POPULAR Computing WEEKLY

35p 23-29 June 1983 Vol 2 No 24

This Week

Spectrum software

Tony Bridge reviews another selection of Spectrum games in his own inimitable style, including *Jetpac*, *Ah Diddums* and *Knot in 3D*. See page 14.

Programming

Bob Skinner looks at the advantages of using two-dimensional string arrays when constructing programs. See page 17.

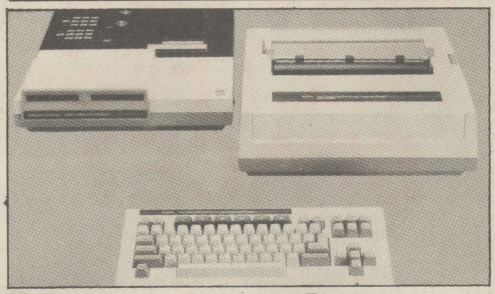
Memory map

Ian Logan explores the intricacies of the Spectrum memory map in the first of a new five-part series starting on page 24.

New releases

Exciting new games for Spectrum, BBC, Vic20 and Dragon 32 including *Jumping Jack* from Imagine, *Starship Enterprise* from Silversoft and *Droids* from J Morrison (Micros). See page 45.

News Desk



Major break-through for Adam

THE Colecovision Adam computer announced at the Consumer Electronics Show in Chicago a fortnight ago has been hailed as a major break-through in both pricing and performance.

The Adam, with a specification typical of machines costing four times its $600 (around £400) price tag, comes as a complete system including the memory and processor module, a separate keyboard and the SmartWriter printer.

The memory module is the Z80A-based processing heart of the Adam with 80K Ram, one built-in stringy micro-floppy drive, a Rom cartridge slot capable of accepting the full range of existing Colecovision games cartridges and four additional expansion slots. Screen output features 36 colours with a 32 sprite capability, and the Adam has three sound channels.

The keyboard is a separate unit with 75 full-travel keys.

The SmartWriter is a letter

Continued on page 5

Earl's Court fair a let-down

DESPITE the increased size of the 1983 Earls Court Computer Fair — with over 135 exhibitors — the event was a disappointment.

Many of the new products shown at the Commodore Show the week before — like the SX64 portable computer and the Commodore 64 Speech Synthesiser — failed even to make the mile-long journey.

Texas and Atari failed to exhibit any new hardware, and Acorn decided to hold off any new advances until its own show in August.

In what was perhaps the biggest disappointment of all, Sinclair Research had no surprises to unveil. Not even any non-surprises — such as a microdrive.

So it was left to the smaller manufacturers to provide the interest. Two new computers were on display for the first time — the Memotech MTX500 machine and the

Continued on page 5

Classified

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JUPITER ACE USERS. Eight new games programs for only £7 plus SAE to: Inkapaxi Software, 17 Patrick Street, Grimsby, South Humberside DN32 0JQ.

Continued on page 40

★ ★ CHICAGO FAIR EXCLUSIVE — PAGE 4 ★ ★

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The Team

Editor
Brendon Gore

News Editor
David Kelly [01-930 3271]

Software Editor
Graham Taylor [01-839 2504]

Production Editor
Lynne Constable

Editorial Secretary
Caroline Owen

Advertisement Manager
David Lake [01-839 2846]

Advertisement Executive
Alastair Macintosh [01-930 3260]

Classified Executive
Diane Davis [01-839 2476]

Administration
Theresa Lacy [01-930 3266]

Managing Editor
Duncan Scot

Publishing Director
Jenny Ireland

Popular Computing Weekly,
Hobhouse Court, 19 Whitcomb Street,
London WC2 7HF
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How to submit articles
Articles which are submitted for publication should not be more than 3,000 words long. The articles, and any accompanying programs, should be original. It is breaking the law of copyright to copy programs out of other magazines and submit them here — so please do not be tempted.

All submissions should be typed and a double space should be left between each line. Please leave wide margins.

Programs should, whenever possible, be computer printed.

We cannot guarantee to return every submitted article or program, so please keep a copy. If you want to have your program returned you must include a stamped, addressed envelope.

Accuracy
Popular Computing Weekly cannot accept any responsibility for any errors in programs we publish, although we will always try our best to make sure programs work.

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Editorial

The second annual Computer Fair, which was held at Earls Court last week, was more notable for its absentees than for its participants. There was no Electron and, despite rumours to the contrary, no microdrive.

The microdrive was first announced at last year's Computer Fair — more than 14 months ago — with the immortal phrase "coming soon". Despite intense pressure from aggrieved Spectrum owners, and the appearance of a microdrive case at one computer show, it is still "coming soon". Indeed, the recent Sinclair advertisements have omitted to mention the microdrive at all.

Provided the microdrive lives up to its specifications — storage of up to 100K, transfer rate of 16K a second and an access time of 3.5 seconds — it is still likely to prove extremely popular. But, if the microdrive does not appear soon, Sinclair may yet find the Japanese have beaten him to it.

The other notable absentee from this year's Computer Fair, the Electron, is likely to appear at the Acorn User exhibition in August. While this is not quite as late as the microdrive, it is still a long time in a market that is becoming increasingly competitive.

All in all, the Computer Fair this year has been fairly subdued, compared to last year's extravaganza which coincided with the launch of the Spectrum.

Next Thursday

Play next week's star game, Satellite Docking for the 16K Spectrum, and see if you can manouevre your space shuttle to match the spin of the satellite in order to dock and refurbish it.

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ULTIMATE PLAY THE GAME is a trade name of Ashby Computers & Graphics Ltd.

Adam Colecovision

Continued from page 1

quality daisy-wheel 80-column printer based on the Smith-Corona TP-1 printer which comes complete with a *Smart-Writer* word processing software package built into Rom.

Adam's Basic is compatible with Applesoft and the machine comes complete with an arcade game — *Buck Rogers Planet of Zoom* — and a pair of joystick controllers.

Expansion options for the Adam include a 64K Ram pack, a further 500K storage drive, an expansion module making the Adam able to accept the full range of Atari VCS cartridges, and a further module giving the Adam CP/M compatibility.

Software for the Adam, apart from Coleco's own Rom games developed for the Colecovision will include Logo, SmartBasic (a simplified Basic for young children) and a range of home management systems.

The $600 Adam computer system can be achieved in two ways: either by buying the Memory module, keyboard and printer outright or by first buying a Colecovision video games console and then adding what is called the Expansion module three, comprising the memory storage unit, keyboard and printer. Either way the result is the same — a complete system for around £400. In the US the price of the games console is $170 and the price of the expansion computer will be around $430.

The Colecovision games console has now gone on sale in this country, price £149. The add-on computer/keyboard/printer Adam system, and the all-in-one Adam system are both expected in the late autumn.

Computer fair

Continued from page 1

Video Technology Laser 200.

Computers showed its 96K version of the Lynx, together with a redesigned Alps disc drive, Centronics printer interface and joystick interface.

Dragon Data showed a prototype of its disc drive, a single half-height 5¼-inch system with a formatted capacity of just over 184K.

Jupiter Cantab slashed the price of its Forth 3K Ace to £57.50 and announced an Ace 16+ machine with 19K for £89.95. Also of note, Mattel put its Aquarius machine on sale for the first time, available on the Silica Shop stand for £79.

On the software side, most new material had already been seen at either the recent ZX Microfair or Commodore Show. Consequently, most of the new material was either for the Dragon or BBC machines.

Memotech emphasis is on expansion

MEMOTECH'S new MTX500 computer, launched at the Earl's Court Fair, places the emphasis firmly on flexibility and expansion.

The basic machine, costing £275, can be expanded more or less indefinitely to a system costing over £45,000.

The starter MTX500 is Z80A-based with 16K Rom, 32K user-Ram and 16K video-Ram. Rom includes MTX Basic with a built-in Z80 Assembler/Disassembler. Display is 16 colours with 40 columns and a 256 × 192 16-colour high-resolution graphics mode. There is a Sprite capability and eight independent virtual screens. A 3-channel sound synthesiser is built-in. The professional-style keyboard features separate numeric and function pads. Outputs include twin joystick, cassette, Centronics, tv, monitor, hi-fi and twin RS232 ports. There is also a Rom cartridge slot and a further, uncommitted I/O port. Expansion options include user-Ram expandable to 512K, an 80-column card, 5¼inch and 8inch floppy discs, Winchester hard discs and up to eight 256K or 1M 'silicon' discs. CP/M will be available. An 8-station 'Oxford-Ring' networking system is being developed and a 16-bit add-on processor is in the pipeline. Then, if desired, keeping all the peripherals, the MTX500 unit can be replaced by Memotech's up-market machine, the Orchid SM1.

All of which makes the MTX500 a machine that can grow from a home micro up to a complete business system.

Software for the MTX500 consists so far of a range of arcade games but more serious packages — word processing, accounting, filehandling — will follow. Other languages include a variant of Logo supplied as standard and Pascal available soon on Rom.

The MTX500 machine should be in the shops in the late Autumn, with the Orchid SM1 to follow early in 1984.

Sinclair option on De Lorean

CLIVE Sinclair has purchased an option on the De Lorean sports car factory in Northern Ireland.

Sinclair, who has been developing an electric car in Winchester, hopes to use the site as an assembly plant. The Dunmurray-based factory possesses one of the most advanced plastic moulding systems in Europe.

Talks between Sinclair and the Northern Ireland Industrial Development Board have been in progress since February. Details of the plan have not been released, but a Sinclair spokesman confirmed that "Sir Clive has purchased an option to acquire a major portion of the assets of the De Lorean plant from the joint receivers".

The first prototype from the Sinclair Vehicle Project is not expected to be unveiled before 1985. However, it is no secret that Sinclair has been working on advanced battery technology with a view to developing the world's first mass-produced electric car.

The Sinclair Vehicle Project is wholly owned by Sir Clive and the De Lorean deal will be financed by Sir Clive personally, not by Sinclair Research, his highly successful computer division.

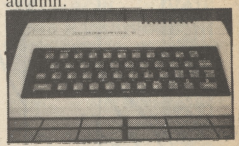
Laser has coherent approach

THE latest micro to lay claim to be the cheapest colour computer is the Laser 200, manufactured by the Hong Kong company Video Technology and now being imported to this country.

At £69.95 the machine offers a Z80A processor with 16K Microsoft Basic, 4K Ram (expandable to 68K), nine colours, one sound channel and a Spectrum-like keyboard. Display is 32 × 16 characters with two graphics modes — 64 × 32 with a colour resolution of 2 × 2 pixels and a high-resolution mode of 128 × 64 with a choice of two sets of one background and four foreground colours.

The Laser features cassette port, tv output, monitor output, expansion and peripheral ports. There is an optional single-keyword entry facility.

The Laser 200 will be available in July. A 16K Ram expansion unit should be available at the same time, for £29.95. August should see joysticks (£19.95 pair) and a Centronics interface (£19.95). A four-colour printer (£149.95) and 64K Ram pack (£59.95) should follow in the autumn.



A range of games, educational and utility software will be available at launch — some 18 titles — with a further 17 titles at the end of the summer. All are on cassette priced at £3.95 (4K) and £4.95 (16K). Some UK software houses are also working on material including Abbex and Protek.

WINDOW ON ANOTHER WORLD

NEW RELEASES

STAR JAMMER — Wiping the sweat from my brow, I searched the inky blackness, ahead for signs of enemy fighters. Through Star Jammer was the best ship in the galaxy, my dwindling energy reserves made me doubt I could reach the next stargate . . . (a one-player space arcade game requiring one joystick).

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Salamander Software

A small bug!

Congratulations and "thank you" to Paul Sellin for the fine adventure program for the Spectrum, published over the last three weeks.

Unfortunately, I'm afraid a small bug has crept into it, resulting in the map not being entirely accurate. The problem lies in the figure "10" at the bottom of the left-hand side of the map. Like the other figures, this has a space printed after it, and in the case of "10" this results in the main line of the map being printed one space too far to the right.

I suggest the following corrections to line 9220 (I refer entirely to program line 9220, and to the lines within it as printed):

On line 2, put a space near the end, before 12 ("12)
On line 4, omit the space between the quotes
On line 4, add AT h – 1,8;
On line 6, change x + 6 into x + 7

Once again, thanks for a fascinating program and thanks, too, for an excellent magazine.

Michael Kirkland
20 Batey Avenue
Rainhill
Prescot
Merseyside L35 8LT

Prompt and polite

I had a 16K ZX Spectrum and I decided to upgrade it to 48K. I looked in all the computer magazines that I read, and saw an upgrade in the classified advertisements at the back of your magazine that I thought offered good value.

I sent off the money for the upgrade kit and four days later, it arrived. I got someone I know who repairs computers to install it for me. Unfortunately, the extra memory did not work. He gave the kit back to me and told me to return it and get a replacement.

I sent off a letter with the chips, explaining the situation. Four days later, I received the replacements, and a letter of apology. The letter also said that the original chips were being tested and, if they were found to be faulty, they would refund postage. They also said that if the chips that were sent as replacements were faulty, I was to send off the machine, with the chips, and they would insert them without any extra cost, as they normally do. The replacements did not work properly, so I packed the Spectrum in its box, and sent it back with the chips and another letter.

Seven days later, I got it back through the post with a letter explaining that although the chips were tested, and found to be in perfect working order, the sockets in the computer to receive them didn't work. They sent back the sockets and, even though they did not usually do repairs, they fitted the chips at no extra cost, directly on to the circuit board. I was told that they hoped that this would in no way prevent me from doing business with them in future.

I would like to thank J C Brewer and the company's representative who sent the letter for prompt, polite service. Also, I would like to say that I will certainly turn to them in future if need be, as I was so impressed with their service.

Peter Mirtitsch
11 Bengairn Street
Haghill
Glasgow G31 3QR

Nice to hear of a company being praised for doing something right. Congratulations to J C Brewer are in order.

Disconnected ear!

Here is a tip which your readers may find useful.

I was fed up with constantly pulling out the Ear plug on my cassette recorder when saving programs from my Spectrum, until I came up with a solution which works really well and enables both Ear and Mic plugs to be left in at all times.

I fitted a lever-operated micro switch (Subminiature SPDT lever switch from Tandy — price 89p) inside the recorder case so that it was operated when the record button was pressed. Using the two outer connections I wired it up in series with the Ear socket, so that in the record mode the Ear socket is disconnected. Only the inner pin of the Ear socket is disconnected, the outer (screened) pin does not matter.

This simple inexpensive modification has proved very effective and easy to fit and use.

Barry Ashfield
37 Cottesmore Road
Hessle
North Humberside

Threatening to leave!

Having just read your adventure column in Vol 2 No 22 where you say "ask a friend to help" in *The Hobbit*, I feel I must ask more than this.

No doubt we all asked for help and received the reply "ask a friend" and no doubt we all decoded the clue, telling us to be carried, but all efforts to get through the window are failing.

My wife is threatening to leave, my kids are begging me to play, the car is due for a service, the house needs painting and my boss wonders why I sit staring into space.

Please help me get out of the Goblin's Dungeon before the Spectrum is tested for its aerodynamic qualities across our lounge!

Roger Spurr
3 Bacchus Way
Morton
Derbyshire DE4 3AG

Without giving too much away, your problem will be eased if you first open the aforementioned window.

Is it gobbledygook?

I am in the process of preparing some material relating to the uses and abuses of microcomputers generally and to the crazy things they say in microcomputer manuals specifically. If any of your readers has a relevant funny story, or can point to specific instances of gobbledygook in manuals, I'd be delighted to hear from them.

Michael Thorne
Computing Mathematics Dept
Mathematics Institute
Senghennydd Road
Cardiff CF2 4AG

Tracing information . . .

The Sinclair Spectrum needs a *Trace* command to print program line numbers, variables, etc, as each one is executed by the computer; a useful aid to debugging.

My method makes use of the printer, as I find that printing *Trace* information on the screen leads to confusion. By setting a 'switch' at the start of the program you can turn the *Trace* on or off.

Here is the system applied to the program on page 38 of the *Spectrum Manual*.

L V Phillips
17 Elizabeth Ave
Ibstock
Leicester LE6 1NG

```
    1 LET TRACE=1: REM The switch
'on', to use trace. To turn off
the trace make this line
    LET TRACE=0
  100 LET x=10: IF trace THEN PRI
NT #3;x: REM This will give the
value of the variable.
  110 GO SUB 500
  120 IF TRACE THEN PRINT #3;"L12
0": PRINT s
  130 LET x=x+4
  140 GO SUB 500
  150 IF TRACE THEN PRINT #3;"L15
0": PRINT s
  160 LET x=x+2
  170 GO SUB 500
  180 IF TRACE THEN PRINT #3;"L18
0": PRINT s
  190 STOP
  500 IF TRACE THEN PRINT #3;"L50
0": LET s=0:          REM The 'L' to
indicate line number rather than
variable value.
  510 FOR y=1 TO x
  520 LET s=s+y
  530 NEXT y
  540 RETURN
```

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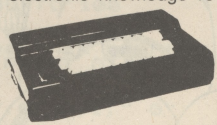

And for the Spectrum only the Spectrum Echo, an amplifier with a tape switching interface giving you the facility to save and load without switching leads. Also incorporates a cueing facility for easy location of programs.
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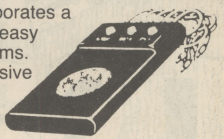

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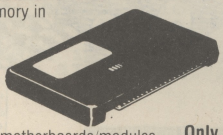

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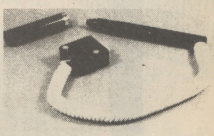

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Fun Fair

A new game for the 16K Spectrum by Jack Knight

Inspiration for this game comes from the fairground, from the booth where the punter pops ping-pong balls into the open mouth of a mock clown, to score on a table below.

That is the inspiration. But, with the power of the micro (in this program, the Spectrum), this simple gamble is built into a sophisticated trial of agility of fingers and quickness of eye. However, the smell of the fairground is still there — the opening includes a snatch of fairground-organ music, and the scene is the barker's booth.

The ball has become a bubble, blown at random from a multi-headed blower which moves irregularly up and down its column at one side of the booth. At the opposite side of the booth is the clown, face peeping from behind the curtain, his mouth open for catching. Up and down he moves trying to follow the blower, manipulated from behind the scenes by the player.

When you play, watch out for what happens when the clown does catch a bubble in his mouth. The bubble may (or may not) drift as it nears the end of its journey — just when you thought you had it in line for catching. If that were not enough, every 10 bubbles (with a tinkling of sound, preceded by a warning beep) the multi-headed blower moves closer. Then try to keep pace with it!

For your 10p you get a generous 50 bubbles to beat the previous score.

The opening gives just enough guidance for a newcomer to play. He/she is directed to *Inkey$ "6"* and *"7"* to move the clown, and is warned about bubble drift. The pause for reading is masked and enlivened by a simulation of fairground music, which also helps to create the atmosphere.

The following scene-setting section cre-

ates the booth. The left-hand margin is used for score and high-score.

In the main routine, *User* graphics create the multi-headed blower and the head of the clown. In contrast, the 0-sign makes as passable an imitation of a bubble as could be hoped for.

The appearance of variable *k* twice in the main routine may be a puzzle. Its purpose is to switch the loop from driving the blower and the clown, to blowing the bubble across the screen whilst still continuing to allow movement of the clown's head.

In the next level section, a new blower column is made to appear, so the blower can move nearer to the clown.

Musical chords mark the closing, with more than a pinch of flash. "Another go?" is the invitation. If taken up, the player is not subjected to the opening again. Also, as *Cls* would lead to the tedium of a repeat of the sets stage sub-routine, selective clearing is used, mainly by *For/Next* loops. Note, line 750 the penultimate print is two spaces wide.

With the graphics, decimal numbers rather than binary have been used to make it easier for you to type in. The graphic of the clown's lips has been confined to one square so that the red *Ink* can be picked up by *Attr* to establish a bubble has been caught. ■

```
  10 REM **FUN-FAIR** © by JACK
     KNIGHT
  80 LET m=0
  90 GO TO 2000
  99 REM *BLOWER* (NB "GRAPHICS"
+E*3)
 100 PRINT AT d,i;" ";AT d+1,i;"
";AT d+2,i;"";AT d+3,i;"";AT
d+4,i;" "
 110 LET c=INT (RND*7): LET f=IN
T (RND*3)
 120 IF d=15 OR d=3 OR c=5 THEN
LET dd=-dd
 130 LET d=d+dd
 140 IF c=6 AND f=1 THEN LET l=d
-dd+g: GO TO 270
 199 REM *CLOWN* (NB "GRAPHICS"+
A,B,C,D)
 210 LET a=a+(INKEY$="6" AND a<=
14)-(INKEY$="7" AND a>=2)
 220 PRINT ; INK 7;AT a,30;" ";A
T a+1,30;"";AT a+2,30;"";" INK
2;AT a+3,30;"";" INK 7;AT a+4,30
;" ";AT a+5,30;" "
 250 IF k=0 THEN GO TO 100
 259 REM *BUBBLE*
 270 IF e=29 THEN GO TO 400
 280 IF l=18 OR l=4 THEN LET b=0
 290 IF e=25 THEN PRINT AT l,e;"
": LET l=l+b
 300 LET k=1
 310 PRINT ; INK 7;AT l,e;" 0"
 320 LET e=e+1
 330 GO TO 210
 399 REM *BURST OR GULPED*
 400 IF ATTR (l,e+1)=10 THEN PRI
NT ; INK 7;AT l,e;" 0": BEEP .1,
20: PRINT ; INK 2;AT l,e+1;"": L
ET s=s+5: PRINT AT 12,1;s
 410 IF ATTR (l,e+1)<>10 THEN BE
EP .1,-20: PRINT AT l,e;" "
 420 LET j=j+1
 430 IF j=10 OR j=20 OR j=30 OR
J=40 THEN GO TO 500
 435 IF j=50 THEN GO TO 600
 440 GO TO 1100
 499 REM *NEXT LEVEL*
 500 PRINT AT d,i;" ";AT d+1,i;"
";AT d+2,i;" ";AT d+3,i;" ";AT
d+4,i;" "
 505 BEEP .5,0
 510 LET i=i+3
 515 FOR n=1 TO 20: PRINT AT n,i
-1;"": BEEP .01,10+n: NEXT n
 520 GO TO 1100
 599 REM *CLOSING*
 600 BEEP .5,0
 610 FOR n=1 TO 3: FOR p=6 TO 1
STEP -1: BORDER p: BEEP .1,10+p:
 BEEP .1,10-p: NEXT p: NEXT n
 699 REM *NEW GAME*
 700 PRINT ; INVERSE 1; FLASH 1;
AT 3,10;"ANOTHER GO SIR/MADAM?";
AT 6,14; INVERSE 0; FLASH 0;"PRE
SS ""ENTER"""
 710 IF INKEY$=CHR$ 13 THEN GO T
O 730
 720 GO TO 710
 730 IF s>m THEN LET m=s: PRINT
AT 7,1;m
 740 PRINT AT 12,1;"    "
 750 FOR n=1 TO 20: PRINT AT n,1
2;" ";AT n,15;" ";AT n,18;" ";AT
 n,21;" ";AT n,30;" ": NEXT n
 760 FOR n=10 TO 30: PRINT AT 3,
n;" ";AT 6,n;" ": NEXT n
 770 GO TO 1000
 999 REM *ASSIGNS VARIABLES*
1000 LET dd=1
1050 LET d=4
1060 LET s=0
1070 LET a=1
1080 LET i=10
1090 LET j=0
1100 LET g=INT (RND*3+1)
1200 LET e=i+1
1300 LET b=INT (RND*3+1)
1400 IF b=2 THEN LET b=-1
1500 IF b=3 THEN LET b=0
1600 LET k=0
1700 GO TO 100
1999 REM *GRAPHICS*
2000 FOR n=1 TO 5
2100 READ a$
2200 FOR p=0 TO 7
2300 READ q: POKE USR a$+p,q
2400 NEXT p
2500 NEXT n
2600 DATA "A",3,7,15,31,31,31,15
,5,"B",5,15,63,127,127,63,15,15,
"C",31,31,3,3,3,3,31,31,"D",15,1
5,7,7,0,0,0,0,"E",63,126,252,252
,252,252,126,63
2999 REM *OPENING*
3000 BORDER 1: INK 6: PAPER 1: C
LS
3100 PRINT ; INVERSE 1;AT 2,6;"*
**FUN-FAIR***"; INVERSE 0;'''TAB
 1;"CATCH BUBBLE IN CLOWN'S MOUT
H";TAB 6;"BY USING ""6"" OR ""7
""""""";TAB 3;"BEWARE - BUBBLE MA
Y DRIFT!"
3200 LET r=10: FOR n=1 TO 3: BEE
P .4,1: BEEP .2,r: PAUSE r: BEEP
 .2,r: PAUSE r: BEEP .4,-4: BEEP
 .2,5: PAUSE r: BEEP .2,5: PAUSE
 r: NEXT n
3300 CLS
3999 REM #SETS STAGE#
4000 PRINT AT 4,0;"HIGH";AT 5,0;
"SCORE";AT 10,0;"SCORE"
4100 FOR n=9 TO 31: PRINT AT 0,n
;"";AT 21,n;"";: NEXT n
4200 FOR n=1 TO 20: PRINT AT n,9
;"";AT n,31;"";: NEXT n
4300 GO TO 1000
```

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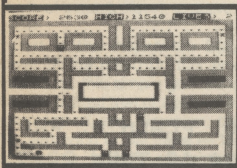

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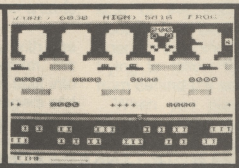

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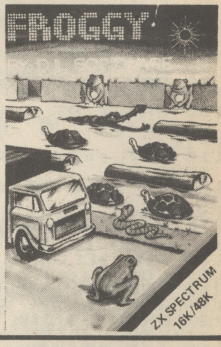

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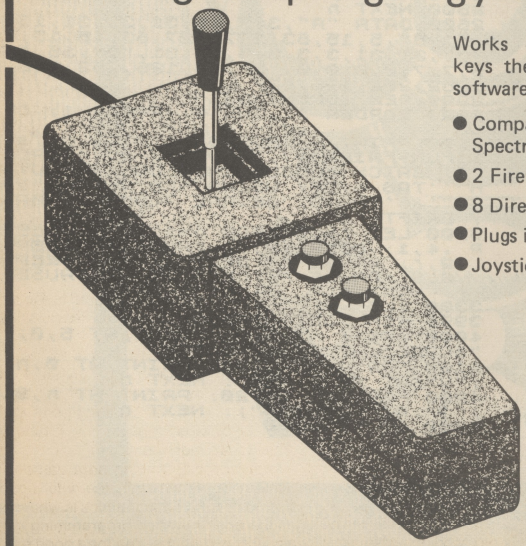

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Life in the fast lane

***David Kelly** talks to John Ritman, author of Artic's 3D Combat Zone*

Step inside any arcade these days and you will see things have come a long way since the first *Pong* tennis game.

A major preoccupation now is simulations of 3-dimensional effects — perspective changes, panning landscapes, all in full colour and sound. Look at Atari's recent *Pole Position* Grand Prix race game or the *Zaxxon* space race.

For home-computer programmers, intent on recreating the thrills of the coin-ops in your own home, these simulations present an enormous challenge.

3D Combat Zone by John Ritman of Artic, is a recent attempt to produce true 3D effects on the Spectrum. You are in command of a tank, looking forward through the tank windows out onto the battle field. You can move forward, backward, left and right — and as you move, the landscape grows or recedes.

This kind of interactive 3D graphics has never been achieved before on one of the low-cost micros. The quality of representation and detail are limited by the Spectrum and the landscape and tanks are represented by simple line shapes.

The reason is simple — how do you make the Spectrum fast enough to draw at the sort of speed needed for a challenging real-time simulation?

John is a 26-year-old who failed maths 'O' level twice. After becoming a field tv engineer, be became interested in computers when his company began to look at the possibility of renting out micros with tvs. He thought he ought to know a bit about it and in January 1982 he bought a ZX81. A week later he bought a Ram pack and, three months on, he had taught himself machine-code. "I couldn't stop playing with the ZX81," he explains.

John actually reckons that machine-code is easier to learn than Basic: "In machine code there are only a very limited number of functions and it is easy to understand each in completeness."

The first program that John wrote was *Namtir Raiders* — a multiple-wave Space Invaders game for the ZX81. In May last year he sent it in to Artic and rather to his surprise he was rung up by Artic's Richard Turner who accepted it. At the same time Richard Turner suggested that John should write for the Spectrum, which had been launched the previous month.

To begin with, John found the Spectrum difficult to work with. Programming on the ZX81 he had found an assembler to be an essential tool — and there wasn't one at the time available for the Spectrum.

An assembler offers a sort of half-way house between a high level language like Basic and machine-code. It has some of the understandibility of Basic — it has loops and labels, for example. But the resultant code — the so-called source-code — can be easily translated or *assembled* into machine-code — the so-called object code.

"You have really got to write using an assembler," says John. "Keying in the code direct you get too many possible errors. It only needs one mistake in hex and you have got a crash."

Machine-code is rather like writing in Basic where there are only eight usable locations or registers.

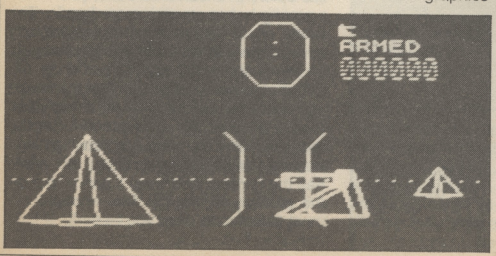
The necessary speed

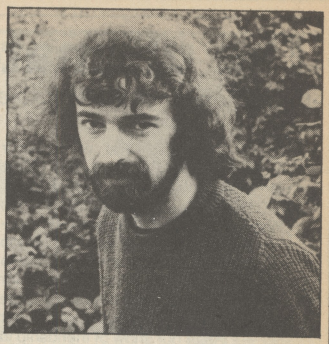
Nearly the whole of machine-code is just loading and saving commands — information is plucked from a particular memory location into one of the eight registers and then saved into a different memory location. Because the screen is memory-mapped, each point on the screen corresponds to a particular memory location and by loading and saving things can be moved on the screen.

While he was waiting for an assembler, John kicked around his idea for a 3D tank simulation game. But, when he finally got one — Artic's own — he put the 3D game aside to write *Cosmic Debris,* an *Asteroids* type game. "I knew that the biggest problem with a 3D simulation would be speed — so I experimented first with *Cosmic Debris.*"

The Spectrum prints in 8 × 8 pixel blocks. To avoid the space craft or asteroids jumping in steps of eight pixels, John designed eight sets of characters, each one with the graphics shapes offset by one pixel from the last. Then by printing each of the eight characters in turn the illusion of smooth movement is created.

Writing *Cosmic Debris* sorted out many of the graphics techniques needed for a 3D simulation. "The only thing I had no idea about was the maths for rotations in 3D. *Practical Computing* came out with a 4-page article on 3D plotting techniques — but it still took me about a month to boil it down to two lines of formulas!"





John then became convinced that there was no way that a 3D simulation was possible on the Spectrum because of the speed neccessary. He wrote his 3D tank game in Basic first and the computer took five seconds to update the screen each time to show the new positions.

A new approach was called for. First, John created a different memory map for the Spectrum including a new, hidden, dot-programmable, high-resolution, screen. "With the finished version of *3D Combat Zone* the Spectrum really is going at full pelt. It draws each move on the hidden hi-res screen — taking about half a second — and then bulk downloads it to the main screen — what you see — in about an eighth of a second." This is how *3D Combat Zone* gets round the problem of jerky movement on the Spectrum.

"If Sinclair had incorporated a proper switchable high-resolution screen in the Spectrum in the first place it would have saved me a lot of effort," explains John.

He uses a series of algorithms to work out each new frame of the simulation. On the high-resolution screen only the minimum number of points are plotted in order to save time. These are then joined up to make the shape of the tank and the pyramids. The only positions worked out are the corners so, for example, the tank is made up of two distorted cubes involving the manipulation of only 16 points to make the tank move. The rotation is effected by the computer applying sine and cosine functions from a table to the points on the screen. Distance is achieved by dividing the up/down and left/right dimensions of a given shape by a factor which represents its distance *into* the screen.

So far John's 3D Tank game is the only one of its type and he is keen to stay ahead of his competitors. "The way I programmed it means that it is not as accurate as I would like. What I am working on now is a series of 3D algorithms that incorporate floating-point arithmetic. That would make any future 3D games much more accurate."

He is currently working on a game with spiralling eggs which hatch into hostile birds. He says: "Fast graphics is what I am good at and I now find programming quite easy. It is getting the idea for a good game in the first place that is difficult." ■

The ultimate horror!

***Tony Bridge** finds that there are hidden perils in being a software reviewer*

Anxpyth, Grand Admiral of Emperor Haile Debeus' 7th Space Fleet (Alien Contact and Subjugation): "Gentlemen, here before you is what Earthmen laughingly refer to as a "Software Reviewer" — weird name, I grant you, but his job is to judge the effectiveness of these so-called "games". An innocent name for a sinister method of indoctrinating a large part of Earth's population to resist our attacks — I mean our show of friendship in the cause of cultural exchange!

"During several centuries, the population has largely devoted its time to killing each other — now, however, a new religion appears to have sprung up. Many now worship a common blood relative, one Uncle Clive, who promises many strange and wonderful things. His followers sit and pray before what they call a Spectrum, which seems to be a wondrous artefact. [He waves a tentacle toward a blob of protoplasm] Lieutenant Snaxthpool, throw the Brain Scanner switch, let us see what this "reviewer" has to tell us!"

Tony Bridge (for it is he!): "I won't tell you anything, you overgrown lump of . . . aaaahhhh! What do you want to know, Master?"

Anxpyth: "That's better, miserable being! Let us know of these "Zapping" games — and be quick, we have no time for your ramblings."

Tony Bridge (whining): "Yes Master."

Well, the Spectrum has been with us now for only a year, yet in that time the software available for it has improved beyond all recognition from the early ICL/Sinclair days. At the price of the machine, recently cut to below £100 for the smaller memory, and the average price of cassettes, £5-6, there is no software in the world to compare . . . [a low rumble from *Anxpyth*] Humble apologies, Sire, I'll get on with it now!

First, a major disappointment in Imagine's follow-up to *Arcadia,* which will remain one of the classic Spectrum games. Whilst the graphics of *Schizoids* are astonishing, even though they are in black and white, the game mechanics unfortunately do not measure up. You are the pilot of a space refuse vessel, and are trying to shove strange alien shapes into a nearby Black Hole. The 3D graphics are, as I've said, superb, but the game has no high score facility, and only a nod towards more difficult levels. Thus any addictiveness is destroyed. I've had this game a month now, and played it twice — not good value.

If you're looking for the successor to *Arcadia,* look no further than *Black Hole,* from Quest Software (although see remarks later in this review on Imagine's other new releases). This is what many people may have expected from *Schizoids,* and is, in fact, a combination of *Schizoids* and *Arcadia.* Your starship (well, it does look like a star) has to fire across the screen (rather than up, which makes a change) at a selection of alien spaceships emanating from a Black Hole — thus making nonsense of current scientific theory (except the Walt Disney Theory of Multiple Returns!).

You have a choice of weapons — a short range, straight-firing cannon, or a couple of longer range torpedoes, which are, however, bent by the gravity well around the Black Hole, so that aiming is a bit of a hit and miss affair (excuse the pun!). Getting in the way of your ship are all the wonderful shapes from the *Arcadia* stable — spinning wheels, falling nails and so on. Collide with one and you are spread across the Galaxy. Although a little plagiaristic, this program has beautiful graphics, and the requisite addictiveness.

The Arcadian is the name of the latest collection from the software house of J K Greye. This company has been looking belatedly for a new Malcolm (Mr 3D) Evans, since he left to start New Generation Software. This tape is a collection of four games, plus a menu. *Invasion* is *Invaders* of course, and *Kamikaze* is *Scramble. UFO* is an asteroid-avoiding game á la those early ZX81 games, while the only original one on the tape is *Minefield.* This game has you laying mines in a forest. Step on the trail you've already laid and you blow up. Really, this tape is a collection of ZX81 1K programs with added colour and (not very imaginative) hi-res graphics. Definitely not good value!

Speaking of Malcolm Evans, he has a couple of new programs, the first being *3D Tunnel.* Most of you have probably seen this now, but in case you have taken to your fallout shelter already, this one takes place in a tunnel (OK, so it's pretty obvious!), that constantly winds, rises and falls as it snakes along. You are rushing down it, and have to zap the various fauna that come bounding towards you.

You'll see frogs, rats, spiders and bats on the various levels, and, if you have the larger memory, the ultimate horror, a London Underground tube train! No, you can't shoot that, you can only press yourself against the wall and goggle in amazement as it rushes past you!

Twist and turn in any direction

3D Man's new release *Knot in 3D* (but it definitely is!) must be one of the most beautiful, graphically, to be seen on the Spectrum. Like all good programs, the idea is very simple — imagine yourself in a cube of unoccupied white space. You are rushing along at breakneck speed, and a trail of green and yellow light is left behind you. From nowhere appear, at intervals, great blocks of magenta and blue, described on the cassette inlay as "Chasers", although they don't chase at all.

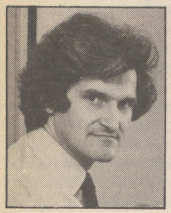
You can twist and turn in any direction to avoid the Chasers (and a joystick may be used as an alternative to the keyboard), but you must also avoid your own trail. Sounds easy, but as the space gradually fills up with varicoloured trails, your manoeuvring becomes ever more frantic. The whole effect becomes rather like rushing down narrow streets with tall skyscrapers on either side, and sudden dead ends.

The object is to fill as much of the space as possible before the final collision (you're allowed 18). The scenario on the cassette inlay is rather confusing, and nobody I know who has seen the game has the faintest idea what it's all about, or the strategy to employ. It is, though, the most astounding thing you'll see for a long time.

Etx is the latest program from Abbex, the Games People (sic). Of course, the main protagonist here can't be confused with the main character of the film of the same — whoops! — nearly the same name. This one is a little three-foot creature with a long neck and bug eyes, not at all like the other one.

Etx's aim is to find bits of a telephone, which he can then use to phone home. Why does that phrase sound familiar? A large matrix of deep pits has to be searched by the little creature in order to find all the components, along with various treasures that will help to boost the final score.

The graphics are superb, almost sprite-like, and well up to Atari standard. 48Kers will have the added feature of speech — although this sounded to me as if the Spectrum had succumbed to a bad case of laryngitis.



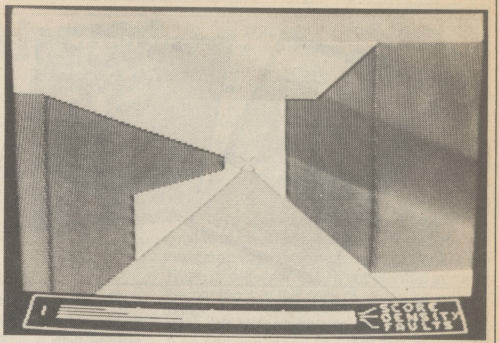
Malcolm Evans, founder of New Generation Software, is the author of Escape, 3D Tunnel and Knot in 3D for the Spectrum.

As you move about, you will travel through many zones in which you can do one of several things. You may, for instance, only call your mothership when standing in a certain spot, and you will need the complete phone. All this time you will be harrassed by certain mean people like the Professor, who will whip you back to his lab for a quick experiment. You have a friend in Elliott who will come to your rescue if you are lucky. Not a bad little arcade game, and good value for money.

Now we come to *Android One,* from Vortex Software. The game is one of those guaranteed to keep you sitting, bleary-eyed, in front of your TV screen until 3 o'clock in the morning. You are in control of the android in the title, whose mission is to enter a nuclear power station and neutralise the core, which has become unstable. Racing against the clock, you must battle your way through the tortuous corridors, fighting all the while the guardians of the power station.

These little horrors take several forms — some come after you, whilst others just bounce up and down blocking your progress. Touch any of them, and you'll lose a life, but you do have a laser and a limited number of force fields for dire emergency. As with most of the good games in the present batch, movement may be effected either from the keyboard or by (Kempston) joystick. Humour (in the android's facial expressions) and suspense combine with fantastic graphics to make an excellent arcade game.

Jetpac, written by Ultimate Play The Game (yes, you did read that right!) is yet another extremely tough and addictive game. This time you are an intrepid interstellar trader and your job is, frankly, plundering innocent planets of their gold and other riches. Starting off on the first planet, you must first assemble your spaceship from the bits scattered around, and then refuel using the fuel tanks dropped to you by some unseen benefactor in the sky. You can also pick up the treasures, such as bars of gold and isotopes.



All this time the, understandably, irritable natives are trying to get their own back on you. You may use your jetpack, which is strapped to your back to hover in mid-air, and your laser to zap the aliens. In true arcade style each level presents you with evermore vicious aliens. The graphics, again, are sensational.

Another new alien-zap game is *Spawn of Evil,* from DK'Tronics [get their address, *Snaxthpool,* they'll pay for this!]. A rather complicated scenario and instruction program is loaded before the main program. What it all boils down to is that you can get the little blighters as they are spawned — if you're skilful! Switch to your Galaxy Scanner (lucky you!) and see the various spawning grounds. Move your ship to a trouble spot and switch to *Fire* mode.

Newly-born aliens are plentiful and relatively easier to hit — however, you don't score so highly for getting them. If you feel lucky, you can wait for them to join together into larger creatures. Now you score much more for hitting them, but of course, it gets harder to do so, and now they fire back. Movement is inertial, that is it takes some time to accelerate to speed, and more time to decelerate, before a change of direction may be made.

Continued on next page

Firm	Program	Price
Abbex 20 Ashley Court Great Northway London NW4	*ETX*	£5.95
DK'Tronics 23 Sussex Road Gorleston Gt Yarmouth Norfolk	*Spawn of Evil*	£4.95
Imagine Masons Buildings Exchange Street East Liverpool Merseyside L2 3PN	*Schizoids* *Molar Maul* *Ah Diddums*	£5.50 £5.50 £5.50
J K Greye Enterprises 16 Park Street Bath BA1 2TE	*The Arcadian*	£4.95
New Generation Software Freepost BS3433 Oldland Common Bristol BS15 6BR	*3D Tunnel* *Knot in 3D*	£5.95 £5.95
Quest 119 The Promenade Cheltenham Gloucestershire GL50 1NW	*The Black Hole*	£5.50
Ultimate Play The Game The Green Ashby de la Zouch Leicestershire LE6 5JU	*Jetpac*	£5.50
Vortex Software 26 Crawford Road Hatfield Herts AL10 0PG	*Android One*	£5.95

The game is a little too subtle for its own good. While one can appreciate the programming skill that has been lavished on it, it is, like the similar *Timegate*, ultimately boring.

At last, the games we've been promised from Imagine have arrived. This company, launched on a wave of very high-powered advertising, has gained an unfortunate reputation for delay — a requisite in the computer world, maybe, but exasperating all the same. Thankfully, the wait has been well worth it.

Molar Maul rewrites the history of dental science. Hands up all those of you who enjoy a visit to the dentist. Well, the rest of us can now fight back with Magico toothpaste, which contains the wonder ingredient, DKX 11. This combats the dreaded bacteria, Dentorium Kamikazium, the DK. These little blighters attack your teeth and, being immortal, keep on coming. Luckily, you have supplies of Magico, and this will restore your teeth to good health.

The screen consists of a wide-open mouth, complete with tonsils in the middle, from which issue the dreaded DKs. You control a toothbrush, which you can charge with a dollop of Magico from the conveniently-situated tube. Then scrub for dear life as the DKs start in on your teeth. Each squirt of toothpaste lasts for a couple of scrubs only, and the brush has to be recharged frequently. You have limitless amounts of Magico, and three brushes.

This is, like all good arcade games, completely dotty, but the great graphics and Atari-like fairground musical make it a game that will be around for a long time.

Ah Diddums (*Snaxthpool*, the Earthman is raving — your interrogation methods may need revising!) is the other game from Imagine, and has another dotty scenario. Mummy and Daddy have left the light on in the nursery so that Baby won't cry (all together now, Ah Diddums!). The toys are happy because they can play. Teddy, however, wants to comfort Baby, and so tries to build a staircase out of the toybox using Baby's bricks. The other toys, knowing that if Baby stops crying the lights will be turned off, thus stopping their playtime, try and stop Teddy from climbing out.

So, Teddy's in for a tough time, with toy soldiers firing at him, giant lumps of plasticine trying to roll him flat, and rattles on the rampage. He's not entirely helpless, luckily, as he can pick up a peashooter and fire at the enemy toys. He can also roll balls at them, or place dolly boots in their way. There is also the ultimate weapon, the Jack-in-the-box! Another highly original game from Imagine, and very good value.

Grand Admiral Anxpyth: "Snaxthpool, I think we can give this solar system a miss! The natives seem to be in an advanced stage of total insanity — either gibbering about psychotic toys, or zapping aliens!"

So, as I was saying, the software for the Spectrum is improving daily. While the consumer should beware the many misleading claims being made for software in the current war of colour advertising, he may also be reasonably sure that most of the arcade games have to come up to a certain (good) standard to survive. A bright future is ahead for Spectrum gamesplayers. ■

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No strings attached

***Bob Skinner** explains some of the advantages in using string arrays in programs*

Arrays or dimensions are probably the first main stumbling block for any programmer. They are also one of the most useful and widely used methods for handling data in memory. *Read* and *Data* are important tools, but arrays are far easier to manipulate.

Basic supports two types of arrays, numeric and string. Numeric arrays can only hold numbers, string arrays hold characters (which means that you can use them for numbers with *Str$* and *Val*).

Here we shall deal with string arrays, as these are most useful. Besides, numeric array handling is almost identical.

To "set-up" an array you use the reserved word *Dim*. You must also give this word parameters which refer to the size of the array you want to use. Such parameters are known as "subscripts" and allow you to fill and access the information in the array at will.

It is easiest to imagine arrays in the form of *Rows* and *Columns*, whose intersections provide *Cells* which can hold information, rather like pigeon-holes. Arrays can have one or more rows and one or more columns. A single dimension string array with four columns can be represented as in Fig 1.

Fig 1

	:COL1	:COL2	:COL3	:COL4	
ROW 1	:	:	:	:	:

To create such an array in Ram, we need to give the array a name: *Ar$* for example, also its size: 4 (columns — 1 row is assumed), like this:

```
10 DIM AR$(4)
```

This particular *Dim* statement could only be used once in a program, though you can set up as many arrays as there are room for in Ram. That is, you cannot alter the number of rows or columns once the array has been *Dimensioned*.

To set up arrays with more than 1 row, you need to use two subscripts, row and column, in that order. So, to get an array, *Ar$* with 3 rows by 5 columns, we simply amend the command line to:

```
10 DIM AR$ (3,5)
```

This will set up an array like this:

	COL1	:COL2	:COL3	:COL4	:COL5	
ROW 1	:	:	:	:	:	:
ROW 2	:	:	:	:	:	:
ROW 3	:	:	:	:	:	:

Such an array is called a 2-dimensional string array. You can set up 3-dimensional arrays in some dialects of Basic with statements like *Dim Ar$*(3,5,7), but this is beyond the scope of this article.

Each "cell" of a strong array can hold up to 255 characters — like a normal string, but check this in your machine's user manual. To put information into the array you simply use statements like:

```
20 AR$(1,1) = "HELLO"
```

This puts the word *Hello* into the cell of *Ar$* which is referenced by the subscripts 1,1 — ie, row 1, column 1. The following example should make this clear:

```
10 DIM AR$(3,5)
20 AR$(1,1) = "FILLING"
30 AR$(2,3) = "AN"
40 AR$(3,2) = "ARRAY"
```

This gives:

	COL1	:COL2	:COL3	:COL4	:COL5	
ROW 1	:FILLING	:	:	:	:	:
ROW 2	:	:	:AN	:	:	:
ROW 3	:	:ARRAY	:	:	:	:

To get the information out, you can simply use *Print*, as in:

```
50 PRINT AR$(1,1)
```

which will display the contents of the cell specified. Or, you can assign the contents of a cell to a simple variable as in:

```
60 LET A$ = AR$(2,3)
```

To use numbers in string arrays, first convert the number to its string representation:

```
100 X = 99
110 X$ = STR$(X)
120 AR$(3,5) = X$
```

To get numbers out, reverse the process using *Val:*

```
200 X = VAL(AR$(3,2))
```

At this point, it should be obvious that to access a given row we can use a *For . . . Next* loop to put information in or get it out. Thus, in our example, if we wanted to see the contents of the cells of row 2, we would write:

```
400 FOR C = 1 TO 5
410 PRINT AR$(2,C)
420 NEXT
```

We don't want to have to write this for every row, so we embed this loop in another:

```
390 FOR R = 1 TO 3
.....                                   INNER LOOP
430 NEXT
```

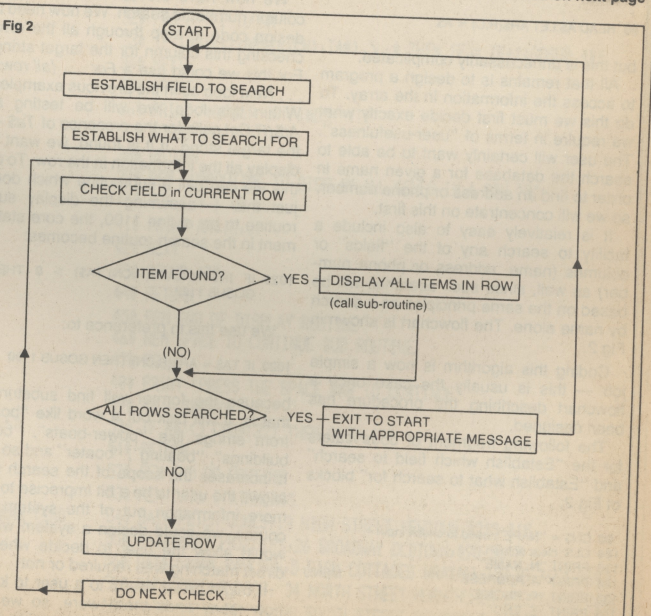
so that the program repeats the above for all rows:

```
390 FOR R = 1 TO 3: for all rows
400 FOR C = 1 TO 5: for all columns
410 PRINT AR$(R,C): print the contents of the cell
420 NEXT C: next column
430 NEXT R: next row
```

A similar technique can be used to fill the cells with information.

Continued on next page

Fig 2



A string array can be used to set up a simple database which can be sorted, searched etc. For example, we can set up an array to hold names (col1), addresses (col 2) and phone numbers (col 3) to act as an address book.

The simplest way to get the data into the array is by using *Read* and *Data* statements, although you could have the program ask the user for the information. The *Data* statements will take the general form: line no. *Data* name, address, phone no. For example:

```
9000 DATA PETER JONES, 13 HIGH STREET
     NEWTOWN, 0213-415
9010 DATA MARY PHILLIPS, 26 BROADWAY OLD-
     TOWN, 098-5647
```

Notice that you cannot put commas into the addresses, or you will have problems as the Basic interpreter will think each comma ends a data field. *Reading* this data into the array now simply requires some variables, eg, the number of rows and columns and a loop structure like the previous one. If we have 100 names, addresses and phone numbers, the program will start like this:

```
10 NR = 100: number of rows
20 NC = 3: number of columns
30 DIM AR$(NR,NC): set up array
40 FOR R = 1 TO NR: for all rows
50 FOR C = 1 TO NC: for all columns
60 READ AR$(R,C): READ a string and put it into a
   cell
70 NEXT C: do the next column
80 NEXT R: do the next row
```

Line 60 could be written:

```
60 READ A$:LET AR$(R,C) = A$
```

but this is unnecessarily complicated.

All that remains is to design a program to access the information in the array. To do this we must first decide exactly what we require in terms of "user-usefulness". The user will certainly want to be able to search the database for a given name in order to find an address or phone number, so we will concentrate on this first.

It is relatively easy to also include a facility to search any of the "fields" or columns (name, address or phone number) as well, since such searches will be based on the same principles as a search by name alone. The flowchart is shown in Fig 2.

Coding this algorithm is now a simple job — this is usually the case once a flowchart describing the procedure has been designed.

The following fragment of code caters for the "Establish which field to search" and "Establish what to search for" blocks of Fig 2:

```
 90 CN$ = "NAPE": used to check input
100 CLS: clear screen
110 PRINT "N: NAME"
120 PRINT "A: ADDRESS"                    MENU
130 PRINT "P: PHONE"
140 PRINT "E: END"
150 PRINT: blank line
160 PRINT "PRESS THE LETTER OF YOUR
    CHOICE": prompt
170 A$ = INKEY$:IF A$ = "" THEN GOTO 170: read
    keyboard
180 CN = INSTR (1,CN$,A$): convert to number
190 IF CN = 0 THEN GOTO 170: key OK? if not
    repeat
200 IF CN = 4 THEN CLS:PRINT "END OF PROG-
    RAM":END: terminate if required
210 CLS clear screen again
220 PRINT "ENTER ITEM TO SEARCH FOR":
    prompt
230 INPUT TA$: get target string
240 GOSUB 1000: do the searches
250 GOTO 100: repeat the main menu
```

This section of code displays the menu and gets the value of the variable *Cn* as the number of the field or column to search. This is achieved by testing the key pressed by the user. If it is one of the letters *"N", "A", "P"*, or *"E"*, then its position in *Cn$ ("Nape")* is given by *Instr* (line 180). This is a much simpler and more elegant method than such lines as:

```
170 IF A$ = "N" THEN CN = 1
171 IF A$ = "A" THEN CN = 2
172 IF A$ = "P" THEN CN = 3
173 IF A$ = "E" THEN CN = 4
```

or the hideous and unnecessarily complex formula beloved of some programmers:

```
170 CN = ABS( (A$= "N") + 2*(A$ = "A") + 3*(A$
    = "P") 1 4*(A$ = "E") )
```

Instr returns the value 0 if the *Target$* is not in the *Source$*, otherwise it returns the starting position of the *Target$* in the *Source$*. The general form of *Instr* is *P = Instr* (starting point in *Source$*, *Source$*, *Target$*).

We now have the variable *Cn* as the column number to search. We now need to design code to step through all the rows checking this column for the target string. For this we could use a *For . . . (all rows) . . . Next* loop as in the previous examples. Within this loop, we will be testing all *Ar$(R,Cn)* cells for the presence of *Ta$* — the target string. If it is found, we want to display all the information in the row. To do this we can call a subroutine which does just this — assuming the display subroutine to be at line 1100, the core statement in the search routine becomes:

```
1020 IF INSTR(1,AR$(R,CN),TA$) > 0 THEN
     GOSUB 1100
```

We use this in preference to:

```
1020 IF TA$ = AR$(R,CN) THEN GOSUB 1100
```

because the former will find substrings; that is, it will pick out a word like "boat", from strings like "power-boats", "boat-buildings", "boating", "boater" and so on. It increases the scope of the search and allows the user to be a bit imprecise to get more information out of the system. Of course, we could design a system which would allow the user to decide whether direct matching was required or not.

It might prove useful to a user to know how many finds there were, so we will have to keep track using a variable such as *Tf – Total Finds* (do make your variables easy to remember by giving them meaningful letters). This means an addition to line 1020:

```
1020 IF INSTR(1,AR$(R,CN),TA$) > 0 THEN TF =
     TF + 1:GOSUB 1100
```

We don't want to increase *Tf* in the display routine because we may want to call this routine from other areas of the program without affecting *Tf*.

Finally, we will want a subroutine which suspends the program at various points to allow the user to assimilate information on the screen. A pause routine would do, but better by far is a routine which prompts the user to press a key in order to proceed. This is necessary in order to prevent too much information scrolling up the screen too fast to be any use to the user. This will take the form:

```
1200 PRINT
1210 PRINT "PRESS THE SPACE BAR TO CON-
     TINUE"
1220 A$ = INKEY$
1230 IF A$ <> CHR$(32) THEN GOTO 1220
1240 RETURN
```

Ideally, the prompt would appear at the foot of the screen and be erased just before the *Return* is executed.

The coding for the search routine is thus:

```
1000 TF = 0
1010 FOR R = 1 TO NR
1020 IF INSTR(1,AR$(R,CN),TA$) > 0 THEN TF =
     TF + 1:GOSUB 1100
1030 NEXT
1040 PRINT
1050 PRINT "NUMBER OF FINDS = ";TF
1060 GOSUB 1200
1070 RETURN

1100 FOR C = 1 TO NC
1110 PRINT AR$(R,C)
1120 NEXT
1130 GOSUB 1200
1140 RETURN

1200 PRINT
1210 PRINT "PRESS THE SPACE BAR TO CON-
     TINUE"
1220 A$ = INKEY$
1230 IF A$ <> CHR$(32) THEN GOTO 1220
1240 RETURN
```

Notice that "UPDATE ROW" in Fig 2 is automatically taken care of by the *Next* in line 1030, being part of the loop which deals with each row in turn.

You should be able to modify this program to improve its appearance on-screen; allow the user to enter the data to begin with and, if you can store string arrays to tape, you have the heart of a personal database!

To sum up, the most important points here are:

a) The use of string arrays to hold related information
b) The building of routines around "core" statements
c) Constructing a program from "blocks" of algorithms
d) Designing part of a program according to the user's point of view ■

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This program was written for the Dragon 32, but it is designed to be easy to convert for all micros.

```
10 REM DATABASE+SEARCH ROUTINE
20 REM SET UP ARRAY
30 CN$="NAPE"
40 NR=5
50 NC = 3
60 DIM AR$(NR,NC)
70 FOR R = 1 TO NR
80 FOR C = 1 TO NC
90 READ AR$(R,C)
100 NEXT C
110 NEXT R
120 REM ARRAY SET UP
130 REM SEARCH ROUTINE MENU
140 CLS
150 PRINT "N...NAME"
160 PRINT "A...ADDRESS"
170 PRINT "P...PHONE"
180 PRINT "E...END"
190 PRINT
200 PRINT "PRESS THE LETTER OF YOUR CHOICE"
210 A$ = INKEY$:IF A$ = "" THEN 210
220 CN = INSTR(1,CN$,A$)
230 IF CN = 0 THEN GOTO 210
240 IF CN = 4 THEN CLS:PRINT "END OF PROGRAM":END
250 CLS
260 PRINT "ENTER ITEM TO SEARCH FOR"
270 INPUT TA$
280 GOSUB 310
290 GOTO 140
300 REM SEARCH ROUTINE
310 TF = 0
320 FOR R = 1 TO NR
330 IF INSTR(1,AR$(R,CN),TA$) > 0 THEN TF = TF+1:GOSUB 400
340 NEXT
350 PRINT
360 PRINT "NUMBER OF FINDS=";TF
370 GOSUB 470
380 RETURN
390 REM SUBROUTINE TO DISPLAY ALL CELLS IN A ROW "R"
400 FOR C = 1 TO NC
410 PRINT AR$(R,C)
420 NEXT
430 GOSUB 470
440 RETURN
450 REM END OF DISPLAY ROUTINE
460 REM SPACE TO CONTINUE SUB ROUTINE
470 PRINT
480 PRINT "PRESS THE SPACE BAR TO CONTINUE"
490 A$ = INKEY$
500 IF A$ <> CHR$(32) THEN GOTO 490
510 RETURN
520 REM END OF ROUTINE
530 REM DATA STATEMENTS
540 DATA PETER JONES,13 HIGH STREET NEWTOWN,0213-415
550 DATA MARY PHILLIPS,26 BROADWAY OLDTOWN,098-5647
560 DATA FRANK PAULSON,5 FARM COTTAGES WRAXALL WILTS,7654-5643
570 DATA FRED BLOGGS, 34 NORTH STREET HORNCHURCH ESSEX,453-7865
580 DATA MARIA TEMME,198 SOUTH STREET DEVONPORT LINCS,0956-3462
```

Play it again . . . and again

***Gordon McQueen** explains how to record and replay sound on your micro*

This program will enable your Dragon or color computer to repeat any sound you input to it.

To input sound to the computer the cassette is used in either of two ways. The first method is the easiest, all you do is record the speech or noise on a tape and then play that tape into the computer.

The second method will only work with some cassette recorders. Remove all the jack plugs from the tape deck, except for the ear jack. Then, look inside the cassette compartment for a little lever which is located opposite the record head.

If you have difficulty locating this lever, then look at a cassette tape and find the tabs that you break if you want to protect the tape from accidental recording. Now, if you look into the cassette compartment where this tab would be positioned you will see the lever.

Once the lever has been located, simply press it in and press record and play on your recorder. When you speak into the microphone on your tape deck, the signal will be sent into the computer and stored.

The machine code routines used to record and playback the sound begin at memory locations *7D00* hex and end at *7D5A* hex. The recorded sound is stored between locations *1E00* hex and *7CFF* hex, hence 32K of memory is required. It would be possible to change these memory locations, but the amount of storage would be greatly reduced.

The record program reads the cassette input, which is bit 0 of location *FF20* hex, and this value is added with 1 to produce a 1 or a zero. Since the required information is only one bit long, then one byte can hold eight bits of information.

The byte being used is shifted to the left and, if the cassette input is a one, then the contents of the byte are incremented, which raises bit zero. If this procedure has been performed eight times, then checks are made to see if the end of the data has been reached. If not, another byte of information is input.

The replay routine enables the sound output by *oring* the contents of *FF23* hex with eight. Each byte of data is then taken in turn and has its bits tested using the *Bit* instruction, which performs an *and* operation and sets the condition code register accordingly, but does not affect the register the operation was carried out on. If, after the *Bit* operation, the result is zero then the sound output addresses *FF28* hex is cleared otherwise it has *Fd* hex stored in it. If *FF* hex was stored in this location and Tandy's *Edtasam+* cartridge was being used then the cartridge would be reset. This process is repeated until the end of the data has been reached.

As well as the assembler listing, I have included a Basic program which loads the machine code from data statements. Instead of using the *Defusrn* statement, I have used the *Exec* statement as I have found that the Dragon can only access *Usro,* whereas the Tandy color computer can access all 10 of the *Usr* routines. Perhaps there is a bug in the Rom. ■

```
7D00                    00100          ORG 32000
        FF20            00110 IN       EQU 65312
        FF28            00120 OUT      EQU 65320
7D00 8E 1E00            00130 START    LDX #7680
7D03 6F 84              00190 GETBIT   CLR ,X
7D05 5F                 00200          CLRB
7D06 68 84              00210 CHECK    ASL ,X
7D08 B6 FF20            00220          LDA IN
7D0B 84 01              00230          ANDA #1
7D0D 27 02              00240          BEQ ZERO
7D0F 6C 84              00250          INC ,X
7D11 5C                 00260 ZERO     INCB
7D12 C1 08              00270          CMPB #8
7D14 26 F0              00280          BNE CHECK
7D16 30 01              00290 NEXT     LEAX 1,X
7D18 8C 7D00            00300          CMPX #$7D00
7D1B 25 E6              00310          BLO GETBIT
7D1D 39                 00320 AAA      RTS
7D1E B6 FF23            00390 GO       LDA >$FF23
7D21 8A 08              00400          ORA #8
7D23 B7 FF23            00410          STA >$FF23
7D26 86 FF              00420          LDA #$FF
7D28 B7 FF28            00430          STA OUT
```

```
7D2B 8E 1E00            00440          LDX #7680
7D2E 108E 7D52          00450          LDY #DATA
7D32 A6 80              00460 SND      LDA ,X+
7D34 A5 A0              00470 SNDOUT   BITA ,Y+
7D36 27 07              00480          BEQ CLEAR
7D38 C6 FD              00490          LDB #$FD
7D3A F7 FF28            00500          STB OUT
7D3D 20 03              00510          BRA FIN
7D3F 7F FF28            00520 CLEAR    CLR OUT
7D42 108C 7D5A          00530 FIN      CMPY #WELLY
7D46 26 EC              00540          BNE SNDOUT
7D48 108E 7D52          00550          LDY #DATA
7D4C 8C 7D00            00560          CMPX #$7D00
7D4F 26 E1              00570          BNE SND
7D51 39                 00580 DONE     RTS
7D52          8040      00590 DATA     FDB $8040
7D54          2010      00600          FDB $2010
7D56          0804      00610          FDB $0804
7D58          0201      00620          FDB $0201
7D5A 12                 00630 WELLY    NOP
                0000    00640          END
00000 TOTAL ERRORS
```

Continued on page 23

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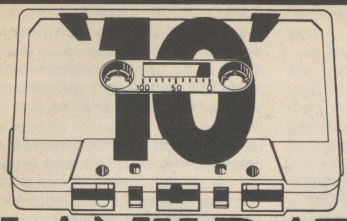

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```
0 'REPEAT FOR THE DRAGON 32
1 'OR THE 32K TANDY COLOUR
2 'COMPUTER
3 'BY
4 'GORDON MCQUEEN
10 PCLEAR1
20 DATA  142, 30, 0, 111, 132, 95,
   104, 132, 182
30 DATA  255, 32, 132, 1, 39, 2,
   108, 132, 92, 193
40 DATA  8, 38, 240, 48, 1, 140,
   125, 0, 37, 230
50 DATA  57, 182, 255, 35, 138, 8,
   183, 255, 35, 134
60 DATA  255, 183, 255, 40, 142,
   30, 0, 16, 142, 125
70 DATA  82, 166, 128, 165, 160,
   39, 7, 198, 253, 247
80 DATA  255, 40, 32, 3, 127, 255,
   40, 16, 140, 125
90 DATA  90, 38, 236, 16, 142, 125,
   82, 140, 125, 0
100 DATA  38, 225, 57, 128, 64, 32,
    16, 8, 4, 2
110 DATA  1, 18
120 FOR I=&H7D00 TO &H7D5A
130 READ P
140 POKEI,P
150 NEXT I
160 CLS
170 PRINT"PLAY OR RECORD (P/R)?"
180 IN$=INKEY$
190 IF IN$<>"P" AND IN$<>"R" THEN
    180
200 IF IN$="R" THEN 240
210 CLS
220 EXEC &H7D1E
230 GOTO 160
240 CLS
250 PRINT"RECORDING"
260 SCREEN0,1
270 EXEC&H7D00
280 GOTO 160
```

AAA	7D1D	IN	FF20
CHECK	7D06	NEXT	7D16
CLEAR	7D3F	OUT	FF28
DATA	7D52	SND	7D32
DONE	7D51	SNDOUT	7D34
FIN	7D42	START	7D00
GETBIT	7D03	WELLY	7D5A
GO	7D1E	ZERO	7D11

Memories are made of this

Ian Logan looks at the Spectrum memory map in the first of a five-part series

In all microcomputers, it is necessary to allocate different parts of the memory map to different tasks. The user is not usually aware of this, but it does affect the 'appearance' of the machine considerably.

In the Spectrum's memory map the first area, from address 0 — address 16383 (0000h-03FFh) is given over to the Rom (Read Only Memory). This single chip contains a complex machine code program that forms the operating system and the Basic interpreter of the Spectrum. It is not possible to move the Rom program to any other part of the memory map, as it contains many absolute addresses and Z80 *Rst* instructions that are dependent on the program being at address 0 onwards. It is however, possible to page-out the Rom completely, which happens whenever the 'shadow' Rom of the microdrive interface unit is used.

There are many subroutines in the Rom that can be used via the Basic *USR* command and some of them will be detailed in this article.

There are four fixed-length areas above the Rom. The first one is the display file (6K) that holds the bit by bit representation of the screen display. The second area is the attribute space (3/4K) that holds the colour details for the character areas of the screen display. It is clearly a limitation of the Spectrum that only two colours can be held for a whole character area at any time. The provision of more memory to this purpose would have made the Spectrum much more expensive.

The third area is the printer buffer (1/4K). This buffer allows for the storage of 32 characters and thereby applies some limitation when lines of a longer length are to be printed. If the printer buffer were longer, say 80 characters, then printing would be easier, but extra locations would have to be dedicated to this purpose.

The fourth fixed-length area is the system variables space. This is a most important part of the Ram and forms a storage area for the many temporary values that have to be held when the Spectrum is being used. The most important system variables are the set of 'pointers' that show where the 'dynamic areas' are to be found.

Within the system variables area there are two special sub-areas. The first of these is the streams area that holds 'offset' values for each of the 19 streams that can be used in the Spectrum system. The second is the calculator's memory area. This forms a temporary store for six 5-byte floating-point numbers and is used as an ordered scratch-pad when performing calculations of many kinds. Overall 182 locations (or 239 locations when the 'shadow' Rom is called), are used to hold the system variables of the Spectrum.

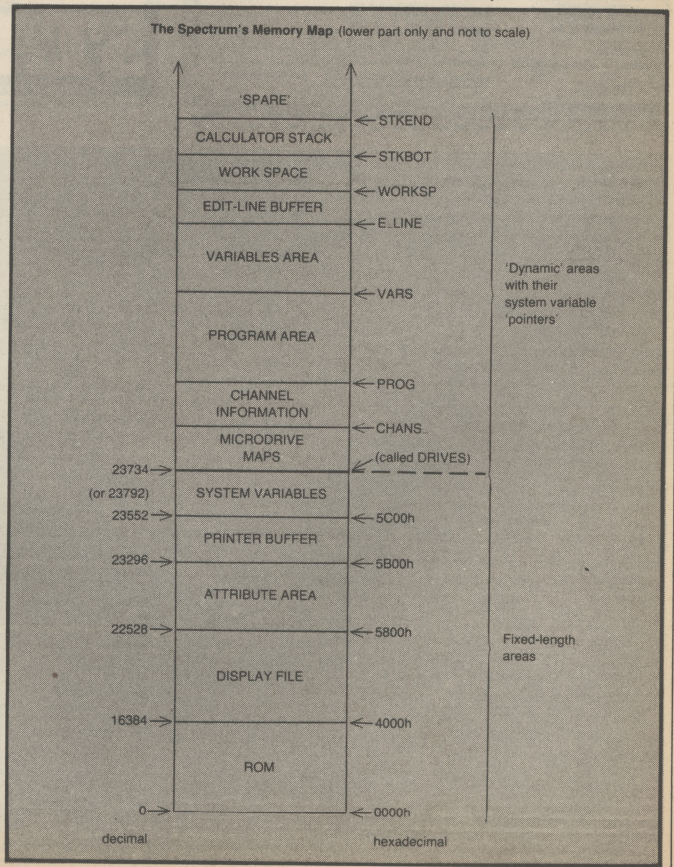
Above the fixed-length areas, starting at 23734 (5CB6h) — or 23792 (5CFOh) — are the dynamic areas of the Spectrum. These areas are of varying length and position. The length allocated to a particular area, at a given moment, depends on how much is to be held in that area at that moment — and the position depends on the size of the areas beneath it. In the Spectrum, locations are allocated to the dynamic areas for a variety of purposes but once the locations are no longer required then they are 'reclaimed'. The locations that are 'free' constitute the 'spare' area above the dynamic areas and below the machine stack.

The first of the dynamic areas is the microdrive map. This area will have 0,32,64,...,256 locations, depending on how many microdrives are *Open* for use. As it is possible to hold 256 bits in each block of 32 bytes, a microdrive can have up to 256 sectors with each sector having a flag that shows whether it is 'free' or 'busy'.

The second dynamic area is the channel information space. This area is addressed by the pointer *Chans*. In this area is held the data referring to the input and output devices currently available to the Spectrum. In the basic Spectrum there are four devices detailed in this area: the keyboard, the screen, the work space and the printer.

For each device, the data consists of an 'output address', an 'input address' and an 'identifying letter'. However, when the microdrive network RS232 interface unit is fitted, it is possible for the 'shadow' Rom to create channel information for these devices. In the cases of microdrive and network channels, it is necessary to set up input and output buffers which are also put in the channel information area.

One of the features of the Spectrum system is the way in which the various



available channels can be linked to the Basic streams. Once linked, the 'stream-bytes' (held in the streams area) hold the 'offset' between the starting location of the required channel information and the address held in *Chains*. Note that several streams may be linked to a single channel at the same time, but that it is impossible, and illogical, to attempt to link one stream to more than one channel.

The third dynamic area is the Basic program area. To the user, it appears that this area is 'in the television' when a listing is being shown, but in reality any lines that have been entered by the user into the Spectrum are stored in the program area. A Basic line in this area is stored in the following format:

the line number, the remaining length, the line itself and finally a carriage return character.

The lines are all stored in ascending order and contain Ascii characters, tokens, control characters and the special floating-point forms. The latter are inserted in syntax time and lead to a faster run time. All decimal numbers are followed by these floating-point forms, although to the user they are normally invisible.

When a listing is produced, the Basic lines are considered in turn. The line numbers are displayed as integers, the tokens are expanded to give the appropriate characters, ordinary Ascii characters are printed and control characters dealt with. The floating-point forms are simply ignored.

Above the program area comes the variables area. This area is only used to hold the current values for Basic variables. All numbers are held in five bytes — either in true floating-point form or in the short integer forms — all strings are held as 'strings of characters'.

There are two points of special note concerning the variables area: 1) 'Garbage collection' is fully integrated with string variable creation and there are never any 'unattached' strings to be 'collected'.

2) The elements of a *For-Next* variable are manipulated by addressing such a variable temporarily as the 'calculator's memory area'. By so doing the subroutines for handling the memory area can be used for a second purpose, thereby saving room in the Rom program.

The next area is the edit-line buffer, which holds the characters entered by the user during 'editing'. These entries can form a Basic line, with a line number that subsequently will be added to the program area, or a 'direct Basic command' that will be executed immediately. Interestingly, the 'edit-line' has the line number '—2' but this is only given during run-time (owners of ZX80s might recognise this '—2').

Above the edit-line comes the work space. This is a most interesting area, as it can be filled from either end as necessary but only 'cleared' in toto. The lower part of the work space is used for replies to the Basic command *Input*. In such cases the work space is used instead of the edit-line buffer, allowing subroutines within the Rom to be used again for two purposes. The upper part of the work space is a true 'scratch-pad' area and is used for a variety of purposes — such as the evaluation of *Val* expressions, the holding of tape-headers, etc.

The last of the dynamic areas is the calculator stack. Once again, this acts as scratch-pad for floating-point numbers (and string descriptors). Indeed there is an internal stack language within the Spectrum for manipulating the items of this stack.

Above the calculator stack comes the 'spare' area that extends as far as the machine stack. In a Spectrum an estimate of the size of this area is given by the line:

```
PRINT 65536-USR 7962;" bytes are free"
```

As explained earlier locations are 'allocated' to the various dynamic areas as required by current needs — these locations are then 'reclaimed' when no longer needed. Indeed, as locations are 'allocated' or 'reclaimed' all the bytes above the 'position of change' have to be moved up/down as needed. Also, the pointers held in the system variables area that point past the 'position of change' have to be increased/decreased as required.

The subroutine for moving the dynamic areas 'up' is to be found at address 1655h and is named, by myself, *Make-room*, and by Sinclair, *Insert*. In order to call this routine the *BC* register pair has to hold the number of bytes to be added and the *HL* register pair the 'position of change'. The actual lines of the subroutine are:

```
MAKE-ROOM (INSERT) EQU 1655h
    PUSH HL
    CALL 1FO5h,TEST-ROOM (CHK_SZ)
    POP HL
    CALL 1664h,POINTERS (REMGSZ)
    LD HL, (STKEND)
    EX DE,HL
    LDDR
    RET
```

Notes:

The *Test-room* subroutine will give error 4 — 'Out of memory' if there are insufficient 'spare' locations. The *Pointers* subroutine increases all the necessary pointers by '*BC*'. The *LDDR* instruction does a block moving operation to copy up all the bytes required.

The 'reclaiming' of bytes is performed most easily by using the *Reclaim–2* (*De-lrec*) subroutine. Once again the *BC* register pair holds the 'length' of the area and the *HL* register pair the address of the 'position of change'. The *Reclaim–2* subroutine is at 19E8h.

It may interest readers to know that there is a definite 'bug' in the 'reclaiming' code, in that the block of memory that is moved is too large. Fortunately no harm is done.

The next article in this series will discuss *Syntax Checking*. ■

Table 1

```
CLASS-00  -  No further operands.
CLASS-01  -  Used in LET. A variable is required.
CLASS-02  -  Used in LET. An expression, numeric or string,
             must follow.
CLASS-03  -  A numeric expression must follow. Zero to be used in
             case of default.
CLASS-04  -  A single character variable must follow.
CLASS-05  -  A set of items may be given.
CLASS-06  -  A numeric expression must follow.
CLASS-07  -  Handles colour items.
CLASS-08  -  Two numeric expressions, separated by a comma,
             must follow.
CLASS-09  -  As for CLASS-08 but colour items may precede the
             expressions.
CLASS-0A  -  A string expression must follow.
CLASS-0B  -  Handles cassette routines.
```

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Long division . . .

***Jeremy Ruston** explains how to translate simple arithmetical operations into assembly language routines*

One stumbling block when you are learning assembly language is the total absence of some of the features that are taken for granted in Basic. These include instructions for such simple operators as multiplication and division, program control statements such as *For — Next* and *Repeat — Until* loops. This article is designed to show you how easy it is to translate your knowledge of arithmetic into assembly language routines, and so to develop routines for addition, multiplication, subtraction and division in assembly language with the minimum of effort on your part.

This article is aimed at users of the 6502 micro-processor inside the BBC Micro. The techniques can easily be applied to other processors, such as the 6809 and the Z80. (In the case of the Z80 you will have to adopt slightly different programming methods. This is because the register orientated architecture of the Z80 is very different from that of the 6502, where virtually all instructions reference external memory.)

If you have studied the 6502 instruction set, you will have discovered the instructions used for shifting the bits in a byte left or right. These instructions come in four forms:

Asl — shifts the contents of a memory location, or the accumulator, one bit to the left. The least significant bit assumes a value of zero. For example, the binary number 01101011 (6B hex, 107 decimal) would turn into 11010110 (D6 hex, 214 decimal) after an *Asl* instruction. The most significant bit of the original number is always copied into the carry flag. The good thing about the *Asl* instruction is that it multiplies by two each time a shift is carried out.

Lsr is the opposite of *Asl*, in that it shifts a byte one position to the right. The most significant bit becomes zero and the least significant bit is copied into the carry flag. Consequently, it divides a memory byte by two.

Rol is identical to *Asl*, except that the least significant bit is not automatically set to zero, instead the current status of the carry flag is used.

Ror is identical to *Lsr*, except that, like *Rol*, the most significant bit is set to the carry flag.

These last two instructions allow you to shift numbers which are larger than a single byte wide. For example, to shift the four bytes starting at address &80, you could use:

```
Asl &80
Rol &81
Rol &82
Rol &83
```

The *Asl* instruction as it stands can be used to multiply by 2, 4, 8, 16, and so on. This can be done because if you follow one *Asl* instruction by another, the effect of each is compounded. For example, three *Asl*s will multiply by 2 three times, giving 2*2*2. This is a total multiplication factor of eight. If you continued along these lines you would get factors of 16 and 32, etc.

But you may wish to multiply by a number other than 2, 4, 8, 16, 32, etc. This is relatively easy to do. Given a multiplication factor, say five, we can see that multiplying X by 5 can be represented as 4*X + X. Therefore, to multiply a number by 5, one need only multiply by 4, using the arithmetic shift left instruction, and then add on the orginal number.

This technique can be extended to apply to other multiplication factors. For example, we can represent a multiplication by 7 as 4*X + 2*X + X. This may not appear to bring us any closer to a fully general multiplication routine which will multiply any two numbers together, but it does come nearer that point.

Part of the solution is to examine our original theory of multiplying by low numbers. We started off with 5*X. Five in binary is 0101. The weightings assigned to each binary digit start at 1 and ascend through 2, 4, 8, etc, multiplying by two each time. The interesting thing to note is that when we were doing multiplication in terms of arithmetic shifts and additions, we multiplied by 4 and then 1 for a multiplication of five. Obviously there is a connection between what you must multiply X by and the binary representation of the number that is being multiplied.

We can now say that to multiply any two arbitrarily long binary numbers we must scan one of the numbers and for every position in which there is a 1 in the number (a bit is set), we must multiply the other number in the calculation by the weighting assigned to the original bit position. We must then add together the results of these calculations.

In other words, if the detected bit has a 'value' of 16, we must multiply the other number by 16 and add this result to the grand total. A perfectly reasonable multiplication routine can be built using this technique. However, it is easier in most circumstances to use the fact that a given multiplication will also do an arithmetic shift left in the process of doing multiplication. This is a complicated way of explaining that if you have two eight bit numbers X and Y, the multiplication process should go something like this:

(1) The result will be stored in location Z.
(2) Do an arithmetic shift left (*Asl* instruction) of the X byte. If the bit that falls off the end of X, ie, the bit that ends up in the carry, is set then set Z to Z + Y.
(3) Shift left Z and X.
(4) Repeat the process as many times as there are bits in the two original numbers.

The following program, written in BBC Basic, shows an assembly language program to multiply two eight bit numbers together (unsigned arithmetic is used, but that's another story).

The program as presented here will not detect overflow (as in 200*200), but this is relatively easy to add. It is interesting to note that if you do decide to detect overflow, you can assume that one of the two numbers will be less than 16, since if they were both 16 or greater, overflow would be bound to result.

Thus, it would be possible to alter the range of the loop in the program to 4, but you would have to swap around the numbers N1 and N2, according to which had the top four bits set to zero, and take appropriate action if neither did.

The brackets in line 180 are necessary to prevent an obscure bug/feature in BBC Basic where if you carry out *Asl* (or *Rol*, *Ror*, etc) on a label starting with 'A', the system interprets you to be using accumulator addressing. This means that *'Asl Ans'* would be treated as *'Asl A/NS'!* ■

This is an extract from *The BBC Micro Compendium*, available from 1 August, from Interface Publications, 44 Earl's Court Road, London W8 6EJ.

```
>LIST
  10 REM 8 bit binary multipilcation
  20
  30 REM (c) 1983 Jeremy Ruston
  40
  50 DIM SPACE 100
  60 N1=&80:REM Storage for first number
  70 N2=&81:REM Storage for second number
  80 ANS=&82:REM Storage for answer
  90 FOR LOOP=0 TO 2 STEP 2
 100 P%=SPACE
 110[OPT LOOP
 120
 130.MULTIPLY
 140 LDA #0      \Zero answer
 150 STA ANS
 160 LDX #8      \Set up loop
 170.START
 180 ASL (ANS)   \Multiply answer
 190 ASL N1      \Copy bit 7 to carry
 200 BCC NO_ADD  \If the bit was zero, skip
    addition
 210 LDA N2      \Get addition factor
 220 CLC         \Clear carry for addition
 230 ADC ANS     \Add into answer
 240 STA ANS     \Store back to answer
 250.NO_ADD
 260 DEX         \Check for end of loop
 270 BNE START
 280 RTS
 290]NEXT LOOP
 300
 310 REPEAT
 320 INPUT "Enter two numbers:"?N1,?N2
 330 CALL MULTIPLY
 340 PRINT "Answer is ";?ANS
 350 UNTIL FALSE
>
```

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Defender

on Vic20

In this game the object is to score as many points as possible and to travel as far as you can along the enemy mountains, before you lose all your ships.

You start off with three ships. You lose a ship for crashing into the ground or into an enemy base, you can also lose a ship for running out of fuel. Your fuel supply is displayed at the bottom of the screen, when you are nearly empty there will be a warning signal and then the last unit of fuel will flash.

You score ten points for each enemy base hit, and you gain fuel.

The controls are:

1—Up

Z—Down

Cursor right—Fire

Cursor down—Bomb

The program uses high resolution graphics and is for the unexpanded Vic20. In the program there is a short machine code routine to scroll the screen from right to left.

```
 0 POKE52,28:POKE56,28
 12 FORA=829TO874:READB:POKEA,B:NEXTA:
    GOSUB1000
 20 DATA169,19,32,210,255,169,29,32,210,255,
    169,13,32,210,255,169,0,141,60,3
 30 DATA169,29,32,210,255,169,20,32,210,255,
    169,13,32,210,255,238,60,3,173,60,3
 40 DATA201,21,208,231,96
 41 POKE36879,8:PRINT"■":POKE36878,15:CR=64
    +128:V=30720:H=0:POKE650,128:P=36877:
    S=0:F=
 42 LIVES=2:PA=10:U=0
 50 POKE7878+D,0:PRINT"■■■
```

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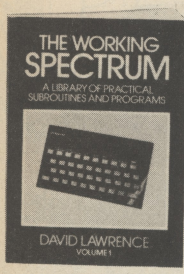

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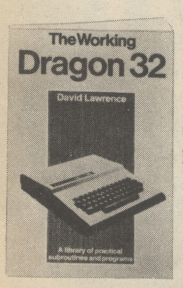

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Documentary

on Spectrum

This games program for the 16K ZX Spectrum is a spin-off of a game I saw in another magazine for the Commodore 64.

It involved shooting down three different types of dangerous 'space waste' which constantly fall towards your planet under its gravitational pull.

You must shoot down this waste before it reaches your planet and reduces your population.

The waste takes on the form of three different shapes; the first is a runaway bomb which will take out 250 people, so is only worth 10 points. The second is an old space ship rolling through space, if hit it is worth 20 points and will kill 500 people. The final piece is an anti-matter crystal which could kill 750 people, but is worth only 30 points.

At the start of the game you are given two laser bolts and two each time you hit a piece of waste.

Program notes

Lines

80-130	Move your spacecraft and check if you are dead
200-280	Fire your laser bolts
30-310	Blow up the waste
800-830	Reduce lives
900-910	Initialise and categorise type of waste
1000-1040	Move the waste — this is the main part of the game
1050-1060	The waste has reached your planet
9000-9100	Set UDG, initialise variables, set up screen
9900-	You have been blown up three times, 'PRINT' insults, end game

Graphics

Line:

100	'L'
9060	'ABCD', 'EFGH', 'IJKJ'

PROGRAM OF THE WEEK

```
   1 PRINT AT 11,0; FLASH 1;"THE
 FIRST SHOT IS IMPORTANT....."'"
"
   2 PAUSE 100
   5 INK 7: PAPER 0: BRIGHT 1: B
ORDER 0: CLS
  10 GO SUB 9000
  20 GO TO 1000
  80 IF ATTR (x,y+1)<63 THEN GO
TO 800
 100 LET y=y+(INKEY$="2" AND y<2
8)-(INKEY$="1" AND y>1): PRINT A
T x,y;" "
 120 IF INKEY$=" " THEN GO SUB 2
00
 130 RETURN
 200 IF shs=0 THEN RETURN
 201 LET shs=shs-1
 210 LET sho=(y+2)*8+5
 220 PLOT sho,32
 230 DRAW OVER 1;0,130
 240 BEEP .01,30
 250 PLOT OVER 1;sho,162: DRAW O
VER 1;0,-130
 270 IF SCREEN$ (g,y+1)="" AND g
<18 THEN GO TO 300
 280 RETURN
 300 FOR w=5 TO -5 STEP -1: BEEP
 .01,w: PRINT AT g,y+1; OVER 1;C
HR$ (RND*30+32): NEXT w: PRINT A
T g,y+1;" "
 301 LET shs=shs+2
 310 LET sc=sc+(c*10): GO TO 900
 800 FOR g=40 TO 0 STEP -5: BEEP
 .08,g: NEXT g: PRINT AT x,y;"
": LET lives=lives-1: IF lives=
0 THEN GO TO 9900
 801 PRINT AT 18,yy;" ";AT 19,yy
;" "
 820 PRINT AT 0,28;"    ": PRINT
 AT 0,28;: FOR d=1 TO lives: PRI
NT INVERSE 1;"■";: NEXT d
 830 PRINT AT 0,30; INVERSE 1;"
"
 900 IF c=3 THEN LET c=0
 901 LET c=c+1: LET x$=a$(c): LE
T yy=RND*27+2
 910 PRINT AT 0,0;"
                "
1000 FOR g=2 TO 20
1001 IF pop<=0 THEN GO TO 9900
1005 PRINT AT 0,2; INVERSE 1;"Sc
ore ";sc;AT 0,12;"Population ";p
op
1010 LET f=f+1
1015 IF f=5 THEN LET f=1
1020 PRINT OVER 1;AT g,yy; BRIGH
T 0;x$(f); BRIGHT 0;AT g-1,yy;x$
(f1)
1022 IF g=2 THEN PRINT AT 1,yy;"
"
1025 LET f1=f
1030 GO SUB 80
1040 NEXT g
1050 LET pop=pop-c*250
1055 BEEP .8,-20: RESTORE : FOR
p=0 TO 12: READ ww,www: BEEP ww/
750,www/10: NEXT p
1056 PRINT AT 20,yy; OVER 1;x$(f
)
1060 GO TO 900
8000 REM ********************
9000 FOR g=32600 TO USR "L"+7
9010 READ a: POKE g,a: NEXT g
9020 DATA 31,17,245,153,159,136,
248,0,16,16,16,16,8,8,8,8,248,13
6,136,189,249,17,17,31,8,8,8,8,1
6,16,16,16
9030 DATA 24,255,126,60,24,24,24
,0,0,0,1,255,128,0,0,0,0,24,24,2
4,60,126,255,24,0,0,0,128,255,1,
0,0
9040 DATA 126,70,74,82,98,126,0,
0,16,56,84,146,84,56,16,0,126,98
,82,74,70,126,0,0
9045 DATA 16,16,56,186,254,186,5
6,254
9050 DIM a$(3,4)
9051 LET pop=5000
9052 PLOT 0,0: DRAW 255,0,-.3
9053 LET lives=3
9055 LET shs=2
9060 LET a$(1)="■■■■": LET a$(2)
="■■■■": LET a$(3)="■■■■"
9065 LET c=1: LET x$=a$(c)
9070 LET yy=RND*27+2: LET x=18:
LET y=13
9080 LET sc=0: LET hs=1000
9090 LET lives=3
9091 PRINT AT 0,0; INVERSE 1;"
                "
9092 PLOT 0,0: DRAW 255,0: DRAW
0,175: PLOT 0,0: DRAW 0,175
9095 LET f=1
9098 FOR d=1 TO lives: PRINT AT
0,28+d;"■": NEXT d
9099 LET f1=f
9100 RETURN
9900 LET w=y*8+12: FOR g=0 TO 10
0: PLOT w,20: DRAW RND*23,g: PLO
T w,20: DRAW -RND*23,g: NEXT g
9910 PRINT AT 3,1;"YOU HAVE LET
THE SPACE-WASTE-"'"          DESTROY
 YOUR PLANET"'''          YOU HAVE S
CORED ";sc
9920 IF pop<2500 AND pop>0 THEN
PRINT '''"YOUR POPULATION HAS BEE
N GREATLY"'"  DECREASED,BUT THEY
 HAVE ALL"'"          EVACUATED SAFE
LY"
9930 IF pop>=2500 THEN PRINT '''
  POPULATION IS NEARLY INTACT"'"
    BUT EVACUATION WAS SLOW "'"
    YOU MAY HOLD YOURSELF "'"
      RESPONSIBLE"
9940 IF pop=0 THEN PRINT '''  YO
U ARE RESPONSIBLE FOR THE "'"  D
EATHS OF 5000 INHABITANTS"'"
 OF YOUR HOME PLANET"
9950 FOR g=0 TO 2500: IF INKEY$=
"" THEN NEXT g
9960 RUN


*********************************
** SPACE-WASTE © D.J.P. 1982 **
*********************************
```

Documentary
by David Parkinson

Globe

on BBC

This program can be used to draw a planet in space and then to create the illusion of rotation. This is done in several procedures:

Procstars – Plots 100 stars in random positions in space.

Procplanet – Draws in the background.

Proclongitude – Draws lines of 'longitude' in colours 7-15 on the planet's background.

Procring – Draws a ring around the planet.

Procrotate – Changes the 'actual colours' of the longitude lines in sequence to produce the impression of rotation.

Fnk and *Fny* – Offsets the planet's axis. (See below).

To save time the sine and cosine values are stored in arrays in lines 40 — 100 so that they will not have to be calculated more than once in the program; this means that there will be a pause when the program is run so do not be alarmed! To make the planet look more realistic the two functions at the end of the program are used to make it seem as though it is revolving about a non-horizontal axis.

```
:VDU1,27,1,81   GLOBE (c) 1983
>L.
  10       REMOVE THESE BUT
  20     REMEMBER JAMES JACKSON'S
  30  MODE2
  40  DIM S(90),C(90)
  50  A%=-1
  60  R%=400
  70  FOR A=0 TO RAD360 STEP RAD4
  80    A%=A%+1
  90    S(A%)=SIN(A):C(A%)=COS(A)
 100    NEXT
 110  VDU23;8202;0;0;0;
 120  VDU19,0,4;0;
 130  VDU19,4,7;0;
 140  VDU19,7,0;0;
 150  PROCSTARS
 160  PROCPLANET
 170  PROCLONGITUDE
 180  PROCRING
 190  REPEAT
 200    PROCROTATE
 210    UNTIL FALSE
 220
 230  DEF PROCSTARS
 240  GCOL 0,3
 250  FOR T%=0 TO 100
 260    PLOT69,RND(1279),RND(1023)
 270    NEXT
 280  ENDPROC
 290
 300  DEF PROCPLANET
 310  VDU29,640;512;
 320  GCOL 0,2
 330  MOVE 0,0
 340  FOR A%=0 TO 90 STEP2
 350    MOVE 0,0
 360    PLOT85,S(A%)*R%,C(A%)*R%
 370    NEXT
 380  ENDPROC
 390
 400  DEF PROCLONGITUDE
 410  C%=6
 420  FOR L%=0 TO 45
 430    C%=C%+1
 440    IF C%=16 THEN C%=7
 450    GCOL 0,C%
 460    FOR A%=0 TO 45 STEP 3
 470      X=S(A%)*C(L%)*R%
 480      Y=C(A%)*R%
 490      IF A% THEN K%=5 ELSE K%=4
 500      PLOT K%,FNX,FNY
 510      NEXT
 520    NEXT
 530  ENDPROC
 540
 550  DEF PROCRING
 560  GCOL 0,4
 570  FOR W%=500 TO 572 STEP 8
 580    FOR R%=36 TO 99 STEP 3
 590      A%=R% MOD 90
 600      IF R%=36 THEN K%=4 ELSE K%=5
 610      X=C(A%)*W%
 620      Y=S(A%)*100
 630      PLOT K%,FNX,FNY
 640      NEXT
 650    NEXT
 660  ENDPROC
 670
 680  DEF PROCROTATE
 690  FOR C%=7 TO 15
 700    VDU 19,C%,7;0;
 710    WAIT=INKEY(10)
 720    VDU 19,C%,2;0;
 730    NEXT
 740  ENDPROC
 750
 760  DEFFNX=(0.9*X)+(-0.4*Y)
 770  DEFFNY=(0.4*X)+(0.9*Y)
```

Globe
by James Jackson

Break the Code

on Vic20

This is a version of the 'Mastermind' game with a slight difference. Not only must you guess the colour combination within 10 moves but also within a time-limit.

There are four levels of play, 4 being the easiest. To make the game easier or harder just change the times in lines 620-650. To input your choice use the colour keys, cyan and blue are not used in the game. After you have put in your guess you will have a chance to change it.

The Computers response to your guess is as follows: For every black square you have a correct colour in the right place, for every white square you have a correct colour in the wrong place.

Program notes

10	Re-seeds random generator
110-140	Computer picks code
180-340	Input guess
350-390	Checks choice against code
500	Times up
530-540	Music routine if right or wrong
600-650	Time-limit routine

```
10 L=RND(-TI)
20 C=7732:D=7690:G=7741:J=30720:K=7734
30 M=36878:N=36876:O=36874:KK=36877:RR=0
40 POKE36879,59:PRINT"■"
50 PRINT"■■■■■■■■BREAK THE CODE■■"
60 PRINT"■■■■■■■BY KEN ADNAMS"
70 PRINT"■■■■■■■■■PRESS SPACE"
80 GETG$:IFG$<>" "THEN80
90 PRINT"■■■■■■INPUT LEVEL (4-1)"
100 GOSUB600
110 PRINT"■":FORI=0TO3
120 A(I)=INT(RND(1)*8)
130 IFA(I)=3ORA(I)=6THEN120
140 NEXT
150 FORI=0TO6:POKED+I,102:POKED+I+J,2:NEXT
160 TI$="000000":FORI=48TO57:POKEC,I:C=C+44:NEXT
```

```
170 PRINT"■TIME "RIGHT$(TI$,3):IFTI$)=B$THEN500
180 R=0:W=0:FORI=0TO3
190 GETC$(I):U(I)=VAL(C$(I))-1:PRINT"■TIME
    "RIGHT$(TI$,3)
200 IFTI$)=B$THEN500
210 IFC$(I)="0"THENN250
220 IFU(I)=-1THEN190
230 IFU(I))7ORU(I)<0ORU(I)=3ORU(I)=6THEN250
240 GOTO260
250 PRINT"■■■■■■ERROR":FORT=0TO750:NEXT:PRINT"□
    ":GOTO190
260 POKEM,15:POKEN,203:FORT=0TO10:NEXT:POKEN,0
270 POKEK,81:POKEK+J,U(I):K=K+2:NEXT
280 PRINT"■■■■■■■OK?":PRINT"Y/N"
290 GETG$:PRINT"■TIME "RIGHT$(TI$,3):IFTI$)=
    B$THEN500
300 IFG$="Y"THEN350
310 IFG$<>"N"THEN290
320 PRINT"■■■■■■   ":PRINT"   "
330 FORT=0TO6:POKEK+T-8,32:NEXT:K=K-8
340 POKEM,7:POKEKK,203:FORT=0TO100:NEXT:POKEKK,
    0:GOTO170
350 FORP=0TO3:X(P)=A(P):NEXT
360 FORI=0TO3:IFU(I)=X(I)THENR=R+1:X(I)=20
    :U(I)=10
370 NEXT
380 FORI=0TO3:FORZ=0TO3:IFU(I)<>X(Z)THENNEXTZ:
    NEXTI:GOTO400
390 W=W+1:X(Z)=20:NEXTI
400 IFR=4THEN510
410 IFR=0ANDW=0THENPOKEG+1,14:POKEG+2,15:POKEG+3
    ,14:POKEG+4,5:FORI=1TO4:POKEG+I+
J,2:NEXT
420 IFR=0THEN440
430 FORT=1TOR:POKEG+T,123:POKEG+T+J,0:POKEO,196:
    FORL=0TO5:NEXT:POKEO,0:NEXT
440 IFW=0THEN460
450 FORT=1TOW:POKEG+T+R,123:POKEG+T+R+J,1:POKEO,
    182:FORL=0TO5:NEXT:POKEO,0:NEXT
460 K=K+36:G=G+44
470 IFTI$)=B$THEN500
480 IFK>8164THENRR=1:GOTO510
490 PRINT"■■■■■■   ":PRINT"   ":GOTO170
500 PRINT"■TIMES UP":RR=1
510 FORI=0TO3:POKED,81:POKED+J,A(I):POKED+1,32:
    D=D+2:NEXT
520 IFRR<>1THEN540
530 FORI=255TO128STEP-1:POKEM,10:POKEO,I:FORT=
    0TO5:NEXT:NEXT:POKEO,0:GOTO550
540 FORI=128TO255:POKEM,10:POKEN,I:FORT=0TO5:
    NEXT:NEXT:POKEN,0
550 PRINT"■■■■■■■
```

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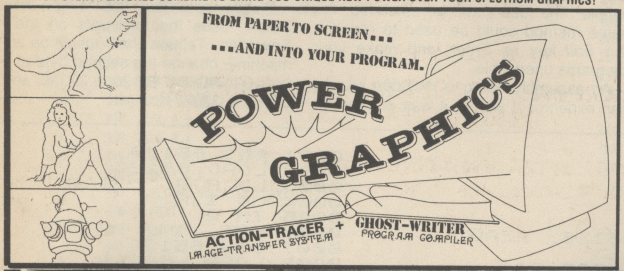

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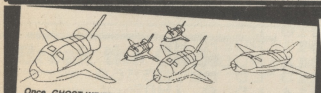
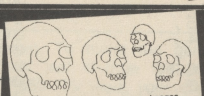
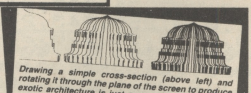
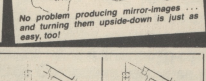
The new program captures your design DYNAMICALLY, giving you instantly the power to MOVE it anywhere, to SHRINK it down to a single pixel, or EXPAND it to fill the screen. You can SQUEEZE or STRETCH it into weird distortions, flip it UPSIDE DOWN or MIRROR-IMAGE it, ROTATE it in the plane of the screen . . . In other words MANIPULATE IT UNDER YOUR FULL CONTROL!


Once GHOST-WRITER has captured Space-Shuttle, you can immediately reproduce it anywhere, any size, AND redesign it too!

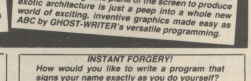

No problem producing mirror-images . . . and turning them upside-down is just as easy, too!


Drawing a simple cross-section (above left) and rotating it through the plane of the screen to produce exotic architecture is just a peep into a whole new world of exciting, inventive graphics made easy as ABC by GHOST-WRITER's versatile programming.

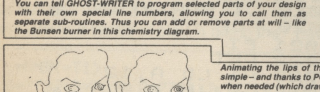
MANIPULATION OR ANIMATION – GHOST-WRITER ALWAYS WRITES EXACTLY THE PROGRAM YOU NEED!
You can tell GHOST-WRITER to program selected parts of your design with their own special line numbers, allowing you to call them as separate sub-routines. Thus you can add or remove parts at will – like the Bunsen burner in this chemistry diagram.



INSTANT FORGERY!
How would you like to write a program that signs your name exactly as you do yourself?



It's just a few minutes' fun with POWER-GRAPHICS!



Animating the lips of this well-known newsreader (recognise her?) is just as simple – and thanks to POWER-GRAPHICS' ability to produce high-speed curves when needed (which draw as fast as straights) her curved lips can be animated in real time!
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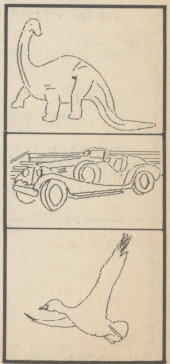

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on ZX81

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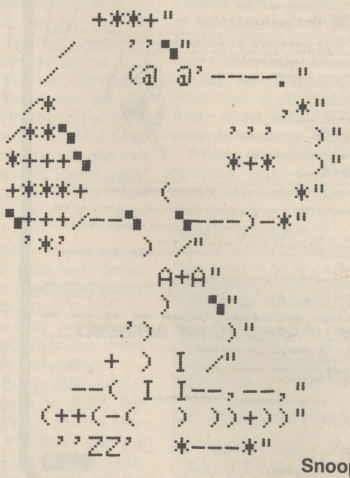
```
6   OPEN1,4:CMD1
169 PRINT#1:CLOSE1
```

```
5 REM SNOOPY PRINT
10 LPRINT "
20 LPRINT "
30 LPRINT "
40 LPRINT "
50 LPRINT "
60 LPRINT "
70 LPRINT "
80 LPRINT "
90 LPRINT "
100 LPRINT "
110 LPRINT "
120 LPRINT "
130 LPRINT "
140 LPRINT "
150 LPRINT "
160 LPRINT "
170 END
```



Snoopy
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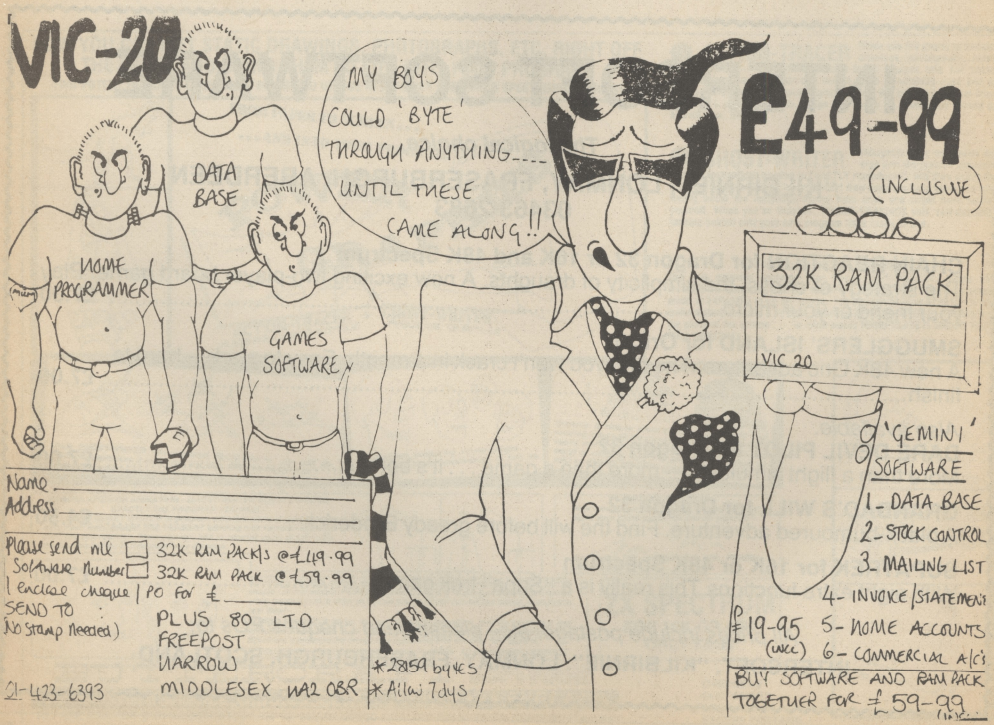

Summer games!

By the time you read this, many of you will have finished your exams — you lucky devils! So, you will now be crawling back into the daylight and looking for a good adventure program to keep you amused throughout the summer months. To bring you up-to-date with what the rest of the world has been up to lately, here are my personal top adventures:

(1) *The Hobbit* — for changing, overnight, the face of Spectrum adventuring. Melbourne House, the publisher of this by-now classic game, should rectify some of the irritating little bugs in the program, which they must be well aware of by now. More importantly, versions for the other popular micros should be released — they can't lose!

(2) *The Scott Adams Adventure Series* — for the Vic20, Texas, and other machines. There is the Willie Crowther/Don Woods classic for mainframe computers, but this series is the classic for home micros. Set purely in text, they pose good problems, with a high degree of difficulty, all set in an imaginative scenario. Titles include: *Voodoo Castle, Strange Odyssey,* and *The Count.*

(3) The Level 9 trio — *Colossal Adventure, Adventure Quest* and *Dungeon Adventure.* The first of these is a version of the Crowther/Woods original, but with a much-expanded endgame. The other two start from locations within the first, thus making an impressive suite of adventures. They are always a pleasure to play, not least because of the comprehensive and well-produced documentation, which even include a SAE, which you may use to ask for *Help* in desperation.

(4) *Pimania,* from Automata — not one of my personal favourites (I don't think the humour of their lovely adverts translates well to the micro adventure), this program nevertheless deserves a place in this survey because it introduced the idea of a prize for the first person to crack the puzzles of the game. Pimania's Golden Sundial thus follows the book world's Golden Rabbit from *Masquerade* into the history books. And nobody's found it yet!

(5) *Madness and the Minatour* — from Dragon Data, for the Dragon. It's here because, after *The Hobbit* and the *Scott Adams* series, this is the one I've had most enquiries about. While difficulty is not the ultimate criterion of a good adventure, this one, as Michael Vesey of Worksop can verify, is crackable. He has written asking what all the fuss is about, as he has no problem in finding the mushroom.

(6) Just about any adventure for the Atari machines. There are not many text programs, and those available are fairly standard, but, in keeping with the Atari's graphic capabilities, the arcade adventures are really special, and can be highly recommended. Representative are *Ghost Encounters, The Pharaoh's Curse, Action Quest* and *Journey to the Planets.*

(7) *Artic Adventures A-E* — these are all of a similar format, pure text, unblemished by graphics. I get many letters asking for help with these programs, and while difficulty may not be the prerequisite of a good adventure, these games are extremely compelling.

(8) Last, but not least, is a graphic adventure that I come back to again and again — *Volcanic Dungeon* from Carnell. Available for the ZX81 and the Spectrum, this has good documentation, which includes a map of the dungeon. Combining elements of *D & D* and the old favourite *Wumpus,* it can be played again and again.

So, there is a quick survey of programs that you are likely to enjoy. But, please write and let me know of your own particular favourites.

Now, a hopeful look forward to packages we would all like to see! First off — *Lord of the Rings,* from Melbourne House, all 89 parts of it. I don't know the legal aspect of this, but if MH have the rights, they must surely be working on the epic.

Then, Artic's Adventure F — and please, Artic, how about just a touch of colour? And, while we're about it, how about versions for other micros?

Finally, *Valhalla,* from Micrel — a program that, according to the publisher, will knock *The Hobbit* from its pride of place. The graphics and game mechanics are, apparently, superb. ■

NB: All entries for the Adventure Competition must reach us by 30 June.

This series of articles is designed for novice and experienced Adventurers alike. Each week Tony Bridge will be looking at different Adventures and advising you on some of the problems and pitfalls you can expect to encounter. So, if you have an Adventure you want reviewed, or if you are stuck in an Adventure and cannot progress any further, write to: Tony Bridge, Adventure Corner, *Popular Computing Weekly,* Hobhouse Court, 19 Whitcomb Street, London WC2 7HF.

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Popular Computing Weekly is offering £10 each month to the player with the highest score on *Cruising.* All you have to do to enter this month's competition is send a print-out of your highest score, together with your name and address, to:

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Each month we will publish the name of the winner and the new *Cruising* high score. Are you good enough to accept the *Cruising* challenge?

The winner of last month's competition with a score of 22664 was I. C. Willis of Shore Lane, Sheffield, who receives £10. Entries for this month's competition close on June 30.

Notes

1) Each entry must consist of a ZX printout and your name and address.
2) Closing date for this month's *Cruising* challenge entries is June 30.
3) The highest score each month will receive £10.
4) High scores cannot be transferred from one month to another.
5) The judges' decision is final.
6) No employees of Sunshine Publications Ltd, or their families, will be eligible to enter.

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The highest score sent in so far this month is 70625 from Stuart Williamson of Bradford, West Yorks. Entries for this month's competition close on June 30.

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DIFFICULT CALL

David Parkinson of Woodcote Road, Tattenhall, Wogverhampton, writes:

Q I have recently acquired a book on Z80 machine code for the Spectrum. I am having difficulty in understanding the Mnemonic *Call*.

Is it the machine language equivalent of the Basic instruction *Usr*? Also, could you explain how the command could be used in an M/C Invaders type program?

A The mnemonic *Call* is very similar to the Basic command *Gosub*, and it can be used conditionally or unconditionally. It is used along with the mnemonic RET which is *Return* in BASIC. In effect what happens when you use *Call* is that you *Push* the return address on to the top of the stack, and then *Jump* to the address you have *Call*ed.

The instruction does not alter the flags, but it is important that you leave the RET address on top of the stack, so you can return. This means that any further numbers put on to the stack by the routine you have *Call*ed must be *Push*ed off again.

I cannot say with any certainty how you could use *Call* in your particular program, because I have not seen it. However, I would presume that it would be used unconditionally to set up each new screen, and conditionally to check such things as hits and damage to the shields.

LACK OF MEMORY

P D Austin of Weston Park Court, Bath, writes:

Q My interest having been much revived by the arrival of the office mini computer, I recently dragged my old ZX80 out of retirement. But I have become frustrated by the lack of memory, though I am still loathe to give it to the dustman — after all, it did cost £100 in 1980.

However, I have been told by Sinclair that the Ram pack needs the new Rom, is this so? If it is, do you know of anyone who can supply any sort of Ram add on for the ZX80, however small?

A I am very surprised at the response from Sinclair. Unless they have made some sort of change in their later Ram packs, there should be no problem on any ZX80. The only difficulties that might occur are with the old 3K add on, that has not been available for some time. Just to check I used my old (did *that* really cost £100) ZX80, with a Big Byte Ram pack and found no problems. I suggest that you buy a Ram pack from a shop, explaining the situation, and asking if you can have a refund, in the event that it does not work.

COMPUTER STUDIES

Steve Spencer of Braddon, near Towcester, Northants, writes:

Q I shall be taking my 'O' levels soon and I wish to go to a sixth form college to do computer studies next year. As I am unaware of the sort of jobs available in computing, I would be grateful if you could print a couple of useful addresses that I could write to for more information.

A This is the sort of question that requires an article in its own right. The best place to start is probably a careers officer, and you will find one attached to your sixth form college.

The range of computer related jobs is large and getting larger. Every big company today has a computing department — in some cases it only deals with one particular aspect of the work, in others a computerised system will be found at all levels, for use in all sorts of applications.

The number and range of computers in business is going to increase. People will be wanted to write, maintain, and update the programs.

Letters to all the big companies in your area will probably produce results. Some companies might well take you on as a trainee, once you have done the basic exams at college, others might want you to do further exams.

SPARE 32K

Sean Conelly of Valley Road, Macclesfield, Cheshire, writes:

Q I have put 64K Hitachi Drams into my Spectrum, to make it 48K. I would like to know how to use the other 32K I have spare. I know that it would have to be switched in and out, but any advice on how to do this would be useful.

A The circuitry to do this is quite complex — and I have no detailed information. The only thing I can suggest is that you should contact someone like East London Robotics who offers a 64K memory add-on for the Spectrum. They might be willing to sell you the circuit board or the plans separately.

Sean also asked about a program he sent in. From the copy, it seems that he is missing a data statement. The data is read by a line *For N = 1 to 10*, the problem is that you only have nine data statements. As it is about resistor colour codes, it is probably green that is missing between yellow and blue.

FUZZY ZX80!

Peter King of Manor Gardens, Saxmundham, Suffolk, writes:

Q I own a Sinclair ZX80. Sometimes when I turn it on, the screen goes fuzzy and the computer will not respond to the keyboard. This also happens when I am typing in a long program. Is there anything that I can do about this? Also, do you know if any ZX80 software is being produced?

A From my mailbag there are still a surprising number of ZX80s in use up and down the country. Your problem could be one of two things — are you using a Ram pack? This used to cause a lot of problems on the ZX80, because as soon as the contacts got dirty between the Ram pack and the port it would cause a crash. The answer to this is to clean the port with some spirit or industrial alcohol.

The second possible cause of your problems is overheating. This is much harder to cure — keeping something cold on the top was the usual solution. But, beware that you do not get any water into the computer!

The other possible modification is to cut slots into the left side of the case above the heat sink. More dedicated/frustrated owners have successfully got round the problem, by literally enlarging the heat sink. This is usually done by cutting out the side of the case above the heat sink and screwing on a piece of copper or brass that then sticks through the gap.

On my ZX80 I used two pieces of thick copper wire that I had beaten flat. Unsubtle, but quite effective.

The problem you sometimes face when you power up at the start could be to do with the restart line. A capacitor between this line and the 0 line will ensure that you get an even pulse, and will slow the restart down enough to cut out any sudden peaks that can occur when powering up. The capacitor needs to be 25v 100 microfarads.

As for ZX80 software, I doubt whether much is still being produced — I certainly have not seen any advertisements for a long while. The only thing that I can suggest is that you scan the small ads in some of the magazines to see if any turn up. If this fails, you could always try placing your own small ad.

Is there anything about your computer you don't understand, and which everyone else seems to take for granted? Whatever your problem *Peek* it to Ian Beardsmore and every week he will *Poke* back as many answers as he can. The address is *Peek & Poke, PCW*, Hobhouse Court, 19 Whitcomb Street, London WC2 7HF.

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ZX 9 volt power pack, £7.50. Tel: Alan 061-973 9728.

VIDEO GENIE E9 3003 and leads, two years old, £135 ono. Tel: Colchester 860710.

VIC20. Many cassettes to swap for unexpanded and 16K. Also Pirate Cove for Vodoo Castle plus count. Tel: Richard, New Milton 0425 611094.

SWAP Adventureland for any other Vic20 adventure not Voodoo Castle. Tel: Swanley 66180 (David).

SECONDHAND APPLE GAMES, half price: Scrabble, Epoch, Microchess — sell or exchange for other Apple programs. Tel: Wigan 47574.

SWAP Mission Impossible for other adventure on Vic. Also swap cartridges, Road Race, Super Lander, Avenger, Alien or sell £12 each. Tel: 0733 241943 (after 6 pm).

SPECTRUM GAMES FOR SALE half original price. Tapes include Hobbit, Penetrator, Hungry Horace, Arcadia and many more. Tel: 0268 27054 (anytime).

SWAP "Know Your Own Personality" for "Know Your Own IQ". Tel: Sandyacre 397892. For Vic20.

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PIRATE COVE adventure cartridge for Vic20. Swap for Voodoo Castle. Tek Simon 673 5819.

ONE SET Apple disc drives with controller card plus manual and DOS disc, £450 ono. Tel: 051-922 3639.

VIDEO GENIE ED3003 with manuals plus box and £90 software, excellent condition, £150. Tel: 0385 67867.

ACETRONIC NPU 2000 and four good cartridges, cost £140, sell for £60 ono. Tel: Bourne End, Buckinghamshire 23797.

GAMES SOFTWARE for Vic20 and ZX Spectrum to swap or sell. Tel: 041-557 1533 after 5 pm.

INTELLIVISION, six months old plus ten cartridges, £130 ono. Tel: Welwyn 4417.

INTELLIVISION plus nine cartridges, boxed and guaranteed, £160 ono or swap for your Atari 400. Tel: 01-310 8109 after 5 pm.

R.D. DIGITAL TRACER, £35. Brand new. Tel: Wigan 58719.

SWAP SHARP MZ80A with software for BBC Model B. Tel: Belfast 221868.

VIC20 SOFTWARE: Robert Camer, Menu Planner, £5. Sub-Space Striker plus 20K, £3.50. Tel: 0983 525737.

VIDEO GENIE Fred sound synthesiser, hi-res graphics board, 16K. Tel: Welwyn 4815.

INTELLIVISION GAMES CONSOLE, eight cartridges, £120. Tel: 591 0915.

ADVENTURELAND CARTRIDGE for Vic20. Swap for The Count. Tel: 0572 3384.

ALIEN CARTRIDGE for Vic 20. Swap for Tank Attack or sell for £10. Tel: 0572 3054.

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WANTED modules for minimum and extended Basic, T99/4a. Any fair price. Tel: Isle of Man, St Johns 309

WANTED. BBC Model B. Tel: Chester 315912 (daytime).

WANTED. Printer ZX Spectrum. Good working order. Tel: Luton 54931.

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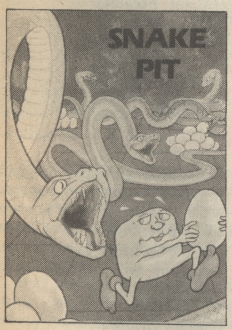

Snake Pit was a popular, even cultish, game on the BBC micro. Now Postern has issued a version for the Spectrum.

The game involves moving around a maze eating snake eggs. This is made more difficult by the fact that a rival snake is also eating them, and is also releasing a number of other snakes by eating the eggs which are keeping them captive. Needless to say, if you touch any one of the snakes, the game is over.

In the unlikely event that you manage to clear the screen, you are rewarded with a chance to eat the other snakes and another screenful of eggs — and a faster speed, of course.

Program *Snake Pit*
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Supplier *Postern*
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Cheltenham
Glos GL54 5SW

OUTER SPACE

Federation Software is another company involved with the Ace. It has issued three cassettes, one for the 3K machine and the others for the expanded 19K version.

Spacehop involves an intrepid space traveller leaving his home world and journeying through space to another planet where he must collect a container before returning home.

It is not, of course, as simple as that. There are many hazards to be overcome and good hand and eye co-ordination is required.

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Price *£6*
Micro *Ace*
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25 VARIETIES

QED systems is another company that has moved its operation from commercial systems to micro computers.

The company has just issued two cassettes for the Dragon. *The Variety Pack* contains 25 programs designed to educate and entertain the recent Dragon owner. Versions are also available for the Oric and the Spectrum.

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Lancs L39 6RZ

SEVEN-UP!

The Soft Seven is a games pack for the Dragon 32. The seven menu driven programs include versions of *Hangman* and *Bomber*, as well as educational games like *Music Maker* and *Wordsearch*.

TD Copsey is a new company which intends to specialise in programs for the Dragon.

Program *The Soft Seven*
Price *£3.50*
Micro *Dragon 32*
Supplier *T D Copsey*
20 Thorington Avenue
Daws Heath
Hadleigh
Benfleet
Essex

WAR GAMES

Impact Software has issued three new games. *Specman* is a version of *Pacman* for either of the Spectrum machines. Both the other games are for the Vic20.

Terminator is a machine code space battle game which will work on the unexpanded machine. There are 16 kinds of aliens with the addition of zaggers and meteors at later levels.

Program *Terminator*
Price *£6.50*
Micro *Vic20*
Supplier *Impact Software*
70 Redford Avenue
Edinburgh EH13 0BW

BALANCED

Earlgate Computers is a company catering for a range of machines in the field of "informational" software. The *Diet Analysis* program calculates your optimum calories intake and analyses your present diet.

Your dietary balance is derived from the list of foods you have eaten and their weight. The program allows you to compare your own food balance with that of the "ideal" for your height and degree of exercise.

It could be useful for computer buffs, who tend to spend all day sitting down peering at television screens.

Program *Diet Analysis Program*
Price *£7.95*
Micro *Spectrum, New Brain and BBC*
Supplier *Earlgate Computers*
PO Box 24 Wokingham
Berkshire RG11 1PE

STOCK CONTROL

A full stock ledger system, comparable to those available on the Apple II or Pet, is provided by *Stock Accounting and Control*, claims Kemp.

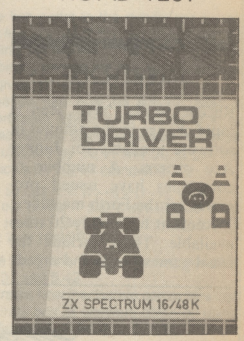
The program will provide a monthly ledger account printout and will accept 15,000 entries a year. Provisions include the assigning of a four digit number to each record to prevent duplication of files.

If a file is to be deleted, the whole record will be printed out prior to deletion as a safety measure.

The program comes with an operators manual, which not only explains use of the program, but also offers advice on tape head cleaning and software maintenance.

Program *Stock Accounting and Control*
Price *£14.95*
Micro *Spectrum 48K*
Supplier *Kemp Ltd*
43 Muswell Hill
London N10 3PN

ROAD TEST



For some reason, nobody has issued a road race game for the Spectrum — until now. A strange situation, since one of the questions I am most often asked is "do you know of any car games for the Spectrum?"

I would guess, therefore, that Boss whose first game is entitled *Turbo Driver* should do quite well.

The game involves steering your car left and right past various hazards, which include manholes, sheep and a funeral procession. Every hazard you fail to dodge will cost you fuel and, if you are particularly unlucky, you may run out of fuel before you reach the finishing line.

Program *Turbo Driver*
Price *£5.95*
Micro *Spectrum 16/48*
Supplier *Boss Flockton House*
Audby Lane
Wetherby
West Yorkshire
LS22 4FD

DESTROYED

Droids is a new machine code game for the Dragon 32 from J Morrison (Micros).

The object of the game is to prevent the *Droids* obliterating the earth, by removing lead shields and releasing trioxtron bombs. The first few *Droids* can be destroyed fairly easily, but the last few will start firing at you.

As the game gets more difficult, the points awarded for each destroyed *Droid* increases.

Program *Droids*
Price *£6.95*
Micro *Dragon 32*
Supplier *J Morrison (Micros)*
2 Glensdale Street
Leeds LS9 9JJ

PRINT-OUT

Recent weeks have seen a rapid change in the amount of software available for Jupiter Ace owners. A number of companies have issued programs for the Forth machine.

Remsoft has nearly 20 titles available. These include the usual games packs and arcade favourites like *Frogger*, as well as some useful utilities.

Tape 11 is a *ZX Printer Driver*. It uses 305 bytes to divert characters from the screen to the printer, enabling Ace owners to print out their programs on the cheap ZX printer.

The current version requires a simple Ace/ZX adaptor, but a program which requires no hardware at all is promised soon.

Program *ZX Printer Driver*
Price *£5.50*
Micro *Ace*
Supplier *Remsoft Computer Software*
18 George Street
Brighton BN2 1RH

STAR TREK

No prizes for guessing the identity of Silversoft's *Starship Enterprise*.

The 30K game has all the usual *Star Trek* features of long and short range scan, shields damage reports, etc.

However, a certain arcade element has been introduced. When you find the enemy ship, it appears on screen and you must use the cursors to aim your phasors.

The program also has a *Timegate-like* graphic display when you warp through space.

Program *Starship Enterprise*
Price *£5.95*
Micro *Spectrum 48K*
Supplier *Silversoft*
2 Hammersmith Broadway
London W6

STUNNING!

The new release from Imagine is called *Jumping Jack* and, true to the tradition of the company, it isn't really like any other game you could name.

You control a little stick man with a large nose whom you must guide to the top of the screen. This involves rising over a number of levels. Each level is moving and, worse still, some of them have gaps through which your man is likely to fall.

If your man does fall through a gap then he will be stunned for a few moments and lay on his back waving his legs in the air. This is likely to cause him to fall still further, since he is unable to run from other gaps in lower levels while he is still stunned.

As the game progresses it gets harder. Once you have completed the first screen, a number of hazards appear including an aeroplane, a bus, a hatchet and a man firing a shotgun.

Program *Jumping Jack*
Price *£5.50*
Micro *Spectrum 16/48K*
Supplier *Imagine Software*
Masons Buildings
Exchange Street East
Liverpool
Merseyside L2 3PN

WORD GAME

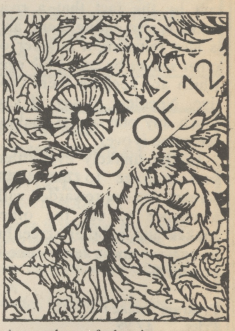
Perhaps because of its "serious" image, there are many more companies offering educational software for the BBC computer than there are for any other machine.

GTM is one such company and it specialises in educational "games".

Highflyer gives practice and tests on homophones — words which sound the same but are spelt differently. As children get the correct answers, an aeroplane will journey from London to Paris.

Program *Highflyer*
Price *£9.95*
Micro *BBC*
Supplier *GTM Software*
864 York Road
Leeds

GANG OF 12



A number of classic computer games are incorporated into the *Gang of 12* games pack from Loach Software.

Included are *Pacman*, *Pontoon*, *Centipede*, *Bomber* and *Kingdom*. All the games will work on both the 16 and 48K machines.

Program *Gang of 12*
Price *£4*
Micro *Spectrum*
Supplier *Loach Software*
8 Cottesford Close
Hadleigh Suffolk
IP7 5JA

New Releases is designed to let people know what software is coming on to the market. If you have a new game or utility which you are about to release send a copy and accompanying details to: New Releases, Popular Computing Weekly, 19 Whitcomb Street, London WC2 7HF.

Ziggurat

Two's company

To understand why there are numerical inaccuracies in micros — which produce such seeming nonsenses as the square of the square root of a value being different from the original value — we need to appreciate how numbers are treated by computers.

Most micros use binary arithmetic, whereas most calculators and some computers use binary-coded decimal (bcd). Start with bcd and consider the number 987. In bcd each of the three digits 9, 8 and 7 is stored exactly, taking up to four bits. In binary arithmetic 9 is 1001, 8 is 1000, and 7 is 0111 (see E P Northrop, *Riddles in Mathematics*, Penguin Books, for an amusing account) and, even though it is possible to use less than four bits for some binary numbers, we have to allow for the greatest number.

The basic blocks in memory, the *bytes*, are of eight bits. In each byte, therefore, there is room for two decimal figures, each occupying up to four bytes. To store the value 987, therefore, we need to use two bytes.

With a calculator or computer using bcd, we can use exact arithmetic and we do not have to convert the value 0.1 to its binary equivalent. Instead we can store it as 1 by the value of 10^{-1}. We still get approximations through rounding, but at least the number can be stored as an exact bcd number.

Now consider this: the value 255 stored as a bcd number is 0000 0010 0101 0101. But 255 stored as an ordinary *binary* number is 1111 1111. The bcd method of storing values is rather expensive in terms of space, compared to the binary method.

As a result, many microcomputers store values as binary numbers rather than as bcd numbers to save space. (Not all micros use binary — the Jupiter Ace uses bcd for floating-point numbers. The Ace also rounds up, not down, and does not 'chop'.).

I will give a simple little routine to turn a decimal value into its binary equivalent, and I will store successive bits in a character array. It is not written for any particular computer, so it may need to be slightly modified to run.

```
10 DIM WORD$(15) : REM 16 elements 0 to 15
20 INPUT "Value"; X
30 FOR I = 0 TO 15
40 WORD$(I) = CHR$(48 + FNBIT(X))
50 X = FNBODY(X) : NEXT I
60 FOR I = 15 TO 0 STEP - 1
70 PRINT WORD$(I);
80 NEXT I : PRINT
1000 DEF FNBIT(X) = X - INT (X/2)*2
2000 DEF FNBODY(X) = INT(X/2)
```

The value is *X*, and we store in successive elements of the character array *Words*, a "1" if *X* is odd, or a "0" if even. *FNBIT* works out the bit value (ie, whether even or odd) and, in line 40, 48 is added on to the result of the function, which is turned into a character (by *Chr$*). Line 50 merely halves the value of *X* (losing any decimal part), to give the new value of *X* its new body.

The answer given corresponds to two bytes (16 bits), sometimes called a *word*, and if a small value (eg, 3) is tried then the word is mostly leading zeros. This emulates sixteen-bit integer numbers.

Take this example: the binary equivalent of 65535, is 1111 1111 1111 1111. The result of *Int*(65535/2) is 32767 and the binary equivalent of 32767 is 0111 1111 1111 1111. So, to divide by 2 in binary arithmetic is to move all the bits one place to the right and introduce a leading 0 (to divide by 10 in *decimal* arithmetic we also drop off the last digit — 1234/10 is 123, with a remainder of 4).

Binary arithmetic on a computer *usually* involves dropping off the last bit, without remembering the value of the remainder and this is called *chopped* arithmetic.

Run the program and input − 1 as the value. The result is 1111 1111 1111 1111 — why? ■

Boris Allan

Puzzle

Number change!

At Greyfriars School, the upper-third maths class was taking a rest from Euclidian geometry.

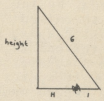
"Please Sir!" queried Jones minor, "If I could buy 2 for fifty pence, 50 for a pound and 100 for one pound-fifty, what would I be buying?"

"House numbers, costing fifty pence each," replied Sir, "I may be old, but I'm not that old. While we're on the subject — here's a similar problem for you! I have a supply of 'stick-on' printed numerals costing a half-penny each, with which I am going to number all the lockers in the gymnasium changing room — commencing with locker number '1' and continuing upwards in sequence. After I have done that I find that the number of the highest locker equals the cost, in pence, of the numerals used.

"And so, Jones minor, how many lockers were there?"

Solution to Puzzle No 56

The ground, pole and cobweb form a right-angled triangle.



Since the two paths to the mayfly are equal: *height of pole* = $7 - H$. Since it is a right-angled triangle, using pythagoras: $(height)^2 + (H+1)^2 = 6^2$. Combining the two equations to eliminate the height gives: $(7-H)^2 + (H+1)^2 = 36$.

This equation can now be solved using a computer program which tests values of *H* to see if they satisfy the above equation. *X* and 36 are both multiplied by 10 in line 30 to get the right accuracy with the *Int* command.

```
10 LET H=7 20 LET X = (7−H) * (7−H) + (H+1) *
(H+1) 30 IF INT (X*10) = 360 THEN GOSUB 60 40
LET H = H−0.01 50 GOTO 20 60 PRINT
"HEIGHT="; 7−H 70 RETURN
```

Using the program, there are two possible answers: 2.57 and 5.42.

This illustrates how inaccurate computers can be. An accurate pair of answers obtained using algebra gives: $4 \pm 2 = 2.5858$ or 5.4142.

Winner of Puzzle No 56

The winners are: the doctors and nurses of Strood Health Centre, Strood, Kent, who receive £10.

Top 10

Dragon

1	(1)	The King	(Microdeal)
2	(2)	Space War	(Microdeal)
3	(4)	Planet Invasion	(Microdeal)
4	(3)	Katerpiller Attack	(Microdeal)
5	(5)	Dragon Trek	(Salamander)
6	(9)	Madness and the Minotaur	(Dragon Data)
7	(—)	Grand Prix	(Salamander)
8	(6)	Alcatraz 2	(Microdeal)
9	(10)	Chess	(Dragon Data)*
10	(—)	Basic Tutorial	(Ampalsoft)

*Cartridge

(Figures compiled by Boots & Co, London)

Spectrum

1	(1)	Flight Simulation	(Psion)*
2	(3)	Jet Pac	(Ultimate)
3	(2)	Penetrator	(Melbourne House)*
4	(4)	Transylvanian Tower	(Richard Shepherd)*
5	(6)	The Hobbit	(Melbourne House)
6	(5)	3D Tanx	(DK 'Tronics)
7	(8)	Ah Diddums	(Imagine)
8	(7)	Horace Goes Skiing	(Psion/Melbourne House)
9	(9)	Arcadia	(Imagine)
10	(—)	Hungry Horace	(Psion/Melbourne House)

*Requires 48K.

(Figures compiled by W H Smith & Son Ltd)

Atari

1	(1)	Zaxxon	(Datasoft)
2	(3)	Hellcat Ace	(Microprose)†‡
3	(—)	Time Warp	(English Software)
4	(—)	Escape from Perilous	(English Software)
5	(5)	Chop Lifter	(Broderbund)*
6	(—)	Preppie 2	(Adventure International)
7	(—)	AE	(Broderbund)§
8	(—)	Castle Wolfenstein	(Muse)‡
9	(—)	The Sands of Egypt	(Datasoft)¶
10	(—)	Necromancer	(Synapse)†‡

*cartridge. †32K cassette. ¶16K disc. ‡32K disc. §48K disc.

(Figures compiled by Calisto Computers, Birmingham 021-632 6458)

Vic20

1	(2)	Panic	(Bug-Byte)
2	(3)	Wacky Waiters	(Imagine)
3	(5)	Arcadia	(Imagine)
4	(7)	Cosmiads	(Bug-Byte)
5	(1)	Introduction to Basic Part 1	(Commodore)
6	(4)	Asteroids	(Bug-Byte)
7	(6)	Amok	(Audiogenic)
8	(—)	Catcha Snatcha	(Imagine)
9	(—)	Alien Blitz	(Audiogenic)
10	(—)	Introduction to Basic Part 2	(Commodore)

(Figures compiled by Boots & Co, London)

BBC*

1	(5)	Word Wise	(Computer Concepts)
2	(4)	Killer Gorilla	(Program Power)
3	(9)	Great Britain Limited	(Simon W Hessel)
4	(1)	Rocket Raid	(Acornsoft)
5	(—)	Meteors	(Acornsoft)
6	(—)	Inheritance	(Simon W Hessel)
7	(—)	Snapper	(Acornsoft)
8	(—)	Graphs and Charts	(Acornsoft)
9	(—)	Home Finance	(BBC)†
10	(—)	Logo 2	(Computer Concepts)

*Model B only except where shown. †Runs on Model A or B.

(Figures compiled by Micro Management, Ipswich 0473 59181)

ZX81

1	(2)	3D Monster Maze	(New Generation)
2	(1)	Flight Simulation	(Psion)
3	(3)	Chess	Psion)
4	(4)	QS Scramble	(Quicksilva)
5	(6)	Galaxians	(Artic)
6	(7)	Space Raiders	(Psion)
7	(8)	Alien Dropout	(Silversoft)
8	(9)	Avenger	(Abacus)
9	(10)	10 Games for 1K	(JK Greye)†
10	(5)	Catacombs	(JK Greye)

*All 16K except where shown. †Runs in 1K.

(Figures compiled by W H Smith & Son Ltd)

Books

1	(1)	Vic Programmer's Reference Guide, *Commodore*	(Commodore)
2	(3)	Spectrum Hardware Manual, *Dickens*	(Melbourne House)
3	(4)	Commodore 64 Programmer's Reference Guide, *Commodore*	(Commodore)
4	(—)	Assembly Language Programming for the BBC Micro, *Birnbaum*	(Macmillan)
5	(6)	6809 Assembly Language Programming, *Leventhal*	(Osborne)
6	(2)	Spectrum Rom Disassembly, *Logan*	(Melbourne House)
7	(—)	The BBC Micro, An Expert Guide, *James*	(Granada)
8	(9)	Enter the Dragon, *Carter*	(Melbourne House)
9	(5)	Machine-code for Beginners, *Stephenson*	(Newnes)
10	(7)	Dynamic Games for Your Dragon, *Hartnell*	(Interface)

(Figures compiled by Watford Technical Books, Watford 0923 23324)

(Last week's position in brackets)

PIMAN TIMES

AUTOMATA IN HOAX TOP 10 SILLY ADVERT MISSPWINT !

EXCLUSIVE SHOCK REPORT by HUGH ANCHOR

The home computer world has been rocked today by the revelation that all so-called "TOP 10 CHARTS" are a massive hoax, perpetrated by the notorious AUTOMATA U.K. Acting on a supergrass tip-off, the C.I.D. (Computer Idiots Dpt.) backed by hooded members of the S.A.S. (Stuff Automata Software) made a dawn swoop on the national centre for all "Top Ten" research: namely, the Cash'n'Carry-Tundoori-Boutique-Garage-Video-Hairdressers. Fraud Squad detectives apprehended master-computer-racketeer....THE PIMAN, caught in the act of faking the honest, sacred and meaningful TOP TEN (see below). Other gang members were caught trying to bribe the country's chief software analyst, (the cleaner's nephew), by repeatedly applying a £6,000 gold and diamond sundial to the side of his head. Detective Sgt. A. Hitler commented,"I'm as sick as a parrott. Automonopoli is the greatest thing since the invasion of Poland. Don't point that thing at me sonny. Is this a clue. Hic. These adverts get sillier every week....."

(please turn to page 94)

OFFICIAL TOP 10

compiled by the cleaner's nephew at the Micro-Cash'n'Carry-Tundoori-Boutique-Garage-Video-Hairdressers. (honest) last week's positions totally made up.

1 (8) TORTURED DEEP-FRY BABIES
(Phamily Phunn)
2 (1) STUFFA COPYRIGHT
(Ripoff Software Ltd.)
3 (-) OLD PROGRAM NEW TITLE
(Fastbuck)
4 (4) DONKEYFROGGERPACTRONKONGINVADERS
(Mitsusaki)
5 (15%) FUN WITH V.A.T.
(Yawnarama)
6 (69)KILLER HOBBIT MEETS EMANUELLE
(See you in Court)
7 (-) DEAD CRUMMY ADVENTURE
(Moronsoft Imitations)
8 (6) A DUFF CASSETTE
(Bedsitter International)
9 (4) HORACE GOES WEE WEE
(Psson)
10(-) HERPIES INVASION
(Whitehouse & Cohen)

AUTOMATA FAKE HORROR TOP 10

compiled by The PiMan from Automata's order book. Last week's places in brackets.

1 (1) AUTOMONOPOLI - Spectrum 48K- £6
(we dare you to play against it)
2 (3) PIMANIA - Spectrum 48K- £10
(the best adventure ever reviewed)
3 (5) PIMANIA - Dragon 32- £10
(why should Spectrums have all the fun)
4 (-) THE BIBLE - ZX81 1K - £3
(slightly outrageous, no offence vicar)
5 (2) PIMANIA - BBC 32K - £10
(why should Dragons have all the fun)
6 (8) BEST POSSIBLE TASTE - zx81 1K - £5
(thirty mad games for a fiver!)
7 (9) BUNNY plus ETa - Spectrum 16K - £5
(2 happy games for the young at heart)
8 (4) PIMANIA - ZX81 1K - £5
(why should BBCs have all the fun)
9 (7) DOODLES AND DEMOS - Dragon 32 - £5
(a must for the graphic designer)
10(6) CAN OF WORMS - ZX81 1K - £3
(why are you still buying this?)

(left to right: 'UNCLE' CLAIR SINCLIVE, the brains behind the conspiracy: THE PIMAN, gang leader: QUEENIE-PI, gangster's Moll: A RED HERRING: LURCH, Automata's so-called Office Parrott: and NUKIE RAYGUN, dangerous psychopathic hit-man)

DEAR AUTOMATA, DESPITE YOUR VERY SILLY ADVERTISING, I AM ORDERING THE FOLLOWING COMPUTER SOFTWARE FROM YOU.....

AUTOMONOPOLI	(Spectrum 48K) @£6.oop	tick
PIMANIA	(Spectrum 48K)@£10.oop	
PIMANIA	(Dragon32)@£10.oop	
PIMANIA	(BBC Micro 32K)@£10.oop	
PIMANIA	(ZX81 16K) @£5.oop	

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STOP PRESS

AUTOMONOPOLI is a unique version of the classic board game, for up to 5 players INCLUDING YOUR SPECTRUM. Moving full-size board: state of play at the touch of a button: we dare you to play against your own machine, but BEWARE it may well win!

STOP STOP PRESS: Piman Knited in Birthday Honours!

Latest Results:

PIMANIA latest: no one has won the £6,000 golden sundial yet. Pimania is now the longest-running best-seller in micros. Several thousand Pimaniacs can't be wrong....JOIN US TODAY oinkburbleblubblengghngghnggrr.