

POPULAR **Computing** WEEKLY

24 June 1982 Vol 1 No 10

30_p

**Shark attack
on ZX81**

**Reviews:
ZX81 assembler**

**ICL education
tapes**

Vic A-maz-ing

Telesound 82

Spectrum graphics





KAYDE Electronic Systems ZX80/1 ZX KEYBOARD WITH REPEAT KEY

£37.95
inc VAT



Fully cased keyboard £37.95
Uncased keyboard..... £27.95
Keyboard Case..... £10.95

This is a highly professional keyboard using executive buttons as found on top quality computers. It has a repeat key and comes complete in its own luxury case. This is a genuine professional keyboard and should not be confused with toy keyboards currently available on the market.

KAYDE 16K RAM PACKS

The 16K RAMPACK simply plugs straight into the user port at the rear of your computer. It is fully compatible with all accessories and needs no extra power and therefore it will run quite happily on your Sinclair power supply. It does not over-heat and will not lose memory at all. As you may know, some makes go down to 11K after being on for a while.

This 16K RAMPACK is very stable and will not wobble or cause you to lose your programme. It comes fully built and tested with a complete money-back Guarantee.

£29.95
inc VAT

KAYDE FLEXIBLE RIBBON CONNECTOR

Stops movement of RAM PACK and other accessories
(Not needed with a KAYDE RAMPACK)

£12.95
inc VAT

KAYDE 4K GRAPHICS BOARD

The KAYDE Graphics Board is probably our best accessory yet. It fits neatly inside your ZX81. It comes complete with a pre-programmed 2K Graphics ROM. This will give nearly 450 extra graphics and with the inverse makes a total of over nine hundred.

The KAYDE Graphics Board has facilities for either 2K of RAM (for user definable graphics), 4K of ROM or our 4K Tool Kit Chips that will be available shortly. All the graphics are completely software controlled, therefore they can be written into your programmes. Here are a few examples: **A full set of space invaders — Puckman — Bullets, Bombs — Tanks — Laser Bases and Alien Ships.**

NO EXTRA POWER NEEDED

£29.95
inc VAT

KAYDE 16K GRAPHICS BOARD SOFTWARE

PECKMAN: The only true ZX version of the popular arcade game.
Centipede: "In all I think this is the best presented moving graphics program I've yet seen." Phil Garratt, Interface.
SPACE INVADERS: The best version available anywhere. Graphics software can only be used with a graphics board.

KAYDE 16K 81 SOFTWARE

Centipede: "In all I think this is the best presented moving graphics program I've yet seen." Phil Garratt, Interface.
3D/3D Labyrinth: A Cubit Maze that has corridors which may go left, right, up, down. Peckman (the latest addition in 81 games).

£5.95
EACH

**WHY WAIT TO PAY MORE —
FAST, IMMEDIATE DELIVERY**

Post to: Dept PW2
Kayde Electronic Systems Ltd
The Conge
Great Yarmouth
Norfolk NR30 1PJ
Tel: 0493 57867 (Dept. PW1)

*Don't forget you can always order on
the telephone with your credit card*

All products include VAT are fully
built and tested and come with a
COMPLETE MONEY BACK GUARANTEE



Please send me ZX Keyboards with repeat key £37.95 each
Please send me 16K RAMPACKS £29.95 each
Please send me Flexible ribbon connectors £12.95 each
Please send me 4K graphics boards £29.95 each
Please send me 16K graphics board software £5.95 each
Please send me 16K 81 software £5.95 each

I enclose _____
Name _____
Address _____

Please add £1.50 p&p for all hardware and 50p for all software. Please make
cheques payable to Kayde Electronic Systems Ltd.

POPULAR Computing WEEKLY

The Team

Editor
Brendon Gore

Reporter
David Kelly [01-930 3271]

Sub-editor
Peter Harvey

Editorial Secretary
Fiona McCormick

Advertisement Manager
David Lake [01-839 2846]

Advertisement Executive
Alastair Macintosh [01-930 3840]

Managing Editor
Duncan Scot

Publishing Director
Nick Hampshire

Popular Computing Weekly,
Hobhouse Court, 19 Whitcomb Street,
London WC2
Telephone: 01-839 6835

Published by Sunshine Publications Ltd.

Typesetting, origination and printing by
Chesham Press, Chesham, Bucks

Distributed by S M Distribution
London SW9. 01-274 8611. Telex: 261643

© Sunshine Publications Ltd 1982

Subscriptions

You can have *Popular Computing Weekly* sent to your home: the subscription rate is £19.95 per year, for addresses in the UK.

How to submit articles

Articles which are submitted for publication should not be more than 1000 words long.

All submissions should be typed and a double space should be left between each line.

Programs should, whenever possible, be computer printed.

At present we cannot guarantee to return every submitted article, so please keep a copy.

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.

This Week



Cover illustration by Ian Craig

News 5

Assurance on BBC delivery.

Club Reports 7

Lessons learnt at Manchester.

Shark Attack 8

Dave McGuire explains how to kill marauding sharks.

Reviews 10

Telesound 82, A-maz-ing Vic-pack and ICL's "Fun to Learn" series for the ZX81.

Open Forum 12

Seven pages of programs for the Vic-20, BBC Micro and ZX81.

Programming 21

Memory saving techniques by Stephen Devine.

Spectrum 22

Nick Hampshire examines more of the Spectrum's graphics facilities.

Hand & mouth 23

Macro Assemblers and Reverse Polish Notation.

Sound & vision 24

Three graphics tricks for the ZX81 by Nick Godwin.

Peek & poke 25

Your questions answered.

Competitions 26

Puzzle, crossword.

Editorial

With the advent of the Sinclair ZX Spectrum and the new range of Commodore Vics, there is a growing market for second-hand microcomputers.

Budding programmers, who learnt their skills on the ZX80/81, are now looking for more advanced machines. Consequently, they are also looking to trade-in their old machines.

The era of the used micro is now upon us.

No one is quite sure, yet, what effects the second-hand market will have on microcomputer users and manufacturers. But some trends are already becoming apparent.

It is now possible for a first-time user to buy a second-hand 1K Sinclair ZX81 for around £50. This puts microcomputers within range of more people than ever before.

Present ZX81 owners will also find it easier to buy more expensive machines, using the money gained from selling their existing ZX81s.

There are pitfalls in buying second-hand micros, just as there are in buying second-hand cars. But, if you take reasonable care to ensure that the micro is in good working order, you could get yourself a bargain.

Next Week



It's an android world and you must master the art of robot control — another game to test your wits

Classified

"ASTEROIDS" for unexpanded Vic-20. Arcade type game on cassette, £3. Tel: 0570 470362.

SELLING ZX81 SOFTWARE. Quality famous material. (Getting Spectrum.) Knockdown prices. Tel: 01-455 2993 6-10 pm (not Saturday).

ZX81 16K. Large keyboard, cassettes and books. Make me an offer. T. McQueen, 25 Blenheim Gardens, Brixton Hill, London SW2.

ZX81 16K. £80-worth software on 13 tapes including Galaxians, £100. Tel: Swindon 770461.

ZX81, NEW 16K RAM. Fourteen games programs, including 3D Defender, 3D Monster, Maze and Invaders, £100. Tel: Watford 37919.

ZX81 plus separate keyboard (computer keyboards type) plus manual and three books, £80. Tel: 041-942 4478, 6 pm.

ZX81 16K, one month old plus two tapes, £80. Tel: Carnforth 735787.

ZX81 16K, under guarantee. Six program cassettes (Invaders and Mazogs), £90. Tel: Totton 861181.

ZX81, perfect, with manual and games, £45. Tel: 254 5645.

3.5K VIC SOFTWARE, Ski-run, 50-flag, slalom, optional joystick control,

£5.95. T. Haywood, Sea Glimpse, Dottery, Bridport, Dorset.

VIC-20 COMPUTER CASSETTE, extra RAM, intro, basic books, covers, software, as new, £170. Tel: 01-603 0363.

ZX81 with 16K RAM, plus many books and tapes, good condition, £80. Tel: Woking 71761 day; Camberley 22499 evenings.

FILER FOR BBC MICRO. Create your own data-files. Define the record format and FILER becomes a complete editor. Options include: Insert, Delete, Find, Load, Save, Sort and Jump. For Model A or B. FILER cassette has three programs, nine data-files. Send £12.50 for cassette, documentation and key card to: AEF, 53 Walsh's Manor, Stantonbury, Milton Keynes, Bucks.

BBC SOFTWARE CASSETTE No. 1. Lunar Lander and Attack, £5. Cassette No. 2: Adventure, £5. Both £9. K. P. Hammonds, 5 Rodborough Road, Dorridge, Solihull, W. Midlands.

CONVERT YOUR ORDINARY CASSETTE to run on VIC-20. Complete instructions, £2 + SAE. RMN, 3 Canberra Road, Shortstown, Bedfordshire.

VICMEN, AMOK, both 3.5K (one set only), £10. Ring now: 01-969 6374.

ZX81 16K, proper keyboard and case, leads, manual, various games, tapes, £85. Tel: Brown, 051-423 1166, daytime.

ACORN ATOM 12K+12K. Nearly new with improved keyboard + PSU + Games, £190. Tel: 01-868 5654.

ZX81 KITS, Inverse Video £2.95, built £3.55; repeat key £3.75, built £4.95. Memory crashes and top line slant cured, £2.95 plus 40p post and packing. B. A. Reader, 45 Alfred Street, Kings Heath, Birmingham B14 7HG.

ZX81 16K plus over £50 of tapes and books, including ICL programme course, £100 ono. J. Hall. Tel: (0639) 55451.

VIC-20 with Arlon expansion unit, 23K RAM cassette and software, £450. Tel: Nigel, 0203 442979.

ZX81 16K, excellent condition, two books plus many tapes, £75. Tel: 01-471 3364.

ZX81 16K RAM, DK Tronics Graphic ROM, 2K UDG available, PSU, leads, etc., books, software, 3 months old, real bargain, £95. Tel: Horsham 57117.

ZX81 16K RAM (still in package) with joystick, 16K tapes, and books, only two months ago, vgc, £100. Tel: Ingrebourne 42803.

VIC-20 and VIC cassette plus programming book. Cost £235, will deliver anywhere in London, £200 wanted. Tel: Doug — 01-789 6160.

ZX81 BLEEP. Provides audible feedback. Improves your keyboard cheaply, fits inside. Simple plug-in; no soldering connections. Aids faster more accurate programming, £8.95 includes instructions, P&P+VAT. Fulcrum Products, Dept. W, Hillside, Steep Lane, Findon, W. Sussex.

TRS-80 16K LII. Includes: keyboard, numeric keypad, leads, box, modulator, amplifier and £500 worth of software (games, utilities), only 10 months old. Tel: (Daniel) 01-349 9091 evenings.

PACMAN on BBC Micros A and B. Addictive arcade game on cassette. Send £4.90 to J. Pryce, 39 Nether Currie Road, Currie, Edinburgh EH14 5HX.

16K ZX81 plus many program cassettes, chess, finance, adventures, console, £130. Tel: 021-553 6734.

VIC-20 (UNEXPANDED) PROGRAMS: Awari, Collision, Infection, Car race, A-maze-ing, Pinball, all six for £2.95. A. Spencer, 230 Low Grange Avenue, Billingham, Cleveland.

CLASSIFIED ADVERTISING RATES:

Line by line: For private individuals, 20p per word, minimum 10 words.

For companies, traders, and all commercial bodies, 40p per word, minimum 20 words.

Semi-display: £10 per single column centimetre, minimum length 3 cm. (Please supply A/W as PMT. Or supply rough setting instructions.)

Popular Computing Weekly will give you one free classified or semi-display advertisement for every two booked.

Conditions: All copy for Classified section must be pre-paid. Cheques and postal orders should arrive at least two weeks before the publication date. If you wish to discuss your ad, please ring Alastair Macintosh 01-930 3840.

Here's my classified ad.

(Please write your copy in capital letters on the lines below.)

Please continue on a separate sheet of paper

I make this words, at per word so I owe you £

Name

Address

.....

.....

Telephone

Please cut out and send this form to: Classified Department, *Popular Computing Weekly*, Hobhouse Court, 19 Whitcomb Street, London WC2

Acorn quells fears over BBC delivery

ACORN have confirmed their commitment to fulfil orders for the BBC Model B by mid-August.

However, orders from as long ago as November 1981 still remain unfulfilled.

An Acorn spokesman explained that a "very large number" of the B models were shortly to be produced.

He said that the delivery dates being given to would-be owners by BL Marketing were

unduly pessimistic, being based on "current production figures".

To ease the difficulties, some Model As are being converted to Model Bs.

However, the main Model A manufacturer, Cleartone Electronics, has now been sold to the AB Electronic Products Group.

The purchase, for an estimated £250,000, ends a period of uncertainty for Cleartone, formerly in receivership.



The BBC's much-awaited micro.

Henry Kroch, AB's chairman, said: "Production of the machine will continue and benefit from the takeover."

AB Products Group, founded in 1935, had a turnover of over £21m in 1981.

John Radcliffe, of BBC Continuing Education, said the Corporation was "delighted that a firm financial base had been found for the Cleartone operation".

Sinclair aims for the main stream

Sinclair Research is to produce a new up-market machine.

The micro, as yet unnamed, is to be aimed at the mainstream business user.

It will incorporate the new ICL flat-screen terminal, full colour and extra memory. The machine uses Sinclair Basic and single-key word entry.

Development of the machine is well advanced and pre-production machines are on trial with certain business users for evaluation.

The new micro will sell for less than £350.

Fewer make a show of it

Despite being more than twice the size of last year's show, only 8,000 visitors attended the 3rd International Commodore Computer Show (June 3-5).

Those who came, 3,500 less than in 1981, saw the largest single-manufacturer show yet staged in the UK.

A Commodore spokesman said: "Despite the sweltering heat, in commercial terms, the show was a resounding success."

The outstanding feature — apart from the first UK appearance of the Vic-10 — was the large number of exhibitors displaying Vic-20 software.

Jack Tramiel, Commodore's Chief Executive, praised British companies. He said: "The show reaffirms my belief that the UK leads the world in micro software expertise."

ZX82 back in full production

Manufacture of the Spectrum has now been restarted, following the production set-back reported in last week's issue.

The first production batch, which was returned to Timex, has been modified and was dispatched from Dundee on June 8.

The exact size of the delivery is not clear, but estimates suggest "several thousand" units are now on their way to buyers.



Vic-20 software proved to be the big hit of the show.

Commodore hijacks Spectrum to America

Robin Bradbeer, co-editor of the Sinclair Spectrum manual and one-time education consultant to Commodore, has lost his Spectrum to America without his permission!

The heist happened at the Commodore Show. Bradbeer said: "People were interested in seeing the Spectrum so I took mine to show them."

"I took it in on Friday and Kit Spencer (Vice-President, Commodore Marketing) asked if he could borrow it overnight. I reluctantly said

OK and arranged to get it back from him at the show at 11.30 on Saturday.

"I waited around but he never turned up. At 4 o'clock they told me that Kit had got the 11 o'clock flight back to the States."

Bradbeer is considerably embarrassed by the proceedings and is "very, very angry".

He said: "I just walked out with a Vic and a colour tv from the exhibition and I said 'I'm taking these till you give me my Spectrum back'."

Ad leaflet ejected

Leaflets advertising the Sinclair Spectrum were unceremoniously ordered out of the Commodore show in London on June 3.

The leaflets were an insert into *Micro Forecast*, the free

fortnightly computer newspaper.

An organiser told the company that if they didn't take the leaflets out of the newspaper he would shut the stand down in 15 minutes.

A machine that speaks

Wideband Products has just launched a new speech synthesizer.

The unit connects to the micro through an 8-bit parallel port and can be used with most machines including the BBC and PET.

Unlike some types of synthesizers, the Wideband model does not have a particular dictionary of words that it can generate but, instead is capable of being instructed to say anything. This is because the machine is programmed to recognise phonetic groups rather than whole words.

Each word is fed in as a series of sound groups. In the basic model it is necessary to key in code numbers associated with the various sounds, and a dictionary is supplied listing the phonetic groups and their codes.

A software package is also available which enables the synthesizer to recognise the phonetic letter-groups directly.

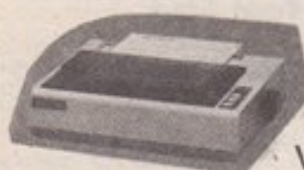
Wideband is currently working on an advanced application for the Anglia Water Authority. The speech synthesizer is incorporated in a unit which will be placed on a river bank. Sensors in the water monitor conditions, such as pollution level or water height.

The basic model is £69 and the additional software pack is £10 (both exclusive of VAT).

Chrisalid -

**BERKHAMSTED'S
COMPUTER
STORE**

Watch this space for the real
computer BARGAINS every week:
EPSON MX80f/t £355+VAT — EPSON



MX80 tractor only

£315+VAT

VIC20 at

£173+VAT

VIC cass



unit £39+VAT — range
of VIC software.

11 x 9 1/2 fanfold paper

at £16.50 per 2000 sheets



GENIE 1 & 2 @ £289+
VAT — All GENIE mods
expansion/disks/mem.

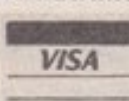
CUMANA disk drives at £199 single
and £369 double —

9" 12MHz monitors for
only £99+VAT (metal).

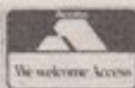
OFFICIAL DEALERS FOR:

Nascom, Genie, Cumana, Vic,

and lots more — RING US NOW on
BERKHAMSTED (04427) 74569 or 5704



**12113 HIGH STREET
BERKHAMSTED HP4 2HY
HERTFORDSHIRE**



**MAKE THE MOST OF YOUR MICROCOMPUTER WITH
OUR POPULAR RANGE OF PROVEN BOOKS:—**

GETTING ACQUAINTED WITH YOUR ZX81. by Tim Hartnell. Eighty
plus programs in this 128-page book, including draughts. **£5.95**

**20 SIMPLE ELECTRONIC PROJECTS FOR THE ZX81 and other
computers** by Stephen Adams **£6.45**

MASTERING MACHINE CODE ON YOUR ZX81 OR ZX80. by Tom
Baker. 180 pages, teaches machine code from first principles. **£7.50**

49 EXPLOSIVE GAMES FOR THE ZX81. edited by Tim Hartnell. **£5.95**

34 AMAZING GAMES FOR THE 1K ZX81 by Alastair Gourlay. **£4.95**

THE GATEWAY GUIDE TO THE ZX81 AND ZX80. by Mark
Charlton. Over 60 programs and routines. ZX BASIC explained in
detail. **£6.45**

**LEARN PASCAL ON ZX81 ZX SPECTRUM OR BBC MICRO-
COMPUTER WITH 'PASCAL FOR HUMAN BEINGS'.** by Jeremy
Ruston, which contains a 12K compiler so you can run a limited version
of Pascal on your ZX81, ZX Spectrum or BBC Microcomputer. Book,
plus compiler listing. **£4.95**

LET YOUR BBC MICRO TEACH YOU TO PROGRAM. by Tim
Hartnell, over 40 programs, BBC BASIC from first principles. **£6.45**

THE BBC MICRO REVEALED. by Jeremy Ruston. The full story on
the BBC Microcomputer for the serious user. **£9.95**

GETTING ACQUAINTED WITH YOUR VIC 20. by Tim Hartnell, with
over 60 programs to get your VIC up and running from day one. **£6.95**

SYMPHONY FOR A MELANCHOLY COMPUTER by Tim Hartnell.
24 great Vic games. **£6.95**

39 TESTED PROGRAMS FOR THE ACORN ATOM Best of Interface
edited by Tim Hartnell. **£6.45**

GETTING ACQUAINTED WITH YOUR ACORN ATOM. by Trevor
Sharples and Tim Hartnell. 184 pages, 80 programs, including
draughts. **£7.95**

INTERFACE, the monthly magazine published by the **NATIONAL
ZX USERS' CLUB** is just £9.50 (U.K.), £12.50 (Europe) for 12 issues.
Sample copy, with many programs for your ZX computer, book,
software and hardware reviews, education, contact addresses,
just £1.

*All ZX81 books now contain Spectrum supplement, not available separately.
All our ZX81 programs will run on your ZX Spectrum.

Please send me the items marked. I enclose £

Name:

Address:

.....

.....

Please make cheques payable to **INTERFACE** and send the above form,
or a copy, to: **INTERFACE, Dept. PC, 44-46 Earls Court Road,**
London W8 6EJ

Please allow up to 28 days for delivery.

STOP PRESS
ZX81
16K RAM
NEW LOW PRICE!
£19.95

FULLY COMPATIBLE, BLACK CASE, GOLD CONNECTOR.

■ ASSEMBLED_TESTED_GUARANTEED. ■

Cheque/P.O.s to:
**PLESSIS ELECTRONICS, CASTLE HOUSE, OLD RD,
LEIGHTON BUZZARD (beds), LU7 7RG.**

PLEASE ADD. £1.55 P.P

14 DAYS DELIVERY

Club Reports

Watching and waiting in Manchester

David Kelly reports on the first ZX fair to take place outside London

Summer may be said to be smiling on Britain now but at traditionally wet Manchester the arrival of the sun cast a shadow over the ZX Microfair.

It was the first such event to be staged outside London. The weather was dazzling and the people stayed away in droves.

As with the last London show, the fair — at the New Century Hall May 29-30 — was spread over two days. There were more than 50 exhibitors and plenty to see, so why was the attendance down to few more than 2,000 for the two days? And why was it that many of the exhibitors commented on the slowness of sales?

Mike Johnston, the ZX Microfair organiser, was able to pin-point several possible reasons.

The most noticeable feature of the show, he said, was the influence of the Spectrum launch, both on the visitors and the exhibitors.

He was quite pleased with the turn-out, particularly on the Saturday, but the uncertainty generated following the Spectrum launch resulted in fewer purchases.

Mike felt the attendance was about right, since the New Century Hall had been chosen to accommodate the sort of numbers that turned up.

When he had been setting up the show in January, he had wanted to include as many local companies as possible. In the event, about one third of the stands represented firms operating in the region.

Rumours of a ZX81 price reduction and uncertainty in the Spectrum delivery dates left most people a little bewildered.

Few exhibitors could be sure of their plans while the Spectrum remained undelivered and the same applied to the buyers.

Mike Johnston is very much aware of the situation. He is going ahead with his next London show, at the New Horticultural Hall in August, but will delay the next regional show, planned probably for Bristol or Southampton, until after the Spectrum is established.

He believes the current mood of despondency cannot last: "People said just the same when the ZX81 was launched — and now look at the number of add-ons and products available for it. Exactly the



Moving in for a closer look ... some of the visitors at the Manchester show



And, at times, jostling for position

same will be true of the Spectrum in a couple of months time."

Of the Manchester show, Mike says: "It seems that anything less than the fantastic success we had in the first London show is regarded as a disaster!"

He did not believe that the response in Manchester would alter his plans for future ZX fairs.

The idea of the fairs has always been to put companies and ZX owners together — and to do so as cheaply as possible. It has been important to keep the entrance fee as low as possible — 60p for adults — and to minimise the expenses to exhibitors.

The cost of a stand at Manchester — £25 — was deliberately kept down to

encourage small businesses which are just beginning to trade.

The next London Show, at the New Horticultural Hall, will be for one day only and in a much bigger venue. The hall has 20,000 sq ft of space, all in one area, so there will be plenty of room for stands and visitors.

Again the show will favour the smaller trader, who will benefit from the lower cost of a one-day event.

Mike hopes that this will result in a show with much interest and variety, but it will be interesting to see what the response from the various ZX businesses will be. Many traders at Manchester had been very disappointed with the attendance and their sales.

The New Horticultural Hall ZX Microfair will be held on Saturday August 21.

For further details contact Mike Johnston, 71 Park Lane, Tottenham, London N17.

What's happening

Manchester Acorn User Group meets fortnightly (during school term time only) on Tuesdays at 7 pm in the Abraham Moss Centre, Cheetham. The next meeting will be on June 22. Either telephone (daytime) Barry Pickles on 061-834 1234 or (evening) John Ashurst on 061-681 4962 or write to Barry Pickles, 1 Cromhall Walk, Manchester M8.

North London BBC Micro Users Group is being formed. It is hoped that the group will hold fortnightly meetings once a suitable venue has been found. All interested parties and potential members should get in touch with Jeremy San, 73 Uphill Road, Mill Hill, London NW7. (Tel: 01-959 0114).

Crawley ZX81 Users Club meets every Monday, nearly all the year round (including school holidays) in the Science Laboratory, Ifield School, Lady Margaret Road, Ifield, Crawley, Sussex. The club meets between 7 pm and 9 pm. Membership is £3 per year and the first meeting is free. Contact John Heron, Club Secretary, 23 Petworth Court, Bewbush, Crawley, Sussex. (Tel: 0293 518396).

Southern Gas Micro Club is open to any employee of Southern Gas. The club meets at the Southern Gas RHQ, 80 St Mary's Road, Southampton, and has access to ZX81s, a Vic-20, an Acorn Atom and BBC machines. In addition the club produces *Microcosm*, a newsletter containing club news, reviews and programming hints and articles. Contact Ian Smith, Floor A1, Management Services, Southern Gas RHQ, 80 St Mary's Road, Southampton.

COVER STORY

Shark Attack

You are a missile-base commander in the suburbs of Atlantis. Your mission is to destroy as many sharks as possible with your 20 missiles. You command three numbered silos, and choose your firing point via the corresponding keys 1-3.

The shark circles at the top of the screen, on the other side of a strong and unpredictable current. The shark doesn't bite, but dies quite impressively when hit.

The code-loader program, and the 10 REM (122 X's) are keyed in first and RUN. Next, enter the machine code one byte at a time. The machine code loader will be overrun by the actual program when you key it in, but it is a good idea to SAVE at this point, just in case.

The program uses the whole screen by poking on to the bottom line the status of your missile dump, which decreases as each missile is fired. At the end of the game, your score and a rating are displayed.

The actual machine code is merely a quick-draw subroutine, which I adopted in an effort to speed up my program. I also experimented with true/false equations, which can, as in line 350, take the place of four lines of IF/THEN statements.

If you happen to bob the shark's tail as it approaches from the right, it does not die. This is because the check for a hit in line 430 PEEKs the position directly to the right of the missile when it reaches line 1. If

it PEEKs a space, the "death plunge" is avoided.

Program Listing: "SHARK"

```
10 REM ( 122 X's )
20 LET A = 16514
30 INPUT B
40 POKE A, B
50 PRINT B : " ";
60 GOTO 30
```

Machine code:

16514: 255	103	19
6	16536: 58	103
0	130	229
166	64	26
64	254	38
237	0	0
91	40	111
131	2	9
64	24	229
42	4	193
12	62	225
64	0	19
25	24	24
229	1	222
237	26	10
91	2	131
133	124	1
64	46	155
26	1	1
19	149	131
193	200	

1	29	0
7	0	29
1	1	137
0	132	1
16580: 29	1	128
138	3	1
1	1	131
128	128	1
1	1	130
3	138	30
1	13	3
7	0	1
1	1	151
0	0	1
10	1	3
0	0	1
1	1	130
132	0	999
1	16618: 1	— stop

Actual program: "SHARK"

```
20 LET S = 0
30 LET B = 19
40 LET E = (PEEK 16396
+ 256 * PEEK 16397) +
760
50 POKE E, 38
60 POKE E + 1, 50
70 POKE E + 2, 50
80 POKE E + 3, 52
90 POKE E + 4, 14
```



A new game for the 16K ZX81
by Dave McGuire

```

10 REM XXXXXXXXXXXXXXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXXXXXXXXXXX
20 LET A=16514
30 INPUT B
40 POKE A,B
50 PRINT B;" ";
60 GOTO 30
20 LET S=0
30 LET B=19
40 LET E=(PEEK 16396+256*PEEK
16397)+760
50 POKE E,38
60 POKE E+1,50
70 POKE E+2,50
80 POKE E+3,52
90 POKE E+4,14
100 FOR Q=0 TO 8
110 POKE E+Q*5,157
120 NEXT Q
130 POKE 16517,186
140 POKE 16515,3
150 POKE 16516,0
160 PRINT AT 20,0;"SCORE =A="
170 PRINT AT 21,5;"
180 PRINT AT 21,0;S
190 LET P=1
200 LET X=3
210 LET T=0
220 IF B<0 THEN GOTO 530
230 IF INKEY$="" THEN GOTO 320
240 LET B=B-1
250 LET T=VAL INKEY$
260 LET M=(T-1)*10+7
270 POKE E+B*6,0
280 FOR V=18 TO 1 STEP -1
290 IF (RAND*4)>3 THEN LET M=M-1
300 PRINT AT V+1,(ABS M)-1+(M=0)
310 PRINT AT V,M;"1"
320 POKE 16515,X
330 RAND USR 16519
340 RAND 0
350 LET X=X+(P=0)+(X=1)-(X=27)-(
(P=1)

```

```

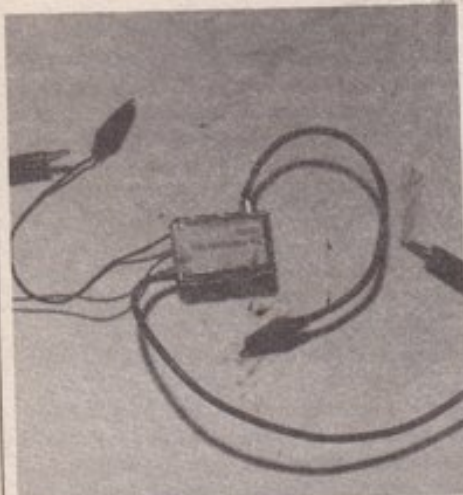
360 LET P=P-(X=2)+(X=26)
370 LET Y=186
380 IF P=0 THEN LET Y=206
390 POKE 16517,Y
400 IF T=0 THEN GOTO 220
410 NEXT V
420 PRINT AT V+1,M;" "
430 IF PEEK ((PEEK 16396+256*PE
EK 16397)+(ABS M)+1)=0 THEN GOTO
210
440 POKE 16517,226
450 FOR Z=X TO (629+X) STEP 33
460 POKE 16518,INT (Z/256)
470 POKE 16515,Z-256*PEEK 16516
480 RAND USR 16519
490 NEXT Z
500 LET S=S+1000
510 CLS
520 IF B>=0 THEN GOTO 50
530 CLS
540 LET C=5/1000
550 IF C=1 THEN PRINT TAB 3;"YO
U KILLED 1 SHARK FOR"
560 IF C<>1 THEN PRINT TAB 3;"Y
OU KILLED ";C;" SHARKS FOR"
570 PRINT
580 PRINT TAB 3;S;" POINTS"
590 IF C=0 THEN LET D$="(THE SH
ARK IS THE BLACK THING)"
600 IF C=1 THEN LET D$="SHARK B
AIT"
610 IF C=2 THEN LET D$="TAKE UP
KNITTING"
620 IF C>=3 THEN LET D$="NOT BA
D,NOT BAD"
630 IF C>=5 THEN LET D$="IF I H
AD EMOTIONS I WOULD BE MILDLY IM
PESSED"
640 IF C>=7 THEN LET D$="CAPTAI
N NEMO WANTS TO KISS YOUR FEET"
650 IF C>=9 THEN LET D$="POSEID
ON, I PRESUME?"
660 IF C>=11 THEN LET D$="HAVE
MERCY ON THEM...GEEZ"
670 IF C>=13 THEN LET D$="SHARK
S ARE AN ENDANGERED SPECIES"
680 IF C>=15 THEN LET D$="HAVE
YOU MADE ANY PACTS WITH HORNED B
EINGS LATELY??"
690 PRINT AT 10,10;"*RATING*"
700 PRINT
710 PRINT D$

```



Reviews

hardware



Box of noise . . . Telesound 82

Telesound 82

COMPUSOUND, 32 Langley Close,
Redditch, Worcs B98 0ET.
Tel: 0725-21439.
Price £9.95 including VAT.

This small metal box sticks on to the back of a ZX81 and enables you to put sounds through your TV speaker. It is connected to the ZX81 by three crocodile clips covered in insulated sleeves, so it can be removed at any time without damaging your ZX81. There is no soldering to be done and no holes to be made in the case.

Once the clips are fitted to the ZX81, the unit may be tested. The audio input to the Telesound 82 is via a 3.5mm jack plug fitted to nine inches of cable. It may be plugged into the output of a tape recorder, soundboard or even the MIC socket of the ZX81.

If you have no sound source then a test program is provided so that the unit can be adjusted with the ZX81 providing the sounds. A program is also included to turn the ZX81 into an electronic organ using the lower two rows of the keyboard.

Telesound 82 will produce sounds through the loudspeaker of a TV set whether or not a program is running. It will also work in FAST or SLOW modes. This can be used to advantage, as a tape giving instructions can be played through the TV, even before the program has been started.

The unit only draws a small current and should not cause any overheating problems with a Sinclair power pack. It does not require any RAM memory to operate and can be used on a 1K or 16K machine.

There were only two problems that I found with Telesound 82. First, the red and black connecting wires were a bit short. If you have one of the larger RAM packs that run along the back of the ZX81, then it could get in the way. Longer leads would

have allowed it to be mounted on the side or the top of the ZX81.

The other problem related to a keyboard bleeper that I have fitted to my ZX81. It also uses the TV Sync signal and the Telesound made this inoperative. I cured this by inserting a 49 ohm resistor in series with the green crocodile clip, allowing both units to work quite happily together.

The unit works best with the sound source volume control on full. Using the TV's volume control to adjust the sound level keeps the background noise down.

Conclusion

This unit makes games and educational uses of the ZX81 much more interesting. A separate amplifier is no longer necessary, as the TV's sound channel replaces it. The instructions are clear and easy to follow.

The two programs included with the kit are a FAST mode electronic organ routine and a short test program. Telesound 82 is excellent value for money and, I believe, the only one on the market. **SA**

RD system

RD Laboratories, 5 Kennedy Road, Dane End, Ware, Hertfordshire SG12 0LU. Tel: 0902 84380.

Prices: RD8100 £40; RD8101 £15; RD8110 £27.50.

The simplest RD system consists of an RD8101 micro-mum and an RD8110 eight bit input/output port. The motherboard is different from most in that it consists of 0.1mm spaced pins which stick up from the motherboard in two parallel rows. There is space for two modules on the RD8101, one on each row of pins.

If more modules are required, RD make the RD8100 which is an eight row motherboard in a case. This large motherboard has several advantages over the simple printed circuit board of the micro-mum. It is contained in a black plastic box, sloped towards you, and is fully buffered which means that there are chips built into the box to amplify the signals coming from the ZX80 or ZX81. This buffering allows the modules attached to the motherboard to be removed at any time without crashing the ZX computer.

The 16K RAM pack and printer can be connected to the back of either motherboard, so that any modules that you wish to use can also be connected here. An extra power supply for the motherboard can be plugged in to a power socket at the back, to relieve the strain on the ZX81's own 5 volt regulator.

The RD8110 provides eight input wires and eight output wires of a memory mapped port which can be used in a variety of

ways. This port is one of the few that is fully decoded, so that it occupies one address and can be treated like a piece of RAM.

The address of the port can be set to one of 14 addresses between 15552 and 15567 by inserting a wire in a five pin socket on the underside of the module. The connections to the port can be made in two ways, by poking bare wire into the sockets on top of the module or by plugging in easily available 0.1mm Molex pinned blocks. No soldering is required.

The booklet that accompanies each part of the system explains what you can do with the port, from using a 64 key keyboard to a remote testing facility.

The RD8100 is, I believe, a very good system for the experimenter or for school. You can add as many modules as you require and it does not take an electronics genius to use them. **SA**

Info and Data

By Barbara and John Jaworski, published by Nelson, 206 pages, paperback. Price £3.95.

Every user of a home computer comes to the time when he or she wants to learn more about computers. When the games pall or the struggles at unstructured programming cease, relax in a chair with this excellent background book.

Computers: Information and Data was written specifically for school and college use, but do not let that put you off. For one thing, text-books are a good starting point for picking up a basic knowledge of almost any field. Also, this book is the best CSE/Ordinary level computing text-book that I have come across. It is certainly tougher going than some, and has few pictures, but it covers the material carefully and thoroughly.

One point to note is that this book does not include material on programming. This is normal educational practice — different people have different approaches to programming and different machines to program. For similar reasons the authors do not cover the history, logic and social impact of computers.

There are chapters on the nature of the digital machine, data, storage, files, hardware, software, systems analysis, programming approaches, processing and applications. The book has plenty of examples and exercises, and the index is excellent.

In every way this is a most useful book, whether you are interested in computers for personal or educational reasons. And it comes at a school-book price — good value in other words. **K.**

Reviews

software

ZXAS

Bug-Byte Software, 98-100 The Albany,
Old Hall Street, Liverpool.

ZX81 16K cassette.

Price £5.00

ZXAS is an assembler for the 16K ZX81, which is written in machine code. The program is 5K long and when run relocates itself in the top five k of ram and reduces RAMTOP by five k. A small BASIC portion of the program inputs the start location of the machine code and calls the assembler.

Standard Zilog mnemonics are used, with the exception of commas which are replaced by full stops. If the operations are separated by semicolons, more than one can be placed in the REM statements which hold the object code. However, this can make debugging a bit harder.

Two hundred and fifty-six labels are allowed, imaginatively called L0 to L255. These are distinguished by placing a colon before them. The assembler is two-pass and jumps using labels are calculated on the second pass.

The assembler works extremely quickly assembling 20 instructions as the screen is displayed, which takes less than one second. The operation codes and locations in hex are displayed, along with the mnemonics and the codes original REM statement.

The program seems bug-free and only has one real fault. This is the lack of a routine to save assembled code on to tape, unless the code is first put in a REM statement.

The program loads well in about two and a half minutes. But the casing on my copy was slightly distorted, so it has to be pressed firmly into the recorder. This could cause some tape problems, but the tape itself sounds OK.

Summary

A well-thought-out product, which is useful to anyone who is seriously interested in machine-code programming on the ZX81.

AE

Fun To Learn

Available from W H Smith branches, or direct from Sinclair Research, Freepost, Camberley, Surrey GU15 3BR.

ZX81 16K cassette.

Price £6.95.

If you go into your local W H Smith, you will see the sombre brown and yellow stripes of the ICL "Fun To Learn" series of software. There are 8 of these tapes, and

they form a large part of Sinclair's latest release of software for the ZX81. The tapes are:

E1/2: English Literature 1 and 2

E3: Geography

E4: History

E5: Mathematics

E6: Music

E7: Inventions

E8: Spelling

Most of these programs take the form of a race between 1 to 4 people, with a menu of about half a dozen categories within the main subject. For instance, the History program will give you the choice of answering questions on, among others, "Monarchs of Britain", "When Did He Reign" and "Pot Luck". Questions are then set, with multiple-choice answers. There is also a teaching mode in some subjects, in which the computer runs through salient points of the subject, with dates and various other informative notes.

The Geography program is designed for one person only, and displays a map of England or Europe. The user then answers questions about the towns of England, or the countries and capitals of Europe. The computer will also run through the locations of these on the maps, in the teaching mode.

Mathematics is set at four levels in each of the four basic disciplines of addition, subtraction, multiplication and division.

Spelling is a test for 6- to 11-year-olds. Sentences are spoken, and words within that sentence tested. The correct spelling will then appear, and the pupil goes on to the next sentence.

Summary

Attractively boxed and easily loaded, the programs are, however, slightly overpriced. Many of the programs share the same basic algorithm. Even though expert knowledge must have been sought to set the questions, the duplication of programs should have brought the price down by a pound or two.

The questions are fairly difficult, and would probably appeal more to older teenagers and adults when used as a General Knowledge Quiz rather than in a strictly classroom environment.

It must be admitted, however, that younger children recognise even the harder questions as they come round for the fourth or fifth time. Unfortunately there is no textbook to refer back to and gain further knowledge. Having learnt that disc brakes were invented in 1902, but were not in general use until 1960, it would be nice to know why.

Spelling mistakes occur occasionally, but are probably due to careless typing. There are one or two more serious mistakes, such as Sir Arthur Bliss's inclusion

in the section on Opera, when Bliss did not write any Operas.

ICL's next addition to their educational range should be a Modular program that would enable the users to set their own questions — there being only a limited amount of data in existing programs.

AB

A-maz-ing Vic Pack

Audiogenic Ltd, PO Box 88, 34-36 Crown Street, Reading.

Vic-20 3K cassette.

Price £6.99 (including VAT).

A-maz-ing is yet another version of the Pac-Man arcade game. The Gobbler wanders around a maze, side-stepping unfriendly ghosts and eating lots of little dots. Quite where it puts them is hard to discover — it is obviously one of those voracious creatures that can eat its own weight, several times over.

In the US the original Atari arcade version coined over \$1 billion in its first year. But, on the strength of this Audiogenic version, it is hard to see why.

The major disadvantage of A-maz-ing is that it soon becomes a walk-over. When the program is first run, everything is fine. After a short while, however, the Gobbler becomes rather easy to control, particularly when using the joy-stick option.

Another problem is that the ghosts do not seem that unfriendly. They prefer to remain somewhat aloof and are not terribly bothered by the ravenous Gobbler. You can quite happily sneak up behind a ghost and chomp the blobs there, secure in the knowledge that the ghost will take some time to turn round.

The game does, however, contain all the features of the original. If you are unlucky enough to be cornered by a ghost, you have no hope and must forfeit one of your three lives.

But, you can turn the tables on the ghosts by eating one of the four power dots in the maze. This sounds a tone and causes the ghosts to change colour. It is then possible to eat the ghosts, until the power runs out and the ghosts revert to their normal colours.

The more blobs you eat, the more points you are awarded, with bonuses for swallowing power dots or ghosts.

Basic instructions and the key-board controls are explained on the insert supplied with the cassette.

Summary

The Vic-Pack version is a little short of A-maz-ing, but it will undoubtedly appeal to Pac-Man enthusiasts.

DK

Open Forum

Open Forum is for you to publish your programs and ideas.

It is important that your programs are bug free before you send them in. We cannot test all of them.

Contributions should be sent to: Popular Computing Weekly, Hobhouse Court,

19 Whitcomb Street, London WC2H 7HF.

How to contribute

Each week the editor goes through all the programs that you send to Open Forum in order to find the Program of the Week.

The author of that program will qualify for DOUBLE the usual fee we pay for published programs.
(The usual fee is £10.)

Presentation hints

Programs which are most likely to be considered for the Program of the Week will be computer printed and accompanied by a cassette.

The program will be well documented, the documentation being typed with a double spacing between each line.

The documentation should start with a general description of the program and then give some detail of how the program has been constructed and of its special features.

Listings taken from a ZX Printer should be cut into convenient lengths and carefully stuck down on to white paper, avoiding any creasing.

Please enclose a stamped, self-addressed envelope.

Ski run

on BBC Micro

The object of the game is to manoeuvre your skier to the "X" in the bottom right hand corner of the screen without hitting any of the trees. If you miss the "X" at the bottom of the screen, you restart at the top of the ski slope automatically.

One point to note is that if you hold down the "Q" key to move left, or the "P" key to move right, your speed increases. But, this is not a disadvantage once you have mastered the game.

Dec binary conversion

on Vic-20

A simple program which uses two loops to convert decimal to binary. The first loop

to next page

Ski run

by Alan Wood

```
10MODE7
20VDU23:8282:0:0:0
30HS=0
40PROCINST
50*FX11,1
60*FX12,5
70T=20
80S=0
90C=40
100CLS
110FORX=HIMEM TO HIMEM+960 STEP 40:TX=%FF:NEXT
120FORX=HIMEM+39 TO HIMEM+999 STEP 40:TX=%FF:NEXT
130FORX=HIMEM TO HIMEM+39:TX=%FF:7(X+960)=%FF:NEXT
140R=HIMEM+82
150TA=124
160T(HIMEM+876)=00
170FORX=1 TOT
180G=ROUND(1000)+HIMEM-1:IF7G<>32 GOTO100
190TG=94
200NEXT
210FORX=1 TO 1000:NEXT
220I0=INKEY$(L)
230IF I0="" C=40:GOTO260
240IF I0="P" OR I0="Q" C=1
250IF I0="Q" OR I0="Q" C=-1
260TA=32
270R=R+C:IF7R=%FF AND (HIMEM+959 R=R-C
280IF R=HIMEM+959 R=HIMEM+82:S=S-20:FORX=1 TO 100:K0=INKEY$(0):NEXT
290IF7R=94 PROCTREE
300IF7R=88 PROCHOME
310TA=124
320GOTO220
330DEFPROCTREE
340SOUND0,-15,20,20
350FORX=1 TO 500:K0=INKEY$(0):NEXT
360PROCAG
370ENDPROC
380DEFPROCHOME
390PRINTCHR$7
400S=S+T
410FORX=1 TO 200:K0=INKEY$(0):NEXT
420T=T+2
430GOTO100:ENDPROC
440DEFPROCAG
450CLS:PRINT
460S=INT(100*(S/(L+10)))
470IFS<0 S=0
480PRINT"YOU scored :L "S"
490IFS>HS HS=S:PRINT"A NEW RECORD":GOTO510
500PRINT"The record is :HS
510K0=INKEY$(500):GOTO40:ENDPROC
520DEFPROCINST:FX11,0
530*FX12,0
540CLS:PRINTTAB(15);"SKI RUN"
550PRINTTAB(15);"----"
560PRINT""You are a skier and are represented by a '|'. You must try to reach the 'X' in the bottom-right-hand corner, avoiding the trees, which are represented by '^'."
570PRINT""If you reach the bottom of the slope without reaching the 'X' your score will be reduced and you will reappear at the top of the slope."
580PRINT""Press 'Q' to move left and 'P' to move right."
590INPUT"Enter speed (0-fast to 25-slow):L
600IF L<0 OR L>25 OR L>INT(L) PRINTCHR$7:GOTO590
610PRINT""TAB(10);"ANY KEY TO CONTINUE"
```

DEC2BIN DEC BIN

Decimal binary conversion

by Ken Clark

```
100 REM DEC BIN VIC 3.5K KEN CLARK 1982
110 REM
120 REM CONVERTS DECIMAL TO BINARY
130 REM POSITIVE INTEGERS ONLY
```


Open Forum

from previous page

finds the position of the most significant bit while the second loop works out the remaining least significant bits.

Big letters

on Vic-20

The program scrolls a message of the user's choice up the screen in large 8x8 letters. Here's how it works:

Lines 0 to 4 print the instructions.

Lines 5 to 7 input the message, print it at the top of the screen and set up the variables.

Line 8 puts the screen codes of the message into an array and sets the print position to the centre of the screen.

Lines 9 to 100 PEEK the character generator, convert the number to binary and then to a series of inverse spaces which make up the characters.

```
140 REM LEADING ZEROS ARE NOT DISPLAYED
150 REM
160 A$=""
170 INPUT"ENTER DECIMAL ":N
180 IF N<1 THEN 160
190 N=INT(N)
200 A=A+I:I=1
210 R=N-I
220 IF R<1 THEN 250
230 I=I*2
240 GOTO210
250 I=I/2
260 A=A+RIGHT$(STR$(A),1)
270 IF I<1 THEN PRINT"BINARY = ":A$:GOTO160
280 IF R>=I THEN A=A+R:R=R-I:GOTO250
290 A=A+0:GOTO250
```

Big letters

by Martin Howse

```
0 PRINT"C BIG LETTERS"
1 PRINT"dTHIS PROGRAM WILL ASK dYOU TO ENTER SOME dWORDS
AND IT WILL"
2 PRINT"dSCROLL THE WORDS IN dLARGE LETTERS UP THE dSCREEN.YOU
MAY HAVE"
3 PRINT"dCOLOUR LETTERS BY dPRESSING CTRL AND THE dCOLOUR WANTED
WHEN YOU"
4 PRINT"ENTER THE WORDS. ";FORF=1TO9000:NEXT
5 PRINT"dPLEASE ENTER MESSAGE":FORJ=1TO5000:NEXT:PRINT"C":INPUTA$
6 A$=" "+A$:PRINT"C":A$
7 AA=LEN(A$):DIMA(AA+1)
8 FORI=0TOAA-1:A(I)=PEEK(7680+I):NEXT:PRINT" ";
9 FORH=0TOAA-1
10 FORF=32768+A(H)*8TO32775+A(H)*8:A=PEEK(F):FORG=1TO8
20 READB:IFA-B=0 THEN A=A-B:PRINT"r o":NEXTG:PRINT"dBBBBBBBB":RESTORE:
NEXTF,H
30 PRINT" ":NEXT:PRINT"dBBBBBBBB":RESTORE:NEXTH:GOTO9
100 DATA128,64,32,16,8,4,2,1
```

N.B.

Because the printer cannot handle graphics. The following VIC cursor controls have been replaced by lower case letters.

c-CLEAR d-CURSOR DOWN r-REVERSE ON o-REVERSE OFF
b-CURSOR BACK

Efficient scrolling

on ZX81

by Peter Sandford

The SCROLL command provides a particularly effective means of display for 'adventure' types programs. Unfortunately, the command requires a separate program line each time it is used, and cannot be incorporated within PRINT statements. In lengthy programs, this can be extremely expensive in terms of memory.

The following machine code routine, which requires 4K+ RAM, overcomes these limitations and allows the display to be scrolled as many times as required within any one program line. Provided the start address of the routine is defined as a single letter variable at the beginning of the program, substantial memory savings can be achieved.

```
START 2A OC 40 LD HL, (D-FILE)
54 LD D,H Assign registers
5D LD E,L
01 21 00 LD BC,21h
09 ADD HL,BC
01 B5 02 LD BC,02B5h
ED B0 LDIR
```

```
13 INC DE Block transfer
ED 53 0E 40 LD(DF-CC),DE
21 21 03 Set system variables to print
LD HL,0321h
at start of line 21
22 39 40 LD(S-POSN),HL
06 20 LD B,20h
Clear line 21
97 SUB A
12 LD (DE),A
13 INC DE
10 FC DJNZ LOOP
C9 RET
Return
```

The routine should be stored in a 33 byte REM statement in program line 1. Run the following BASIC program, and enter each

New ZX81 Software from Sinclair.

A whole new range of software for the Sinclair ZX81 Personal Computer is now available – direct from Sinclair. Produced by ICL and Psion, these really excellent cassettes cover games, education, and business/household management.

Some of the more elaborate programs can only be run on a ZX81 augmented by the ZX 16K RAM pack. (The description of each cassette makes it clear what hardware is required.) The RAM pack provides 16-times more memory in one complete module, and simply plugs into the rear of a ZX81. And the price has just been dramatically reduced to only £29.95.

The Sinclair ZX Printer offer full alphanumerics and highly-sophisticated graphics. A special feature is COPY which prints out exactly what is on the whole TV screen without the need for further instructions. So now you can print out your results for a permanent record. The ZX Printer plugs into the rear of your ZX81, and you can connect a RAM pack as well.

Games

Cassette G1: Super Programs 1 (ICL)

Hardware required – ZX81.

Price – £4.95.

Programs – Invasion from Jupiter. Skittles. Magic Square. Doodle. Kim. Liquid Capacity.

Description – Five games programs plus easy conversion between pints/gallons and litres.

Cassette G2: Super Programs 2 (ICL)

Hardware required – ZX81.

Price – £4.95.

Programs – Rings around Saturn. Secret Code. Mindboggling. Silhouette. Memory Test. Metric conversion.

Description – Five games plus easy conversion between inches/feet/yards and centimetres/metres.

Cassette G3: Super Programs 3 (ICL)

Hardware required – ZX81.

Price – £4.95.

Programs – Train Race. Challenge. Secret Message. Mind that Meteor. Character Doodle. Currency Conversion.

Description – Five games plus currency conversion at will – for example, dollars to pounds.

Cassette G4: Super Programs 4 (ICL)

Hardware required – ZX81.

Price – £4.95.

Programs – Down Under. Submarines. Doodling with Graphics. The Invisible Invader. Reaction. Petrol.

Description – Five games plus easy conversion between miles per gallon and European fuel consumption figures.

Cassette G5: Super Programs 5 (ICL)

Hardware required – ZX81 + 16K RAM.

Price – £4.95.

Programs – Martian Knock Out. Graffiti. Find the Mate. Labyrinth. Drop a Brick. Continental.

Description – Five games plus easy conversion between English and continental dress sizes.

Cassette G6: Super Programs 6 (ICL)

Hardware required – ZX81 + 16K RAM.

Price – £4.95.

Programs – Galactic Invasion. Journey into Danger. Create. Nine Hole Golf. Solitaire. Daylight Robbery.

Description – Six games making full use of the ZX81's moving graphics capability.

Cassette G7: Super Programs 7 (ICL)

Hardware required – ZX81.

Price – £4.95.

Programs – Racetrack. Chase. NIM. Tower of Hanoi. Docking the Spaceship. Golf.

Description – Six games including the fascinating Tower of Hanoi problem.

Cassette G8: Super Programs 8 (ICL)

Hardware required – ZX81 + 16K RAM.

Price – £4.95.

Programs – Star Trail (plus blank tape on side 2).

Description – Can you, as Captain Church of the UK spaceship Endeavour, rid the galaxy of the Klingon menace?

Cassette G9: Biorhythms (ICL)

Hardware required – ZX81 + 16K RAM.

Price – £6.95.

Programs – What are Biorhythms? Your Biohythms.

Description – When will you be at your peak (and trough) physically, emotionally, and intellectually?

Cassette G10: Backgammon (Psion)

Hardware required – ZX81 + 16K RAM.

Price – £5.95.

Programs – Backgammon. Dice.

Description – A great program, using fast and efficient machine code, with graphics board, rolling dice, and doubling dice. The dice program can be used for any dice game.

Cassette G11: Chess (Psion)

Hardware required – ZX81 + 16K RAM.

Price – £6.95.

Programs – Chess. Chess Clock.

Description – Fast, efficient machine code, a graphic display of the board and pieces, plus six levels of ability, combine to make this one of the best chess programs available. The Chess Clock program can be used at any time.



Cassette G12:

Fantasy Games (Psion)

Hardware required – ZX81 (or ZX80 with 8K BASIC ROM) + 16K RAM.

Price – £4.75.

Programs – Perilous Swamp. Sorcerer's Island.

Description – Perilous Swamp: rescue a beautiful princess from the evil wizard. Sorcerer's Island: you're marooned. To escape, you'll probably need the help of the Grand Sorcerer.

Cassette G13:

Space Raiders and Bomber (Psion)

Hardware required – ZX81 + 16K RAM.

Price – £3.95.

Programs – Space Raiders. Bomber.

Description – Space Raiders is the ZX81 version of the popular pub game. Bomber: destroy a city before you hit a sky-scraper.

Cassette G14: Flight Simulation (Psion)

Hardware required – ZX81 + 16K RAM.

Price – £5.95.

Program – Flight Simulation (plus blank tape on side 2).

Description – Simulates a highly manoeuvrable light aircraft with full controls, instrumentation, a view through the cockpit window, and navigational aids. Happy landings!

Education

Cassette E1: Fun to Learn series – English Literature 1 (ICL)

Hardware required – ZX81 + 16K RAM.

Price – £6.95.

Programs – Novelists. Authors.

Description – Who wrote 'Robinson Crusoe'? Which novelist do you associate with Father Brown?

Cassette E2: Fun to Learn series – English Literature 2 (ICL)

Hardware required – ZX81 + 16K RAM.

Price – £6.95.

Programs – Poets. Playwrights. Modern Authors.

Description – Who wrote 'Song of the Shirt'? Which playwright also played cricket for England?



Cassette E3: Fun to Learn series - Geography 1 (ICL)

Hardware required - ZX81 + 16K RAM.

Price - £6.95.

Programs - Towns in England and Wales. Countries and Capitals of Europe. Description - The computer shows you a map and a list of towns. You locate the towns correctly. Or the computer challenges you to name a pinpointed location.

Cassette E4: Fun to Learn series - History 1 (ICL)

Hardware required - ZX81 + 16K RAM.

Price - £6.95.

Programs - Events in British History.

British Monarchs.

Description - From 1066 to 1981, find out when important events occurred. Recognise monarchs in an identity parade.

Cassette E5: Fun to Learn series - Mathematics 1 (ICL)

Hardware required - ZX81 + 16K RAM.

Price - £6.95.

Programs - Addition/Subtraction.

Multiplication/Division.

Description - Questions and answers on basic mathematics at different levels of difficulty.

Cassette E6: Fun to Learn series - Music 1 (ICL)

Hardware required - ZX81 + 16K RAM.

Price - £6.95.

Programs - Composers. Musicians.

Description - Which instrument does James Galway play? Who composed 'Peter Grimes'?

Cassette E7: Fun to Learn series - Inventions 1 (ICL)

Hardware required - ZX81 + 16K RAM.

Price - £6.95.

Programs - Inventions before 1850.

Inventions since 1850.

Description - Who invented television?

What was the 'dangerous Lucifer'?

Cassette E8: Fun to Learn series - Spelling 1 (ICL)

Hardware required - ZX81 + 16K RAM.

Price - £6.95.

Programs - Series A1-A15. Series B1-B15.

Description - Listen to the word spoken on your tape recorder, then spell it out on your ZX81. 300 words in total suitable for 6-11 year olds.

Business/household

Cassette B1: The Collector's Pack (ICL)

Hardware required - ZX81 + 16K RAM.

Price - £9.95.

Program - Collector's Pack, plus blank tape or side 2 for program/data storage.

Description - This comprehensive program should allow collectors (of stamps, coins etc.) to hold up to 400 records of up to 6 different items on one cassette. Keep your records up to date and sorted into order.

Cassette B2: The Club Record Controller (ICL)

Hardware required - ZX81 + 16K RAM.

Price - £9.95.

Program - Club Record Controller plus blank tape on side 2 for program/data storage.

Description - Enables clubs to hold records of up to 100 members on one cassette. Allows for names, addresses, 'phone numbers plus five lots of additional information - eg type of membership.

Cassette B3: VU-CALC (Psion)

Hardware required - ZX81 + 16K RAM.

Price - £7.95.

Program - VU-CALC.

Description - Turns your ZX81 into an immensely powerful analysis chart. VU-CALC constructs, generates and calculates large tables for applications such as financial analysis, budget sheets, and projections. Complete with full instructions.

Cassette B4: VU-FILE (Psion)

Hardware required - ZX81 + 16K RAM.

Price - £7.95.

Programs - VU-FILE. Examples.

Description - A general-purpose information storage and retrieval program with emphasis on user-friendliness and visual display. Use it to catalogue your collection, maintain records or club memberships, keep track of your accounts, or as a telephone directory.

How to order

Simply use the FREEPOST order form below and either enclose a cheque or give us your credit card number. Credit card holders can order by phone - simply call Camberley (0276) 66104 or 21282 during office hours. Either way, please allow up to 28 days for delivery, and there's a 14-day money-back option, of course.

sinclair ZX81 SOFTWARE

Sinclair Research Ltd,
Stanhope Road, Camberley, Surrey,
GU15 3PS.
Tel: Camberley (0276) 66104 & 21282.

To: Sinclair Research, FREEPOST, Camberley, Surrey, GU15 3BR.
Please send me the items I have indicated below.

Qty	Cassette	Code	Item price	Total
	G1: Super Programs 1	30	£4.95	
	G2: Super Programs 2	31	£4.95	
	G3: Super Programs 3	32	£4.95	
	G4: Super Programs 4	33	£4.95	
	G5: Super Programs 5	34	£4.95	
	G6: Super Programs 6	35	£4.95	
	G7: Super Programs 7	36	£4.95	
	G8: Super Programs 8	37	£4.95	
	G9: Biorhythms	38	£6.95	
	G10: Backgammon	39	£5.95	
	G11: Chess	40	£6.95	
	G12: Fantasy Games	41	£4.75	
	G13: Space Raiders & Bomber	42	£3.95	
	G14: Flight Simulation	43	£5.95	
	E1: English Literature 1	44	£6.95	

Qty	Cassette	Code	Item price	Total
	E2: English Literature 2	45	£6.95	
	E3: Geography 1	46	£6.95	
	E4: History 1	47	£6.95	
	E5: Mathematics 1	48	£6.95	
	E6: Music 1	49	£6.95	
	E7: Inventions 1	50	£6.95	
	E8: Spelling 1	51	£6.95	
	B1: Collector's Pack	52	£9.95	
	B2: Club Record Controller	53	£9.95	
	B3: VU-CALC	54	£7.95	
	B4: VU-FILE	55	£7.95	
	ZX 16K RAM pack	18	£29.95	
	ZX Printer	27	£59.95	
	Post & packing - only if ordering hardware		£2.95	

TOTAL £

I enclose a cheque/postal order to Sinclair Research Ltd for £.

Please charge my *Access/Barclaycard/Trustcard no.

*Please delete as applicable.

Mr/Mrs/Miss

Address

NSA07

Open Forum

pair of hex codes in turn.

```
1 REM 33 zeroes
10 for X=16514 TO 16546
20 INPUT AS
30 IF LEN AS<>2 THEN GOTO 20
40 SCROLL
50 POKE X,16*CODE AS + CODE AS(2) - 476
60 PRINT X,AS
70 NEXT X
```

To see how the routine is used, delete lines 50 to 70, and add the following:

```
2 LET S=16514
10 PRINT TAB USR S: "THIS IS AN EXAMPLE";
TAB USR S: "OF THE USE OF THIS
SUBROUTINE"; TAB USR S: TAB USR S
20 FOR I=1 TO 50
30 NEXT I
40 GOTO 10
```

Star Trek

on BBC Micro

It is a little known fact that the scripts of *Star Trek* were produced by Paramount's enormous 1960s valve operated computer. I have replicated the program for the BBC Micro. Indeed, it has proved possible to improve upon the original, producing scripts of a higher calibre than those filmed.

Of course, the program produces scripts of variable length. Paramount handled this by inserting fights and noble profile shots to pad out the episodes.

The program will run on either the Model A or B. Make sure that the strings in lines 130 and 505 are identical or the program will never end (that's how they got the motion picture).

Note that the only DATA strings requiring quotes are those containing commas. Also note the spaces which prevent words being split by line feeds.

Partial screen clear

on ZX81

by Calum Steen

After writing a program to help with tax returns, I found I needed a program to clear parts of the ZX81's display while leaving the lines showing the totals of each column intact.

The following machine code routine does this very quickly and needed only small changes to make it function as a very fast equivalent to the CLS command. This was considered necessary as the CLS command takes some time when the display and memory are full. It also leaves characters moving up and down the edge of the screen while it is working.

Rather than use the first REM statement and call the routines by USR 16514, which I find hinders the LOADING of some programs, he decided to make use of the NXTLIN system variable. This is the BASIC loader program for the partial screen clear routine:

```
9900 LET A=(PEEK 16425+256*PEEK 16426+5)
9910 REM 12345678901234567890123456
9920 FOR N=A TO A+25
9930 INPUT B
9940 POKE N,B
9950 NEXT N
```

The program can then be RUN and the decimal codes entered one at a time followed by NEWLINE. This piece of code is 26 bytes long and works as explained in the right hand column, the decimal codes being in the left hand column each separated by a comma.

```
42,58,64 — LD HL,(16442): Register L is loaded with the
line number for PRINT position.
69 — LD B,L: This value is put into register B.
42,14,64 — LD HL,(16398): Register is loaded with
```

PROGRAM OF THE WEEK

address of PRINT position in D FILE.

```
126 — LD A,(HL): Accumulator is loaded with value from
address specified through HL.
254,118 — CP 118: Accumulator decremented by 118.
32,8 — JRNZ B: If result = 0 then jump forward 8 bytes.
5 — DEC B: Register B is decremented by one.
120 — LD A,B: Load accumulator with value in B.
254,0 — CP 0: Accumulator decremented by 0.
32,4 — JRNZ 4: If result = 0 then jump forward 4 bytes.
24,5 — JR 5: Jump forward 5 bytes.
54,0 — LD (HL),0: Memory location addressed through HL
is loaded with 0.
35 — INC HL: Register HL is incremented by 1.
24,238 — JR -18: Jump back 18 bytes.
201 — RET: Return to BASIC.
Lines 9920,9930,9940,9950 can now be deleted.
Line 9900 can be changed to LET RR=USR(PEEK
16425+... etc)
Add 9915 RETURN
```

This routine can now be called by GOSUB 9900. Its effect will depend on the last PRINT statement executed. If it is like:

```
100 PRINT AT 10,5;"ZX81";
```

```
110 GOSUB 9900
```

then the screen will be cleared from line 10, column 10 to the bottom corner of the screen. If the statement is:

```
100PRINT AT 10,5;"ZX81"
```

```
110 GOSUB 9900
```

then the screen will be cleared from line 11, column 0 to the bottom of the screen. The effect of this will only be seen if the screen was already full, of course. Using this property of the last semi-colon the desired type of display clearing can be obtained.

The second program was written to overcome the slowness of the CLS function. It is 24 bytes long and can be entered using a similar program to the one used previously.

```
9900 PRINT AT 0,0;
9905 LET A=(PEEK 16425+256*PEEK 16426+5)
9910 REM 123456789012345678901234
9920 FOR N=A TO A+23
9930 INPUT B
```

to next page

```
50 MODE7:FOR I=2 TO 3:VDU31,7,I,141,131:PRINT "S T A R T R E K":NEXT VDU31,12,5
:PRINT "by Ian Bell"
90 B$=""
100 R=RND(11):IF R>7 X=500 ELSE IF R>4 X=520 ELSE X=500+20*R
105 FOR DD=0 TO 999:NEXT
110 PROC SAY(X):IF A$=B$ GOTO 100
120 PRINTN$;A$;" "
130 IF A$<>"Take us out of orbit, Mr Sulu" OR RND(4)<>4 B$=A$:GOTO 100
140 PRINT "ALL: Hah! Hah! Hah!" " " " " THE END"
150 END
300 DEF PROC SAY(X)
310 RESTORE X
320 READ N$,A
330 FOR I=1 TO RND(A):READ A$:NEXT
340 ENDPROC
500 DATA KIRK: ,4,I'm responsible for the lives of 3000 crewmen,It's a thousa
nd to one against but it's our only chance
505 DATA "Take us out of orbit, Mr Sulu","That's what makes us human, Mr S
pock"
520 DATA SPOCK: ,3,It appears to be some kind of unknown energy,Fascinating
,Most illogical
540 DATA SCOTTIE: ,2,"The enjins canna take it, Cap'n","She canna take the
strain, Cap'n"
560 DATA SULU: ,1,"Captain, it just ... disappeared"
580 DATA MCCOY: ,1,"He's dead, Jim"
```

Star Trek
by Ian Bell

Open Forum

from previous page

9940 POKE N,B
9950 NEXT N

The code to be entered is similar to that of the other routine but always assumes that the PRINT position is at line 0, hence the need for line 9900 to ensure that it is. The decimal codes for this program are as follows:

42,14,64,6,22,126,254,118,32,8,5,120,254,0
32,4,24,5,54,0,35,24,238,201

Delete lines 9920,9930,9940,9950

Change 9905 to LET RR=USR/PEEK 16425+... etc)

ADD 9915 RETURN

This routine can now be called by GOSUB 9900 wherever a CLS command would previously be used in the main program. The screen clearing operation is far quicker than CLS if the display and memory are completely full.

If the program is very long then it may be advantageous to put this subroutine at the beginning of the main program by altering the line numbers and using a GOTO statement to jump over it to start the main program. This will stop BASIC wasting time searching through many line numbers until it finds the one referred to by the GOSUB. This is a point to bear in mind when writing any long program with many GOSUB's that refer to line numbers at the end of the main program. To put these subroutines at the beginning will help speed up program running time.

Maze

on Vic-20

This program runs on a standard Vic and is a maze game where you compete against the clock. Movement is through the four function keys and full instructions are included in the program. Take care when keying in the program to put spaces in lines as it adds to the layout of the screen.

Hex-decimal converter

on Vic-20

This program is quite straightforward. The control is passed to one of two routines dependant upon the last character entered.

If the last character is 'h' the hex to decimal routine is called, otherwise the input is checked for a numeric value (line 190). The error message is displayed if the input does not meet these criteria, and the program returns to the start. The error message is also called if spaces are embedded in the string during the hex to decimal routine.

When using the STR\$ function a space is added to the front of the result, line 250 to next page

Maze

by T. Wolton

```

0 REM
0 REM
1 REM ***MAZE GAME**
2 REM **BY T. WOLTON**
3 REM **RUNS IN 2.50**
10 PRINT "Q" IF$="25":GOTO 1000
11 POKE36879,27:Y=0:Y1=0:Y2=0:Y3=0
20 FORA=0TO1:POKE7688+A,100:POKE368400+A,0:POKE368400+A,0:POKE368400+A,0:POKE368400+A,0
30 POKE368400+A,0:POKE368400+A,0:POKE368400+A,0:POKE368400+A,0:POKE368400+A,0:POKE368400+A,0
40 FORB=0TO484STEP22:POKE7688+B,168:POKE368400+B,0:POKE368400+B,0:POKE368400+B,0:POKE368400+B,0
45 FORD=0TO484STEP22:POKE7688+D,160
50 POKE368421+D,0:POKE368421+D,0:POKE368421+D,0:POKE368421+D,0:POKE368421+D,0:POKE368421+D,0
55 REM **INSTRUCTIONS**
60 PRINT "*****"
70 PRINT "*****MAZE GAME*****"
80 PRINT "*****"
90 PRINT "*****HIT A KEY TO START*****"
100 GETA:IF A=" " THEN GOTO 110
110 PRINT "Q"
115 POKE36879,26
120 PRINT "YOU MUST MOVE UP DOWN LEFT TO RIGHT AROUND"
130 PRINT "THE MAZE."
140 PRINT "YOU ARE IN THE < IN THE BOTTOM RIGHT HAND CORNER"
150 PRINT "AND YOU MUST REACH 'HOME' MARKED H IN THE TOP LEFT CORNER"
160 PRINT "THIS MUST BE DONE IN AS QUICKER TIME AS POSSIBLE."
170 PRINT "BUT BEWARE HIDDEN IN THE MAZE."
180 PRINT "ARE 4 MINES. IF YOU TREAD ON ONE OF THESE YOU WILL BE DESTROYED"
190 PRINT "*****HIT KEY TO CONTINUE*****"
200 GETA:IF A=" " THEN GOTO 210
210 PRINT "Q"
220 PRINT "YOU MAY MOVE USING THE FOLLOWING KEYS:"
230 PRINT "*****F1***** UP"
240 PRINT "*****F2***** LEFT"
250 PRINT "*****F3***** RIGHT"
260 PRINT "*****F4***** DOWN"
270 PRINT "*****HIT A KEY TO START*****"
280 GETA:IF A=" " THEN GOTO 290
290 PRINT "Q"
300 PRINT "PLEASE ENTER LEVEL OF DIFFICULTY (1-10)"
310 PRINT "*****F5***** IF YOU HIT ONE OF THE BLOCKS."
320 PRINT "OF THE MAZE 25 WILL BE ADDED TO YOUR SCORE"
330 INPUT Q
340 IF Q=0 THEN GOTO 350
350 PRINT "Q"
360 REM **PRINT MAZE**
370 FORC=0TO360
380 POKE36879,10:PRINT (RND(1)*506):POKE36879,10:POKE36879,10:POKE36879,10:POKE36879,10:POKE36879,10
390 POKE36879,0:POKE36879,0:POKE36879,0:POKE36879,0:POKE36879,0:POKE36879,0
400 Y=0:Y1=0:Y2=0:Y3=0
410 FORA=0TO4
420 Z=INT(RND(1)*506)
430 RND=2+7688:POKE36879,0:POKE36879,0:POKE36879,0:POKE36879,0:POKE36879,0:POKE36879,0
440 Y1=0:Y2=0:Y3=0
450 POKE36879,60:POKE36879,8:POKE368444,1
460 PRINT "*****SCORE*****"
470 PRINT "*****"
480 GETA:IF A=" " THEN GOTO 490
490 POKE36879,32
500 IF ASC(A)=13 THEN Y=Y-22:GOTO 510
510 IF ASC(A)=14 THEN Y=Y-1:GOTO 520
520 IF ASC(A)=15 THEN Y=Y-1:GOTO 530
530 IF ASC(A)=16 THEN Y=Y-1:GOTO 540
540 IF ASC(A)=17 THEN Y=Y-1:GOTO 550
550 IF ASC(A)=18 THEN Y=Y-1:GOTO 560
560 IF ASC(A)=19 THEN Y=Y-1:GOTO 570
570 IF ASC(A)=20 THEN Y=Y-1:GOTO 580
580 IF ASC(A)=21 THEN Y=Y-1:GOTO 590
590 IF ASC(A)=22 THEN Y=Y-1:GOTO 600
600 IF ASC(A)=23 THEN Y=Y-1:GOTO 610
610 IF ASC(A)=24 THEN Y=Y-1:GOTO 620
620 IF ASC(A)=25 THEN Y=Y-1:GOTO 630
630 IF ASC(A)=26 THEN Y=Y-1:GOTO 640
640 IF ASC(A)=27 THEN Y=Y-1:GOTO 650
650 IF ASC(A)=28 THEN Y=Y-1:GOTO 660
660 IF ASC(A)=29 THEN Y=Y-1:GOTO 670
670 IF ASC(A)=30 THEN Y=Y-1:GOTO 680
680 IF ASC(A)=31 THEN Y=Y-1:GOTO 690
690 IF ASC(A)=32 THEN Y=Y-1:GOTO 700
700 IF ASC(A)=33 THEN Y=Y-1:GOTO 710
710 IF ASC(A)=34 THEN Y=Y-1:GOTO 720
720 IF ASC(A)=35 THEN Y=Y-1:GOTO 730
730 IF ASC(A)=36 THEN Y=Y-1:GOTO 740
740 IF ASC(A)=37 THEN Y=Y-1:GOTO 750
750 IF ASC(A)=38 THEN Y=Y-1:GOTO 760
760 IF ASC(A)=39 THEN Y=Y-1:GOTO 770
770 IF ASC(A)=40 THEN Y=Y-1:GOTO 780
780 IF ASC(A)=41 THEN Y=Y-1:GOTO 790
790 IF ASC(A)=42 THEN Y=Y-1:GOTO 800
800 IF ASC(A)=43 THEN Y=Y-1:GOTO 810
810 IF ASC(A)=44 THEN Y=Y-1:GOTO 820
820 IF ASC(A)=45 THEN Y=Y-1:GOTO 830
830 IF ASC(A)=46 THEN Y=Y-1:GOTO 840
840 IF ASC(A)=47 THEN Y=Y-1:GOTO 850
850 IF ASC(A)=48 THEN Y=Y-1:GOTO 860
860 IF ASC(A)=49 THEN Y=Y-1:GOTO 870
870 IF ASC(A)=50 THEN Y=Y-1:GOTO 880
880 IF ASC(A)=51 THEN Y=Y-1:GOTO 890
890 IF ASC(A)=52 THEN Y=Y-1:GOTO 900
900 IF ASC(A)=53 THEN Y=Y-1:GOTO 910
910 IF ASC(A)=54 THEN Y=Y-1:GOTO 920
920 IF ASC(A)=55 THEN Y=Y-1:GOTO 930
930 IF ASC(A)=56 THEN Y=Y-1:GOTO 940
940 IF ASC(A)=57 THEN Y=Y-1:GOTO 950
950 IF ASC(A)=58 THEN Y=Y-1:GOTO 960
960 IF ASC(A)=59 THEN Y=Y-1:GOTO 970
970 IF ASC(A)=60 THEN Y=Y-1:GOTO 980
980 IF ASC(A)=61 THEN Y=Y-1:GOTO 990
990 IF ASC(A)=62 THEN Y=Y-1:GOTO 1000
1000 IF ASC(A)=63 THEN Y=Y-1:GOTO 1010
1010 IF ASC(A)=64 THEN Y=Y-1:GOTO 1020
1020 IF ASC(A)=65 THEN Y=Y-1:GOTO 1030
1030 IF ASC(A)=66 THEN Y=Y-1:GOTO 1040
1040 IF ASC(A)=67 THEN Y=Y-1:GOTO 1050
1050 IF ASC(A)=68 THEN Y=Y-1:GOTO 1060
1060 IF ASC(A)=69 THEN Y=Y-1:GOTO 1070
1070 IF ASC(A)=70 THEN Y=Y-1:GOTO 1080
1080 IF ASC(A)=71 THEN Y=Y-1:GOTO 1090
1090 IF ASC(A)=72 THEN Y=Y-1:GOTO 1100
1100 IF ASC(A)=73 THEN Y=Y-1:GOTO 1110
1110 IF ASC(A)=74 THEN Y=Y-1:GOTO 1120
1120 IF ASC(A)=75 THEN Y=Y-1:GOTO 1130
1130 IF ASC(A)=76 THEN Y=Y-1:GOTO 1140
1140 IF ASC(A)=77 THEN Y=Y-1:GOTO 1150
1150 IF ASC(A)=78 THEN Y=Y-1:GOTO 1160
1160 IF ASC(A)=79 THEN Y=Y-1:GOTO 1170
1170 IF ASC(A)=80 THEN Y=Y-1:GOTO 1180
1180 IF ASC(A)=81 THEN Y=Y-1:GOTO 1190
1190 IF ASC(A)=82 THEN Y=Y-1:GOTO 1200
1200 IF ASC(A)=83 THEN Y=Y-1:GOTO 1210
1210 IF ASC(A)=84 THEN Y=Y-1:GOTO 1220
1220 IF ASC(A)=85 THEN Y=Y-1:GOTO 1230
1230 IF ASC(A)=86 THEN Y=Y-1:GOTO 1240
1240 IF ASC(A)=87 THEN Y=Y-1:GOTO 1250
1250 IF ASC(A)=88 THEN Y=Y-1:GOTO 1260
1260 IF ASC(A)=89 THEN Y=Y-1:GOTO 1270
1270 IF ASC(A)=90 THEN Y=Y-1:GOTO 1280
1280 IF ASC(A)=91 THEN Y=Y-1:GOTO 1290
1290 IF ASC(A)=92 THEN Y=Y-1:GOTO 1300
1300 IF ASC(A)=93 THEN Y=Y-1:GOTO 1310
1310 IF ASC(A)=94 THEN Y=Y-1:GOTO 1320
1320 IF ASC(A)=95 THEN Y=Y-1:GOTO 1330
1330 IF ASC(A)=96 THEN Y=Y-1:GOTO 1340
1340 IF ASC(A)=97 THEN Y=Y-1:GOTO 1350
1350 IF ASC(A)=98 THEN Y=Y-1:GOTO 1360
1360 IF ASC(A)=99 THEN Y=Y-1:GOTO 1370
1370 IF ASC(A)=100 THEN Y=Y-1:GOTO 1380
1380 IF ASC(A)=101 THEN Y=Y-1:GOTO 1390
1390 IF ASC(A)=102 THEN Y=Y-1:GOTO 1400
1400 IF ASC(A)=103 THEN Y=Y-1:GOTO 1410
1410 IF ASC(A)=104 THEN Y=Y-1:GOTO 1420
1420 IF ASC(A)=105 THEN Y=Y-1:GOTO 1430
1430 IF ASC(A)=106 THEN Y=Y-1:GOTO 1440
1440 IF ASC(A)=107 THEN Y=Y-1:GOTO 1450
1450 IF ASC(A)=108 THEN Y=Y-1:GOTO 1460
1460 IF ASC(A)=109 THEN Y=Y-1:GOTO 1470
1470 IF ASC(A)=110 THEN Y=Y-1:GOTO 1480
1480 IF ASC(A)=111 THEN Y=Y-1:GOTO 1490
1490 IF ASC(A)=112 THEN Y=Y-1:GOTO 1500
1500 IF ASC(A)=113 THEN Y=Y-1:GOTO 1510
1510 IF ASC(A)=114 THEN Y=Y-1:GOTO 1520
1520 IF ASC(A)=115 THEN Y=Y-1:GOTO 1530
1530 IF ASC(A)=116 THEN Y=Y-1:GOTO 1540
1540 IF ASC(A)=117 THEN Y=Y-1:GOTO 1550
1550 IF ASC(A)=118 THEN Y=Y-1:GOTO 1560
1560 IF ASC(A)=119 THEN Y=Y-1:GOTO 1570
1570 IF ASC(A)=120 THEN Y=Y-1:GOTO 1580
1580 IF ASC(A)=121 THEN Y=Y-1:GOTO 1590
1590 IF ASC(A)=122 THEN Y=Y-1:GOTO 1600
1600 IF ASC(A)=123 THEN Y=Y-1:GOTO 1610
1610 IF ASC(A)=124 THEN Y=Y-1:GOTO 1620
1620 IF ASC(A)=125 THEN Y=Y-1:GOTO 1630
1630 IF ASC(A)=126 THEN Y=Y-1:GOTO 1640
1640 IF ASC(A)=127 THEN Y=Y-1:GOTO 1650
1650 IF ASC(A)=128 THEN Y=Y-1:GOTO 1660
1660 IF ASC(A)=129 THEN Y=Y-1:GOTO 1670
1670 IF ASC(A)=130 THEN Y=Y-1:GOTO 1680
1680 IF ASC(A)=131 THEN Y=Y-1:GOTO 1690
1690 IF ASC(A)=132 THEN Y=Y-1:GOTO 1700
1700 IF ASC(A)=133 THEN Y=Y-1:GOTO 1710
1710 IF ASC(A)=134 THEN Y=Y-1:GOTO 1720
1720 IF ASC(A)=135 THEN Y=Y-1:GOTO 1730
1730 IF ASC(A)=136 THEN Y=Y-1:GOTO 1740
1740 IF ASC(A)=137 THEN Y=Y-1:GOTO 1750
1750 IF ASC(A)=138 THEN Y=Y-1:GOTO 1760
1760 IF ASC(A)=139 THEN Y=Y-1:GOTO 1770
1770 IF ASC(A)=140 THEN Y=Y-1:GOTO 1780
1780 IF ASC(A)=141 THEN Y=Y-1:GOTO 1790
1790 IF ASC(A)=142 THEN Y=Y-1:GOTO 1800
1800 IF ASC(A)=143 THEN Y=Y-1:GOTO 1810
1810 IF ASC(A)=144 THEN Y=Y-1:GOTO 1820
1820 IF ASC(A)=145 THEN Y=Y-1:GOTO 1830
1830 IF ASC(A)=146 THEN Y=Y-1:GOTO 1840
1840 IF ASC(A)=147 THEN Y=Y-1:GOTO 1850
1850 IF ASC(A)=148 THEN Y=Y-1:GOTO 1860
1860 IF ASC(A)=149 THEN Y=Y-1:GOTO 1870
1870 IF ASC(A)=150 THEN Y=Y-1:GOTO 1880
1880 IF ASC(A)=151 THEN Y=Y-1:GOTO 1890
1890 IF ASC(A)=152 THEN Y=Y-1:GOTO 1900
1900 IF ASC(A)=153 THEN Y=Y-1:GOTO 1910
1910 IF ASC(A)=154 THEN Y=Y-1:GOTO 1920
1920 IF ASC(A)=155 THEN Y=Y-1:GOTO 1930
1930 IF ASC(A)=156 THEN Y=Y-1:GOTO 1940
1940 IF ASC(A)=157 THEN Y=Y-1:GOTO 1950
1950 IF ASC(A)=158 THEN Y=Y-1:GOTO 1960
1960 IF ASC(A)=159 THEN Y=Y-1:GOTO 1970
1970 IF ASC(A)=160 THEN Y=Y-1:GOTO 1980
1980 IF ASC(A)=161 THEN Y=Y-1:GOTO 1990
1990 IF ASC(A)=162 THEN Y=Y-1:GOTO 2000
2000 IF ASC(A)=163 THEN Y=Y-1:GOTO 2010
2010 IF ASC(A)=164 THEN Y=Y-1:GOTO 2020
2020 IF ASC(A)=165 THEN Y=Y-1:GOTO 2030
2030 IF ASC(A)=166 THEN Y=Y-1:GOTO 2040
2040 IF ASC(A)=167 THEN Y=Y-1:GOTO 2050
2050 IF ASC(A)=168 THEN Y=Y-1:GOTO 2060
2060 IF ASC(A)=169 THEN Y=Y-1:GOTO 2070
2070 IF ASC(A)=170 THEN Y=Y-1:GOTO 2080
2080 IF ASC(A)=171 THEN Y=Y-1:GOTO 2090
2090 IF ASC(A)=172 THEN Y=Y-1:GOTO 2100
2100 IF ASC(A)=173 THEN Y=Y-1:GOTO 2110
2110 IF ASC(A)=174 THEN Y=Y-1:GOTO 2120
2120 IF ASC(A)=175 THEN Y=Y-1:GOTO 2130
2130 IF ASC(A)=176 THEN Y=Y-1:GOTO 2140
2140 IF ASC(A)=177 THEN Y=Y-1:GOTO 2150
2150 IF ASC(A)=178 THEN Y=Y-1:GOTO 2160
2160 IF ASC(A)=179 THEN Y=Y-1:GOTO 2170
2170 IF ASC(A)=180 THEN Y=Y-1:GOTO 2180
2180 IF ASC(A)=181 THEN Y=Y-1:GOTO 2190
2190 IF ASC(A)=182 THEN Y=Y-1:GOTO 2200
2200 IF ASC(A)=183 THEN Y=Y-1:GOTO 2210
2210 IF ASC(A)=184 THEN Y=Y-1:GOTO 2220
2220 IF ASC(A)=185 THEN Y=Y-1:GOTO 2230
2230 IF ASC(A)=186 THEN Y=Y-1:GOTO 2240
2240 IF ASC(A)=187 THEN Y=Y-1:GOTO 2250
2250 IF ASC(A)=188 THEN Y=Y-1:GOTO 2260
2260 IF ASC(A)=189 THEN Y=Y-1:GOTO 2270
2270 IF ASC(A)=190 THEN Y=Y-1:GOTO 2280
2280 IF ASC(A)=191 THEN Y=Y-1:GOTO 2290
2290 IF ASC(A)=192 THEN Y=Y-1:GOTO 2300
2300 IF ASC(A)=193 THEN Y=Y-1:GOTO 2310
2310 IF ASC(A)=194 THEN Y=Y-1:GOTO 2320
2320 IF ASC(A)=195 THEN Y=Y-1:GOTO 2330
2330 IF ASC(A)=196 THEN Y=Y-1:GOTO 2340
2340 IF ASC(A)=197 THEN Y=Y-1:GOTO 2350
2350 IF ASC(A)=198 THEN Y=Y-1:GOTO 2360
2360 IF ASC(A)=199 THEN Y=Y-1:GOTO 2370
2370 IF ASC(A)=200 THEN Y=Y-1:GOTO 2380
2380 IF ASC(A)=201 THEN Y=Y-1:GOTO 2390
2390 IF ASC(A)=202 THEN Y=Y-1:GOTO 2400
2400 IF ASC(A)=203 THEN Y=Y-1:GOTO 2410
2410 IF ASC(A)=204 THEN Y=Y-1:GOTO 2420
2420 IF ASC(A)=205 THEN Y=Y-1:GOTO 2430
2430 IF ASC(A)=206 THEN Y=Y-1:GOTO 2440
2440 IF ASC(A)=207 THEN Y=Y-1:GOTO 2450
2450 IF ASC(A)=208 THEN Y=Y-1:GOTO 2460
2460 IF ASC(A)=209 THEN Y=Y-1:GOTO 2470
2470 IF ASC(A)=210 THEN Y=Y-1:GOTO 2480
2480 IF ASC(A)=211 THEN Y=Y-1:GOTO 2490
2490 IF ASC(A)=212 THEN Y=Y-1:GOTO 2500
2500 IF ASC(A)=213 THEN Y=Y-1:GOTO 2510
2510 IF ASC(A)=214 THEN Y=Y-1:GOTO 2520
2520 IF ASC(A)=215 THEN Y=Y-1:GOTO 2530
2530 IF ASC(A)=216 THEN Y=Y-1:GOTO 2540
2540 IF ASC(A)=217 THEN Y=Y-1:GOTO 2550
2550 IF ASC(A)=218 THEN Y=Y-1:GOTO 2560
2560 IF ASC(A)=219 THEN Y=Y-1:GOTO 2570
2570 IF ASC(A)=220 THEN Y=Y-1:GOTO 2580
2580 IF ASC(A)=221 THEN Y=Y-1:GOTO 2590
2590 IF ASC(A)=222 THEN Y=Y-1:GOTO 2600
2600 IF ASC(A)=223 THEN Y=Y-1:GOTO 2610
2610 IF ASC(A)=224 THEN Y=Y-1:GOTO 2620
2620 IF ASC(A)=225 THEN Y=Y-1:GOTO 2630
2630 IF ASC(A)=226 THEN Y=Y-1:GOTO 2640
2640 IF ASC(A)=227 THEN Y=Y-1:GOTO 2650
2650 IF ASC(A)=228 THEN Y=Y-1:GOTO 2660
2660 IF ASC(A)=229 THEN Y=Y-1:GOTO 2670
2670 IF ASC(A)=230 THEN Y=Y-1:GOTO 2680
2680 IF ASC(A)=231 THEN Y=Y-1:GOTO 2690
2690 IF ASC(A)=232 THEN Y=Y-1:GOTO 2700
2700 IF ASC(A)=233 THEN Y=Y-1:GOTO 2710
2710 IF ASC(A)=234 THEN Y=Y-1:GOTO 2720
2720 IF ASC(A)=235 THEN Y=Y-1:GOTO 2730
2730 IF ASC(A)=236 THEN Y=Y-1:GOTO 2740
2740 IF ASC(A)=237 THEN Y=Y-1:GOTO 2750
2750 IF ASC(A)=238 THEN Y=Y-1:GOTO 2760
2760 IF ASC(A)=239 THEN Y=Y-1:GOTO 2770
2770 IF ASC(A)=240 THEN Y=Y-1:GOTO 2780
2780 IF ASC(A)=241 THEN Y=Y-1:GOTO 2790
2790 IF ASC(A)=242 THEN Y=Y-1:GOTO 2800
2800 IF ASC(A)=243 THEN Y=Y-1:GOTO 2810
2810 IF ASC(A)=244 THEN Y=Y-1:GOTO 2820
2820 IF ASC(A)=245 THEN Y=Y-1:GOTO 2830
2830 IF ASC(A)=246 THEN Y=Y-1:GOTO 2840
2840 IF ASC(A)=247 THEN Y=Y-1:GOTO 2850
2850 IF ASC(A)=248 THEN Y=Y-1:GOTO 2860
2860 IF ASC(A)=249 THEN Y=Y-1:GOTO 2870
2870 IF ASC(A)=250 THEN Y=Y-1:GOTO 2880
2880 IF ASC(A)=251 THEN Y=Y-1:GOTO 2890
2890 IF ASC(A)=252 THEN Y=Y-1:GOTO 2900
2900 IF ASC(A)=253 THEN Y=Y-1:GOTO 2910
2910 IF ASC(A)=254 THEN Y=Y-1:GOTO 2920
2920 IF ASC(A)=255 THEN Y=Y-1:GOTO 2930
2930 IF ASC(A)=256 THEN Y=Y-1:GOTO 2940
2940 IF ASC(A)=257 THEN Y=Y-1:GOTO 2950
2950 IF ASC(A)=258 THEN Y=Y-1:GOTO 2960
2960 IF ASC(A)=259 THEN Y=Y-1:GOTO 2970
2970 IF ASC(A)=260 THEN Y=Y-1:GOTO 2980
2980 IF ASC(A)=261 THEN Y=Y-1:GOTO 2990
2990 IF ASC(A)=262 THEN Y=Y-1:GOTO 3000
3000 IF ASC(A)=263 THEN Y=Y-1:GOTO 3010
3010 IF ASC(A)=264 THEN Y=Y-1:GOTO 3020
3020 IF ASC(A)=265 THEN Y=Y-1:GOTO 3030
3030 IF ASC(A)=266 THEN Y=Y-1:GOTO 3040
3040 IF ASC(A)=267 THEN Y=Y-1:GOTO 3050
3050 IF ASC(A)=268 THEN Y=Y-1:GOTO 3060
3060 IF ASC(A)=269 THEN Y=Y-1:GOTO 3070
3070 IF ASC(A)=270 THEN Y=Y-1:GOTO 3080
3080 IF ASC(A)=271 THEN Y=Y-1:GOTO 3090
3090 IF ASC(A)=272 THEN Y=Y-1:GOTO 3100
3100 IF ASC(A)=273 THEN Y=Y-1:GOTO 3110
3110 IF ASC(A)=274 THEN Y=Y-1:GOTO 3120
3120 IF ASC(A)=275 THEN Y=Y-1:GOTO 3130
3130 IF ASC(A)=276 THEN Y=Y-1:GOTO 3140
3140 IF ASC(A)=277 THEN Y=Y-1:GOTO 3150
3150 IF ASC(A)=278 THEN Y=Y-1:GOTO 3160
3160 IF ASC(A)=279 THEN Y=Y-1:GOTO 3170
3170 IF ASC(A)=280 THEN Y=Y-1:GOTO 3180
3180 IF ASC(A)=281 THEN Y=Y-1:GOTO 3190
3190 IF ASC(A)=282 THEN Y=Y-1:GOTO 3200
3200 IF ASC(A)=283 THEN Y=Y-1:GOTO 3210
3210 IF ASC(A)=284 THEN Y=Y-1:GOTO 3220
3220 IF ASC(A)=285 THEN Y=Y-1:GOTO 3230
3230 IF ASC(A)=286 THEN Y=Y-1:GOTO 3240
3240 IF ASC(A)=287 THEN Y=Y-1:GOTO 3250
3250 IF ASC(A)=288 THEN Y=Y-1:GOTO 3260
3260 IF ASC(A)=289 THEN Y=Y-1:GOTO 3270
3270 IF ASC(A)=290 THEN Y=Y-1:GOTO 3280
3280 IF ASC(A)=291 THEN Y=Y-1:GOTO 3290
3290 IF ASC(A)=292 THEN Y=Y-1:GOTO 3300
3300 IF ASC(A)=293 THEN Y=Y-1:GOTO 3310
3310 IF ASC(A)=294 THEN Y=Y-1:GOTO 3320
3320 IF ASC(A)=295 THEN Y=Y-1:GOTO 3330
3330 IF ASC(A)=296 THEN Y=Y-1:GOTO 3340
3340 IF ASC(A)=297 THEN Y=Y-1:GOTO 3350
3350 IF ASC(A)=298 THEN Y=Y-1:GOTO 3360
3360 IF ASC(A)=299 THEN Y=Y-1:GOTO 3370
3370 IF ASC(A)=300 THEN Y=Y-1:GOTO 3380
3380 IF ASC(A)=301 THEN Y=Y-1:GOTO 3390
3390 IF ASC(A)=302 THEN Y=Y-1:GOTO 3400
3400 IF ASC(A)=303 THEN Y=Y-1:GOTO 3410
3410 IF ASC(A)=304 THEN Y=Y-1:GOTO 3420
3420 IF ASC(A)=305 THEN Y=Y-1:GOTO 3430
3430 IF ASC(A)=306 THEN Y=Y-1:GOTO 3440
3440 IF ASC(A)=307 THEN Y=Y-1:GOTO 3450
3450 IF ASC(A)=308 THEN Y=Y-1:GOTO 3460
3460 IF ASC(A)=309 THEN Y=Y-1:GOTO 3470
3470 IF ASC(A)=310 THEN Y=Y-1:GOTO 3480
3480 IF ASC(A)=311 THEN Y=Y-1:GOTO 3490
3490 IF ASC(A)=312 THEN Y=Y-1:GOTO 3500
3500 IF ASC(A)=313 THEN Y=Y-1:GOTO 3510
3510 IF ASC(A)=314 THEN Y=Y-1:GOTO 3520
3520 IF ASC(A)=315 THEN Y=Y-1:GOTO 3530
3530 IF ASC(A)=316 THEN Y=Y-1:GOTO 3540
3540 IF ASC(A)=317 THEN Y=Y-1:GOTO 3550
3550 IF ASC(A)=318 THEN Y=Y-1:GOTO 3560
3560 IF ASC(A)=319 THEN Y=Y-1:GOTO 3570
3570 IF ASC(A)=320 THEN Y=Y-1:GOTO 3580
3580 IF ASC(A)=321 THEN Y=Y-1:GOTO 3590
3590 IF ASC(A)=322 THEN Y=Y-1:GOTO 3600
3600 IF ASC(A)=323 THEN Y=Y-1:GOTO 3610
3610 IF ASC(A)=324 THEN Y=Y-1:GOTO 3620
3620 IF ASC(A)=325 THEN Y=Y-1:GOTO 3630
3630 IF ASC(A)=326 THEN Y=Y-1:GOTO 3640
3640 IF ASC(A)=327 THEN Y=Y-1:GOTO 3650
3650 IF ASC(A)=328 THEN Y=Y-1:GOTO 3660
3660 IF ASC(A)=329 THEN Y=Y-1:GOTO 3670
3670 IF ASC(A)=330 THEN Y=Y-1:GOTO 3680
3680 IF ASC(A)=331 THEN Y=Y-1:GOTO 3690
3690 IF ASC(A)=332 THEN Y=Y-1:GOTO 3700
3700 IF ASC(A)=333 THEN Y=Y-1:GOTO 3710
3710 IF ASC(A)=334 THEN Y=Y-1:GOTO 3720
3720 IF ASC(A)=335 THEN Y=Y-1:GOTO 3730
3730 IF ASC(A)=336 THEN Y=Y-1:GOTO 3740
3740 IF ASC(A)=337 THEN Y=Y-1:GOTO 3750
3750 IF ASC(A)=338 THEN Y=Y-1:GOTO 3760
3760 IF ASC(A)=339 THEN Y=Y-1:GOTO 3770
3770 IF ASC(A)=340 THEN Y=Y-1:GOTO 3780
3780 IF ASC(A)=341 THEN Y=Y-1:GOTO 3790
3790 IF ASC(A)=342 THEN Y=Y-1:GOTO 3800
3800 IF ASC(A)=343 THEN Y=Y-1:GOTO 3810
3810 IF ASC(A)=344 THEN Y=Y-1:GOTO 3820
3820 IF ASC(A)=345 THEN Y=Y-1:GOTO 3830
3830 IF ASC(A)=346 THEN Y=Y-1:GOTO 3840
3840 IF ASC(A)=347 THEN Y=Y-1:GOTO 3850
3850 IF ASC(A)=348 THEN Y=Y-1:GOTO 3860
3860 IF ASC(A)=349 THEN Y=Y-1:GOTO 3870
3870 IF ASC(A)=350 THEN Y=Y-1:GOTO 3880
3880 IF ASC(A)=351 THEN Y=Y-1:GOTO 3890
3890 IF ASC(A)=352 THEN Y=Y-1:GOTO 3900
3900 IF ASC(A)=353 THEN Y=Y-1:GOTO 3910
3910 IF ASC(A)=354 THEN Y=Y-1:GOTO 3920
3920 IF ASC(A)=355 THEN Y=Y-1:GOTO 3930
3930 IF ASC(A)=356 THEN Y=Y-1:GOTO 3940
3940 IF ASC(A)=357 THEN Y=Y-1:GOTO 3950
3950 IF ASC(A)=358 THEN Y=Y-1:GOTO 3960
3960 IF ASC(A)=359 THEN Y=Y-1:GOTO 3970
3970 IF ASC(A)=360 THEN Y=Y-1:GOTO 3980
3980 IF ASC(A)=361 THEN Y=Y-1:GOTO 3990
3990 IF ASC(A)=362 THEN Y=Y-1:GOTO 4000
4000 IF ASC(A)=363 THEN Y=Y-1:GOTO 4010
4010 IF ASC(A)=364 THEN Y=Y-1:GOTO 4020
4020 IF ASC(A)=365 THEN Y=Y-1:GOTO 4030
4030 IF ASC(A)=366 THEN Y=Y-1:GOTO 4040
4040 IF ASC(A)=367 THEN Y=Y-1:GOTO 4050
4050 IF ASC(A)=368 THEN Y=Y-1:GOTO 4060
4060 IF ASC(A)=369 THEN Y=Y-1:GOTO 4070
4070 IF ASC(A)=370 THEN Y=Y-1:GOTO 4080
4080 IF ASC(A)=371 THEN Y=Y-1:GOTO 4090
4090 IF ASC(A)=372 THEN Y=Y-1:GOTO 4100
4100 IF ASC(A)=373 THEN Y=Y-1:GOTO 4110
4110 IF ASC(A)=374 THEN Y=Y-1:GOTO 4120
4120 IF ASC(A)=375 THEN Y=Y-1:GOTO 4130
4130 IF ASC(A)=376 THEN Y=Y-1:GOTO 4140
4140 IF ASC(A)=377 THEN Y=Y-1:GOTO 4150
4150 IF ASC(A)=378 THEN Y=Y-1:GOTO 4160
4160 IF ASC(A)=379 THEN Y=Y-1:GOTO 4170
4170 IF ASC(A)=380 THEN Y=Y-1:GOTO 4180
4180 IF ASC(A)=381 THEN Y=Y-1:GOTO 4190
4190 IF ASC(A)=382 THEN Y=Y-1:GOTO 4200
4200 IF ASC(A)=383 THEN Y=Y-1:GOTO 4210
4210 IF ASC(A)=384 THEN Y=Y-1:GOTO 4220
4220 IF ASC(A)=385 THEN Y=Y-1:GOTO 4230
4230 IF ASC(A)=386 THEN Y=Y-1:GOTO 4240
4240 IF ASC(A)=387 THEN Y=Y-1:GOTO 4250
4250 IF ASC(A)=388 THEN Y=Y-1:GOTO 4260
4260 IF ASC(A)=389 THEN Y=Y-1:GOTO 4270
4270 IF ASC(A)=390 THEN Y=Y-1:GOTO 4280
4280 IF ASC(A)=391 THEN Y=Y-1:GOTO 4290
4290 IF ASC(A)=392 THEN Y=Y-1:GOTO 4300
4300 IF ASC(A)=393 THEN Y=Y-1:GOTO 4310
4310 IF ASC(A)=394 THEN Y=Y-1:GOTO 4320
4320 IF ASC(A)=395 THEN Y=Y-1:GOTO 4330
4330 IF ASC(A)=396 THEN Y=Y-1:GOTO 4340
4340 IF ASC(A)=397 THEN Y=Y-1:GOTO 4350
4350 IF ASC(A)=398 THEN Y=Y-1:GOTO 4360
4360 IF ASC(A)=399 THEN Y=Y-1:GOTO 4370
4370 IF ASC(A)=400 THEN Y=Y-1:GOTO 4380
4380 IF ASC(A)=401 THEN Y=Y-1:GOTO 4390
4390 IF ASC(A)=402 THEN Y=Y-1:GOTO 4400
4400 IF ASC(A)=403 THEN Y=Y-1:GOTO 4410
4410 IF ASC(A)=404 THEN Y=Y-1:GOTO 4420
4420 IF ASC(A)=405 THEN Y=Y-1:GOTO 4430
4430 IF ASC(A)=406 THEN Y=Y-1:GOTO 4440
4440 IF ASC(A)=407 THEN Y=Y-1:GOTO 4450
4450 IF ASC(A)=408 THEN Y=Y-1:GOTO 4460
4460 IF ASC(A)=409 THEN Y=Y-1:GOTO 4470
4470 IF ASC(A)=410 THEN Y=Y-1:GOTO 4480
4480 IF ASC(A)=411 THEN Y=Y-1:GOTO 4490
4490 IF ASC(A)=412 THEN Y=Y-
```


Open Forum

from previous page

takes this space out so that the output looks neater. Lines 360 and 240 take care of the hex values A to F by converting them to decimal 10 to 15 and vice versa.

Sketch pad

on ZX81

This sketch pad program enables you to draw your own pictures and diagrams. To start simply type in line 10 as:

```
10 REM XXXX....36X's....XXXX
```

Then type:

```
20 FOR N=16514 TO 16550
```

```
30 INPUT A
```

```
40 POKE N,A
```

```
50 NEXT N
```

and then RUN.

Follow on by inputting these numbers in turn:

42, 12, 64, 35, 22, 1, 30, 1, 126, 6, 128, 203, 79, 40, 3, 144, 24, 1, 128, 119, 35, 20, 62, 33, 186, 32, 237, 35, 22, 1, 28, 62, 23, 187, 200, 24, 227.

After doing that delete lines 20 to 50 by typing in the rest of the program. SAVE all your work on to cassette before running. When RUN all will be made clear.

The inverse-video function enables you to edit your picture by changing to inverse and then filling in the white where the mistake was, then change back to normal video.

Maybe the National Gallery will accept some ZX masterpieces or have a special modern art display.

220675 VIC-DECHEXDEC

Hex-decimal converter
by Ken Clark

```
100 REM VIC-DECHEXDEC 3.5K VIC KEN CLARK 1982
110 REM
120 REM CHANGES DECIMAL TO HEXDECIMAL & VICE VERSA.
130 REM FOLLOW HEX INPUT WITH THE LETTER 'H'
140 REM WITH NO INTERVENING SPACES EG. FFH
150 REM INPUT DECIMAL WITH OUT EXTRA CHARACTERS
160 REM
170 INPUT A$
180 IF RIGHT$(A$,1)="H" THEN L=LEN(A$)-1:GOTO320
190 IF ASC(A$)<48 OR ASC(A$)>57 THEN420
200 REM** DEC TO HEX **
210 A=VAL(A$)
220 Q=INT(A/16)
230 R=A-16*Q
240 IFR>9 THEN R$=CHR$(R+55):GOTO260
250 R$=RIGHT$(STR$(R),1)
260 S$=R$+S$
270 A=Q:IF A=<0 THEN290
280 GOTO220
290 PRINTA$;" DECIMAL=";"S$;" HEX"
300 GOTO430
310 REM** HEX TO DEC **
320 B$=LEFT$(A$,L)
330 FOR I=0 TO L-1
340 T$=MID$(A$,L,I)
350 IF ASC(T$)=32 THEN 420
360 IF ASC(T$)>64 THEN T=ASC(T$)-55:GOTO380
370 T=VAL(T$)
380 W=T*16*I+W
390 L=L-1:NEXT I
400 PRINTB$;" HEX=";"W;"DECIMAL"
410 GOTO430
420 PRINT"INPUT ERROR TRY AGAIN"
430 W=0:S$="" :A$="" :GOTO170
```

```
10 REM EERND7-2-77=Y54
GOSUB 7:BY-COS / STOP
15 DIM P$(704)
20 REM ADRIAN JONES 5/4/1982
30 PRINT TAB 10;"SKETCH PAD",T
40 PRINT "THIS PROGRAM IS A
POWERFUL AID FOR DRAWING PICTUR
ES ON TO THE SCREEN OR PRINTER"
50 PRINT "THE SCREEN IS USED
AS A SKETCH PAD ON A 64 BY 42
GRID. (0,0 IS IN THE BOTTOM LEFT
)"
60 PRINT "THE X CO-ORDINATE
IS THE NUMBER OF SPACES ALONG TH
E BOTTOM AND THE Y CO-ORDINATE
IS THE NUMBER UP THE SIDE."
70 PRINT "WHAT DO YOU WANT Y
OUR STARTING POSITION TO BE?"
80 PRINT "X=? ";
90 INPUT X
100 IF X<64 AND X>=0 THEN GOTO
120
110 GOTO 90
120 PRINT X
130 PRINT "Y=? ";
140 INPUT Y
150 IF Y<42 AND Y>=0 THEN GOTO
170
160 GOTO 140
170 PRINT Y
180 LET Y=Y+2
190 CLS
200 GOTO 9000
1000 LET A$=INKEY$
1010 IF A$="4" AND A$="9" THEN G
OTO 2000
1020 IF A$="I" THEN RAND USR 165
14
```

Sketch pad
by A. Jones

```
1030 IF A$="X" THEN GOTO 5000
1040 IF A$="Z" THEN COPY
1050 IF A$="L" THEN GOTO 3000
1060 IF A$="S" THEN GOTO 4000
1070 GOTO 1000
2000 REM PLOT NEW X,Y
2010 LET C=CODE A$-26
2020 LET X=X+((C=6)*(X<63))-((C=
5)*(X>0))
2030 LET Y=Y+((C=7)*(Y<43))-((C=
5)*(Y>3))
2040 PLOT X,Y
2050 GOTO 1000
3000 REM LINE ROUTINE
3010 PRINT AT 21,0;"POINT1. HOW
MANY SPACES ALONG?"
3020 INPUT A
3030 IF A>0 AND A<64 THEN GOTO
3050
3040 GOTO 3020
3050 PRINT AT 21,0;"POINT1. HOW
MANY SPACES UP?"
3060 INPUT B
3070 IF B>0 AND B<42 THEN GOTO
3090
3080 GOTO 3060
3090 LET B=B+2
3100 PRINT AT 21,0;"POINT2. HOW
MANY SPACES ALONG?"
3110 INPUT C
3120 IF C>0 AND C<64 THEN GOTO
3140
3130 GOTO 3110
3140 PRINT AT 21,0;"POINT2. HOW
MANY SPACES UP?"
```


Open Forum

Square roots

on Vic-20

Here are two suggestions for generating square roots on a Vic-20. Both first write the number T as $T=X \cdot 4 \uparrow N$ with N an integer and $.25 \leq X < 1$.

The first method then approximates $\text{SQR}(X)$ by linear approximations using knowledge of square roots of $(5/10)^2$, $(6/10)^2$, $(7/10)^2$, $(8/10)^2$, $(9/10)^2$, and $(10/10)^2$. The second method approximates $\text{SQR}(X)$ by using a quadratic obtained by using the square roots of $(5/10)^2$, $(7/10)^2$ and $(10/10)^2$. Finally, the approximation is completed by a Newton method.

Fog

on ZX81

In this 5.75K program the idea is to get from one side of the grey fog to the other. However, there are a number of invisible objects which you must get past to reach the other side. You must also avoid a pursuing zombie and watch out for the mines. But do not take too long or you will run out of time.

When the game starts you will receive instructions. The screen will go black for a few seconds and then the fog and a time gauge will appear. You are represented by a '>' sign while the zombie appears as a 'Z'. If you find that you cannot move then you have hit a wall and will have to try a different direction.

REM statements show how the program is structured. Line 1 gives a 24 line screen. Putting all the instructions in one string enables them to be printed one character at a time.

Lines 2000 onward enable the game to start straight from loading. However, when SAVING you must type 'RUN 2000' instead of the normal 'SAVE'. My high score is 26, if you do better then change line 285.

```
3100 PRINT AT 21,0;"POINT2. HOW
3110 SPACES ALONG 7
3120 INPUT C
3130 IF C=0 AND C<64 THEN GOTO
3140
3150 GOTO 3110
3160 PRINT AT 21,0;"POINT2. HOW
3170 SPACES UP 7
3180 INPUT D
3190 PRINT AT 21,0;"
3200 IF D>=0 AND D<42 THEN GOTO
3210
3220 GOTO 3140
3230 LET D=D+2
3240 LET R=C-D
3250 LET S=D-D
3260 LET T=ABS R
3270 IF ABS S<T THEN LET T=ABS S
3280 FOR I=0 TO T-1
3290 LET X=R+I*S/T
3300 LET Y=D+I*S/T
3310 PLOT X,Y
3320 NEXT I
3330 GOTO 1000
3340 REM SAVE ROUTINE
3350 FAST
3360 FOR I=0 TO 20
3370 FOR J=1 TO 32
3380 LET P(32+I+J)=CHR$ PEEK (P
3390 PEEK 16390+356*PEEK 16397+I*33+J)
3400 NEXT J
3410 NEXT I
3420 CLS
3430 SLOW
3440 PRINT "START RECORDING THEN
3450 PRESS A KEY
3460 IF INKEY$="" THEN GOTO 4000
```

```
4100 SAVE "PICTURE"
4110 CLS
4120 PRINT P$
4130 GOTO 1000
5000 REM CLEAR SCREEN
5010 CLS
5020 LET X=0
5030 LET Y=0
5040 PLOT X,Y
5050 GOTO 1000
5060 REM COMMANDS
5070 PRINT "THESE ARE YOUR COMMA
5080 NOS:"
5090 PRINT "5-MOVES THE LINE TO
5100 THE LEFT"
5110 PRINT "6-MOVES THE LINE DOU
5120 NWARDS"
5130 PRINT "7-MOVES THE LINE UP
5140 ARDS"
5150 PRINT "8-MOVES THE LINE TO
5160 THE RIGHT"
5170 PRINT "9-SAVES THE PICTUR
5180 E ON TAPE"
5190 PRINT "Z-SENDS A COPY OF
5200 THE PICTURE TO THE PRINTER"
5210 PRINT "I-CHANGES THE SCRE
5220 EN TO INVERSE VIDEO"
5230 PRINT "L-PLOTS A STRAIGHT
5240 LINE FROM THE CO-ORDINATES IT AS
5250 KS FOR"
5260 PRINT "X-CLEARs THE SCREE
5270 N"
5280 PRINT "PRESS A KEY TO CON
5290 TINUE"
5300 IF INKEY$="" THEN GOTO 5120
5310 CLS
5320 PLOT X,Y
5330 GOTO 1000
```

```
10 REM *****
20 REM *SQUARE ROOTS*
30 REM * BY *
40 REM *CZES KOSNIOWSKI*
50 REM *****
60 REM * METHOD 1 *
70 REM *****
80 INPUT T
90 IF T=0 THEN 90
100 REM T=X*4/N WITH .25<=X<1
110 X=T/N*4
120 IF X<.25 THEN 150
130 IF X<1 THEN 180
140 N=N+1:X=X/4:GOTO 130
150 N=N-1:X=X*4
160 IF X<.25 THEN 150
170 REM FIRST APPROXIMATION TO SQR(X)
180 IF X=.81 THEN Y=X-.81:Y=.9+Y/1.9:GOTO 240
190 IF X=.64 THEN Y=X-.64:Y=.8+Y/1.7:GOTO 240
200 IF X=.49 THEN Y=X-.49:Y=.7+Y/1.5:GOTO 240
210 IF X=.36 THEN Y=X-.36:Y=.6+Y/1.3:GOTO 240
220 Y=X-.25:Y=.5+Y/1.1
230 REM FURTHER APPROXIMATION TO SQR(X)
240 Y=(Y+X/Y)/4+X/(Y+X/Y)
250 Y=(Y+X/Y)/4+X/(Y+X/Y)
260 REM Z=SQR(T)
270 Z=Y*2/N
280 PRINT Z,Z*2
290 GOTO 80
```

Square roots

by Czes Kosniowski

```
10 REM *****
20 REM *SQUARE ROOTS*
30 REM * BY *
40 REM *CZES KOSNIOWSKI*
50 REM *****
60 REM * METHOD 2 *
70 REM *****
80 A=1232/4896:B=7/3-5*A:C=1-A-B
90 INPUT T
100 IF T=0 THEN 90
110 REM T=X*4/N WITH .25<=X<1
120 X=T/N*4
130 IF X<.25 THEN 160
140 IF X<1 THEN 190
150 N=N+1:X=X/4:GOTO 140
160 N=N-1:X=X*4
170 IF X<.25 THEN 160
180 REM FIRST APPROXIMATION TO SQR(X)
190 Y=X+X/X+X/X
200 REM NEXT APPROXIMATION TO SQR(X)
210 Y=(Y+X/Y)/4+X/(Y+X/Y)
220 Y=(Y+X/Y)/4+X/(Y+X/Y)
230 REM Z=SQR(T)
240 Z=Y*2/N
250 PRINT Z,Z*2
260 GOTO 90
```

Fog

by Ian Fletcher

```
1 POKE 16416,0
2 REM *****
3 REM *****
4 REM *****
10 PRINT TAB 7;"THE INVISIBLE
MAZE"
15 PRINT TAB 7;"*****
*****"
20 GOSUB 1000
25 FAST
30 LET J=INT (RND*20)+1
35 DIM A(20,20)
40 LET K=INT (RND*20)+1
45 LET X=10
50 LET Y=1
60 LET A$=""
70 FOR I=1 TO 100
80 LET C=INT (RND*20)+1
90 LET D=INT (RND*20)+1
100 LET A(C,D)=1
120 NEXT I
125 CLS
127 SLOW
130 FOR I=1 TO 20
140 PRINT "*****
*****"
```

```
150 NEXT I
152 FOR I=1 TO 60
154 PLOT I,3
156 NEXT I
158 PRINT AT 19,21;"TIME"
160 LET B=60
161 REM *****
162 REM *****
163 REM *****
170 LET B=B-.5
180 IF B<=0 THEN GOTO 300
183 UNPLOT B,3
185 LET H=INT (RND*270)+1
190 LET F=X
193 PRINT AT J,K;">"
194 LET O=J
195 LET L=INT (RND*4)+1
196 LET P=K
199 LET Z=0
200 LET G=Y
210 LET X=X+(INKEY$="6")+(X=0)-(X=20)-(INKEY$="7")
```


Open Forum

```

220 LET Y=Y-(INKEY$="5")+(INKEY
$="6")
225 IF H=47 THEN GOTO 400
230 IF Y>20 THEN GOTO 280
231 IF L<=3 THEN GOTO 240
232 IF J>X THEN LET J=J-1
233 IF J<X THEN LET J=J+1
235 IF K>Y THEN LET K=K-1
237 IF K<Y THEN LET K=K+1
239 LET Z=1
240 IF A(X,Y)=1 THEN GOTO 320
246 IF J=1 THEN LET J=2
247 IF J=20 THEN LET J=10
248 IF K=1 THEN LET K=2
249 IF K=20 THEN LET K=19
250 PRINT AT F,G;" "
255 IF Z=1 THEN PRINT AT P,Q;"
"
260 PRINT AT X,Y;A$
265 PRINT AT J,K;" "
266 IF J=X AND K=Y THEN GOTO 47
0
270 GOTO 170
271 REM *****
272 REM END OF GAME
273 REM *****
280 PRINT AT 21,1;"WELL DONE,YO
U ESCAPED IN ";INT (60-B)*2;"
MINUTES"
285 IF INT (60-B)*2<26 THEN GOT
O 600
290 GOTO 350
300 PRINT AT 21,1;"UNLUCKY,OUT
OF TIME."
310 GOTO 350
320 LET X=F
330 LET Y=G
340 GOTO 170
350 PRINT AT 22,10;"AGAIN ?"
360 IF INKEY$="" THEN GOTO 350
365 LET A$=INKEY$
370 IF A$="Y" THEN GOTO 22
380 IF A$<>"N" THEN GOTO 520
399 STOP
400 FOR I=1 TO 30
410 PRINT AT X,Y;" "
420 PRINT AT X,Y;" "
440 NEXT I
450 PRINT AT 21,1;"HIT MINE,YO
LOSE"
460 GOTO 350

```

```

470 FOR I=1 TO 75
480 FAST
485 SLOW
495 NEXT I
500 PRINT AT 21,1;"ZOMBIE GOT Y
OU,YOU LOSE"
510 GOTO 350
520 PRINT AT 22,10;" EH"
530 FOR F=1 TO 50
540 NEXT F
550 GOTO 350
600 PRINT AT 22,1;"EXCELLENT TH
AT IS A BEST SCORE"
610 FOR A=1 TO 30
620 NEXT A
630 PRINT AT 22,1;"
"
640 GOTO 350
999 STOP
1000 REM *****
1001 REM INSTRUCTIONS
1002 REM *****
1005 LET A$="IN THIS GAME YOU AR
E IN A MAZE WHICH IS FULL OF FO
3 30 YOU CANTSEE WHERE YOU ARE G
OING,YOU HAVETO GET OUT,THE EXIT
IS ALONG ALLTHE FAR SIDE,YOU MU
ST GET OUT BEFORE YOU RUN OUT
OF TIME,THEREIS A ZOMBIE WHO IS
OUT TO GET YOU ,HE CAN BE SEEN
FLASHING, MOVES SLOWLY AND CA
N GO THROUGH WALLS, BEWARE OF TH
E FEW MINES,
OUR MOVEMENT KEYS ARE: - 8....
....FORWARD 7....
....UP 6....
....DOWN 5....
....BACKWARDS"
1010 FOR I=1 TO LEN A$
1020 PRINT A$(I);
1030 NEXT I
1035 PRINT AT 20,8;"PRESS ANY KE
Y"
1040 IF INKEY$="" THEN GOTO 1040
1050 RETURN
2000 REM *****
2001 REM START GAME
2002 REM *****
2004 LET A$="MAZE"
2005 SAVE A$
2010 GOTO 1

```



**Available at
your
newsagent -
NOW**

POPULAR Computing WEEKLY

HOBHOUSE COURT, 19 WHITCOMB STREET WC2

Every week for 30p

Competitions

To tease and squeeze the best out of your rapidly developing computer brain.

Programming

To help you build your knowledge of sophisticated techniques. Step by step the secrets of the pros will be unfolded.

Clubs

What's happening inside Britain's mushrooming micro club world. Interviews and profiles of the new computing breed.

News

A really fast up-to-the-minute analysis of all that's going on

in the expanding world of micro technology.

Reviews

A panel of experts assess the latest products both soft and hard as and when they become available.

Programs

Readers' own programs published each week with prizes for the best entries.

Questions

Answered by an expert who knows ... In short, it's a package you can't afford to be without. Make sure, place an order with your newsagent.



Programming

Knowing where the next byte is coming from

Stephen Devine explains how to squeeze programs into 1K by memory-saving techniques

ZX81 owners are often disappointed by the lack of memory on the basic machine. They often find themselves with programs which are just too long to fit within the available 1K. However, by using various memory saving techniques, it is often possible to sufficiently shorten these programs so that they can be run in 1K.

Since the method of storing floating point numbers on the ZX81 uses six bytes for each number, considerable savings in memory can be obtained by replacing all of the numbers in a program (except the line numbers) by equivalent symbols. If the numbers 0 and 1 are replaced by NOT PI and SGN PI respectively then four bytes are saved each time.

For larger single- or double-digit numbers the VAL function can be used. For example, VAL"4" saves two bytes since the digit 4 is stored as a string and not as a floating point number.

The CODE function can be used for even larger numbers, provided that there is a symbol in the character set which corresponds to the number to be replaced. For example, CODE "IF" will replace the number 250.

If the same number is used repeatedly throughout a program, then it may be worthwhile assigning that number to a variable at the start of the program and using the variable each time the number is required. If the number 500 appears repeatedly in a program then it could first be assigned to a variable by, say, LET N = 500. Then statements such as LET X = X + 500 could be replaced by LET X = X + N saving five bytes each time.

Replacing all the literal numbers in a program will often save enough memory to enable the program to be run successfully but, if not, there are some further techniques which can be applied.

One method of saving memory is to reduce the memory requirements of conditional statements. For example, a statement of the form: IF A = X THEN LET P = P + 1 can be replaced by LET P = P + (A=X)

with a saving of six bytes. Much used statements in arcade type games are those using the INKEY function such as:
10 IF INKEY\$ = "8" THEN LET X = X + 1
20 IF INKEY\$ = "5" THEN LET X = X - 1

which might be used to move an object

back and forth across the screen. These can be replaced by the single statement:

```
10 LET X = X + (INKEY$="8") - (INKEY$="5")
```

saving 20 bytes each time. If the variable is to be incremented or decremented by more than one then the parentheses can be multiplied by the required number, for example:

```
10 IF INKEY$="6" THEN LET Y = Y + 2  
20 IF INKEY$="7" THEN LET Y = Y - 2
```

can be replaced by:

```
10 LET Y = Y + VAL"2" *  
  ((INKEY$="6") - (INKEY$="7"))
```

saving thirteen bytes.

Many PRINT statements can also be modified to consume less memory. For example, when printing instructions many words can often be replaced by single byte keywords.

Single stroke keywords

Take the statement PRINT "ENTER YOUR NAME". This can be replaced by the equivalent PRINT "INPUT YOUR NAME" where INPUT is entered as a single-stroke keyword. This saves six bytes, since the spaces before and after the word INPUT are free. Many more keywords such as IF, OR, TO, AND, THEN and others can also be used in this way. However, to enable certain words to be entered, it may be necessary to first enter THEN and edit it out afterwards.

When a text of concurrent lines is to be printed, such as:

```
10 PRINT "....."  
20 PRINT "....."  
30 PRINT "....."
```

it can be replaced by:

```
10 PRINT "....."  
"....."  
"....."
```

which, in this case, saves six bytes.

It should also be remembered that GOTO's and GOSUB's need not be assigned a literal numerical value, such as GOTO 100, but can be used with functions. For example the routine:

```
10 IF X = 1 THEN GOTO 100  
20 IF X = 2 THEN GOTO 200  
30 IF X = 3 THEN GOTO 300
```

can be replaced by the single statement:

```
10 GOTO 100 * X
```

saving a massive 40 bytes.

By using some, or all, of the techniques outlined above and by experimenting with others you should find that there are few short programs which cannot be squeezed into 1K. Even some larger ones, which would normally use up to 2K of memory, can be effectively halved and run in 1K.

If a 16K RAM pack is added to the basic machine, the conservative use of memory should not be neglected. It makes for very efficient programming and, even with 16K of memory, there will still be some programs which are just that little bit too long.

There are more ways to find extra bytes than the addition of a RAM pack.



Spectrum

In this new slot various contributors explore different aspects of the ZX Spectrum.

Making these graph-ics is easy as pie!

Nick Hampshire explains how to put different shapes into your circles

Line 10 Location of centre of disc on screen.
Line 20 Radius of disc.
Line 30 Increment of radius between circles.

The simple way to draw a disc is to use the CIRCLE command in a program loop. This varies the radius from the centre of the disc to the outside perimeter, thereby drawing a set of concentric circles. The distance between each concentric circle can be varied by changing the step value in the radius increment loop.

This method will accurately draw a high resolution disc on the screen, but it has two drawbacks: (a) the spacing between the dots in each concentric circle cannot be varied, and (b) it is impossible to draw a segment of a disc.

These drawbacks are overcome by the following program:



40 disc centre co-ordinates.
50 radius.
60 spacing between circles.
65 spacing between dots in a circle.

In this program lines 70 to 100 draw a circle on the screen at centre co-ordinates x0, y0, of a radius ra and with a spacing between the dots of dp degrees. It should be noted that line 70 converts the degree angle dot increment into radians.

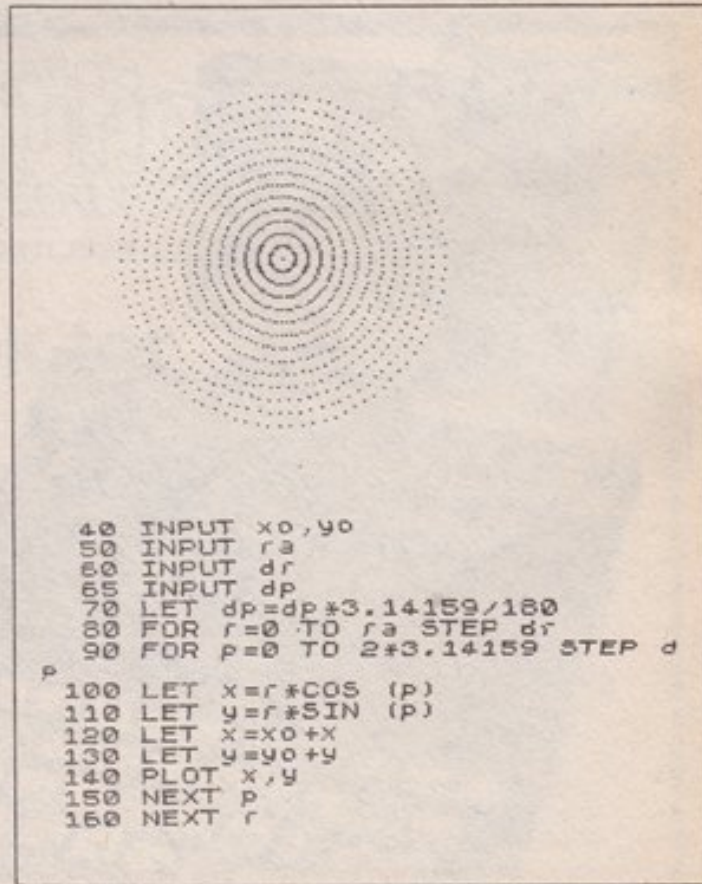
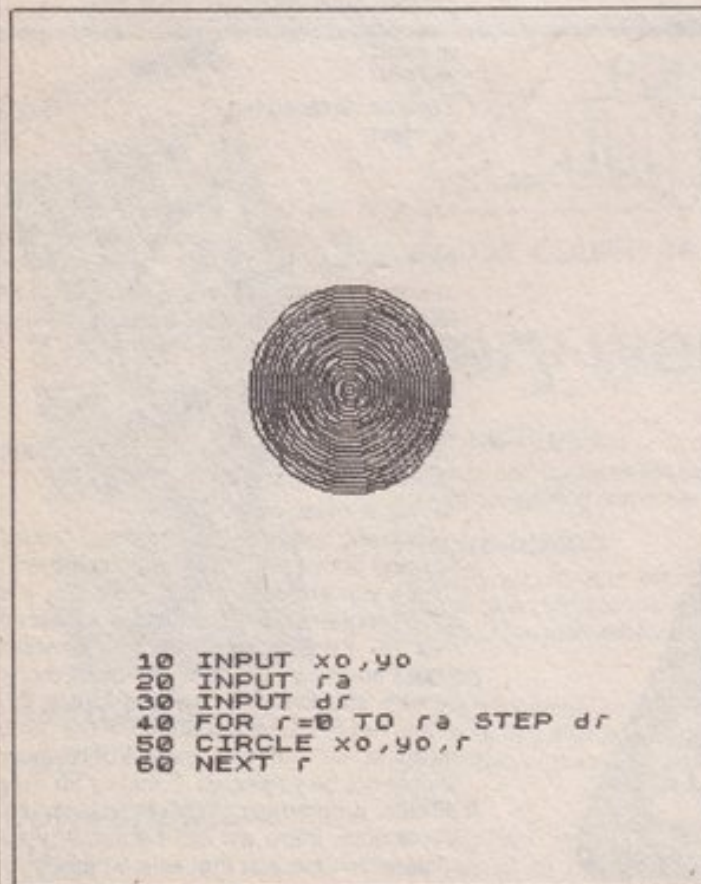
55 beginning angle of segment.
56 end angle of segment.

A variation of the previous program can be used to draw this segment of a disc. This requires two new parameters — the beginning angle of the segment and the end angle.



By using a combination of different segments, each with different dot densities, you can draw pie charts — a useful way of graphically representing data. The following program draws such a chart:

10 set centre to screen co-ordinates x0=100, y0=100.
12 set radius of full disc to 40.
14-58 the data used for each segment. This is in the following form — p1=start angle, p2=end angle (these determine the segment or wedge size). D2 and dp determine the dot spacing and therefore the density of the wedge.
70-160 the sub-routines to draw a disc segment.



Hand & mouth



Down to the bare essentials

A friend of mine recently received a clever little badge proclaiming "RPN OK RULES". Now, we all know that RPN — or Reverse Polish Notation — stands for the system of calculation in Hewlett Packard calculators and that everybody argues as to whether it is far better or far worse than the "Algebraic Logic" systems of other machines. Have you ever wondered about the derivation of this odd term?

Well, the connection with Poland comes from a man by the name of Jan Lukasiewicz, who was born in the Polish city of Lwów in 1878. He was a logician and mathematician, as well as an admired and articulate teacher, who eventually died in exile in Dublin in 1956. He arrived, at an early stage, at the conception of calculat-



ing the truth value of a logical statement — True, False or Don't Know — which is now seen in the Boolean Logic tables familiar to computing buffs.

His attempts to strip things down to only the bare essentials were highlighted in his "Polish Notation". This notation simplifies the evaluation of arithmetic expressions by eliminating parentheses and all punctuation.

Hewlett Packard have modified this by

specifying the operation to be performed after the entry of variables, as opposed to before as on the 'Polish' system. Hence 'Reverse Polish Notation'.

Lukasiewicz was no mean writer, too, so I'll leave the last words to him: "Just as art grew out of the craving for beauty, science was created by the urge for knowledge. The saying 'art for art's sake' and 'science for science's sake' are equally valid."

John Gowrie



Make macro moves on your micro

If you are writing a long program in assembly language you will find inevitably that some sections of the program are repeated more than once.

A macro assembler is simply a program with all the assembler features I have described in previous articles and the additional facility of assigning a name to a group of commands. For example, you could write a "macro" to set two zero page locations to a particular address:

```
MACRO1 LDA $S00
        STA REFERENCE,X
        LDA $S00
        STA REFERENCE,X
```

Whenever you want to use those instructions you simply insert the instruction

MACRO1 into your source code listing:

```
START LDX $1
        MACRO1
        LDX $3
        MACRO1
        LDX $10
        MACRO1
```

When you assemble the program the machine code instruction defined by the macro source code list will be inserted in the right place, with all the relative jumps worked out automatically.

A simpler version of the same idea is a facility to copy a block of source code lines from one place to another. In this case you will see all the instructions in the source code listing before it is assembled.

A macro assembler may seem much like using a call to a subroutine. This is not the case. A macro is an assembly time facility while a subroutine is an execution time function. Using a macro command to insert object code uses more memory than calling a subroutine but produces machine code that will run faster.

The Jump to SubRoutine (JSR) and ReTurn from SubRoutine (RTS) instructions each take 6 microseconds in a system using a 1MHz clock. If you have saved the CPU registers at the beginning of the SR and restored them at the end that will add a further 36 microseconds. By

contrast, a macro command uses as much RAM as the component instructions demand on each occasion, while a call to a subroutine only takes three bytes.

The time penalty imposed by subroutine calls can give you a measure of the efficiency of the program. Suppose you wrote a subroutine to double the contents of a zero page location:

- | | | |
|---|-----------|---------------------------------|
| 1 | PHP | Push CPU status |
| 2 | PHA | Push the accumulator |
| 3 | LDA WHEAT | Load the accumulator with WHEAT |
| 4 | ASLA | Shift the accumulator left |
| 5 | STA WHEAT | Store result in WHEAT |
| 6 | PLA | Pull the accumulator |
| 7 | PLP | Restore the CPU status |
| 8 | RTS | |

You can see that three instructions (lines 3,4,5) carry out the function of the SR and the others would not be present in a macro command.

The percentage inefficiency is calculated thus:

$$\% \text{ Inefficiency} = \frac{\text{Total} - \text{Body}}{\text{Body}} \times 100$$

If you add up the microseconds for each instruction in the program above, you get the result:

$$\frac{28 - 8}{8} \times 100 = 250\% \text{ inefficient}$$

John Dawson

Sound & vision



Stringalonga maximum trickery!

The three routines listed will enable you to manipulate a string array containing a full screen image of 704 bytes. First of all, however, you need to put your string together. This can be done as follows. First, set RAMTOP with the following three commands:

```
POKE 16388,0
POKE 16389,125
NEW
```

Now LOAD any program which produces an interesting screen image. Then add the following subroutine to that program. I have numbered the subroutine to start at 9000, but you can use any convenient numbers.

```
9000 LET Q=1+PEEK 16396+256*PEEK 16397
9010 FOR I=0 TO 703
9020 POKE 32000+I,PEEK (Q+I+INT (I/32))
9030 NEXT I
9039 RETURN
```

You will also need to add some method of calling that subroutine when a suitable image is displayed on the screen. RUN the program and, when you have a good image, call the subroutine. When it has run

its course, STOP the program and clear it by pressing NEW. Provided you do not turn off the power, the image will remain in store over RAMTOP.

The next step is to call this image into a literal string:

```
10 LET AS=""
20 FOR I=32000 TO 32703
30 LET AS=AS+CHR$ PEEK I
40 NEXT I
50 PRINT AS
```

RUN this program and the image will be displayed. From now on, it is important not to use CLEAR or RUN, as these will lose AS. Press newline, and write the following program over the existing one (Note that the contents of XS must be the graphics characters represented on the keys in line 20):

About Turn

```
10 PRINT AS
20 LET
  XS="123456789QWERTYAH214385WQREYTHA"
30 LET ZS=""
40 LET I=PEEK 16396+256*PEEK 16397+1
50 LET I=I TO 694 STEP 33
60 FOR J=I+31 TO I STEP -1
70 LET X=PEEK J
80 IF X>0 AND X<9 AND X<>3 OR X>128 AND
  X<137 AND X<>131 THEN GOSUB 150
90 LET ZS=ZS+CHR$ X
100 NEXT J
110 NEXT I
120 CLS
130 PRINT ZS
140 STOP
150 FOR K=15 TO 28
160 IF X=CODE XS(K) THEN GOTO 180
170 NEXT K
180 LET X=CODE XS(K-14)
190 RETURN
```

To operate this program, use GOTO 1. The screen image will be printed as before, but with one important difference — it has been reversed left to right.

The key to the system is the string set up in line 20. This ensures that those charac-

ters which are asymmetrical (apart from letters and numbers) are reversed, to preserve the integrity of the image. Any words or numbers will be reproduced backwards.

A similar device is used in the next routine, which has the effect of turning the image through 180 degrees. This routine is exactly the same as About Turn, except for the following lines which should be altered. As with About Turn, the numbers and letters in the string in line 20 represent the graphics characters which are to be found on those keys. Again, do not RUN the program, but GOTO 1:

Tricky Turnover

```
20 LET XS="123456789QWERSDFG34128765
  ERQWDSGF"
40 LET I=PEEK 16396+256*PEEK 16397-694
50 FOR I=I TO I-694 STEP -33
60 IF X>0 AND X<11 AND X<>6 AND X<>8 OR
  X>128 AND X<139 AND X<>134 AND
  X<>136 THEN GOSUB 150
150 FOR K=17 TO 32
180 LET X=CODE XS(K-16)
```

This routine produces a straightforward reversal top to bottom. It is the same as Tricky Turnover except for the following lines. The characters in the string in line 20 represent the graphics characters found on those keys:

Upside Downside

```
20 LET XS="123467QWERTYASDFGH432176
  REWQYTHDSGFA"
60 FOR J=I TO I+31
80 IF X>0 AND X<11 AND X<>5 AND X<>8 OR
  X>128 AND X<139 AND X<>133 AND
  X<>136 THEN GOSUB 150
150 FOR K=19 TO 36
180 LET X=CODE XS(K-18)
```

The same rules apply as for the other routines, ie: GOTO 1, not RUN in all cases. The second image is transferred into ZS, which is a literal string 704 bytes long (ie: LEN ZS=704). **Nick Godwin**

Being backwards in coming forward

This week, two programs using the important pair of commands on the BBC Micro known as VDU5 and VDU4.

Briefly, VDU5 causes the text cursor to be positioned exactly (not just to the nearest print position) in the same place as the graphics cursor. So you can plot text, even in colour, anywhere on the screen.

VDU5 switches this effect on, VDU4 switches it off again.

The following programs both generate lissajous, curves on the screen. But they use words, not lines.

Two psychologically unsettling effects are used: one where the names of colours are written in another coloured text, the other using the words FORWARD and BACK to flash back and forth on the

```
100 REM DRIVENAD B.R.SMITH 1282
110 DIM C$(2)
120 FOR I=1 TO 2:READ C$(I):NEXT I
130 DATA FORWARD,BACK
140 HIGH=478:WIDE=530:REM (to leave room for text)
150 IF HIGH<478 THEN HIGH=478:IF WIDE<530 THEN WIDE=530
160 REM (i.e. model = or b)
170 P=0:MODE=0
180 VDU19,1,11,0,0,0:VDU19,2,12,0,0,0
190 FOR I=0 TO 9999 STEP .01
200 X=WIDE*SIN(P*(I+WIDE))
210 Y=HIGH*COS(P*(I+HIGH))
220 MODE=X/Y
230 SOUND1, -(X/78),Y/4,1
240 COL3,RND(2)
250 VDU5
260 PRINT C$(RND(2))
270 VDU4
280 NEXT I
```

screen, not always doing what they say.

Finally, note that VDU19,N,C,0,0,0 is used to change colour number N to actual colour number C — for instance, you can

```
100 REM LISSAJOUS/TEXT B.R.SMITH 1902
110 DIM C$(3)
120 FOR I=1 TO 3:READ C$(I):NEXT I
130 DATA RED,GREEN,BLUE
140 HIGH=478:WIDE=530:REM (to leave room for text)
150 IF HIGH<478 THEN HIGH=478:IF WIDE<530 THEN WIDE=530
160 REM (i.e. model = or b)
170 P=0:MODE=0
180 VDU19,1,11,0,0,0:VDU19,2,12,0,0,0
190 FOR J=1 TO 3:VDU19,J,RND(15),0,0,0
200 X=WIDE*SIN(P*(I+WIDE))
210 Y=HIGH*COS(P*(I+HIGH))
220 MODE=X/Y
230 SOUND1, -(X/78),Y/4,1
240 COL3,RND(2)
250 VDU5
260 PRINT C$(RND(3))
270 VDU4
280 NEXT I
```

make colour 1 (normally red) become blue. The three zeroes are there for other purposes, and should always be left like that. **Brian Reffin Smith**

Peek & poke

Peek your problems to our address. Ian Beardsmore will poke back an answer.

DON'T GIVE UP ON DEAR OLD AUNTY

R. Bass of Beech Road, Northwich, Cheshire, writes:

Q I recently received a BBC microcomputer. After trying the test Mr Reffin Smith gave in his article in your April 23 issue, I found that I have a BBC micro with the older operating system. Mr Smith said, '... doubtless all will be put right', but what do owners of such machines need to do?

Also the *FX function is inadequately defined, and apparently is not going to be put in the guide. Where can I find out about its uses? Even Peek & poke just give 'bad command'.

Lastly, when can we expect the impatiently-awaited full guide.

A BBC micro owners need to resist the temptation to give up in despair. The full guide should cover all the points you raise in more detail than I can here.

A lot of pressure has been put on the BBC, and it now seems likely that the full guide will be ready for dispatch on June 10. I am afraid that I cannot offer you much more until the guide arrives.

JUST MAKE A NEW GEAR RESOLUTION

A. D. Hoadley of Haslet Avenue, Crawley, Sussex, writes:

Q In your review of the ZX Spectrum in the May 6 edition you said '... screen resolution of 32 x 24 is adequate ... although this can be enlarged under software control to normal teletext standard.'

Please could you explain what this means. What software? When is it available? Does it mean that adequate resolution is made sharper by this process?

A Teletext standard is 40 characters per line as opposed to the 32 which the spectrum will use normally. As for the software mentioned no

one is as yet quite sure what is meant by that.

There is an architecture within the ROM for maintaining a teletext compatible 40 x 24 screen display. But, strictly speaking, that is firmware. The teletext adaptor is, of course, hardware.

So far we can only hazard one of two guesses. Either the PR boys who have been telling everyone about this software have in fact confused their terms, or the teletext architecture will be accessed by an, as yet, unrevealed machine code routine. On reflection, I think that I marginally favour the first option.

As for making the resolution sharper, I doubt it. With the extra characters per line, you are trying to get more, not less, into the same space. Nevertheless, indications are that the screen resolution will still be sufficiently good enough for this not to cause any problems.

THERE'S LIFE IN THE OLD DOG YET

David Paine of Victoria Road, Pembroke Dock, Dyfed, writes:

Q As an avid fan of the ZX81 I am very interested in its long life on the computer market. But, after reading your review of the ZX Spectrum, I am not sure whether the ZX81 will still be made after the Spectrum becomes available. Please could you tell me what will happen to the ZX81?

A To date, approximately four hundred thousand ZX81s have been made. A few months ago Clive Sinclair signed a much publicised deal with the giant American company, Timex, to make ZX81s under licence. Conservative estimates maintain that, as a result of this deal, the ZX81 will become the world's first million selling computer by the end of the year.

In this country, even if half the ZX users decide to change, it will take quite a few months for the new machines to be dispatched. Many of the

ZX81s will probably be sold second hand to first-time users, who quite naturally will be interested in ZX81 material.

So, while this country will probably be the first to see the phasing out of the ZX81, there are just too many machines in use for this to be a quick process. I am sure that the ZX81 will enjoy considerable support for some time yet.

AND THE MEMORIES STILL LINGER ON

John Bender of Felton Close, Orpington, Kent, writes:

Q I have a ZX81 with a 16K RAM pack and have written quite a long program. I know it is too long for the standard 1K machine, but how can I find out how much actual memory it has taken?

A The program file starts at the address 16509. The last address of the program file is called D-FILE, which is located at addresses 16396 and 16397. The difference between 16509 and the address in D-FILE is the number of bytes in a program. If you enter as a direct command:

PRINT PEEK 16396+256• PEEK 16397-16509

you will get the amount of bytes in your program. If you enter:

PRINT PEEK 16464+256• PEEK 16405-16384

you will get the number of bytes occupied by the program, all the variables and the screen. The following commands:

PRINT PEEK 16386- PEEK 16412+256•

(PEEK 16387-PEEK 16413)-50

will give you an idea of how many bytes you have left in which to work at a particular time.

IT'S ALL A QUESTION OF COMPATIBILITY

Alasdair Crawford of Murray Drive, Stonehouse, Scotland, writes:

Q I have a BBC micro-computer model A. Having read your review of the ZX Spectrum, I am still convinced that the BBC is the

best machine yet available. But I am very interested in the £50 ZX Microdrive. Can you please tell me if it would be possible to connect the Microdrive to the BBC Micro-computer?

A There is a general feeling that if the ZX Microdrive meets the quoted specifications, then it will be of far greater importance to the world of computing than the Spectrum. After all, it does seem to be something of a storage revolution.

It must, however, be borne in mind that the Microdrive has only been seen once in public, and that very briefly at the launching of the ZX Spectrum. To my knowledge, no one has had so much as a close look at it, yet let alone a chance to do a thorough benchtest to analyse its full potential.

While it is due to be launched about August, Sinclair Research and launch dates do not always coincide. So, I do not think it will be readily available until the autumn at least.

Given that the ZX printer can now be interfaced with other computers, I am sure that the Microdrive will also breed a host of compatible interfaces. Even if an interface costs £100, which I doubt, I am sure that it would sell.

A quick comparison with the New Vic disc drive will illustrate just how important this microdrive could be. With an interface costing £100, you would still get more storage with a Microdrive for almost £200 less than the Vic disc drive.

If the microdrive is not bugged, and that must still be quite a big if, then a race will be on to make it compatible with other computers. But this is several months in the future. Perhaps an early letter to Father Christmas might not come amiss.

Send your questions to Peek & poke, Popular Computing Weekly, Hobhouse Court, 19 Whitcomb Street, London WC2 7HF.

Competitions

Puzzle No 10

Young David was playing with his pocket calculator the other day, when he discovered that if he multiplied 21 by 87 the answer, 1827, consisted of the same four digits, though differently arranged.

This set him thinking of how many other similar examples were possible, each having this property.

How many other sets of numbers are there?

Remember that each set must consist of two two-digit numbers which, when multiplied together produce a four-digit number formed from the same numbers. In each case, all four digits should be different.

Solution to Puzzle No 6

The simplest way of solving this problem is to generate the values for INCH in sequence, using four FOR/NEXT loops. The process is simplified if we realise that the value of INCH must be greater than the square root of 10000000 (the smallest product with at least eight digits). We can therefore commence the 'I' loop at the value 3. To put into the program extra lines to further define the minimum value of INCH as 3162 would probably be more involved than letting the program run from the starting value of 3000. The only point to be borne in mind is that these first few seven-digit numbers could cause an error condition in line 90 if the substring was defined as (5 TO 8). Consequently I have used the form (5 TO) which will permit both seven and eight digit numbers to be divided without error. Users of other forms of Basic will need to make their own adjustments.

H can only be equal to either 0, 1, 5, or 6 so lines 40 to 60 correct this.

10 FOR I = 3 TO 9

20 FOR N = 0 TO 9

```
30 FOR C = 0 TO 9
40 FOR H = 0 TO 9
50 IF H = 3 THEN LET H = 5
60 IF H = 7 THEN NEXT C
70 LET INCH = I * 1000 + N * 100 + C * 10 + H
80 LET P$ = STR$(INCH * INCH)
90 IF VAL P$(5 TO) = INCH THEN PRINT INCH
100 NEXT H
110 NEXT C
120 NEXT N
130 NEXT I
```

Answer: INCH = 9376

Winner of Puzzle No 6

The winner is: Ian Black, Great Wymondley, Hitchin, Herts, who receives £10.

Solution to Crossword No 6

Across: 8 Aha 9 Statement 10 Detritus 11 Loop 13 Memory 14 Length 17 Goto 18 Tangents 20 Dimension 21 Val.

Down: 1 Random 2 Waste my time 3 Ostiary 4 Value 5 Len 6 Men of Geneva 7 Stop 12 Reagent 15 Hustle 16 Basic 17 Gods 19 Int.

Winner of Crossword No 6

The winner is: B. Tunks, Chingford Hatch, London, who receives £10.

Rules

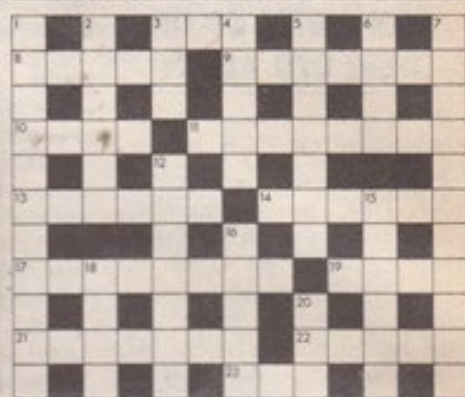
The winner of the puzzle will be the reader who, in the opinion of *Popular Computing Weekly*, has submitted the best solution. Preference will be shown to submissions which show how the entrant arrived at the correct answer, and to entries that indicate, in any way, how a micro might be applied.

The winner of the crossword will simply be the first name out of the hat.

The closing date for both the puzzle and the crossword is Monday, July 5.

Please mark your envelopes clearly with either CROSSWORD or PUZZLE.

Crossword No 10



ACROSS

- 3 Chip starts examination of freezing water (3)
- 8 Rots a minced joint (5)
- 9 Spirited chip add-on (7)
- 10 Pleasant place to give directions to a chip (4)
- 11 A 'uge loan arrangement that's not digital (8)
- 13 Concealed one and tuppence in fowl (6)
- 14 Pain reliever has principle ingredient (6)
- 17 Fairy tale for a dead empire and first true chip (8)
- 19 Return mount for a wager (4)
- 21 Forgave and left with permission (7)
- 22 Slopes that start regulating current (5)
- 23 Total chip removed from music and returned (3)

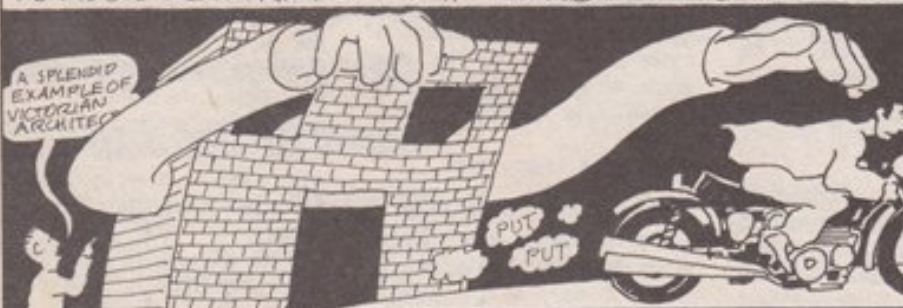
DOWN

- 1 Chips for Gallic cooks (11)
- 2 Gone off and managed detectives (6)
- 3 Articles that sit about (3)
- 4 Not odd — true happening (5)
- 5 Any salt confused the investigator (7)
- 6 Open-mouthed, go up under a good leader (4)
- 7 Without a care for worthless, effortless combination (4, 3, 4)
- 12 Seven ways to find freshness (7)
- 15 Men are changed into new identity (6)
- 16 Turns and blows! (5)
- 18 Chip in, me rodents! (4)
- 20 Supply weapons for a member (3)

CITIZEN PAIN

BY DAVID IRELAND and JAMES MACDONALD

HOW HAD CITIZEN PAIN ESCAPED THE HORRIBLE JOB CENTRES?...



HE WAS PAID 10 GROATS A WEEK

* NOT VERY MUCH

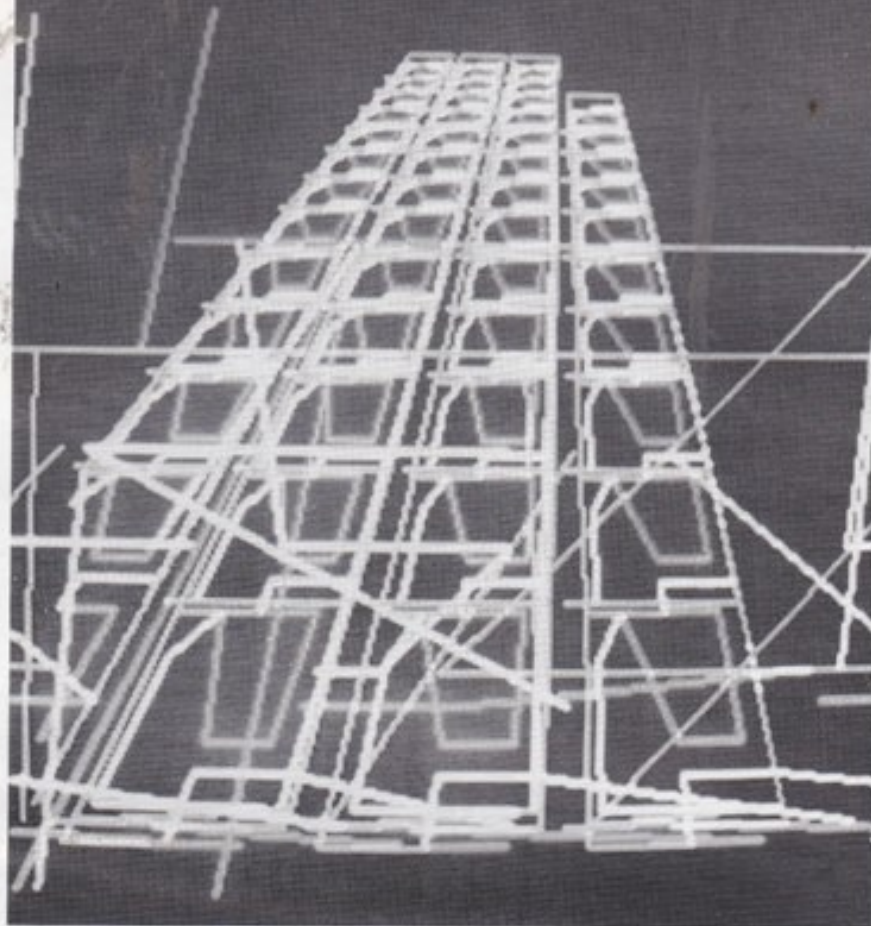


ON A GOVERNMENT TRAINING SCHEME....

commodore

COMPUTING

April/May 1982 £1.25



An exciting new Commodore peripheral

Own or use a Pet or a Vic?
Fed up with being ignored by all the traditional monthly magazines?
Fed up with listings, which are too simple or simply do not work?

You need *Commodore Computing*, the new monthly magazine. *Commodore Computing* is published by Nick Hampshire, author of *The Pet Revealed*, *Pet Graphics*, *A Library Subroutines* and *The Vic Revealed*.

Each issue is packed with advanced

advice on how to make the most of your computer, whether you use a Pet or a Vic.

Each issue covers a host of applications – software, hardware, machine code, games, business use – whatever it is you'll find it in *Commodore Computing*.

If you want to learn more about your computer, take out a subscription to *Commodore Computing*.

That's the only way to get it, and get it straight.

Send £12.50 for 1 year's subscription (10 issues) to:

Commodore Computing,
Magsub, Oakfield House, Perry Mount Road, Haywards Heath, Sussex RH16 3DH

Bunnet.

ANGLO AMERICAN SOFTWARE CO.

SOFTWARE SPECIALISTS

Starfleet Orion	PET 8K TRS-80 Level II 16K TRS-80 32K w/disk	£19.50
Invasion Orion	APPLE Integer BASIC 16K APPLE Integer BASIC w/disk 48K TRS-80 Level II 16K — ATARI 32K TRS-80 32K — APPLE 48K w/disk ATARI 32K w/disk	£19.50
Temple of Apshai	TRS-80 Level II 16K TRS-80 32K — APPLE 48K w/disk ATARI 32K ATARI 32K w/disk IBM 64K w/disk	£23.50
Hellfire Warrior	TRS-80 Level II 16K TRS-80 32K — APPLE 48K w/disk	£23.50
Upper Reaches of Apshai	TRS-80 Level II 16K TRS-80 32K — APPLE 48K w/disk	£15.50
The Keys of Acheron	TRS-80 Level II 16K TRS-80 32K — APPLE 48K w/disk	£15.50
Curse of Ra	TRS-80 32K — APPLE 48K w/disk TRS-80 Level II 16K 24K PET w/disk TRS-80 32K APPLE 48K w/disk	£15.50 £32.00
Introductory 3-Pack 3-Pack: Morloc's Tower, Rescue at Rigel and Datesones of Ryn	TRS-80 Level II 16K — ATARI 32K TRS-80 32K — APPLE 48K w/disk ATARI 32K 2/disk	£15.50
Datestones of Ryn	PET 24K TRS-80 Level II 16K TRS-80 32K — APPLE 48K w/disk APPLE 32K	£15.50
Morloc's Tower	32K PET APPLE 48K w/disk	£19.50
Dragon's Eye	TRS-80 Level II 16K TRS-80 32K — APPLE 48K w/disk	£21.50
Sorcerer of Siva	TRS-80 Level II 16K — ATARI 32K TRS-80 32K — APPLE 48K w/disk ATARI 32K w/disk	£21.50
Rescue at Rigel	TRS-80 Level II 16K — ATARI 32K TRS-80 32K — APPLE 48K w/disk ATARI 32K w/disk	£23.50
Star Warrior	TRS-80 Level II 16K — ATARI 32K TRS-80 32K — APPLE 48K w/disk ATARI 32K w/disk	£21.50
Crush, Crumble and Chomp!	TRS-80 32K — APPLE 48K w/disk ATARI 32K w/disk	£21.50
Tuesday Morning Quarterback	TRS-80 48K — APPLE 48K w/disk ATARI 16K — TRS-80 Level II 16K TRS-80 32K — APPLE 48K w/disk ATARI 32K w/disk	£19.95
Richochet	TRS-80 32K — APPLE 48K w/disk IBM 64K w/disk	£21.50
Jabbertalky		

SEND 75p FOR FULL CATALOGUE
(Refundable against purchase)
DEALER ENQUIRIES WELCOME

ANGLO AMERICAN SOFTWARE

138a Stratford Road, Sparkhill
Birmingham B11 1AG 021-771 2995/2736

ALL PRICES INCLUDE VAT & POSTAGE
24 Hour answering service
on 021-771 2995 for Access orders.



PLEASE SUPPLY

I enclose a cheque/PO for £..... made payable to
ANGLO AMERICAN or debit my

Access and number

Signature

NAME

ADDRESS