 .print
1380 AND #&0F:ORA #&30:CMP #&3A
1390 BCC oscall
1400 .hex CLC:ADC #&07
1410 .oscall JSR oswrch%
1420 RTS
1430 .cantopen
1440 LDA #error MOD 256:STA &80
1450 JSR display
1460 RTS
1470 .prompt
1480 LDA #syntax MOD 256:STA &80
1490 JSR display
1500 RTS
1510 .spool
1520 CPY #&03:BEQ userprint
1530 RTS
1540 .userprint CMP #&00
1550 BEQ printok:CMP #&01
1560 JSR printok:CLC
1570 RTS
1580 .printok
1590 TXA:PHA:TYA:PHA:LDA #&91
1600 JSR osbyte%:BCS empty:TYA
1610 LDY handle%:JSR osput%
1620 .exit
1630 PLA:TAY:PLA:TAX:RTS
1640 .empty
1650 LDA #&7B:LDX #&03:JSR osbyte%
1660 JMP exit
1670 .display JSR osnl%:LDY #&0
1680 .loop
1690 LDA (&80),Y:JSR oswrch%:INY
1700 CMP #&0D:BEQ nldrts:CMP #&0
1710 BEQ drts:JMP loop
1720 .nldrts JSR osnl%
1730 .drts RTS
1740 .syntax
1750 ]
1760 $syntax="Syntax: DISCSPL <afsp>" + C
HR$13
1770 P%=P%+LEN($syntax)+1
1780 [ OPT I%
1790 .message
1800 ]
1810 $message="Spool file opened channe
l "&+CHR$0

```

```

1820 P%=P%+LEN($message)+1
1830 [ OPT I%
1840 .error
1850 ]
1860 $error="Unable to open file"+CHR$1
3
1870 P%=P%+LEN($error)+1
1880 NEXT I%
1890 ENDPROC
1900 :
1910 DEF PROCautosave
1920 DIM save 30
1930 $save="SAVE DISCSPL 900 "+STR$~P%+
" 900"
1940 X%=save MOD 256
1950 Y%=save DIV 256
1960 CALL oscli%
1970 *ACCESS DISCSPL L
1980 ENDPROC
1990 :
2000 DEF PROCautosave
2010 DIM save 30
2020 $save="SAVE DISCSPL 900 "+STR$~P%+
" 900"
2030 X%=save MOD 256
2040 Y%=save DIV 256
2050 CALL oscli%
2060 *ACCESS DISCSPL L
2070 ENDPROC
2080 :
2090 DEF PROCinstructions
2100 CLS
2110 PRINT"Disc Spooler saved as 'DISCS

```

```

PL"
2120 PRINT"it will operate from PAGE &
900"
2130 PRINT$syntax
2140 PRINT"File can be closed by 'CLOS
E # channel"
2150 PRINT"Spooler is activated by '*F
X 5,3'"
2160 PRINT"Spooler is de-activated by:
"
2170 PRINT" '*FX 5,1' for parallel pr
inters or"
2180 PRINT" '*FX 5,2' for serial pr
inters."
2190 ENDPROC
2200 :
2210 DEF PROCtitle
2220 CLS
2230 FOR LA%=2 TO 3:PRINT TAB(13,LA%)CH
R$(141);"DISC SPOOLER":NEXT
2240 PRINTTAB(9,7)"Printer output to Di
sc"
2250 PRINTTAB(14,12)"written by"
2260 PRINTTAB(14,14)"D. R. Floyd"
2270 PRINTTAB(7,21)"Press any key to as
semble"
2280 G=GET
2290 ENDPROC
2300 :
2310 DEF PROCerror
2320 CLS:REPORT:PRINT" at line ";ERL
2330 ENDPROC

```

B

## BOXED IN THE CARPARK (continued from page 9)

```

1800 IF W=A AND D1=0 AND D2=0 GOD=0
1810 IF D=b AND L1=0 GOL=0
1820 IF D=B AND L1=0 AND L2=0 GOL=0
1830 IF D=b AND R1=0 GOR=0
1840 IF D=B AND R1=0 AND R2=0 GOR=0
1850 IF D1=3 AND W=A AND D=B GOD=0
1860 ENDPROC
1870 :
1880 DEFPROCEND
1890 PRINTTAB(2,29)"NOW PRESS SPACE BAR
AND PUT IT BACK":VDU7:Solve=0:M$="J"
1900 REPEAT UNTIL GET=32
1910 PRINTTAB(2,29)SPC(36)
1920 PROCdraw(0,M$,X%,Y%,W,D,x,y):Y%=Y%
+108:PROCdraw(2,M$,X%,Y%,W,D,x,y):PROCdr
aw(3,"",236,360,240,100,0,0):JX%=X%:JY%=
Y%
1930 ENDPROC
1940 :

```

```

1950 DATA D,136,H,138,I,137,A,138,G,137
,C,139,A,136,G,138,I,136,I,136,B,139,B,1
37,D,139,D,139,G,137,C,137,C,138,I,138,D
,136,D,136,B,136,B,136,G,139,H,139,C,137
,C,137,A,137,A,137,I,138,D,138,D,137,E,1
38,E,138,J,136,G,139,G,139,H,136,C,139
1960 DATA C,139,A,137,A,139,I,137,I,137
,E,138,B,136,D,139,E,137,B,138,D,136,E,1
39,I,136,I,136,A,138,C,138,A,136,C,138,H
,137,E,137,D,137,B,139,I,139,A,136,A,136
,C,136,C,136,H,138,E,138,D,137,D,137,B,1
37,B,137,I,139,A,139,C,136,E,136,B,138
1970 DATA B,138,G,138,G,138,F,136,D,139
,H,139,B,137,G,138,F,138,D,139,D,136,H,1
39,H,139,B,139,B,139,G,137,F,138,F,138,B
,136,B,139,H,138,D,137,B,139,F,139,F,139
,E,137,A,137,A,138,I,138,J,138,B,136,B,1
36,D,136,D,136,F,139,H,139,E,139,G,139
1980 DATA A,137,A,137,C,137,C,137,I,138

```

B



# 1<sup>st</sup> COURSE

## Character Control (part 3)

*Mike Williams concludes this mini-series on the use of Basic's string functions.*

I hope you followed last month's article and the ideas on using string functions to justify both strings and numbers. Another application which uses very similar ideas is in file handling.

Many filing systems use a sequence of fixed-length records

each containing the same number of fixed length fields. Each piece of data (which is variable in length) needs to be either left or right justified (or padded out) within the appropriate field, depending on whether it is a string or a number. In fact, many file handling programs store all data in string format, converting to and from other formats when needed. The advantage of this approach is that the files themselves contain only a single data type and need just one set of procedures to handle them correctly. See our new series on file handling starting in this issue for more information on this subject.

### CHARACTER SORTING

As a further example of the use of string functions I thought it would be instructive to look at a function for ordering the characters alphabetically within a single string. Thus, given a string of characters passed as a parameter, the function is required to return a string with the same characters ordered alphabetically. It is the ability of a function to return a value (or string) that makes that structure a better choice than a procedure in this case.

Although there are many sort techniques available, I propose to use one of the simplest and best known; the bubble sort. This technique

'bubbles' each item up to its correct position in the list. The function to do this may be written thus:

```
1000 DEF FNsort(string$)
1010 LOCAL n:n=LEN(string$)
1020 FOR i=n TO 1 STEP -1
1030 FOR j=1 TO i-1
1040 IF MID$(string$,j,1)>MID$(string$,j+1)
    THEN string$=LEFT$(string$,j-1)
    +MID$(string$,j+1,1)
    +MID$(string$,j,1)
    +RIGHT$(string$,n-j-1)
1050 NEXT j:NEXT i
1060 =string$
```

The bubble sort, as used in the function, compares adjacent characters in the string, and if necessary re-orders them so that 'lower-value' characters move towards the front of the list, all done with string functions alone.

The function depends upon the fact that characters may be compared together just as with numbers. In fact, it is their ASCII codes which are compared by Basic, and as we saw before, the ASCII codes representing the alphabet are in ascending numeric order. It also means that any digits will be ordered to appear before any genuine alphabetic characters, and that lower case characters will all appear after upper case ones.

As the program moves through the string, the character in each position *j* is compared with that in position *j+1* and the two characters re-ordered if necessary. On each occasion that this happens, line 1040 ensures that the existing string is replaced by a new string consisting of that part of the original string to the left of the *j*th position, plus the character in position *j+1*, followed by the character previously in position *j* (thus reversing these two characters), and lastly the remainder of the original string to the right of position *j+1*.

All the work is done by the one line, and just the one string variable is needed for the purpose. The 'heaviest' character is moved to the right-hand end of the string, and the process repeated until all characters are in order.

If you want to try out this function, add the following lines:

```
100 MODE 7
110 INPUT "Enter any string: " chars$
120 PRINT FNsort(chars$)
130 END
```

This will allow you to enter any string (up to the maximum length of 255 characters allowed by Basic), and will then print the string with the characters in alphabetical order. If you add the following line to the procedure as well you will be able to see on the screen how the letters are gradually re-ordered:

```
1045 PRINTTAB(0,12)string$
```

There is one point to draw to your attention here, and that concerns the value of p (say) when used with string functions in the form:

```
LEFT$(string$,p)
```

In the sort function it is j and j+1 which are used. What happens if the value of p (or j or whatever) is out of step with the length of the string? If you try to extract more characters than exist all behaves as expected. For example, consider:

```
string$="abcdefgh"
PRINT LEFT$(string$,p)
```

IF p=20, for example, then "abcdefgh" will be displayed. The fact that the string actually contains fewer characters doesn't matter. If p=0 then again you get what you would expect, no characters at all. But what if p=-1 or any other negative number. You might expect that as with p=0 no characters at all would be displayed. In fact, the complete string would once again appear. Basic treats -1 here as a representation of the positive number 255 (256-1), as it assumes that the value of p in this context has to be positive.

Now you might say, at this stage, that using our example with p=-1 is hardly a sensible thing to do, and that's right, but when you are developing a program using string functions which include variables, this is a quite possible error that may inadvertently occur, and much confusion can arise if you are unaware of this possibility. In our sort example it may not be entirely clear what the full range of values is likely to be, or you might have used j-1 and j rather than j and j+1 to select characters. Understanding how Basic works can often help to resolve problems.

## CHARACTER INPUT AND OUTPUT

If you want to enter simple character strings and print them out or display them on screen, then the standard Basic INPUT and PRINT will be quite sufficient. Once we start dealing with individual characters, other instructions generally prove more useful. GET and GET\$ both input a single character, returning its ASCII code or the character itself. Experienced users generally find that GET is more useful than GET\$.

Remember that when you use GET or GET\$ nothing is echoed on the screen as happens with INPUT. This can sometimes prove to be quite useful. Alternatively, characters entered could be echoed with a different character altogether, a common practice for password entry, for example. The simplest way to echo just a single character on the screen is to use the VDU command - that's one of the reasons why GET is preferable to GET\$. For example:

```
char=GET:VDU char
```

would input one character and echo it on the screen. If you put instead:

```
char=GET:VDU char+1
```

then any character input would be echoed by the one next in the alphabet, so 'A' would be echoed by 'B' and so on. Using GET and VDU, here is a simple password function.

```
1000 DEF FNcheckpassword(password$)
1010 LOCAL char,pos,string$
1020 pos=1:string$=""
1030 PRINT "Enter password:";
1040 REPEAT
1050 char=GET
1060 IF char=127 AND pos>1 THEN
    VDU8,32,8:
    string$=LEFT$(string$,LEN(string$)-1)
    ELSE string$=string$+CHR$(char):
    pos=pos+1:VDU42
1070 UNTIL char=13:PRINT
1080 string$=LEFT$(string$,pos-2)
1090 =(string$=password$)
```

Calling this function with:

```
IF FNcheckpassword("BEEBUG") THEN . . .
would proceed only if the password prompted
for were "BEEBUG".
```

The function is fairly simple and makes no other checks on the characters input or the

length of the string entered. It does, however, respond to the the Delete key (ASCII 127) by outputting the sequence:

```
<backspace><space><backspace>
```

That's the function of the VDU8,32,8. At the same time the last character is deleted from the input string. Characters that are accepted are echoed as asterisks (ASCII 42). The function bears quite strong similarities to the input function I gave in the first article in this series (Vol.6 No.9).

GET and VDU work together quite neatly. Do remember, though, that VDU (unlike PRINT) will not automatically output a Carriage Return/Linefeed sequence at the end of a string of characters. You will need to provide this explicitly (VDU13,10).

Another bonus that results from using ASCII codes with GET, and more particularly with VDU, is that it becomes quite simple to deal with non-printing characters, or indeed any character which cannot be generated from the keyboard. Such characters are the ones with codes from 0 (the so-called null character) up to 31. These are the characters that are entered as Control codes from the keyboard, like Ctrl-N or Ctrl-B for example. They can be readily output by a program using VDU14 or VDU2 respectively. All these codes are listed in the User Guide under the heading of VDU codes. A good many of them duplicate statements in Basic like MOVE and DRAW. All in all, both GET and VDU can prove most useful and effective for many purposes as your programming skills develop.

One further single character input function is INKEY. This is like the GET function (and likewise INKEY\$ is similar to GET\$), but it waits for input for a limited time only. If no character is entered within the time specified, then a -1 is returned. GET will wait for ever.

## THE EVAL FUNCTION

Finally, I would like to draw your attention to the EVAL function in BBC Basic. This is an often misunderstood and little used facility, and yet it can be extraordinarily powerful. It is also quite unlike any of the other functions which I have covered, and really deserves a

whole article to itself (see First Course Vol.4 Nos8 & 9 for a much more detailed discussion of this).

EVAL accepts a single string argument and attempts to evaluate this as an expression. Thus if we write:

```
formula$="u*t+0.5*a*t^2"  
s=EVAL(formula$)  
PRINT s
```

then the formula specified as a string will be evaluated by the EVAL function using the current values (in this case) of u, t and a.

One easy to understand application of this principle is the writing of a program to draw a graph of a function input by the user, for example:

```
100 MODE 0  
110 VDU5,29,640;512;  
120 INPUT"Give function of x: " f$  
130 FOR x=-6.4 TO 6.4 STEP 0.1  
140 MOVE 100*x,100*EVAL(f$)  
150 PRINT "**";  
160 NEXT x  
170 END
```

This is indeed quite crude, but if you run this short program and enter any reasonable function of x - for example, try  $3*\sin(x)+\sin(3*x)$  - you should get some kind of result. Without EVAL there would simply be no way of entering a formula from the keyboard for evaluation within a program.

The graph of the function specified will be plotted with asterisks - you could change this. The VDU codes at line 100 select text printing at the graphics cursor and move the graphics origin to the centre of the screen. A slightly more elaborate version of this program is included on the magazine disc/tape. The EVAL function is capable of very much more than I have covered here, and really is worth investigating further to exploit its full power.

This concludes our present discussion of string functions. Do let me know if you have any questions arising out of these three articles, or if there are any other topics you would like to see covered in future First Course series. B



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#### Technical Summary

Beebug C is a full implementation of the Kernighan & Ritchie standard. The following is a summary of the full specification.

**Expressions:** \*, &, ~, !, ~, ++, --, sizeof, -, \*, /, %, +, -, >>, <<, <, >, <=, >=, &, ^, |, &&, ||, ?:

**Assignments:** =, +=, -=, \*=, /=, %=, >>=, <<=, &=, ^=, |=

**Declarations:** char (8 bits), int (16 bits), short (8 bits), long (32 bits), float (32 bits), double (32 bits), unsigned, void, pointer, auto, static, extern, typedef

**Statements:** if, while, do, for, switch, case, default, break, continue, return, goto, struct, union

**Preprocessors:** #define, #undef, #redef, #include, #if, #ifdef, #ifndef, #else, #endif, #line, #pragma

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To write C programs you will need a text editor or word-processor such as View, Wordwise, InterWord etc. Beebug C is supplied with a detailed user guide, however this does not teach C, and a basic knowledge of the C programming language is assumed. The definitive book on C is **The C Programming Language** by Kernighan & Ritchie available from BEEBUG.

# Personal Ads

**Master 128** £290, Morley EPROM Programmer £22, Clares Artroom 80 track ADFS. Tel. (04243) 4500.

**6502 Acorn Processor** and DNFS and HiBasic £120. Microtec colour monitor £135. Aries B20 and B12 and 16K RAM £65. Zenith Green Screen Monitor £45. Viglen cartridge system and 8 cartridges for Master £12. Romit ROM £15. Acorn/Mirle complete business system (7 Discs) £42. Joystick £5. Watford Mk II ROM board £15. All internal units can be fitted free if required. Tel. (040 381) 4976.

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**BBC B Issue 7**, DFS, ADFS, 3.5" Mitsubishi 80T drive with PSU, Replay tape/disc ROM, Microvitec 1451AP-DS med. res colour monitor with TV Tuner, many games, utilities, FORTH, etc, User and Advanced Guides £450. Tel. (0327) 704401.

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**D.R. DOS plus manual** £15. Mastering DOS Plus £5. AMX Super Art (Master) with mouse £20. DDCPM £10. Acorn Prestel adaptor £35. Wordstar Professional for Acorn 280 £50. Exmon II £10. BEEBUG Vol 1 - Vol 6 £15. Masterfile II £8. Elite £5. Creative Sound £8. Microtext £25. Acheton £5. Tel. (0533) 312661.

**Electron/BBC games**, originals, mostly cassette, £1-£4. SAE for list. Danny Langton, 13 Whitmore Close, New Southgate, London, N11 1PB.

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**BBC B Issue 7**, 1.2 OS £195 ono. Tel. (0724) 720675.

**Solidisk SWRAM 32K** and manual. Watford Electronics double density filing system board and ROM and manual, also WE DFS ROM. OPUS 40T S/S disc drive and manual and utilities disc. Cassette software. The Advanced User Guide for BBC. Z80 2nd processor and bundled software. Wordwise ROM and manual. Shinwa CP 80-TI printer, 80 cps, Epson compatible, NLQ mode. AMX mouse with Super Art, manual, discs, etc (for Master 128). Offers invited. Tel. (0229) 62566.

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*Continued on page 36*



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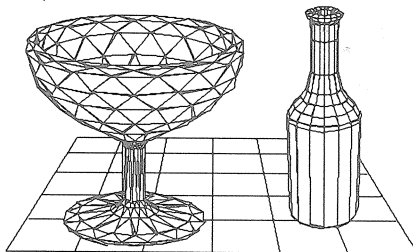
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## BBC USER GROUP INDEX (continued from Vol.6 No.10)

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Contact Roul Sebastian John, Wasserstrasse 475, 4630 Bochum 1, West Germany.

### HONG KONG

#### **'BBC Micro Computer Users Informal Liaison Group.'**

Contacts: R Lumb (5-921985) P Monger (3-7217585)

#### **Acorn Computer Users Society of Hong Kong**

Meet on the first Wednesday of each month at the Brainchild Computer Centre, Far East finance centre at 7.30 p.m. Contact the society at P.O.Box 13330, Central Post Office, Hong Kong.

### NEW ZEALAND

#### **BBC-Acorn Computer User Group of NZ.**

PO Box 9592, Wellington, New Zealand.

B.M.Wilkinson, Einstein Scientific, 177 Willis Street, PO Box 27138, Wellington, New Zealand. Tel: 851-055.

### NORWAY

Oivind Grennes, BBC Norway, O-INFORM, Postboks 716, 3191 HORTEN, Norway.

### PAKISTAN

Anyone interested in forming a BBC User group in

Karachi Contact Capt. Z.A.Kidvai on Karachi 540986.

### REPUBLIC OF SOUTH AFRICA

**BBC User Group of Pretoria.** P.O. Box 32798, Glenstantia 0100, South Africa

**Pretoria BBC User Group.** Contact: Stan Miller, P.O.Box 117, Montana, 0151 Pretoria, Rep. of S.Africa.

**The Durban BBC User Group,** P.O.Box 148, Umhlanga Rocks, 4320, South Africa. All enquiries to the secretary, Frank Calboutin.

**Tygerberg BBC User Group (Tygerberg)** For Electron, BBC and Master. R.P.Donovan (Secretary) 16 Bakker Street, Welgemoed, Bellville, 7530 South Africa. Tel: 021-953 2210

### ZAMBIA

**BBC User Group.** Contact J.Maurice Brown. For enquiries in or near Zambia: c/o British High Commission, P.O. Box 50050, Lusaka. FOR enquiries from UK: c/o F.C.O. (Lusaka), King Charles Street, London. SW1A 2AH.

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Here are some of the topics covered in the first six issues of RISC User:

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An introduction to the Archimedes WIMP environment for Basic programmers.

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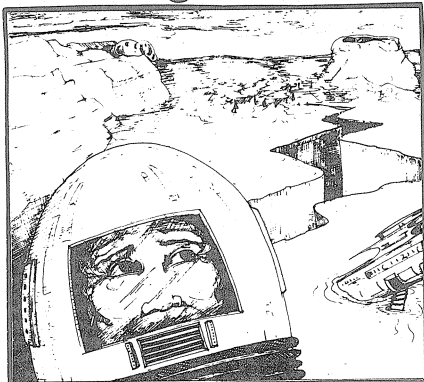
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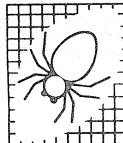
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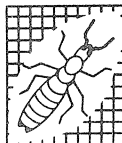
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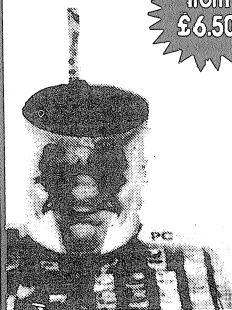
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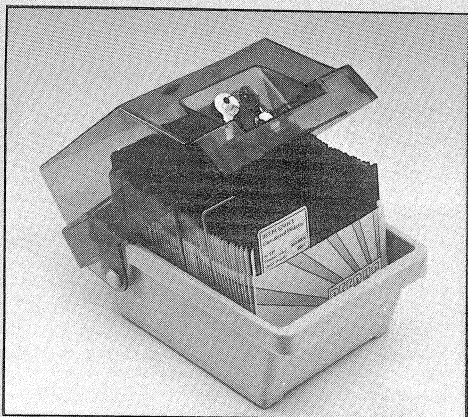


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and &20F, the extending routine is at &FF15, and the extended vector at &DB4 - &DB6.

The best way of calling your own machine code routine residing in sideways RAM is to set one of the unused extended vectors in page &D to point to the routine, and then call the routine by calling the appropriate address in page &FF. For example, if the address of a machine code routine in sideways RAM was stored in the extended vector at locations &DDB - &DDD, which is the keyboard vector, then the routine could be called from Basic by CALL &FF3C. An example of this is given in listing 1, which assembles a short piece of code to print a message, copies it to sideways RAM, and then calls the routine through an extended vector.

### CHOOSING EXTENDED VECTORS

The problem with using this technique is in choosing which extended vector to use. If you use a vector that has already been extended by a sideways ROM for its own use, then as soon as that vector is changed, the computer will crash. Which vectors are used by ROMs inside the computer depends very much on the ROMs installed, although on a Master the filing system vectors will always be extended. Listing 2 is a machine code utility that will list out the contents of each vector, so that you can see if it is extended. When run, the program saves a machine code program to disc under the name 'VECTOR'. Once the code is assembled, typing \*VECTOR will list all the vectors along with their contents. Alternatively, the command can be followed by a vector name or number to list information on one particular vector. For example, \*VECTOR CNP or \*VECTOR 23, both of which produce the same results.

The display produced by \*VECTOR consists of eight items for each vector. The first two are the vector number, mentioned earlier, and the vector name. The next two are the address of the vector in page 2, and its current contents. Then comes the address of the extended routine in page &FF, and the address of the extended vector in page &D. Finally, the display shows the current value of the extended vector, including the ROM number to which it points.

The best way of telling if a vector is extended or not is to look at the value of its main vector in page 2. If this is between &FF00 and &FF4E

then the vector is being used in extended mode, and you shouldn't use it yourself. Any other value means that the operating system isn't using that vector in its extended form, meaning that it can be used freely by your own program. The only exception to this is the FSC vector. Because of the way the operating systems handles temporary filing systems, this vector appears not to be extended, while in fact it always is.

By using \*VECTOR to find out the current state of the vectors, it should be very easy to choose which extended vector is best used to call a routine in sideways ROM or RAM.

#### Listing 1

```
10 REM Program Extended Vector Demo
20 REM Version B1.0
30 REM Author Claus Alsted
40 REM BEEBUG May 1988
50 REM Program subject to copyright
60 :
100 PROCassemble
110 :
120 REM Copy code to SRAM
130 *SRWRITE 900 A00 9234 5
140 :
150 REM Setup extended vector
160 ?&DDB=&9234 MOD &100
170 ?&DDC=&9234 DIV &100
180 ?&DDD=5 : REM Sram bank 5
190 :
200 REM Call routine
210 PRINT'
220 CALL &FF3C
230 END
240 :
1000 DEFPROCassemble
1010 osasci = &FFE3
1020 FOR pass%=4 TO 7 STEP 3
1030 P%=&9234 : O%=&900
1040 [OPT pass%
1050 LDX #0
1060 .loop
1070 LDA text,X:BEQ done
1080 JSR osasci:INX:JMP loop
1090 .done
1100 RTS
1110 :
1120 .text
1130 EQU$ "Hello World": EQU$ 13
1140 EQU$ 0
1150 ]
1160 NEXT
1170 ENDPROC
```

## Listing 2

```

10 REM Program Vector Lister
20 REM Version B1.0
30 REM Author Claus Alsted
40 REM BEEBUG May 1988
50 REM Program subject to copyright
60 :
100 ON ERROR GOTO180
110 DIM code 1000
120 PROCassemble
130 PRINT"Press Space to save machine
code"
140 REPEAT UNTIL GET=32
150 OSCLI ("SAVE VECTOR "+STR$~code+"
"+STR$~0%+" 410 410")
160 END
170 :
180 ON ERROR OFF: IF ERR<>17 REPORT:PR
INT" at line ";ERL
190 END
200 :
1000 DEF PROCassemble
1010 gsinit=&FFC2:gsread=&FFC5
1020 osargs=&FFDA:osasci=&FFE3
1030 osnewl=&FFE7:oswrch=&FFEE
1040 temp=&70:ptr=&71
1050 buff=&73:len=&77
1060 FOR pass=4 TO 7 STEP 3
1070 0% = code:P% = &410
1080 [OPT pass
1090 LDX#&F2: LDY#0: LDA#1: JSR osargs
1100 LDY#0: JSR gsinit: BNE oneonly
1110 JMP listall
1120 .oneonly
1130 JSR gsread: CMP #ASC"0": BCC notno
1140 CMP #ASC"9"+1: BCS notno
1150 AND #&F: STA temp: JSR gsread
1160 BCC more
1170 JMP nok
1180 .more
1190 CMP #ASC"9"+1:BCS syntax
1200 CMP #ASC"0":BCC syntax
1210 AND #&F:PHA
1220 LDA temp:ASL A:ASL A:ADC temp
1230 ASL A:STA temp:PLA:ADC temp
1240 STA temp:BRA nok
1250 .notno
1260 STA buff:LDX #1
1270 .rdnam JSR gsread:BCS namend
1280 STA buff,X:INX:BRA rdnam
1290 .namend
1300 STX len:LDA#vtab MOD &100:STA ptr
1310 LDA#vtab DIV &100:STA ptr+1
1320 CLR temp
1330 .nxtv
1340 LDY #0:LDA (ptr),Y:BEQ nferr
1350 .nxtv2

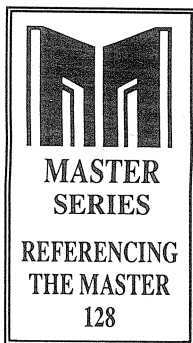
```

```

1360 CPY len:BEQ nok
1370 LDA (ptr),Y:CMP buff,Y:BNE trynext
1380 INY:CMP #4:BEQ nok:BRA nxtv2
1390 .trynext
1400 INC temp
1410 LDA ptr:CLC:ADC #4:STA ptr:BCC nxt
v
1420 INC ptr+1:BRA nxtv
1430 :
1440 .syntax
1450 BRK:EQUB &DC
1460 EQU "Syntax: VECTOR (<no.>|<name>
)"
1470 EQUB 0
1480 :
1490 .nok
1500 LDX temp:CPX #27:BCC nok2
1510 .nferr
1520 BRK:EQUB 0:EQU "Vector not found"
:EQUB 0
1530 .nok2
1540 JSR header:BRA vlist
1550 :
1560 .listall
1570 JSR header:LDX #0
1580 .liall2
1590 PHX:JSR vlist:PLX
1600 INX:CPX #27:BNE liall2
1610 RTS
1620 :
1630 .header
1640 JSR txtprt
1650 EQU "## Name Vadd Value OSadd Xad
d Value Rom"
1660 EQUB 13
1670 EQU STRING$(39,"-")
1680 EQUB 13
1690 .NOP:RTS
1700 :
1710 .vlist
1720 PHX:TXA:LDX #0
1730 .vlist2 CMP #10:BCC vlist3:SBC#10:
INX:BRA vlist2
1740 .vlist3 PHA:LDA #ASC" ":CPX #0:BEQ
vlist4
1750 TXA:ORA #&30
1760 .vlist4 JSR oswrch:PLA:ORA#&30:JSR
oswrch
1770 JSR spprt:PLA:PHA:ASL A:ASL A:TAX:
LDY #3
1780 .vlist5 LDA vtab,X:JSR oswrch
1790 INX:DEY:BPL vlist5:JSR spampprt
1800 LDA #ASC"2":JSR oswrch
1810 PLA:PHA:ASL A:TAX:JSR hexprt
1820 JSR spampprt:LDA &201,X:JSR hexprt
1830 LDA &200,X:JSR hexprt

```

*Continued on page 46*



*Peter Rochford reports on the latest publication to provide support for Master users, The Advanced Reference Manual from Watford Electronics, priced at £19.*

When the BBC Master was first released some two years ago, there was much justifiable criticism over Acorn's decision to issue only a fairly basic Welcome Guide with the machine and charge for the additional reference manuals. The additional manuals were to comprise three volumes, Part 1, Part 2 and an Advanced Reference Guide.

Part 1 and 2 appeared after several months, and satisfied the immediate needs of many who had bought a Master and wanted to get the best out of their machine. However, others like myself, still considered that much of the detailed information required by programmers and hardware designers was not available in either of these manuals.

During the last two years, no advanced guide to the Master has been available, Acorn having failed to release the third manual. Recent months have seen the release of an updated version of the old *Advanced User Guide*, (the new one containing extra information on the Master), and a book from Dabs Press called *The Master Operating System*. Both of these books were reviewed in BEEBUG Vol.6 No.6.

Now, finally, the long awaited *Advanced Reference Guide* for the Master has been published and interestingly enough, not by Acorn. Instead, Acorn gave permission to publish the 288 page spiral-bound book to Watford Electronics, a company who are well-known to the majority of Beeb users as a major supplier of Acorn equipment, and also as designers and manufacturers of numerous add-ons and software packages for the BBC micros.

The front cover of the book is very similar to that of the manuals already published by Acorn for the Master series, with the same picture of the Master and the large M logo, while the back cover carries a picture of Watford Electronics' premises, lest you forget who the publishers are. The layout and general design of the book also follows closely the same pattern as the Acorn manuals, although much thicker paper is used, probably to make the book appear longer.

## MACHINE ARCHITECTURE

The book kicks off with a look at the machine architecture of the Master. This is a general overview describing the various sections of the Master's hardware and their functions.

What follows after this is a fairly detailed description of the circuitry of the Master. Included at the back of the book are copies of two circuit diagrams supplied by Acorn Computers. The material in both of these first two chapters will be familiar to anyone who has read the Acorn service manual for the Master.

The next few chapters take a look at memory organisation, the keyboard controller, the screen display, the real-time clock, the user port, serial port, peripheral bus controller and the 1MHz bus. For those who have always wanted to gain access to the alarm function of the real-time clock, there is a very informative section devoted to this, but be warned that it is only of use to those who have good machine code knowledge.

The chapter on the machine operating system mercifully has not been padded out with all the FX calls that already appear in Part 1 of the Acorn manuals. It is a relatively small section of the book, but does contain detailed information on the address map and explains how to extend the MOS.

## DUAL PROCESSOR SYSTEMS

Dual processor systems are covered in great depth, and for me this is one of the highlights of the book. Tube architecture, tube protocols,

operating system usage and operating system calls are all covered. The 6502, Z80 and 80186 second processors are all covered in detail, and I found the section on the 80186 most interesting and informative.

The sections on the disc filing systems occupy only a few pages, these being given over mainly to describing the track format of the DFS, ADFS and CP/M. Quite rightly, the book points out that Acorn's *Master Reference Manual Part 1* already contains much detailed information on the two main disc filing systems.

The final few chapters of the book are devoted to the network filing system (ANFS), the Terminal Emulator, the Editor and a description of the View and ViewSheet formats.

## APPENDICES

The last 120 pages of the book are split into eight appendices (i.e. nearly half its length). The first three of these deal with the functional differences between the various Acorn BBC machines. These are excellent and will be extremely useful to those who need a quick reference guide when writing software and wish to make it portable across the whole range of machines.

Appendix 4 covers differences between the ANFS and the older NFS, while appendix 5 looks at the changes introduced in Basic IV.

Appendices 6 and 7 will be of most use to hardware designers as they cover PCB selection links, test points and the cartridge interface.

The final appendix is a bit of a disappointment as it takes up 67 pages of the book to list the 65C12 instruction set. The codes are already listed in the Acorn manuals, and elsewhere, and to take up one page for each code is silly.

As far as I am concerned this is just padding out the book.

## CONCLUSIONS

Well, should you buy this book or not? A lot depends on where your particular interest lies in relation to your Master. The book definitely

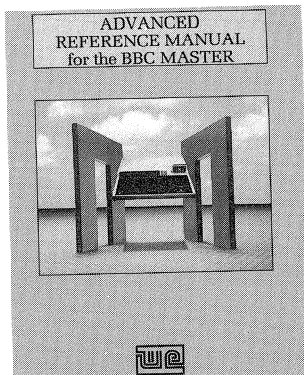
contains a lot of information about the hardware of the machine. The opening chapters are particularly detailed in this area, but throughout the book too, there is much information on this subject.

Software writers will find the book useful as well though, with plenty of material to interest them. However, because of the nature of most of this material, a competent knowledge of machine code

programming is essential to make use of it.

How does the new book compare with the other two referred to earlier? There is certainly some duplication of information that also appears in both the Acorn Reference manuals and the *New Advanced User Guide*. In fact, it is rather difficult to compare this book with the *New Advanced User Guide* (NAUG) and indeed Dabs Press' *Master Operating System*. The Dabs book certainly has more detailed information on the MOS as one would expect. The NAUG, however, covers many more areas than the *Advanced Reference Manual* and I think that it has greater appeal to a wider number of Master users as a general reference manual.

At the end of the day it is best to sum up by saying that *The Advanced Reference Manual* will appeal to hardware designers, software writers who need very detailed information, and those who just have an unquenchable thirst for knowledge about their Master. I found it a fascinating book to browse through and there is certainly plenty of in-depth information in it which has not until now been generally available to the public. However, I do feel that the book is over priced for what it offers. **B**



# Hints Hints Hints

## TALKING TO EDIT

*Peter Smith*

Most people know how to transfer a Basic program into EDIT and back again by typing EDIT from Basic, and then pressing Shift-f4 and typing BASIC to return. To allow this to work, both Basic and Edit have a special feature for transferring data between each other, and this could be used in your own programs.

If, when Basic is invoked by \*BASIC, the command is followed by an '@', (i.e. \*BASIC @), then the Basic ROM will take the address in memory locations 0 and 1 as a pointer, and read the ASCII text from that address onwards, transferring it into its buffer, just as if it had been typed at the keyboard. For example, if ASC-PROG is a Basic program saved in ASCII format, then an alternative to using \*EXEC to load it is to use instead:

```
*LOAD ASC-PROG E00
```

```
!0=&E00:*BASIC @
```

and the program will be read in by Basic.

## EDIT SEARCH AND REPLACE

*Jane Fletcher*

While on the subject of Edit, here are two useful search and replace sequences for editing Basic programs:

```
$* ^#/$<Return>
```

will strip the line numbers from a Basic program, while:

```
|J/<Return>
```

will strip out the linefeeds added to each line when a listing is spooled to a file.

## OVERVIEW PROBLEMS

*David Spencer*

Some members have written to say that the Keeper in Acorn's Overview, which is used to allow different View packages to be used simultaneously, clashes with certain other ROMs. The reason for this is that the Keeper claims the command line vector, as do some other ROMs. The solution is simply to unplug either Overview or the offending ROM, using \*UNPLUG.

**B**

## VECTERING AROUND (continued from 43)

```
1840 JSR spampprt:LDA #FF:JSR hexprt
1850 PLA:STA temp:TXA:ADC temp:STA temp
1860 JSR hexprt:JSR spampprt
1870 LDA #ASC"D":JSR oswrch
1880 LDA temp:CLC:ADC #9F:STA temp:TAX
1890 JSR hexprt:JSR spampprt
1900 LDA &D01,X:JSR hexprt
1910 LDA &D00,X:JSR hexprt
1920 JSR spprt:JSR spprt
1930 LDA &D02,X:JSR hexprt2
1940 JMP osnewl
1950 .spprt
1960 LDA #ASC" ":JMP oswrch
1970 .spampprt
1980 JSR spprt
1990 LDA #ASC"&":JMP oswrch
2000 .hexprt
2010 PHA:LSR A:LSR A:LSR A:LSR A:JSR hexprt2
2020 PLA:AND #&F
2030 .hexprt2
2040 ORA #30:CMP #3A:BCC hexprt3:ADC
#6
```

```
2050 .hexprt3
2060 JMP oswrch
2070 .txtprt
2080 PLA:STA ptr:PLA:STA ptr+1:BRA txtprt3
2090 .txtprt2
2100 JSR osasci
2110 .txtprt3
2120 INC ptr:BNE txtprt4:INC ptr+1
2130 .txtprt4
2140 LDA (ptr):BPL txtprt2:JMP (ptr)
2150 .vtab
2160 EQU "USERBRK IRQ1IRQ2CLI BYTEWORD WRCH"
2170 EQU "RDCHFILEARGSBGETBPUTGBPFIND FSC"
2180 EQU "EVNTUPRTENETVDU KEY INS REM CNP"
2190 EQU "IND1IND2IND3"
2200 EQU 0
2210 JNEXT
2220 ENDPROC
```

**B**



# DEBUGGING DATA STATEMENTS

*Peter Osborn describes his simple technique for checking the many DATA statements often found in magazine listings, including some of those in BEEBUG.*

When a BBC Basic program containing many DATA statements, each with many data items, is typed into the micro from a listing, it is easy to make mistakes. The short program, COMMAS, listed here is a utility designed to help with pin-pointing any faulty DATA lines.

The output of the program is a list of the line numbers of the DATA statements, and the number of data items contained in each. Once this has been obtained, a comparison with the original listing will help to show up any discrepancies.

## USING THE PROGRAM

Type in the program and save before trying it out. When run, it prompts for the name of the target program. Once this has been entered, the target program will be scanned, and output to screen and printer (if enabled) will follow.

## PROGRAM NOTES

The target program is loaded at a suitable address (loadaddr%) with an OSFILE call. The end address of the loaded program is calculated from information in the OSFILE block, and a pointer to the start of the first line (pointer%) is initialised.

The REPEAT-UNTIL loop takes each line in turn and examines it for the presence of the token for the DATA statement, &DC (User Guide page 483). If it is found, PROCcount is entered. This counts the number of commas

(ASCII &2C) present, and at the end of the line outputs the current line number and the number of data items apparently found (commas+1). Then pointer% is set to the start of the next line of the target program, and the process repeated until the end address of the file is reached.

```

10 REM Program COMMAS
20 REM Version B1.3
30 REM Author   Peter Osborn
40 REM BEEBUG   May 1988
50 REM Program subject to copyright
60 :
100 MODE 7:VDU 15
110 ON ERROR GOTO 300
120 filename%=&C00:osfile=&FFDD
130 loadaddr%=PAGE+&500
140 block%=&70:block%?6=0
150 !block%=filename%:(block%+2)=load
addr%
160 INPUT"Input the name of the file:
" A$
170 $filename%=A$
180 X%=&70:Y%=0:A%=&255:CALL osfile
190 pointer%=loadaddr%
200 endaddr%=loadaddr%+256*block%?&B+B
lock%?&A-3
210 REPEAT
220 eoln%=pointer%+pointer%?3-1
230 FOR J%=pointer%+4 TO eoln%
240 IF ?J%=&DC THEN PROCcount(J%):J%=-e
oln%
250 NEXT J%
260 pointer%=pointer%+pointer%?3
270 UNTIL pointer%>endaddr%
280 END
290 :
300 ON ERROR OFF:CLOSE#0
310 REPORT:PRINT" at line ";ERL
320 END
330 :
1000 DEF PROCcount(J%)
1010 LOCAL I%,commas%
1020 FOR I%=J%+1 TO eoln%-1
1030 IF ?I%=&2C THEN commas%=commas%+1
1040 NEXT I%
1050 PRINT 256*pointer%?1+pointer%?2:SP
C1:commas%+1
1060 ENDPROC

```

**B**

*In this, the final Workshop dealing with printers, we shall cover the use of \*FX3 and \*FX5, and delve into the printer itself to explain how to configure it to print in different character sets.*

Inside every printer is a bank of DIP (dual in parallel) switches. There may even be two or three such banks of DIP switches, the number depending upon the complexity of the printer. Each switch will be numbered for simplicity and will have two settings, on or off. To gain access to the bank of switches you must either remove a panel (as with the Epson FX80) or remove the top of the printer (as with some Taxan printers). The most common features that these switches control are:

1. Page length.
2. Paper end detection.
3. The input buffer.
4. Slashed zero.
5. Automatic line feed.
6. Character set.

A detailed account of each feature will be given in your manual (look in the index under 'DIP switches'). There is a detector in most printers that will determine when there is no more paper. One of the DIP switches will decide whether the printer should stop printing or not when the paper has run out. Although disabling this facility may allow you to print right to the bottom of a sheet of paper, you may well run the danger of getting ink on the roller. For this reason it is wise to keep this facility enabled. Should it need to be

disabled temporarily you should do this in software e.g. the KP815 code is 27,56 whilst 27,57 enables it. The page length switch must be set according to the paper being used. The choice is usually between 11 and 12 inch paper. The automatic line feed switch determines whether a Line Feed will be performed every time a Carriage Return character is received. The \*FX6 command performs much the same function in software. We would recommend that this feature is disabled so that the software can decide whether a Line Feed is to be performed or not. Many printers provide a choice of two alternative characters for the number zero. In one form it will have a slash through it, in the other it won't. Set this switch according to your own taste.

Practically all modern printers incorporate some resident RAM. If this is the case with your printer, there will be a switch that will determine whether this RAM is to be used to store new character definitions, or whether it is to be used as a printer buffer. Many people do not realise that they can configure their printer to use a buffer by the mere setting of a switch, which is usually set for character definitions. If this is the case, altering this switch will activate the buffer. If you are interested in defining new characters to download to the printer, refer to the article Epson Character Definer in BEEBUG Vol.6 No.6.

Most dot matrix printers support more than one character set, the one in use being selected by up to three DIP switches. The different character sets are much the same as the default, but with variations on half a dozen or so characters. For example, if your printer is configured for the American character set it will print a hash sign instead of a pound character on receipt of the character Shift-3 (ASCII 35). The exact differences, and the character sets available, will be described in some detail in your printer manual. Note that the other

character sets can be software selected, so you can still print a pound character even with the DIP switches set to the American character set.

There are, of course, many other features that can be selected from the switches such as NLQ, disable bell etc, but these tend to be very 'printer specific' and a description of their use is best left to the appropriate printer manual. Finally, make sure that the printer is turned off before altering any of the switch settings because these are read only when the printer is turned on. Altering the switches while the printer is powered up will have no effect.

### USING \*FX3 AND \*FX5

These two commands control the output streams to which data is sent by the computer. Because of the large variety of printers available, provision has been made for the use of both parallel and serial printers. The four output streams available are the screen, the RS423 port, the printer and spool. The \*FX3 command must be followed by a single value specifying the output stream. The most useful values are in the range 0 to 11 (values 16 through to 27 do the same as 0 to 11 but turn

spool off) and allow data to be sent to all or any of the output streams as shown in the table.

Note that the printer may be on, off, or just enabled. If the printer is on, data will be sent to it irrespective of whether a VDU2 has been issued or not. However, if it is 'enabled' data will be sent to it only if a VDU2 (Ctrl-B) has been issued. A useful combination is \*FX3,10. This will send data purely to the printer. If you are printing a document using lots of control codes, this is an easy way of making sure that these codes do not go to the screen where they could have unpredictable results. With this command there is no need to issue any VDU2 or VDU1 commands, but you will need to issue \*FX3,0 to restore output to the normal default of screen only when printing is finished.

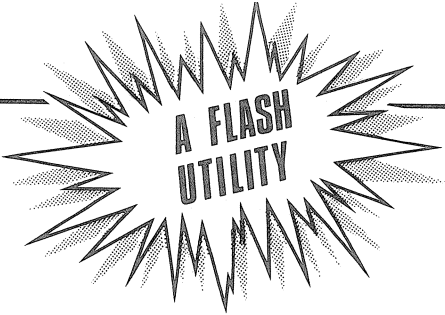
The \*FX5 command deals purely with the printer output stream. There are four possible values in the range 0 to 3. \*FX5,1 and \*FX5,2 select output to the printer (parallel) or serial ports respectively. \*FX5,3 selects a user supplied printer driver. For more details refer to the article 'Disc Spooler Utility' in this issue of BEEBUG. The \*FX5,0 command selects a 'printer sink' where characters are simply 'lost'. This avoids wasting paper when testing programs that output their data to the printer, or where a printer is temporarily unavailable. The Beeb will not then 'hang' waiting for the printer to go 'on line'.

That concludes this series of Workshops on the use of printers. You should now be able to use most of the facilities that your printer offers from within Basic or any word processor. Equally important, you should now be able to extract the relevant commands for any function from your printer manual, and use these in your own programs. **B**

## *Points Arising....Points Arising....Points Arising....Points Arising....*

### VIDEO CATALOGUER (Vol.6 Nos.9 and 10)

Unfortunately the three additional lines included under points arising last month were incorrectly numbered to fit in with part two. To correct this, change lines 3930, 3940 and 3950 to read 3915, 3916 and 3917 respectively. **B**



*If you find the BBC's flashing colours limited and not particularly useful, read how Colin Reynolds' utility transforms this situation, and provides a useful tool for animation.*

Have you ever wished to use a flashing colour that was not black & white, red & cyan, or one of the other defaults? The flashing colour combinations and rates on the BBC micro are very basic, and users may find these limiting. This program extends flashing colours to a level where they can produce some really interesting effects if used imaginatively.

COLOUR	TIME 1/50 SECOND	
	0	85
1	RED	BLUE
2	BLACK	RED

*Colour/Time Chart Example 1*

The program allows the user to re-define any of the logical colours to flash between any two of the physical colours at any rate. You can even switch between two physical flashing colours.

### HOW TO USE THE PROGRAM

Each logical colour is re-defined by seven values. To use the program, after you have typed it in and saved it, you will need to specify suitable values in DATA statements between lines 800 and 990. The meaning of these values is:

- 1 - Logical colour to be defined.
- 2 - 1st physical colour.
- 3 - 2nd physical colour.
- 4 - Period of 1st colour (50ths of a second)

- 5 - Period of 2nd colour (50ths of a second)
- 6 - Counter (usually 1)
- 7 - Flag (usually 0)

The sixth value can nearly always be set to 1 for each colour defined. It is however possible, by changing this value, to get special effects, as described in the second example below. The flag is used to keep track of which colour is selected, and can always be left as 0.

To re-define another logical colour just add another DATA statement with the information in it as described above. The example in the program will re-define logical colour 1 (selected by COLOUR 1 or GCOL 0,1 etc.) to flash between colours 1 & 7 (red & white), with red selected for 1 second (50/50 ths) and white for 0.4 seconds (20/50 ths). When the program is run, it will set up the new colours, and these can then be disabled with \*FX13,4, and subsequently re-enabled with \*FX14,4 from within your own program.

### PROGRAM NOTES

The program uses the start of vertical sync event, which is enabled by \*FX14,4, to generate an event 50 times a second. For each logical colour defined, a counter is decremented each time the event occurs. Once this reaches zero the next colour is selected and the counter is loaded with the 'on' time of the new colour.

COLOUR	TIME 1/50 SECOND															
	20	40	60	80	100	120	140	160	180	200	220	240	260			
0	BLUE															
1	RED				YELLOW				ETC							
2	RED		YELLOW		ETC											
3	RED		YELLOW		ETC											
4	RED		YELLOW		ETC											
5	RED		YELLOW		ETC											
OFFSET																

*Colour/Time Chart Example 2*

As the program is so short (80 bytes), it can be fitted, together with enough data to re-define all 16 colours, into 200 bytes of memory. This means that it could be assembled, say, in the serial buffer at &900, and \*SAVEed as a block of memory.

## SCREEN DESIGNS

If you wish, you can define colours so that as one goes off another comes on, and so simple animation can be produced. This is illustrated in the examples below. To help you design these colours it is best to draw time/colour charts, and these are included for each of the following examples. To use the examples, in each case load in the the main program and then type in the example lines before running.

### Example 1.

```
600 MODE 2
610 COLOUR 1:PRINT TAB(5,10);"BEEBUG"
620 COLOUR 2:PRINT TAB(8,13);"BEEBUG"
630 COLOUR 7:END

800 DATA 1,1,4,70,15,1,0
810 DATA 2,0,1,70,15,1,0
```

### Example 2.

```
600 MODE2
610 FOR I=0 TO 15:GCOL 0,(I MOD 5)+1
620 PLOT 4,640,0:PLOT 5,I*80,900
630 NEXT:END

800 DATA 0,4,0,250,10,1,0
810 DATA 1,1,3,50,50,1,0
820 DATA 2,1,3,50,50,21,0
830 DATA 3,1,3,50,50,41,0
840 DATA 4,1,3,50,50,61,0
850 DATA 5,1,3,50,50,81,0
```

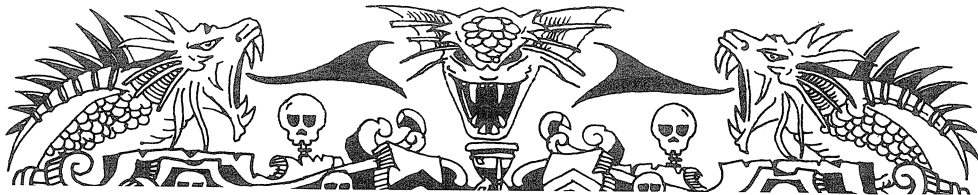
In colours 2 to 5 of the last example, the start counter (the 6th value in the data statement) has been set to a value other than 1. This means that although all the colours have the same flash rate, the flashing is staggered because of the different starting values. There is a lot of scope for experimentation here.

```
10 REM Program Multi Flash
20 REM Version B1.2
30 REM Author Colin Reynolds
40 REM BEEBUG May 1988
50 REM Program subject to copyright
60 :
100 DIM PROG% 200
110 OSWORD=&FFFF1
120 FOR C=0 TO 3 STEP 3
```

```
130 P%=PROG%
140 [OPT C
150 .start
160 PHP:PHA:TXA:PHA:TYA:PHA
170 LDX #&00
180 .loop
190 LDA sto,X:CMP #&FF:BEQ exit
200 DEC sto+5,X:BNE next
210 TXA:CLC:ADC sto+6,X:TAY
220 LDA sto+3,Y:STA sto+5,X
230 LDA sto+6,X:EOR #&01:STA sto+6,X
240 LDA sto,X:STA spc
250 LDA sto+1,Y:STA spc+1
260 TXA:PHA
270 LDX # (spc AND 255)
280 LDY # (spc DIV 256)
290 LDA #&0C:JSR OSWORD
300 PLA:TAX
310 .next
320 TXA:CLC:ADC #&07:TAX
330 JMP loop
340 .exit
350 PLA:TAY:PLA:TAX:PLA:PLP
360 RTS
370 ]
380 spc=P%
390 $spc=STRING$(5,CHR$(0))
400 P%=P%+6
410 sto=P%
420 RESTORE
430 REPEAT
440 READ A%
450 ?P%=A%:P%=P%+1
460 UNTIL A%=255
470 NEXT
480 ?&220=PROG% AND 255
490 ?&221=PROG% DIV 256
500 *FX 14,4
510 :
800 DATA 1,1,7,50,20,1,1
990 DATA 255
```

B

This month's magazine disc contains an extended demonstration, illustrating some of the effects that can be achieved with the new flashing colours.



## ADVENTURE GAMES by Mitch ADVENTURE GAM

Wrenching the controls to port caused the ship to keel over and drop sickeningly out of the purple rain-clouds. Glancing at the orward view-screen, I could make out the far mountain range piercing the shroud of the perpetual thunderstorm. The deeper hued purple of the cratered plain rushed skyward as the retro-rockets cut in, causing the ship's hull to shudder uncontrollably. Spying a small clearing lying at the foot of a large rock-strewn defile, I kicked the rudder and applied lateral thrust until the ship grudgingly lurched into the shadow of the overhang. With a final roar of triumph the engine cut and allowed the support struts to sink into the purple sands of Doom. I had returned.



Product	RETURN TO DOOM
Supplier	Topologika P.O. Box 39, Stilton PE7 3RL. Tel. 0733-244682
Price	£12.95 inc. VAT (disc only)

Having previously survived the acid rain of the planet Doom, only a fool would return, but who could ignore the distress signal of the space cruiser Galapoxi? The ship was carrying the Earth's Ambassador to Flux, and somehow it had been forced down over the dreaded planet. In the short time available before your ship is destroyed by the metal-rotting rain you must overcome the obstacles and rescue the Ambassador from her captors.

In this sequel to Countdown to Doom, Peter Killworth has managed to squeeze a quart of fun and puzzles into the BBC's pint of memory. Peter has again disregarded the opportunity to include an over-clever command parser, and instead opted for small answers to big puzzles. You will find that in general, dropping, throwing and waving are the order of the day without any superfluous subtleties. However, this does not mean that things are any the easier for the player as the problems are as convoluted as ever.

To tighten the screw, the game appears to include more than a few red herrings. Inserting objects which have no purpose is one way of confusing the player, but Peter has taken the dishonourable step one stage further. By permitting the player to use a useless object in what appears to be a useful manoeuvre, he thereby convinces the player that the object is bona fide, but in fact takes him further up the creek. In addition, the game is required to be played in the correct sequence of moves, as failure to arrive at a certain location within a set number of moves will also seal your fate.

The game does not permit you to EXAMINE objects, and this I personally find annoying. I have heard and appreciate Peter's argument that such fripperies are not required, but I don't agree. With a disc-based database to which this game has access, there is the space to provide a more friendly interface between the player and the adventure. If I am holding an object such as a computer and the game does not understand EXAMINE COMPUTER, SWITCH ON COMPUTER or USE COMPUTER I start to get resentful. I realise that if I bide my time, sooner or later in the game there will arrive a time where the appropriate use of the object in question will become more obvious, but before that happens a novice player will have stamped the obdurate machine into a pile of silicon chips with frustration.

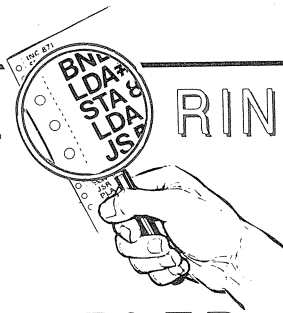
Return to Doom contains all the humour you would expect from Peter, and again his 'engineering bent' lends credibility to the puzzles. There is a Montypython who will squeeze you, a Grobber who will gobble you, and a Stereo Rock monster who will grind you up. For the faint-hearted a built-in hint facility has been included from which you may request a series of increasingly obvious clues to any problem. It should be mentioned that the game does contain a bug which surfaces if you should die at certain locations. On being asked if you wish to start a new game, the program crashes with a 'NOT FOUND' message if you

*Continued on page 66*

**Beebug May 1988**



# EXPL RING



## ASSEMBLER

### Part 10

A series for beginners  
to machine code by Lee Calcraft

This month: Integer Division

#### DEDUCING AN ALGORITHM

Last month we tackled the problem of multiplication in assembler. Division, I am afraid, is no easier - though as with multiplication, dividing by powers of two is extremely easy. To divide an integer by 2, just shift it right by one place. To divide by 4, shift by two places, and so on. But for a general purpose division routine, our best bet is to begin by taking a look at longhand division, to see the exact process involved.

Take for example the number 325 divided by 14. In longhand this will take the following form:

	<u>023</u>	Quotient
Divisor	14   325	Dividend
	3	
	<u>14</u>	
	0	
	32	
	<u>14</u>	
	2	
	45	
	<u>14</u>	
Remainder	3	

Here we begin by taking the first digit of the dividend (3), and trying to divide the divisor into it. It will not go, so we place a zero as the leftmost digit of the quotient. The next digit of the dividend (2) is taken down and placed

beside the first digit, making 32. We again see how many times 14 will divide into it. The answer this time is 2, so we insert a 2 as the second digit of the quotient.  $2 \times 14$  is then subtracted from the 32, and the remainder (4) is used as the top digit of the partial dividend for the next division. This time the final digit of the dividend (5) gives a final partial dividend of 45. The result of this division is 3, and this takes its place as the final digit of the quotient. Finally we subtract  $3 \times 14$  from the partial dividend to give the remainder. The final result is thus 23, with a remainder of 3.

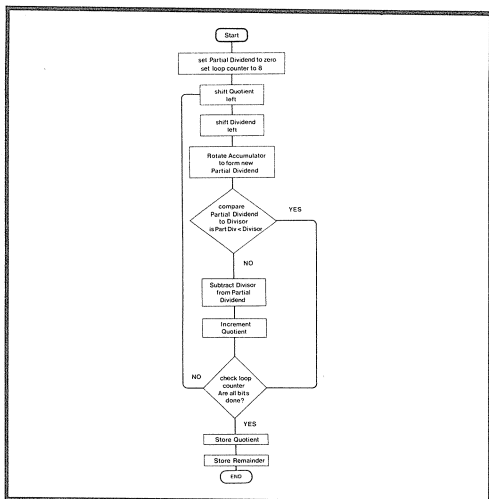
What happens in binary arithmetic is very similar, except that we never need to see how many times the divisor will divide into the partial dividend: we need only see if it can or cannot be subtracted from it (because we are dealing with binary numbers, the partial dividend must be less than twice the divisor). To establish the basis for an integer division algorithm, we will try dividing 110110 by 101 (i.e. 54 divided by 5).

	<u>001010</u>
101	110110
	101
	<u>001</u>
	111
	<u>101</u>
	10
	100
	<u>101</u>

The first step is to attempt to subtract the divisor (101) from the top bit of the dividend. It will not go, so we place a 0 in the top bit of the quotient, and tack on the next bit of the dividend. This partial dividend (11) is still too small, so we repeat the process. This gives us a partial dividend of 110. The divisor *can* be subtracted from this, so we perform the subtraction, and the remainder (1) drops down to take its place as the top part of the next partial dividend, and we place a 1 in the next position of the quotient.

We repeat this process until we have made the attempted subtraction a total of  $n$  times, where  $n$  is the number of bits in the dividend. The

result is 001010 with a remainder of 100; or in decimal terms, 54/5 gives 10 with a remainder of 4.



We can now establish five main steps in the division process, and I can do no better than to quote Leo Scanlon's extremely succinct presentation of them in his *6502 Software Design*.

1. Shift the quotient left (initially zero) to provide a (least significant) bit position for the next quotient digit.
2. Shift the dividend left, so that another bit from the partial dividend is tested.
3. Compare the divisor to the partial dividend.
4. If the divisor is less than or equal to the partial dividend, subtract the divisor from the partial dividend and enter a 1 in the quotient.
5. If any digits remain in the dividend, return to step 1.

```

Dividend (1-255) ? 233
Divisor (1-255) ? 19
Result= 12
Remainder= 5

Dividend (1-255) ?
  
```

### AN INTEGER DIVISION PROGRAM

A program to implement these steps is

given in listing 1. When it is run, it will request a dividend and divisor in the range 1 to 255, and will perform the division, and display the result. It works as follows. The dividend and divisor are held in RAM at &70 and &71, and

### Listing 1

```

10 REM Integer divide
20 REM Author Lee Calcraft
30 REM Version B 0.6
40 :
50 dividend=&70:divisor=&71
60 quotient=&72:remainder=&73
70 MODE7
80 FOR pass=0 TO 1
90 P%=&900
100 [
110 OPT pass*3
120 LDA #0
130 LDX #8
140 .next
150 ASL quotient
160 ASL dividend
170 ROL A
180 CMP divisor
190 BCC skip
200 SBC divisor
210 INC quotient
220 .skip
230 DEX
240 BNE next
250 STA remainder
260 RTS
270 ]
280 NEXT
290 :
300 REPEAT
310 INPUT"Dividend (1-255) ? "divid
320 INPUT"Divisor (1-255) ? "divis
330 ?divisor=divis:?dividend=divid
340 CALL &900
350 PRINT"Result= "?quotient
360 PRINT"Remainder= "?remainder
370 UNTIL FALSE
  
```

the partial dividend will be held in the accumulator. This is zeroed at the start (line 120), and the X register, which will hold the loop count, is set to 8. The quotient and the dividend are then both shifted one position to the left. The dividend must be shifted last, because the purpose of shifting it is to transfer its top bit to the carry flag. The accumulator is then rotated left (line 170), and as you may remember from last month, this causes the carry flag to be placed in bit zero of the accumulator, and thus forms the first bit of the partial dividend.

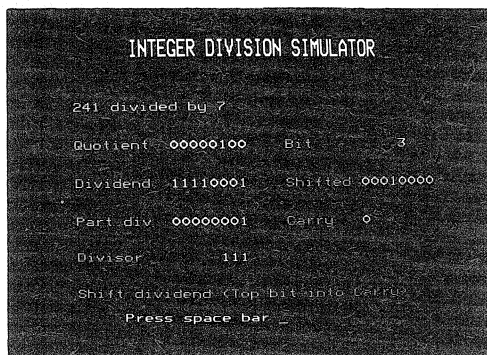
The instruction CMP divisor is then encountered in line 180. This is central to the whole process, since it checks whether the divisor will divide into the partial dividend. If it will not, then the next couple of lines are skipped. These actually subtract the divisor from the partial dividend (SBC divisor in line 200), leaving the remainder in the accumulator as the top part of the next partial dividend. The quotient is then incremented. This just places a one at the appropriate position in the quotient if division took place.

Now the loop counter is decremented (line 230), and the loop repeated until all 8 bits have been processed. Just before the routine terminates, the contents of the accumulator (which must of course hold the final remainder), are saved to *remainder* at &73.

Considering all that is involved, the routine is extremely short. But Scanlon has spotted a way to shorten it still further, and slightly increase its speed. He stores both dividend and quotient at the same location in RAM. This saves a shift operation at each of the routine's 8 cycles, and takes advantage of the fact that as the quotient builds up in RAM from the right, so the dividend is shifted out to the left.

## AN INTEGER DIVISION SIMULATOR

Because of the complexity of the division algorithm outlined above, I have included a second listing which provides a demonstration of the process in action. It is written in Basic, and displays the various registers and their contents, together with the state of the carry flag during an 8 bit division. To use the program, type it in, and save it away. When it is run it will request the input of a dividend and divisor, and will then move into display mode. All the major registers will be displayed, and text indicating each step in the process will appear at the foot of the screen. At each press of the space bar, another step will be performed, and its effect will be seen on the display. This continues until the full 8 bits have been



processed, and the quotient register contains the result of the division, with the remainder in the accumulator.

Next month we move on to an altogether different topic: The 6502's stack, and the use of subroutines.

### Listing 2

```
10 REM Program Division Simulator
20 REM Version B 0.9e
30 REM Author Lee Calcraft
40 REM BEEBUG May 1988
50 REM Program subject to copyright
60 :
100 MODE7
110 PROCinit
120 REPEAT
130 PROCsetup
140 PROCdivide
150 UNTIL FALSE
160 :
1000 DEFPROCinit
1010 X1=0:X2=11:X3=22:X4=31
1020 Y$=CHR$131:C$=CHR$134
1030 PRINT TAB(5,1)Y$CHR$141"INTEGER DI
VISION SIMULATOR"
1040 PRINT TAB(5,2)Y$CHR$141"INTEGER DI
VISION SIMULATOR"
1050 ENDPROC
1060 :
1070 DEFPROCsetup
1080 quot=0:partd=0
1090 VDU28,0,23,39,3:CLS
1100 INPUT TAB(0,8)"Dividend (1-255) ",
divid
1110 INPUT TAB(0,12)"Divisor (1-255) "
,divis
```

```

1120 CLS:VDU26
1130 PRINTTAB(X1,6)C$:"divid;" divided b
y ";divis
1140 PRINTTAB(X1,9)C$"Quotient"Y$
1150 PRINTTAB(X1,12)C$"Dividend"Y$ TAB(
X3)C$"Shifted"Y$
1160 PRINTTAB(X1,15)C$"Part div"Y$ TAB(
X3)C$"Carry"Y$
1170 PRINTTAB(X1,18)C$"Divisor"Y$
1180 PROCputbin(quot,X2,9,FALSE,TRUE)
1190 PROCputbin(divid,X2,12,FALSE,TRUE)
1200 PROCputbin(divid,X4,12,FALSE,TRUE)
1210 PROCputbin(0,X2,15,FALSE,TRUE)
1220 PROCputbin(divis,X2,18,TRUE,TRUE)
1230 ENDPROC
1240 :
1250 DEFPROCdivide
1260 FOR count=7 TO 0 STEP -1
1270 RESTORE
1280 PRINTTAB(X3,9)C$"Bit";SPC8 Y$;coun
t
1290 PROCText:PROCwait
1300 quot=FNshift(quot)
1310 PROCputbin(quot,X2,9,FALSE,FALSE)
1320 PROCText:PROCwait
1330 divid=FNshift(divid)
1340 PRINTTAB(X4,15);ABS(carry)
1350 PROCputbin(divid,X4,12,FALSE,FALSE
)
1360 PROCText:PROCwait
1370 partd=FNrotate(partd)
1380 PROCputbin(partd,X2,15,FALSE,FALSE
)
1390 PRINTTAB(X4,15)"0"
1400 PROCText:PROCwait
1410 IFpartd>=divis THEN success=TRUE:P
ROCText:READA$:quot=quot+1:partd=partd-d
ivis ELSE success=FALSE:READA$:PROCText:
READA$:READA$
1420 PROCwait
1430 IF success THEN PROCText:PROCwait:
PROCputbin(quot,X2,9,FALSE,TRUE):PROCTex
t:PROCwait:PROCputbin(partd,X2,15,FALSE,
TRUE)
1440 IFcount=0 THEN READA$
1450 PROCText:PROCwait
1460 NEXT
1470 PROCText:PROCwait:PROCText:PROCwai
t
1480 SOUND 1,-15,50,2:PROCText:PROCwait
1490 ENDPROC
1500 :

```

```

1510 DEFPROCputbin(no,X,Y,suppress,fast
)
1520 PRINTTAB(X,Y);
1530 FOR n=7 TO 0 STEP -1
1540 IF NOT fast THEN Z=INKEY(10)
1550 bit=no DIV 2^n
1560 IF bit>0 OR n=0 suppress=FALSE
1570 IF bit=0 AND suppress=TRUE THEN bi
t=-16
1580 VDU bit+48
1590 no=no MOD 2^n
1600 NEXT
1610 ENDPROC
1620 :
1630 DEFPROCwait
1640 *FX15
1650 PRINTTAB(5,23)Y$"Press space bar "

1660 REPEAT UNTIL GET=32
1670 ENDPROC
1680 :
1690 DEFFNshift(param)
1700 result=param*2
1710 carry=(result>255)
1720 =result AND 255
1730 :
1740 DEFFNrotate(param)
1750 =-carry+FNshift(param)
1760 :
1770 DEFPROCtext
1780 READ A$
1790 PRINTTAB(0,21);SPC40;
1800 PRINTTAB(0,21)C$A$
1810 ENDPROC
1820 :
1830 DATA Shift quotient ready for next
bit
1840 DATA Shift dividend (Top bit into
Carry)
1850 DATA Rotate part div (Shift & pick
up carry)
1860 DATA Compare part div to divisor
1870 DATA Comparison succeeds
1880 DATA Comparison fails
1890 DATA So increment quotient
1900 DATA and put remainder into part d
iv
1910 DATA Repeat for next bit
1920 DATA Division complete
1930 DATA Quotient holds the result
1940 DATA Remainder in partial dividend
1950 DATA Press space for new division

```



# MS-DOS TRANSFERS (pt2)

*In this article Bernard Hill presents the second of two utilities to provide a means of transferring files between the Beeb and PC micros.*

In last month's article we produced a program that would copy files from a disc formatted on an IBM PC to one formatted on a Beeb (provided that the Beeb has a 1770 disc interface). This second article introduces a program to reverse that process, i.e. to copy files from DFS format to MS-DOS\*, which can then be read on your IBM PC (or Amstrad, or whatever). Again your machine must be fitted with a 1770 disc interface.

Before setting out, however, we had better clear the air on a potential problem for 80-track disc users. If you are using a standard 40-track 360K DOS format disc then this will have been formatted using a 40-track drive so the tracks will be wider than those on your 80-track BBC system. This may give rise to read errors when you attempt to read them on your PC's 40-track drives. This is an unavoidable hardware problem (familiar to users of both AT's and PC's) which cannot be completely overcome by software. In order to minimise this problem I have found it useful to save a file twice (the program will automatically use different names). For some reason my drives give better results when the files are on lower-numbered tracks, so use an empty MS-DOS disc.

If problems persist with your hardware combination then you will have no option other than to use 40-track drives on your BBC machine (as you will find recommended on commercially available transfer packages).

My failure rate on 80-track drives seems to be about one error in every 250K transferred, so I have been able to use my BBC at home to talk

to my MS-DOS machine at work quite reliably for some weeks now.

## CUSTOMISING

To convert the program for use with your system you may need to alter some of the parameters at the beginning of the program (for details see last month's article).

a. Line 140 contains a speed specification; use a value 0 to 3, 0 is the fastest, 3 the slowest drive speed.

b. The MS-DOS disc is assumed to be in drive 1 and the BBC disc in drive 0. If you have a single drive only, set D=0 in line 160 and switch discs when the program requests it.

c. Line 170 is set for 80-track drives. If you are using 40-track then change this line to read track80=FALSE.

d. The end-of-line and end-of-file conventions are different in MS-DOS and DFS. If you are transferring ASCII files then set asc%=TRUE in line 150, but if you are transferring binary data files then set asc%=FALSE. Furthermore, if your ASCII files are View files then you will need to set View%=TRUE, but if your files are spooled from any other BBC wordprocessor (such as Wordwise or EDIT) then set View%=FALSE. This is because View distinguishes between hard spaces (ASCII 32) and soft (ASCII 26) and we will need to convert to ASCII 32 for the PC.

## RUNNING THE PROGRAM

When the program runs, it reads the MS-DOS directory and evaluates the free space on the disc. This may take a second or two, but eventually the menu is displayed. Options are available to catalogue the MS-DOS disc, issue a star command such as \*DRIVE, \*DIR or \*CAT to see your BBC disc, delete a file on the MS-DOS disc (to make room for any files you wish to transfer) or, of course, to transfer a file. The file will be saved with a name which is the same as the BBC's but with the MS-DOS extension ".BBC". Should a file of this name already exist on the MS-DOS disc then it will be



saved with an extension of ".BBD" (and ".BBE" if that exists, etc.). Since a "." is not allowed in MS-DOS names then it is not possible to copy from directory X by giving a filename of "X.<file>". Instead issue \*DIR X and use the short name.

If you are using a Master then the date/time stamp on the MS-DOS disc file will be taken from the system clock, otherwise it will be set to the MS-DOS default of 1-01-80. To remain consistent with last month's utility, provisions have been included to read/write the 720K discs supported by the Archimedes under the PC Emulator.

*"MS-DOS is a registered trade mark of the MicroSoft Corporation."*

We hope that the combination of this excellent utility, along with the one published last month, will provide a quick and easy way of transferring files between the two machines. We are already finding them invaluable here at BEEBUG.

```

10 REM Program BBC to IBM transfer
20 REM Version B1.7
30 REM Author Bernard Hill
40 REM Beebug May 1988
50 REM Program subject to copyright
60 :
100 ON ERROR GOTO 610
110 MODE7
120 bufsiz=8*1024
130 DIM buf% bufsiz,fat 2048,dir 3584
140 speed=0
150 asc%=TRUE:View%=TRUE
160 D=1
170 track80=TRUE
180 A%=0:X%=1:A%=(USR&FFF4 DIV 256) AND
D &FF:Master=A%>2
190 c$=STRING$(13," ")&CHR$(134
200 M=112:DIMSIZ(M),CL%(M),N$(M),F M+
3
210 FOR i=0 TO 112 STEP 4:F!i=-1:NEXT
220 L$="":PROCswitch("DOS")
230 PROCinitpc(Master)
240 PROCsetradr(fat):PROCgetsec(1)
250 d2=fat?21=&F9
260 IF d2 THEN track80=FALSE:dirsec=8
ELSE dirsec=6
270 ns=fat!19 AND &FFFF
280 IF ns<>720 AND ns<>1440 THEN PRINT
"Not DOS format disc":END

```

```

290 IF fat?21=&F9 THEN maxclus=714 ELS
E maxclus=355
300 PROCswitch("DOS")
310 PROCtitle:PROCdirfat2
320 dosfree=FNdosfree
330 REPEAT:REPEAT:PROCdosfree(dosfree)
340 f=0
350 CLS:PRINT"TAB(13)CHR$133"OPTIONS:
"
360 PRINT"" ?";c$;"DOS Directory"
370 PRINT"" ^";c$;"Delete a DOS file"
380 PRINT"" *....";TAB(16):CHR$134;"I
ssue * command"
390 PRINT"" <filename>";TAB(16):CHR$1
34;"Transfer file to DOS"
400 PRINT"" RETURN/Escape";TAB(16):CH
R$129"End program"
410 PRINT":INPUT" Option : "f$
420 IF ASCf$=94 THEN PROCdelete:IF nf=
0 OR n=0 THEN 500
430 IF f$="" THEN MODE7:END
440 IF ASCf$=63 THEN PROCdosdir:PROcke
y:GOTO 500
450 IF ASCf$=42 THEN PROCswitch("BBC")
:OSCLI(f$):PROCkey:GOTO 500
460 IF nf=112 THEN PRINT"TAB(10)"DOS D
irectory full":PROCkey:GOTO 500
470 IF INSTR(f$,".") THEN PRINT"""".""
not allowed in filename":PROCkey:GOTO 5
00
480 PROCswitch("BBC")
490 f=OPENINF$:IF f=0 THEN PRINT "File
not found":PROCkey
500 UNTIL f<>0 : size=EXT#f
510 IF size>dosfree THEN PRINT"" Not
enough room on DOS disc":PROCkey
520 UNTIL size<dosfree
530 PROCadddir(f$):ptr%=0:S%=0
540 PROCswitch("BBC")
550 REPEAT PROCxfer(BGET#f):UNTIL EOF#
f
560 IF asc% THEN PROCxfer(26)
570 PROCxferbuff:PROCputclus(free,&FFF
)
580 CLOSE#f:dir!(32*ifn+28)=S$
590 PROCdirfatback:RUN
600 :
610 CLOSE #0
620 IF ERR<>17 THEN MODE7:REPORT:PRINT
" at line "ERL:END
630 PRINT:END
640 :
1000 DEFPROCxfer(B%)

```

```

1010 IF B%=26 THEN IF asc% THEN IF View
% THEN B%=32
1020 IF B%>126 THEN IF asc% THEN ENDPRO
C
1030 buf%?ptr%=B%:S%=S%+1:ptr%=ptr%+1
1040 IF ptr%=bufsiz THEN PROCxferbuff
1050 IF B%=13 THEN IF asc% THEN PROCxfer
r(10)
1060 ENDPROC
1070 DEFPROCxferbuff:s=PTR#f:CLOSE#f
1080 PROCswitch("DOS")
1090 IF ptr%<bufsiz THEN FOR I%=ptr% TO
bufsiz:buf%?I%=0:NEXT
1100 FOR i=0 TO (ptr%-1) DIV 1024
1110 IF NOT first THEN last=free:free=F
Nnextfreeclus:PROCputclus(last,free):PRO
Cputclus(free,&FFF)
1120 first=FALSE:sec=FNsecno(free)
1130 PROCsetwadr(buf%+1024*i)
1140 PROCputsec(sec):PROCputsec(sec+1)
1150 NEXT:PROCswitch("BBC"):DISC
1160 f=OPENINF$:PTR#f=s:ptr%=0:ENDPROC
1170 DEFPROCdosfree(n)
1180 LOCALx,y:x=POS:y=VPOS
1190 VDU26,31,6,3,135
1200 PRINTFNU(n,6);" (&";~n;") DOS byte
s free"
1210 VDU28,0,24,39,5,31,x,y:ENDPROC
1220 DEFPROCtitle:VDU26,12
1230 T$=CHR$132+CHR$157+CHR$131+CHR$141
+" BEEBUG BBC to PC transfer"
1240 PRINTT$'T$'LEFT$(T$,2)+CHR$130+"
(Drive 0 to drive "+STR$~D+)"'"CHR$
129;CHR$157
1250 VDU28,0,24,39,5:ENDPROC
1260 DEFFNU(v,@%):v$=STR$v
1270 IF LENv$<@% THEN v$=STRING$(@%-LEN
v$," ") +v$
1280 =v$
1290 DEFPROCKey
1300 PRINT"Any key to continue...":IF G
ET
1310 ENDPROC
1320 DEFPROCadddir(file$):LOCAL f
1330 ifn=0:REPEAT c=(dir+32*ifn)
1340 ifn=ifn+1
1350 UNTIL ifn>113 OR c=0 OR c=&E5
1360 IF ifn>113 THEN full=TRUE:ENDPROC
1370 ifn=ifn-1:free=FNnextfreeclus
1380 IF LENfile$>7 THEN name$=LEFT$(nam
e$,7) ELSE name$=file$+STRING$(8-LENfile
$," ")
1390 ch=ASC"C":REPEAT

```

```

1400 new$=FNuc(name$)+"BB"+CHR$ch:f=0
1410 REPEAT f=f+1:already=N$(f)=new$
1420 UNTIL f>=nf OR already
1430 IF already THEN ch=ch+1
1440 UNTIL NOT already
1450 PRINT" File saved as ";new$
1460 $(dir+ifn*32)=FNuc(name$)+"BB"+CHR
$ch
1470 dir?(ifn*32+11)=&20
1480 FOR j=12 TO 21:dir?(ifn*32+j)=0:NE
XT
1490 dir!(ifn*32+22)=FNstamp
1500 dir!(ifn*32+26)=free
1510 PROCputclus(free,&FFF)
1520 full=FALSE:first=TRUE:ENDPROC
1530 DEFFNUc(a$):LOCAL x$,a,i
1540 FOR i=1 TO LENA$:a=ASCMD$(a$,i)
1550 IF a>96 AND a<123 THEN x$=x$+CHR$(
a-32) ELSE x$=x$+CHR$a
1560 NEXT:=x$
1570 DEFPROCputsec(N):LOCAL r
1580 PROCswitch("DOS")
1590 T=(N-1) DIV 9:S=(N-1) MOD 9 + 1
1600 PROCrwsec(T,S,FALSE):ENDPROC
1610 DEFFNclus(n)
1620 !&70=fat!(3*(n DIV 2)):!&73=0
1630 IF n MOD 2=0 THEN !=!&70 AND &FFF E
LSE =(!&71 DIV 16) AND &FFF
1640 DEFFNsecno(c)=2*c+dirsec+3
1650 DEFPROCdirfat2:PROCsetradr(fat)
1660 PROCgetsec(2):PROCgetsec(3)
1670 PROCgetsec(4):PROCsetradr(dir)
1680 FOR s=dirsec TO dirsec+6
1690 PROCgetsec(s):NEXT
1700 loc=dir-32:nf=0:REPEAT loc=loc+32
1710 t=loc?11:IF ?loc=0 OR ?loc=&2E OR
?loc=229 OR t AND &18 THEN 1740
1720 nf=nf+1:loc?11=13:N$(nf)=LEFT$(lo
c,8)+"."+RIGHT$(loc,3):loc?11=t
1730 siz%(nf)=loc!&1C:cl%(nf)=loc!&1A A
ND &FFFF:F?nf=(loc-dir) DIV 32
1740 UNTIL ?loc=0 OR nf=M:ENDPROC
1750 DEFPROCgetsec(N):PROCswitch("DOS")
1760 PROCswitch("DOS")
1770 T=(N-1) DIV 9:S=(N-1) MOD 9 + 1
1780 PROCrwsec(T,S,TRUE):ENDPROC
1790 DEFPROCrwsec(T,S,read)
1800 *fx143,12,255
1810 val=rst:IF D=0 THEN val=val OR 1 E
LSE val=val OR 2
1820 IF T MOD 2=1 THEN val=val OR sel
1830 ?ctrl=val
1840 ?flag=1:?cmd=&C+speed:PROCwait

```

```

1850 IF track80 THEN ?datareg=(T DIV 2)
*2 ELSE ?datareg=T DIV 2
1860 ?flag=1: ?cmd=&18+speed : REM seek
1870 PROCwait
1880 ?trackreg=T DIV 2: ?secreg=S
1890 ?flag=1: IF read THEN ?cmd=&84 ELSE
?cmd=&A6 : REM read/write
1900 PROCwait: *DISC
1910 ENDPROC
1920 DEFPROCwait
1930 REPEAT UNTIL (?status AND 1)=0
1940 IF (?cmd AND &10) <> 0 THEN PRINT "Re
ad error drive "FNU(D,1)" track "FNU(T,1
)" sector "FNU(S,1): END ELSE ENDPROC
1950 DEFPROCinitpc(master)
1960 IF master THEN wd=&FE28: ctrl=&FE24
: sel=16: dden=&20: rst=4 ELSE wd=&FE84: ctr
l=&FE80: sel=4: dden=8: rst=&20
1970 cmd=wd: status=wd: trackreg=wd+1
1980 secreg=wd+2: datareg=wd+3: S=0: T=0
1990 ?ctrl=rst+D+1: ENDPROC
2000 DEFPROCsetradr(a)
2010 FOR opt=0 TO 2 STEP 2
2020 P%=&D00: [OPT opt : PHA
2030 LDA status: AND #1: STA flag
2040 LDA status: AND #&1F: CMP #3
2050 BNE exit: LDA datareg
2060 .dest STA a: INC dest+1
2070 BNE exit: INC dest+2
2080 .exit PLA: RTI
2090 .flag BRK
2100 ]: NEXT: S=0: T=0: ENDPROC
2110 DEFPROCswitch(a$): *fx15,1
2120 IF D=0 AND L$<>a$ THEN PRINT "Inser
t "a$" disk : press a key": IF GET
2130 L$=a$: ENDPROC
2140 DEFPROCsetwadr(a)
2150 *fx143,12,255
2160 FOR opt=0 TO 2 STEP 2
2170 P%=&D00: [OPT opt: PHA
2180 LDA status: AND #&1F: CMP #3
2190 BNE exit
2200 .dest LDA a: STA datareg: INC dest
+1
2210 BNE exit: INC dest+2
2220 .exit
2230 LDA status: AND #3: STA flag
2240 PLA: RTI
2250 .flag BRK
2260 ]: NEXT: S=0: T=0: ENDPROC
2270 DEFFNnextfreeclus: LOCAL i: REPEAT
2280 i=i+1
2290 UNTIL i>maxclus OR FNclus(i)=0
2300 IF i<=maxclus THEN =i
2310 PRINT "Cluster limit exceeded": END

```

```

2320 DEFFNdosfree: LOCAL i, T
2330 FOR i=1 TO maxclus
2340 IF FNclus(i)=0 THEN T=T+1
2350 NEXT: =T*1024
2360 DEFPROCputclus(n, v)
2370 !&70=fat! (3*(n DIV 2))
2380 IF n MOD 2=0 THEN !&70=(!&70 AND &
FFFFF000) OR v ELSE !&70=(!&70 AND &FFF00
0FFF) OR 4096*v
2390 fat! (3*(n DIV 2))=!&70: ENDPROC
2400 DEFPROCdirfatback: PROCsetwadr(fat)
2410 PROCsetwadr(fat)
2420 PROCputsec(2): PROCputsec(3)
2430 IF d2 THEN PROCputsec(4)
2440 PROCsetwadr(fat)
2450 IF d2 THEN s=5 ELSE s=4
2460 PROCputsec(s): PROCputsec(s+1)
2470 IF d2 THEN PROCputsec(s+2)
2480 PROCsetwadr(dir)
2490 FOR s=dirsec TO dirsec+6
2500 PROCputsec(s): NEXT
2510 ENDPROC
2520 DEFFNstamp
2530 IF NOT Master THEN =&210000
2540 X%=&70: Y%=0: A%=14: ?&70=1: CALL &FFF
1
2550 y=FNbcd(&70)-80: m=FNbcd(&71)
2560 d=FNbcd(&72): h=FNbcd(&74)
2570 n=FNbcd(&75): s=FNbcd(&76) DIV 2
2580 =s+32*n+2048*h+65536*(d+32*m+512*y
)
2590 DEFFNbcd(x)=10*(?x DIV 16)+?x MOD
16
2600 DEFPROCdelete: LOCAL n$: PROCdosdir
2610 IF nf=0 THEN PROCkey: ENDPROC
2620 PRINT "TAB(10);
2630 INPUT "Which : "n$: n=VALn$
2640 UNTIL F?n<>255 OR n<=0 OR n>nf
2650 IF n<=0 OR n>nf THEN n=0: ENDPROC
2660 n=F?n
2670 IF n=255 THEN PRINT "File not found
": ENDPROC
2680 dir?(32*n)=&E5: c=dir?(32*n+26)
2690 REPEAT v=FNclus(c): PROCputclus(c, 0
)
2700 c=v: UNTIL c>&FF7
2710 PROCdirfatback: RUN
2720 DEFPROCdosdir: LOCAL i: CLS
2730 IF nf=0 THEN PRINT "'TAB(16); "No fi
les"' : ENDPROC
2740 FOR i=1 TO nf
2750 PRINTFNU(i, 3); TAB(10); N$(i); TAB(25
); FNU(siz%(i), 6)
2760 NEXT: PRINT: ENDPROC

```

B



```

char string[], part1[], part2[];
{
  int c, n=0, m=0;
  while((c=string[n++]) != ' ' && c != '\n' && c
    != '\0' && c != ',')
    part1[m++]=c;
  part1[m] = '\0';
  m = 0;
  if(string[n] == '\0'){
    for(m = 0; m <=6 ; m++)
      part2[m]='\0';
  }
  else
  {
    while((c=string[n++]) && c != '\n' && c !=
    '\0')
      part2[m++]=c;
    part2[m] = '\0';
  }

  /* test part1, return TRUE if numeric */
  n = TRUE;
  for(m = 0; part1[m] != '\0'; m++){
    n = n & (part1[m] >= '0' && part1[m] <=
    '9');
  }
  if (m = 0)
    n=FALSE;
  return(n);
}

/* INSERT */
insert(linen, line)
int linen;
char line[];
{
  struct txtcontrol *ptr;
  struct txtcontrol *ptr1;
  int n;
  char c;

  /* Check for null line (delete) */
  ptr1 = firstpointer;
  if(line[0] == '\0'){
    /* null input - delete line */
    while(ptr1->linenum < linen && ptr1->next
    != NULL){
      ptr1 = ptr1->next;
    }
    if(ptr1->linenum == linen){
      if(ptr1->prev != NULL){
        ptr1->prev->next = ptr1->next;
      }

```

```

      ptr1->next->prev = ptr1->prev;
      if(ptr1 == firstpointer){
        firstline = ptr1->next->linenum;
        firstpointer = ptr1->next;
      }
      if(ptr1 == lastpointer){
        lastline = ptr1->prev->linenum;
        lastpointer = ptr1->prev;
      }

      return(NULL);
    }
  }
  return(NULL); /* null input, no such line */
}

/* non-null line */
ptr = &info[nfs++]; /* Next free cell in
info */

/* check for first/last line */
if(linen == firstline){
  ptr->linenum = linen;
  ptr->next = firstpointer->next;
  ptr->prev = NULL;
  ptr->next->prev = ptr;
  firstpointer = ptr;
}
if(linen == lastline){
  ptr->linenum = linen;
  ptr->next = NULL;
  ptr->prev = lastpointer->prev;
  ptr->prev->next = ptr;
  lastpointer = ptr;
}
if(linen < firstline){
  ptr->linenum = firstline = linen;
  ptr->prev = NULL;
  ptr->next = firstpointer;
  firstpointer = ptr;
  ptr->next->prev = ptr;
}
if(linen > lastline){
  ptr->linenum = lastline = linen;
  ptr->prev = lastpointer;
  lastpointer = ptr;
  if(ptr > info)
    ptr->prev->next = ptr;
}

/* line to be inserted between 1st and last */
if(linen > firstline && linen < lastline){
  while(ptr1->linenum < linen && ptr1->next !=
  NULL)

```

```

        ptr1 = ptr1->next;
    if(ptr1->linenum == linen){
        ptr->prev = ptr1->prev;
        ptr->next = ptr1->next;
        ptr->prev->next = ptr;
        ptr->next->prev = ptr;
    }
    else{ /* inserting a new line */
        ptr->prev = ptr1->prev;
        ptr->next = ptr1;
        ptr1->prev->next = ptr;
        ptr1->prev = ptr;
    }
}
ptr->linenum = linen;
ptr->ptext = pfree;

/* info pointers now set up */
/* copy line into text */
n=0;
while((c=line[n++]) != '\0'){
    *pfree = c;
    pfree++;
}
*pfree = '\0';
pfree++;
}

/* INITIALISE */
/* reset all pointers */
initialise(){
    int n;
    struct txtcontrol *ptr;
    ptr = info;
    for (n = 0; n <= LINEMAX; n++){
        ptr->prev = ptr->ptext = ptr->next = NULL;
        info[n].linenum = 0;
        ptr++;
    }
    pfree = text;
    firstline = 32000;
    lastline = 0;
    firstpointer = info;
    lastpointer = NULL;
    nfs = linenos = 0;
}

/* PROGLOAD */
progload(filename)
char filename[];
{
    int c, sub, n;
    char inline[80];
    if((in=fopen(filename,"r")) == NULL){
        printf("can't open file!");

```

```

        return(NULL);
    }
    linenos = 10;
    sub = n = 0;
    while((c=fgetc(in)) != EOF){
        if(c != '\n' && c != EOF)
            inline[n++] = c;
        else{
            if(n == 0)
                inline[n++] = ' ';
            inline[n] = '\0';
            insert(linenos,inline);
            linenos += inc;
            n=0;
        }
    }
    fclose(in);
    /* list first 21 lines */
    proglis(10,210);
}

/* PROGSAVE */
progsave(filename)
char filename[];
{
    int c,n;
    char *textptr;
    struct txtcontrol *ptr;
    /* check if ok to overwrite existing file */
    if((out=fopen(filename,"r")) != NULL){
        fclose(out);
        if(! (c=confirm()))
            return(NULL);
    }
    if((out=fopen(filename,"w")) == NULL){
        printf("unable to open file!!");
        return(NULL);
    }
    ptr = firstpointer;
    n = 0;
    while(ptr != NULL && (textptr = ptr->ptext) !=
    NULL){
        fputs(textptr,out);
        fputc('\n',out);
        ptr = ptr->next;
    }
    fclose(out);
}

/* CONFIRM */
confirm(){
    int c;
    printf("Do you wish to overwrite this file?
    Y/N");
    while((c=getchar()) != 'y' && c != 'n' && c !=

```

```

'Y' && c != 'N');
if(c=='Y' || c == 'y')
    return(TRUE);
else
    return(FALSE);
}

/* PROGLIST */
proglis(n1,n2)
int n1;
int n2;
{
    int n = 0;
    char *tpt;
    struct txtcontrol *pt;
    pt = firstpointer;
    if(n1 <= 0){
        n1 = firstline;
        n2 = lastline;
    }
    while(pt->linenum < n1){
        pt = pt->next;
    }
    if(n2 == 0 || n2 < n1){
        n2=lastline;
    }
    do{
        tpt = pt->ptext;
        if(pt->ptext != NULL){
            printf("%4d. %s\n",pt->linenum, tpt);
            pt = pt->next;

```

```

        }
        else{
            n2 = 0;
        }
    } while(pt->linenum <= n2 && n2 > 0 && pt !=
    NULL);
}

/* Convert a string to an integer */
atoi(str)
char *str;
{
    int x=0;
    int ans =0;
    if(str[0] == '\0')
        return(0);
    for( ; str[x] != '\0'; x++){
        ans = (10 * ans) + (str[x] - '0');
    }
    return(ans);
}

/* Put zero in null strings */
editcheck(s1,s2)
char s1[];
char s2[];
{
    if(*s1 == '\0')
        *s1 = '0';
    if(*s2 == '\0')
        *s2 = '0';
}

```

B

## MULTI-COLUMN PAGE PRINTER (continued from page 11)

```

3520 .cnoc DEX:BNE cloopl
3530 RTS
3540 :
3550 .makeline LDY #S:LDX bufptr
3560 .charloop JSR osbget:BCS eof
3570 CMP #ASC("{}"):BEQ eop
3580 CMP #ASC("{}"):BEQ eoc
3590 CMP #&OD:BEQ eol:CMP #ASC" ":
BCS notc:LDA #ASC" "
3600 .notc STA buffer,X:INX:CPX #cwid%
3610 BEQ charloop:BCC charloop
3620 DEX:CMP #&20:BEQ eol
3630 JSR split:JMP storebuffer
3640 .eof LDA #&FF:STA eoflfg
3650 .eop LDA #&FF:STA eopflg
3660 .eoc LDA #&FF:STA eocflg
3670 .eol LDA #&FF:STA eolflg
3680 LDA #0:STA bufptr
3690 DEX:CPX #&FF:BEQ return
3700 .storebuffer TXA:TAY

```

```

3710 .stloop LDA buffer,Y:STA (lbase),Y
3720 DEY:CPY #&FF:BNE stloop
3730 .return RTS
3740 :
3750 .sploop DEX
3760 .split LDA buffer,X
3770 CMP #&20:BEQ spc:CPX #0:BNE sploop
3780 LDX #cwid%
3790 .spc DEX:RTS
3800 :
3810 .bufferreset LDY #0
3820 .buloop INX:LDA buffer,X
3830 CMP #&20:BEQ next
3840 STA buffer,Y:INY:STY bufptr
3850 .next CPX #cwid%BCC buloop
3860 RTS
3870 :
3880 ]:NEXT
3890 ENDPROC

```

B



# VIEW SHEET & STORE

*Peter Rochford gives an overview of the latest Dabhand guide to Acorn's View family.*

When I reviewed Acornsoft's ViewStore database management ROM in BEEBUG Vol.4 No.5, I was full of praise for this excellent piece of software. I did, however, point out that to get the full power from this package, you needed to study the manual very carefully. Perhaps I should have been more forthright and said that the manual was not as easy to follow as it should have been and lacked in detail in certain areas.

This criticism I think would also apply to the manuals that accompany the rest of the View family. The View productivity software suite is indeed excellent and powerful, but the manuals are neither comprehensive, nor easy to follow, particularly for those new to computing.

Dabs Press has not been slow to seize on this long-standing weakness, and following on from its initial Dabhand Guide to View, it has now released a guide to both ViewSheet and ViewStore in one book.

The Dabhand Guide to ViewSheet and ViewStore is a 340 page spiral-bound book aimed at those who want to get the best from their View database and spreadsheet. It is written by Graham Bell who is the editor of Acorn User.

The book is a complete tutorial and reference guide to both software packages, and contains several examples of setting up and using a database and a spreadsheet. A number of very

useful utility programs are included, and these can be purchased on disc at a cost of £7.95 if you do not want the chore of typing them in.

Apart from clarifying and expanding on the information in the original manuals, the book provides a host of hints and tips, which make using both pieces of software that much simpler and quicker. Also provided are some excellent quick reference guides to both commands and error messages.

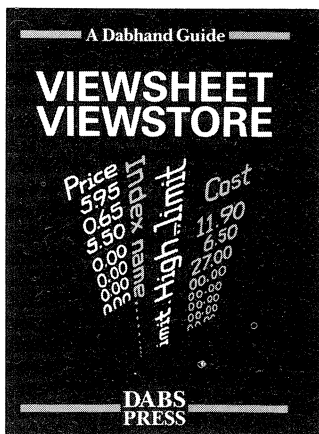
To give a detailed breakdown of the matter covered by this book is not really within the scope of this review, as there is just so much information on both pieces of software. Suffice to say that it is very comprehensive indeed, and certainly provides answers to the many questions left by the original manuals. As an example, the REPORT utility in ViewStore is one which has caused problems to many, myself included, as the detail in the original manual was so vague. This book has a large section devoted to this particular area. By use of several examples it unveils the mysteries and enables the setting up of some very complex reports with relative ease.

The book is written in an easy to follow style and should find favour with both newcomers and old hands. There are numerous examples which help to illustrate the areas

covered. In addition to the information on ViewSheet and ViewStore, the author has provided details of ViewPlot and the OverView package for the Master.

In conclusion, I can find little to criticise in this book. It is well-written, instructive and informative, and provides all the right kind of information that users of ViewSheet and ViewStore are likely to need. Highly recommended.

**B**



ViewSheet & ViewStore.  
A Dabhand Guide by Graham Bell,  
published by Dabs Press at £12.95.

## BEEBUG MINI-WIMP (Continued from page 23)

8820:C8B1	F229	DFC9	57D0	F0D9	8918:696F	6E3E	0D20	204D	D12E	8A10:6E64	6F77	7300	0000	0313
8828:29A9	6985	77A9	8885	A796	8920:574C	4F41	4420	3C66	339C	8A18:D54E	6F20	7769	6E64	D91E
8830:78A0	00B1	7720	E3FF	9BEF	8928:696C	656E	616D	653E	7360	8A20:6F77	206F	7065	6E00	98B2
8838:C8D0	04E6	78A0	00AA	E33C	8930:203C	7374	6172	7420	EB86	8A28:0000	0000	D642	6164	79C8
8840:D0F1	4CA2	80A2	00BD	E8D0	8938:6963	6F6E	3E0D	2020	7388	8A30:2070	6172	616D	6574	B554
8848:5588	20E3	FFE8	C9D0	C910	8940:4D57	5341	5645	203C	7A88	8A38:6572	7300	0000	0000	0C25
8850:D0F5	4C9B	800A	4D49	7A14	8948:6669	6C65	6E61	6D65	07BA	8A40:D742	6164	2069	636F	8605
8858:4E49	5749	4D50	2052	70C4	8950:3E20	3C73	7461	7274	5BE8	8A48:6E00	0000	0000	0000	3115
8860:4F4D	2056	312E	3030	5156	8958:3E20	3C65	6E64	3E0D	3E79	8A50:0000	0049	434F	4E20	F103
8868:0D0A	4D49	4E49	5749	FABE	8960:0D50	6F69	6E74	6572	D590	8A58:2020	204F	5045	4E20	C807
8870:4D50	2052	4F4D	2056	90FB	8968:3A0D	0D20	204D	5743	785F	8A60:2020	2053	4554	5550	FFF9
8878:312E	3030	2028	4329	7F79	8970:4F4F	5244	203C	302D	4C94	8A68:2020	2043	4F4F	5244	7815
					8978:3339	3E20	3C30	2D33	38C3	8A70:2020	2050	4F49	4E54	D0C4
										8A78:4552	2053	4855	5420	39BB
8880:2044	414A	2031	3938	9A1B	8980:303E	0D20	204D	5750	C130	8A80:2020	2053	5449	434B	81B4
8888:370D	0D20	204D	5753	633A	8988:4F49	4E54	4552	0D0D	76EF	8A88:2020	204B	4559	2020	B9AA
8890:4554	5550	0D20	204D	EC8E	8990:4E65	7720	6572	726F	BF92	8A90:2020	204D	4F55	5345	AC3A
8898:574B	4559	0D20	204D	C25B	8998:7273	3A0D	0D20	2032	EFAD	8A98:2020	2044	4546	2020	847A
88A0:5753	5449	434B	0D20	9D3E	89A0:3132	2D54	6F6F	206D	3F12	8AA0:2020	204C	4F41	4420	66A2
88A8:204D	574D	4F55	5345	3D71	89A8:616E	7920	7769	6E64	AEBE	8AA8:2020	2053	4156	4520	C334
88B0:0D0D	5769	6E64	6F77	0D73	89B0:6F77	730D	2020	3231	C1A8	8AB0:2020	20AB	80BC	8117	645D
88B8:733A	0D0D	2020	4D57	DF0B	89B8:332D	4E6F	2077	696E	0F9E	8AB8:843C	8475	841D	86D6	1400
88C0:4F50	454E	203C	6C78	9148	89C0:646F	7720	6F70	656E	C051	8AC0:86DD	86E4	86EB	8649	E5BF
88C8:2C62	792C	7278	2C74	9208	89C8:0D20	2032	3134	2D42	5FC3	8AC8:8786	8707	0F1F	3F7F	E3DA
88D0:793E	0D20	204D	5753	F3CE	89D0:6164	2070	6172	616D	69C1	8AD0:FFFF	FFFF	3C3C	3838	FAC5
88D8:4855	540D	0D49	636F	6467	89D8:6574	6572	730D	2020	0A8A	8AD8:0000	0000	0206	0E1E	3106
88E0:6E73	3A0D	0D20	204D	1CC9	89E0:3231	352D	4261	6420	1D9D	8AE0:3E7E	7E08	0810	1000	18FB
88E8:5749	434F	4E20	3C30	7E83	89E8:6963	6F6E	0D00	5853	0886	8AE8:0000	0000	0000	0000	E7B3
88F0:2D36	333E	0D20	204D	1B82	89F0:482E	0D58	4C2E	330D	5B3A	8AF0:0000	0000	0000	0000	4365
88F8:5744	4546	203C	6963	D039	89F8:5848	492E	0D19	0000	82D8	8AF8:0000	0000	0000	0000	D0C8
					8A00:0000	0000	D454	6F6F	0A5C					
8900:6F6E	206E	6F2E	2026	C0A5	8A08:206D	616E	7920	7769	4A61					
8908:2033	3220	6279	7465	6B87										
8910:2064	6566	696E	6974	F769										

B

## ADVENTURE GAMES (continued from page 52)

if you wish to start a new game, the program crashes with a 'NOT FOUND' message if you reply 'Y'. Generally speaking the disc handling routines are unfriendly. When attempting to reload a saved game there is no way to obtain a list of the saved files from within the program, and should you find yourself in such a position, there is no elegant way to recover. Equally frustrating, the program will crash if you mistakenly confirm that the program disc is in the drive when in fact your saved game disc is still resident.

This game is one for the experienced player. Individually the puzzles are not too difficult

but when woven into a web such as this you will need to be prepared to restart continually from square one, and re-examine your logic repeatedly to ensure that all your basic assumptions are correct.

### ARCHIMEDES NEWS

A piece of news which should be of interest to Archimedes owners is that Robico Software are at present putting the finishing touches to the upgraded version of 'Enthar Seven'. This S.F. adventure was a great favourite of mine on the BBC, and as the new version comes complete with graphics and an updated parser, I'm sure it will be a great hit on the wonder machine. B



# POSTBAG



# POSTBAG

## EXPANDING THE COMPACT

Can you please tell me if there are any ROM expansion boards, either internal or external, which are suitable for the Master Compact. I have already fitted the Merteck Compact Companion to the expansion socket so I am wondering if its bus connection is any use.

S.B.Birks

*We do not know of any ROM board for the Compact, but an alternative solution is the Viglen Cartridge system - see Postbag Vol.6 No.8.*

## USING SHADOW RAM

I have a query concerning the shadow RAM used on the B+ and the Master. I have a font designer program which I have written which uses normal RAM to store the font, and then calls OSWRSC and OSRDSC (OSRDRM) to read and write to the screen. Although this works, on the Master the operations are much slower with a noticeable flickering. Can you tell me if it is possible to read and write shadow RAM whilst viewing a normal screen. This would give me 20K of storage space whilst being able to read and write to normal memory very quickly. Andrew Fletcher

*The answer, at least as far as the Master is concerned lies in the call FX108. This call allows you to select whether peeking and poking addresses between &3000*

*and &7FFF accesses main or shadow memory. \*FX108 will access main memory, while \*FX108,1 will access shadow memory. Therefore, putting \*FX108,1 before you access the screen, and following it with \*FX108, will let you read and write the shadow screen directly. Incidentally, for details of other shadow screen FX calls see the hint on page 45 of BEEBUG Vol.5 No.5. We hope to deal with this topic more fully in the next issue.*

## 512 CO-PROCESSORS UNCOVERED

In the March issue of BEEBUG (Vol.6 No.9) you asked what readers would like to see in the magazine. I was pleased to see the article on C, and have also found the Master pages very useful.

But there is never anything on the 512 co-processor. For instance, better and cheaper versions of C may be used with this but there was no mention of this in your C article. Your readers could be reminded that Acorn has issued a second version of the operating system software for the 512. Some help as to which Basics can be used would be useful.

I have subscribed to BEEBUG since issue 1, and I feel that if it is to meet its claim of supporting serious users, SOME help should be given to 512 users.

Mrs.E.M.Kenward

*It is true that we have largely ignored the 512 co-processor in the past, as we felt this to be very much a minority interest and not within the normal ambit of BBC micro users. However, Mr. Michael Nyman of Birmingham and Mr.S.J.O'Donnell of Cornwall both wrote in similar vein supporting the 512 co-processor and seeking more support for this system from BEEBUG, and as a result we are now investigating an article on this subject. Mr O'Donnell also writes further:*

## C AND OTHER LANGUAGES

In your "Jottings" you ask for comments about the wisdom of running a series on programming in C. One of the prime advantages of C is its transportability and therefore its independence of machine or hardware. I wonder about the worth of an extended series on such a topic, although I would certainly encourage a short series on this or any other language. Could we perhaps have one on Pascal as well?

S.J.O'Donnell

*Others have also written to indicate their approval of our series on C, and to date no voice has been raised in dissent. We do not feel, though, that Pascal warrants the same level of coverage at this time, and we have no immediate plans for any articles on this language.*

B

# HINTS HINTS HINTS HINTS HINTS

*and tips and tips and tips and tips and tips*

## NEAT LISTINGS

*Wayne Johnson*

If you dislike the '>' prompt which is inevitably printed at the end of Basic program listings, there is an easy way to prevent this. List the program as normal, using Ctrl-B to turn the printer on, but when the listing is finished press Ctrl-A followed by the Delete key, before using Ctrl-C to turn the printer off. This little trick works by sending a delete character directly to the printer, which 'rubs out' the prompt before it is printed. This will only work on printers that buffer a whole line before printing, but this includes most dot matrix printers. The Ctrl-A makes the operating system send the delete character to the printer rather than the screen.

## HIGHLIGHTING A VIEW PROBLEM

*Mandy Dunn*

The majority of printer drivers used with the View word processor, including those supplied by Acorn, cancel any highlights that are in operation when the end of each line is reached. This can cause a real problem if you don't spot what has happened, because the second highlight code, which is supposed to turn the highlight off, will then turn it back on again. Obviously, line breaks can change while text is being

edited, so special attention must be paid to highlights before printing the text. A further problem with highlights is that on version 1.4 of View (the original version), highlight codes are treated as individual characters, which upsets formatting.

Finally, most printer drivers reset the printer just before printing a document, which means that it is impossible to set up a special printing mode beforehand, as it will be cleared as soon as printing starts. The only way around this is to use a printer driver that allows the required effects to be set from within the text.

## DISABLING THE ADFS

*David Spencer*

Many people using a model B with a 1770 disc interface, or a B+, complain that if both the ADFS and the DFS are present then PAGE is set too high to run many Basic programs. However, as long as both the DFS and ADFS are not needed at the same time, it is possible to 'remove' one of them in software, and claim back some memory. To do this, you must first find out which ROM sockets the ADFS and DFS are in. If you have a utility ROM with a \*ROMS or \*ROMLIST command then this is easy, otherwise you must look inside the machine to

determine this. Once you know where the ROMs are, one of them can be unplugged by entering ?&DFx=-1 and pressing Ctrl-Break, where x is the single digit ROM number in hex. For example, if the ADFS is ROM 14, it can be unplugged with ?&DFE=-1, (14 being E in hex). Once disabled, the ROM remains inactive until the machine is turned off, or the appropriate location is reset to zero, e.g. ?&DFE=0, and Ctrl-Break is pressed to reclaim the workspace. Alternatively, the \*PANEL command on the BEEBUG Master ROM can be used to unplug and insert ROMs.

## DISC WRITE PROBLEMS

*James Francis*

Attempting to save a program using Acorn's 1770 DFS will sometimes result in the error message 'Disc read only'. This does not always mean that the disc is write protected, but can arise if a 40 track disc is used in an 80 track drive, even though the command \*DRIVE 0 40 has been issued. The reason is that the 1770 DFS will not allow any write operations on a disc which is being double stepped. The only solution is to use a 40 track drive, or a 40/80 track drive switched to 40 track mode. You will also need to restore single stepping mode with \*DRIVE 0 80. B

# BEEBUG Technical BEEBUG Technical

*In response to the many requests for help we have received since reviewing Cambridge Computer's Z88 in BEEBUG Vol.6 No.7, David Spencer presents some hints and tips to help users.*

## BBC BASIC

There are some subtle differences between the Z88 version of BBC Basic, and the genuine article.

The first of these is that if a procedure or function takes parameters then there should be no space between the name and the opening bracket on the Z88. For example:

PROCaverage (total,count)  
is valid on BBC micros, but on a Z88 the space must be removed to give:

PROCaverage(total,count)

The second quirk concerns the nesting of FOR-NEXT and REPEAT-UNTIL loops, and functions and procedures. As most users are aware, it is very bad practice to jump out of half completed loops, but the BBC micro lets you get away with such bad habits. However, the Z88 is less forgiving and will give an error message if any loops are badly nested. For example, consider the following:

```
10 DEF PROCnaughty
20 FOR count = 1 TO 10
30 IF count = 20 THEN
PRINT "Line 30":ENDPROC
40 NEXT count
50 PRINT "Line 50"
60 ENDPROC
```

If this procedure is called on either the Z88 or BBC it works fine, producing the output

'Line 50'. However, if the 20 in line 30 is changed to a 5, and the procedure called again, then 'Line 30' is printed, but the program then crashes on the Z88. This is because the procedure attempts to exit before the FOR-NEXT loop has properly terminated. The answer is to keep your programs well structured.

## RECHARGEABLE BATTERIES

While the Z88 uses very little battery power when compared to other portables, it still doesn't come cheap when you have to spend about £2.00 on batteries for every twenty hours of use. Many people have turned to using rechargeable Nickel Cadmium (Ni-Cad) batteries instead. However, there are problems with such a move. Firstly, Ni-Cads provide only 1.2V per cell, rather than the 1.5V of ordinary batteries. With 4 batteries in the Z88 this means that the overall voltage is down by over a volt when Ni-Cads are used. The Z88 will quite happily work at this lower voltage, but it does mean that the low battery indicator soon comes on, making it impossible to judge accurately when the batteries are dangerously low. Secondly, when Ni-Cads start to flatten they do so very quickly, which means that if the Z88 starts to play up one evening, then by the next morning all the stored data may have been lost - so be warned. Incidentally, the batteries have to be recharged in a separate charger; they

don't charge up when the external mains adaptor is plugged in.

## CAPS LOCK

The Caps Lock on the Z88 can be set to produce lower case when Shift is held down. For example the A key on its own produces an 'A', but with Shift pressed produces an 'a'. To set this mode press Caps Lock while holding down the Square key. The Caps symbol on the display changes to lower case, and the feature remains in operation if the Caps Lock is turned off and on again. To go back to normal Caps Lock operation press the Caps Lock key while holding down the Diamond key.

## DISPLAY EFFECTS

By using a simple VDU command from Basic, it is very easy to obtain effects on the LCD display such as bold and flashing. The various effects are all turned on by VDU1 followed by a character, and turned off again by the same sequence. The possible effects, which can be mixed if needed, are:

VDU 1,ASC"B"	Bold on/off
VDU 1,ASC"C"	Cursor on/off
VDU 1,ASC"F"	Flashing text on/off
VDU 1,ASC"G"	Grey text on/off
VDU 1,ASC"R"	Reverse video on/off
VDU 1,ASC"T"	Tiny font on/off
VDU 1,ASC"U"	Underlining on/off

For example:

```
VDU1,ASC"B",1,ASC"U":
PRINT"HELLO WORLD":VDU1,
ASC"B",1,ASC"U"
will produce the words
"HELLO WORLD" in bold,
underlined text.
```

**B**

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Tel. St. Albans (0727) 40303

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Editor: Mike Williams

Assistant Editor: Kristina Lucas

Technical Editor: David Spencer

Technical Assistant: Lance Allison

Production Assistant: Yolanda Turuelo

Membership secretary: Mandy Mileham

Editorial Consultant: Lee Calcraff

Managing Editor: Sheridan Williams

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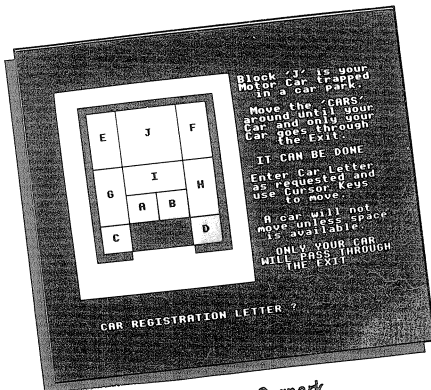
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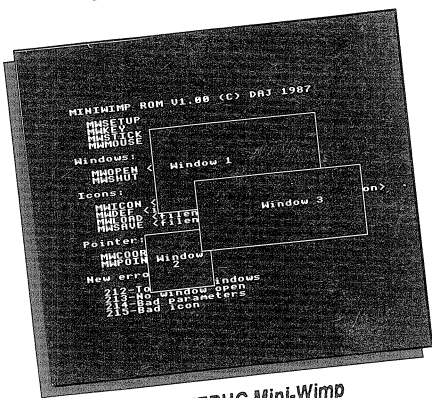
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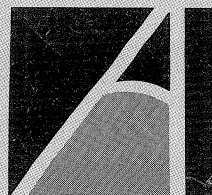


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