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PAINT PLUS "The new star to watch for with a utility program" (GZ Computing) "If you've been looking for a Spectrum graphics aid, this seems like one of the best." (PopCompMag) The reviews refer to the original PRINTICE. The review has 24 new commands and an 80-page colour manual. MICROSOFT and GRAFAP Developer. LDG Editor, Drawing Board, March, 2nd, Precision Plotter and Screen Painter. AMAZING DEMO on Equate. The very best Spectrum graphics kit. STICKS Kempton/Carner. (Buyer) CASSETTE £8.95

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SUPERCODE 3 "This amazing collection brings the speed of access within the reach of any programmer familiar with BASIC." (PopCompMag) "An excellent collection of routines and utilities that no serious user should be without." (CT & S) Special software techniques available as you wish. 120 Machine-code routines. Helpful instruction manual. The ultimate Spectrum BASIC, 100% re-entrant. On-screen training. If you're writing in BASIC or NAT, you need the fast NO STICKS. (GZ Software) CASSETTE £12.95

TECHNICIAN TED "Some of the best, most detailed and imaginative graphics I've seen . . . it must be a great joy to use this collection. Truly amazing, truly detailed, truly wonderful!" (GZ) "I can't say the same teacher that made ITBUTWELL so clever and professional. Perfect collision detection, very carefully constructed screens, nicely designed sprites." (PopCompMag) 56 KBYTES. Save issues. Includes manual. It's got everything! STICKS Kempton/Interface/Carner. (Buyer) CASSETTE £8.95

MINI OFFICE "GREAT EXCEPTIONAL VALUE" - the best affordable program ever. I have seen . . . I strongly recommend it to those who are looking for a program in this type, all working with (PC) compatible printers. MICROSOFT (MAG) / DATABASE / SPREADSHEET / GRAPHICS. An amazing collection at an unbelievable price, no wonder we've sold so many! (Database) CASSETTE £8.95

GYRON "There is little to rival it in the entire world of Spectrum programs . . . totally original, compulsive" (PopCompMag) "An amazing program which requires equal arcade progress, a great deal of thought and should provide hours of satisfying distraction . . . the graphics are breathtaking." (GZ) "A brilliant game combining strategy and arcade action . . . a game in which tactics and logic count, there's a class of its own." (Nimbus) "GIVE HIM YOURSELF A POUND'S WORTH!" If you solve Gyrin before 27/08/85, then may have to be a (re-bank) competition. 1 single and leader games on different sites of the type. 12 levels. All STICKS. (Buyer) CASSETTE £9.95

SHADOWFIRE "Graphically superb and shines very convincingly . . . it's going to be a game in a month far more months." (PopCompMag) "THE WORLD'S BEST ICON-DRIVEN ADVENTURE. Makes your Spectrum seem a little like a Macintosh." The best yet from the "Shadow" company. Fascinating graphic adventure without words as you organize the (big) items. 3 different missions. Stunning graphics. 28-page full-colour manual. You have 30 minutes to solve! DEMO. HELP. STICKS Kempton/Interface/Carner. (Buyer) CASSETTE £8.95

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ASP FIGHTS SOFTWARE PIRACY

Much has been said and written in condemnation of software piracy but few have taken a positive stand against it. ASP is among those few that have taken action to help curb the grave problem of home copying of commercial software.

ASP has already taken steps to eliminate shortcomings in our magazines which relate to tape duplication for piracy purposes. While it is appreciated that individuals may take 'back-up' copies of their own programs, it should be noted that it is ILLEGAL to copy commercially available software for other than personal use.

Software piracy is costing the software industry huge sums of money which is detrimental to the future development of the industry. It is in everybody's interests to drastically reduce the level of software piracy primarily because firms need funds raised from software sales to plough back into research and development of new products. This means that the standard of software products can only improve.

ASP hopes our action will help combat this serious problem in order to maintain and improve the high standards of the UK software industry. We are asking you to do the same by refraining from duplicating or copying commercially available software for anything other than personal use.

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ZX Computing is exclusively on the look out for well written articles and programs. If you think that your efforts merit our standards, please feel free to submit your work to us for consideration for publication.

All submitted material should be typed if possible. Handwritten work will be accepted but please use good readable handwriting. Any programs submitted should be latest a version of your program else will not be considered. All programs must come complete with a full explanation of the operation and where relevant the algorithm. Spectrum programs should be accompanied with a cassette of the program, as well as the listing.

All submissions will be acknowledged and the copyright in such works which will pass to Argus Specialist Publications Ltd will be paid for at appropriate rates. All enquiries for contribution should be sent to the Editor at our Gables Square offices.

WELCOME

GPO PS.

Things are still not as they should be, if you have sent in a program or inquiry and more than six weeks have elapsed without our replying then mean at them. We know for certain that a number of letters and parcels sent to our offices have not arrived. If enough of us complain then they'll get fed up and do something just to get us off their backs!

On Friday I had something to eat at lunchtime. So what? You say, there's nothing special in that. Well, the significance was that by Monday I'd been lunched into hospital with a rather overheated Pancreas. For those of you fortunate enough not to have experienced this, it can only be described as having a berserk football fan repeatedly stab you in the stomach with a red hot penknife. So, groaning and cursing — this was my fourth attack in five years — headlines read PANCREAS STRIKES AGAIN — NHS BAFLED. Anyway, mumbling incoherently, I was attached to a plethora of tubes, needles and wires, questioned in detail about my internal bodily functions, given a pain killing injection and handed over to those aptly named beings, the Angels. (Nurses)

Now, if you've ever been in hospital then you'll know there

is one sign which strikes dread into the hearts of the most hardened. No it's nothing as simple as INFECTIOUS or PLAGUE, it's the three words NIL BY MOUTH. These are attached to patients such as I and mean just that. Feeding is irrelevant, nothing is swallowed. Well, after a couple of days as the pain subsides and the injections wear off and an interest in human occupations returns, then these words strike into the depth of your being. It matters not that you are in no danger of malnutrition due to the saline purged into your veins, the hunger builds. The rasp of the tea trolley, cheerful calls of "What do you want to eat today Mr. T?" to more fortunate patients become a torture more refined than any deliberately devised by man.

I don't want to force the point down your throat, for as that

turn of phrase too inappropriate?) and I don't want sympathy (then again... I But if I felt like that after two days then you can imagine how those in Ethiopia feel after many months. I'm told the pain fades with time and that I find awful as well. And I know the media go on and on, T.V., newspapers all trying to show the most horrific picture. But we ought to be horrified and we ought to keep having our noses rubbed into it and maybe we will buy the record or the software tape and pay out £1.25 or £4.99 and feel smugly pleased with ourselves.

But until we've tried going hungry even for a day, we cannot begin to imagine the horror of the situation. So I'm asking, if you haven't yet bought SOFT- TAID if you have, then get a copy for a friend! PLEASE buy SOFT- TAID and make it stay No. 1 in the charts for a long time.

Something Different

Some of you may have noticed that we were getting a little behind (there's a joke there somewhere) with our reviews of new software. Now obviously a bimonthly magazine is unlikely to be as up to date as a monthly, nonetheless we are now going to attempt to provide more up to date reviews than we may have done previously, and to that end we have recruited a bunch of jaundiced arcade addicts ('Gimme another shot man') to sweat blood over the latest releases. These dedicated persons (including me!) are all enthusiasts who have died a million deaths at the hands of aliens, crashes, falls etc. Even so they still only give their own opinions and I'm sure you may not agree with them at times so write in and let us know!

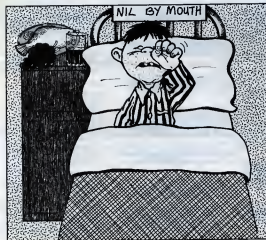
If Music Be The Food . . .

In this issue I reveal the results of an exciting investigation into the use of the Spectrum in the expanding field of home music, not aimed at the musician or the fanatic but at ordinary people — US. All the equipment has now been returned, the office has a strange empty quality, Cliff and the typists have removed their ear plugs and my fingers itch. What can I stick them in next — Cliff looks anxious — I wonder . . .

On with the show, overture, curtain, dancing jigs . . .

Warning

We recently received this message from Dean Electronics: "Dean Electronics Limited, the sole authorised importers of Alphacom printers, wish to issue a warning to anyone purchasing an Alphacom 32 printer for use with a Sinclair home computer."





AlphaCom 32 — The real McCoy

Recently printers have been introduced into the market place which are similar or even identical in appearance to the AlphaCom 32 and have connectors which will fit the 3v DC power socket on the Sinclair Spectrum. In some cases these connectors will provide 25 volts AC to the Spectrum not the required 9 volts DC and will destroy the computer.

Deen electronics wish to point out that they are in no way associated with any such product. The authorised version of the AlphaCom 32 supplied by Deen is fitted with a fail safe power supply and it is not possible to accidentally plug this into the Sinclair Spectrum.

The authorised version of the AlphaCom 32 printer is available from W.H.Smith's, Currys, John Menzies, Prism Distribution, Terry Blood Distribution or direct from Deen Electronics Ltd.

POKES

Dear Sir
I am in the process of compiling a book for Spectrum Games players, which will include hints and tips for adventure games and POKE's for infinite lives etc for arcade games.

I would welcome contributions from your readers and should any be used in the book then the sender will be subsequently rewarded.

Yours sincerely
N ZUCHOWSKA
37 Grove Gardens
Off Grove Lane
Handsworth
Birmingham

Absent Minded

Dear Ray,
Using my favourite program

WORD SHEEP and my ALPHACOM 32 printer I often curse my memory forgetting what I typed just 10 seconds before. This is the occasion:

Having filled a screenful of text I press CAPS SHIFT + 9 to send it to the printer and afterward CAPS SHIFT + 4 to clear the screen. And now I just can't remember which was the last word I can't see it because it is still under the paper-tearing edge and I can't pass the advance key because there would be an ugly gap in the text.

Thanks to the genius of Tom Baker there is a simple solution by using the YOURS routine for a slightly altered version of the CLEAR_SCREEN routine which will clear only the upper part of the screen; I omitted 3E02h and 32515Ch and changed 01DF02h into 015F02h. This spurs out L-TABLE from clearing. The new CLEAR_U-TABLE routine must be attached to the WORDSHEEP program which ends at 80B57 and this will do it:

```
1010 RESTORE 1040
1020 FOR n = 60958 TO 60977
1030 READ a, POKE n,a;
NEXT n
1040 DATA 33,0,232,34,
32,205,97,236,206,
12,236,195,229,235
```

And now:

Write a screenful of text plus the next words in the lower part of the screen, send the text to the printer and afterward press CAPS SHIFT + SYMBOL SHIFT. Your last words will stay on the screen to the great relief of that short time memory sevel
Sincerely yours,
Louis Colomber
W Germany

Froggy II

Dear Sir,

I have just read the review of Softwars Farm's Frog Hopper II game in the October/November issue of your magazine. It was in the ZX81 Soft Selection.

I don't know who reviews these games, but whoever does makes a very poor job of it. The reviewer says, "there is only one speed, which is perhaps a little slow" — this is totally untrue as the game speeds up with each difficulty level. This is obvious to anyone who has played the game for more than five minutes. I hope you will correct this mistake in a future issue. Unsigned

Consider it corrected.

Help!

Dear ZXc,

HELPII I am a regular subscriber to ZXc and I have numerous programs that will not run. My copy of Meteor Madness tells me that I have faults that do not exist for that I cannot find, and I am still trying to get out of the market place in Chelso. Most others that I copy tell me that it is "Nonsense". With monotonous regularity, is there anyone in the Tamworth area with enough patience, who can assist me? I would ask my seven year old son, but my ego has already taken a severe beating.

Desperately yours,
George Burn,
88 Shorepit,
Kettlebrook
Tamworth
Staffs.

Buyers' Guide

Dear Mr Elder:

I am publishing a "BUYERS GUIDE TO SINCLAIR — TIMEX PRODUCTS & SERVICES" and wish to include information on your publication in it. There is a need for quality publications, such as yours, to keep users informed about their computer. Information on subscription rates, correct mail address, and a description of what is featured in the publication would make sure that you are listed correctly. If you do not distribute overseas to USA & Canada especially please send the information anyway. I will make note of that fact in the guide.

I wish to make the guide as complete as possible covering ALL Sinclair and Timex computer products and services. With this in mind I have already

sent over 1200 requests for product information out world wide. Most requests when sent to US firms or individuals that have products or services, but over 100 were sent to the United Kingdom. Only ten of these firms answered the request, so I am requesting your assistance in gathering information. If you could supply a list of advertisers that I may try to contact or if you could make mention of my need for information in your publication, this would be a great help.

The guide is a full size 8 1/2" x 11" set in a three ring binder that allows for easy updating. Now containing over 120 suppliers of Sinclair-Timex products from the ZX-80 to the QL and the TS-1000 to the TS-2088. Over 800 software titles are listed along with over 100 books and hardware items. Priced at US\$12.00 posted to USA and Canada, others add \$1.50 surface or \$5.00 airmail. This includes an update to keep it complete in 1985.

I will send you a complimentary copy if you so request it. I am looking forward to hearing from you as soon as possible to make sure that your information gets in the next update. Thank you for your time and consideration in this matter.

Very truly yours,
Dale F. Lipinski

We've sent out what info we've got, meanwhile, maybe some of our advertisers will read your letter — Ed

POKES

Dear ZX Computing
I am a 15 year old student and I own a 48K ZX Spectrum. One day playing around with the POKE command, I finally came up with a short program which I find very useful. Once placed before your program it will erase everything if BREAK/SPACE is pressed during the program; a good program to prevent your program being changed. Here is the program:

```
10 POKE 23613,2
20 POKE 23614,91
30 POKE 23298,0
40 POKE 23299,0
50 REM YOUR PROGRAM
SHOULD START FROM
HERE
```

I hope that if you print this in ZX Computing the readers will find it useful. I find ZX Computing a great magazine and am an en-

thrustastic reader: keep up the good work!
Yours faithfully
HARRON ANSARY
Lusaka, Zambia

Anomalous Phenomena?

Dear Sir,
As a member of the Association for Scientific Study of Anomalous Phenomena I am interested in cases of anomalous computer effects.

Can I appeal to readers for any information, at first or second hand, no matter how bizarre, concerning unexplainable malfunction or unexpected output? All accounts will be treated in strictest confidence, and should be sent to: Roger C Morgan
15A Kensington Court Gardens
London W8 6DF

Golden Chalice

Dear Sir,
Just wanted you to know how much I enjoy your magazine. More's the pity it couldn't be brought out monthly! I started computing November '83, and haven't switched off my TV since!

My admiration and congratulations go to Alan Davis for "The Golden Chalice". I almost pulled my hair out trying to solve it, but it's worth going bald over: well worth five stars. Let's have more mind-benders like this. Your last edition (Dec/Nov) was too ZX81 oriented: I have a Spectrum, so I'm biased, let's have more balance.

Wishing you, the staff and all readers the best for '85.

Regards
Leuanne Creighton
S. Africa

P.S. Anyone want a code to Break into "Marc Mender"? Write to me enclosing a S.A.E. with I.R.C.'s

Bad Attitude

Sir,
In previous issues of your magazine, as well as other magazines coming to owners of Sinclair machines, I have from time to time come across letters from readers praising the after-sales service offered by certain software houses.

I too have had similar experiences but in addition, as a user of mainly business and utility software, I was especially pleased that there are software

houses which market such software which offer an update or exchange deal to their existing customers. Such software houses realise the importance of customer relations and so benefit from the most effective and yet the cheapest form of publicity that is available to anyone: refer to advertisement through word of mouth from their satisfied customers.

Regrettably, CP Software is not such a company! It is indeed most unfortunate that they do not believe in offering their customers an after sales service to equal, let alone rival companies such as OCP, MICROSPHERE, LERM, and CAMPBELL SYSTEMS, to name a few.

I bought a copy of CP Software's "SUPERCODE II", which is an excellent utility program, as well as their "BRIDGE PLAYER", "BRIDGE TUTOR - ADVANCED" & "BRIDGE TUTOR - BEGINNERS" and have been very pleased with all of them. In fact I went as far as to review their "BRIDGE PLAYER" program in the "READERS' REVIEWS" section of your magazine. However, when I recently came across their advertisement announcing "SUPERCODE III" and "BRIDGE PLAYER 2", I very foolishly believed that they, like some of the other software houses mentioned above, would also offer their existing customers an update service. But not! I was told quite bluntly that they would only exchange faulty tapes and if they upgraded their programs, then they would draw the line there.

It is sad that CP Software should take this attitude and all I can say to them is, they should take a lesson in customer relations from the companies that I have mentioned earlier in this letter.

Yours faithfully,
S. Detro

I.S.U.G.

Sir,
I would like to bring to the attention of your readers what some "computer clubs" truly are. In July of last year I sent an application together with a cheque for £14 to VIC WEBBER I.S.U.G. (i.e. International Spectrum Users Group 77777 of 189 Rosehill Road, Burnley, Lancs., BB11 2DX, after reading about the "club" [sic] in a magazine. On paper the "club" really seemed a good one but in truth it's a real NOTHING. I never even received

an acknowledgement of my application. Let alone any newsletters. I wrote back three times since mid-September after I learnt that the cheque had been cashed on the 4th September, twice through registered mail to make sure that my letters reached their destination. However I never got an answer to those letters either. My conclusions are that the I.S.U.G. is another way for its organisers to make a quick buck. (Does a Vic Webber really exist?)

I wrote to you hoping you would publish this letter so that your esteemed readers would not be cheated out of their money just as I have been. It would also be a good idea were Computer magazine publishers to check on the authenticity or otherwise of the clubs mentioned in their columns.
Yours sincerely,
Charles Bajada
Melba

I.S.U.G.

Re: International Sinclair User Group.

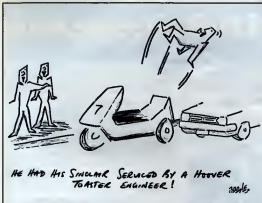
I write to enquire whether any of your readers have encountered a problem similar to mine. In June 1984 I paid £10 to the Independent Sinclair User Group, 189 Rosehill Road, Burnley, Lancs as my first annual membership fee. Within a few days I received the first newsletter. Since then, despite writing several letters, I have received nothing further. Neither have I had a reply to my letters.

I consider that I am therefore justified in denouncing the I.S.U.G. as nothing more than a sham. It is reputedly run by a man called Vic Webber. If Mr. Webber is reading this letter I would invite him to justify his lack of action with money belonging to other people. If any of your readers have had this problem, or indeed if they have had successful dealings with this group, I should be obliged if they would write to me as soon as possible. I am contemplating a certain course of action but would welcome comments from other interested persons before I do so.
Yours sincerely,
John Schofield,
Blackburn, Lancs.

Bank Charges

Dear Sir,
After reading your article about joystick interfaces for the Spectrum, I ordered by bank draft a stick at Downways Electronics, because you tested it as one of





the best. Unfortunately the bank in England deducted £3 in charges, so I phoned Downsway how to handle this. They said, they would send the passport to my address, so ignoring the £3 they did not get. Otherwise I would have had to pay again by bank £3 and £3 cents. I think this is a way of service giving of more than 100%.

May be it should be useful if you could indicate in your magazine a way to handle far readers on the continent to send money to your advertisers. Now the total extra costs for me were £2 at the bank in Holland, £2 at the bank in England, about £3.50 plus £2.75 for export tax and tax administration fee. Yours faithfully
H. A. van Brakel
Pernasseweg 9
6861 CE West Terschelling
Holland

Well, personally, when I've had to send money abroad I've found an International Money Order, bought from a Post Office (no bank charges!) the best way of doing things — Ed.

Wafadrive

Dear Ray,
You mentioned in the Dec./Jan. issue of ZX Computing that you intend shortly to give a detailed

report of the Wafadrive. Although I still think it is a splendid item, I think that I have found a small 'bug' in its ROM.

You have probably come across it yourself already, but if you have not, the enclosed copy of my letter to the manufacturers will explain it. It may be something that you would like to pass on to the readers.

"Recently, I bought a Retrotronic Wafadrive, and although I am delighted and impressed with it, there is one small point which I find inconvenient, and which makes me think that I have stumbled upon a 'bug' in the Wafadrive ROM.

If you are trying to save onto wafer a block of machine code which resides at the top of the memory, it is impossible to save byte 65535. The necessary instruction, such as 'SAVE * "name", 65501, 36' produces the report 'Out of range'. I have tried to save the byte by itself, but SAVE .65535,1 produces the error report, and SAVE .65535,0 does not save the byte.

For the same reason, it is impossible to save all the User Defined Graphics. The usual instruction 'SAVE * "name", USR "a", 21 * 6' produces the same error report, though if you are prepared to save only 20 UDG's, all is well.

The only solution that I have so far found, is to PEEK 65535

before saving the code, and to save it with a BASIC loading line such as 'LOAD * "name"; POKE 65535,n' (n being the PEEK value of 65535). This is effective, though a little cumbersome.

I suspect that somewhere in the Wafadrive ROM is a checking routine which ensures that the address does not exceed 65535, but that the ROM writer has overlooked the fact that, when saving machine code, the sum 'starting address + number of bytes' = 65536. My purpose in writing to you is to ask whether you can suggest any short machine code routine which would correct this, and which could be used whenever it was necessary to save byte 65535. I am happy that you are able to give me."

I will let you know what they say about it, if they reply. Yours sincerely,
(Mrs.) Carol Brookbank
Tile Hill
Coventry

More POKES

Having been a ZX-01 computer enthusiast for a few years now, I have packed up many bits and bobs which have helped me on my journey through BASIC. I have compiled a list of some of these bits and bobs into the following list:

RAND USR 836

This is a loading function which loads your program and automatically breaks into it. To use the function, type an FAST and then RAND USR 836.

USR 3086

This function scrolls the screen and prints something at the same time. To use it in your program, type in PRINT TAB USR 3086;"whatever the message is" or if you want to wait 3 spaces from the beginning of the line, PRINT TAB USR 836 + 5;"whatever the message is".

RAND USR 0

This function clears all memory including whatever is above RAMTOP. It is also a quick way of restoring RAMTOP to normal if you have lowered it.

POKE 16418,x

This function will LIST any line from 0 to 255. Just LIST the line that you want to view from (e.g. LINE 17) and then type in POKE 16418,x where x is the line which you have just LISTED.

POKE 16418,0

This function will allow the use of the bottom two lines of the screen. Use the statement with a program, as it will not work after the program has been broken into or if it is not a program line or after the program has stopped. Do not INPUT or SCROLL in this mode, as the machine will crash. To get back into normal mode, type in: POKE 16418,2.

POKE 16510,0

If you have a machine code routine at line 1, and you do not wish it to be accidentally edited, type in POKE 16510,0 and line 1 will change to line 0. This line cannot be edited. If you want it changed back to line 1 again, type in, POKE 16510,1.

POKE 16389,68

If you have got a RAM-pack connected, and you wish to go into 1K Mode without disconnecting the RAM-pack, then you can lower RAM-TOP to 1K by typing in POKE 16389,68 and then NEW.

POKE 16389,128

If you are in 1K Mode, and you would like to get back to 16K Mode without losing your program, type in FAST and then POKE 16389,128. Now type in LIST and WAIT. Yours faithfully,
S. Huggins,
Northampton.

Shoptalk Shoptalk

Odds and ends, letters, and company info

OCP and Watford = Business

The OCP suite of office programs Stock, Purchase and Sales Manager really provide impressive power for a small business, handling 6000 items as a standard and up to 15,000 items if required.

The choice of the Watford Electronics disk interface from those available was explained as ideal because of the compact DOS, the small amount of Spectrum memory required by the system, its speed, and high capacity (800K on a single double sided disk up to 3.2Mbytes with a four drive system).

This is in line with the existing program available with this system. Tatford II, Masterform and Omnicalc is supplied on disk with the system as part of the package.

I have been convinced of the potential of the Spectrum for serious use for quite some time now, in fact this issue is typed on a Spectrum with Sage I, Emperor keyboard, Tatford II, Euroelectronics ZXPrint III, Centronics printer interface and a Shinwa CP80 printer, so it is good to see companies taking advantage of its capabilities.

QL Drive

It is no secret that Sir Clive is disappointed in the response to the QL in respect of the number sold but rather than cut and run, Sinclair Research have decided to put more money and more promotion into their wonder machine.

One of the problems is that the market has moved on from the hobbyist/enthusiast owner who could discuss at length the relative merits of the Z80, 8502 and the 8502D CPU to the general user who simply looks at the amount of equipment he gets for his money. In this light who can deny that the Amstrad looks to be one of the best deals? However, Sinclair are convinced that they can educate the non-specialist into understanding what the benefits of the QL are, in many

I'm not too sure of them myself so I'll be reading their press releases with interest!

Meanwhile

The slowly developing market for QL software and peripherals looks a little healthier lately. Strangely enough the falling pound has been cited as a factor. It appears that as our pound is worth less, the QL is more competitive in the international market. It's an ill wind etc, etc.

Anyway, at the time of going to press there are 33 software packages, available with several more in the pipeline, and 17 peripherals on sale for the machine. One such package is GST's QLAssembler, this tends to emphasize the "serious" use of the machine as only keen programmers or commercial writers are likely to want to use machine code.

The other interesting thing is the price, £39.95. Those who upgraded from the Spectrum will be upset at the price of QL software, but you have to bear in mind that the machine was designed as a business machine and business users are used to paying in the hundreds for their software due to the limited sales such programs can be expected.

QLUB revamped

Not only the software but also the organisation has been modified and now members of the QL User Bureau have better facilities.

For a start, membership is free to all purchasers of the QL after March 4th upon product registration (that'll peeve those who paid), and a free telephone helpline service is available from Pison between 9.30 and 6.30 every weekday.

Old members of the QLUB may feel less irritated however as they will not have to pay for the new, improved version 2.0 of the Abacus, Archive, Easel and Quill programs. Non-members are being charged at £15.00 per program or £50.00 for the set. New owners should, of course, check that these are

the versions supplied with their machine!

One of the greatest benefits of the new versions is that they can operate with floppy and hard disk peripherals, a serious criticism of the older programs as public confidence in the microseries has yet to be won. Still determined to get into the educational field, and why not I ask, I know of many teachers who prefer to use the Spectrum to the BBC. Sinclair Research gave 525 machines to Strathclyde University with the intention that every student who needed one for his studies could have one. A great idea Sir Clive, but why stop there, why not give one or two to every school in GB, that would really upleverage Atari! And how about one for our office while you're at it, Thanks.

QL steps out

Sinclair's aim is to sell 200,000 QL's in the UK this year and I hope he achieves that target, but there will no doubt be a few minor modifications before the public take it to their bosom, it could do with a drop of £50.00 or so for a start. Outside the UK, Sinclair will be launching the QL via mail order in the United States for \$499. Managing Director Nigel Seale will be heading the operation which will include marketing and collaboration with American Express. A similar arrangement some years ago led to 50,000 sales of the now mythical ZX80, and Sinclair obviously hope to repeat this success.

CS trundles on

The CS has gained a certain notoriety, especially as it is a fairly regular star of Spitting Image. Many members of the public have taken to it and I suspect that it is because it looks like fun, not a word usually associated with travel nowadays.

Quite a few retail shops have decided to stock it including Comet and selected Woolies (why doesn't some enterprising

supermarket fit shopping baskets to them and let shoppers drive around their stores?). With a bit more enterprise from other areas life could be much more interesting!

A lot of promotion is going into this product, rallies, exhibitions and even a Land's End to John O'Groats run is being considered. Despite criticisms on the grounds of safety, 5,000 CS's have been sold so far.

I am peeved!

I asked for one to try out saying I was waiting for the review sample and was told I would have to wait a long time. I get the impression that Sinclair won't be sending us one.

Cut price Saga

Sage Systems have cut the price of their Emperor keyboard for the Spectrum. Explaining that drop from £54.45 to £49.95, Sage's David White commented that: "because we have now reached sales of 10,000 units, the manufacturing cost has fallen and we have passed this reduction on to the consumer."

David White also remarked that the Emperor is compatible with the Spectrum+, though quite how that would work escapes me at the moment. Nonetheless the Emperor is a nice unit and received a good review in our February issue.

Abs on the way from Sage are a Graphpad and joystick interface which, used together will allow you to draw pictures onto the television screen using a joystick. Further details should be available shortly. Sage can be contacted at 2 Eric Road, Woking, Surrey GU21 4JT.

New Gen Squash

The latest in the long and increasingly sweetie line of games based on sports is New Generation Software's "Jonah Berlington Squash". Developed with the help of no less than Jonah himself, the game features voice synthesis which announces the scores. The price is not yet known, but hopefully we will review the game next time around.

BOOK NEWS

Collins Collection

For general interest or CSE/O level exams, an interesting book is "The Automated Office" by Burgess and Joseph St. John Bates, priced at £7.95. The author attempts to show the development of the new technology and its effects upon the traditional office worker and even which jobs may cease to exist. Each member of the office is examined in detail, the secretary, clerk, manager and executive. Equipment and developments in technology are examined and discussed and an idea of the future is formulated.

If you are fortunate enough to own an Epson printer then you will know that it is harder to understand some bits of the manual than to learn machine code!

Susan Curran to the rescue with her book "Get More From The Epson Printer" which costs

£7.95. This is well written, much easier to understand and contains information and instructions on the text and graphic functions of the complex and versatile piece of equipment. Perhaps the manuals are deliberately badly written to allow enterprising individuals to write books on it, a sort of job creation scheme?

Gary Marshall has written "Microcomputer Puzzles" which is a collection of problems which first appeared in the Observer magazine. Each puzzle is set up with background information and hints and techniques are suggested, you are then left to write the program. Solutions are given at the back of the book so if you are the compulsive puzzle type then there is not much point buying the book, but if you enjoy a challenge and are wondering what to turn your computing ability to then this is an amusing and absorbing way of spending some time. £6.95

In Brief

Fontana have an interesting range of books on the market for the Spectrum and even one which includes the ZX81. Carolyn Hughes has written the 1st and 2nd "Steps With Your Spectrum" at £1.25 and £1.50. "Tim Hensell's Giant Book Of Spectrum Games" is £3.95, "The Good Software Guide" by Matthew Spencer is £3.05, "Better Programming for your Spectrum and ZX81" and "New Adventure Systems for the Spectrum" are both by S. Robert Speed at £3.50 and £3.95.

Andrew Pennell has written "The Sinclair OOOO Companion" which gives would-be machine code programmers a good idea of how the QL performs and how to utilize some of the powerful features built into its operating system. £8.95 from Sunshine Publications, 12/13 Little Newport St, London WC2H 7PP. Also from them is "Sinclair QL Adventures" by Tony Bridge and Richard Williams which features a specially devised adventure generator. £5.95.

Attention all TEACHERS! If you're browsing hoping to make sense of this technology because the Head has dumped a computer on you then I recommend "Computers In The Primary School" as a book full of advice, simple beginners instructions, ideas, suggestions and reviews. Perfect material and should be compulsory reading, available from Macdonald & Evans Ltd, Bovey Rd, Plymouth and written by Terry Russell.

"Beginning BASIC with the ZX Spectrum" (iSpectrum+) by Judith Miller is published by Macmillan at £3.95 and is a straightforward guide to programming concentrating on practical examples. The more complex mathematical functions are deliberately omitted and at the end of each chapter some questions and tasks are set, there is an excellent chapter on making music! If you want to study programming then this could be the book for you.

Our own regular contributor Alan Giles is a professional writer and his latest book, published by Melbourne House is "Quick QL Machine Language" which costs £7.95.

Fans of his series who own a QL will no doubt rush to get it. If you are not interested in the topic on which he writes for us at least you can read it to get an idea of his literary style. It's well produced as are all the books we've seen from this company.

Fontana Paperbackbacks came out with a great idea some time back with a series of books which involved the "Byes Brothers". These books provided pure enjoyment but also some educational value as computer programs were a feature of each episode. They are all written by Lois and Floyd McCoy and at £1.25 each they provide simple computer concepts and a means of motivating slower readers. The full range consists of: Input an Investigation, Programs a Problem, Enter the Evidence, Compute a Clue, Record a Robbery, and Go To A Getaway.

An unusual book from Sigma Technical Press, written by Gareth Greenwood and priced at £8.95, the "Moro Cloak and Dagger Book" is a book about creating, writing and solving codes and about cryptography in general. I know from the letters and programs we get sent that there is a good deal of interest in this field and I expect it will sell well.



Accolade indeed! when a book such as "The Sinclair Story" is published by Ouseworth. Written by Rodney Gale and priced at £8.95 I'm sure the interest in the erstwhile folk here of the masses (and that includes yours truly) will ensure good sales.

"Capitol Radio's Book of Computers & Simple Programming" is jointly credited by Interface Publications as being written by Kelly Temple (Capitol Radio GUT) and Roger Mumford (EX ZX Computing Editor) and Peter Shewe (EX ZX Computing contributor). Obviously we wish them well with it and it's nice to know there's life after ZXCI!

Sinclair's Logo program is comprehensively documented and I was surprised to see "Logo on the Sinclair Spectrum" by Graham Reid published by Papermac.

As I glanced through I realized that this is actually a nice complement to the manuals supplied and suggests alternative means and methods. Logo is such a vast and versatile language that no doubt it could support several books like this without exhausting the possibilities.

"Machine Code Extensions for Spectrum Basic" by Rob Saines and published by Hewson Consultants at £4.95 is a superb collection of routines which add BASIC commands such as PROC, DEFPROC, ENDFPROC, IF/THEN/ELSE.

Careful entering and a fair bit of time is needed to enter all these routines but it is a task worth undertaking if you intend doing a lot of basic programming.

Two books from Century Publishing Co. Teach Yourself Assembler Z80 by Paul Overas and "Assembler Routines for the Z80" by David Barrow and both are £7.95.

The first is a rather general but nonetheless good book and the second is a collection of general routines, most of which can be used on the Spectrum or ZX81 but is most suited to the programmer who thinks in Hex and considers Basic beneath contempt.

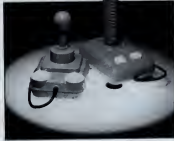
Kempston Grand Prix

Two new joysticks from Kempston, the Formula 1 is based on the Pro 5000 model but has the switches changed to micro switches and has been moulded in the colours of the Kempston racing team, as has the Formula 2, which is in the pistol grip style with buttons on both the base and the top of the stick.

Their new model of joystick interface retains their 'Kempston' standard mode of operation but has rehoused in a case more fitting to the Spectrum+ style. Complimenting this is their 'Pro' joystick interface

which has three sockets and provides for the Kempston, Sinclair or cursor keys control, which makes it a very versatile device. Also added is a ROM cartridge port for the rather rare cartridges that were supposed to take the game playing world by storm.

And finally, rehoused in a Spectrum+ type case is their Centronics interface to run one of the many full size printers. They claim it is compatible with most other interfaces such as disk, micronet and interface 1. Although their publicity department sent five press packs on these items, not one of them mentioned a price!



Microframe gives a little bit more

Gordon Micro Ltd. has just announced their Microframe. Apparently, it not only has a floppy disc controller interface for use in any model of the Spectrum, but because of its five slot motherboard, they say it's a micro-sized version of the Mainframe Computer, allowing the serious user the opportunity to learn and experiment with real computer applications.

The floppy disc interface, after a reset and a RUN command, automatically, through the on-board PROM, calls the file "SYSTEM" and loads the disc operating system (DOS) into the on-board 16K RAM, which has the same address location as the BASIC ROM which means that no register or memory are used on the Spectrum.

The DOS seems very comprehensive and supports the commands "Load", "Save", "Merge", "Open", "Close",

"Catalogue", "Format", and "Erase". The system used in the DOS is logical and simple, a Load 01 "name". The commands are programmable and the "name" can be a variable assigned during the run of the program.

Because the Microframe has a soft operating system, each of the interface cards shortly to be announced by Gordon Micro, such as RS232 - Centronics Parallel, Input/Output Ports, Digital to Analogue Converters, Robotics, Bar Code Reader and Joystick Controller will have basic statements directly programmable to operate them.

They are keen to promote the educational value of the Microframe and cards, therefore with each of the modules, documentation is given explaining the circuits and the software used. For further information, contact: Gordon Micro Ltd., 3 Colander Road, Heathfield Industrial Estate, Ayr KA8 8DU. Tel: 02921 280467.



1.44 MB disk system for QL

Micro Peripherals Ltd have produced a 3.5 inch floppy disk drive system to operate with the Sinclair QL.

The system which has been designed and manufactured in the UK with cost in mind is available in three separate units which can be purchased individually. These are an interface module, first and second disk drives. Each drive is housed in a rigid black textured steel case. The two Drive system has a total formatted capacity of 1.44MB and provides fast file handling using the multitasking

feature of the QL. The interface which supports up to four drives on a stand of multibyte provides a whole host of resident utilities including a screen editor, job control as well as additional file handling commands.

With its ease of installation the disk drive system makes an ideal compliment to the QL's powerful 68008 processor and is suited to small business and mass storage applications. The interface module has an RRP of £99 and the first and second Disk Drives are available for £189 and £159 respectively (all prices ex VAT). Micro Peripherals Ltd, Intec Unit 3, Harrocks Wood, Wade Road, Beauntingshoe, Hants RG24 0NL.



The year of the robots?

As prices drop and technology advances more people are becoming more interested in the application of the computer to robotics. Innegellecto Robots Ltd (IGR) have produced a versatile device which sells for £79.95 in kit form, £99.95 fully built or £129.99 inclusive of Sinclair's Logo program. The latter in particular seems a very good deal.

Apart from the great fun this area of computing opens up there are many practical and

educational dimensions which could be explored, for instance IGR suggests it could be used to play with the cat[1].

Now, regular readers may have noticed that my moggie has not been mentioned for the last couple of issues, this is because after the last encounter with a computer when he was nearly electrocuted every time the power went on, he avoids it whenever he can. Still I'll ask IGR for a loan of one of these Zero 2 robots and let you know what it does for the Spectrum/Feline relationship. IGR, Unit 208, Highbury Workshops, 22 Highbury Grove, London N5.



Data Deutche

From Germany and marketed by TwiStar Computers, 117 Regina Road, Souths, Middlesex) comes a large impressive looking cassette data recorder.

The unit stands upright and TwiStar claim that it has a precision tape drive and was designed specifically as a computer recorder to make it more reliable.

Manufactured by the Welton Electronics plant in Munich and given the title MC3810 it features a tape counter and a series of lamps to indicate the various functions. It is also

claimed that the head is easily adjustable from the outside, an important feature which is important yet all too frequently omitted.

I would have liked to have commented on how it performed and indeed, TwiStar very kindly sent one along, unfortunately the mains adaptor was a two pin round one and incompatible with our three pin-square sockets, the instructions were in German and I did not like the look of a sentence that began "Achtung..." The cost is £28.95 + £3.95 for cables + £4.95 for the PSU.



In Brief

- Turn your ZX81 into a robot with Mepl'n's "Trundle" package, on sale for only £49.95 (not including a ZX81). Contact them at PO Box 3, Rayleigh, Essex S58 8LR.
- Full colour screen dumps can now be printed on the Seikohe GP700 or the Epson LX80, and four colour dumps on the CGP115 and the MCP40, thanks to the latest version of the Euroelectronics ZX1 part II.
- The software is included in an onboard Eprom and it still costs £34.95 + £9.95 for a cubic 1 use this interface to produce the listings for ZXC and have nothing but praise for it and the company. They can be contacted at 26 Clarence Square, Cheltenham, Glos.
- Chess was ousted over the suppliers of the Borno device which we reported on recently, however all is now clear and it is being marketed by Addi Valley Micro Products Ltd., Stepping Stones House, Thame Hill, Knebworth, N. Yorkshire at £14.95 and a super, useful little device it is too!

BUDGET SOFTWARE

Lately the market has seen an increase in the amount of software available in the £1.75/£3.50 range and I thought we'd take a closer look this month.

Games Without Frontiers 8th Day Software

There are six programs available from this company at the moment, all text adventure games and all produced using the Quill adventure writing program. Although they have been out for a while now, testing and reviewing adventure games tends to take longer than arcade games.

The set is very well presented and each program has a difficulty level given so you can go straight to the more complex if you are a hardened adventurer or ease in gently if not. The topics are varied and interesting and, to give them briefly are:

ICE STATION ZERO — a beginners game which has you trying to defeat Sargis, the mad terrorist who has taken over the polar research station and threatens to destroy New York. It has some quite devious twists, and once you get to the station you only have 3D moves in which to complete the necessary tasks in sequence!

CUDDLES — moderate difficulty in which you are a young child entering the rather unfriendly land of make believe. CMI said I

should try this one as I'm in my second childhood already!

QUANN TULLA — a moderate difficulty space adventure where your task is to save the universes from the Empire. I spent ages on this one. I solved the initial problems easily enough but then couldn't find the cupboard key even with the aid of the Hint Sheet. Frustrating!

IN SEARCH OF ANGELS — again moderate difficulty but with a "James Bond" type theme.

FAERIE — is an advanced difficulty game which they describe as a "surrealistic fantasy". Titans, Cyclops and a Snowman are among the cast of characters.

FOUR MINUTES TO MIDNIGHT — also advanced level, sets you as one of the 10% of the survivors of a bacterial holocaust. Here you don't save civilisation, you rebuild it.

A great selection to cover most tastes, the games have a nice atmosphere and are well designed to allow you to begin play and then present a problem, by then you're hooked and will spend time working out the solution. (Hopefully!) At this price you may be tempted to buy one even if you've never played an adventure before and I'm sure a lot of new fans will be won, greatly recommended. Available from 18 Flaxhill, Moreton, Wexal L46 7UH.

Atlantis Software

This company has two ranges of games available, their normal products at £1.99 which include "Blight", a card game favourably reviewed by Olive Smith, and the new £2.99 "Atlantis Gold" program.

As we go to press there are two in the latter category, *Nicotine Nighmare* and *Self Destruct* which are arcade type programs with elements of the chess and jump programs. They are fair games, the graphics are not bad, rather like early Spectrum games and movement is a little jerky. This is probably a result of the fact that they were

compiled from BASIC to machine code using the Mcode from PSS. This is not bad in itself, but to get professional graphics you need separate user-written routines.

Good games which would have been excellent value at the £1.99 price and, though lacking sophistication, are fun.

El Dorado is their adventure game in which you are trying to re-establish Inl as one of the Inca Gods. This is quite complex and interesting and one to collect if you are into adventures or one to try if you are not. This one is priced at £1.99. Atlantis Software, 18 Prebend Street, London N1 3PP.



5D Software

Six tapes each at £3.45 and each tape contains two or three games. Gevin Baker has shown great initiative in setting up this venture and I only wish I could recommend his programs to you.

The fact is that they are not very good, they all seem to be based on other games, although quite ingeniously disguised, and are either written in BASIC (not very successful for arcade games) or compiled by the PSS program which produces the problems we mentioned with the Atlantis games.

Also, they suffer from interesting flaws, in *PAINTCRAZE* for instance, if you are caught at the paint pot then you have no way of avoiding the monster when your subsequent lives

start. The inserts are commercially printed but with amateur artwork, some of this does look quite attractive though, *Racehorse Trainer* for example.

Cavern Chaos and *Platman* on one tape are two adventure programs which work quite well and in my opinion are the best of the bunch, mainly because adventure games are reasonably acceptable in BASIC. *Weed Attack*, *Electron*, *Wash 'n' Slob* are the main titles of the other three separate tapes. All these games are of about the standard of listings which are printed in BASIC in most mags.

As I said, I admire the attempt but really you ought to take the time to learn machine code, don't take the admiration of friends and relatives too seriously and look at the competition from companies like Master-

tronic before rushing into the cut throat, competitive world of commercial software.

Gevin Baker, 12 Fleming Field, Shotton Colliery, Co. Durham DH6 2JF.

Finders Keepers Mastertronic (1.99)

Having mentioned Mastertronic it is nice to be able to give the thumbs up to their latest release. When they began they suffered from much the same problems as does 5D but they have listened, learned and succeeded.

This game is a beautifully produced graphic maze game, the animation is smooth and colourful, and in play it is quite addictive. You, as a knight of the Polygon table must search and find as many treasures as you

can, an unusual feature is that some creatures will trade with you rather than simply attempt to destroy you.

At the price they sell at I would wholeheartedly recommend that you add this one to your collection.

Soft aid

Computer people have always impressed me as being the most pleasant and cheerful that I have met. There are a few exceptions I admit, but in general that goes for the users, the manufacturers and the media.

It was only to be expected really that when someone came up with the idea to do with software what Bob Geldof did for music in aid of Ethiopia then the response would be overwhelming.

Soft Ad is the title of the completion of programs from most of the major software houses which have been donated for this project. And every program on it has been a best seller. In fact, the response was so great that several companies could not get their programs included, and those acknowledged on the insert. However the games from those who did get their programs used make this the best collection of programs ever to be marketed.

For £4.99 in many cases this is less than the original price of the individual games on the tape, you get Spellbound from Beyond, Snake from The Edge, Kokoron Will from Elite, The Pyramid from Fantasy, Horace Goes Skiing from Melbourne House, Gilligan's Gold from Ocean, Ant Attack from Quackadee, 3D Tank Duel from Real Time, Jack and the Beanstalk from Thor and Sorcery from Virgin. Plus the hit single recorded by Band Aid.

Out of every tape sold £3.00 goes to the fund, the rest is used to cover basic production and distribution costs. So if you haven't got it by now, go get it

and get a superb collection and help those less fortunate than ourselves. And if you press it then may your Spectrum wish!

Go for Gold

British Telecom leaves the realms of budget software with the launch of their "Gold Edition" range of programs. These sell at the more normal price of £5.95 for the graphically excellent Buggy Blast and the top paced and challenging Gyron at £9.95.

Gyron is a 3D maze game which requires both strategy and arcade reactions to succeed. Two programs are supplied on the cassette, a beginners game and the "real" game. With each copy of the game there is a free-entry form to allow you to take part in their competition, each entrant who sends the correct solution will gain a place in a tournament to find the overall winner. And what does the winner get? Nothing less than a Porsche G24 (One owner, as software house programmer - not really, only joking) or its cash equivalent. Can't be beat!



Activision action

With their stated aim of being the leading software house of 1985, Activision have a whole new range of programs released or about to be released.

Ghostbusters must be their most spectacular success so far and it will be interesting to see if any of their subsequent games will match its success.

The Music Studio is an ambitious program which uses the limited sound features of the Spectrum to create music. As it was initially planned on the C64, Amstrad and MSX machines it will be interesting to see whether it manages the con-

vention.

Great European Road Race requires the skills involved in driving in a rally and could be a hit among fans of the kind of game. For fans of their program, Activision are running their own software club, membership of which is free. The main business is, of course, to advertise and sell their games, however the last issue contained 16 colour pages and also contained news, articles and reviews. Anyone who wishes to join the club should write or phone Activision at 15 Harley House, Marylebone Road, London NW1. Tel 01-486 7588.

In Brief

- From Collins publishers comes the Collins Gem Revision Software, there are four sets of their established revision booklets complete with a question and answer type computer tape which consists of nine independent programs. Suggested for CSE, O level and the new 16+ exams the subjects covered are Physics, Biology, Chemistry and of course, Computer Studies. Each pack costs £8.95 and is available from most larger stores.

- Leonardo is the program which should put the spark into the Creative Sparks products. It is a graphics package which appears to provide sophisticated drawing capabilities for the Spectrum. Aimed at programmers, artists, draughtsmen and doodlers, it consists of the drawing package and a user program to allow you to actually make use of your creations.

Priced at £9.95 we'll get Colin Christmas to give it an in depth review as soon as we get a copy. Available from good computer shops.

- All four of the Picon GL programs have been modified and improved, if you get a GL now make sure the version supplied is the 2.0 set. Deleting owners who have looked out to be members of the GL club get it, but if you haven't then it'll cost you.

- More revision software from Megacycal Software Ltd. All are good study aids and the titles are Images (high construction diagrams), DC (current electricity), Motion (velocity and acceleration) and Revise Physics.

I haven't got a price list but the company is at PO Box 6, Bickenhead, Nantwydad L43 8XH. I have sent them to Mike Edmunds for a review along with the Collins programs

- Even more Educational programs! Two tapes from Software Cottage each with two programs on a musical note. Firework Music and Water Music provide drill and practice exercises and Jumpy Snake Blues and Honkey-Tonk are game based activities. The cassettes are £8.95 each and can be obtained from 19 Westfield Drive, Loughborough, Leics LE11 3DJ.

A great bit of news is that they also do ZX81 programs, Music Education 1, 2, and 3 and Firework Music are the four programs in the range and cost £5.00 each.

- Level 8's adventure programs must be among my favourites, I haven't started to play one or that's the end of my work for a week or two! It could be even longer, I still haven't solved Lords Of Time! So, it was with mixed feelings that I saw Emerald Isle released, not only with 230 locations but with 230 graphic illustrations too. They assure me that it is slightly simpler than their other adventures and because of that it sells at £6.95 instead of their usual £9.95 price. Oh well, if this issue is late then you'll know why.

Level 8 are at 229 Hughenden Road, High Wycombe, Bucks HP13 5PG.

- Light Magic sounds like an impressive art and design program from New Generation Software, brush mode has ten different brushes in twenty different sizes!

It was developed as an aid to their in-house graphic designer Sally Ann Bartley and proved so impressive that they decided to market it. Many exciting features such as mirror, copy, move, enlarge, fit and rotate, are also included.

It is available from the company at The Brooklands, 16 Sunningbank, Lymcombe Vale, Bath BA2 4NA and will set you back £14.95.

- Memoart continue to keep up their output of a variety of programs, Princess Frog, Secret Agent is described as an arcade adventure, Ancient Guests is a two-game pack which puts you in the pyramids and in Oracule's castle, and Caesar's Travels is described as a "unique animated interactive program/storybook pack". Sounds fascinating.

Star Seeker is a planet, star and constellation simulation program. The first three cost £7.95 and the last is priced at £9.95.

- Highsoft announced recently that their acclaimed Highsoft C compiler is to be sold retail and should be available from most discerning software shops.

Look out for the game of the show Supergran, will it do for TyneSoft what the song did for Billy Connolly?

● We look forward to receiving a review copy of Caidron from Palace Software, the screen shots look first rate. They are at 275 Fernoville Road, London, N1 9NL and the game costs £7.99.

● We keep getting press releases for The Rocky Horror Show program but so far it has failed to materialise, it had better be good after all this delay! CRL describe it as a fully animated graphic adventure and guaranteed non-existent.

● Minder is complete and DK'Tronics tell us they're only waiting Thames TV's approval, hopefully they will have it before the gets on the shelves of your local newsagents.

● With the 128K of memory available Talent Computer Systems have released two text adventures for the QL. The Lost Kingdom of Zou is a traditional sorcery game and West is set in Indian territory. Both are priced at £19.95.

● GraphQL looks like a very comprehensive graphics utility program and most of the functions you can think of are included, I say most because no matter how comprehensive it is someone is bound to think of something not included if I say "all". This one costs a massive £34.95, expensive by home computer standards but cheap by business/professional standards.

Talent are at Curran Buildings, 101 St James Road, Glasgow G4 0NS.

● For the machine code programmer, Tomorrow's Dream Software have produced Titan. This is a machine code monitor and debugging utility and is well written, easy to use and an invaluable aid to sorting out those fatal crashes. A wide range of useful functions are provided including relocation, single stepping, string research and breakpoints.

The company hopes to branch out into arcade, adventure and strategy programs, and if they are as well written as Titan then it will be a new and exciting company to watch. Available from Richmond House, 18 Sydenham Road, Brentford TW8 6SH. Titan costs £8.00 on tape and £15.00 on microdot/cassette.

● A load of releases from Games Workshop recently which includes Tower of Desser and its sequel Key of Hope. We received our first copy of one of these games recently and it should be featured in one of the review sections, look for Talesman. (£7.95).

Chaos is their latest and is for one to eight players. The press release looks interesting (£7.95). And finally, D Day has been converted to run on the QL, however it has also undergone a price conversion to £24.95 - if you buy an expensive machine than you can afford.

● Metacomco have reduced the price of their QL Assembler Development Kit to a mere £39.95, above comment applies. No address but their phone number is 0272 428781.

● Two good adventures which fans of the genre could well enjoy are Clues 'O' and Curses of the Seven Faces from Imperial Software.

Clues 'O' has many references to a certain French detective and some quite humorous messages and events. The programs are £9.95 each and should be available from your local shop, if not try Imperial House, 153 Churchill Road, Pools, Dorset.

● Smirton of 4 Clarence Drive, East Grinstead, West Sussex RH19 4RZ have produced Car Cure which is a sort of computerised fault finding manual. An interesting idea especially if you have been banished to the garage with your computer. Smirton are selling their program at £9.95.

● Stay Cool continues the trend of mascot titles. This one is from that well respected and experienced company Bug Byte. For £9.95 you can explore over fifty locations of a speechie in full cartoon style animated graphics. Available from most stores or Bug Byte Ltd., Mulberry House, Canning Place, Liverpool L1 5JB.

● CCS extend their already vast range by two more programs. Maverick lets you play Jackpot Draw Poker against five opponents, each with different "characters". Learn or develop your skill without risk of losing a lot of money or getting shot.

Nato Alert is a non-nuclear strategy/wargame simulation which I'm sure will find enthusiasts ready and willing to purchase. Both games are priced at £5.95 from Cases Computer Simulations Ltd, 14 Langdon Way, Blackheath, London SE3 7TL.

● Ski Star 2000 marks Richard Shepherd's debut into the arcade field. It appears to be a very flexible and unusual program in that you get a 3D skier's view as you run the course and there are 18 basic courses of which two are infinitely re-designable. The company reside at Elm House, 23-25 Emshot Lane, Capperham, Slough, Berks and the price of the program is £7.95.

original as it must be possible to get, a straightforward Zap-em-all game, it will be a favourite among young arcade fans and I forecast that it will have a goodly run at the top end of the charts.

In line with the general trend of boosting sales with prizes they are offering a genuine Moon Crests arcade machine to the first person to get a score of over 30,000. Check with them first that it hasn't been won as these offers tend to be won almost before we can print them. £9.95.

Also at the same price is Confusion of which I have little information except "Hundreds of confusion bombs on sixty four levels". Make of that what you will.

U.S. go for gold

The adverts for this range of programs from the states have been around for a while now but at last the games have started to emerge from the confused

distribution system. Ocean have acquired most of the rights and are actively involved with Websters in the distribution of these games, the only thing now is to see whether they match up to the advance publicity.

Blue Max is a flying game which involves dealing out death and destruction by shooting down enemy planes, bombing targets and strafing gun emplacements and tanks. Good clean family fun.

Bruce Lee gets you against various foes including a wizard and you have to dispatch them using your more human, but no less lethal, weapons of hands and feet. This features twenty locations and multiple player options. £7.95.

Yet another club to join, the US Gold Club, however this will cost you £8.95 + 75p P&P. For this you get a sweatshirt, badge, poster, membership card and discount on software.

US Gold, Unit B, The Parkway Industrial Estate, Hereage St., Birmingham B7 4LY.



The incentive incentive

Well the Kat trilogy was finally won by Tom Frost aged 47 and it's great that, for a change, it wasn't a young whizz kid. Don't get me wrong, I've nothing against younger computers, it's just that we all tend to forget sometimes that people of all ages use and enjoy this

technology.

Anyway, congratulations to Tom and runners up Rex Taylor and Mark Prochym.

Incentive's latest program is a conversion of the arcade classic Moon Crests, now this was a particular favourite of mine in the arcades and I was rather dubious about how it would transfer. But, was I surprised! It is as close to the

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Discovery Disc Drive System

With a flourish and fanfare Opus Supplies Ltd. announced the launch of the "most advanced and comprehensive" disc drive system for the Spectrum yet.

First Impressions

This is a completely self-contained unit consisting of 3.5" disc drive, interface, power supply unit which provides power for the Spectrum as well as through port, Centronics printer port, joystick port and S/W video port. An impressive set of extras indeed!

I unpacked it and was pleased to find the manual/booklet very simply written. To use the unit with virtually any Spectrum, Spectrum+, or other keyboard, all you do is plug it into the user port at the back end, in the case of the Sinclair keyboards, screw it into place with a single screw.

My first problem came in working out how to position the TV aerial lead as the case was so close and wide it covered this and all the other Spectrum sockets. The phono plug fitted to my Spectrum's lead was too bulky and I had to find a spare, but then I realized that a slight gap in the case which coincided with the cable's position was to be used and, with a bit of twisting and bending, the Spectrum and drive were connected.

Power on, an on/off switch at the back of the case was another useful extra, and all seemed to function perfectly. The system uses all the Microdrive syntax plus some abbreviations and operates in a similar fashion. This means that the use of sequential files, not feasible with some other drive systems, is possible, and another advantage is that many programs may be compatible. The disadvantage is that interface I and the Microdrives are incompatible



The manual explains its operation and gives some examples, I found it easy to understand and the examples were good. The joystick port is Kempston compatible and the makes it usable with a great many games.

The system is available in two formats, a single drive unit for £199.95 and a dual drive unit for £329.95. There is an upgrade drive available to convert a single drive to double drive at £139.95.

One of the problems that has held up the development of disc drive systems for the Spectrum is the marketing of such units. Opus have made an impressive start in this area by selling exclusively through the Boots chain of stores. Another limitation is the software available in this format and again Opus have had the foresight to arrange

with some S/W houses to supply their programs on disc. At the time of writing there are six packs available each at £14.95 and they are:

Technician Ted/International ATC from Newson Muggie/Sports Hero from Melbourne House
Codename Mat/Kentile/Usper from Micromega (an excellent set!)
Designers Pencil from Activision
Trans Express from Romanto Robot (a good tape to disc utility)

Mine Office from Database Publications (a good general business pack, see our full review in this issue.)

In Use

Earlier on I said that the unit may be compatible with Microdrive S/W, unfortunately nothing I

had that worked with them would operate on the system. My copy of the original Trans Express on tape for tape to midrive transfer would not even load successfully, however their specially written disc version will no doubt work as impressively as did their original, and the various programs which included options for making microdrive backup copies also failed to work.

Oh well back to hard conversions, no immediate apparent advantage to the use of microdrive syntax. Doing it the way varies between easy and impossible and my yardstick is how long it takes to convert Towerkill. This conversion was completed in fifteen minutes with a further half hour to add features like a CAT and ERASE option to the menu. Easy!

There was one other problem, the manual had not instructed me to connect the Mic/Ear leads so I had to unscrew the assembly and plug them in, these were now so tight against the drive case that they kept twisting the unit out of place. I tightened the screw to hold it but a nagging worry that the thing might move and cause the port connector tracks to short out remains with me now. I consider this to be a major design fault and I got round it by adding a ribbon extender cable and not having the units connected by the screw. It is possible to obtain such a ribbon from Opus themselves, but as an optional extra, not included with the drive itself.

In operation the drives were about as fast as the other systems I'd used, about twenty seconds to load a program which normally took close to five minutes, but they operated almost silently, a great change from the strangled gurgle I'm used to. The 3.5" discs are double density 40 track and two are supplied free by Memorex who are to make and sell them.

Finally we would just like to add that any questions or problems we had with the unit were very promptly dealt with by the people at Opus, and if their sales support is as efficient as that then it is to be recommended. All in all, the unit seems to represent very good value for money, and with the distribution and software backup that they have arranged this is likely to represent a serious challenge to the other disc drives on the market.

Opus can be contacted at: 55 Ormside Way, Holmesthorpe Industrial Estate, Redhill, Surrey RH1 2LW



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3



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3. Burrowing Rat
4. Support
5. Cave In
6. Snake
7. Snake Nest
8. Gremkin
9. Mound
10. Pile of Earth
11. Cave

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Riches await you - but so do the hazards!

ROCKET MAN

Get rich quick by collecting Diamonds that are simply lying there waiting for you!

Oh... I forgot to mention that there are one or two problems!

There is an expanse of shark infested water between you and the Diamonds and a strange breed of Bubble that seems hell bent on getting you in it! Somehow you must cross it...

You have a Rocket Pack to help you (a Vulture on higher levels) but you must rush around the platforms and ladders collecting cans of fuel (legs of lamb with the Vulture) and cursing that weird Bubble. Once you have enough fuel then it's Chods Away!

Oh... but don't run out of fuel on the way - otherwise it's... SPLASH!



1. Diamonds
2. Sea
3. Platforms
4. Ladders
5. Fuel Cans
6. Rocket
7. Vulture
8. Leg of Lamb
9. Player
10. Bubble
11. Fuel Gauge
12. New revelation



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Use Your ROM

Norman Green in Derbyshire makes life a little easier for 16 and 48K programmers



When I was a schoolboy, I was often told to use my loaf. Any day now, I expect to hear some youngster told to use his ROM! It would be sound advice, even though not a true parallel. Using one's loaf is to use one's own brain, to use your ROM would be to make use of someone else's, and if, like me, your computer is a Spectrum, the brain you would be using are those of Uncle Dave and his team of experts at Sinclair Research. The Spectrum ROM, with over sixteen thousand bytes of permanent memory, contains many very useful subroutines just waiting to be called by some grateful user (or should I say USER?).

Although ROM can be called from the keyboard using the USER Key in instructions such as 'RAND USER 0000' or 'LET L=USER 0000', the ROM routines are at their most useful when called from machine code programs, in which the programmer can easily arrange for the entry conditions of any particular routine to be satisfied. In this short article, I shall

limit myself to discussing just two of the many routines in Spectrum ROM and then show how they may be linked together to provide a short but very powerful utility program. Readers who do not yet feel at home with machine code will nevertheless be able to key-in and use the concluding program, which is written entirely in BASIC with the machine code stored in a data line from which it will be transferred to a temporary home in the printer-buffer section of RAM each time the program is RUN.

Into the ROM

The first of the aforementioned routines is situated in the Spectrum ROM at decimal address 6510. Its function is to determine the address in RAM of the first byte in a program line whose line number has been previously entered into the HL register pair. After calling 6510, the HL register will contain the required address.

The other routine may be

entered at 6626. Its function is to delete lines from the basic program. Before this routine is called, the address of the first byte in the lowest-numbered line of the block to be deleted must be loaded into the DE register pair, and the address of the first byte following the last byte in the highest-numbered line of the block must be loaded into the HL register pair.

Although they may sound convoluted, use of these two routines is simplicity itself. I have seen complicated machine code programs of considerable length which take several minutes to delete a block of lines. The code which I am about to offer is a mere 19 bytes long and can delete a large chunk of unwanted program in a fraction of a second. It is more straightforward than the much-used method of computing the length-of-line bytes in order to fool the computer into thinking a block of lines is all one single line, and then having to delete this by keying.

For those familiar with assembly language instructions

these are printed below, alongside the 19 bytes of decimal machine code.

Any line numbers are admissible, providing the first is not higher than the second. If the two are equal, then single line deletion is effected. If numbers which have not been allocated to program lines are entered, then all lines encompassed by the two numbers will be deleted. (This also applies to the number zero and to all numbers greater than 9999.)

I conclude with the promised

basic program. The lines are numbered 9990 to 9998 so that if transferred to tape by keying SAVE "delete", it may be recalled whenever required by keying MERGE "delete", when the high line-numbers are unlikely to clash with the program being added. When no longer required, "delete" may be used to delete itself; although it should be noted that the deletion of line 9998 by this method will produce the report "C Nonlinear in BASIC, 9998:1", but on this occasion it may be ignored.

Ld HL,0	33,0*,0*	First line no. into HL.
CALL \$10	205,110,25,	Using your ROM.
PUSH HL	229,	Store returned address on Stack.
Ld HL,0	33,0*,0*	Second line no. into HL.
Inc HL	35,	Line no. above deletion Stack.
CALL \$10	205,110,25,	Using your ROM.
POP DE	209,	Reclaim address from Stack to DE.
CALL \$20	205,220,25,	Using your ROM.
Ret	201,	Return to Basic.

Line numbers are poked here in usual way, least significant byte first.

Assembly Language Listing

9990 REM DELETIONS

```
9991 DATA 33,0,0,205,110,25,229,
33,0,0,35,205,110,25,209,205,229,
25,201
```

```
9992 RESTORE 9991: FOR n=0 TO 18
I READ a: POKE 23300+n,a: NEXT n
9993 INPUT "Enter lowest line-number in" block to be deleted:
"j#
```

```
9994 POKE 23301,a-256:INT (a/256)
: POKE 23302,INT (a/256)
```

```
9995 INPUT "Enter highest line-number in" block to be deleted:
"j#
```

```
9996 IF b<a THEN INPUT "Re-enter second line-number," "i" FLASH 1
:"NOT" FLASH 0: " lower than the first: "j# GO TO 9994
```

```
9997 POKE 23303,b-256:INT (b/256)
: POKE 23304,INT (b/256)
```

```
9998 RANDOMIZE USR 23300
```

DK'Tronics programmable joystick interface

I had never been lucky enough to own a joystick interface (so bi, so when our kind editor offered me this one to review I eagerly accepted it, listened to have silly ideas about winning a game in 'March Point', and even worse, escaping from the honors of the 'Underside'. With these promising thoughts in mind I set about discovering the relative merits of the DK'Tronics programmable joystick interface.

The £22.95 package includes the interface unit, a cassette containing the driver

program, and a fairly brief set of instructions. The interface unit is well put together and fits snugly behind the spectrum via a through ported edge connector. The joystick socket is sensibly located on top of the unit so the joystick plug does not foul on any larger add-on keyboard fitted. The interface is compatible with interface 1 and microdrives.

Following the instructions carefully, I plugged in my joystick, flicked the little switch on top of the interface and then

loaded the driver program. The program, encouragingly entitled 'Joy', loaded in about 30 seconds and auto-ran. After a further 30 seconds of key pressing I had a fully operational joystick ready to do its worst. I find that I rarely program the interface manually as it is much more complicated, and the diagonals are not programmed (ie you cannot fire and move at the same time).

The interface supports the autofire option found on some joysticks, but surprisingly the in-

structions do not mention the fact incidentally, make sure the autofire switch is off when programming the interface, otherwise strange things happen.

During the few weeks I have had the interface, it has always performed perfectly. Coupled with my Quikshot II joystick it proved a worthy addition to my armoury (although I still haven't beaten McEnroe and his friends in 'March Point'). When compared to other programmable interfaces on the market, the DK'Tronics product emerges favourably. It is certainly one of the cheapest available (some non-programmable interfaces cost only a few pounds less), and reliability should be assured coming from DK'Tronics. The only real criticism is the complexity of manual programming; it is far easier to stick to using the tape.

After all those kind words, it would be very hard for me not to recommend the DK'Tronics interface to prospective purchasers. So I'm going to take the easy way out and give the thumbs up to a good product at a competitive price.

DK'Tronics, Saffron Walden, Essex.

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GREAT MINDS



Mathmania — Primefact

Wembley teacher R. S. Moreland invites you to have fun with numbers.

These are many programs which have been written for playing games, zapping aliens, working through an adventure trail, and the like. All of these give the player a sense of excitement based upon speed of reaction or working through a set of clues given in an adventure. There is however an area which can be just as exciting to many people, and that is 'discovery', in particular, discovering the solution to a puzzle, or a problem. Playing with numbers can be a very rewarding pastime and, who knows, one may make an important discovery in number theory.

Before computers were invented, mathematicians did all of their calculations on longhand or paper. When logarithmic and other tables were published, this made things a bit easier, but verifying and proving new mathematical propositions was still a tedious task. For example the evaluation of $\pi(7)$ to, say, a few hundred decimal places took many months of painstaking work. Again the determination of whether a number was prime could take many weeks to work out for only a six or seven digit number. A prime number is a whole number which has no factors other than 1 or itself. Try working out using only pencil or paper whether 1333 is a prime number. Simply try to divide 1333 by successive known primes up to the number which is the nearest to the square root of 1333. Time yourself to see how long it takes. Next, using the program 'PRIME FACTORS' see how the same job takes a matter of seconds.

Now for the interesting part, the program will find out whether any whole number, (integer) up to 4,284,967,295 (the limit of integer accuracy on the Spectrum) is a prime number. If it isn't, the program will give all of its prime factors. Try and invent some prime numbers and test them. If you have found a prime number which contains more than one odd digit try and re-arrange the digits to see whether the number is still prime, putting the odd digits at the end of the number of course. For example, 567323 is a prime

number, but are re-arrangements of these digits still prime? Try timing how long it takes the computer to do the calculations for numbers of varying length. Also, try numbers which are the sum of a prime and different even numbers, such as 11+6, or 11+8, or 13+20, etc. Is there a pattern?

Another problem to try is: "For a given perfect square (take a fairly large one, a calculator would be handy for this) how many ways are there of adding two primes to make up that square? ... For example 25 may be made up of 2 and 23, both primes, but 36 can be made up adding 5+31, or 7+29, or 13+23, or 17+19. Can the sum of three primes make up a perfect square?"

Numbers have fascinated mathematicians and laymen alike for centuries, and in particular the problem of finding a formula for generating prime numbers has occupied more man-hours than many other problems. Even today mathematicians have not yet discovered a formula for yielding all of the known primes. There are many formulae which will give a whole set of prime numbers, but not a general formula for all of them.

The great mathematician Euler proposed the formula $x^2 + x + 41$ for producing primes, but there are many numbers given by this formula which are not primes. Try using 'PRIME FACTORS' as a subroutine to a small program which evaluates the Euler primes from this formula. Another well known expression is that which generates Mersenne numbers (after the 17th century mathematician Marin Mersenne, a Parisian monk). This formula is $2^n - 1$ where n itself is prime. Again, write a small program to generate these numbers and test them with the program 'PRIME FACTORS'. An interesting fact is that for 208 years the Mersenne number $2^{47} - 1$ was thought to be prime; in 1903 an American professor showed that it had factors of 193, 707, 721 and 741, 938, 257, 287.

The largest prime number found by a computer in 1962 was $2^{111} - 1$. In 1962 the largest was $2^{431} - 1$. In 1968 in Illinois the 23rd Mersenne prime, $2^{1103} - 1$, was discovered by using an Atlas computer. A special postmark showing this, was struck and used on envelopes for a long time afterwards. By 1971 the largest prime was $2^{1993} - 1$ discovered by Bryant Tuckerman at the IBM research centre in New York.

The method for generating prime numbers is the same one which has remained unchanged for nearly 2000 years, it was developed by Eratosthenes of Alexandria, and is called 'The Sieve of Eratosthenes'. The technique is to write down the sequence of positive integers and then to proceed systematically to cross out all composite numbers, (ie. numbers which are products of previous numbers) those which are thus sieved out will be the primes.

There are many other interesting facts about prime numbers, for example the diagram shows a 'Magic Square' of prime numbers only. If any row or column or either diagonal is added up, the sum

will always be 111. Another interesting fact is that the first five digits of the decimal part of form a prime number — 3.14159....., thus 14159 is prime. Try it out on the program. Again, there is a group of numbers called 'repunit' numbers which are all repeated units. The numbers 111, 1111, 11111, are all repunits. Which of these and other repunits are primes?

Finally, here are two problems which should keep you busy for a while, and both may use the program 'PRIME FACTORS':

Problem 1
How many 'palindroma' prime numbers can you find? A palindroma number is one which reads the same both backwards and forwards, for example 3156513.

Problem 2
Using each of the nine digits, 1, 2, 3, 4, 5, 6, 7, 8, 9 once only, form a set of three primes which have the lowest sum. Thus the primes 941, 663, 827 add up to 2,421 but this is not the smallest sum.

67	1	43
13	37	61
31	73	7

6789

10 PRINT "Program to verify th
at a number is prime"

20 PRINT "Type in your number
, one at a time as requested."
30 "To stop at any stage key in a
40 "Press any key to start"

40 DIM L(100)

50

60 REM *** Input module ***

65


```

70 INPUT B$: CLS
80 INPUT "Number please "
100
90 IF B$="a" OR B$="5" THEN
STOP
100 LET number=VAL B$
110 IF number=INT (number)<100
THEN PRINT "Not an integer"
: GO TO 80
120
130 REM *** Initialize module ***
135
140 IF number=3 OR number=2 THEN
GO TO 290
150 LET index=1:
LET temp=number:
LET flag=0
160
165 REM *** Mainline module ***
166
170 IF 24INT (temp/2)=temp THEN
LET L(index)=2:
LET flag=1:
LET index=index+1:
LET temp=INT (temp/2):
GO TO 170
180 LET factor=3
190 IF factor*INT (temp/factor)
=temp THEN
LET L(index)=factor:
LET index=index+1:
LET flag=1:
LET temp=INT (temp/factor)
or: GO TO 190
210 IF factor^2>temp AND flag=0
THEN GO TO 290
220 IF factor^2=temp AND flag=1
THEN LET L(index)=temp:
LET index=index+1:
GO TO 245
230 LET factor=factor+2:
GO TO 190
235
240 REM *** Printing module ***
242
245 PRINT number;" is NOT prime"
***"its factors are:- ***
250 FOR j=1 TO index-1
260 PRINT L(j)
270 NEXT j
280 PRINT : GO TO 80
290 PRINT " "number;
" IS a prime number":
PRINT :
GO TO 80

```

We, The Jury

If you would like to have your views taken into account when we print our arcade reviews then send us the sheet (or a photocopy or handwritten copy) and we'll feed them all into our overworked Spectrum to get an overall assessment. We are only interested in the very latest games on the market though!

Program name _____
 Supplier _____
 Price _____
 Type _____ (znp, jump, adventure movies, etc.)
 Description _____
 Graphics % _____
 Instructions % _____
 Difficulty % _____



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So all-in-all there's no way you can afford to be left out of the great new revolution in games computing — rush out and buy your copy NOW!

Spectrum lessons

Will Mike Edmunds administer the cane or give gold stars to Sinclair's latest?



It always seems to be a very long time between releases by Sinclair, and when they do appear they often seem like the famed curse's egg — good in parcel. Not so this selection, which appear to provide a wealth of educational experiences. With the exception of Number Racer and Estimator Racer, both of which bear the Pison and A.S.K. labels, all the other titles are published under the Macmillan Education banner. The leading screens however, bear the logo of Freeways Software — always an indication of software of educational merit.

Each of the Macmillan titles are well presented and come with the usual comprehensive parent guide, for it must be said that the intended market is more home than school use. Having said that however, there is certainly a great deal of material that can and will be used in many classrooms. There is plenty of advice for those parents who may be unsure of the part that they can play in developing the child's reading skills. Parents are also encouraged to work through the programs with the child and to reinforce the skills gained at the keyboard with

follow-up writing activities together with lots of praise and encouragement.

The guides give the general aims of the programs and outline the role of the parent in the education of children. There follows a step by step run-down of the program, and information detailing how to transfer the programs to microdrive. This last feature should be standard on all 'educational' programs this being a plea from many teachers with Spectrums in their classrooms. Perhaps now that the price of cartridges has fallen, software houses will at last make life just a little easier for all those who have to wait, and wait, while their cassettes load.

Learn to Read

There are five new programs which follow on from the Learn To Read series, these are Alphabetter, Wordsetter, Spellbox, Soundabout and Bodyswap. All have a similar format and graphical content to that found in the previous series, containing such entertaining characters as Deb the Rat, Ben the Dog and, of course, the Fat Pig.



The redefined character sets are clear and easy to read, an essential for the child who is just beginning the reading process. The graphics are delightful, and good use is made of both colour and sound throughout the whole series. A recent review said that the animals are not particularly well represented but I could find no fault and the animation sequences only add to the appeal of the programs.

Briefly, Alphabetter deals with sequential alphabetical order and ordering of words according to their second letter. These programs have several speed options which enable them to be used at various levels and with children of differing abilities. A graphic reward follows each section and the child is given a score to aim for the next time around.

Wordsetter helps children to sort words and pictures into sets. This concept is an important stage of the learning process and there are two levels available, each of which can be played at three speeds. The program is ideally for two players, each of whom aims to be the first to complete their set or theme. A picture or word is generated at random in the middle of the screen and each child must decide if it fits into his or her set. Correct answers give the child the picture, incorrect responses take one of the pictures away. There is a healthy sense of competition and the program not only helps with sor-

ting but also encourages accurate and rapid responses.

The next title, Spellbox, contains activities to aid word building and accuracy. There are two sections both of which are based upon the traditional games, Noughts and Crosses and Pelmanism. Although these could quite easily be played by more traditional methods, it is by using pencil and paper! It must be said that the instant feedback of the computer provides an additional incentive for most children. Perhaps one vital element that computers cannot provide is the warm encouragement of an adult and this aspect is strongly stressed within the notes.

Both parts of Soundabout help children to recognise and use initial sounds. Pictures shown require the child to press the appropriate letter on the keyboard, but it is a shame that programs of such overall quality take no note of the fact that the keyboard uses upper case! I suppose it might be argued that this is a deliberate attempt to match upper to lower case but an overlay would be a distinct advantage in the instance!

Bodyswap contains some very effective anagrams and requires the child to spell the word corresponding to the highlighted part of the forward anagram. Help options are available with the required answers either displayed or hidden. These programs introduce, reinforce and test vocabulary based upon parts of the body. The final section is more of an award than a teaching program, and is an updated form of the 'make a Beetle' game.

Taken as a suite of programs these contain many and varied ideas and exercises which will help to introduce and reinforce the necessary skills required in an effective and appealing way.

This is a job for . . .

Maths programs are perhaps the most common type of educational software available at present so it takes something quite different to make an impact, particularly with teachers. Macmillan appear to have come up with a new idea for their latest

ventures into mathematics, just as the current trend for adventures is the "Part one, followed by the sequel approach, and for arcade games to have successive programs based around the same character, so, now we have Macman!

Macman is the star of four programs, The Caper Eater, The Treasure Caves, The Magic Mirror and the Great Escape. In the Caper Eater, the emphasis is on Addition and Subtraction. This is achieved in several ways but essentially deals with "find the difference" type problems and "math rats" or "sentences". The idea is that children become aware of relationships between numbers, thereby increasing skills and confidence. All of this leading to increased enjoyment.

Macman in the Treasure Caves concentrates upon subtraction and, as with The Caper Eater there are five levels of increasing difficulty. The adult can set the required level if necessary or the child can progress throughout the program at his or her own rate. Both of these programs follow a similar format, progress, reinforcement and reward. There are also Help facilities which automatically come into play when errors are made. Each of these programs include entertaining games which also provide opportunities for the child to plan strategies to maximise their scores.

Good graphics and sound together with the chubby little figure of Macman marching steadily around the screen have certainly appealed to the classes that have used these programs so far. For the pupils the mathematical content is almost an aside, but learning is most definitely taking place! The other titles in the Macman series, Macman and the Great Escape and Macman's Magic Mirror complement each other. The former deals with shape and conservation of area, whilst the latter is concerned with reflection, translation and rotation.

The Great Escape has six levels of difficulty ranging from the making of shapes with 'bricks', through estimation and conservation, to rotation, reflections and translations. I was very impressed by this program — it covers the subjects comprehensively and in a most enjoyable manner. Macman is again the star and the representations on-screen are superb,

maintaining the interest of the children throughout.

The format on each level is the same — Macman regarding a wall, behind which one or more prisoners are trying to escape. Unfortunately, holes keep appearing in the wall and it is the child's job to help Macman plug the gaps before a prisoner can escape! The number of prisoners is always on the increase and, needless to say, Macman's job becomes increasingly difficult. Watch out when one of them escapes!

In the Magic Mirror the child needs to guide Macman to reproduce the image on the other side of a mirror. The idea is well implemented and a great deal of thinking is required on some of the higher levels to get a correct pattern before time runs out and the mirror cracks. The different levels are achieved by using different numbers of mirrors and the angles at which they are set. This program also helps with the concepts of co-ordinates, plotting and grid-work. First rate in all aspects.

The two Pison/ASK programs are not nearly as impressive in terms of packaging or length but nevertheless are equally as effective as learning aids. Each will fit into the 16K Spectrum and are more clearly recognised as games with an educational content.

These are the types of programs that make children think and who is to say that this cannot also be a hugely enjoyable process?

Number Painter sets a target number which must be made by combining numbers and mathematical operations. This follows the style of the 'platform and ladders' games that are currently so popular, and has much of their appeal in play. Four different speeds are available depending upon the character

chosen, from Mr. Plod to Mr. Speedy. This is a very effective way of developing a fluency with numbers and operations.

Estimator Racer is essentially Chequerboard Flag with sums! The child needs to guide a chosen car along a racetrack, all the while having to estimate the answer to a displayed problem. This program encourages the essential skill of estimation and after a few runs you begin to get a real feel for numbers, the mental arithmetic that takes place is tremendous, and thankfully the choice of cars available includes a fairly slow one. Good competitive fun against others or against the computer, and fun which develops skills that are needed every day.

Science Horizons

The last four programs come under the Science Horizons heading and are simulations, of a sort. Even a review of this sort cannot do full justice to these programs, as I feel that the full potential of these demands a concentrated approach for those intending to use them in the classroom.

Oil Strike is a business simulation concerned with the search for oil. It is reminiscent in some ways of The Mary Rose (for the BBC) and gives graphical representations of sea drills and rock strata etc. There are comprehensive notes, enough to ensure that the could form the basis or be an integral part of a classroom topic for a considerable time.

Planet Patrol is a graphical version of Mastermind but, much, much more complex. It also stimulates logical thinking and forward planning. Put these factors together with an illustration of the solar system, relative positions, sizes and motions of the planets and you have some

idea of the wealth of material available for further study. None of these four programs is immediately playable, you must take a little time to soak up the instructions and the intricacies of play. Once you are familiar with them however, they are great fun and very demanding in terms of thought!

Diseases Dodgers almost stands on its own as an arcade game. It is concerned with keeping the Dodger family alive when faced with a multitude of diseases and germs. The program shows how health, diet and exercise are interrelated and also illustrates that people living in different countries of the world face different problems of health and diet. Of all the programs this perhaps is the least effective graphically, there are colour attribute problems and some of the foods represented are not clear. This aside it is very playable and should provide much 'food for thought'!

Finally, Weathermaster. This is a novel use for a computer, basic meteorology (Nothing novel about that, have a look at Metplot, ZX October '84 — ED). After using the program I have no doubt that television weather forecasts will take on a new clarity. The program familiarises the user with the charts, symbols and terminology used by the media. These ideas are set in a game format with impressive results.

In conclusion I can only say that although these reviews may seem overly-enthusiastic I have been pleasantly surprised at the new levels that educational software, whether for home or school, have reached. Take two gold stars Macmillan and Sinclair! If you are somewhat skeptical about my comments, I can only suggest that you get hold of some of these new titles and see for yourself!

SINCLAIR MACMILLAN

MACMAN MATHS

Macman and the Caper Eater
Macman and the Great Escape
Macman in the Treasure Caves
Macman's Magic Mirror

SCIENCE HORIZONS

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Diseases Dodgers
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Spectrum Arcade

David Howard tests his reactions on another batch of arcade releases

Match Day Ocean £7.95

You may remember WORLD CUP by ANCTIC COMPUTING, one of the first good football games on the market. MATCH DAY is far superior to any other and is of the same quality as International Soccer for the Commodore 64 — please ed, may I just mention the computer — (No, ED?) Obviously the graphics are not as good, but they are very clear and the problem of bleeding did not seem to occur. The ability to alter the colour of the teams is a good idea, so you can pick the one that is most pleasing to the eye and easiest to recognise.

The extensive menus at the beginning are very useful, where a number of details about the game can be changed. There is not enough space to list them all here and you more than likely would get bored, but to give you an idea it is possible to alter the names of the teams, play against the computer, a friend or in a league, alter the length of each game, choose how each player is to control his team, difficulty levels of play, and so on.

The game starts as the teams line up on the pitch, with the tune Match of the Day sounding (and no Jimmy Hill). It is a bit tedious waiting for positions to be taken, but it is at least realistic.

The whirled sounds and the game begins. Playing against the computer can be quite difficult, especially if playing on one of the harder levels (there are three levels in all — amateur, professional and international). As in most of these games, you are in control of the player nearest the ball. At times it can be difficult to gain control of the ball, especially as there is no facility to strike the opposing player, but once in control, you can pass to fellow members, dodge the other team and hopefully score. Then a kick or

throw-in is taken, the direction is controlled depending on the movement of the joystick or keys, so passing to your own team should be easier than on a real football ground.



The game is ideally played with a joystick, but if you are challenging a friend it is unlikely that you will possess two joysticks, so the keyboard will just about suffice.

As with most of these games on the Spectrum, due to the limitation of sound, headaches can be obtained quite easily, but the on/off sound switch is a Godsend! The reality of the whole match, with a reflection as the ball bounces and the quality graphics makes this a worthwhile buy, allowing you to play football from the comfort of your armchair.

INSTRUCTIONS	95%
PRESENTATION	90%
ADDICTABILITY	85%
VALUE FOR MONEY	85%
ZXC FACTOR	7

Ghostbusters Activision £9.95

Having heard the record and seen the film, you can now play the game, courtesy of Activision. This is the game everybody

has been shouting about on the Commodore (not that word again) and the same scenario is present on the Spectrum version.

The game starts with you being granted a franchise to rid the city of ghosts, and to set you on your way the bank is lending the hefty sum of \$10,000. Instead of reeling there and then, you have to purchase various items to help you achieve fame, fortune and rid the city of all these evil spirits.

There are three screens where you select all your equipment, from transport to the intricate ghost-busting traps. Having loaded up your vehicle, a map of the city appears and all the places that are having trouble with the headshrinker flash red, and once at these haunted venues, GHOSTBUSTING can begin.

Whilst travelling around the map, if you should pass over a Roamer (a wandering ghost), he is frozen and can be vacuumed up just before you arrive at the haunted venue. After detecting

the Simer (technical term for ghost) into the trap and capturing him, it's onto the next one folks, before the energy from all the ghosts gets too large or the centre spot of the city, the Temple of Zuul is reached by the Gatekeeper and Keymaster.

A marshmallow alert can happen at any time, where all the Roamers will quickly join forces to form the Marshmallow Men. A dollop of bait must be immediately dropped to prevent him crushing any buildings. The game will end if you can sneak two ghostbusters into the Temple of Zuul, but be prepared as this can take time while the forces of the spirit world join up to turn the city into mayhem.

Although this game does not create the same atmosphere as the film, it is quite fun to play, but I can see it at the bottom of my tape rack after a few months. Putting all this aside the speech synthesis and theme music of GHOSTBUSTERS at the beginning of the game should even put Ray Parker Junior to shame.

INSTRUCTIONS	95%
PRESENTATION	80%
ADDICTABILITY	75%
VALUE FOR MONEY	70%
ZXC FACTOR	8

Gift From The Gods Ocean £8.95

Ocean have delved into the depths of Greek legend and come up with an adventure game to play on your ancient Spectrum.



The game is based upon the life of Orestes. For those lesser mortals who are reading this page and do not know who this person was, I shall explain. Orestes had a mother, Clytemnestra, a father, Agamemnon and a sister, Electra. Clytemnestra, in order to rule over Mycenae, evilly kills her husband and banishes her two children from the land. Electra is hidden in the catacombs below the palace, where Clytemnestra lives with her new husband Aegisthus, and Orestes, the Hero of the game, with the help of the gods must try and regain the kingdom from his mother.

You are Orestes and control your figure on screen with a joystick (virtually any) or keyboard. It is better to use a joystick as the game has an intelligent joystick facility, leaving out the need for complex combinations of keys.

In order to reclaim Mycenae, Orestes must travel around the labyrinth and collect 16 Euclid shapes (geometric designs) and place them in the correct order around the chamber to find the exit and end of the game. Orestes has been given a sword and seven tears, which act as markers, to help him find his god. Electra can also help in finding the shapes, and appears as an apparition and will lead you to the correct place. Scattered around are terrifying objects, placed by the Dem-gods, which will zap your strength and eventually send you to the underworld.

I enjoyed playing this game very much. The graphics are excellent, with smooth animation and although I seemed to be running around the maze doing nothing for quite some time, *Gift From The Gods* is totally absorbing, interesting and fun.

INSTRUCTIONS	95%
PRESENTATION	90%
ADAPTABILITY	90%
VALUE FOR MONEY	95%
ZXCFACTOR	9

Skooldaze Microsphere £6.95

Microsphere have produced a game that will not teach you to spell, as in the 1980s, but teach obedience or good manners, but will enable you to enter a classroom where you can do what you like, and even invent names for the lengthy cast.

You are ERIC, a mischievous little brat whose school report is locked away in the staffroom

safe. You have to get this report before the headmaster does, or else. In order to uncover the hidden combination, the statistics that are hanging on the walls have to be hit. The masters will become disorientated by the flashing shields and will reveal part of the combination. The only problem, of course, is the history master, who cannot remember his part, so you must get his bedsheet out of him, and write this on the blackboard, at which point his memory will be jogged and he will reveal all.

As well as this task, you must take part in the normal activities of school, which involve going to lessons and playing. If you do not go to the correct classroom at intermission, you will receive lines as punishment. More than 10,000 lines will end this game as Eric is suspended from the school with writer's cramp. Finding a seat during a lesson is not always as easy as it seems as they are soon taken up by other pupils. Even if you manage to find a seat, you are invariably shoved off onto the floor, gaining more lines. This school is very much like a cartoon strip, and the characters could be straight from the *Beano*. The graphics are fair, but not so clear although they do not really let the game down too much, as it is very enjoyable playing school, fighting the bully, using catapults and having lessons with Mr. Whitby and Mr. Cassak. A must for all Non-Schools.

INSTRUCTIONS	90%
PRESENTATION	85%
ADAPTABILITY	85%
VALUE FOR MONEY	85%
ZXCFACTOR	9

Pitfall II Activision £6.95

This is a nifty little number and is of the Arcade Adventure sort. Pitfall Harry must find his niece Rhonda, her cat, Quacklow, and the Big Diamond as well as gathering up all the gold along his journey. You are Pitfall Harry and travel through many scenes containing balloons, caverns and various dangers such as bats, frogs, and scorpions. You start off with 4000 points and aim for a perfect score of 199,000.

The best thing about this game is that if you happen to die along the way, you are transported back to the previous rest cross, which you pass over during your mission. This means that the game is virtually endless



and although your score declines when you get killed, once it reaches zero, that's it. With a lot of practice, the ideal score could perhaps be reached. As with all these games, annoying tunes are played along the way, but luckily there is an on/off button. Pitfall II is also compatible with all major joysticks.

The graphics are adequate, but I feel could be a lot better to match the standard of the rest of the game, but all in all, a good buy and stimulating.

INSTRUCTIONS	95%
PRESENTATION	90%
ADAPTABILITY	80%
VALUE FOR MONEY	85%
ZXCFACTOR	8

Hellfire Melbourne House £7.95

This is the game I have been waiting for. I have not had so much excitement in all my life. A wonderful game. Steady on you might say, have you got shares in Melbourne House? Isn't this going a bit heavy AND before the game has been properly reviewed? Perhaps, yes, but HELLFIRE is a game that requires skill, concentration and nimble fingers and is the same as a 30 year old finding out what it is like to play space invaders for the first time. There are three tasks that have been set upon you

by the gods, and you must complete all three to show your worthiness.

My first task is the easiest, but requires a lot of initial thought. Once done, it appears to be quite easy. I suggest, switch off the computer, have a five minute break, and try again. It is still frustratingly difficult to . . . To what? The idea is to climb the ledges and arrive at the cave entrance. You jump from ledge to ledge avoiding the falling boulders, but one slip could quite easily see efforts lost. Having completed the first task and given yourself a pat on the back, task two immediately ensues. You enter a sacred temple inside the mountain that you have just entered. Manotaurus are on guard and the idea is to reach the top right pillar to get to the next level. The fun comes when running from pillar to pillar as you are transported to another part of the temple and you have to

kick the right combination to reach the exit. An added bonus was the springboard, which you can use to reach different levels. The third and final task is to find your way through the maze and locate the exit. Your mice will kill any attacking monsters and break down the exit. The graphics in this game are faultless and so is the game.

INSTRUCTIONS	95%
PRESENTATION	100%
ADAPTABILITY	100%
VALUE FOR MONEY	100%
ZXCFACTOR	10

PAUL McCARTNEY'S *Give my regards to*

BROAD STREET

When the music stops, the mystery begins...



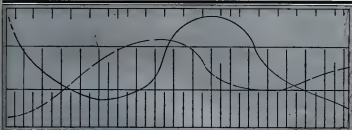
MIND GAMES

A MIND GAMES PRODUCTION



Sounds!

We take an in-depth look at an area which is getting a lot of interest.



A couple of issues ago I reported on a visit to Electromusic Research Ltd and Mike Satchler, the owner, who makes the Midi interface sold by Ross Morse. The response was fantastic, a letter flooded in, and all the way from Southern!

But seriously, this article did generate a lot of interest from all over the world and so we thought we'd have a special issue on sounds. There are several ways of creating sounds on the computer - even the ZX81 is capable, with a suitable peripheral, of sounds better than the Spectrum's unsaid BEEP.

The first way . . .

With a Spectrum only, it is to utilize the beep in an efficient and clever manner and, by an amazing coincidence we have a program which does this! If you have no musical ability and want to know how to go about programming music into your computer, we have an article on how to do that too!

The second way . . .

In to add on a sound unit, there are several for the Spectrum and even some for the ZX81, we give a round up of all these.



And finally . . .

to approach the whole thing from the other direction, get an instrument, keyboard or synthesizer, and use your computer as a tool to create music with it.

We wondered how many readers would be interested in this rather expensive way of doing it, but two factors encouraged us, one was the amount of letters about our last item as mentioned, and the other was my personal knowledge of two young people, both at school who worked all through their holiday last year and asked for money for birthdays and Xmas so that each could buy a £655 Korg Poly-800 synthesizer.

Also, the recent appearance of the Casio CZ101, a full Midi synth for £395 and the likelihood of even cheaper machines to follow helped us to make the final decision to present Midi in the home, an in-depth look at how the system can be used by the non-professional. By the way, should any reader reach top of the pops, let us know! Meanwhile here is ZX Computing's contribution to the world of Culture, join the Club and Boy, won't you have a lot of fun by George!

A Spectrum spectacular of Melodic Masterpieces from Maestro Colin Christmas.

PROGRAMMING FEATURE

Well perhaps not quite so extreme, but the interest in macros and music is increasing and with a little time and effort it can be a fascinating and fun way of whiling away an hour or two. Not only that, but a game benefits greatly from having a burst of a recognisable tune played at appropriate times even with the Spectrum's limited BEEP.

There are plenty of articles and programs which help you to enter and play sounds but very little has been produced for the non-musician to convert melodies into code which the computer will recognise. The aim of this article is to remedy that and to give hints for the musically illiterate on how to produce computer music from musical notation.

The ability to read music takes a great deal of study and dedication but it is still possible for even the most musically incompetent to convert the manuscript into recognisable tunes — all you have to do is follow this guide!

Even the Spectrum manual presumes some knowledge of music and although the Spectrum 4 manual is a little better, I hope to explain and develop some of the assumptions which the manual makes.

First things first.

The Spectrum produces sounds by the BEEP command, the technical method and the use of machine code are not going to be dealt with here, but if we get enough requests then perhaps a future article?

BEEP is followed by two numbers, the first is the duration or length of time the note will sound for, and the second is the pitch or the actual note value. Let's have a look at the notes as written in script form. Put in a simplified manner, each note

provides two pieces of information, the duration and the pitch — how convenient! Each note has a name, a letter of the alphabet, and these run from A to G, if you go higher than G then you start with A again but it is said to be an OCTAVE higher. The same applies if you want to go lower than A except you then go to G and work backwards.

The position in the STAVE, the five lines running across the page, determines its name (pitch). The diagram (fig. 1) shows the most common notes found on a stave. The curly sign at the start of the stave indicates that it's the TREBLE clef, there is another sign which looks like a backward C with two dots after it which indicates the BASS clef. The great majority of the music that you will encounter will be written in the Treble clef and so, for the sake of keeping this article short enough for publication, I'll only deal with this one.

In fig. 1 you will see the names of the notes and beneath them their pitch values for the Spectrum, if you have another micro then look up the value of middle C in your manual and pencil it in under the FIRST C shown, adjust the value up and down by a similar number as each note is offset on the diagram. All Spectrum users need do is look up the appropriate note and transfer the value to the SECOND of the BEEP numbers.

But, beware! Music also contains strange devices called SHARPS (#) and FLATS (b) and these can affect the pitch value. If one of these appears at the very start of the stave then all the notes of that name, no matter what octave they are, are affected. If one of these appears just before the note then only the notes of that name in that BAR are affected. Oh, and one more thing to add to the confusion, there is also a sign called a NATURAL (♮) and this cancels



the effect of any sharps or flats which may have altered the value of the note previously, including those at the very beginning of the music, for the duration of the bar.

These BARS I have been talking about are not those which sell refreshment (which I'm sure you must all feel like indulging in by now), but the set of notes between any of the two vertical lines which divide up each stave

as it runs across the page. The placing of these is not random, but determined by the timing of the music which again would take too long to explain in this article. So, how do these flats and sharps affect our pitch values? If a note is flattened simply subtract 1 from its value, if it is sharpened then add 1 to its value. Try to remember this as all too frequently it is the cause of some strange sounding notes in a melody!

The Duration

This is determined by the type of blob put on the stave line. These all bear some relationship to each other, if you are familiar with Beery then it'll help, and also depend on the TIME SIGNATURE and TEMPO of the music. In the majority of cases this does not affect the result, in practical terms, when converting to the computer.

In fig. 2 I have given the duration names of the notes and underneath the values which I found most existing for the duration of the BEEP. These are easily changed if a piece of music needs to be faster or slower and if you use the system of programming music that I suggest later on, then among these is very simple indeed. Of course it's not quite that simple, sometimes there is the need for a period of time where there is nothing played at all, these are signified by RESTS and these also have durations which correspond to the durations of the notes, these are given as part of fig. 2.

And then there are extended notes, these may be shown in one of two ways, a dot (.) which comes immediately after the note and this extends the duration by one half the note duration value. For example, a crotchet followed by a dot is a DOTTED crotchet has a duration of .75 — the same as a crotchet and a quaver together — 5 + .25.

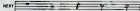
The other way of extending the length of a note is to TIE it with a line curving between the two (or more) notes. This has the simple effect of adding the duration value of every note so tied, together.

Micro Music

PITCH VALUES



DURATION VALUES



NOTE NAME	W	H	Q	E
W	4	2	1	0.5
H	2	1	0.5	0.25
Q	1	0.5	0.25	0.125
E	0.5	0.25	0.125	0.0625

IF I HAD A HAMMER

Musical score for 'IF I HAD A HAMMER' in treble clef, 2/4 time. The score consists of four staves of music. Below each note are pitch and duration values.

Staff 1: 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100

Staff 2: 101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125 126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143 144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198 199 200

Staff 3: 201 202 203 204 205 206 207 208 209 210 211 212 213 214 215 216 217 218 219 220 221 222 223 224 225 226 227 228 229 230 231 232 233 234 235 236 237 238 239 240 241 242 243 244 245 246 247 248 249 250 251 252 253 254 255 256 257 258 259 260 261 262 263 264 265 266 267 268 269 270 271 272 273 274 275 276 277 278 279 280 281 282 283 284 285 286 287 288 289 290 291 292 293 294 295 296 297 298 299 300

Staff 4: 301 302 303 304 305 306 307 308 309 310 311 312 313 314 315 316 317 318 319 320 321 322 323 324 325 326 327 328 329 330 331 332 333 334 335 336 337 338 339 340 341 342 343 344 345 346 347 348 349 350 351 352 353 354 355 356 357 358 359 360 361 362 363 364 365 366 367 368 369 370 371 372 373 374 375 376 377 378 379 380 381 382 383 384 385 386 387 388 389 390 391 392 393 394 395 396 397 398 399 400

WE SHALL OVERCOME

Musical score for 'WE SHALL OVERCOME' in treble clef, 2/4 time. The score consists of three staves of music. Below each note are pitch and duration values.

Staff 1: 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100

Staff 2: 101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125 126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143 144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198 199 200

Staff 3: 201 202 203 204 205 206 207 208 209 210 211 212 213 214 215 216 217 218 219 220 221 222 223 224 225 226 227 228 229 230 231 232 233 234 235 236 237 238 239 240 241 242 243 244 245 246 247 248 249 250 251 252 253 254 255 256 257 258 259 260 261 262 263 264 265 266 267 268 269 270 271 272 273 274 275 276 277 278 279 280 281 282 283 284 285 286 287 288 289 290 291 292 293 294 295 296 297 298 299 300

Programming

When writing a piece of music for the computer the most frequent method seems to be to simply get each duration and pitch and write it as BEEP .5,7,BEEP .25,9,BEEP .5,11 etc. etc. But if the tune is lengthy then an excessive number of Beeps are needed, which of course means a great deal of memory, and editing is a confusing task to say the least!

As there are only two variables, plus the rests when required, I set up a subroutine which uses DATA and READ. This is an all purpose routine and could be used to play several tunes in any specified sequence from the main program.

The number of READs that we make may vary from tune to tune so I use the bogus value 99 as a Data terminator when read into the duration and as a rest in-

dicator when read into the pitch variable.

The "Play" Subroutine

```
9000 READ dur,pitch: IF
dur=99 THEN
RETURN
9010 IF pitch=99 THEN
PAUSE 50 *dur:
GO TO 9000
9020 BEEP dur, pitch: GO
TO 9000
```

Notice that the data termination value has to be duplicated or the subsequent READING of "pitch" would cause the machine to crash with an "out of DATA" report.

The music itself is held in a series of DATA lines which contain the values for each BEEP. My suggestion is that you put each bar in a separate line to aid debugging.

9100 Data .5,7,
.25,7,.75,9,.5,7

To use this from a main program or in a sequence then RESTORE to the first DATA line of the tune you require and GO SUB 9000, in this way you can have several tunes which you can call as often as you like and in which ever order you require.

If you want to increase or decrease the speed of your tune then all you have to do is alter the BEEP in line 9020 as appropriate BEEP dur/2, pitch to double the speed or BEEP dur *2, pitch to slow it to half speed. Alternatively, multiplying "dur" by a variable preset by the program will allow varying speed music to be played in the same program.

Finally

I include a short demo program

which will show these techniques in operation.

If this has whetted your appetites then learning to read music will not be that hard for you and perhaps even learning to play an instrument may be on the cards!

As far as existing computer kits is concerned then I would personally recommend the "Music Typewriter" from the Romeric Robot company as one of the best produced for the Spectrum. This is closely followed by "Musicmaster" from Sinclair. The DK Tronic sound synthesizer comes with a free program which acts as a three track digital recorder and is great for experimenting with. For the more dedicated, William Short Systems produce hardware and software to produce some sophisticated sounds, but of course it is fairly expensive.

But now I'm off to get Brahms and Liszt. . . .

```
10 FOR I=1 TO 2: RESTORE 9100:
GO SUB 9000: NEXT I
20 FOR I=1 TO 3: RESTORE 9200:
GO SUB 9000: NEXT I: STOP
@9999 REM Play tune routine
9000 READ dur,pitch: IF dur=99 T
HEN RETURN
9010 IF pitch=99 THEN PAUSE 50 *
dur: GO TO 9000
9020 BEEP dur,pitch: GO TO 9000
9099 REM data for
WE SHALL OVERCOME
9100 DATA .5,7,.5,7,.5,9,.5,9
9101 DATA .75,7,.25,5,1,4
9102 DATA .5,7,.5,7,.5,9,.5,9
9103 DATA .75,7,.25,5,1,4
9104 DATA .5,7,.5,7,.5,9,.5,11
9105 DATA 1,12,1,14
9106 DATA 1.25,11,.25,9,.75,11,.
25,9
9107 DATA 1,7,.5,9,.5,11
9108 DATA 1,12,.5,12,.5,9
9109 DATA 2,7
9110 DATA 1,9,.5,7,.5,5
9111 DATA 2,4
9112 DATA .5,7,.5,7,.5,8,.5,5
9113 DATA 1,4,1,2
9114 DATA 3.5,8
9115 DATA .5,99,99,99
9116 REM some notes may need
adjusting to suit personal
taste, I would shorten 3.5
in line 9115 to 3 and make
the .5 in line 9116 up to 1
9199 REM data for
```

```
IF I HAD A HAMMER
9200 DATA .5,99,.5,3,.25,7,.5,18
,.25,7
9201 DATA .75,18,1.25,18
9202 DATA .5,99,.5,12,.25,12,.25
,18,.25,7,.25,3
9203 DATA .75,7,1.25,3
9204 DATA .5,99,.5,3,.25,7,.25,1
8,.25,18,.25,7
9205 DATA .75,18,1.25,18
9206 DATA .25,99,.5,13,.5,13,.25
,18,.5,12
9207 DATA 2,18
9208 DATA .5,99,.5,18,.25,12,.25
,18,.5,12
9209 DATA .75,15,1.25,15
9210 DATA .5,99,.5,12,.25,12,.25
,18,.25,7,.25,3
9211 DATA .75,7,1.25,7
9212 DATA .5,99,.5,12,.25,12,.25
,18,.5,7
9213 DATA .75,3,.25,8,1,3
9214 DATA .25,3,.25,3,.5,3,.25,8
,.75,-2
9215 DATA 2,3
9216 DATA .75,7,.5,5,.25,3,.5,5
9217 DATA 1,3,1,99,99,99
9218 REM some note lengths may
```

sound slightly too long or short, a musician would make allowances, you may change note dur lengths but try to keep the total length of the notes to a value of 2.

SHARP'S INVADES ENGLAND!

WAR in the EAST £9.95

The simplest of the four but our best seller. As commander of the German forces you must launch a surprise invasion of Russia, capture and hold Moscow before the weather and the Red Army overwhelms you. Effects of terrain, weather and fuel supply. Eleven types of divisions and brigades. 1½ hr. playing time. Also for 16K-2X51.

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In a desperate attempt you have to break through the Allied lines, inflict heavy losses and capture as many towns as possible to prevent "Fall of the Third Reich". Scrolling map—brigade and regiment size. 2 hours playing time.

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The most advanced of the four games. The player must defend England in this hypothetical invasion during WW II. Effects of rail lines, weather, terrain & ports. Scrolling map, multiple attacks. Every German invasion is totally different! All this, and more makes this game a must! 1½ hr. playing time.

Each game has a hi-res. map in color with sound. These are true military recreations of what happened. The ending depends on you. These are not arcade or adventure games! No fast reflexes required. Not recommended for young children.

Spectrum 48K

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Now available to you only by:
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Rt. 10 Box 459
Mechanicville, VA 23111
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Tel: (804) 730-9697

OMNICALC 2

★ OMNICALC 2 £14.95

THE most successful spreadsheet available for the Spectrum.

Featuring:

- Full support for the Micro-drive/ret/RS232 facilities within Interface 1.
- Inbuilt graphics to draw histograms from your data.
- Insert/Delete column and row functions.
- Separate work area to enable transfer of data between spreadsheets (for consolidation etc).
- Can be used with or without micro-drives, with a full-size printer.
- Comes with comprehensive manual.

★ OMNICALC 2 EXTENSION KIT £6.95 NEW!

- Run your programs from disk, with the extension kit you can incorporate additional commands. Suitable for most available disk drives, including wide drives. Also can be used to add in special printer commands.
- Screen-paging routine designed primarily for Interface 1 owners with Epson-type printers, this routine has single and double size facilities and can be used to help print the histograms produced by Omnicalc 2 and general screen-copy routines in other programs.
- External (print-out routine) by separate request. Prints-out if the format used in every cell of the spreadsheet.

MICROSPHERE

NEWSTRAT COMPUTER SERVICES LTD. 724-92056 (0447)
1000-930-264 TELEPHONE 01-234911



This program not only turns the Spectrum keyboard into a piano keyboard with an excellent graphical representation of the keyboard, but actually allows you to play more than one note at once! This is achieved by using a vibrato effect and the final result sounds like a Mandolin. Unusual and very pleasing to the ear.

The instrument will play notes over one octave from middle C to upper E. Keys A to ENTER act as the white notes on a piano and the appropriate keys on the line above play sharps and flats.

As you may imagine, the BASIC REEP could not possibly cope with this, and so Gavriel has resorted to machine code which has to be put into the memory by a special program.

Entering the Program

First type in the program given in Fig 1. This is a loader program which will put the machine code into memory. Now look at Fig 2.

This mass of numbers is made up in the following way, first is a five figure number (starting at 32768) this is the address at which the code is stored.

This address is followed by five numbers, these are the bytes of machine code which need to be entered, and finally there is a number at the end of the line, this number is the sum of all the five bytes of machine code and is used as a check. (See Fig 1a for an example).

ADDRESS	(MACHINE CODE - five bytes)	CHECKSUM
32768	205 87 130 33 255	710

Figure 1a

So now run fig 1 and enter the five bytes of machine code, one at a time, pressing ENTER after

Gavriel Hajibab of London wrote this brilliant program which will give your Spectrum a musical keyboard.

each one, and when all five have been entered the screen will display a number. This number MUST be the same as the one given at the end of the line. If it is not then answer 'y' to the prompt and re-enter that line again.

Once all these numbers have been entered you have finished with the fig 1 program, so type NEW and ENTER, and the machine will give the same effect as when you first switched it on. But don't worry, the code is safe. (If you are worried then SAVE "music" CODE, 1010 before NEWing your computer.)

Now type in the fig 3 program and RUN it. Save the program, there are two sections to it, on tape and verify it. On all subsequent loadings the program will auto run load in the machine code and be ready to use.

If you want to test it without reloading, then type RANDOMIZE USR 32768. When you wish to end your musical renditions then press CAPS/

LOCK and SPACE. To re-start after a break use the USR number as above.



FIGURE 1 Loader Program

```

10 BORDER 6: PAPER 2: INK 7: C
LEAR 32766
20 LET CHECK=0: LET C=0: PRINT
AT 15,12: PAPER 3: "BYTELOADER":
PAUSE 50: CLS
30 FOR A=32768 TO 33770
40 INPUT "40-DELETE LAST ENTRY
5: (A)"; "1A0: IF A0=" THEN 6
7 TO 40
50 IF A0="0" THEN LET A=A+1
PRINT AT C,1,0, AT C-1,0: LET C
CHECK=CHECK+IFEEK A: LET C=C+1:
PRINT N0: INK 4: PAPER 0: FLASH
1: "ENTRY DELETED": REEP .5,0: PA

```

Mandolin Keyboard

48K SPECTRUM PROGRAM

```

USE 1: PAUSE 50: GO TO 40
40 LET B=VAL A#
70 POKE A,B
80 PRINT A# *18
90 LET CHECK=CHECK+B
100 LET C=C+1
110 IF (C/5)=INT (C/5) THEN PR
INT AT 10,0: FLASH 1: INK 4: PAP
ER 0: CHECKSUM:=1: CHECK: PRINT :
DEEP .5,0: PAUSE 1: PAUSE 50: IN
PUT "ANY CORRECTIONS (Y/N) *1AB:
IF A#="Y" THEN LET CHECK=0: LE
T C=0: LET A=A-5: ELSE 1 GO TO 14
0
120 IF (C/5)=INT (C/5) AND A#="
N" THEN LET C=0: LET CHECK=0: C
LS : GO TO 140
130 IF (C/5)=INT (C/5) AND A#="
"N THEN GO TO 110
140 NEXT A: STOP
    
```

FIGURE 2

32768	205	87	130	53	254	710
32773	127	62	127	219	254	709
32778	203	71	202	53	129	650
32783	62	283	219	254	203	991
32788	71	204	78	129	6	400
32793	11	14	27	196	53	381
32798	130	62	253	219	254	910
32803	207	79	204	89	129	704
32808	6	11	14	25	196	252
32813	53	130	62	253	219	712
32818	254	203	87	204	100	840
32823	129	6	11	14	23	183
32828	196	53	130	62	253	694
32833	219	254	203	95	204	975
32838	111	129	6	11	14	271
32843	21	196	53	130	62	662
32848	253	219	254	203	103	1032
32853	204	127	129	6	11	472
32858	14	19	196	53	130	412
32863	62	191	219	254	203	929
32868	71	204	179	129	6	589
32873	11	14	17	196	53	291
32878	130	62	191	219	254	854
32883	203	79	204	167	129	792
32888	6	11	14	15	194	242
32893	53	130	62	191	219	655
32898	254	203	87	204	153	983
32903	129	6	11	14	13	173
32908	196	53	130	62	191	632
32913	219	254	203	95	204	975
32918	144	129	6	11	14	384
32923	11	196	53	130	62	452
32928	191	219	254	203	103	978
32933	204	133	129	6	11	483
32938	14	9	196	53	130	482

32943	62	251	219	254	203	989
32948	79	204	191	129	6	689
32953	13	14	26	196	78	319
32958	130	62	251	219	254	916
32963	203	87	204	203	129	626
32968	6	13	14	24	196	253
32973	78	130	62	251	219	732
32978	254	203	103	204	215	979
32983	129	6	13	14	20	182
32988	194	78	130	62	223	681
32993	219	254	203	103	204	903
32998	227	129	6	13	14	309
33003	18	196	78	130	62	476
33008	223	219	254	203	95	994
33013	204	239	129	6	13	591
33018	14	16	196	78	130	426
33023	62	223	219	254	203	961
33028	79	204	251	129	6	649
33033	13	14	12	196	78	383
33038	130	62	223	219	254	988
33043	203	71	204	7	130	615
33048	6	13	14	18	196	239
33053	78	130	195	6	128	829
33058	126	87	14	60	62	349
33063	253	243	211	254	238	1281
33068	155	66	16	254	13	384
33073	32	246	251	201	62	792
33078	254	219	254	203	71	1001
33083	202	65	129	195	2	599
33088	129	1	64	196	11	388
33093	237	95	211	254	204	919
33098	177	32	247	201	54	711
33103	8	6	11	14	22	58
33108	205	19	130	24	201	529
33113	54	225	6	11	14	318
33118	23	205	19	130	24	483
33123	198	54	200	6	11	461
33128	14	23	205	19	130	391
33133	24	179	54	192	6	455
33138	11	14	21	205	19	270
33143	138	24	168	54	167	513
33148	6	11	14	19	205	255
33153	19	130	24	157	54	384
33158	150	6	11	14	17	198
33163	205	19	130	24	166	524
33168	54	134	6	11	14	219
33173	15	205	19	130	24	393
33178	135	54	125	6	11	331
33183	14	13	205	19	130	381
33188	195	34	129	54	118	522
33193	6	11	14	11	205	247
33198	19	130	195	34	129	587
33203	54	97	6	11	14	182
33208	9	205	19	130	195	558
33213	34	129	54	242	6	465
33218	13	14	26	205	34	294
33223	138	195	34	129	54	542
33228	218	6	13	14	24	267

48K SPECTRUM PROGRAM

```

33233 285 36 138 195 34 488
33238 129 54 177 6 13 379
33243 14 28 285 36 138 485
33248 195 34 129 54 158 578
33253 6 13 14 18 285 256
33258 36 138 195 34 129 524
33263 54 143 6 13 14 238
33268 16 285 36 138 195 582
33273 34 129 54 115 6 358
33278 13 14 12 285 36 288
33283 138 195 34 129 54 542
33288 184 6 13 14 18 147
33293 285 36 138 195 34 688
33298 129 229 197 193 285 933
33303 217 13 17 117 131 493
33308 1 2 8 285 68 268
33313 32 228 281 229 197 884
33318 193 285 217 13 17 645
33323 121 131 1 2 8 255
33328 285 68 32 228 281 723
33333 229 197 193 285 217 1841
33338 13 17 119 131 1 281
33343 2 8 285 68 32 299
33348 228 281 229 197 193 1845
33353 285 217 13 17 123 575
33358 131 1 2 8 285 339
33363 68 32 228 281 62 588
33368 134 58 123 92 62 481
33373 131 58 124 92 33 438
33378 8 64 17 1 64 144
33383 1 255 23 34 8 333
33388 237 176 33 8 88 534
33393 17 1 88 34 112 272
33398 1 8 3 237 176 417
33403 62 128 58 141 92 465
33408 62 2 285 1 22 292
33413 13 229 88 17 238 597
33418 88 1 21 8 54 164
33423 96 237 126 33 197 739
33428 89 17 198 89 1 394
33433 21 8 54 96 237 488
33438 174 6 4 62 96 346
33443 33 8 89 119 17 263
33448 21 8 28 119 17 182
33453 11 8 28 16 244 294
33458 6 23 14 27 285 275
33463 217 13 1 21 8 252
33468 17 125 131 285 68 538
33473 32 6 16 14 27 93
33478 285 217 13 17 55 587
33483 131 1 28 8 285 357
33488 68 32 6 15 14 127
33493 27 285 217 13 17 479
33498 55 131 1 28 8 287
33503 285 68 32 6 14 317
33508 14 27 285 217 13 476
33513 17 55 131 1 28 224
33518 8 285 68 32 6 383

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33523 13 14 27 285 217 476
33528 13 17 76 131 1 238
33533 28 8 285 68 32 317
33538 6 12 14 27 285 264
33543 217 13 17 38 131 413
33548 1 28 8 285 68 286
33553 32 6 11 14 27 98
33558 285 217 13 17 97 549
33563 131 1 28 8 285 357
33568 68 32 281 132 32 477
33573 132 32 132 32 132 528
33578 32 132 32 132 32 488
33583 132 32 132 32 132 528
33588 32 132 32 132 32 521
33593 134 133 134 32 132 645
33598 133 134 133 134 133 767
33603 134 32 132 133 134 645
33608 133 134 32 132 132 643
33613 146 147 146 147 32 618
33618 132 146 147 146 147 738
33623 146 147 32 132 146 623
33628 147 146 147 32 132 624
33633 138 131 138 131 138 782
33638 131 138 131 138 131 753
33643 138 131 138 131 138 752
33648 131 138 131 138 131 783
33653 148 149 138 131 144 742
33658 145 146 147 43 43 524
33663 43 32 77 83 83 328
33668 73 67 32 77 65 314
33673 69 83 84 82 79 397
33678 32 43 43 43 8 161
33683 8 8 8 8 8 8
33688 8 8 15 15 15 45
33693 15 15 15 7 8 52
33698 248 248 248 248 248 1288
33703 248 224 128 15 15 622
33708 15 15 7 8 8 37
33713 8 248 248 248 248 968
33718 224 128 128 128 128 736
33723 128 128 128 128 255 767
33728 128 128 8 8 8 256
33733 8 8 255 8 8 255
33738 128 128 255 128 128 767
33743 128 128 128 8 8 384
33748 255 8 8 8 8 255
33753 8 128 128 128 128 512
33758 128 128 128 128 15 527
33763 15 15 15 15 15 75
33768 15 15 248 248 248 758
33773 248 248 248 248 248 1288
33778 8 8 8 8 8 8
33783 8 8 8 8 8 8
33788 8 8 8 8 8 8

```

Page 3

```

18 SAVE "music" LINE 28: SAVE
"maestro"CODE 33768,1818
28 CLEAR 33766: LOAD **CODE
38 RANDOMIZE USR 33768

```


Midi In The Home

Talented? Musically frustrated? Read on...

There is a growing trend towards using the computer as a tool in the composition and performance of music using the new range of low cost keyboards and synthesizers. We decided to keep up with this trend and present a guide to what is available and how it can be used for both expert and newcomer alike.

As we are a computer magazine we are concentrating on this aspect and our information on the instruments is not "in depth" — this could be the subject of a magazine in its own right!

Arguably, CASIO are the Sincier of the keyboard world, three years ago their E40 machine ceased as much as the ZX81 in its day, and even now their CZ101 is the cheapest MIDI machine on the market at around £350.00. I know several people personally who owned an early Casio, went into computing and, returning to bigger machines have now linked both interests together, and they are not all millionaires either — one is a schoolboy and another is unemployed!

Instruments

JVC KB600 £650.00 Arbiter Ltd.

This machine has 48 keys (4 octaves), 10 voices, PCM drum sequencer with 14 preset rhythms and 4 variations on each for drums, bass, rhythm, and arpeggio — each with individual volume control. The keyboard can be split as desired so that left and right halves of the instrument can play different voices, the voices are in two groups so that some voice combinations are not possible. There is a chord and rhythm sequence recorder and a melody line can also be recorded. One finger chords are provided or full finger chording, and the rhythm unit follows the chord played on the left hand. A useful feature is Ultra Chord which adds an appropriate harmony to notes on the right hand in relation to the chord played on the left.

You cannot create your own rhythms on the basic machines but for an extra £120 JVC also produce a Composer unit which plugs in and makes this feasible. This machine seems aimed at the home user rather than the professional, a 2.5 Watt stereo amplifier is built in and is very loud in an enclosed unit, Output is via phono plugs rather than the professional standard jack plug. Optional extra accessories include a stand, expression pedal (volume) and carrying bag.

This is a high quality unit which allows inexperienced players to produce interesting sounds quite quickly, but which is also versatile enough to please the experienced. A guided set of tunes in script form complete with suggested settings is also included. The drums sound very realistic, though a little monotonous, a common problem, and the voices are very good — note though, that you cannot alter them, the Jazz Organ, Piano, and Harpsichord in particular, but this is very much a matter of personal preference. Manual drums can be played and there are 24 percussion effects!

Arbiter Ltd, JVC House, Eldon Wall Trading Estate, Staples Corner, Princes Way, London NW2.

Siel MK900 £459.00 Siel (UK) Ltd.

Spectrum users will feel at home with this one as the control buttons have the same kind of rubbery feel that the original Spectrum had!

However, this is no criticism, the thinking behind it being that a musician wishing to change something during his performance would not be over-gentle in hitting the button and for this they are ideal. This instrument features 51 keys (5 octaves), 10 voices, a rhythm unit which includes drums, bass, rhythm and arpeggio and 10 preset rhythms. You can program your own rhythmic sequences from the manual drum option which has four percussion effects. One finger chording, which the rhythm pattern

follows is available on the left hand part of the keyboard which can be split into any of these preset positions.

The power supply unit is separate from the instrument and is plugged in in a similar manner to the Spectrum's PSU. A 4 Watt per channel stereo amplifier is built in, which is very loud. A counter melody option adds harmonics to the melody line and an interesting feature called "left to mono" plays the top note of right hand chord as a separate single note in the left hand voice.

The drums are not very realistic and rather limited, however the rhythm patterns are very good and have a nice "feel" which makes playing along easier. After a little confusion the machine fell into place and I found it easy to get what I wanted, the five octave keyboard gave a healthy range and the sounds were very well created. In particular I liked the Pipe Organ, Strings and the Trombone, the latter not sounding quite like the real thing, but giving a great sound anyway. It is more for the player with added accompaniment, but versatile enough to enable an inexperienced musician to make good music.

See [UK] Ltd, AHED Depot, Hookwood, Baggate, Horley, Surrey RH8 0HY.

Siel DK80 £699.00

A deceptively simple looking machine which is a true synthesizer at a reasonable price.

It features 12 voices, double sound generation, dynamic keyboard (usually only found on instruments at twice the price), 87 programmable parameters, ADSR, two DCO's and VCF's and four LFO's (see glossary), MIDI IN, OUT and THRU sockets are provided and both OMNI and POLY modes are available.

This unit actually represents great value for money, having many features normally not included on the cheaper synths — such as a pitch wheel, for instance. The Midi format is very well implemented, and they market their own interface and software which is, naturally,

compatible. Unusual for this kind of instrument is a sequencer recorder which allows two-track recording of two independent sound generations. A full five octave, 81 key keyboard is fitted.

This is an exciting machine, which could take up hours of your time playing with the different sounds and the millions of variations. The fifty alterable sounds supplied show the range of instruments which can be mimicked and the beautiful (and weird) sounds possible. If sound, professional quality, and versatility are what you want, coupled with a comparatively simple set of controls then this one demands your attention.

Siel's address is as previously mentioned.

Korg Poly 800 £635.00 Rose Morris & Co Ltd.

This has proved to be a popular machine, and computer users are made to feel at home by the little joystick fitted in the top left corner of the instrument!

The keyboard has 48 keys (4 octaves) and the rear has two main panels, a raised control panel and a flat reminder panel, the latter simply shows the related parameters and possible values and is there to provide information rather than having any function. It features a MODE function which allows you to choose between a single DCO operation with eight voices or two DCO's of four voices each. VCI on three DEG's (Digital Envelope Generator which includes the ADSR. A step time sequencer is built in which provides a 256 note memory.

MIDI is very comprehensive but in the short while I had the unit I couldn't find out how to switch from POLY to OMNI mode which the specifications said it would do. However I found that OMNI is not essential, although it can be useful. This is another fairly simple to use machine with a tremendous range of sounds and options, it may seem a bit expensive but it is well built and has many extra features which may be useful to you, such as the joystick pitch

blend (L/R) and DCO/VCF modulation (L/D).

Rose Morris and Co, 32-34 Gordon House Rd, London NWS 1NE.

Casio CZ-101 and CZ1000 £345/£499 Casio Electronics

We couldn't go without looking at the Casio machines. These two are essentially the same, but the CZ1000 has full-sized keys rather than the miniature CZ-101 version. Apart from that they are identical in operation, so, are full size keys worth £150,000 to you?

The units have two sets of DCO, DCW and DCA parameters, an envelope generator with eight preset values, and a 49 key keyboard. There are 18 preset, 16 programmable and 16 optional RAM voice memories, 48 tone memories and programmable pitch bend and portamento. Even though the range of sounds is limited by the use of presets for some parameters there is still a wide range of sounds and a tremendous variation in each to be explored.

This is the ideal instrument for those who wish to experiment and have no preconceived ideas of what they are trying to produce. I think it may be too limiting for a synth expert who has audio images in his head, but for most of us it is a wonderful machine with enough scope to keep us happy for hours. It also provides a reasonably cheap means of acquiring a second machine to layer or contrast up to form a Mod orchestra.

The small size of the keys on the CZ-101 may cause problems to trained musicians, as fingers tend to get in a twist, however the average person should not find any problems and you soon get used to their size. I liked it a lot and suggest

that you try one out before parting with almost twice the money for a "real" one.

Casio Electronics Ltd, 1000 N. Circular Rd, London NW2 7JD.

Caution!

In nearly all the instrument manuals the Mod functions have been rather vague, though the Siel and Korg manuals were very good.

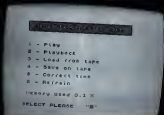
It is important that you check that the machine will do what you want it to do and therefore it is worth checking on the following modes which may or may not be operational on the instrument:

OMNI mode is a general all-purpose mode where the instrument receives and plays ALL the information sent to it on all 16 channels. It transmits signals on channel 1 only. This is useful if you want to write and play parts for a single instrument or do simple layering. It is USELESS if you want to create multi-instrument parts each playing independently through several machines. The better instruments feature this as well as Poly mode. The JVC is common with most keyboards was OMNI mode only.

POLY mode is the mode in which you assign a channel to the instrument and it only plays the information sent on that channel, there are 16 channels and the info on the other 15 is ignored. This is essential for creating multi-instrumental musical pieces, but can be time consuming if you have to keep adjusting recordings to accommodate at the mixing stage, this is where OMNI mode is useful.

Most synths run in POLY Mode, but check before buying!

There is a third mode, MONO but this tends to only be included on the top end of the range, ie. £1000.00+ instruments. ▶



Interfacing

The instrument is connected to the computer, as you may have guessed, by an appropriate interface. This interface consists of a means of connecting and converting the signals from the DIN pin connector to the Spectrum via its user port. The bare essentials must be a MIDI OUT socket to send information to the instrument's MIDI IN socket, a MIDI IN to get signals from the instrument's MIDI OUT and preferably, but not technically essential, SYNC IN and SYNC OUT sockets to enable control of, or from, an external source such as a MIDI drum unit.

Software

The range and applications are extending daily, but the most common and most generally useful are the following:

SEQUENCER

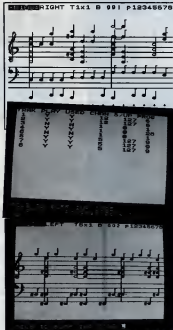
The stores and replays a series of notes. These are computer variations of what is often built into an instrument but have advantages in that it can be easier due to a higher degree of control and editing of the music.

There are two main modes, STEP TIME which is writing music note by note as many computer music programs tend to be written, and is like "music by numbers". The advantages are that it is easy to convert from manuscript to machine and editing should be very easy. It is also a great way to experiment as mistakes are not fatal, and the graphic displays can be impressive.

The disadvantages are that some knowledge of music is needed and it takes a very long time to produce tunes of any great length. The second is LIVE or REAL TIME and here the player simply plays and the computer records what has been played. Favoured by the "play by ear" musician and those with little or no formal training. Disadvantages are that editing is difficult if not impossible and graphic representations are not usually possible.

EDITOR

Only of use to the synthesizer owner, this makes creating or modifying sounds a fascinating and much easier job as you should get a graphic representation of the sound you're working on. Only the most expert land that does not include midi can "hear" a sound and visualize the parameters required. Although I have tried to be simple and clear



in my explanations I know when it comes to the producing effects many readers will have given up. If you could see it graphically and hear the changes while seeing them then I'm sure you'd agree that this is one area where a picture really is worth a thousand words! An Editor is an essential and important application, especially as sounds can then be stored and recalled.

COMPOSER

Again this can be Step Time or Real Time. At the moment there is only one company with a completely real-time composer program, and that is Electromusic Research, run by Mike Beecher (marketed by Rose Morris Ltd)

Having made the statement there will probably be several others which have been produced since this was written — let us know and we'll put the record straight.

A Composer program is similar to a sequencer program except it tends to be used to hold several parts which go to make up a piece of music, ie. Bass line, Viole sections, Brass sections etc. These may play different pieces of music at different times and is useful if you have more than one instrument or "slave" units, such as Sir's EXPANDER. These are either specialised but we will look at them as I do know of some people who get together with their machines, link them together and have their own orchestral!

Micon Interface £108.00 XRI Systems

(Including Step and Real Time Interface)

This is one of the cheapest on the market and it shows in the rather functional look of the interface, but don't be put off, it works perfectly and is easy to use. The interface is a large plastic box which stands upright and is connected by a small plug, the DIN sockets are fitted at the top of the unit and consist of MIDI IN, two MIDI OUT, and SYNC IN and SYNC OUT. This arrangement may pose problems if a lot of lead swapping is required during a program run and buying an extender cable helps eliminate this, otherwise it is stable enough.

STEP TIME SEQUENCER

The Software is top quality, especially the Step Time sequencer, this allows for ten or more tracks to be recorded either singly or in blocks of chords.

The procedure is to select which track you want to record on, indicate how many other tracks you want to involve (2/3 for chords perhaps), press the note(s) and tap the Space bar to enter it. The note(s) appears on the staff in the base time length — down to 1/32 of a note, as previously decided by you — and further taps of the space bar increase the note length in steps of the base value. This can be repeated until all ten tracks are used, previously written tracks can be edited or completely overwritten.

This is a very powerful piece of software, and all the control options you could think of are included, such as Tempo, Pitch change, Replay with or without music displayed (time is not accurate, but acts as a "trace on"), and individual channel assignment to each track. A copy to record/review facility is included and I converted it to Disk in about ten minutes.

REAL TIME SEQUENCER

The Real Time Sequencer acts as a simple recorder which replays the music as you play it. It worked perfectly but I found that it didn't have the same interest for me as the other program. It performs a task similar to the sequencer record option built in to most keyboards. I must add though, that it does allow ten individual recordings to be made, a far greater number than usually supplied, and this ability is not usually included on synths.

On Test

I tried it with the POLY 800 and the JVC KR500 and it worked well on both. The JVC disappointed me because it only functioned in GMINI Mode, is accepted and played the music from ALL the channels. This means it is not suitable for playing specific parts of a composition. It also only played in one voice and the drum/rhythm unit was not triggered, this means that all the sophisticated extras were unavailable when using Mid.

However, some impressive single voice stuff can be produced, after all, a Piano only has one voice! and by splitting the keyboard so that all the keyboard is the left hand and then splitting the voices, you can record a chord and rhythm backing and add a live melody in a different voice.

The Kong performed as expected, except that I had problems making the patch-change operate mid-way through a piece of music.

Assessment

Impressive, especially the software, and well worth the money. My only real criticism is that the instructions, although well written are supplied on single sided computer printout paper, and trying to find something by searching through twenty four joined sheets was most frustrating. In the end I pulled them apart and tied them in a ring binder — end of problem.

XRI Systems, 10 Sunnyside Rd, Sutton Coldfield, W. Midlands.

JMS Midi Interface £94.95

Sold by both SIEL and ROSSETTI, for two different prices (£74.00 and £94.95 respectively) this Italian interface is a very professionally made unit. It consists of two units connected by a ribbon cable some 60cms long. This means you can plug or unplug DIN sockets, while connected to the Spectrum, with confidence.

One end of the cable is fitted to a slim, tall box which fits on the user port, the other end is attached to the middle of a large box with the DIN sockets either side of it. There are three sockets on the left, Control IN for a rhythm unit or pedals, THRU and MIDI IN. On the right are three further sockets, all MIDI OUT. The only visible di-

ference between the two versions available is that the Rossetti interface is bright blue with JMS on it and the Siel one is black with "SIEL" written on it.

Software from either company runs on either interface, though the Micon software did not work with it. All in all, this is a sturdy, good looking, well designed piece of equipment.

Rossetti Software

8 TRACK COMPOSER £40.00
LIVE SEQUENCER
ARPEGGIATOR £10.95
I See our Special Offer Coupon for Rossetti's address!

Two things are immediately obvious with this company's wares; first, they all come in distinctive blue library cases and secondly the instructions, although commercially printed are VERY brief. There is less text on the Arpeggiator leaflet than on most cassette inserts. The assumption is that you should know what you are doing, both musically and computer-wise.

Having moaned, it is only fair to say that as a user with only general knowledge I really didn't have any major problems, except that I couldn't operate the Arpeggiator with the footpedals

supplied. This was a pity as this is a very strong and interesting feature of the program.

The Arpeggiator

... was interesting but of limited value, useful for playing along with and, when used with the footpedals, can store and replay in sequence up to 40 chord arpeggios. It would have been more use if the patterns could have been varied rather than the fixed run up or run down the chord notes. A feature to allow you to decide the order of play or a random option would have made this much more versatile. Verdict: fair, a pity it wasn't developed further.

Live Sequencer

The computer acts as a straightforward tape recorder — well, slightly more actually as you can also auto start it or playback at varying tempos without pitch distortion, and loop the sequence so that it replays continuously. Oh, and you can also get the machine to smooth out and adjust the tempo and reassign the channel so that another instrument replays it.

It is enjoyable to use and a little more versatile than most built-in sequencers, though whether you decide it's worth £29.95 is up to you and the user to which you want to put your machine.

Composer

This is Rossetti's star program, it is very similar to the XRI step time sequencer, and is not really my idea of a full composer program.

The one merited four and a bit pages of a leaflet! It actually took me an hour to get to grips with the program and I was quite impressed. Each of the eight tracks hold only one-note sequences, these are played into the computer from the keyboard, the only thing that is recorded is the pitch of the note, all note lengths are set to quavers. Once the sequence has been played then the fun begins. Lines of music shorthand are presented in five rows which are the note or line number, pitch eg. 4D (note D in 4th octave), duration as a note symbol, gate time (sustain), velocity (volume). The last three are alterable (editable) from a cursor and this is where a composition takes shape.



A wide range of editing options are provided and you could then go away and work completely on the computer. Each of the eight tracks are entered in this way and edited, and each can be assigned to individual channels and replayed. A very worthwhile program and one which could help in your quest to produce music. However, as with all their programs I feel that there could have been more test, the method of entry seems an uneasy compromise between the musician and the computer. Perhaps this may have the effect of appealing to both.

The graphic content of all these programs is very elementary and most consist of menu options and prompts. Information is given clearly and plainly and the whole set is functional and workable. I may have given the impression that I don't like these programs but I must assure you that this is not, as they are all competent and will add new dimensions to your music. I was sad when I returned them to Rosset — I think I'll take up their offer. . .

Siel Programs Live Sequencer £122.00 Sound Editor £54.35

Two variations on each of these programs, each designed for the Siel Instruments, either the DK600 range (£99.99) or the MK300 range. Although primarily for their synths, they often work with other instruments, this is well worth checking especially for the Editor which is superb (but I couldn't get it to work with the Korg).

But first, a mention of the Sequencer, this does the same job as the others mentioned, neither better nor worse, so what else is there to say except that it worked on the JVC as well as the Siels?

Sound Editor

This is the "Ultimate" program of the synth world. It has everything, great graphics, user-friendly and (eventually) what sounds!

The program is menu driven and every screen allows you to access an appropriate help page. Most of the program operates from screen pictures selected by cursor. From the larger master displays you change to more detailed panels and as you alter the settings of

Glossary

Some terms for the uninitiated.

ADSR: These are the four main variables of the average envelope generator, and stand for **ATTACK** — the speed at which a note reaches full volume, **DECAY** — the rate which it then drops to its playing level, **SUSTAIN** — this is the level at which the note sounds continuously, and **RELEASE** — the speed with which the note fades away after the key has been released.

ARPEGGIO: series of notes which form a chord played in sequence.

DC: Digitally Controlled Item. Synthesizer operations are controlled either by numbers (digital) or by voltages, the newer systems are digital but there are still advantages to the earlier means of using voltages. Many synths have a combination of both systems. Some operations are Digitally Controlled Oscillators — **DCO:** Digitally Controlled Amplifiers — **DCA.**

FILTER: These are designed to block out frequencies selected by the user, this changes the quality of the note produced by the oscillator and allows you to adjust the "tone" or timbre of the note. Most frequently controlled by voltage as in **VCF.**

KEYBOARD: Generally accepted as being an instrument which has several preset and unalterable sounds or "voices". These are often bundled with sophisticated extras such as rhythm units, sequencing and recording facilities.

LAYERING: Using more than one voice, usually played in unison to create the final sound. This is the most elementary way in which MIDI can be used by simply connecting two or more synth/keyboards with a five pin DIN lead.

LFO: Low Frequency Oscillator, this is used to "fatten out" a tone or as a modulating waveform.

MIDI: Musical Instrument Digital Interface, the interface which should be (and is getting close to) a universal standard for transmitting information to and from a musical instrument. Note that these are in two forms for our purposes, as fitted to the keyboard/synth in the form of DIN sockets and as the familiar add-on unit to be plugged into the back of the long suffering Spectrum.

MODULATION: Using a predefined voltage or control (LFO) to adjust and modify a target sound.

OSCILLATOR: The source of the sound, a signal generator, as in **DCO.**

PATCH: A set up of the synth sound generation which is stored for later recall. Similar to a "voice" on a keyboard.

PCM: Pulse Code Modulation, this is something we computer users are more familiar with, an effect it is a form of sound sampling, storage and replay. It tends to produce startlingly realistic sounds but with a mechanical "feel" to them. Often used for drum reproduction.

SEQUENCER: repeated patterns are usually stored in memory and replayed "in sequence". This is often an inbuilt feature but the computer variations usually offer a lot more versatility and control.

SYNTHESIZER: An instrument which generates a sound which can then be modified by the adjustment of **VCF's**, **DCP's**, **LFO's** and a wide range of tone and pitch controls. The end result is that many instruments can be mimicked very accurately and some strange and very unusual sounds can be created.

VC: Voltage Controlled Item, this is essentially how the thing operates, but adjusting the sound via voltage variations to such circuits as an Oscillator — **VCO**, Filter — **VCF**, or Amplifier — **VCA.**

WAVEFORM: The form of the oscillation produced electronically usually these can be produced in one of two forms, **SQUARE**, which produces 'flurry', smooth sounds and **SAWTOOTH** which produces 'breathy' sounds.

the physical knobs they change to the correct position.

The **DEG** stage is displayed and modified as you alter the parameters, and there is also a histogram and numeric representation of the parameters. Colour is used well to highlight all these displays.

The only blamash on the horizon is a warning they give that some issues of Spectrum cause a problem with the **CHORD** option, the synth doing a **Smeller** type rise. This did in fact happen and, as I was using a Spectrum 1, it is likely that this option is 95% useless.

I loved the **PLAY** test option which arpeggios up and down and around the scale to try out the sound, I could listen to it for hours. You guessed it, I'm impressed.

If you've got a **DKSD** then this program is a must, and if you haven't then it's a good reason for considering buying one! All their documentation is on double thickness printer paper, (rather down-market) it is easy to understand yet enough information is also provided so that a machine code expert could write his own programs.

Rose Morris Interface and Software

At the time of going to press we have not yet received their products for review. We know though that they were produced by Mike Beecher of Electronic Research who we featured in a recent issue, which is an indication of high class. If it arrives we will update this article in the next issue but meanwhile I recommend that you take them into consideration before making your choice. Their Composer in particular is impressive.

And Finally . . .

The prices of the instruments will vary quite a lot from place to place so don't take them as gospel, they are meant as a guide.

I must say a sincere thankyou to all those who let me use all the very expensive equipment. Vince Hill Associates and Siel, Mr. Chapman and Roberts, Richard Young and Cesko, XRI (who have just brought out a Juno 108 and DX7 editor and are about to release a composer program) and Paul Waby for lending me his Korg.

Software

Music Maker £1.99
Mean
PO Box 380, Purleigh, Essex
CM2 6DD

Not very good and probably not worth even the low asking price.

Play, Type and Transpose
£4.95

Hizon Computer Services
14 Avalon Rd, Orpington, Kent
BP6 5AX

A waste of money.

Music Maker £5.75
Beilflower Software
8 Rosewood Avenue, Green-
ford, Middlesex

Disappointing, not bad for an early attempt, but slow and limited.

Spectrum £4.95
XDFact

Very good: a good teaching section will help you learn the basics of music, both step time and real time record/play. Recommended, especially if you have little or no musical knowledge.

Music Master £7.95
Enclair Research

A good program though rather expensive. S/Time and R/Time entry and good playback and printout options. Instructions somewhat sparse.

Music Typewriter
Romantic Robot £9.95
113 Meirice Ave., London NW2

Excellent, although S/Time entry only. Graphics and ease of use make this program worth the high price. Printout option provided and accurate timing on replay. Top mark!

Make Music £5.95
Buffer Micro Ltd.
3120 Brixton High Rd,
London SW15 5HG

For use with any programmable sound peripheral using the AY-3-8912 chip, this simulates a three channel recorder. Could be useful.

Freework Music/Water Music
£5.95

Jimmy Snake Blues/Honkey
Tonk £6.95

Software Cottage
18 Westfield Drive,
Loughborough, Leics, LE11
3QU

Two packages, each containing two programs which are drill and practice exercises in the form of games. An interesting and painless way of improving your knowledge of musical notation.

JVC KB-600

Stereo keyboard
SUPER REPRODUCTION OTHER INSTRUMENTS



Hardware

BEEP AMPS

These simply amplify the volume of the Spectrum BEEP DK'Tronics £14.95 (interface and separate speaker "pod") Unit 6, Shire Hill Ind. Est. Saffron Walden, Essex CB11 3AQ
Chertah £9.95
24 Ray St, London EC1R 3DU

Sound Units

These have a built-in sound generating chip, usually of the AY type and offer three channels of programmable sounds for music or effects.

DK'Tronics £29.95
Separate speaker and interface, AY-3-8912 chip. Good software program to use as a three track recorder supplied with the unit. Takes a bit of time to get

used to but produces very effective sounds

TRICHORD £29.95
Newtech (Micro) Developments, 1 Courtyard Rd, Newton Abbot, Devon TQ12 2JA
For both the ZX81 and Spectrum, this small but surprisingly

loud, all-in-one interface is superb. The difference between the ZX81 and Spectrum unit is ONLY the software, so you can get one for your '81 and if you upgrade to the Spectrum use it with that for the price of the appropriate software.

I respect this company as they have always been helpful and seem to supply good backup to their customers who write from all over the world. Peter Moore, the designer, is known to our regular readers for his hardware project articles last month's was a Beep Booster. Backup provided includes the production of music books covering Trichord arranged coding. The first in this series is "Christmas Carols" and contains 25 tracks set out in the score code (three columns of notes/octave above/below - C2) and the score. This is on sale from them for £6.95 with 50p plus for European sales and £1.60 for the rest of the world. No notes for GB. I Highly Recommended.

William Stuart Systems
Quenley Down House, Cholderton, Nr Salisbury, Wiltshire, SP4 0DZ

This company markets a range of sound add-ons for both the ZX81 and the Spectrum and they have some interesting software, an assembler and a compiler program. Using these products you can produce some of the effects described in the MIDI article.

I suggest enthusiasts phone them on 098 054-235 and discuss your requirements with them. An example of their product is the MUSIC SYNTHESISER (ZX81 and Spectrum) £25.50. This is similar to the other units except that up to three can be used simultaneously to produce 3 music channels. An offshoot of this unit is that 16 input/output lines are also provided for control of switchable devices.

SPECIAL OFFER FROM ROSETTI

SAVE £49.90

In a special offer to ZX Computing readers ROSETTI are giving a free copy of their LIVE SEQUENCER and ARPEGGIO programs when you buy both the INTERFACE at £94.95 and the B TRACK COMPOSER at £49.95. A SAVING OF £49.95.

Send your cheque/PO for £145.95 (£2.00 for p&h) made out to FD & H MUSIC, 138-140 CHARING CROSS ROAD, LONDON WC2 and be sure to cut out and include this coupon as proof that you are a ZXc reader! (Photocopies will do also.)

A PUZZLE FOR THE QL

—by David Nowotnik

The first few months of existence for the QL have not been happy ones. The computer and its producer have deservedly received a lot of criticism from the computer press. But now that many of the 'rough edges' have been smoothed, the QL is beginning to fulfil all those pre-launch promises made for it. The QL will be a big seller, and, no doubt, many Spectrum owners will be making the transition to the QL. To help with that transition, this article will be offering advice to Spectrum and ZX81 owners to adapt to SuperBASIC. And, for QL owners, there is a 'serious' game to play on your 'serious' home computer.

In the same way that the BASIC of the Spectrum was derived from that of the ZX81, so does QL's programming language owe much to its predecessor. I'm sure we'll see yet better versions of BASIC in the future, but SuperBASIC deserves its name by present-day standards. Spectrum owners may care to glance at the program listing in this article; many structures may look familiar, but SuperBASIC also has much more to offer. Particularly notable are PROCedures, and here's why —

PROCedures are similar to subroutines, but there are enough differences to make them much more powerful. PROCedures work on their own set of variables (although you can pass variables to and from PROCedures in the normal way). Using the LOCAL command, you can identify those variables which are used within the PROCedure. Even if they are identical in name to variables within the main routine or other procedures, use of the LOCAL command keeps them quite independent. This leads to an interesting and powerful possibility. You can readily build up a library of PROCedures. You need only know the input and output variables, and, of course, the purpose of the PROCedure, and your PROCedures can be slotted into any program in which it might be required. And

the QL's powerful line number facility can replace the PROCedure in any position required in a program.

You call a procedure simply by using its name. Hence, in my program, when you see 'init' or 'set_up' in a program line, these are effectively new commands calling the procedures of that name. Even when the program is not running you can call a procedure by typing in its name — as you would a direct command.

The use of PROCedures, and some of SuperBASIC's other constructions encourage what is commonly called structured programming. A simple way of looking at this is that GOTOs and GOSUBs are excluded (although the QL still has these if you really must use them); the aim is to make programs more 'readable', making them easier to understand and de-bug.

The strategy of program writing in SuperBASIC is quite different to Spectrum BASIC. You aim to build up a series of PROCedures, each being a distinctly independent new command, which you can test and de-bug, before moving onto the next PROCedure. The program is then brought together by calling these new commands in the correct sequence. See if you can spot that design in my program. Even if you can't see that, one thing for sure — in the true spirit of the QL, you won't see any GOTOs or GOSUBs!

The main ways by which you can avoid using GOTOs are in the modified format of IF...THEN, and the new command of SELECT. You'll see both in my program. You can use IF...THEN in the same way as on the Spectrum, but you have a more powerful option of IF...THEN...ELSE

...END IF. To use this form of the IF command, start with the line:

IF condition THEN

Put nothing after the THEN; you can place several statements on any number of lines after this line, and all will be carried out if the condition's met. If you want to have some instructions if the condition is not met, then the ELSE command follows next. Again, you can have several program lines following ELSE, all of which would be carried out if the original condition was not met. Finally, to inform the computer that you have come to the end of the IF structure, use the command END IF (for an example, see lines 593 to 633).

Examples of SELECT appear in lines 6559-6650 and 8000-8120. SELECT enables the value of a variable to be tested, and various actions to be performed as a result of that test. In line 6550, the first statement ' = 1' effectively means 'if the variable move...one is equal to one then...'. As with the IF command, you could have several lines of options if you wish before testing another value of the variable. You even have an ELSE equivalent with SELECT. You can say ON REMAINDER, and have several





programs lines on what to do if the variable does not have any of the previous values tested. SELECT is a more powerful variant of the IF command.

Other features you may spot in the listing are the two types of loop-structure: FOR...NEXT is one you'll know from Spectrum BASIC, but REPEAT may be new to you. An example appears in lines 50 to 110. The end of the REPEAT loop appears in line 110. The loop is given a name (in this case 'demo_option'), and the loop is ended with END demo_option. You can go around this type of loop forever if you don't have some exit possibility. With a REPEAT loop, to exit the loop a condition normally has to be met (see line 70 for the construction). The EXIT command reflects a GOTO, to the line immediately following the END REPEAT.

While liberally said Spectrum owners will recognise FOR and NEXT on the QL, there are modifications which can make the QL version more powerful. These are EXIT and END commands, similar to those for the REPEAT loop.

All the preceding explanations of QL commands should make my program listing reasonably clear to Spectrum users, but there remains one more item to explain before I describe the program itself in use. The program will demonstrate the powerful WINDOW, SCROLL and PAN commands of the QL. By using WINDOW, you can identify to the computer a specific area of the screen, which you can control in many ways quite independent of the rest of the screen. For instance, you can print to that window, SCROLL or PAN the window, or change the colour of that window. Lines 1070 to 1110 re-define the shape and colour of two of the windows which are 'provided' by the computer when it is switched on, and lines 1120 to 1240 define 13 new windows which are used in the game. The window is identified by the Z number; this is the channel which 'communicates' to that

window. The initials 'scr...' indicate that the device you are aiming that channel at is the screen, and the numbers which follow those initials define the width and height (in pixels) of the window, and the position on the screen of the top left-hand corner of that window.

SCROLL is a command which appeared on the ZX81, but disappeared on the Spectrum. The much more powerful version on the QL allows a window to be SCROLLED up or down, and by a specified number of pixels (for examples, see lines 7140 and 7540). SCROLL can be modified further to SCROLL only a specified number of rows of pixels within a window. The command PAN allows the specified window to be SCROLLED either left or right.

You will notice quite a few REM statements in my listing. This is quite deliberate, for the following reason. One disadvantage of PROCedures compared with GOSUBs is that the former can be used anywhere in the program. So can a GOSUB, of course, but not without a line number to identify its place in a program. So, to make the QL program easier to read, I have identified the start of each PROCedure with a double row of stars, with the name of the PROCedure about to be defined held within the stars. You should do something similar if you write your QL programs to be readable.

And now, at last, the program itself. For me it has a short history, and you may be interested in the story behind the game. It originated three years ago when, whilst teaching myself Z80 machine code, moving blocks of characters around the screen developed into a game idea. What resulted was a mixture of the Rubik Cube, and a sliding puzzle. It was the similarity to the former which inspired a friend to nickname the program after myself, and that name stuck when the ZX81 version was marketed by a software house I went on to produce commercial versions, bearing the same name, for the Spectrum

and Cric Atmos. This is my first version for the QL.

When you RUN the program, you will get a choice of options, for a demonstration, or to play the game. The demonstration will show you the starting (and finishing position) of the puzzle, and the way in which it is shuffled, for you to return to its original orientation.

The puzzle appears as a large square on the screen, which is divided into four smaller, coloured squares of red, yellow, blue and green. If you watch the shuffling movement carefully, you should notice that there are 8 possible ways in which the puzzle can be moved: inagine that you can divide the puzzle into two equal halves, both horizontally and vertically. This gives you 4 possible 'halves'. The movement of these halves involves sliding a half in the direction of its longest side. As each half could be moved in one of two directions, there are a total of 8 ways in which parts of the puzzle can be moved. In sliding half of the puzzle, the piece which 'falls off' the edge of the puzzle re-appears on the opposite side.

The same eight movements are used to solve the puzzle. On the screen, you will see numbers and arrows. The numeric keys 1 to 8 are used by you in solving

the puzzle. The arrows show you which number will move which half, and in which direction. The object is to re-form the original four large squares and place them in the same arrangement they were in prior to shuffling. At the top right of the screen you will see a miniature version of the final arrangement of squares, to remind you of your aim in solving the puzzle. A checking routine is built into the program, and you will be informed when you have successfully solved the puzzle, and how many moves it took you. Unlike the commercial versions of this program, this version has only one level of difficulty, so once you develop a strategy for solving the puzzle, your aim must be to minimise the number of moves necessary to solve it.

This version also differs from commercial versions in that it is written entirely in BASIC. This is achieved by using the QL's enhanced BASIC facilities, particularly SCROLL and PAN in pre-defined windows. I hope that the program is sufficiently well documented to allow it to be understood without a detailed description of how it works. After all, 'readability' must be one of the aims of all programmers switching to QL's Super-BASIC.

Program Listing: Newcock Puzzle

```

10 REMARK The Newcock Puzzle
20 REMARK by David Newcock
30 REMARK September, 1988
40 INIT
50 REPEAT demo_option
60 title: key_press
70 IF @="n" THEN EXIT demo_option
80 set_up
90 shuffle
100 PAUSE 200
110 END REPEAT demo_option
120 set_up: view: shuffle
130 @=""
140 REPEAT game
150 @=""
160 AT @Z,0,0: PRINT #2,"Move ",@
170 your_move
180 check
190 IF OK THEN EXIT game
200 END REPEAT game
    
```

QL PROGRAM

```

210 CLS
220 AT 2,4: PRINT " well done!"
230 PRINT: PRINT " you solved the puzzle!"
240 PRINT " in " ; t ; " secs."
250 STOP
500 REMark *****
510 REMark your_move
520 REMark *****
530 REMark
540 DEFINE PROCEDURE your_move
550 REPEAT keys
560 key_press
570 move_one=CODE (a$)-48
580 IF move_one>0AND move_one<9 THEN EXIT keys
590 END REPEAT keys
600 slide_piece
610 END DEFINE
700 REMark *****
710 REMark check
720 REMark *****
730 REMark
740 DEFINE PROCEDURE check
750 OK=0
760 IF box$(1)="rrry" THEN OK=OK+1
770 IF box$(2)="rrry" THEN OK=OK+1
780 IF box$(3)="ggbb" THEN OK=OK+1
790 IF box$(4)="ggbb" THEN OK=OK+1
800 IF OK=4 THEN
810 OK=1
820 ELSE OK=0
830 END IF
840 END DEFINE
1000 REMark *****
1010 REMark init
1020 REMark *****
1030 REMark
1040 DEFINE PROCEDURE init
1050 MODE 256
1060 DIM box$(4,4)
1070 WINDOW #1,512,256,0,0
1080 WINDOW #2,20,1,1 BORDER #1,20,1,1
1090 PAPER #1,7: PAPER #2,7
1100 CLS #1: CLS #2
1120 OPEN #4, scr_312x96x100:32
1130 OPEN #5, scr_312x96x100:128
1140 OPEN #6, scr_156x192x100:32
1150 OPEN #7, scr_156x192x256:32
1160 OPEN #8, scr_156x96x256:128
1170 OPEN #10, scr_312x48x100:32
1180 OPEN #11, scr_312x48x100:60
1190 OPEN #12, scr_312x48x100:128
1200 OPEN #13, scr_312x48x100:176
1210 OPEN #14, scr_76x192x100:32
1220 OPEN #15, scr_76x192x176:32
1230 OPEN #16, scr_76x192x256:32
1240 OPEN #17, scr_76x192x334:32
1250 CLOSE #1,1: INK #1,3
1260 END DEFINE
2000 REMark *****
2010 REMark title
2020 REMark *****
2030 REMark
2040 DEFINE PROCEDURE title
2050 REMark
2060 CLS
2070 AT #1,4,3: PRINT #1,"The Nowotnik Puzzle"
2080 AT #2,12,1: PRINT #2,"Do you want a demonstra-
tion? (y/n)"
2090 END DEFINE
3000 REMark *****
3010 REMark set_up
3020 REMark *****
3030 REMark
3040 DEFINE PROCEDURE set_up
3050 CLS #1
3060 PAPER #4,2: CLS #4
3070 PAPER #7,6: CLS #7
3080 PAPER #5,4: CLS #5
3090 PAPER #8,1: CLS #8
3100 AT #2,5,2: PRINT #2,"D"
3110 PRINT #2: PRINT #2," C"
3120 AT #2,5,32: PRINT #2," **"
3130 AT #2,7,32: PRINT #2," *2"
3140 AT #2,14,32: PRINT #2,"*3"
3150 PRINT #2: PRINT #2," 6v"
3160 AT #2,14,32: PRINT #2," *4"
3170 AT #2,16,32: PRINT #2,"*8"
3180 FOR i=1 TO 2
3190 box$(i)="rrry"
3200 NEXT i
3210 FOR i=3 TO 4
3220 box$(i)="ggbb"
3230 NEXT i
3240 END DEFINE
4500 REMark *****
4510 REMark key_press
4520 REMark *****
4530 REMark
4540 DEFINE PROCEDURE key_press
4550 a$=INKEY$(1)
4560 END DEFINE
5000 REMark *****
5010 REMark shuffle
5020 REMark *****
5030 REMark
5040 DEFINE PROCEDURE shuffle
5050 VALUE 100
5060 FOR k=1 TO 30
5070 move_one=RND (1) TO 8)
5080 slide_piece
5090 PAUSE 50
5100 NEXT k
5110 END DEFINE
5500 REMark *****
5510 REMark slide_piece
5520 REMark *****
5530 REMark
5540 DEFINE PROCEDURE slide_piece
5550 SELECT ON move_one
5560 =1: swap1: move_left
5570 =2: swap1: move_right
5580 =3: swap3: move_left
5590 =4: swap3: move_right
5600 =5: swap1: move_up
5610 =6: swap1: move_down
5620 =7: swap3: move_up
5630 =8: swap3: move_down
5640 END SELECT
5650 END DEFINE
6000 REMark *****
6010 REMark move_left
6020 REMark *****
6030 REMark
6040 DEFINE PROCEDURE move_left
6050 LOCAL j
6060 FOR i=move TO swap1
6070 a$=box$(i,1):b$=box$(i,2 TO 4)
6080 box$(i)=a$ & b$
6090 colour
6100 PAPER #9+i,cc
6110 PAPER #9+i,-76
6120 END FOR i
6130 END DEFINE
6500 REMark *****
6510 REMark move_right
6520 REMark *****
6530 REMark
6540 DEFINE PROCEDURE move_right
6550 LOCAL j
6560 FOR i=move TO swap1
6570 a$=box$(i,4):b$=box$(i,1 TO 3)
6580 box$(i)=a$ & b$
6590 colour
6600 PAPER #19+i,cc
6610 PAPER #19+i,76
6620 END FOR i
6630 END DEFINE
7000 REMark *****
7010 REMark save_up

```

```

7020 REMark *****
7030 REMark
7040 DEFine PROCEDURE move_up
7050 LOCa1 1,2
7060 FOR i:=a TO num+1
7070 a:=box@1,i
7080 FOR j=1 TO 3
7090 box@j,i:=box@j,i+1
7100 NEXT j
7110 box@4,i:=a
7120 colour
7130 PAPER @(13+1),cc
7140 SCROLL @(13+1),-40
7150 NEXT 1
7160 END DEFine
7500 REMark *****
7510 REMark      move_down
7520 REMark *****
7530 REMark
7540 DEFine PROCEDURE move_down
7550 LOCa1 1,2
7560 FOR i:=num TO num+1
7570 a:=box@0,i
7580 FOR j=3 TO 1 STEP -1
7590 box@j,i:=box@j,i+1
7600 NEXT j
7610 box@1,i:=a
7620 colour
7630 PAPER @(13+1),cc
7640 SCROLL @(13+1),40
7650 NEXT 1
7660 END DEFine
8000 REMark *****
8010 REMark      col
8020 REMark *****
8030 REMark
8040 DEFine PROCEDURE colour
8050 colour_code:=CODE (a)
8060 SELECT ON colour_code
8070   ON colour_code=90: cc=1
8080   ON colour_code=134: cc=2
8090   ON colour_code=12:cc=6
8100   ON colour_code=103:cc=4
8110 END SELECT
8120 END DEFine
9000 REMark *****
9010 REMark      view
9020 REMark *****
9030 REMark
9040 DEFine PROCEDURE view
9050 AT #2,1,32: PAPER#2,2: PRINT#2," ";
9060 PAPER#2,6: PRINT#2," "; AT #2,2,32
9070 PAPER#2,4: PRINT #2," "; PAPER#2,1: PRINT #2
" "
9080 PAPER #2,7
9090 END DEFine

```



Gun Shot Joystick



From Vulcan Electronics comes a joystick. Joysticks tend to be a matter of personal preference but if you like this type which essentially needs a fair bit of

what action than you could do worse than look at this one.

It has a nice solid feel, even though it appears to be made of ABS plastic, and movement is firm and positive. There are two fire buttons, one on the base and one on the top of the pistol grip stick. These fire quickly and with a definite "click" which I liked. A set of rubber suction caps are fitted to the base, so it can be stuck to a table or desk for added control.

I tried it with a selection of games and found it made a noticeable improvement in my playing, on Moon Cresta my score went from four figures to five on the first play and I even beat the built in high score! I found that after about an hour playing I don't suffer in our efforts to review for you! that my wrist and thumb ached, but I suppose with constant use this would cease to be a problem, anyway there is an auto fire feature on the next model up in the range.

Priced at £8.95 it is one of the best of its type, but I wouldn't like to play Deathon with it (or any other joystick for that matter).

Grandstand

The Middlesex master ZX80 programmer Mike Hyams strikes again with a Strategy game!



ZX80 owners of the world arie. At least you can join the masses with a football management simulation. No longer will you have to endure the seven day

wait between editions of "Match of the day". Grandstand, a game of strategy, takes you into the world of football wheeling and dealing.

Don't be fooled into thinking that because it's for a ZX80 it must be a poor version. Grandstand takes up over 15K when running and pulls no punches

when it comes to detail. At the start of the game you can choose from any team in the four divisions plus a large selection of non-league clubs. Once you have chosen your team they are placed at the bottom of division four.

At the beginning of each season there is a pause of about 4 minutes while the F.A. Cup first round draw is made. Each season is a major undertaking as full league tables are supported. This means 48 games in Division 4, plus any cup games played. As it will take quite some time to play even one season, now is a good time to explain saving to tape. At the beginning of each week, option 4 allows you to save the game so far to tape. After you have acknowledged that you really do want to save, place a blank tape in the cassette player (not the master copy) and start recording. Then press NEWLINE and wait about six minutes while it saves. It is advisable to save again if you are not too confident of your recorder. As the SAVE command returns the computer to command mode the program automatically stops. To restart the game, and to start a game that has been loaded from a previous session, type GOTO 800.

The F.A. Cup is present in all its glory, showing all the results even when you are no longer in the cup. At the end of each season the promotions and relegations are calculated, and if you are lucky enough to gain promotion you will find life harder the further up the divisions you go.

One last note, keep a careful eye on your bank balance. As there are no facilities for bank loans, the Board of Directors will take a very dim view of going in to the red, and will not hesitate to show you the door!

IMPORTANT NOTICE Lines 1-7 MUST be copied exactly as listed. That is, each name is nine letters long (including spaces) and is followed by a ' '. All spaces must be included, and there are no spaces after the last name on each line:

```
1  REM LIVERPOOL /MAN. UTB. /NOT
   TM. P./O. P. R. /STAMPTON/WEST
   MAN /TOTTENHAM/ARSENAL /A. VILL
   A /LUTON T. /MATFORD /NORWICH
   /LEICESTER/EVERTON /COVENTRY /S
```

```
UNREPLND/CHELSEA /WEST BRON/STO
   VE C. /IPSWICH T./SHEFF WED/MENCA
   STLE/
```

```
2  PEN BTPNHOHAN/MOTTS CTY/WOL
   VES /MAN. CITY/DRINSBY /CARLI
```

```

SLE /BLACYBURN/CHARLTON /BRIGHTON
N /LEEDS U. /SHREWSBURY/BARNESLEY
/HUDDESFIELD/CARDIFF /PORTSMOUTH /P
ULHAM /MIDDLESBROUGH/C. PALACE/OLD
HAM /OXFORD U./WIMBLEDON/SHEFF
UTD/

```

```

3 REM DERBY CITY/SWANSEA /CAN
BRIDGE/HULL CITY/BRISTOL R./WALSAL
LL /BOLTON /BRADFORD /GILLING
HAM/NEWPORT C./SUNLEY /MILLWALL
/WIDAN A. /WRIGHT /LINCOLN /P
RESTON /BRENTFORD/BOURNEMOUTH/PLY
MOUTH /ROTHERHAM/YORK CITY/BRIST
OL C. /DONCASTER/READING /

```

```

4 REM SCUNTHORPE/SOUTHEND /POR
T VALE/EXETER /ALDERSHOT/BLACY
POOL/TRANMERE /PETERBORO/COLCHES
TR/TORQUAY /HEREFORD /CHESTERF
IELD/STOKEPORT/CREME A. /SWINSON /B
URY /NORTHAMPTON/DARLINGTON/MAN
CHESTER/DONCASTER /WREYHAM /HALIF
AX /WARTLEPOOL/CHESTER /

```

```

5 REM CHELTENHAM/ORAVERHAM/GLO
UCESTER/GRIMSBY /ALVECHURCH/WDRY
NGHAM /OSWESTRY/WORKINGTON/HARRO
GATE/SUTTON U./MADSTONE/NURETON
/PLYMOUTH /ALTRINCHAM/WEALDSTONE/W
IMBORNE/BATH /NORTHWICH/SCA
RBORO /WARRINGTON/FRITCHELEY /TELF
ORD /BARNET /ENFIELD /GATESHE
AD/BOSTON /WEYMOUTH /WETTERING
/YEAVIL T./BAGENHAM /BANSOR /T
OWNBRIDGE/

```

```

6 REM TEAM NAME /
7 REM CLEMENCE /SHILTON /NEA
L /HANSEN /OSMAN /BUTCH
ER /MCQUEEN /KENNEDY /KEEGAN
/ROBSON /WHELAN /DALGLISH
/SOUNESS /LEE /HOBBS /R
IX /RUSH /STAPLETON/DAV
IS /WITHE /BRAZIL /CROOK
S /NICHOLAS /FRANCIS /

```

```

10 GO TO 9000
20 GO SUB 30
23 FOR C=0 TO 9
24 PRINT CHR$(PEEK(IX+10*(C-1)+
C))

```

```

25 NEXT C
26 RETURN
27 IF A=1 THEN LET X=16427
28 IF A=2 THEN LET X=16651
29 IF A=3 THEN LET X=16875
30 IF A=4 THEN LET X=17119
31 IF A=5 THEN LET X=17363
32 IF A=6 THEN LET X=17607
33 IF A=7 THEN LET X=17851
34 RETURN

```

```

41 IF HOME=AWAY THEN GO TO 47
42 IF HOME=AWAY THEN GO TO 51
43 LET P(B1)=P(B1)+3
44 LET W(B1)=W(B1)+1
45 LET L(B2)=L(B2)+1
46 GO TO 55

```

```

47 LET P(B2)=P(B2)+3
48 LET W(B2)=W(B2)+1
49 LET L(B1)=L(B1)+1
50 GO TO 55

```

```

51 LET P(B1)=P(B1)+1
52 LET P(B2)=P(B2)+1
53 LET D(B1)=D(B1)+1
54 LET D(B2)=D(B2)+1
55 LET F(B1)=F(B1)+AWAY
56 LET A(B1)=A(B1)+HOME
57 LET F(B2)=F(B2)+HOME
58 LET A(B2)=A(B2)+AWAY
59 RETURN

```

```

101 PRINT
102 PRINT "PRESS N/L TO SET UP
NEW SEASON"

```

```

103 INPUT Z0
105 RANDOMIZE
110 FOR A=1 TO 24
120 LET C(A)=RND(10)+10
130 LET E(A)=RND(5)
140 NEXT A

```

```

150 LET MATCH=0
200 LET M=42
210 IF DIV=3 OR DIV=4 THEN LET
M=44

```

```

220 FOR Q=1 TO 90
230 LET H=RND(100)
240 IF R(H)=-1 THEN GO TO 230
250 LET R(H)=-1
260 IF H>40 THEN LET H=500+H-4
0

```

```

270 IF H<25 THEN LET H=300+H
280 IF H<24 AND H<49 THEN LET
H=400+H-24
290 LET G(H)=H
295 NEXT G

```

```

300 LET INCUP=1
310 LET ROUND=1
311 IF DIV<3 THEN LET ROUND=3
320 FOR B=1 TO 90
331 IF Q>24 THEN GO TO 300

```

```

332 LET W(B)=0
333 LET D(B)=0
334 LET L(B)=0
335 LET F(B)=0
336 LET A(B)=0
337 LET P(B)=0
338 LET G(B)=0
340 LET R(B)=0
345 NEXT B

```

ZX80 PROGRAM

```

500 LET POS=0
510 LET MOR=10
520 LET UPDATE=0
530 LET CUPGAME=0
540 GO TO 1000
600 GO SUB 9960
610 GO TO 1010
1000 FOR P=1 TO M
1010 CLS
1020 PRINT "SELECT AN OPTION"
1030 PRINT
1040 PRINT "1 - SELL A PLAYER"
1050 PRINT
1060 PRINT "2 - CLUB REPORT"
1070 PRINT
1080 PRINT "3 - PERFORMANCE THIS SEASON"
1090 PRINT
1100 PRINT "4 - SAVE TO TAPE"
1110 PRINT
1120 PRINT "5 - MOVE ON TO MATCH"
1130 PRINT
1140 INPUT Z
1150 IF Z<1 OR Z>5 THEN GO TO 1140
1155 CLS
1160 GO TO 1100+Z*100
1210 PRINT "SELL A PLAYER"
1220 GO SUB 9400
1240 PRINT "ENTER NO. OF PLAYER TO SELL OR"
1250 GO SUB 9800
1255 INPUT Z
1260 IF Z'0 OR Z'24 THEN GO TO 1255
1261 IF Z=0 THEN GO TO 1010
1265 IF B(Z)=0 THEN GO TO 1255
1270 CLS
1275 LET A=RND(4)
1276 LET B=RND(22)
1277 GO SUB 20
1278 PRINT "HAVE OFFERED"
1280 LET AA=5*(5-DIV)B(Z)+RND(6)-3
1281 PRINT
1285 PRINT "A*(AA)*000 FOR "
1287 LET A=7
1288 LET B=2
1289 GO SUB 20
1290 PRINT
1291 PRINT "DO YOU ACCEPT THE OFFER (Y/N)"
1292 INPUT Z
1293 IF Z="N" THEN GO TO 1010
1294 IF NOT Z="Y" THEN GO TO 1292
1295 LET CAGN=CASH+AA
1298 LET B(Z)=0
1299 GO TO 1010
1310 PRINT "CLUB REPORT FOR "
1311 LET A=DIV
1312 LET B=M/2+1
1313 GO SUB 20
1315 PRINT
1316 PRINT "SEASON "
1320 PRINT "DIVISION "
1321 PRINT "POSITION "
1322 PRINT "MORALE "
1331 PRINT
1335 IF ROUND=1 THEN GO TO 1344
1336 IF INCUP=1 THEN GO TO 1340
1337 PRINT "OUT OF F.A. CUP"
1338 GO TO 1345
1340 PRINT "THROUGH F.A. CUP "
1341 IF ROUND<0 THEN PRINT "ROUND "
1342 IF ROUND=0 THEN PRINT "SEMIFINAL"
1355 PRINT "CLUB PERFORMANCE FOR PAST "
1361 PRINT
1365 PRINT "SSN LEAGUE", "CUP"
1370 FOR N=1 TO 9
1375 PRINT N; " "
1376 IF Z(N)'0 THEN PRINT "ROUND "
1380 IF Z(N)=7 THEN PRINT "SEMI-FINAL"
1385 IF Z(N)=0 THEN PRINT "FINALISTS"
1390 IF Z(N)=9 THEN PRINT "INNERS"
1392 NEXT N
1395 GO SUB 9040
1399 GO TO 1010
1400 PRINT "CLUB PERFORMANCE"
1401 PRINT
1405 LET GAME=0
1410 FOR N=1 TO 60
1411 IF PEEK(16421)>5 THEN GO TO 1419
1412 PRINT
1413 GO SUB 9040
1415 CLS
1416 GO TO 1411
1419 IF R(N)=0 THEN GO TO 1400
1420 IF R(N)=1000 THEN GO TO 1450
1423 LET GAME=GAME+1

```


ZX80 PROGRAM

```

1425 IF R(N)>199 THEN PRINT "
A "
1426 IF R(N)<200 THEN PRINT "
H "
1427 LET A=DIV
1428 LET B=GAME
1430 GO SUB 20
1435 LET Z=R(N)-(R(N)/100)*100
1440 PRINT " *1Z-(Z/10)*10" - "
I
1445 LET Z=Z/10
1446 PRINT Z
1447 GO TO 1460
1450 PRINT "CUP "
1451 LET B=R(N)/100
1452 LET A=B-(B/10)*10
1453 LET B=(B-A)/10
1455 GO TO 1430
1460 NEXT N
1460 NEXT N
1400 PRINT
1405 GO SUB 9000
1490 GO TO 1010
1500 PRINT "SAVE TO TAPE"
1501 PRINT
1502 PRINT "ARE YOU SURE (Y/N)"
1503 INPUT Z0
1504 IF NOT Z0="Y" THEN GO TO 1
010
1510 PRINT
1520 PRINT "PREPARE CASSETTE PLA
YER AND THEN"
1530 PRINT
1540 GO SUB 9000
1550 SAVE
1560 STOP
1601 CLS
1605 IF CUPGAME=1 THEN GO TO 16
19
1610 IF DIV<3 AND (P=30 OR P=33
OR P=20 OR P=23 OR P=10 OR P=13
OR P=0) THEN GO TO 0000
1615 IF DIV>2 AND (P=42 OR P=37
OR P=32 OR P=27 OR P=22 OR P=17
OR P=12) THEN GO TO 0000
1619 LET CUPGAME=0
1620 PRINT "LEAGUE MATCH"
1630 PRINT
1640 LET HNE=1
1650 IF P=(P/2)*2 THEN LET HNE=
2
1660 LET DIV1=DIV
1661 LET DIV2=DIV
1670 LET B1=P
1671 IF B1>N/2 THEN LET B1=B1-N
/2
1675 GO SUB 1600
1676 GO TO 1750
1680 LET B2=N/2+1
1685 PRINT " "
1690 IF HNE=1 THEN GO TO 1720
1695 LET B=B1
1696 LET A=DIV1
1700 GO SUB 20
1705 LET B=B2
1710 LET A=DIV2
1710 PRINT " V "
1715 GO SUB 20
1716 GO TO 1741
1720 LET B=B2
1721 LET A=DIV2
1725 GO SUB 20
1730 PRINT " V "
1735 LET B=B1
1736 LET A=DIV1
1740 GO SUB 20
1741 RETURN
1750 PRINT
1760 PRINT
1761 PRINT "ENTER " FOR LEAGUE
TABLE","SINCE LAST CALCULATED,
OR"
1762 GO SUB 9000
1763 INPUT Z
1764 IF Z=0 THEN GO TO 4000
1765 IF NOT Z=1 THEN GO TO 1763
1760 PRINT
1770 PRINT "LEAGUE DIV. " DIV1 "
AFTER " UPDATE " GAMES"
1700 PRINT
1705 LET M2=(M+2)/4
1790 FOR N=1 TO M2
1000 LET B=D(N)
1001 IF M<10 THEN PRINT " "
1005 PRINT N; ". "
1010 GO SUB 20
1020 PRINT "
1030 PRINT N+M2; ". "
1040 LET B=B*(N+M2)
1050 GO SUB 20
1060 PRINT
1070 NEXT N
1000 GO SUB 9000
1090 GO TO 4000
1900 FOR N=1 TO 24
1901 IF B(N)=0 THEN GO TO 1903
1902 NEXT N
1903 LET TNPX=P*(B1)
1904 LET EN2=RND(10)+RND(10)*(TH
P+1)/P
1905 LET NDR2=RND(10)+RND(10)*(TH
PK+1)/P
1906 LET DEF2=RND(10)+RND(10)*(TH
PK+1)/P

```

```

1987 LET MID2=RND(10)+RND(10)*(TM
PK+1)/P)
1988 LET ATT2=RND(10)+RND(10)*(TM
PK+1)/P)
1910 CLS
1915 PRINT ,
1919 LET A=DIV2
1920 LET B=92
1930 GO SUB 20
1940 PRINT " "
1950 LET B=B1
1955 LET A=DIV1
1960 GO SUB 20
1970 PRINT
1975 LET EN=0
1980 FOR N=1 TO 24
1990 IF B(N)=2 THEN LET EN=EN+C
(N)
2000 NEXT N
2005 LET EN=EN/11
2007 LET DEF=0
2008 LET MID=0
2009 LET ATT=0
2010 FOR N=1 TO 8
2015 IF B(N)=2 THEN LET DEF=DEF
+E(N)
2020 IF B(N+8)=2 THEN LET MID=N
D+E(N+8)
2025 IF B(N+16)=2 THEN LET ATT=
ATT+E(N+16)
2040 NEXT N
2090 PRINT "ENERGY",EN," "
2100 PRINT "MORALE",MOR," "
2110 PRINT "DEFENCE",DEF," "
2120 PRINT "MIDFLD",MID," "
2130 PRINT "ATTACK",ATT," "
2140 PRINT
2150 PRINT "ENTER *1* TO CHANGE
TEAM OR"
2160 GO SUB 9000
2170 INPUT Z
2180 IF Z=0 THEN GO TO 3000
2190 CLS
2200 GO SUB 9600
2205 LET PLA=0
2210 FOR N=1 TO 24
2215 IF B(N)=2 THEN LET PLA=PLA
+1
2220 NEXT N
2230 IF PLA>11 THEN GO TO 2300
2240 PRINT "ENTER PLAYER TO ADD
TO TEAM OR"
2250 GO SUB 9000
2260 INPUT Z
2265 IF Z>24 THEN GO TO 2260
2270 IF Z<1 THEN GO TO 1910
2275 IF NOT B(Z)=3 THEN GO TO 2
240
2280 LET B(Z)=2
2290 GO TO 2190
2300 PRINT "ENTER PLAYER TO REMO
VE"
2310 INPUT Z
2320 IF Z<1 OR Z>24 THEN GO TO
2310
2325 IF NOT B(Z)=2 THEN GO TO 2
310
2330 LET B(Z)=3
2340 GO TO 2190
3001 LET HOME=0
3002 LET AWAY=0
3003 PRINT
3005 FOR N=1 TO RND(10)+2
3006 IF N=1 THEN GO TO 3400
3010 LET SHOT=RND(3)
3020 IF SHOT=1 THEN GO TO 3100
3025 IF SHOT=2 THEN GO TO 3500
3030 LET GOAL=EN+MOR+ATT-EN2-MOR
2-DEF2+RND(20)
3045 IF GOAL<0 THEN GO TO 3500
3050 LET HOME=HOME+1
3060 GO TO 3400
3100 LET GOAL=EN2+ATT2+MOR2-EN-N
OR-DEF+RND(20)
3115 IF GOAL<0 THEN GO TO 3500
3120 LET AWAY=AWAY+1
3400 LET B=92
3405 IF HME=2 THEN LET B=B1
3410 LET A=DIV2
3415 IF HME=2 THEN LET A=DIV1
3420 GO SUB 20
3430 IF HME=1 THEN PRINT " *1HD
HE1" - "1AWAY1" *1
3435 IF HME=2 THEN PRINT " *1AW
AY1" - "1HOME1" *1
3440 LET B=81
3445 IF HME=2 THEN LET B=92
3450 LET A=DIV1
3455 IF HME=2 THEN LET A=DIV2
3460 GO SUB 20
3470 PRINT
3480 INPUT Z0
3490 IF PEEK(16421)<6 THEN CLS
3500 NEXT N
3510 PRINT "END OF GAME"
3520 LET MATCH=MATCH+1
3550 RETURN
4000 GO SUB 1900
4001 GO SUB 40
4011 FOR N=1 TO 24

```

ZX80 PROGRAM

```

4812 LET U(N)=#
4813 NEXT N
4818 IF HME=1 THEN LET GATE=(5-
DIV)#P(B2)*28/(P#3)+1+RND(5-DIV)
4819 IF HME=2 THEN LET GATE=(5-
DIV)#P(B1)*28/(P#3)+1+RND(5-DIV)
4828 PRINT "GATE #";GATE;"888"
4821 GO SUB 9848
4823 CLS
4825 LET R(MATCH)=188#HME+HOME+A
WAY#18
4838 PRINT "RESULTS :- DIVISION
";DIV
4836 IF HOME>AWAY THEN LET NOR=
NOR+(21-NOR)/2
4837 IF HOME<AWAY THEN LET NOR=
NOR/2
4845 PRINT
4858 LET U(B1)=1
4868 LET U(B2)=1
4878 IF N=46 THEN GO TO 4888
4875 LET U(23)=1
4876 LET U(24)=1
4888 FOR N=1 TO (M-2)/4
4898 LET Z=RND(24)
4188 IF U(Z)=1 THEN GO TO 4898
4118 LET B2=Z
4128 LET U(Z)=1
4138 LET HOME=RND(28#P(Z)/P+4)-1
4148 LET B=Z
4158 GO SUB 28
4168 PRINT " " ;HOME;" V " ;
4178 LET Z=RND(24)
4188 IF U(Z)=1 THEN GO TO 4178
4198 LET B1=Z
4288 LET U(Z)=1
4218 LET AWAY=RND(28#P(Z)/P+3)-1
4228 LET B=Z
4238 PRINT AWAY;" " ;
4248 GO SUB 28
4258 PRINT
4268 GO SUB 48
4278 NEXT N
4288 PRINT
4298 PRINT "THE NEW LEAGUE POSIT
IONS TAKE ABOUT 68 SECS TO CAL
CULATE. ENTER *I* FOR NEW TA
BLE OR"
4295 GO SUB 9888
4388 INPUT Z#
4384 IF P=# THEN GO TO 4318
4385 IF Z#=#* THEN GO TO 4858
4386 IF NOT Z#=#1* THEN GO TO 4
388
4318 CLS
4315 LET UPDATE=P
4328 FOR H=1 TO M/2
4338 FOR I=H+1 TO M/2+1
4348 IF P(B(H))>P(B(I)) THEN DD
TO 4388
4358 LET DUMMY=B(H)
4368 LET B(H)=B(I)
4378 LET B(I)=DUMMY
4388 NEXT I
4398 NEXT H
4395 LET A=DIV
4396 PRINT "TEAM W D
L F A PT",,,,
4488 FOR H=1 TO M/2+1
4418 IF NOT H=13 THEN GO TO 443
8
4415 GO SUB 9848
4428 CLS
4425 PRINT "TEAM W D
L F A PT",,,,
4438 LET B=B(H)
4431 IF B=M/2+1 THEN LET POS=H
4435 PRINT H;" " ;
4436 IF H<18 THEN PRINT " " ;
4448 GO SUB 28
4458 PRINT " " ;
4455 IF M(B)<18 THEN PRINT " " ;
4468 PRINT M(B);" " ;
4465 IF D(B)<18 THEN PRINT " " ;
4478 PRINT D(B);" " ;
4475 IF L(B)<18 THEN PRINT " " ;
4488 PRINT L(B);" " ;
4485 IF F(B)<18 THEN PRINT " " ;
4486 IF F(B)<188 THEN PRINT " "
;
4498 PRINT F(B);" " ;
4495 IF A(B)<18 THEN PRINT " " ;
4496 IF A(B)<188 THEN PRINT " "
;
4588 PRINT A(B);" " ;
4585 IF P(B)<188 THEN PRINT P(B
)
4586 IF P(B)>99 THEN PRINT ,,,,
" " ;P(B)
4518 NEXT H
4528 PRINT
4525 PRINT "TABLE AFTER *I* GA
MES"
4526 PRINT
4538 GO SUB 9848
4558 IF HME=1 THEN LET CASH=CAS
H+GATE#2/3
4568 IF HME=2 THEN LET CASH=CAS
H+GATE/3
4688 FOR H=1 TO 24
4618 IF B(H)=3 OR R(H)=1 THEN L
ET C(H)=C(H)+18
4615 IF C(H)>28 THEN LET C(H)=2
8

```

```

4628 IF B(H)=2 THEN LET C(H)=C
H1-1
4624 IF (B(H)=2 OR B(H)=3) AND R
ND(48)=48 THEN LET B(H)=1
4625 IF B(H)=1 AND RND(18)>5 THE
N LET B(H)=3
4638 IF C(H)=8 THEN LET B(H)=1
4648 NEXT H
4658 LET DUMMY=8
4668 FOR H=1 TO 24
4678 IF B(H)>8 THEN LET DUMMY=D
UMMY+E(H)
4688 NEXT H
4698 LET DUMMY=(5-DIV)*DUMMY/18
4708 LET CASH=CASH-DUMMY-5+DIV
4718 CLS
4715 IF P=H THEN GO TO 5988
4728 PRINT "TRANSFER MARKET"
4738 PRINT
4748 PRINT "CASH IN HAND :- R";
CASH;"888"
4758 PRINT
4751 LET B=8
4752 FOR H=1 TO 24
4753 IF B(H)>8 THEN LET B=B+1
4754 NEXT H
4755 IF B<14 THEN GO TO 4768
4756 PRINT "YOU HAVE A FULL SQUA
D"
4757 GO TO 5988
4768 LET B=RND(24)
4778 IF NOT B(B)=8 THEN GO TO 4
768
4788 LET A=7
4785 PRINT B;"", "1
4798 GO SUB 28
4795 PRINT
4796 PRINT
4808 PRINT "ENERGY :- "1C(8)
4818 PRINT "SKILL :- "1E(8)
4828 PRINT
4838 PRINT "DO YOU WANT THIS PLA
YER ?","Y/N"
4848 INPUT Z8
4858 IF Z8="N" THEN GO TO 5988
4868 IF NOT Z8="Y" THEN GO TO 4
848
4878 LET GATE=E(B)*15-DIV145
4888 PRINT
4898 PRINT "YOU HAVE PAID R"1GA
TE;"888"
4908 LET CASH=CASH-GATE
4958 LET B(B)=3
5008 GO SUB 2848
5988 IF CASH<-1 THEN GO TO 6888
5918 CLS
5928 PRINT "THE CLUB OWES R"1AB
S(CASH);"888"
5938 PRINT
5948 PRINT "A NEW BOARD OF DIREC
TORS HAVE"
5958 PRINT
5968 PRINT "TAKEN OVER , AND YOU
HAVE BEEN"
5978 PRINT
5988 PRINT "SACKED "1
5998 GO TO 5988
6088 IF CUPGAME=1 THEN GO TO 18
18
6018 NEXT P
6118 GO TO 8888
6128 PRINT "PRESS N/L FOR END OF
SEASON","RESULTS"
6138 INPUT Z8
6148 LET SET=8
6158 CLS
6201 IF DIV=1 THEN GO TO 6488
6205 LET I=3
6206 IF DIV=4 THEN LET I=4
6208 PRINT "PROMDTE"
6209 PRINT
6218 FOR H=1 TO I
6215 LET A=DIV
6228 LET STDIV=DIV
6225 LET STTH=B(H)
6227 LET B=STTH
6228 GO SUB 28
6229 PRINT
6238 LET FINDIV=DIV-1
6235 LET FINTH=17+H
6248 IF B(H)=N/2+1 THEN LET FIN
TH=22
6245 IF DIV=4 AND B(H)=N/2+1 THE
N LET FINTH=24
6246 IF STTH=N/2+1 THEN LET SET
=-1
6258 GO SUB 9388
6268 NEXT H
6488 IF DIV=4 THEN GO TO 6688
6481 PRINT
6482 PRINT
6483 PRINT "RELEGATED"
6484 PRINT
6418 LET I=3
6428 IF DIV=3 THEN LET I=4
6425 LET GATE=N/2+2
6438 FOR H=1 TO I
6435 LET A=DIV
6448 LET STDIV=DIV
6458 LET STTH=B(GATE-H)
6455 LET B=STTH
6456 GO SUB 28
6457 PRINT
6468 LET FINDIV=DIV+1

```

```

6478 LET FINTM=H
6488 IF STTN=N/2+1 THEN LET FIM
TN=22
6495 IF DIV=3 AND STTN=N/2+1 THE
N LET FINTM=24
6496 IF STTN=N/2+1 THEN LET SET
=1
6498 GO SUB 9388
6508 NEXT H
6608 LET H=9
6618 LET X(H)=X(H-1)
6628 LET Y(H)=Y(H-1)
6638 LET Z(H)=Z(H-1)
6648 LET H=H-1
6658 IF H>1 THEN GO TO 6618
6668 LET X(1)=DIV
6678 LET Y(1)=POS
6688 LET Z(1)=RNDOUT
6698 LET DIV=DIV+SET
6698 LET SEASON=SEASON+1
6708 GO TO 100
7999 STOP
8888 LET I=244
(9-ROUND)
8881 IF ROUND<3 THEN LET I=(3-R
OUND)*48
8882 IF DIV<3 AND ROUND<3 THEN
GO TO 8588
8884 IF INCUP=1 THEN GO TO 8818
8885 GO SUB 8288
8886 PRINT "YOU ARE NOT IN THE C
UP."
8888 GO TO 8588
8818 LET HNE=-1
8828 FOR H=1 TO 88
8825 LET HNE=-HNE
8838 IF NOT G(H)/100=DIV THEN G
O TO 8848
8848 IF NOT G(H)-(G(H)/100)*100=
N/2+1 THEN GO TO 8868
8858 GO TO 8188
8868 NEXT H
8188 IF HNE=-1 THEN LET HNE=2
8118 LET B2=N/2+1
8128 LET DIV2=DIV
8125 IF HNE=2 THEN GO TO 8158
8138 LET DIV1=G(H+1)/100
8135 LET B1=G(H+1)-DIV1*100
8148 GO TO 8185
8178 LET DIV1=G(H-1)/100
8188 LET B1=G(H-1)-DIV1*100
8185 GO SUB 8288
8198 GO TO 8258
8288 PRINT "FA CUP "
8218 IF ROUND<7 THEN PRINT "ROU
ND "1ROUND
8228 IF ROUND=7 THEN PRINT "SEN
I-FINAL"
8238 IF ROUND=8 THEN PRINT "FIN
AL"
8248 PRINT
8245 RETURN
8258 GO SUB 1608
8268 PRINT
8265 PRINT
8278 PRINT "ENTER "1" FOR THE FU
LL DRAW OR"
8288 GO SUB 9888
8298 INPUT Z
8308 IF Z=8 THEN GO TO 8488
8318 IF NOT Z=1 THEN GO TO 8298
8315 PRINT
8335 LET H8=" "
8336 LET A8=" "
8348 FOR H=1 TO 1
8341 IF (H/2)*2=H THEN GO TO 83
85
8342 IF PEEK(16421)>5 THEN GO T
O 8385
8343 PRINT
8344 GO SUB 9848
8345 CLS
8346 GO TO 8385
8358 LET A=G(H)/100
8368 LET B=G(H)-A*100
8378 GO SUB 28
8375 IF NOT (H/2)*2=H THEN PRIN
T " "1H8" V "1A8" "1
8388 IF (H/2)*2=H THEN PRINT
8384 RETURN
8385 GO SUB 8358
8398 NEXT H
8395 PRINT
8396 GO SUB 9848
8408 LET THPK=(5-DIV1)*P
8418 GO SUB 1984
8415 LET GATE=ROUND*5+RND(5*ROUN
D)
8416 PRINT "GATE "1GATE"1888"
8417 LET CASH=CASH+GATE
8418 PRINT
8419 LET R(MATCH)=2181000+DIV1*8
18+HNE+AWAY*818
8428 IF HNE>AWAY THEN GO TO 84
98
8438 IF HNE=AWAY THEN GO TO 84
68
8448 LET INCUP=8
8441 LET RNDOUT=ROUND
8445 LET MOR=MOR/4
8458 GO TO 8588
8468 PRINT "REPLAY TO FOLLOW :-"
8465 GO SUB 9848
8478 GO TO 8488

```

ZX80 PROGRAM

```

0490 LET MOR=MOR+(21-MOR)/2
0495 IF ROUNS=8 THEN LET RNDOUT
=9
0500 LET DUMMY=N/2+1+DIV*100
0505 GO SUB 9040
0506 CLS
0507 GO SUB 0200
0508 PRINT , " RESULTS"
0509 PRINT
0510 FOR N=1 TO 1
0511 IF PEEK(16421)/5 THEN GO S
UB 9040
0516 IF PEEK(16421)/5 THEN CLS
0520 IF DUMMY=0(H) OR DUMMY=G(H+
1) THEN GO TO 0600
0530 LET H0=STR0(RND(7-G(H))/100)
-1)
0540 LET A0=STR0(RND(7-G(H+1))/10
01-1)
0550 IF A0=H0 THEN GO TO 0530
0560 GO SUB 0350
0570 LET H=H+1
0580 GO SUB 0350
0590 GO TO 0630
0600 LET A0=STR0(AWAY)
0605 LET H0=STR0(HOME)
0610 IF HNE=2 THEN LET A0=STR0(
HOME)
0615 IF HNE=2 THEN LET H0=STR0(
AWAY)
0620 GO TO 0560
0630 IF H0>A0 THEN LET G(H/2)+0
(H-1)
0640 IF H0<A0 THEN LET G(H/2)-0
(H)
0650 NEXT H
0660 LET ROUND=ROUND+1
0670 IF NOT ROUND=3 THEN GO TO
0700
0675 FOR N=1 TO 22
0680 LET G(H+20)=100+H
0685 LET G(H+42)=200+H
0690 NEXT H
0700 FOR N=1 TO 30
0710 LET A=RND(64)
0720 LET B=RND(64)
0730 IF A=B THEN GO TO 0710
0740 LET DUMMY=G(A)
0750 LET S(A)=G(B)
0760 LET G(B)=DUMMY
0770 NEXT H
0780 LET CUPGAME=1
0790 GO SUB 9040
0800 IF RNDOUT<9 THEN GO TO 085
0
0810 FOR N=1 TO 20
0820 PRINT "WINNERS " ;
0830 NEXT H
0840 GO SUB 9040
0850 IF RNDOUT=9 THEN GO TO 6120
0860 GO TO 4000
0865 DIM W(24)
0870 DIM O(24)
0880 DIM L(24)
0885 DIM F(24)
0890 DIM A(24)
0895 DIM P(24)
0900 DIM S(24)
0905 DIM G(24)
0910 DIM C(24)
0915 DIM E(24)
0920 DIM G(24)
0925 DIM X(9)
0930 DIM Y(9)
0940 DIM Z(9)
0950 DIM Q(24)
0960 LET SEASON=1
0970 DIM R(20)
0980 DIM U(24)
0990 GO SUB 9960
1000 LET DIV=4
1010 FOR A=1 TO 5
1015 CLS
1020 PRINT "PICK A TEAM BY NUMBE
R OR"
1030 GO SUB 9900
1040 LET M=22
1050 IF A=3 OR A=4 THEN LET M=2
4
1060 IF A=5 THEN LET M=32
1070 PRINT
1080 FOR B=1 TO M
1090 IF B<10 THEN PRINT " " ;
1100 PRINT B ; ". " ;
1110 GO SUB 20
1120 PRINT ,
1130 NEXT B
1140 PRINT
1150 INPUT Z
1160 IF Z>B AND Z<M+1 THEN GO T
O 9250
1170 NEXT A
1180 GO TO 9110
1190 LET STDIV=A
1200 LET STTH=2
1210 LET FINDIV=4
1220 LET FINTH=24
1230 GO SUB 9300
1240 GO TO 9500
1250 LET A=STDIV
1260 LET B=STTH
1270 LET C=4
1280 LET D=1
1290 GO SUB 9950

```

```

9398 LET A=FINDIV
9399 LET B=FINTH
9399 LET C=STDIV
9399 LET D=STTH
9399 GO SUB 9999
9400 LET A=6
9410 LET B=1
9420 LET C=FINDIV
9430 LET D=FINTH
9440 GO SUB 9950
9450 RETURN
9500 LET M=24
9510 RANDNIZE
9520 FOR A=1 TO 12
9530 LET B=RND(24)
9535 IF B(1)>6 THEN GO TO 9530
9540 LET B(2)=2
9545 NEXT A
9550 LET B=RND(24)
9555 IF B(2)=0 THEN GO TO 9550
9560 LET B(2)=3
9560 GO TO 100
9600 CLS
9601 PRINT "TEAM PLAYERS"
9607 PRINT " I=INJURED P=PLA
YING"
9609 PRINT "ND NAME", "SKL EGY
STATUS"
9619 LET A=7
9620 FOR B=1 TO 24
9630 IF B(2)=0 THEN GO TO 9640
9635 IF B(1) THEN PRINT " "
9636 PRINT B(1), " "
9640 GO SUB 20
9645 PRINT "E(1)"; " "C(B), " "
"
9646 IF B(2)=1 THEN PRINT "I"
9647 IF B(2)=2 THEN PRINT "P"
9648 IF B(2)=3 THEN PRINT
9660 NEXT B
9670 RETURN
9800 PRINT "ENTER "0" TO CONTINU
E"
9810 RETURN
9840 PRINT "PRESS N/L TO CONTINU
E"
9850 INPUT Z0
9860 RETURN
9952 GO SUB 30
9953 LET AA=X
9954 LET A=C
9955 GO SUB 30
9956 FOR E=0 TO 8
9957 POKE X+(D-1)*10+E,PEEK(AA+(
D-1)*10+E)
9958 NEXT E
9959 RETURN

```

```

9960 CLS
9961 LET A=CHR(128)
9962 LET B=CHR(136)
9963 PRINT " " " " " " " " " " " " " " " "
9964 PRINT " " " " " " " " " " " " " " "
9965 PRINT " " " " " " " " " " " " " " " "C
NR0(130)"; " " " " " " " " " " " " " "
9966 PRINT " " " " " " " " " " " " " " " "
" " " " " " " " " " " " " " " " " " " "
9967 PRINT " " " " " " " " " " " " " " " "
132)"; " " " " " " " " " " " " " " " "
9968 PRINT " " " " " " " " " " " " " " " "
132)"; " " " " " " " " " " " " " " " "
9969 PRINT " " " " " " " " " " " " " " " "
0)"; " " " " " " " " " " " " " " " " " " "
0)"; " " " " " " " " " " " " " " " " " " "
9970 PRINT " " " " " " " " " " " " " " " "
" " " " " " " " " " " " " " " " " " " "
9971 PRINT " " " " " " " " " " " " " " " "
" " " " " " " " " " " " " " " " " " " "
" " " " " " " " " " " " " " " " " " " "
" " " " " " " " " " " " " " " " " " " "
9972 PRINT " " " " " " " " " " " " " " " "
" " " " " " " " " " " " " " " " " " " "
9973 PRINT " " " " " " " " " " " " " " " "
" " " " " " " " " " " " " " " " " " " "
9974 PRINT " " " " " " " " " " " " " " " "
" " " " " " " " " " " " " " " " " " " "
" " " " " " " " " " " " " " " " " " " "
9975 PRINT " " " " " " " " " " " " " " " "
" " " " " " " " " " " " " " " " " " " "
" " " " " " " " " " " " " " " " " " " "
9976 PRINT " " " " " " " " " " " " " " " "
" " " " " " " " " " " " " " " " " " " "
" " " " " " " " " " " " " " " " " " " "
9977 PRINT " " " " " " " " " " " " " " " "
132)"; " " " " " " " " " " " " " " " "
" " " " " " " " " " " " " " " " " " " "
" " " " " " " " " " " " " " " " " " " "
9979 PRINT " " " " " " " " " " " " " " " "
" " " " " " " " " " " " " " " " " " " "
9980 PRINT " " " " " " " " " " " " " " " "
" " " " " " " " " " " " " " " " " " " "
9981 PRINT " " " " " " " " " " " " " " " "
" " " " " " " " " " " " " " " " " " " "
" " " " " " " " " " " " " " " " " " " "
9982 PRINT " " " " " " " " " " " " " " " "
" " " " " " " " " " " " " " " " " " " "
9983 PRINT " " " " " " " " " " " " " " " "
" " " " " " " " " " " " " " " " " " " "
9984 PRINT " " " " " " " " " " " " " " " "
" " " " " " " " " " " " " " " " " " " "
9985 PRINT " " " " " " " " " " " " " " " "
" " " " " " " " " " " " " " " " " " " "
9986 PRINT
9987 INPUT Z0
9988 RETURN
9999 PRINT PEEK(16396)+PEEK(1639
7)*256

```

The Binatone Data Recorder

This issue we have half a dozen of Binatone's new Data Recorders to give away!



A few weeks ago a young lady came to the ZX office, laden with bulky looking carrier bags.

"Oh my gawd," we all cried. "Not another tape recorder to review?" But it was, of course. However, this particular unit turned out to be really rather good, and so, when we received a phone call from the people at Binatone asking — "How would you like to run a competition with the Data Recorder as a prize?" — we jumped at the chance, so we now have six of these fine units to give to our readers, regardless of which machine you own.

The Review

But first, we'll let you hear what our reviewer said when we sent him the recorder to look at.

"From Binatone comes their contribution to the computer industry. This recorder is an impressive looking unit which is rather large and the cassette housing is upright while the keys form a ledge at right angles at the bottom of it.

The whole unit is almost square and as well as the usual Play/Record/F.F./F.F./Rewind/Stop/Pause keys

tape counter, monitor switch and power switch are mounted on the front panel.

On the left hand side are the ear and mic sockets — marked "output/load" and "input/ave" — a remote socket and a sliding volume control (output/level level). Also on this panel is a phase switch which gives normal or reverse phasing to the output, as far as I can tell this has no effect on the loading of spectrum programs.

A serious omission is that no provision for adjusting the head azimuth has been made, this is

usually a small hole for inserting a screw driver, a quick twiddle of which has loaded many a reluctant program, however, Binatone assure us that they would be happy to adjust any units which seem to have alignment problems.

The instruction booklet is well produced and you'd have to be a complete idiot to misunderstand it. I tried it with a variety of tapes, some old and some new and all but one loaded successfully, then I tried it with a program which had failed to load on all my other recorders, and, surprise, surprise it loaded first time!

At £29.95 it is by no means cheap, but it looks very impressive and has performed admirably. I would recommend it to anyone who feels that it is worth getting a dedicated recorder for their computer."

For what it's worth, I can also add that the recorder has been more or less adopted for use in our offices when we want to try out software.

The Competition

Somewhere on these two pages you will see a small captioned cartoon featuring (among other things) a tape recorder. All you have to do to win one of the Binatone recorders is to supply an absolutely hilarious caption to accompany the cartoon. The captions should be "suitable for mass consumption" i.e. not too disgusting. Other than that, you can do what you want.

To Enter

Entries should be written either on a postcard, or the back of an envelope.

The rules

- This competition is open to all UK and Northern Ireland readers of ZX Computing, except employees of Argus Specialist Publications Ltd, their printers and distributors, employees of Binatone and anyone else associated with the competition. As long as each entry is sent on an individual envelope/postcard, there is no limit to the number of entries from each individual.

- All entries must be postmarked before 21st July 1985. The prizes will be awarded to the six entrants who provide the best captions to accompany our cartoon. No correspondence will be entered into with regard to the results, and it

is a condition of entry that the Editor's decision is final.
 ■ The winners will be notified by post and the results published in a future issue of ZX Computing.

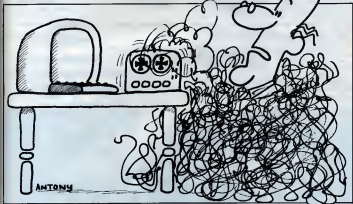
Temptation competition

The winners of this competition (their names were published last issue), should by now have received their prizes, as Temptation have written to us to confirm that the prizes were sent out. The people at Temptation tell us that they are surprised by the immortality of the ZX81, and as a result have now released a triple-pack of ZX81 games.

Hopefully we will be able to carry a full review elsewhere in this issue.

Unique

The bad news is that Unique appear to have bitten the dust, leaving the winners of their Sandbarcher competition prizeless. The good news is that ZXC has managed to arrange for alternate prizes to be sent out. The kind people at Argus Press Software have offered to supply us with copies of their game, Allen, which has received some rather good reviews in some other mags. The only reason we haven't reviewed it yet is that Ray's, ahem, 'distressed condi-



tion' and a change in some of our review team has thrown a bit of a spanner into the works. The prizes should have arrived as you read this. We hope all the winners enjoy them, and we apologise for their having to wait such a long time.

Thurnall Disc Drive Winner

And now, the moment you've all been waiting for, the announcement of the winner of the Thurnall Disc Drive. This incredibly lucky person is none other than Alan Smith, of Basingstoke.

The drive should have reached you by the time you read this, and we hope you enjoy it.

Software Farm

As I write this, our April/May issue has only just hit the newsstands, but entries for the Software Farm competition are already starting to come in. We will of course, announce the winners in our next issue.

Next time around, with a little luck, we hope to be able to offer you the chance to win a wonderful colour monitor for use with the Spectrum. Don't say we aren't good to you!

Death Caves

A brilliant and machine code game from Stephen Ives to test would be spaceship pilots in Essex.

The first sighting of planet ASP was unimpressive, nothing but desolate waste and litter from ponding aliens. The heat sensors of the Mk. 1 Corina Space Shuttle pinpointed a small entrance leading into the depths of the planet.

Being a Wonderfully Alert Life Loving Yobbo (Welly for short) I pointed my go-faster striped bonnet towards it and floored the pedal.

Fancy the inhabitants being unfriendly!

Just because our goffball team supporters destroyed a planet or two during the last interplanetary cup season there's no need to take it out on the average tourist!

And wouldn't you know it, my dam fuel tanks have started leaking! Still all I've got to do is shoot their fuel tanks so the ships' built in fuel absorbers can collect it, and simply dodge their

missiles — should be easy ...!

REMs and so forth

Machine code is always a source of problems so great care must be taken over the program. I can assure you it's worth it! Enter the whole program, saving at regular intervals, and making sure that each of the REM lines 1 to 22 contain 32 characters — these often include quarter character characters found on keys 1 to 4.

Line 50 MUST contain 800 characters, so this is where the machine code will be stored once you have entered the type PRINT PEEK 17350 newline and the answer should be the code of the character you used (e if you used 800 zero then the number should be 28) if this is not so then check the REMs carefully.

Lines 100 to 160 contain the machine code and the program to load it into line 50 REM.

Lines 200 to 7030 is the main program, and line 9999 REM is also important.

Making quite sure that you have copies on tape, RUN the program. After a few minutes the program should stop with error report 9/129.

Now for the big test

Type RUN 200, newline. To the prompt for SPEED try 30, hopefully you will be betting for survival! If this is the case now remove one at a time (by typing the line number and newline) all the lines 104 to 160.

SAVE your final program two or three times by typing GOTO 8000 newline, and relax!

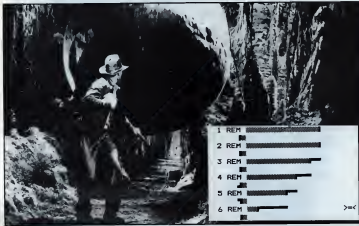
If it goes wrong

If the program crashes at any stage, reload it and check the following lines:

- 100-125 and 1001-3016 if it crashes immediately without producing any display.
- 111 if it crashes when you move.
- 114 if it crashes when you fire.
- 121 if it crashes when you hit a fuel dump.
- 116-119 if it crashes when 0 appears.

Amendments

You can redesign the cave by changing the patterns in REM lines 1 to 22 but each line must have 32 characters and the two 0 must remain in the same positions.



ZX81 GAME

```

7 REM                                     >=< >=<
      .
8 REM                                     >=<
9 REM                                     .
10 REM                                    .
11 REM                                    .
12 REM                                    .
13 REM                                    .
14 REM                                    .
15 REM                                    .
16 REM                                    .
17 REM                                    .
18 REM                                     ( )
      .
19 REM                                     ( )
      .
20 REM                                     .
21 REM                                     .
22 REM                                     .

50 REM THIS LINE CONTAIN
    600 CHARACTERS FOR THE
    MACHINE CODE.

100 LET A=17350
104 REM
105 LET P#="ED5B8C4021210019010
602EDB02A2C4001860209E82A4040012
000EDB07CFE43200C7DFED0200721824
0224040C901060009224040C9"
107 REM
111 LET P#=#+"ED400C4021FA0009
223C402A3C40012100AFED42220E40D7
D7D72A3C403A2540FEF200123FEF720
01200603E57EFE002007E12142403605
C92310F1E1220E403E06D73E09D73E06
D7223C40C9"
112 REM
114 LET P#=#+"3A2140FE00201321
25403E0F0E20002A3C4001220009223E
40C921214036002A3E4001210007ED42
220E403E00701420009223E40220E40
2A0E407EFE1420062143403605C9FE00
20043E18D7C921214036052A3C400122
0009223E40C9"
115 REM
116 LET P#=#+"3A4440FE00203B2A
4540012100AFED427EFE00E2006214440
3605C9AF220E40D787ED427EFE092006
2144403605C9
220E403E0ED7224540C9"
117 LET P#=#+"2A34403E0FA467CB
4ED0CB66C01611210E00ED400C40097E
FE112B00012100091520F4C9B7ED4222
4540360E2144403600C9"
118 LET P#=#+"3A4040FE00203B2A
4940012100AFED427EFE00E2006214040
3605C9AF220E40D787ED427EFE092006
2142403605C9FE0020062140403605C9
220E403E0ED7224940C9"
119 LET P#=#+"2A34403E0FA467CB
560CB6EC01611219100ED400C40097E
FE112B00012100091520F4C9B7ED4222
4940360E2140403600C9"
120 REM
121 LET P#=#+"21434036002A3E40
01210007ED427EFE1420010920060336
002310FB011E0009060336002310FB2A
4B4001960009224B40C9"
122 REM
123 LET P#=#+"2A40407CFE00200B
7DFE0020062142403605C9010A0007ED
42224B40C9"
124 REM
125 LET P#=#+"CDC43CDC1453A42
40FE05C8C007443A4240FE05C8CD4944
3A4340FCE05CC0F45CDA744CD18452A4D
40207C0520F82A4F4023224F40C3DE45
"
129 IF P#="" THEN STOP
130 POKE A, CODE P#*16+CODE P#(2
)-476
140 LET A=A+1
150 LET P#=#(3 TO )
160 GOTO 129
195 REM
196 REM
197 REM
200 REM
201 REM
202 REM
203 REM
210 PRINT AT 0,11;"DEATH CAVES"
220 PRINT AT 1,11;"-----"
230 PRINT AT 2,0;"YOU MUST STEE
R YOUR CRAFT -> THROUGH THE C
AVES DODGEING THE WALLS AND ENEM
Y FIRE."
240 PRINT AT 6,0;"YOU MUST ALSO
COLLECT FUEL BY SHOOTING THE
FUEL DUMPS -> IF YOU RUN OU
T OF FUEL YOU GET KILLED."
245 PRINT AT 11,0;"THE DEEPER Y
OU GO THE HIGHER YOUR SCORE"
250 PRINT AT 14,0;"KEYS"
260 PRINT AT 15,0;"-----"
270 PRINT AT 16,0;"*5" MOVES

```

```

SHIP LEFT."
200 PRINT AT 17,0;"*B*" MOVES
YOU RIGHT."
290 PRINT AT 10,0;"*U*" FIRES
LASER BEAM."
300 PRINT AT 21,0;"ENTER SPEED
0(FAST) TO 200(SLOW)"
310 INPUT SPEED
999 LET A$="

```

```

1000 CLS
1001 POKE 16461,255
1002 POKE 16462,SPEED
1010 POKE 16450,0
1020 POKE 16417,5
1030 POKE 16452,5
1050 POKE 16459,200
1060 POKE 16410,0
1065 POKE 16463,0
1066 POKE 16464,0
1070 PRINT AT 22,0;"*****00
*****"
1080 PRINT AT 23,0;"*****00
*****"
1085 POKE 16410,2
1090 PRINT AT 0,0;
2000 RAND USR 17404

```

```

3000 POKE 16440,130
3010 POKE 16449,64
3015 REM *****
3016 RAND USR 17004
4000 IF (PEEK 16459+256+PEEK 164
60)<>0 THEN GOTO 5000
4010 CLS
4020 PRINT AT 10,0;"YOU RAN OUT
OF FUEL"
4030 GOTO 7000
5000 CLS
5010 PRINT AT 10,0;"YOU WERE DES
TROYED "
5020 GOTO 7000
7000 PRINT AT 12,0;"YOU SCORED "
;(PEEK 16463+256+PEEK 16464)*10
7010 PRINT AT 14,0;"PRESS *T*"
TO PLAY AGAIN"
7020 IF INKEY<>"T" THEN GOTO 70
20
7021 POKE 16410,2
7022 CLS
7030 GOTO 200
8000 SAVE "DEATH CAVE0"
8010 RUN 200
9999 REM *****

```

Slomo

Tired of being unable to play those fast games, or do you wish to take screen shots, or just stop a game that has no "pause"? Then Nidd has the answer to your problem — the "Slomo". It is a handy emulator comprised of sloped hand control (2.75" by 1.75"), and a yard of cable leading to a user port extender which can be attached to the computer or behind any peripheral which has a suitable extender.

As with all "add-ons", it is essential to switch the computer off when fitting the "Slomo", which can then be left permanently plugged in. The instruction sheet offers a simple test program involving filling the screen with asterisks and then pressing "Freeze Frame". The screen should stand still until the button is released. Pressing the "Slow Motion" button should

cause the red indicator to light, and allow the speed control knob to be turned anti-clockwise to slow the screen display to a standstill. Turning the knob clockwise results in the display gradually speeding up to virtually normal speed at full turn. Press "Slow Motion" again and the light goes out showing that the "Slomo" is switched off.

When loading or saving a program the device must be switched off, otherwise nothing will happen. Load one of those games that require fast reactions — such as "Bug-Eyes", "Leapfrog" or "Buce Lee" — switch on "Slomo", select the speed that you feel able to cope with and sit back to enjoy the game as never before. When the game becomes too easy at that speed, just turn the knob slightly and play it faster. You should

soon find yourself playing it at normal speed.

The only minor irritation — perhaps caused by having a Disk

game take to LOAD. That aside, the "Slomo" is a valuable addition to any computer buff's armoury of peripherals.



Drive and an FD5 keyboard — is that occasionally programs have crashed after using the "Freeze Frame" button — which can be most frustrating, especially considering the time some pro-

The Slomo costs £14.95, and is available from Nidd Valley Micro Products, Stepping Stones House, Thistle Hill, Knaresborough, North Yorkshire.

Building An Adventure Brain — Part 2

Continuing his guide to Adventure writing, Brian Robb introduces some special subroutines.

In the first article of this series I began to explain how to build an adventure "brain". To complete this brain, several specialized subroutines are needed and it is these subroutines which I shall consider in this article.

To start with, after initializing the verbs (as shown in the previous article), the objects to be used within the adventure have to be initialized in the same way. Figure one shows a listing which does this and matches figure five accompanying the last article. Figure two shows the Spectrum version. The objects used in these listings are only examples and should be replaced with the objects you will be using in your own adventure. The number which follows each object is the location number where that object will first be encountered by the player (and this will change as the game proceeds and objects are moved around).

It is necessary on the Spectrum, but not on the ZX81, to have a program module which reads both the verb and object data into the computer's memory. Figure three shows this routine.

Now that the computer has a list of objects, a program module needs to be added to the location description printing routine to print out the object's name, along with the room description, if the player should walk into a room containing an object. Figure four shows this self-explanatory routine for both the ZX81 and Spectrum, and almost completes the central brain program.

A final routine is needed for the brain program to use the verbs and to direct the computer to the specific subroutine which deals with that verb. Figure five shows this routine for both Sinclair computers.

In the first article of this series, X8 held the player's verb input and V1 the verbs that the computer understands. This module compares the first three letters of the player's input with the first three letters of all the known verbs, and, if a match is found then the computer jumps to the subroutine represented by V1N1, the program line number where the subroutine begins. If no match is found the computer then prints "I CAN'T":X8, and the player must rephrase his command until he finds a verb that the computer understands. The number of these verbs depends upon the size of your adventure and the memory available to you. To illustrate how this adventure game system works, I shall explain four necessary subroutines.

Vocabulary

To start with, I shall consider one of the most common adventuring verbs — TAKE. Figure six shows the complete module to which the computer is directed, and I shall explain how this module works.

As an example I shall assume that the player is in location five, where a knife is to be found. The player types "TAKE KNIFE", which is split into X8, "TAKE", and Y8, "KNIFE". "TAKE" is verb number two and "KNIFE" is object number one, found in location five. Following on from the string splitting module (covered in the previous article) the program comes to the module in figure 5. Going through this module, N is given the value one to begin with, so X81 TO 31 is equal to "TAK", and V88, TO 31 is equal to "GO". These two are not equal and so N is increased to 2. V12, TO 31 is equal to "TAKE". As these two are equal the program then reaches "THEN

OIN" which equals minus one, which indicates that the object is being held by the player. The computer then checks if Y81 TO 21, which is "KN", is equal to O1N, TO 21, also "KN", to be sure that it is the same object, as players can obviously carry more than one object. As this comparison is true, the flag, FL, is set to one and O1N is set to the present location number, L. The object will stay at the location where it is dropped, unless moved again by the player. As FL = 1, the message "OK — YOU DROPPED IT" is displayed to the player. The computer then returns to the main "brain" program and continues the game.

Inventory

Another necessary routine dealing with objects is the inventory which prints a list of all the objects carried by the player. Figure eight shows the inventory listing, which begins at line 4000. Once more the flag, FL, is set to zero and the message "YOU ARE CARRYING —" is printed. The following lines print out the full list of the player's objects if the variable O1N has the value minus one and not the value of a location number, then this indicates that the player is carrying object number N. The flag is set to one and O1N8, the object's name is printed on the screen. In this way a list of objects carried by the player at any time is printed on the screen. If O1N is never equal to minus one for all the objects then the player is carrying nothing and the flag stays set at zero. If, after completing the loop, FL is still equal to zero then the message "NOTHING" is printed, indicating exactly what the player is carrying. The computer then returns from the subroutine to the main "brain" program once more.

Figure nine is a diagram showing the structure of the program so far and where the various listings fit in. In the next article in this series I shall deal with specific subroutines needed for this particular example adventure, incorporating techniques you can use in your adventures, and round up any loose ends.

Figure 1: Z801 verb initialising

```

2700 DIM O(15,10)
2720 DIM O15
2724 RPN PUT OBJECTS INTO O8
2738 LET O(1) = "KNIFE"
2739 REM ASSIGN OBJECT LOCATION

```

```

8748 LET O(1)=5
8750 LET O(2)="PISTOL"
8768 LET O(2)=2
8769 REM ..AND SO ON..

```

Figure 2: Spectrum version

```

8203 DATA "Knife",5,"Pistol",2:
REM etc. etc....

```

Figure 3: ZYBI SET UP

```

10 GO TO 8000

```

Figure 3B: Spectrum data module

```

70 RESTORE 8200: FOR I=1 TO 9
10 READ O(I),O(I)
50 NEXT I
60 FOR I=1 TO (number of verbs)
70 READ V(I),V(I)
90 NEXT I

```

Figure 4: Object printing routine

```

270 PRINT
280 PRINT "YOU CAN SEE "
290 LET FL=0
299 REM 9=NO OF OBJECTS
300 FOR N=1 TO 9
310 IF L=O(N) THEN PRINT O(N)
320 IF L=O(N) THEN LET FL=1
330 NEXT N
340 IF FL=0 THEN PRINT "NOTHING USEFUL"

```

Figure 5: Verb routine

```

800 FOR N=1 TO (number of verbs)
810 IF X(1 TO 3)=V(N, TO 3) TH
EN COSUB V(N)
820 NEXT N
830 PRINT "I CANT ":(X)
840 GO TO 100

```

Figure 6: Take routine

```

2000 LET FL=0
2005 REM 7=NO OF OBJECTS
2010 FOR N=1 TO 7
2020 IF L=O(N) AND Y(1 TO 3)=O(
N, TO 3) THEN LET FL=1
2030 IF L=O(N) AND Y(1 TO 3)=O(
N, TO 3) THEN LET O(N)--1
2040 NEXT N
2050 IF FL=0 THEN PRINT "IT IS N

```

```

OT HERE"
2060 IF FL=1 THEN PRINT "OK - IT
IS YOURS"
2070 PAUSE 500
2080 RETURN

```

Figure 7: Drop routine

```

3000 LET FL=0
3010 FOR N=1 TO 7
3015 REM 7=NO OF OBJECTS
3020 IF O(N)--1 AND Y(1 TO 3)=O(
(N, TO 3) THEN LET FL=1
3030 IF O(N)--1 AND Y(1 TO 3)=O(
(N, TO 3) THEN LET O(N)=L
3040 NEXT N
3050 IF FL=0 THEN PRINT "YOU DUN
T HAVE IT"
3060 IF FL=1 THEN PRINT "OK, YOU
DROPPED IT"
3070 PAUSE 500
3080 RETURN

```

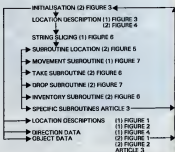
Figure 8: Inventory routine

```

4000 LET FL=0
4010 PRINT "YOU ARE CARRYING:--"
4020 FOR N=1 TO 7
4030 IF O(N)--1 THEN LET FL=1
4040 IF O(N)--1 THEN PRINT O(N)
4050 NEXT N
4060 IF FL=0 THEN PRINT "NOTHING
"
4070 PAUSE 500
4080 RETURN

```

FIGURE NINE : PROGRAM STRUCTURE



Light Screen Designer

Part Six

Toni Baker continues our machine code mega-program

This part of the program concentrates on some of the simpler geometry functions. In particular, I intend to activate four more of the keys. In order of complexity, TRIANGLE (key K), RECTANGLE (key J), PARALLELOGRAM (key U), and CIRCLE CENTRE (key H). In addition I intend to modify the main loop and ESCAPE routine (key SPACE) so that a full return to BASIC is possible in all circumstances and without error.

The MAIN LOOP for this program was first listed in Light Screen Designer Part 3. The addition of new code in part 4 (a copy screen subroutine) meant that the main loop could be improved by allowing part of the code, however the new code was in error and the correction for it appeared in part 5. It stands to reason, therefore, that if I make further alterations in part six then things will get very, very confusing indeed, with the

00000	MAIN_LOOP	01A 0000_000000	Draw all required screens.
00001		01B 0000_000000	Wait for key press.
00002	MAIN_LOOP_1	01C 0000_000000	"Default" line screen.
00003		01D 0000_000000	
00004		01E 0000_000000	
00005		01F 0000_000000	
00006		020 0000_000000	Wait if "arrow down" pressed.
00007		021 0000_000000	
00008		022 0000_000000	Wait if "arrow left" pressed.
00009		023 0000_000000	
00010		024 0000_000000	Wait if "arrow up" pressed.
00011		025 0000_000000	
00012		026 0000_000000	Wait if "arrow right" pressed.
00013	00_0000	027 0000_000000	
00014		028 0000_000000	Is key pressed to exit? Select
00015		029 0000_000000	Wait if so.
00016		02A 0000_000000	
00017		02B 0000_000000	Copy screen if allowed.
00018		02C 0000_000000	
00019	00_0000	02D 0000_000000	Wait keyboard scan.
00020		02E 0000_000000	Store interrupt/scan return address
00021		02F 0000_000000	to be 0000_0000.
00022		030 0000_000000	
00023		031 0000_000000	Key release "ENTER" pressed.
00024		032 0000_000000	Copy MAIN_LOOP address.
00025		033 0000_000000	Prepare to return to BASIC.
00026	00_0000	034 0000_000000	Go key code.
00027		035 0000_000000	
00028		036 0000_000000	
00029		037 0000_000000	
00030		038 0000_000000	
00031		039 0000_000000	
00032		03A 0000_000000	Go pointer to subroutine address.



listing of a single routine spread over four issues. I intend, therefore, to re-list the MAIN-LOOP and ESCAPE routines in full and in one piece in this issue. NOTE THAT BOTH OF THESE ROUTINES HAVE BEEN UPDATED, SO EVEN IF YOU HAVE

THE MAIN LOOP WORKING ALREADY YOU SHOULD REPLACE IT BY THAT GIVEN IN THIS ARTICLE.

The MAIN LOOP has been altered for two reasons: (i) to get rid of the six NOP instructions which are currently stuck in the middle, and (ii) to make room for the new improved ESCAPE routine. The ESCAPE routine has been extended by five bytes of code which guarantees a return to BASIC following all of the procedures. The improvement is, essentially, to ensure that the HL register contains a value of 2758 on return to BASIC. It means that HL now no longer needs to be preserved by individual procedures and

therefore represents a saving of space. (All of the procedures in this article corrupt HL, as I'm sure, will many in the future. Also, it has been pointed out to me that the DRAWLINE routine corrupts HL, which is a bug I had overlooked.)

TRIANGLE



RECTANGLE



PARALLELOGRAM



CIRCLE_CENTRE



```

48 10 0,100          n
49 100 45
46 10 0,100
47 100 90          M= relative address.
48 10 0,100
49 100 100
50 10 0,100
51 100 100
52 10 0,100
53 100 100
54 10 0,100
55 100 100
56 10 0,100
57 100 100
58 10 0,100
59 100 100
60 10 0,100
61 100 100
62 10 0,100
63 100 100
64 10 0,100
65 100 100
66 10 0,100
67 100 100
68 10 0,100
69 100 100
70 10 0,100
71 100 100
72 10 0,100
73 100 100
74 10 0,100
75 100 100
76 10 0,100
77 100 100
78 10 0,100
79 100 100
80 10 0,100
81 100 100
82 10 0,100
83 100 100
84 10 0,100
85 100 100
86 10 0,100
87 100 100
88 10 0,100
89 100 100
90 10 0,100
91 100 100
92 10 0,100
93 100 100
94 10 0,100
95 100 100
96 10 0,100
97 100 100
98 10 0,100
99 100 100
100 10 0,100
    
```

```

10000 100 1000 1000 1000
10001 100 1000 1000 1000
10002 100 1000 1000 1000
10003 100 1000 1000 1000
10004 100 1000 1000 1000
10005 100 1000 1000 1000
10006 100 1000 1000 1000
10007 100 1000 1000 1000
10008 100 1000 1000 1000
10009 100 1000 1000 1000
10010 100 1000 1000 1000
10011 100 1000 1000 1000
10012 100 1000 1000 1000
10013 100 1000 1000 1000
10014 100 1000 1000 1000
10015 100 1000 1000 1000
10016 100 1000 1000 1000
10017 100 1000 1000 1000
10018 100 1000 1000 1000
10019 100 1000 1000 1000
10020 100 1000 1000 1000
10021 100 1000 1000 1000
10022 100 1000 1000 1000
10023 100 1000 1000 1000
10024 100 1000 1000 1000
10025 100 1000 1000 1000
10026 100 1000 1000 1000
10027 100 1000 1000 1000
10028 100 1000 1000 1000
10029 100 1000 1000 1000
10030 100 1000 1000 1000
10031 100 1000 1000 1000
10032 100 1000 1000 1000
10033 100 1000 1000 1000
10034 100 1000 1000 1000
10035 100 1000 1000 1000
10036 100 1000 1000 1000
10037 100 1000 1000 1000
10038 100 1000 1000 1000
10039 100 1000 1000 1000
10040 100 1000 1000 1000
10041 100 1000 1000 1000
10042 100 1000 1000 1000
10043 100 1000 1000 1000
10044 100 1000 1000 1000
10045 100 1000 1000 1000
10046 100 1000 1000 1000
10047 100 1000 1000 1000
10048 100 1000 1000 1000
10049 100 1000 1000 1000
10050 100 1000 1000 1000
    
```

```

10051 100 1000 1000 1000
10052 100 1000 1000 1000
10053 100 1000 1000 1000
10054 100 1000 1000 1000
10055 100 1000 1000 1000
10056 100 1000 1000 1000
10057 100 1000 1000 1000
10058 100 1000 1000 1000
10059 100 1000 1000 1000
10060 100 1000 1000 1000
10061 100 1000 1000 1000
10062 100 1000 1000 1000
10063 100 1000 1000 1000
10064 100 1000 1000 1000
10065 100 1000 1000 1000
10066 100 1000 1000 1000
10067 100 1000 1000 1000
10068 100 1000 1000 1000
10069 100 1000 1000 1000
10070 100 1000 1000 1000
10071 100 1000 1000 1000
10072 100 1000 1000 1000
10073 100 1000 1000 1000
10074 100 1000 1000 1000
10075 100 1000 1000 1000
10076 100 1000 1000 1000
10077 100 1000 1000 1000
10078 100 1000 1000 1000
10079 100 1000 1000 1000
10080 100 1000 1000 1000
10081 100 1000 1000 1000
10082 100 1000 1000 1000
10083 100 1000 1000 1000
10084 100 1000 1000 1000
10085 100 1000 1000 1000
10086 100 1000 1000 1000
10087 100 1000 1000 1000
10088 100 1000 1000 1000
10089 100 1000 1000 1000
10090 100 1000 1000 1000
10091 100 1000 1000 1000
10092 100 1000 1000 1000
10093 100 1000 1000 1000
10094 100 1000 1000 1000
10095 100 1000 1000 1000
10096 100 1000 1000 1000
10097 100 1000 1000 1000
10098 100 1000 1000 1000
10099 100 1000 1000 1000
10100 100 1000 1000 1000
    
```


First steps in Machine Code

Part 3. Bits and Stacks

An introduction to Z80 Machine Code by David Nowotnik



Ever wondered how a computer remembers when to turn to after completing a subroutine? All will be revealed in this, the fourth part of my machine code series. And, we will see lots of ways in which the smallest unit of memory, the bit, can be utilised to produce interesting machine code routines. But first, the stack!

The stack

So far, we've dealt with many instructions to transfer bytes from one place to another — mainly from one register to another, and between memory and the registers. There is a special store of bytes of information in RAM called "the stack" which has its own set of machine code instructions. The curious thing about the stack is that you usually don't have to worry about where in RAM it is stored; the processor does this for you automatically. You can change the position of the stack. If you want to (with special machine code instructions), but it is usual to leave it where the processor puts it after power-up, which is just below RAMTOP.

What is "the stack"? It's a "pile" of bytes starting, as I said, just below RAMTOP, and building in a downward direction in RAM. The purpose of the stack is to have a temporary store of information (bytes) which you can dump there with a simple one byte instruction, then remove just as simply. It works something like this:

There is a special two byte register in the Z80 called SP, the stack pointer, which contains the first vacant address in the stack. If you want to store some information temporarily then you use the instruction PUSH to place that information (bytes) onto the stack. You can only PUSH onto the stack the value in a pair of registers; for example, PUSH HL, PUSH DE, PUSH BC,

and PUSH AF (the "A" register and the flag register combined) are the only PUSH instructions permitted. When you PUSH values onto the stack, the SP register is decremented by two, so that it contains the new address of the next free position in the stack. The stack is built up by moving DOWN in memory

machine code routine in the demonstration of flags program (Fig.1 in part 3) had as consecutive instructions PUSH AF, POP DE. This placed the values A and F onto the stack, then placed them in D and E, respectively. This enabled the F register to be copied into the E register, from where it can be

and causing yourself some real headaches.

Working with Bits

There are far more machine code instructions that deal with bits than there are ones which manipulate bytes. So, it won't be of surprise to you that I won't be covering all of them this time, and I'll be saving some for the next part of this series. However, having said that, there is a very large number of instructions which can all be grouped into a relatively small number of categories. But before we start to examine some of these, it might be useful to re-examine what a bit just happens to be.

Every byte of memory or register in the Z80 processor is made up of 8 bits. Each bit is, effectively, an electrical switch; it has two states, on or off, which can be represented by the values 1 or 0. There are 256 possible combinations of ones and zeros in the eight bits that make up a byte, hence the value range that a byte can hold is 0 to 255. In fig.1 there is a BASIC program for both ZX81 and Spectrum which demonstrates how the values of bits are combined to make up the value of a byte. When you RUN the program, the first thing you have to do is enter a decimal value. The binary representation of that value is the way it is held as ones and zeros in a byte! It shows on the screen. These bits are numbered 0 to 7 from right to left. Then watch the screen when you get a display of how to calculate the decimal value of a byte. Every time there is a "1" in a bit, then the value of that bit is added to the total. See if you can work out the relationship between a bit value and its number 0 to 7, if you want to slow down the display, then increase the size of the loop in line 1000.

With the knowledge that each bit has the effective value



To remove a value from the stack, the instruction POP is used, and the value "POPed" from the stack can be placed in one of the register pairs. As part of the POP instruction, the SP register is twice incremented, to show once more the address of the next free piece on the stack. All the opcodes for the PUSH and POP instructions are shown in table 1. All are one byte instructions.

The stack is designed to make life easier for programmers. For example, if you want to preserve the value in one of the registers while you use it for something else, simply PUSH the value onto the stack, then POP it off when you need it. There will be examples of this later on. To transfer the values from one register pair to another all you have to do is to PUSH one register pair value into the stack, then POP it into the other register pair. I demonstrated this in the last issue, although I didn't explain how it worked. The

more closely examined.

You have to be quite careful how you use the stack. It operates by a last-in, first-out principle, so you must get the order on and off just right. The stack is also used by the Z80 processor outside of your control. Here's the answer to the subroutine question!

When you call a subroutine, either in BASIC, or a machine code subroutine, the return address is dumped onto the stack. If you call several subroutines, the return addresses are placed onto the stack in the correct order, and you'll always return to the right place in the program after each RETURN instruction because of the last-in, first-out principle of the stack. It is important therefore, to make sure that the number of POP instructions within a subroutine balances the number of PUSH instructions (and not to POP a value off the stack before one is PUSHed there), otherwise you could end up removing a return address,

Table 1. Opcodes for PUSH and POP instructions

Registers:	NL	DE	BC	AF
PUSH	E5	D5	C5	F5
POP	E1	D1	C1	F1

Table 2. Opcodes for the SET/RESET/BIT instructions

SET		Bit:	0	1	2	3	4	5	6	7
Register:	A	C7	CF	D7	DF	E7	EF	F7	FF	
	B	C0	C8	D0	D8	E0	E8	F0	FF	
	C	C1	C9	D1	D9	E1	E9	F1	F9	
	D	C2	CA	D2	DA	E2	EA	F2	FA	
	E	C3	CB	D3	DB	E3	EB	F3	FB	
	H	C4	CC	D4	DC	E4	EC	F4	FC	
	L	C5	CD	D5	DD	E5	ED	F5	FD	
(HL)	C6	CE	D6	DE	E6	EE	FE	F6	FE	
RESET		Bit:	0	1	2	3	4	5	6	7
Register:	A	B7	BF	97	9F	A7	AF	B7	BF	
	B	B0	B8	90	98	A0	A8	B0	B8	
	C	B1	B9	91	99	A1	A9	B1	B9	
	D	B2	BA	92	9A	A2	AA	B2	BA	
	E	B3	BB	93	9B	A3	AB	B3	BB	
	H	B4	BC	94	9C	A4	AC	B4	BC	
	L	B5	BD	95	9D	A5	AD	B5	BD	
(HL)	B6	BE	96	9E	A6	AE	BE	B6	BE	
BIT		Bit:	0	1	2	3	4	5	6	7
Register:	A	47	4F	57	5F	67	6F	77	7F	
	B	40	48	50	58	60	68	70	78	
	C	41	49	51	59	61	69	71	79	
	D	42	4A	52	5A	62	6A	72	7A	
	E	43	4B	53	5B	63	6B	73	7B	
	H	44	4C	54	5C	64	6C	74	7C	
	L	45	4D	55	5D	65	6D	75	7D	
(HL)	46	4E	56	5E	66	6E	76	7E		

NOTE: All BIT/SET/RESET opcodes are preceded by CB

Table 3. AND/OR/XOR Opcodes

Register/byte:	A	B	C	D	E	H	L	(HL)	n*
AND:	A7	A0	A1	A2	A3	A4	A5	A6	E6
OR:	B7	B0	B1	B2	B3	B4	B5	B6	F6
XOR:	AF	AB	A9	AA	AB	AC	AD	AE	EE

* - n refers to an operand appearing immediately after the opcode for AND, OR, or XOR in the machine code routine.

of one or zero, it may not come as a surprise to learn that the simplest of machine code bit operations involves setting the value of a specified bit to 1, or 0, or testing whether a bit's value is either 1 or 0. You can SET (bit = 1) or RESET (bit = 0) values, or test them with the BIT instruction, for any bit in the main registers, A, B, C, D, E, H, L, or a bit in a byte of memory addressed by HL. If you work out all the combinations, then there are 64 SET instructions, 64 for RESET, and 64 for BIT. All are shown in Table 2. The SET, RESET and BIT instructions are all two bytes long, and all have as the first byte of the instruction, the hex value CB.

All the assembly language instructions for BIT, SET, and RESET require two arguments to complete the instruction, the first is the identifying number of the bit (0 to 7), and the second is the register, or byte (with (HL)) identifier. For example, SET 5,E places the value 1 in bit 5 of the E register, and RESET 1,L places the value 0 in bit 1 of the L register.

The BIT instruction tests the value of the specified bit, and places the result in the zero flag. If the bit value is 1, then 1 is placed in the Z flag. The Z flag can then be tested, as described in the last issue. For example, BIT 3,(HL) tests the value of bit 3 in a byte of memory identified by the value in HL.

Another group of machine code instructions which work on bits have the opcodes AND, OR, and XOR. The first two will be familiar to BASIC programmers: the machine code and BASIC instructions of AND and OR are related, although that may be difficult to understand while I explain how they work!

AND, OR, and XOR carry out bit-by-bit comparisons of two bytes. One byte must be in the 'A' register, the other byte must exist in any register (including 'A'), or a byte of memory addressed by HL, or a byte of data stored immediately after the operand in the machine code routine. The result of this comparison is stored in the 'A' register, replacing the previous value there. The result will affect the values of the sign, zero, and parity flags. Therefore, AND, OR and XOR are very similar to arithmetic machine code operations, except that their function is described as 'logic' rather than arithmetic.

Fig 2 shows a number of what are called 'truth' tables. These show the result of comparing two bits by one of the

'logic' operations, AND, OR, or XOR. For example, if you AND a bit value 1 with a bit of value 0, then the result is 0. OR the same two values, and the result will be 1; XORing 1 and 0 also gives you 1. In fact, OR and XOR are very similar, except that 1 OR 1 = 1, whereas 1 XOR 1 = 0.

How these 'truth' tables work in practice is also shown in Fig. 2. Work your way through the three logic 'sums' comparing each pair of bits with the corresponding truth table. Then try the three 'sums' which do not have an answer. The answer does appear at the end of this article, together with the decimal equivalent of the binary answer. You should be able to work out for yourself the decimal value — if you've practised using the program in Fig. 1. You may well be asking by now "what is the use of these 'logical operators'?" There will be some examples of them later on, but, in summary,

AND is used mainly for masking 'bits' within a byte. Say you wanted to reset bits 0 to 3 (i.e. make them all 0). You could use the RESET command four times, but it is far easier to use the machine code command AND 11110000. As bits 0 to 3 in the operand are all zero, then (from the truth tables) the bits 0 to 3 in the result must also be zero.

OR — in a similar manner to AND, the instruction OR will set a block of bits so that they all have the value '1'. For example, OR 00001111 ensures that bits 0 to 3 will all be 1 in the result.

XOR allows comparisons of bits such that, if they are the same, then the result is 0, and if they are different, the resultant bit value is 1. When you PRINT OVER 1 on the Spectrum, you are, in fact, using the XOR instruction. Think of a pixel in the INK colour as '1' and a pixel in the PAPER colour as '0' (which they are), and try a few PRINT OVER 1s to see the effect. AND, OR, and XOR opcodes appear in table 3.

In the style of previous parts of the series, we'll now move onto some machine specific examples: ZX81 first, followed by examples for the Spectrum. You should see several of the items of theory covered in this, and previous parts, hopefully helping you to clarify the theory. The ZX81 examples contain more on PUSH and POP, whereas the ones for the Spectrum have more on the logical operators, so it's advised that you read through both sets of examples.

Fig. 1. Binary Demonstration Program

```

10 REM BINARY DEMONSTRATION
20 REM BY DAVID HOWTHIK
30 REM MARCH, 1985
40 REM
100 CLS
110 PRINT AT 21,0;"ENTER A VALUE (0-255) "
120 INPUT A
130 IF A<0 OR A>255 THEN GOTO 120
140 LET B=INT A
150 LET B$=""
160 LET Z=A
170 IF Z=0 THEN GOTO 250
180 LET X=Z/2
190 IF X=INT X THEN LET B$="0"+B$
200 IF X<>INT X THEN LET B$="1"+B$
210 LET Z=INT X
220 GOTO 170
250 PRINT AT 4,2;"NUMBER=" ;A
260 LET B$="00000000"+B$
270 LET L=LEN B$
280 LET B$=B$(L-7 TO )
300 PRINT AT 8,2;"BINARY=" ;B$
400 PRINT AT 21,0;"NOW CONVERT BINARY TO DECIMAL"
410 LET S=0
420 PRINT AT 20,12;"TOTAL=" ;S
500 FOR I=0 TO 7
520 GOSUB 1000
530 PRINT AT 7,17-[];"V "
540 PRINT AT 10,2;"BIT VALUE = ";2^I
550 GOSUB 1000
560 LET T=VAL B$(B-I)*2^I
570 PRINT AT 12,5;B$(B-I) " X ";2^I;" = "T
580 LET S=S+T
590 GOSUB 1000
600 PRINT AT 12,2B;S
610 GOSUB 1000
620 NEXT I
630 PRINT AT 21,0;" PRESS ANY KEY TO CONTINUE "
640 IF INKEY$="" THEN GOTO 640
650 RUN
700 REM
1000 FOR J=1 TO 200
1010 NEXT J
1020 RETURN

```

Fig. 2. Truth Tables, and examples of AND, OR, and XOR

a) Truth Tables

AND Truth Tables:

	Bit 1s	0	1	1	
Bit 2s	0	1	0	1	0 AND 0 = 0
	1	0	1	0	0 AND 1 = 0
	1	1	0	1	1 AND 1 = 1

OR Truth Table

	Bit 1s	0	1	1	
Bit 2s	0	1	0	1	0 OR 0 = 0
	1	0	1	1	0 OR 1 = 1
	1	1	1	1	1 OR 1 = 1

XOR Truth Table

	Bit 1s	0	1	1	
Bit 2s	0	1	0	1	0 XOR 0 = 0
	1	0	1	1	0 XOR 1 = 1
	1	1	1	0	1 XOR 1 = 0

b) Example Logical Operations

	AND	OR	XOR
.	00110101 = 43	01001000 = 72	11100000 = 224
.	10100100 = 174	00101001 = 41	01010001 = 81
.	00100100 = 36	01101001 = 105	10110001 = 177

c) Examples to try for yourself

	AND	OR	XOR
.	01010101	10100110	11001010
.	00110011	11001100	01101100

Answers at the end of this article

Fig.3. ZX81 Machine code examples

```

10 REM .....
20 LET X=16514
40 FOR I=1 TO LEN A$/2
50 LET J=16*(CODE A$(2B)+CODE A$(2)-29
60 IF PEEK X=27 THEN POKE X,J
70 LET X=X+1
90 LET A$=A$(3 TO 4)
90 NEXT I
100 CLS
110 FOR I=1 TO 10
120 PRINT "1234567890ABCDEFGHI"
130 PRINT "ABCDEFGHIJKLMNQRST"
140 NEXT I
150 IF INKEY#="" THEN GOTO 150
160 RAND USR 16514
170 GOTO 150

```

First machine code routine:

```

30 LET A$="13C4029C40012100C809C8E5EDB0E154
50C10901F702E080E1C1E2B0C9"

```

Assembly language listing

LD DE,16444	11C40	DE=printer buffer address
LD HL,(16396)	29C40	HL=display file start
LD BC,33	012100	Length of character row
PUSH BC	C5	Store for future use
PUSH DE	05	
PUSH BC	C5	
PUSH HL	E5	
LDIR	E0B0	Store row in printer
POP HL	E1	buffer
LD D,H	54	DE has first screen
LD E,L	50	address
POP BC	C1	Put 33 back into BC
ADD HL,BC	09	HL=HL+BC
LD BC,789	01F702	Chars. for block move.
LDIR	60B0	Block move for SCROLL
POP HL	E1	Printer buffer address
POP BC	C1	BC=33
LDIR	E0B0	Replace bottom line
RET	C9	Return to BASIC

b) Second Machine code routine

```

30 LET A$="29C400618C50620237EF6807710
F923C110F209

```

Assembly Language Listing

LD HL,(16396)	29C40	Load HL with 0-File
LD B,24	0618	B= number of rows
LOOP1	PUSH BC	Save row counter
	LD BC,32	Number of characters/row
LOOP2	INC HL	Get next character
	LD A,(HL)	Load with screen character
***	OR 120	F&B0 Convert to white on black

ZX81 Examples

Before we begin with the ZX81 examples; a word of warning about the stack on the '81. As I mentioned earlier, the stack appears just below RAMTOP, i.e. RAMTOP as set up by the computer on power-up. If you lower RAMTOP, for example, to make space for a machine code routine, then you could be encroaching into the stack area. POKing anything into the stack area by mistake is a certain recipe for disaster. The safest way to create space for machine code at the top of RAM is to use NEW after lowering RAMTOP. This will relocate the stack below the new RAMTOP, but, of course, wipe out any BASIC program, such as a machine code loader.

To avoid any danger of corrupting the stack, the examples in this issue use another method of saving machine code on the ZX81; in a REM line. The method was introduced in the last part, but wasn't fully explained at that time. The position of a BASIC program is fixed in the ZX81's memory, starting at address 16509. If the first line is a REM statement, then it will like all other REM lines) is ignored by the BASIC interpreter, so you can put anything you like into it, including machine code bytes. And that is what the hex loader in fig.3 does out. The first byte after the REM token in line 10 will always be address 16514 (as long as no other line precedes 10), so you can replace the 'dummy' full stop in the REM line by machine code bytes. Line 80 checks that you are overwriting a full stop, and not another character, then the machine code byte is POKed in. Once in the REM line the machine code can be stored with the rest of the BASIC program. But beware, if you LIST the program, then you might corrupt the display file with 'unprintable' machine code values. Better to LIST 20, so that line 10 does not appear on the screen. First of all, enter the main listing in Fig.3, then add whichever line 30 is appropriate for the routine you want to try.

The two machine code examples in Fig.3 produce effects on the display file, so you'll see straight away if they are working correctly. The first causes the screen to 'rotate'; i.e. it is like a normal SCROLL, except that the line which disappears off the edge of the screen reappears on the other side. The rotate routine works on all 24 ▶

rows of the screen, express any key a few times to appreciate the effect. The second routine converts the entire screen to a white on black display - instantly!

As before, use a 16K (or larger) RAM pack with these examples, otherwise they may not work.

Spectrum Examples

The two Spectrum examples use the same decimal loader as used in Part 3. The CLEAR instruction lowers RAMTOP and moves the stack to below the new RAMTOP, so giving you an area of RAM which is quite safe to use. Type out the loader, then add the DATA lines appropriate to the routine you want to try.

The first routine scans the display file, and inverts every bit (i.e. changes 1 to 0, and 0 to 1), so reversing INK and PAPER. The important instruction for this is XOR ZSS. The second routine scans the attribute file and 'toggles' the flash bit (that is, turns FLASH on if it finds the bit off, and vice versa). So, from a non-flashing screen, you should get the entire screen flashing. Try it!

Both Spectrum examples display one way of overcoming a major error in the Z80. Surprisingly, when using DEC on a two byte register, it doesn't test the zero flag when the double register holds a value of zero. So, when using, say, BC as a counter, JRNZ after DEC BC will not work when BC becomes zero. It's a common mistake amongst beginners to machine code to assume (inevitably) that it does. The way to overcome this is shown in the examples. Having cleared out the DEC BC, the values in B and C are effectively ORed (after the value in B is transferred to the A register). Only when both B and C contain zero will the result of the OR operation be zero. The zero flag is reset when the result of a logical operation is zero, so the flag can be tested after the OR operation.

The final items for this part are the results of the tests. These are as follows: AND; 00010001 (17); OR; 11101110 (238); XOR; 10100110 (186). If you don't agree with these results, then try again, working through the program in Fig 1 and the examples in Fig 2.

LD (HL),A	77	Place in display file
CJNZ, LOOP2	10F9	Repeat to row end
INC HL	23	Jump over NEWLINE
POP BC	C1	Recover the row counter
DJNZ, LOOP1	10F2	Do again, until all done.
RET	C9	Return to BASIC

*** This routine will always give you a white on black display. You can change it quite simply to interconvert black on white and white on black by changing the line marked with three asterisks to:

```
ADD 120      C680
```

Fig.4. Spectrum Machine Code Examples

```
10 CLEAR 24999
20 LET I=25000
30 READ H: IF H=-1 THEN GO TO 200
40 POKE I,H: LET I=I+1
50 GO TO 30
190 DATA -1
200 CLS
210 FOR I=1 TO 10
220 PRINT "abcde fghi jklmnopqrstuvwxyz"
230 PRINT "ABCDEFGHIJKLMN O PQRSTU VWXYZ"
240 NEXT I
250 RANDOMIZE USR 25000
260 IF INKEY$="" GOTO 260
270 GOT TO 250
```

First Machine Code Example

```
100 DATA 33,0,64,1,0,24,126
110 DATA 238,255,119,35,11,120
120 DATA 177,32,246,201
```

Assembly Language Listing

	LD HL,16384	210040	HL=Display File start
	LD BC,6144	01001B	Bytes in display file/x
LOOP	LD A,(HL)	7E	Transfer bytes to A
	XOR ZSS	EEFF	Invert bits
	LD (HL),A	77	Put byte back
	INC HL	23	Next byte
	DEC BC	08	Decrement counter
	LD A,B	78	Test if 0
	OR C	B1	
	JR NZ, LOOP	20F6	If not, repeat
	RET	C9	Else return to BASIC

Second Machine Code Example

```
100 DATA 33,0,88,1,0,3,126,198,128
110 DATA 119,35,11,120,177,32,246,201
```

Assembly Language Listing

	LD HL,22528	21005B	Start of Attributes
	LD SC,768	010003	Number of attribute bytes
LOOP	LD A,(HL)	7E	Load A with attribute
	ADD 120	C680	Toggle on/off FLASH
	LD (HL),A	77	Return the byte
	INC HL	23	Next byte
	DEC BC	08	Decrement counter
	LD A,B	78	Test if 0
	OR C	B1	
	JRNZ, LOOP	20F6	If not, repeat
	RET	C9	else return to BASIC

Across The Pond

Mark Fendrick looks at the U.S. market place

It is interesting to note how the North American Sinclair (Times) market has developed along entirely different lines from that of counterparts in the rest of the world. Today, in England, you can walk into practically any shop that handles computers and find Sinclair computers, software and peripherals. Chain operations such as John Mannes, and W. H. Smith carry a vast assortment of goodies to interest the Sinclair computerist. No ZX owner ever has to explain his pride in his micro.

In North America, however, the Sinclair community has developed into somewhat of an underground society. Walk into any computer establishment and announce that you are looking for Times/Sinclair computers, and you are either laughed at, or find yourself trying to explain how powerful these little micros are. For a while, while Times was in the business of selling Sinclair computers, a few select stores did have an over the counter trade in T/S 1000's of a few software titles, if never spotted a store which stocked the software that Times licensed from me, for example, and possibly a T/S 2040 printer (now available as the Alpacorn 321) but more likely than not, the line was more of an afterthought than an actively displayed product.

When Times stopped producing computers, and got out of the business, even this half-hearted effort at marketing stopped cold! The T/S 1000's which were left were selling for as little as \$29.00! Software could be had for as little as three or four dollars in some discount stores. Soon, you could not find any Times/Sinclair related product in any store. Many people were already writing the Times/Sinclair obituary. The Sinclair dedicated publications folded, and the general computer magazines were no longer interested in reporting on our computers. In fact, only one national publication is sold on the newsstands which carries a Times/Sinclair Survival Column.

No hope then for our Times/Sinclair owners? Quite the contrary, things have been developed faster than before

Times pulled the plug. Although many of the third party suppliers were initially uncertain of the future, it soon became obvious that the new Times/Sinclair computers (T/S 1500 and T/S 2040) would be in demand until such time as new owners would want to use their micros to the fullest. A few tentative attempts from the people who were supporting the Times/Sinclair line for the previous two years proved successful, and things were underway.



New Products

Two products developed for Times were ready for the market, and were soon released by third parties, the modern, to be produced by Anchor Automation for Times, was released by Anchor after licensing both telecommunication software packages from Micro-Systems. The other package which Times commissioned Micro-Systems to produce was a word processing program which would take advantage of many of the T/S 2040's advanced features (such as 64 column display, and print to a full size printer. The result was MSCRIPT, a program comparable to any available for the TRS-80 or IBM PC. (MSCRIPT has become my wordprocessor.) Without Times, though, there was no distributor - that is until Twenty-first Century Electronics 18813 Park Street, Guttenburg, NJ 07033; (201) 869-2310 licensed it for distribution.

Soon it was business as usual for most of the Times/Sinclair developers and suppliers. But unlike in the rest of the world, the products did not find their way into the stores, and reverted to an almost solitary

mail order culture. Even in the few shops where there is an over the counter Times/Sinclair business, it represents a small part of the business which relies on mail order business.

One such company, whose business is Sinclair computers, is Zebra Systems, Inc., 178-06 Jamaica Avenue, Woodhull, NY 11421; (718) 296-2385, and they are still very actively developing and producing additions for our micro. Their most recent development is a graphics interface which permits the use of a Koala Digitizing tablet. This combination allows you to "draw" on the tablet with the enclosed stylus, and see the picture appear on the screen.

The package comes with the graphics interface, which attaches to the rear expansion bus of the T/S 2040 and has a through connector which permits additional peripherals to be added, the Koala Pad, stylus, Zpaint software, and an instruction booklet. The Koala pad is connected directly to the interface (there are two sockets, presumably for future developments), you LOAD the software, and you are ready to go.

You have two development screens on which to work, one active and one inactive, and may switch back and forth between them at will along the bottom of the screen is your control menu, from which you can set various parameters for use in creating your graphics. By moving the cursor to a spot on the menu, and pressing the command button on the pad, you may select the colour of the screen border, paper and ink. To draw, you place the stylus on the pad, press the draw button and draw on the tablet. As you draw, the tablet translates the pressure into a digital signal which the computer can understand and transfer to the display file. You may draw in one of two modes; either a thin stroke (pen) or wide stroke (brush). The width is selected from the command menu. If you make a mistake, or want to change some part of your graphic just change the DRAW toggle to BRASE, and instead of piecing something on

the screen, you will erase anything in the path of the cursor as you move it across the screen.

There are other choices available to you as you proceed along the command menu. If you want to draw perfectly straight lines, proceed to the VERTICAL/HORIZONTAL toggle, and select either direction. (Normal drawing is in the VSH mode.) In either VERTICAL or HORIZONTAL mode, only movement in the desired direction will be recognized. Any motion in the other plane will be ignored. If you want to create a straight line between any two points, go to the LINE selection and press the command button. Then by moving the cursor to each of the desired end points, the computer will supply the line on the screen. Want to draw a circle but freehand circles never look right? The CIRCLE option allows you to define the position of the centre of the circle, and the location of the circumference, and the circle is drawn automatically. You also have the ability to insert text into your graph from the keyboard.

The final option allows you to type in other commands which include switching the active and inactive screens, SAVING the current active screen, LOADING a screen to the active file, or COPYING to your T/S 2040 (or Alpacorn 321) printer. (Note: the original ZX printer, only a few of which found their way to the U.S., does not work on the T/S 2040.) Also from here you can clear the screen to start creating a new graphic.

Finally, as promised, I have been seeking out sources of software for the American T/S owner. Now the SPECTRUM EMULATORS, ROMSWITCHES, and SPECTRUM ROMS are readily available and popular in the U.S., mail order houses in the U.K. can supply a variety of titles. A very reliable company is SOFTWARE SUPERMARKET (BT Howard's Lane, London SW15 5NJ, England) They promise, and deliver, a very fast turn around time, and I have always received my order from them in less than ten days after I mailed my order to them. (Always use airmail when sending trans-atlantic mail, otherwise you will find it takes over a month to arrive - one way!) They accept VISA and MASTERCARD which makes the exchange of currency extremely easy.

Keep those cards and letters coming and I will see you right here next time.

Warts and all (or a novice's guide to machine code)

E Hutchinson is a brave man, here he reveals his darkest secrets from the depths of Inverness...

Scroll left

Whilst working on a project I had need of a Scroll Left routine and the following is an account of how it was developed, including all the mistakes I am a novice at the game, being self-taught, and I found that, in the main, books gave me techniques and end results, but with little indication of how they were developed. So, here now is my novice's guide to Machine Code, Warts and all!

First, I found the display file where the picture is stored. Address 18396 contains the bottom half of the address, and address 18397 the top half (see ch.27 of ZX81 manual, for details of the system variables). So...

PRINT PEEK 18396 + 256 *
PEEK 18397

Table 1	
Op Code 42	LD HL, NN N 12 * 1 + N 04 * 256
Start	
Op Code 35	INC HL
Op Code 35	INC HL
Op Code 125	LD A, (HL)
Op Code 43	DEC HL
Op Code 119	LD (HL), A

and... Bingo! The display starts here at 18509. Try it...

Now to put something into it, take the code for the letter A (which is 38) and Poke it into 18509. POKE 18509,38. And there we are, the system crashes. Why?

It turns out that the Display File Address is the last one before the display and NOT the first one on the screen. This is the Display File Address + 1. So,

POKE (18509 + 1),38.

An A appears at the top left hand corner. To save writing we'll call this position X. So,

X = (PEEK 18398 + 256 *
PEEK 18397) + 1

This is the first column on the top line. There are 32 columns, so the last column is X + 31, and

Loads the L Register with Contents of Location = 18396

And then loads the H Register with the contents of Location 18397. This is the start of the D File, and contains 118. The first displayed Character is at location (HL) + 1.

Therefore Increase HL by 1. HL now contains the Address of the first Displayed Character. We do not want this one... so

Again. Now we have the Address of the 2nd Character in the top line.

Put the Code for the Character into the Accumulator. Then go back to the Address of First Character. Put 2nd Character into 1st Address. Jump back to start.

the next Address is at the end of the line which contains a New Line Chr. Code 118. The next Address is the first column on the second line, so it looks like this:

Address	Contents
18509	118 New Line
18510 + 31	Chr. Code 1st Column Top Line Column 0 = 32 Characters
18541	Chr. Code Last column Top Line Column 31
18542	118 New line
18543	Chr. Code 1st Column 2nd Line

And so on (refer to Sinclair Manual Page 123)

In order to Scroll Left we have to take the Code in Address X + 1 and move it back to Address X, then move on, take X + 2 and move it to X + 1 and so on. There are several ways to do this. For instance, line by line, all have, or column by column un-

take a while, so we do exactly the same thing using Machine Code instead. I used the HL Register, B Register and Accumulator. And the sequence went like this.

The Registers in the Z80 M.P.U. are empty temporary storage locations. I've used them as pigeon holes holding an 8 Bit Binary Number (see Table 1).

This would, unfortunately, keep Scrolling the first line until the end of line marker 118 at Address No 1 + 32 was overwritten and the system would crash. So, we keep this routine, but insert some means of checking when we have reached the line end.

Now, we can do this by putting the Newline Code into the Accumulator and comparing the contents of the Accumulator with the contents of the Address held in HL. The number we want to compare is 118, but unfortunately if we enter this into our REM where we are saving

this Routine, the computer will think this is the end of the line, and do all sorts of funny things. Therefore, we put in 119 and DEC, or subtract 1. Now, we also want someone to keep count of how many lines we have done and when we get to 22 to return to the Basic Program. So, table 2 looks like this:

Table 2		
Op Code 42	LD HL, 12, 84	Lower Value
	N 12	Higher Value
Op Code 8	Nh 84	Load B with
	LD B, N	This number
	N 22	This is how many lines we have to do
Op Code 35	INC HL	
Op Code 35	INC HL	
Op Code 62	LD A, N	Load Accumulator with
	N 119	This number
Op Code 81	DEC A	Subtract 1 = 118
Op Code 190	CP (HL)	Compare with the number at Address (HL)

ing another Loop. In Basic we could do this by PEEKing into each Address in turn, checking to see if it is the end of a line, checking if we have done every line and then POKE it into the previous address. This would

Now, if these numbers are the same, in this case, 118, then the Z flag is set. In other words, the answer is 0. I found this rather confusing at first, because if the answer is 0 the Z flag is set to "1", but in fact the

flag is asking 'Is the answer zero?', and the flag then indicates 'YES' flag set or 'NO' flag reset. Rather a case of yes we have no bananas!

If a match is found then we are at the end of the line, so we do not overwrite the end marker. Instead, we subtract 1 from our number of lines.

DEC B

And jump back to INC HL twice. We can do this in several ways. We can find the Address of the first INC HL and just use JP N1 N1, where the Address is $(N1 * 256) + (N1 * 1)$. The trouble with this is that if you move the routine to a different part of the memory it all has to be re-calculated.

However, we have a lovely instruction just made to order. It is called DJNZ e, which means Decrement B and if the result is not zero then jump backwards or forwards a number of addresses, indicated by 'e'. If e is greater than 130 then we jump backwards (256-e) places. If e is less than 130 then we jump forward e places (I suppose that if e = 130 we jump up and down on the spot, though I haven't tried it). For reasons I don't yet understand you have to subtract 2 from e before you use it. If a match is not found then we carry on (Table 3).

This means jump forwards or backwards, but without any

conditions attached. In our case, jump back to the start. Now there is only one other thing. If B is zero after we Decrement it, then the job is done and we want to return to the Basic Program. All we have to do then is, after comparing A and (HL), if a match is found we DEC B, and if B does not equal 0,

jump to start. If B is zero, we return to the Basic Program. So, now our Program looks like this (Table 4).

Now, before we develop it further, by this one, I found it fascinating. Use the Leader Program to enter the into a REM statement, then fill the screen with Characters using:

```
10 FOR N=0 TO 255
20 PRINT CHR#N:
30 NEXT N
```

Then start the SCROLL with:

```
40 RAND USR 16614
```

Put in a timing loop:

```
50 FOR N=1 TO 20
60 NEXT N
70 GOTO 40
```

This moves everything to the left except the last column which it repeats all the way across the screen.

For my purposes I needed to blank out the last Column so that I could print or plot other things in it, and then move them across the screen. To print a blank the Code C has to be put in. When (HL) contents are 11B we are past the last Column. So, now our program looks like this (Table 5).

Note that we have changed the DJNZ,e to jump to the blanking routine before going to start.

Machine code loader

```
1 REM
AAAAAAAAAAAAAAAAAAAA
AAAAAAAAAAAAAAAAAAAA (about
30 or so)
10 FOR N = 16514 to 16544
20 INPUT A
30 PRINT N,A
40 POKE N,A
50 NEXT N
```

Table 4

Relative Address	Op Code	Op-erend	Assem. Lang.	Comment
1	42	end	LD HL, N1 N1	
2	12	N1	N1	Low Value Byte
3	64	Nh	Nh	High Value Byte
4	6	LD B, N	LD B, N	Load B with
5	22	N	N	the number
6 Start	35	INC HL	INC HL	jumps to here if B ≠ 0
7	35	INC HL	INC HL	
8	82	LD A, N	LD A, N	Load A with
9	119	N	N	the number
10	61	DEC A	DEC A	Subtract 1
11	190	CP (HL)	CP (HL)	Compare with Number
12	32	JNZ, e	JNZ, e	at Address (HL)
13	3			If they are not the
14	16	DJNZ, e	DJNZ, e	same jump forward 5
15	246	(e-2)	(e-2)	places otherwise
16	201	RET	RET	Subtract 1 from B
17	126	LD A, (HL)	LD A, (HL)	and if B=0 jump to
18	43	DEC HL	DEC HL	start otherwise
19	119	LD (HL), A	LD (HL), A	return to Basic Program
20	24	JR, e	JR, e	Jumps to here if (HL)
21	240	(e-2)	(e-2)	is ≠ 11B
				Jumps back to start.

Table 3

Op Code	126	LD A (HL)	Take the number out of Address (HL)
Op Code	43	DEC HL	Find the previous Address
Op Code	119	LD (HL), A	That is, one place to the left
Op Code	24	JR e	And put the number into it
			Then go back to the start and start again

Table 5

Op Code	Operend	Assem. Lang.	Comment
43		DEC HL	This is the last Column
54		LD (HL), N	Put into the last Column
	0	N	Code for a blank
35		INC HL	Put HL back to its end of
			line value
24	JR, e		Jump back to
	233	(e-2)	the start again



Table 6
Relative
Address

Relative Address	Cp Code	Op-erand	Asm. Lang. LD HL, NN	Comment				
1 start	42			Address of the start of the D. File	18	43	DEC HL	
2	12	N1			19	119	LD (HL),A	Replace it one step back
3	84	NH			20	24	JR,e	
4	6	LD B,N			21	240	(e-Z)	Jump to loop 1
5	22	N		Number of lines to be Scrolled	22	43	DEC HL	Jump to here if (HL) = 118
6 Loop 1	35	INC HL		Address of 1st Character	23	54	LD (HL),N	
7	35	INC HL		Address of 2nd Character	24	0	N	Blank the last Column
8	62	LD A,N		Character	25	35	INC HL	Sets HL to the end of Line Address
9	119	N		118 into the Accumulator	26	24	JR,e	
10	61	DEC A		118 in the Accumulator	27	234	(e-Z)	Jump to loop 1
11	190	CP (HL)		Compare with Contents of HL Address and if they do not match jump 3 + 2 places.				
12	32	JR NZ,e		if they do, Dec B and, if the Result is not 0, jump 6 + 2 places.				
13	3	(e-Z)						
14	16	DJNZ,e						
15	6	(e-Z)						
16	201	RET		if it is 0 return to Basic				
17 Move Chr.	126	LD A,(HL)		Take Character from (HL)				

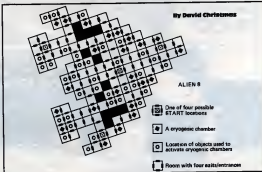
When you have entered all the Machine Code just enter STOP (shifted A) and NEWLINE. You will have a few 'A's left over, but they don't matter. When the Program is SAVED the REM statement is also saved so that the Routine can be used with any Program.

The Routine has several uses where a continuous graph of a varying quantity is required. Fed by an Analogue-to-Digital Con-

verter it would plot a continuous moving graph of temperature, pressure and light intensity, in fact, any varying quantity which can be represented by a varying voltage. But I hope to go into this later, the project I was working on when I developed the Routine was an Echo Sounder interface to turn the ordinary rotating LED Echo Sounder into a chart recorder.

Alien 8

This map was drawn and sent in by super spaceman David Christmas of deepest Dulverton.



ZX81 Soft Selection

Nick Pearce looks at the new 'three pack' from Temptation.



Admiral Graf Spee

It is 1940 and you are in command of the Admiral Graf Spee prowling the Atlantic. The mission is to sink as many enemy — Allied — ships as possible. The Graf Spee is armed with six 11 inch guns and two torpedo tubes. The support ship Albatross is at hand to replenish your supplies and ammunition.

There are two main screen displays. Firstly a map of the South Atlantic is displayed showing the location of the Graf Spee (denoted by a flashing pixel), and the allied ships (intermittent flashing pixels). Also shown is your instrument display giving speed, compass heading, fuel, target distance, and so on.

You close in on the allied ships using the map, and then move to the second screen

display which shows the horizon and, when you get very close, the allied ship itself. To destroy the target you must fire whilst it is in visual range. The instrument panel continues to be shown in this second display. Instrument readings are constantly updated.

The game gets quite exciting as you get close to an allied ship and it starts to fire at you, rocking the Graf Spee and inflicting damage, or taking evasive action and moving out of range.

Graf Spee has the makings of a good game. I thought the graphics had been used to good effect, but the game is let down by its slow response to keyboard commands. This is partly because the player has to wait between moves whilst each instrument reading is updated in turn, and partly because the game is written entirely in BASIC. The incorporation of

machine code routines to speed up the programs would result in a faster, more interactive and improved game.

Baron

Baron is a role playing game of strategy for one to four players. Each player starts with 1500 doubloons, 70 acres of land, and 100 workers. The decisions to be made each year include whether to buy or sell land, whether to feed all your workers, or let some starve — merciless dog, whether to hire or fire mercenaries; and so on. If you are too extreme your workers revolt and invade you on the castle portcullis. Games last for five to 60 moves (selectable at the start), if you can survive that long! There is a year by year analysis of your performance as a Baron, and a final

score is given. There are frequent disasters to thwart your struggle for success, for example the plague may strike or rats eat your grain.

Baron is a text-only game. It is a reasonable simulation although perhaps somewhat short on interest to hold the attention of the avid role player for long.

Dungeons of Doom

Finally in this set of three cassettes from Temptation Software is Dungeons of Doom, a maze game for up to four players. In this game you have to find your way through some 600 rooms and 600 corridors in an attempt to build up a high score by surviving for as long as possible, and at the same time kill monsters or collect treasure.

The screen displays the room or corridor you are in, and black squares to the North, South, East and West, and above and below. Only on attempting to move into one of these squares is its nature revealed — corridor, room, cave, or stone wall. And any content — monsters or treasure — becomes apparent.

Again the game is written in BASIC, and is consequently rather slow. After each move there is a few seconds wait whilst the display is updated to show your current position. Dungeons of Doom is not really a computer "adventure" in the true sense; it has locations and objects, but no vocabulary. Control is effected through the use of movement keys. A reasonably good game.

Each of these three programs from Temptation Software use most of the available 16K memory and take 7 to 8 minutes to LOAD. They each feature a 20 second "pre-load" program, a good idea which overcomes the frustrating problem of waiting for perhaps ten minutes only to find that the volume settings were wrong, the program hasn't LOADED and you have to start again. Incidentally I had no trouble loading any of these cassettes.

The games are sold as a "triple-pack", and are available only as a set by mail order. Three cassettes each containing a reasonable game for just under £6.00 must be good value for money.

Admiral Graf Spee, Baron and Dungeons of Doom are available as a set, price £5.99 inclusive of VAT postage and packing, from Temptation Software Limited, 27 Circus Ports Street, Rye, East Sussex. ■

IQ test



Part two of Greg Turnbull's probing program, full details of which were printed last issue.

```

1600 IF X=99 THEN LET SCORE=SCORE+1
1601 IF X=0 THEN GO TO 1603
1602 GO SUB 90
1603 FOR A=2 TO 4: PRINT AT A,0)
US: NEXT A
1604 GO TO 1640
1602 PRINT AT 2,0) "0's. 37-42: M
ID-TERMS: 0.37." OVER 1) AT 2,0)
"
4,0) "IN EACH 0. THE THREE UPPER
TERMS CORRESPOND TO THOSE BELOW,
INSERT THE MISSING LETTERS
.
1693 PRINT AT 0,0) "FACE (BODY) L
600 : ", "NOSE (NEE) KNEES"
1695 GO SUB 500
1696 IF AS="ave1" OR AS="nave1"
THEN LET SCORE=SCORE+1
1697 IF AS="0" THEN GO TO 1699
1698 GO SUB 90
1699 FOR A=2 TO 7: PRINT AT A,0)
US: NEXT A
1700 GO TO 1840
1700 PRINT AT 2,0) "0. No. 30: "
OVER 1) AT 2,0) "
1709 PRINT AT 4,0) "PAST (PRESENT
) FUTURE : ", "WAS (I) WILL BE"
1711 GO SUB 500
1712 IF AS="s" OR AS="ie" THEN
LET SCORE=SCORE+1
1713 IF AS="0" THEN GO TO 1715
1714 GO SUB 90
1715 FOR A=2 TO 5: PRINT AT A,0)
US: NEXT A
1716 GO TO 1840
1724 PRINT AT 2,0) "0. No. 39: "
OVER 1) AT 2,0) "
1725 PRINT AT 4,0) "COMPLETE (INC
OMLETE) BLANK : ", "ALWAYS (S)
NEVER"
1727 GO SUB 500
1728 IF AS="sometimes" OR AS="som
etimes" THEN LET SCORE=SCORE+1
1729 IF AS="0" THEN GO TO 1731
1730 GO SUB 90
1731 FOR A=2 TO 5: PRINT AT A,0)
US: NEXT A
1732 GO TO 1840
1740 PRINT AT 2,0) "0. No. 40: "
OVER 1) AT 2,0) "
1741 PRINT AT 4,0) "GLUT (SCARCIT
Y) FAMINE : ", "MANY (F) NONE"
1743 GO SUB 500
1744 IF AS="ew" OR AS="few" THEN
LET SCORE=SCORE+1
1745 IF AS="0" THEN GO TO 1747
1746 GO SUB 90

```

```

1747 FOR A=2 TO 5: PRINT AT A,B
W8: NEXT A
1748 GO TO 1048
1754 PRINT AT 2,B;"R. No. 411:"
OVER 1:AT 2,B;" "
1757 PRINT AT 4,B;"RUSHING (PASS
ING) ENDURING :","EVANESCENT (T8
84T) ETERNAL"
1759 GO SUB 588
1768 IF A$="ransien" OR A$="tran
sient" THEN LET SCORE=SCORE+1
1761 IF A$="8" THEN GO TO 1763
1762 GO SUB 98
1763 FOR A=2 TO 5: PRINT AT A,B
W8: NEXT A
1764 GO TO 1048
1770 PRINT AT 2,B;"R. No. 42:"
OVER 1:AT 2,B;" "
1773 PRINT AT 4,B;"NASCENT (NATU
RE) SENILE :","GREEN (R444) DECA
YED"
1775 GO SUB 588
1776 IF A$="ipe" OR A$="ripe" TH
EN LET SCORE=SCORE+1
1777 IF A$="8" THEN GO TO 1779
1778 GO SUB 98
1779 FOR A=2 TO 5: PRINT AT A,B
W8: NEXT A
1780 GO TO 1048
1788 PRINT AT 2,B;"R's.43-47:SIM
ILAR/OPPOSITE: 8.26:" OVER 1:AT
2,B;" "
"AT 4,B;"ENTER THE No.8 OF
TWO WORDS WITHEITHER NEARLY EQU
AL MEANINGS OR ALMOST OPPOSITE N
EANINGS."
1789 PRINT AT 8,B;"RAPPORT, MERC
URIAL, HAPPY,":AT 10,B;"RAPACIOU
S, PHEGMATIC"
1798 PRINT AT 9,3;"1" :TAB 13;"2"
:AT 22;"3" :AT 11,3;"4" :TAB 15;"
5"
1791 GO SUB 388
1792 IF X=2 OR X=5 AND Y=2 OR Y=
5 THEN LET SCORE=SCORE+1
1793 IF X=8 AND Y=8 THEN GO TO
1795
1794 GO SUB 98
1795 FOR A=2 TO 11: PRINT AT A,B
W8: NEXT A
1796 GO TO 1048
1804 PRINT AT 2,B;"R. No. 44:"
OVER 1:AT 2,B;" "
1805 PRINT AT 4,B;"TENACIOUS, RE
SOLVE, IRRESOLUTE,":AT 6,B;"SOLU
TION, TENACITY"
1806 PRINT AT 5,4;"1" :TAB 13;"2"
:AT 25;"3" :AT 7,3;"4" :TAB 13;"5

```

```

"
1807 GO SUB 388
1808 IF X=1 OR X=3 AND Y=1 OR Y=
3 THEN LET SCORE=SCORE+1
1809 IF X=8 AND Y=8 THEN GO TO
1811
1810 GO SUB 98
1811 FOR A=2 TO 7: PRINT AT A,B
W8: NEXT A
1812 GO TO 1048
1820 PRINT AT 2,B;"R. No. 45:"
OVER 1:AT 2,B;" "
1821 PRINT AT 4,B;"REAL, RENAL,
LITERALLY,":AT 6,B;"SIMILARLY, V
ERITABLY"
1822 PRINT AT 5,11;"1" :TAB 8;"2"
:AT 16;"3" :AT 7,3;"4" :TAB 15;"5"
1823 GO SUB 388
1824 IF X=5 OR X=3 AND Y=5 OR Y=
3 THEN LET SCORE=SCORE+1
1825 IF X=8 AND Y=8 THEN GO TO
1827
1826 GO SUB 98
1827 FOR A=2 TO 7: PRINT AT A,B
W8: NEXT A
1828 GO TO 1048
1836 PRINT AT 2,B;"R. No. 46:"
OVER 1:AT 2,B;" "
1837 PRINT AT 4,B;"TOPOGRAPHY, H
CAP, PRIME, PLATEAU":AT 6,B;"HOL
E"
1838 PRINT AT 5,4;"1" :TAB 13;"2"
:AT 28;"3" :TAB 20;"4" :AT 7,11;"5
"
1839 GO SUB 388
1848 IF X=5 OR X=2 AND Y=5 OR Y=
2 THEN LET SCORE=SCORE+1
1841 IF X=8 AND Y=8 THEN GO TO
1843
1842 GO SUB 98
1843 FOR A=2 TO 7: PRINT AT A,B
W8: NEXT A
1844 GO TO 1048
1852 PRINT AT 2,B;"R. No. 47:"
OVER 1:AT 2,B;" "
1853 PRINT AT 4,B;"HATE, AFFECTI
ON, AFFLICTION,":AT 6,B;"LOVE, P
ASSION"
1854 PRINT AT 5,11;"1" :TAB 10;"2"
:AT 22;"3" :AT 7,11;"4" :TAB 9;"5"
1855 GO SUB 388
1856 IF X=1 OR X=4 AND Y=1 OR Y=
4 THEN LET SCORE=SCORE+1
1857 IF X=8 AND Y=8 THEN GO TO
1859
1858 GO SUB 98
1859 FOR A=2 TO 7: PRINT AT A,B
W8: NEXT A

```

```

1868 GO TO 1848
1868 PRINT AT 2,8) 'Q'*.48-58: NA
TNG MID-TERMS: R.26') OVER 1)AT
2,8) *
_____
)AT 4,8) 'IN EACH Q. THE 3
No. 8 ON THE LEFT ARE RELATED
TO THOSE ON THERIGHT, ENTER THE
MISSING VALUE.*
1869 PRINT AT 8,8) ' 7 (12) 5 : 8
(A) 3 *
1871 GO SUB 488
1872 IF X=11 THEN LET SCORE=SCOR
RE+1
1873 IF X=8 THEN GO TO 1875
1874 GO SUB 98
1875 FOR A=2 TO 8: PRINT AT A,8)
W8: NEXT A
1876 GO TO 1848
1884 PRINT AT 2,8) 'Q. No. 49:')
OVER 1)AT 2,8) *
_____
1885 PRINT AT 4,8) ' 3 (6) 2 : 3
(A) 3 *
1887 GO SUB 488
1888 IF X=9 THEN LET SCORE=SCOR
E+1
1889 IF X=8 THEN GO TO 1891
1890 GO SUB 98
1891 FOR A=2 TO 4: PRINT AT A,8)
W8: NEXT A
1892 GO TO 1848
1900 PRINT AT 2,8) 'Q. No. 58:')
OVER 1)AT 2,8) *
_____
1901 PRINT AT 4,8) ' 49 (15) 64 :
16 (A) 144 *
1903 GO SUB 488
1904 IF X=16 THEN LET SCORE=SCOR
RE+1
1905 IF X=8 THEN GO TO 1907
1906 GO SUB 98
1907 FOR A=2 TO 4: PRINT AT A,8)
W8: NEXT A
1908 GO TO 1848
1918 REM TIME UP/FINISHED.
1950 PRINT AT 2,8) FLASH 1) 'TIME
UP') FLAG 8) PAUSE 75
1955 PRINT AT 2,8) 'YOU HAVE FINI
SHED ALL THE Q's.' : PAUSE 75
1968 PAPER 6: BORDER 4: INK 8: C
LS
1978 GO SUB 4888: REM IS RESULT
1998 GO TO 35
2808 REM PERSON. TEST NO.1.
2818 PAPER 6: BORDER 4: INK 8: B
RIGHT 8: CLS : LET PT1A=8
2828 PRINT 'PERSONALITY TESTS:')
OVER 1)AT 8,8) *
_____
***
2838 LET Y8=* THESE ARE TWO TEST

```

```

S WHICH HAVE NO RIGHT OR WRONG A
NGWERS, THEY ARE UNRELATED TO TH
E I.Q. TEST. YOU MUST ANSWER THE
Q's. WITH A OR B AS QUICKLY AND
AS HONESTLY AS POSSIBLE, DO NOT
THINK ABOUT THEM FOR TOO LONG A
S EMOTIONS ARE IMPORTANT, THE
RESULTS WILL BE GIVEN SOON AFTER
THE END OF EACH TEST.*
2848 RANDOMIZE USR 65118: FOR Z=
1 TO LEN Y8: IF Y8(Z)=* * THEN
PRINT * '): GO TO 2868
2858 PRINT Y8(Z):: BEEP .85,25:
PAUSE 2
2868 NEXT Z: RANDOMIZE USR 65128
: PAUSE 25: GO SUB 58: CLS
2865 PRINT 'P.TEST NO.1:') OVER
1)AT 8,8) *
_____
***
2878 PRINT '1) WHICH WOULD YOU P
REFER TO BE A SCIENTIST (A) OR A
POLITICIAN (B)?': GO SUB 488
2888 PRINT '2) DO YOU THINK THAT
SOME WELL-KNOW, 'HONEST' PROFE
SSIONS DO MORE HARM (A) THAN B
OOD (B) FOR THIS COUNTRY?': GO S
UB 488
2898 PRINT '3) WHICH IS MORE IMP
ORTANT TO A CRITIC, DISCRIMINATI
ON (B) OR TOLERANCE (A)?': GO
SUB 488
2108 PRINT '4) WOULD YOU RATHER
BE YOUR OWN BOSS (A), OR A RECEP
TIONIST (B)?': GO SUB 488
2118 PRINT '5) SHOULD A DOCTOR A
LLOW HIMSELF TO BE EMOTIONAL (B)
IN TREATING PATIENTS, OR NOT (A)
?': GO SUB 488
2128 PRINT '6) DO YOU FIND IT HA
RD (A) TO MODIFY BEHAVIOUR REL
ATED TO EVERYDAY RELATIONSHIP
S OR NOT (B)?': GO SUB 488
2138 PRINT '7) ON HOLIDAY DO YOU
PREFER TO SPEND TIME READING &
WALKING (A) OR MEETING PEOPLE (B
)?': GO SUB 488
2148 PRINT '8) WOULD YOU FIND BE
ING A HERMITEADY (A), OR HARD (B
)?': GO SUB 488
2158 PRINT '9) WOULD YOU PREFER
TO MARRY A THOUGHTFUL (A), OR S
OCIAL PERSON (B)?': GO SUB
488
2168 PRINT '10) ARE MOST PEOPLE
GENERALLY TRUSTWORTHY (B), OR
NOT (A)?': GO SUB 488
2178 PRINT '11) DO YOU LIKE ORGA
NISING PARTIES (A), OR NOT
(B)?': GO SUB 488

```

2188 PRINT *12) WOULD YOU PREFER TO BE A LIBRARIAN (A), OR A SALESPERSON (B)?*: GO SUB 688

2198 PRINT *13) WOULD YOU DESCRIBE YOURSELF AS CAUTIOUS (A) OR OUT-GOING (B)?*: GO SUB 688

2208 PRINT *14) WOULD YOU LIKE TO BE A CIVILSERVANT (A) OR IN THE GOVERNMENT (B)?*: GO SUB 688

2218 PRINT *15) DO YOU ENJOY QUIET, NOISY PARTIES (B), OR NOT (A)?*: GO SUB 688

2228 PRINT *16) WOULD YOU FIND IT DIFFICULT TO MAKE A PUBLIC SPEECH (A), OR EASY (B)?*: GO SUB 688

2238 PRINT *17) IN A THEATRE WOULD YOU LIKE TO BE A STAGE-HAND (A), OR AN ACTOR (B)?*: GO SUB 688

2248 PRINT *18) DO YOU HAVE A READY REPLY FOR MOST CONVERSATION (B), OR ARE YOU MORE RESERVE (A)?*: GO SUB 688

2258 PRINT *19) ARE YOU SLOW (A), OR QUICK (B) AT MAKING NEW FRIENDS?*: GO SUB 688

2268 PRINT *20) WOULD YOU DESCRIBE YOURSELF AS BEING FULL OF ENERGY (B), OR NOT (A)?*: GO SUB 688

2278 PRINT FLASH 1: AT 10,7) *TEST NO.1 OVER!*: FLASH 8: GO SUB 58

2288 CLS : PRINT *RESULTS OF P.T TEST NO.1: OVER 1: AT 8,8)* _____

2298 PRINT *YOU ARE *:

2298 GO SUB 888

2308 GO SUB 58

2318 GO TO 35

3888 REM PERSON. TEST NO.2.

3818 PAPER 6: BORDER 4: INK 8: BRIGHT 8: CLS : LET PT28=8

3828 PRINT *PERSONALITY TEST NO. 2: OVER 1: AT 8,8)* _____

3838 GO SUB 58

3848 PRINT *1) AS FAR AS YOU KNOW HAVE YOU EVER (A) WALKED IN YOUR SLEEP, OR NOT (B)?*: GO SUB 658

3858 PRINT *2) HAVE YOU BEEN OFF WORK DUE TO ILLNESS FOR A TIME PERIOD LONGER THAN MOST PEOPLE (A), OR NOT (B)?*: GO SUB 658

3868 PRINT *3) DO YOU HAVE A TENDENCY TO FEEL CONFUSED IF INTERRUPTED WHILE WORKING (A), OR NOT (B)?*: GO SUB 658

3878 PRINT *4) DO YOU ENJOY SOME EXERCISE EVERY DAY (A), OR NOT (B)?*: GO SUB 658

3888 PRINT *5) THE LAST TIME YOU BEGAN TO LEARN A NEW SKILL DID YOU FEEL CONFIDENT (B), OR NOT (A)?*: GO SUB 658

3898 PRINT *6) HAVE YOU FELT STRONGLY ABOUT EVERYDAY IRRITATIONS (A), OR NOT (B)?*: GO SUB 658

3188 PRINT *7) HAVE YOU EVER WORRIED FOR HOURS AFTER A SITUATION WHERE YOU FELT HUMILIATED (A), OR NOT (B)?*: GO SUB 658

3118 PRINT *8) WOULD PEOPLE REGARD YOU AS A SENSITIVE PERSON (A), OR NOT (B)?*: GO SUB 658

3128 PRINT *9) DO YOU USUALLY GET TO SLEEP EASILY (B), OR NOT (A)?*: GO SUB 658

3138 PRINT *10) WOULD MANY PEOPLE CONSIDER YOU SHY (A), OR NOT (B)?*: GO SUB 658

3148 PRINT *11) DO YOU FEEL DISTURBED IF SOMEONE YOU KNOW FAILS TO GREET YOU (A), OR NOT (B)?*: GO SUB 658

3158 PRINT *12) DO YOU (A) SOMETIMES FEEL HAPPY OR SAD WITHOUT ANY REAL CAUSE, OR NOT (B)?*: GO SUB 658

3168 PRINT *13) AT WORK DO YOU OFTEN FIND YOURSELF DAY-DREAMING (A), OR NOT (B)?*: GO SUB 658

3178 PRINT *14) CAN YOU (A) REMEMBER HAVING ANY NIGHTMARES IN THE LAST FIVE YEARS, OR NOT (B)?*: GO SUB 658

3188 PRINT *15) HAVE YOU A REAL FEAR OF HEIGHTS/TUNNELS OR OUT-DOORS (A), OR NOT (B)?*: GO SUB 658

3198 PRINT *16) DO YOU USUALLY BEHAVE CAREFULLY EFFICIENTLY IN AN EMERGENCY (B), OR NOT (A)?*: GO SUB 658

3208 PRINT *17) ARE YOU A VERY EMOTIONAL PERSON DURING NORMAL SITUATIONS (A), OR ARE YOU NOT (B)?*: GO SUB 658

3218 PRINT *18) DO YOU (A) FREQUENTLY WORRY ABOUT YOUR HEALTH, OR NOT (B)?*: GO SUB 658

3228 PRINT *19) CAN YOU REMEMBER

```

DEFINELY ANNOYING SOMEONE THI
5 YEAR (A), OR NOT (B)?": GO SUB
658
3238 PRINT "20) DO YOU SWEAT WIT
HOUT DOING MUCH EXERCISE (A), O
R NOT (B)?": GO SUB 658
3248 PRINT "21) CAN YOU REMEMBER
YOUR MIND GOING BLANK WHILST B
OING A JOB DURING THE LAST FIVE
YEARS (A), OR NOT (B)?": GO SUB
658
3258 PRINT "22) WITHIN THE LAST
YEAR CAN YOU REMEMBER MEETING AT
LEAST THREE PEOPLE THAT YOU THOU
GHT WERE DEFINELY UNFRIENDL
Y TOWARDS YOU (A), OR NOT (B)?
": GO SUB 658
3268 PRINT "23) HAVE YOU EVER (A
) BEEN SHORT OF BREATH WITHOUT DO
ING ANY EXERCISE, OR NOT (B)
?": GO SUB 658
3278 PRINT "24) ARE YOU USUALLY
TOLERANT OF OTHER PEOPLE'S MAYS
(B), OR NOT (A)?": GO SUB 658
3288 PRINT "25) ARE THERE ANY NO
RMAL SITUATIONS WHERE YOU
FEEL DEFINELY SELF-CONFID
IOUS (A), OR NOT (B)?": GO SUB 65
8
3298 PRINT "26) DO YOU OFTEN FE
EL UNHAPPY (A), OR NOT (B)?": G
O SUB 658
3388 PRINT "27) HAVE YOU SUFFERE
D FROM DIARRHOEA MORE THAN
ONCE IN THE LAST TWO YEARS (A),
OR NOT (B)?": GO SUB 658
3318 PRINT "28) ARE YOU USUALLY
SELF-CONFIDENT (B), OR NO
T (A)?": GO SUB 658
3328 PRINT "29) DO YOU BELIEVE Y
OU CAN COPE WITH EVERYDAY SITUAT
IONS AS WELL AS ANYONE ELSE (B),
OR NOT (A)?": GO SUB 658
3338 PRINT "30) DO YOU USE ASPIR
IN/SLEEPING-TABLETS OR TRANQUILI
ZERS MORE THAN ONCE A MONTH (A
), NO:(B)?": GO SUB 658
3588 PRINT FLASH 1;AT 18,7;"YES
Y NO.2 OVER!"; FLASH 8; GO SUB 5
8
3518 CLS : PRINT "RESULTS OF P.T
EST NO.2:" OVER 1;AT 8,8;"_____
***
3515 PRINT "YOU ARE "I
3528 GO SUB 988
3538 GO SUB 58
3548 GO TO 35
4888 REM 18. RESULT.
4818 PRINT "I.O. TEST RESULT:";
OVER 1;AT 8,8;"_____
**
4815 IF SCORE=8 THEN LET I8=88
4828 IF SCORE>8 AND SCORE<=5 THE
N LET I8=85+(28*SCORE)
4838 IF SCORE>5 AND SCORE<=12 TH
EN LET I8=INT (95+(28*(SCORE-6))
)
4848 IF SCORE>12 AND SCORE<=18 T
HEN LET I8=INT (184+(28*(SCORE-1
2)))
4858 IF SCORE>18 AND SCORE<=25 T
HEN LET I8=114+(SCORE-18)
4868 IF SCORE>25 AND SCORE<=30 T
HEN LET I8=128+(SCORE-25)
4878 IF SCORE>30 AND SCORE<=35 T
HEN LET I8=125+(SCORE-30)
4888 IF SCORE>35 AND SCORE<=40 T
HEN LET I8=138*(SCORE-35)
4898 IF SCORE>40 AND SCORE<=45 T
HEN LET I8=135+(SCORE-40)-1
4188 IF SCORE>45 AND SCORE<=49 T
HEN LET I8=138+(SCORE-45)-1
4118 IF SCORE=58 THEN LET I8=14
2
4128 PRINT "YOUR SCORE IS "I8COR
EJ"/58""
4125 PRINT "YOUR I.O. RESULT IS
"118"
4138 IF SCORE=48 THEN PRINT "P
ERHAPS YOU SHOULD THINK ABOUT A
PPLYING TO JOIN MENSA! T
HAT WAS AN EXCELLENT SCORE."
4148 IF SCORE<40 AND SCORE>=38 T
HEN PRINT "THAT WAS A GREAT SCO
RE, WELL DONE! NOT QUITE
UP TO MENSASTANDARDS BUT IN THE
UPPER 18% AREA OF THE POPULATI
ON."
4158 IF SCORE<38 AND SCORE>=25 T
HEN PRINT "THAT WAS A VERY GOOD
SCORE, IN THE UPPER 15% OF THE
POPULATION."
4168 IF SCORE<25 AND SCORE>=20 T
HEN PRINT "GOOD SCORE, WELL ABO
VE THE POPULATION AVERAGE."
4178 IF SCORE<20 AND SCORE>=15 T
HEN PRINT "FAIR SCORE, JUST ABO
VE THE POPULATION AVERAGE."
4188 IF SCORE<15 AND SCORE>=8 TH
EN PRINT "AVERAGE SCORE, WITHIN
THE 68% OF THE POPULATION BRACKE
T."
4198 IF SCORE<8 AND SCORE>=5 THE
N PRINT "POOR SCORE, BELOW THE
POPULATION AVERAGE."
4288 IF SCORE<5 AND SCORE>=1 THE

```




```

N PRINT "VERY POOR. WITHIN THE
LOWER 16% OF THE POPULATION RANG
E!"
4210 IF SCORE=0 THEN PRINT "GUP
ER CREYIN! YOU BOT THEM ALL WRO
NG."
4220 GO SUB 50
4230 RETURN
5000 REM IQ. TEST EXAMPLES.
5010 INK @: PAPER 6: BORDER 6: B
RIGHT @: CLR
5020 PRINT "I.Q. TEST EXAMPLES:"
I OVER I;AT @,@]
***
5030 PRINT "A) ANALOGIES:***"BARK
IS TO LIGHT AS X IS TO Y: (I)
FLASH I;"BLACK": FLASH @]"; TREE
, PLANT, "I FLASH I;"WHITE": FLA
SH @]***"
5040 PRINT "B) SIMILARITIES:***"
FLASH I;"ENTIRE": FLASH @]"; WID
E, EMPTY, "I FLASH I;"WHOLE": FL
ASH @: PRINT
5050 PRINT "C) EQUATIONS:***"21-4
=38(A) "I FLASH I;"5": FLASH @:
PRINT
5060 PRINT "D) LINKS:***"INVOICE

```

```

(200L) BEAK "I FLASH I;"IL": FLA
SH @: PRINT
5070 PRINT "E) OPPOSITES:***" FLA
SH I;"TENSE": FLASH @]";, TENSE,
SERIOUS, "I FLASH I;"RELAXED": F
LASH @: PRINT
5080 PRINT "F) MID-TERMS:***"FIR
S T (SECONDS) THIRD : ONE (T@)THRE
E "I FLASH I;"WO": FLASH @: PRIN
T
5090 GO SUB 50: CLR
5100 PRINT "G) SIMILAR/OPPOSITE
I:***" FLASH I;"PUNISH": FLASH @]";
, REPUTE, REPLY, "I FLASH I;"REW
ARD": FLASH @: PRINT
5110 PRINT "H) MATHS MID-TERMS:"
" " I (I2) I3 : 4 (A) 6 "I FLA
SH I;"5": FLASH @: PRINT
5120 GO SUB 50
5130 GO TO 35
9990 RER SAVE ROUTINE.
9990 CLR : PRINT "SAVE:": SAVE "
I.B. TEST." LINE I: CLR : PRINT
"VERIFY:": VERIFY "I.B. TEST.":
CLR : PRINT "O.K.": STOP
9999 REM LISTING OCCUPIES 34.5K.

```



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5 different games and increased difficulty options. (S)

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With increased difficulty options. (S) (C) (M) (U)

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With increased difficulty options. (S) (C) (U)

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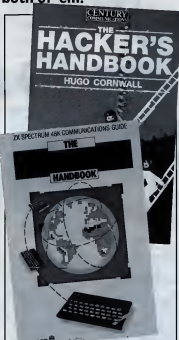
This issue, we look at The Hacker's Handbook — both of 'em!

It's nice to see some computing books coming out that aren't just variations on the '25 Spitting Games/Machine Code for Morons' format.

April saw two new releases for those who want to explore the communications abilities of their machines. Coincidentally, they were both called The Hacker's Handbook (which may make this review a bit confusing) but they take quite different views of the subject of hacking itself. The first, published by Century Communications and written by Hugo Cornwall (an alias, of course) explores the glamorous semi-legal aspect of hacking and caused a certain amount of controversy when published, with a top Scotland Yard Detective declaring 'no good can come of anything in this book.' This of course will probably do wonders for sales but whether or not the criticism will be proven true remains to be seen.

Admittedly, the book does give detailed accounts of events such as 'The Great Prince Philip Peasel Hack' and even of bugs in those hole-in-the-wall cash dispensers, so I suppose that the Police concern is not entirely without justification of some sorts. The problem here is that theft of information is not illegal, merely because the law hasn't yet caught up with recent advances in information technology — it could certainly be argued though, that breaking into private files is immoral and ought to be illegal. But here, the book's author adheres to the view of the Hacker as a sort of computerised Raifiles — more interested in the challenge of a good break-in than in material gain, and having a strict code of honour. 'Hackers', he tells us, 'should not be interested in fraud.'

It's a matter of semantics really, but a Hacker, according to Cornwall's definition is not interested in criminal activities, therefore anyone who does embark on hacking with criminal intent is not a Hacker, but a criminal. Still, the ethics of hacking aside, the Century Handbook is a very good read. It is, I



think a little too technical in places for the beginner (I got lost on several occasions whilst reading it), and probably requires some experience with modems and knowledge of things like protocols in order to get the best of the book. Even so it is much better written than the

average computer book. The author's style is clear and uncomplicated and his enthusiasm for the subject carried me through the technical bits that went over my head. Well worth buying.

The second Hacker's Handbook, published by Longman

and written by Geoff Wheelwright and Ian Scales is probably required reading for anyone who wants to read the Cornwall Handbook. Subtitled 'The ZX Spectrum 48K Communications Guide' it is a machine-specific introduction to the subject and actually explains all the technical bits that I didn't understand in the first book. The page layout is quite useful in that the margins carry brief explanations of any jargon that may appear in the main text. Starting absolutely from first principles with a chapter entitled 'Why Communications?' the authors assume no prior knowledge of the hardware, software and facilities available. This Handbook though, is not concerned with breaking into other people's systems and deals only with the 'legitimate' services available quite freely to anyone.

There are chapters on Peasel and Micronet, Bulletin Boards, various types of electronic mail, and, thank heavens, a gentle introduction to modems and interfaces (ok, reads up everyone, me included, that has seen the legendary RS232 interface referred to all over the place — even on Spitting Image — but never had the faintest idea what the damn thing actually does). The authors' style is a little drier than Cornwall's but as they had a lot of explanatory material to present, that was probably inevitable.

It is interesting to compare the attitude that this book takes to the kind of hacking that Cornwall deals with. This, the authors tell us, is necessarily becoming an activity for professional criminals, whereas the 'sporting activity' that Cornwall discusses is now the exception rather than the rule. This is a debate that will go on for ages, and if you want to be in on it, then I can recommend both these books to you, though I should add that for the beginner the Longman Handbook is probably the more essential of the two, and provides the experience and information that you will need to fully appreciate the Century Handbook. S.D.

Title: The Hacker's Handbook
Author: Hugo Cornwall
Publisher: Century Communications
Price: £4.95

Title: The Hacker's Handbook
Author: Geoff Wheelwright and Ian Scales
Publisher: Longman Software
Price: £5.95

We the jury . . .



A Day in The Life £5.95 Micromega

A humorous game dedicated to "the man who put us all into business", this has you guiding the Head of Sinclair around several screens of objects to collect and people to avoid. An unusual combination of platform and maze games and all in a 3D perspective.

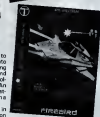
The graphics looks sparse in comparison to some games on the market, but after a few plays I came to appreciate the uncluttered display — simple in concept it may be, but simple to play it is not. A nice sense of humour runs throughout, and I even found the insert notes funny.

The object of the game is to get Clive to Buck House to be in-vented as Dame Commander of the British Empire, you start in his house in bed and have to get clothes and a key to get out, avoiding the animated TV, Spectrum, cat (so far it's just like home — Ed) and the bug in the attic. Objects bounce off each other and just as you think you've got it sussed they collide and come back unexpectedly — eat one of your five lives. Scoring is simply calculated by the time in which you complete each screen and the top score is kept and displayed.

I liked it but found it frustrating as it looked so easy, probably Underworld experts may find it rather easy, but for most of us the difficulty is just right, making you want just ONE more go.

Micromega, 230/238 Lavender Hill, London SW11.

GRAPHICS *****
ADDICTIVITY *****
OVERALL *****



Buggy Blast Firebird £5.95

This is a graphically excellent "zap the aliens" type of game, which I found very difficult to master. One of the reasons I found it difficult was that there are no joystick options. There is a choice of two sets of keys, QWERTY for Life, Right, Up, Down, phaser and normal fire, and the cursor keys plus X.

I personally preferred the first option, but, although the cassette tells you to remove all peripherals, I tried it with the AKG Protocol 4 joystick interface and guess what? It worked. Life became easier.

There is a lot happening in this game, different aliens attack you from all sides, and deciding which one to try and hit needs quick assessment of the relative value of each. On my first go I killed nine or ten and scored nothing! This is a full blooded program and it is quite hard to score in the early stages — it's not for those who give up easily or want a pushy mindless slaughter of offending aliens. Experienced players may find this challenge will keep them on their toes for some time.

Your task is to progress through eight sectors which are variations on the corridor flying theme, finally destroying 20 Lurgons in that sector in order to cause a power reversal which will destroy them. There are a lot of things to watch, scanner, computer, life mode, phaser lights and energy, and all the while the attacking aliens!

GRAPHICS *****
ADDICTIVITY *****
OVERALL *****



Moon Cresta £6.95 Incentive Software

WOW!

This was one of my favourite arcade games and I thought when I saw the advert "Oh yes, another inferior, highly hyped copy", but boy was I wrong!

This has all the challenge and features of the original, if you want to try it out just go to your nearest arcade and put 20p in the machine of the same name. Even the music sounds are the same. You are travelling in a three-stage rocket when the evil aliens materialise in the centre of the screen and attack in a swirling pattern. Hit them and they split into two, hit them again and they die, destroy them all and another wave appears. After five waves the second stage of your rocket appears, and if you successfully dock with it you continue with Twice the firepower! You'll need it!

In the next section the aliens materialise, rip backwards and forwards before finally making kamikaze dives on you. The play levels are perfect, you can achieve reasonable success in the first few attempts and this will encourage you to try for a higher position in the high score chart. You just KNOW you'll do better next time. As a pure zap 'em all space game it is one of the best, a must for arcade enthusiasts.

GRAPHICS *****
ADDICTIVITY *****
OVERALL *****



Brian Bloodaxe £5.95 The Edge

The first ever game to feature "Primary Imbalance" quoth the insert. I still don't know for sure what it is but I hazard a guess that it is the silly/unlikely solutions to the problems such as walking on the Shark's tail!

You as Brian, have invaded the Brits in 1883, you have to wander round collecting and using objects until you get the crown jewels and sit on the throne. Once you have done that their insert notes say the REAL task of the game will be explained.

This is a platform and jump type program but with a style of its own. It is unfair to categorize it more than generically, each screen is carefully laid out in line with the plot, although no attempt to stay in a logical time sequence has been made — Nights and Cruise missiles in the same game!

The animation is very good, movements and jumps must be timed accurately. I'm afraid that I didn't get very far before I had to write this review, but it is one that I shall be going back to. There is a great deal of influence from the Monty Python team in the logic of this program, the is implicitly acknowledged in the cassette picture and the ear-curling music. It was not hard to get started, however I soon got stuck only a couple of screens into the 100 that are there to be explored. Quite often I found myself sitting and trying to puzzle out the next move, not too successfully in most cases - although I enjoy adventures, some of the logic baffled and exasperated me!

GRAPHICS *****
ADDICTIVITY *****
OVERALL *****



Halaga
£5.95
Interceptor Software

Sent to Cygnus Major for minimal resources by the Federation of Space Research, you run into a hostile alien reception. Only your skill with the anti-matter plasma gun will save you.

This is an average shoot 'em up space game which you can play with most of the joystick options available. The aliens zoom onto the screen in set patterns, take up their positions while the next squadron enters, and finally, when they are all in

place, make bombing runs on your spaceship. As they enter and attack they send down a stream of missiles.

Simply by dodging back and forward and firing continuously I got through the first few sheets, (there are four screens to a sheet), before the speed of the attackers increased to such a rate that I couldn't survive. One thing I found interesting was the style of presentation and movement, this reminded me very much of the Demo screens of Oasis' Whirl Lightning program. I suspect that this was written using it and would be interested to know if this is the case. If so then it is one of the first commercial quality programs I have seen produced by a "games writer" utility.

Although not particularly inspired or inspiring there is not a lot wrong with this game, the graphics are good, movement is smooth and it is enjoyable to play. I suppose that it lacks sophistication when compared to other programs. I played it for over an hour but have not really experienced a desire to have another go.

Interceptor Software, London House, The Green, Tedley, Herts

GRAPHICS *****
ADDICTIVITY *****
OVERALL *****



World Series Baseball
£6.967
Imagine

Imagine do for Baseball what Paco did for tennis!

If you like sporting action simulations or even if you haven't up to now, this is a must as it provides all the best in computer graphic sports action. Baseball is very similar to Boulder which most of us have played at some time. This game allows you to play either the computer or an opponent, using the keyboard or a Sinclair type twin joystick interface.

There are not many two player interactive games around and this is strange considering that the game that started the video game craze was just that - remember Pong? Just about every option you can think of has been included - number of innings per game, difficulty level, select playing keys, names and team colours. Each team takes a turn to bat and field. The normal rules apply, three strikes, run out, getting round the bases, either in one go or in stages, score a run.

The screen display is nothing short of brilliant! The top third shows the crowd with a huge display type scoreboard which at various times shows close ups of the pitcher, batsman or even cheerleaders, as well as the score and advertisements for various companies. The bottom two thirds show a 3D bird's-eye view of the whole field. When playing, each player controls various actions and men in turn and a real degree of skill can be acquired with practice.

Imagine is dead, long live Imagine!

GRAPHICS *****
ADDICTIVITY *****
OVERALL *****



The Mighty Magus
Quicksilver
£7.99

If it wasn't for one absolutely

unforgivable design flaw, then I would give The Mighty Magus an unqualified "thumbs-up", but as it is, that one flaw spoils the game.

You play the part of the aforesaid Magus. Starting at the topmost level of an underground dungeon, you must penetrate deep into the lowest levels to face your arch-enemy, Frigg the Dragon. As you descend, you can move around various sets of stairs and platforms, and use a SEARCH option to look for useful objects along the way. You begin with a certain amount of power and magic which are depleted by falls from platforms and magical combat with the denizens of the dungeon but can be boosted by things you find along the way.

These underground monsters are well animated, though your own movement and the scrolling dungeon layout are fairly jerky. Also, some of the traps on the dungeon floor are quite difficult to avoid as they often look no different from the normal, set, floor tiles.

I was really enjoying playing this game until the fatal flaw that I mentioned earlier became apparent. The dungeon layout is randomly generated, which is fine as it provides plenty of variation but the drawback to this is that very often you can drop into a dead-end and find yourself with no way out. This means that you simply have to abort and start the game again from the beginning. This, as I said, is an unforgivable oversight, and makes the game incredibly frustrating. Surely some sort of check could have been built into the game to prevent this?

Mighty Magus is far rather, could be a very good game, but the "dead end" syndrome could well result in the cassette being thrown out the window in frustration. It's up to you to decide if you're prepared to risk it.

GRAPHICS *****
ADDICTIVITY *****
OVERALL *****





Gremlins Adventure International £9.95

Following their Marvel Comics tie-in series, Adventure International have now moved into the film world with a game based upon the Christmas hit, *Gremlins*.

Gremlins is a sort of introductory adventure aimed at people who may not have played adventure games before, but who may be attracted to the game having seen the film. And anything which helps to make adventuring more popular is to be welcomed.

The wintery parser is very sophisticated, and the graphic drawings of the locations are excellent. As well as being highly detailed and colourful (the picture of Gizmo is sooo cute!), the graphics also feature a limited animation. In one scene, there is a 'flashing' Gremlin, just as in the film, and the pictures change in response to your commands: in one location, the command 'Kill Gremlin' results in a picture of a headless Gremlin being added to the scene.

The quality of the graphics and parser are just the sort of thing that will encourage the first-time adventurer to get to grips with the techniques of this type of game, but they have taken a toll on the memory available, so that there are relatively few locations to explore, and the problems will not be too hard for seasoned adventurers to solve. But then, *Gremlins* wasn't designed for veterans, so we can't criticise it on that score.

So, if you're a novice adventurer looking for a place to start, then go and get *Gremlins*. If you can afford it — the price is it's only real flow!

GRAPHICS *****
ADDICTIVITY *****
OVERALL *****



Everyone's a Wally Mikro-Ger £6.95

Mikro-Ger's Wally games seem to be taking on a life of their own and multiplying to form a whole series of games. However, if they're all as good as *Everyone's a Wally*, then I shan't be complaining.

Unlike any other arcade or adventure type game, this one allows you to control more than one character — you can choose between Wally himself, Thelma his wife and the rest of the cast of thousands (well, six actually). As all these characters wander around town they must figure out how to complete various tasks, eventually opening a safe to get at their wages.

The locations in the town are all well drawn, and contain some interesting surprises. On one occasion I took Wally into a telephone box and ended up playing some sort of Asteroids game!

The animation of all the characters is very good. They are all drawn in big chunky sprites and really do 'walk' rather than just wiggling their legs. The inevitable colour clashes occur, but the characters always remain clearly defined and solid-looking. To be honest, I've not made much of a dent in the game so far as the instructions don't give too much away. But this is intentional of course, for, as with Ultimate's games, half the fun lies in figuring out the mechanics of the game and what you are supposed to do with all the objects that you come across.

I understand that Mikro-Ger's next offering will be a game based on Wally's son, Herbert. I look forward to it with quivering anticipation.

GRAPHICS *****
ADDICTIVITY *****
OVERALL *****

All the graphics are well drawn and the animation is very smooth. Even the movement of the Wiggler is novel in that rather than just moving left/right/up/down, you have to adopt a sort of wiggly side-to-side movement if you want to move quickly.

The only minor irritation that I found was the tune that played after losing a life. Why do programmers insist on using these silly little tunes? Nobody likes them and they only slow the game down while you're waiting to get on with it.

Still, that aside, I enjoyed Wiggler and will be going back to it, to try and find the rest of the locations. It's just that little bit different from the rest of the current crop and well worth buying.

P.S. I'd just like to thank RR for the cute fluffy toy they sent along to publicise the game which has proved very popular in the ZX offices.

GRAPHICS *****
ADDICTIVITY *****
OVERALL *****



Wiggler Romantic Robot £6.95

Despite the cassettes cover that seems to promise yet another 'shoot the outspiller' game, Wiggler is more original and more fun to play than you might expect.

You play the part of a worm (that's novel for a start) taking part in a race around a garden. The garden is populated by assorted nasties, ants of various types and a superbly animated spider that is instant death if it touches you. Beyond the boundaries of the garden are an underground labyrinth and (although I haven't found them yet) a mansion and planet surface, so there's plenty of scope for wandering around and exploring.

Scattered along the way are various items including food to keep you going, anti-spiders for when you're caught in a tight spot, extra lives, and even a



Bruce Lee US Gold £7.95

I enjoyed playing this quite a lot. Basically, it's just a glorified plot-

form game in which you, Bruce Lee, have to go through the chambers of a Wizard's fortress collecting lanterns which will enable you to continue deeper into the fortress and eventually confront the Wizard himself.

But, what makes this so much more fun than the average platform game is the presence of your two foes, the Ninja and the wobbly Samurai called the Green Yamo. In most games of this type, the monsters which you must avoid are simply sprites moving in a fixed pattern. However, in this game, the Ninja and Yamo are fully animated opponents who chase you all around the temple, the Ninja bashing you over the head with his broken stick, and the Yamo leaping at you with a flying kick.

Of course, you can retaliate with flying and karate chops of your own, and must admit that I found this the most enjoyable aspect of the game. Working out how to get through the fortress chambers isn't terribly hard, but watching as your Bruce Lee figure leaps across the screen and kicks the Yamo all around the floor is great fun. I got my younger brother to play, using the two player option, and the house resounded to ones of "kick him in the eye" and "kick his head in", until well after midnight. It's a bit terribly childish, I know, but great fun nonetheless.

All the figures are very nicely animated and detailed, and you can make out who's who even when they're all on top of each other, kicking and punching for all they're worth. The chambers that you pass through are all well designed, and the ornate designs make a nice, colourful change from the usual type of graphics in platform games. My only criticism of the game is that your path through the fortress is fixed unlike the rooms in JSW which allow you to take any path through the house that you want. Consequently, after a few games I can get a bit boring having to go through the same route time after time, but this is where the combat saves the game from getting stale. Of course, if the fortress were more complicated than the memory wouldn't be available for the combat and animation, so the game as it is probably struck the right balance. Definitely worth getting, I think.

GRAPHICS *****
ADDICTIVITY *****
OVERALL *****



Stay Kool Bug Byte E6.95

Chuckie Egg 2 managed to add a couple of new features to the standard platform format, but Stay Kool is about as unoriginal an addition to the hordes of JSW clones as you can get. In fact, you could even say that it's more of a Mantic Miner clone than of the more modern JSW. There is one room in Stay Kool that is more or less a straight copy of one in MM (I think it was called Return of the Kong Beast, or something like that).

Even the graphics are a step backwards, for although the various "monster" sprites are animated adequately the figure of Luke Warm (the hero of the piece) is pretty slow moving, and very flickery.

The plot of the game, such as it is, is that Luke's spaceship has been damaged in a battle and that Luke, in order to launch his escape pod (that nash around the ship collecting fuel pods before the ship overheats. The logic of all this seems pretty dubious when you actually see the sort of rooms that the ship contains, but what the heck, it's your game.

Most of the rooms are quite well designed, being hard enough to require a bit of thought, but not so hard that you die instantly. And, as in JSW, you don't have to collect the objects in each room before moving on to the next, so if an object seems too hard to reach you can carry on exploring and come back later. And, as a matter of fact I did find the game interesting enough to want to carry on wandering through the rooms. Despite the simplicity of the game it is well enough designed to hold my attention. In fact, it's not a bad game at all really, it's just that it's so clone-like that I can't really get very ex-

ited about it. If it were a budget game say, £1.99/£2.50 it would be excellent value, but for £6.95 it's not top of my shopping list.

GRAPHICS *****
ADDICTIVITY *****
OVERALL *****



Chuckie Egg A & F Software E6.90

At long last the sequel to one of my all time favourite games has arrived. At first I was a bit disappointed to see that all the cute ducks and hens of the original game had been abandoned in favour of a more conventional platform game arrangement. But, Chuckie Egg 2 (or Checcie Egg as it is cutely subtitled due to its Easter release date) is still very enjoyable.

You must move Henhouse Harry around a large factory (120 rooms) and collect the ingredients to make Easter Eggs. Along the way you will meet manic hoovers, shaggy dogs, moles and other assorted deadly sprites. In addition, Chuckie Egg 2 has an arcade/adventure element that allows you to carry various objects (initially only two at a time) that you will need to solve some puzzles (for instance, in order to get past the shaggy dog, you must first collect a bone to distract him with).

Another adventure-type element is the inclusion of a SAVE game facility that comes in very handy, if you come across any screens that look too tricky, you can just SAVE the game pos-

tion, try to navigate the new screen, and, if you lose all your lives, you can just reload the SAVED game and try again.

The graphics are quite good, some of the sprites are very good, but the attribute problems of the original are still present and Harry himself seems to move rather more slowly than he used to (getting old perhaps?) But all things considered, if you're in the market for yet another platform game you could do worse than taking a bite out of Checcie Egg.

GRAPHICS *****
ADDICTIVITY *****
OVERALL *****



Death Star Interceptor System 3 Software E7.95

Some of the more game oriented "lines" have been saving about this, but I can't really see what all the fuss is about if I'm honest. Death Star Interceptor is a very competent piece of programming, but apart from the third screen it's really just space invaders with souped-up graphics.

The first screen is a bit of a bore. You have to launch your ship from a runway and steer it through some sort of portal. The whole thing lasts about five seconds and seems fairly hit or miss, as the ship never over-reacts to its controls. The launch is announced by some good speech synthesis, better than in Ghostbusters I think, but listening to this doesn't make the screen any more interesting to play.

The second screen is the Space Invaders Bit. The graphics are excellent, no doubt about it. The attacking ships start off as points moving against the stary background and growing and taking on shape as they zoom in on you, but you are still just stuck moving your ship left and right (with a small room for up and down movement) at the bottom of the screen, space invaders style.

The third screen is far and away the best. The action for once matches the graphics as you zoom along the trench searching for the Death Star's weak spot. The perspective graphics are excellent and the chase through the trench gets pretty frantic.

If you're looking for a shoot 'em up, then I suppose that this or Incentive's Moon Cresta are the zap games of the moment, but I'm afraid that for me the trench sequence on this just didn't make up for the other screens that you have to go through first.

GRAPHICS *****
ADDICTIVITY *****
OVERALL *****

good, or the plot which is extremely challenging, but the subtlety and range of control which is possible using only five controls either via a joystick or the keyboard.

The game continues the adventure of Maroc and his graphic representation is the same as in Avalon. However this is not just a simple case of reworking the plot to cash in on Avalon's success, as there are enough new features to make it a game in its own right. The screen is presented in the same



The plot is based on mythological characters and involves Maroc attempting to reconstruct the all-powerful Dragontorc. Maroc's almost impossible task is to prevent her from doing this and to rescue Merlyn who is being held prisoner by her. With the character interaction, locations which need mapping, puzzles to be solved and a specific task, this must be close to perfect in the implementation of adventuring in a graphic manner.

I find Maroc's tendency of



The House That Jack Built Thor £5.95

This program presents you with nineteen screens of cartoon quality scenes which you must discover and explore to find the hidden objects. Not content with having cats or dogs for pets Jack has a selection of very vicious monsters who wander around killing him on contact. The graphics are very well drawn and the animation is good. However the infamous Spectrum colour attributes problems which cause colours to overlap is rather evident, something which is almost unavoidable with the brightly coloured screens of this program.

The actual insert instructions contain an unforgivable error, the keys mentioned are ZX:/for LRUD, in actual fact they were DWJK in my version. A joystick option was provided.

Control is good, Jack moves positively and accurately. Some of the entrances and exits need specific directions to operate, you can move freely from location to location without having to collect the object first and many of the locations are ingeniously designed.

I enjoyed the program for about an hour and then got bored, I have considered re-running it from time to time but never got round to it. There doesn't appear to be enough variation in the action to make it really addictive. This would be an excellent game for those who enjoy the maze-these type of programs with excellent graphics.



Dragontorc Hewson Consulants £7.95

The amazing thing about this is not the graphics, which are superb, the sound which is very

way as Avalon, 3D perspective with the scroll at the bottom for messages and options. One of the new features is "Sensory Animation" which makes the characters react to you depending on how you act towards them. Most are initially rather aggressive!

bouncing off boundaries one that makes control difficult and frustrating, and the colour attributes sometimes overlap, but these are minor quibbles.

GRAPHICS *****
ADDICTIVITY *****
OVERALL *****

ZX

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SIGNALMAN

Duncan Munro has done a lot of research in Londonderry to ensure the accuracy of his signal box simulation

This program simulates the working of a modern signal box and is based on the actual working practice of the local Coleraine box. In order to get the details right, I spent some time with the signal man on a recent Saturday afternoon when traffic was quite busy. I had a very interesting time, away from the computer for a change, discussing and watching the actual operations and working methods.

The Coleraine Section incidentally was one of the first to be fitted with track circuiting, colour light signalling, and a route indicator board in the box in the late 1930's.

The Coleraine signal box has many interesting features, including control of two level crossing gates, a lifting cantilevered rail bridge across the river Bann, and control of trains on the main Belfast-Londonderry line as well as the branch line to Portrush. There are 48 levers in the lever frame so my computer simulation is a considerable simplification with only 111 16 levers. Nevertheless, the program does include all the essential features. These include full interlocking of the crossing gates with the signals and points levers through a king lever as in real life. The lever colour coding is also accurately represented within the limits of the Spectrum's 8 colours. It does not attempt however, to handle the various bell code exchange between adjacent signal boxes, as this would require a program in its own right, and also slow operation down to an unacceptable level. There may seem to be a lot of bells used but, in practice, a signal box is a surprisingly noisy place with different bells, buzzers, and telephones sounding every few minutes.

The program contains several novel features, including working in real time to a pre-set timetable. At the end of the program, the overall efficiency of the signalman is calculated and displayed. This takes into account both the efficiency in running the trains to the timetable and the delays imposed on the road traffic. This delay has been

made proportional to time on an exponential, rather than linear basis, so that a balance has to be achieved, as in real life, between running the trains on time, and keeping the road open to traffic for as long as possible.

Skill is required in efficient and effective route setting and driving the trains while in the section. The program is not 'fast moving' in the arcade game sense but rather corresponds to the speed of operation required in real life practice. The degree of difficulty can be changed by small alterations in the delay function exponential power value. A value of 2, for example, instead of 1.5 will increase road delays to the point where a high score is almost impossible. A demo mode option is included, allowing the user to familiarise himself with the lever codes and the operation of the gates, signals, points, trains, etc. merely by pressing one key when instructed.

Once a train is accepted and a route set up for it, the operator changes roles to become the engine driver. After driving the train to its correct place to stop signal, across a junction, or out of section, he reverts back to the signalman role.

The program structure and detailed instructions are described separately. However one or two items are noteworthy —

1. Due to the large number (37) of user-defined graphics, these are split into two sets and each set called up as needed by poking values into system variable 23675.
2. The program makes full use of Boolean operators (AND, NOT) to ensure correct signal interlocking with the gates, and to ensure correct subroutines are used to run the trains correctly at a points various possible scenarios, and is essential in directing the trains correctly at a points junction.

The method of directing the train at a junction, as I believe, somewhat unique, it is fully explained in the subsequent text.

Finally, the program requires 24.1K for the Basic listing and consequently re-

quires a 48K Spectrum.

It has been thoroughly tested and debugged. It is 'idiot proof' and will not permit trains to be driven while the gates are closed to rail traffic, neither can a train be driven past a signal at danger. It will also stop and request an immediate 'Accident Investigation' if two trains are allowed to collide, or are driven into the buffers.

Operating instructions

You are in charge of a Signal Box. Your section is controlled by colour lights based on British Signaling Practice. Seven trains will be offered to you in sequence of the operating timetable, from 18.00 hours onwards (you will find it useful to make a note of the timetable codes for reference). No more than 2 trains in section are permitted. The branch line train is a local rail bus. After discharging passengers, the rail bus must wait for the MAIN line train, and then be routed back via the DOWN BRANCH line. Therefore, the rail bus must cross over to the Down Line before you can accept an UP MAIN line train. The seventh and final train is a DOWN freight train which has to be diverted to the siding, and then all signals set to 'ON' and the crossing gates closed. Your score will then be shown, BUT NO SCORE IF YOU CRASH!

The score takes into account delays in routing of trains through your section and excessive delays to road traffic due to keeping the crossing gates closed. Car drivers' aggravation is indicated on an exponential rising decibel scale!

For safety reasons, the gates, and the signal levers are fully interlocked. Gates must be opened first before pulling off any other levers. The King lever interlock (labelled KI) must then be pulled off before you can pull off any signal levers. This sequence must be reversed before closing the gates (remember that closing the gates here means closing to rail traffic, not

road traffic).

The levers are colour coded (Yellow = distant, red = starter or home or advanced starter, black = ground signal, green = gate lever, magenta = king lever, and cyan = down line junction route indicator).

1 = 'ON' (at danger or caution)
0 = 'OFF' (clear)

So, to pull off the Down Starter, input 050. A demo mode operation is available to assist in familiarising the lever frame operation. When you have accepted a train, and set the route up, you change roles and become the engine driver. When you have driven the train to its correct position, i.e. up to signal at danger, or out of section, you will return to the box automatically. Otherwise key 'S' to return to the box.

A description of the train codes and the operating timetable are shown at start of the program. The train codes are alpha numeric, containing 5 characters. The first is a numeral, 1 to 4, giving the train description, the second and third characters are alpha and indicate the line on which the train is travelling when entering section, and the last two are digits showing the time due in section. Thus, '2DM05' signifies ordinary (stopping) passenger train due on the down main line at 1605 hours.



Lever interlocking

There are 3 types of interlocks — variables LDCK, KL and L IN — to ensure that:
a) the signals cannot be set to clear if gates are shut to rail traffic,
b) the gates cannot be shut if a signal is at clear.

As in real life practice, it is necessary to have an intermediate lever, called a KING lever, which must be pulled off before any signal lever is pulled. It must also be set back 'ON' before the gates can be opened or closed, when the gates are opened, they are physically locked in position by latch set in the road surface. The diagram illustrates the sequence of interlocking. '1' means lever is pulled 'OFF', '0' means lever is set 'ON'.

Program structure

Lines					
20-80	Train codes and timetable.		two trains already in section and whether a train has been accepted into section		lever routines including interlock setting (see text for details).
100-254	Define USR graphics and store first 17 characters at addresses 65366 upwards. Store remainder at addresses 64,000 and up.	1000-1090	Controls the lever frame operation and calls appropriate subroutine.		9000-9300
280 and 600 etc.	Pole system variable 23675 to tell up required set of graphics.	1100-1160	Finds starting coordinates of a train entering section and lights up route indicator	3300-4050	Operates signal levers, sets appropriate signal colour, changes the points, and sets signal interlock.
295-660	Draw layout (the draw statements are left in the original format of one number minus another. I found this was essential to the task of plotting and drawing to an exact scale) position and connecting any errors).	1170-1360	Main routine to drive trains.	5000-5380	Evaluates the track on which each train is standing. Sets the appropriate variables pt 1, pt 2, pt 3, pt 4, for train 1 and vt 1, vt 2, vt 3, vt 4, for train 2.
760-790	Add ink colours.	1400-1590	Accident Notices. Program stops if activated.		Returns to subroutines 2100-2220 to evaluate the correct direction to move S, W, NE, SE, SW, or NW for in keys 'S', 'W', or 'Q' or 'P' (see text for details).
600-605	Store lever codes and corresponding signal print coordinates for use in subsequent subroutines.	1600-1720	Warning Notices if incorrect lever operation attempted.	7000-7015	Subroutines to call up appropriate set of graphics.
865-877	Start the clock (see the Sinclair Manual).	1900-1950	Calculates the time, in minutes, that the gates have been opened and increments the value to the power 1.5 to give appreciation level on an exponentially rising scale of 'decibels' (nd).	8000-8060	Calculates the actual time for
900-965	Main control program — controls which subroutines to call depending on whether one or	2000-2040	Exit from driving routine, and return to signal box operation.		the digital clock display. Calculates the display final scores as separate performances against rail timetable operation and road traffic delay and also shows overall performance. Demonstration mode routine.
		2100-2220	Subroutines for trains 1 and 2 to determine new print positions, individual train codes.		Use the graphics mode key when typing the letters A, B, C, Q, etc. after the PRINT AT statements in lines 300, 305, 330, 360, 390-400, 410, 414, 416, 418, 620, 622, 620-642, 676, 677, 678, 750-790, BUT NOT in lines 850 or 652 or 654 or 600.
		3000-3070	Gets and King		Use graphics key again at lines 3180, 3208, 3218, 3219, 3222, 3225, 3270, 3277, 3278, 3284, 3285, 3287, 3356, 3378, and again at lines 3916 to 3950, but only the letter after the PRINT statement, not the letter after IF $q8 = "$

To open the gates:

At the start, LOCK=0
(gate lever)
KL=1 (DING lever)
Lni to L114)=1
(the signal lever
locks are all set
to 1).

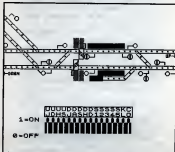
Pull off CD Open Gates.
LOCK=1

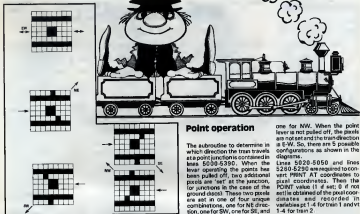
Pull off KL KL=0
Signal levers can now be pulled
off. (L1), etc. 01.

To shut the Gates:

All the signal levers must be
reset to ON (Lni to L114)=1).
Set on KL KL=1
Set on CD Close Gates
LOCK=0

LOCK	KL	L	
0	1	1	START — GATES CLOSED OPEN GATES PULL KING LEVER SET SIGNALS RESET SIGNALS RESET KING LEVER CLOSE GATES
1	1	1	
1	0	1	
1	0	0	
1	0	1	
1	1	1	
1	1	1	
0	1	1	
0	1	1	
0	1	1	





Point operation

The subroutine to determine in which direction the train travels at a point junction is contained in lines 5030-5390. When the lever operating the points has been pulled off, two additional pixels are 'set' at the junction, (or junctions in the case of the ground disc). These two pixels are set in one of four unique combinations, one for NE direction, one for SW, one for SE, and

one for NW. When the point lever is not pulled off, the pixels are not set and the train direction is E-W. So, there are 5 possible configurations as shown in the diagrams.

Lines 5020-5050 and lines 5250-5290 are required to convert PNT AT coordinates to pixel coordinates. Then the POINT value is set; 0 if not set, obtained of the pixel coordinates and recorded in variables pt 1-4 for train 1 and vt 1-4 for train 2.

```

5 CLEAR 63999
18 REM *Signalman* by D.J.Munro
20 REM train codes
25 PRINT AT 0,3;"DESCRIPTION
  CLASS"
30 PRINT AT 1,3;"-----
  -----"
35 PRINT AT 2,0;"EXPRESS PASSE
NGER" AT 2,25;"1"
40 PRINT AT 3,0;"ORDINARY PASS
ENDER" AT 3,25;"2"
45 PRINT AT 4,0;"EXPRESS FREIG
HT" AT 4,25;"3"
50 PRINT AT 5,0;"ORDINARY FREI
GHT" AT 5,25;"4"
55 PRINT N1;"Press any key to
continue": PAUSE 0: CLS
60 PRINT AT 0,12;"TIMETABLE"
65 PRINT AT 1,12;"-----"
70 PRINT AT 3,1;"DESCRIPTION
TIME DUE CODE"
72 PRINT AT 4,15;"IM SECTION"
74 PRINT AT 5,1;"-----
-----"
76 PRINT AT 6,0;"UP EXPRESS PA
SS. 1501 1UM01"
78 PRINT AT 7,0;"BRANCH ORD PA
SS. 1503 2UB03"
80 PRINT AT 8,0;"DOWN ORD PA
SS. 1505 2OM05"
82 PRINT AT 9,0;"UP EXPR. FREI

```

```

GHT 1509 2UM09"
84 PRINT AT 10,0;"BRANCH ORD P
ASS. 1512 2UB12"
86 PRINT AT 11,0;"UP ORD P
ASS. 1516 2UM16"
88 PRINT AT 12,0;"DOWN ORD FRE
IGHT 1520 4OM20"
90 PRINT N1;"Press any key to
continue": PAUSE 0: CLS
95 INPUT "PLEASE SET CAPS MODE
, THEN ENTER" : c$
100 PRINT AT 14,0;"PLEASE WAIT"
"
105 RESTORE
110 FOR n=1 TO 37
115 IF n>=10 THEN GO SUB 7010
120 READ a#
130 FOR x=B TO 7
140 READ a
150 POKE USR a#*x,a
160 NEXT x
170 NEXT n
175 REM route indicator light
180 DATA "a",0,0,0,24,24,0,0,0
181 REM up arrow
182 DATA "b",07,05,07,04,116,0,
0,0
184 DATA "c",4,2,127,2,4,0,0,0
185 REM down arrow
186 DATA "d",0,0,0,32,64,254,64
,32

```

SPECTRUM SIMULATION

```

188 DATA "e",8,8,8,286,178,178,
178,286
198 DATA "f",8,8,8,169,173,239,
235,169
191 REM road surface
192 DATA "g",171,85,171,85,171,
85,171,85
194 DATA "h",42,85,42,85,42,85,
42,85
195 REM gate warning lights
196 DATA "i",8,8,8,8,96,248,248
,96
198 DATA "j",6,13,15,6,8,8,8,8
199 REM right gate post
200 DATA "k",231,183,183,183,18
3,183,183,231
201 REM closed gates, right
202 DATA "l",255,129,193,193,16
1,185,181,211
203 DATA "m",283,173,157,133,13
1,131,129,255
204 REM closed gates, left
205 DATA "n",255,129,131,131,13
3,157,173,283
206 DATA "o",211,181,185,161,19
3,193,129,255
208 REM track section
209 DATA "p",8,255,8,24,24,8,25
8,8
210 REM left gate post
211 DATA "q",7,8,8,8,8,8,8,7
213 REM down line light arm
214 DATA "r",8,56,68,138,138,13
8,68,56
216 DATA "s",1,1,1,1,255,8,8,8
217 REM up line light arm
218 DATA "t",8,8,8,255,128,128,
128,128
220 DATA "u",56,68,138,138,138,
68,56,8
221 REM down line colour light
222 DATA "v",8,56,124,254,254,24
8,124,56
223 REM up line colour light
224 DATA "w",56,124,254,254,254,
124,56,8
225 REM junction indicator
226 DATA "x",24,12,6,3,1,8,8,8
227 REM ground disc on
228 DATA "y",68,98,153,153,153,
153,98,68
229 REM ground disc off
230 DATA "z",68,78,143,157,185,
241,98,68
231 REM ground disc area
232 DATA "1",128,128,128,128,28
8,8,8,8
236 DATA "2",8,8,8,255,1,1,1,1
237 REM junction arm
238 DATA "3",8,8,8,8,24,36,66,1
29
239 REM lever
240 DATA "4",8,24,68,68,68,68,6
8,24
241 REM lever frame
242 DATA "5",231,231,231,231,23
1,231,231,231
243 REM route indicator light
244 DATA "6",8,8,8,24,24,8,8,8
245 REM siding junction arm
246 DATA "7",1,1,1,1,255,8,8,8
247 REM up line open gates
248 DATA "8",255,129,138,132,13
3,142,177,255
250 DATA "9",255,141,113,225,33
,65,129,255
251 REM down line open gates
252 DATA "a",255,177,142,135,13
2,138,129,255
254 DATA "b",255,129,65,33,225,
113,141,255
288 GO SUB 7888
295 FOR y=8 TO 31
388 PRINT AT 9,y;"8"
385 PRINT AT 12,y;"8"
318 NEXT y
328 FOR x=3 TO 8
325 LET y=x-3
338 PRINT AT x,y;"8"
335 NEXT x
348 FOR x=6 TO 12
358 LET y=x-6
368 PRINT AT x,y;"8"
388 NEXT x
398 PRINT AT 18,11;"8"
392 PRINT AT 18,25;"8"
396 PRINT AT 11,18;"8"
398 PRINT AT 11,24;"8"
488 PRINT AT 13,23;"8"
482 PRINT AT 13,22;"8"
485 FOR y=17 TO 22
418 PRINT AT 14,y;"8"
412 NEXT y
413 PRINT AT 14,18;"8"
414 PRINT AT 18,38;"8" AT 13,8
;"8"
416 PRINT AT 7,13;"8" AT 8,131
;"8" AT 13,131;"8" AT 14,131;"8"
418 PRINT AT 8,151;"8" AT 13,121
;"8"
419 REM up line
428 PLOT 8,73: DRAW 255,8
422 PLOT 8,78: DRAW 255,8
423 REM down line
424 PLOT 8,97: DRAW 255,8
426 PLOT 8,182: DRAW 255,8
427 REM siding
428 PLOT 133,62: DRAW 46,8

```


SPECTRUM SIMULATION

```

876 PRINT AT 10,29;"HRS"
877 PRINT AT 10,25;"MIN"
878 PRINT AT 10,20;"SEC": KEEP .#1,2
8
888 INPUT "DEMO MODE? (Y/N)";q#
889 IF q#="Y" THEN GO TO 958#
890 GO SUB 900
891 IF tr># THEN GO SUB 1000:
LET cuard=cuard+r#; GO TO 900#
897 GO TO 898
900 REM ##### main program
901 LET nt1=#; LET nt2=#
910 IF tr1 AND tr2 THEN GO TO
965
920 GO SUB 3000+(tr#1#)
930 INPUT "ACCEPT CODE ";id#11"
7(Y/N)" ;q#
935 IF q#="Y" AND (tr1 OR tr2)
THEN LET tr=tr+1; GO TO 950
937 IF q#="Y" AND NOT tr1 AND N
OY tr2 THEN LET tr=1; LET nt1=
1; LET tr=tr+1; GO TO 956
940 IF q#="" THEN GO TO 930
945 IF q#="N" THEN GO TO 960
950 IF tr1 THEN LET tr2=1; LET
nt2=1; GO TO 956
954 LET tr=1; LET nt=1
956 PRINT AT 0,3;"TRAIN ";id#;"
accepted"
958 GO SUB 1000; GO SUB 1000; G
O SUB 1170; RETURN
960 IF NOT tr1 AND NOT tr2 THEN
GO SUB 1000; RETURN
965 GO SUB 1000; GO SUB 1170; R
ETURN
1000 REM lever frame operation
1005 GO SUB 1000
1010 IF LOCK THEN GO SUB 1000
1012 IF NOT LOCK THEN PRINT AT
6,61"
1015 INPUT "ENTER LEVER CODE";r#
1020 IF LEN r#(<)3 AND r#(<)"RS" T
HEN GO TO 1015
1025 IF r#="RS" THEN RETURN
1030 IF r#(1 TO 3)="COB" THEN G
O SUB 3200; GO TO 1010
1032 IF r#(1 TO 3)="KLB" THEN G
O SUB 3100; GO TO 1010
1034 IF r#(1 TO 3)="CO1" THEN G
O SUB 3250; GO TO 1010
1036 IF r#(1 TO 3)="KLI" THEN G
O SUB 3150; GO TO 1010
1038 IF r#(3)<)"# AND r#(3)<)"1
" THEN GO TO 1010
1039 IF r#(1)<)"U" AND r#(1)<)"D
" AND r#(1)<)"G" THEN GO TO 101
0
1040 REM first check interlocks

```

```

set for signal operation
1045 IF KL OR NOT LOCK THEN GO
SUB 1000; GO SUB 1000; GO TO 101
5
1050 REM ### find lever & signal
colour and print position
1000 GO SUB 3300
1005 GO TO 1010
1100 REM find entry point
1105 IF d#(2 TO 3)="US" AND nt1
THEN LET x(1)=3; LET y(1)=0
1110 IF d#(2 TO 3)="US" AND nt2
THEN LET x(2)=3; LET y(2)=0
1115 IF d#(2 TO 3)="UM" AND nt1
THEN LET x(1)=9; LET y(1)=0
1120 IF d#(2 TO 3)="UM" AND nt2
THEN LET x(2)=9; LET y(2)=0
1125 IF d#(2 TO 3)="BN" AND nt1
THEN LET x(1)=12; LET y(1)=31
1130 IF d#(2 TO 3)="OM" AND nt2
THEN LET x(2)=12; LET y(2)=31
1140 REM show train position
1145 IF nt1 THEN PRINT BRIGHT
11 OVER 11AT x(1),y(1))"Q"
1155 IF nt2 THEN PRINT BRIGHT
11 OVER 11AT x(2),y(2))"Q"
1160 RETURN
1170 REM ### drive train ###
1174 PRINT AT 0,3;" OPERATE TR
AIN CONTROLS "
1175 PRINT AT 1,3;"SHORT FLASH:
key 'S' or 'B' "
1176 PRINT AT 2,3;"LONG FLASH:
key 'B' or 'P' "
1177 PRINT AT 3,3;" Key 'S' t
o call box "
1178 PRINT AT 4,3;"
1180 REM #####tr1-short flash;
tr2-long flash
1182 IF tr2 THEN PRINT BRIGHT
0) OVER 11AT x(2),y(2))"Q"; PAUS
E 15
1183 IF tr2 THEN PRINT BRIGHT
1) OVER 11AT x(2),y(2))"Q"; PAUS
E 15
1184 IF tr1 THEN PRINT BRIGHT
0) OVER 11AT x(1),y(1))"Q"
1185 IF tr1 THEN PRINT BRIGHT
1) OVER 11AT x(1),y(1))"Q"
1186 IF INKEY#="" THEN GO TO 11
82
1190 IF tr1 THEN PRINT BRIGHT
0) OVER 11AT x(1),y(1))"Q"
1191 IF tr2 THEN PRINT BRIGHT
0) OVER 11AT x(2),y(2))"Q"; PAUS
E 15
1192 IF INKEY#="S" THEN GO TO 2
000

```

SPECTRUM SIMULATION

```

1193 IF tr1 THEN GO SUB 5000
1194 IF tr2 THEN GO SUB 5200
1195 IF NOT tr1 THEN LET pt1=0:
LET pt2=0: LET pt3=0: LET pt4=0
1196 IF NOT tr2 THEN LET vt1=0:
LET vt2=0: LET vt3=0: LET vt4=0
1200 REM *****check for signal at
danger
1202 IF INKEYS="0" AND x(1)<10 A
ND ATTR (x(1)-1,y(1)+1)=50 THEN
GO TO 2000
1204 IF INKEYS="5" AND x(1)>10 A
ND ATTR (x(1)+1,y(1)-1)=50 THEN
GO TO 2000
1206 IF INKEYS="P" AND x(2)<10 A
ND ATTR (x(2)-1,y(2)+1)=50 THEN
GO TO 2000
1208 IF INKEYS="R" AND x(2)>10 A
ND ATTR (x(2)+1,y(2)-1)=50 THEN
GO TO 2000
1210 IF INKEYS="5" OR INKEYS="R"
THEN GO SUB 2100
1220 IF INKEYS="B" OR INKEYS="P"
THEN GO SUB 2200
1230 REM ****check if train hit
buffers
1235 IF (y(1)<=17 AND x(1)=14 AN
D tr1) OR (y(2)<=17 AND x(2)=14
AND tr2) THEN GO TO 1500
1240 REM check for train out of
section
1244 IF (y(1)<0 OR y(1)>31) AND
tr1 THEN LET tr1=0: GO TO 2000
1245 IF (y(2)<0 OR y(2)>31) AND
tr2 THEN LET tr2=0: GO TO 2000
1290 REM *****check trains not
collided
1295 IF x(1)=x(2) AND y(1)=y(2)
THEN GO TO 1400
1350 REM If all O.K.,repeat for
next inkey entry
1355 IF tr1 THEN PRINT BRIDHT
1) OVER 1)AT x(1),y(1))"Q"
1356 IF tr2 THEN PRINT BRIDHT
1) OVER 1)AT x(2),y(2))"Q"
1358 BEEP .1,40
1360 GO TO 1190
1400 REM trains collided
1420 PRINT AT 0,0) FLASH 1) BRIG
HT 1) INK 2) "YOU CRASHED INTO O
THER TRAIN!"
1440 PRINT AT 1,0) FLASH 1) BRIG
HT 1) INK 2) "CONDUCT ACCIDENT IN
VESTIGATION!"
1460 GO TO 1550
1500 REM hit siding buffers
1520 PRINT AT 0,0) FLASH 1) BRIG
HT 1) INK 2) "YOU CRASHED INTO T
HE BUFFERS!"
1540 PRINT AT 1,0) FLASH 1) BRIG
HT 1) INK 2) "CONDUCT ACCIDENT IN
VESTIGATION!"
1550 PRINT AT 2,2) INK 2) " KE
Y 'R' TO TRY AGAIN"
1560 PRINT AT 3,2) INK 2) "
KEY 'E' TO END"
1565 FOR n=15 TO 10 STEP -1: BEE
P 10/n,n: NEXT n
1570 IF INKEYS="R" THEN RUN
1580 IF INKEYS="E" THEN STOP
1590 GO TO 1570
1600 REM warning routine -
attempting interlock override
1610 FOR n=1 TO 10
1620 BEEP .1,50
1630 NEXT n
1640 PRINT AT 1,3) FLASH 1) INK
2) " GATES MUST BE OPERATED!"
1650 PRINT AT 2,3) INK 2) " KIN
G LEVER MUST BE 'ON'"
1660 PRINT AT 3,3) INK 2) " ALL
SIGNALS MUST BE 'DN'"
1670 PRINT AT 4,3) INK 2)"PULL S
IGNAL IF KINGS LEVER OFF"
1680 PAUSE 100
1700 LET a0="
1710 PRINT OVER 1)AT 0,3)0)AT
1,3)0)AT 2,3)0)AT 3,3)0)AT 4,
3)0)
1720 RETURN
1800 REM lever frame header
1810 LET a0="
1820 PRINT AT 1,3) " OPERATE LE
VER FRAME"
1830 PRINT AT 2,3) " Key 'RS' w
hen route set."
1840 PRINT AT 3,3)0)AT 4,3)0)
1850 RETURN
1900 REM road traffic delay
1910 LET r=INT (1111*(FN t(1)14600
68)^(t/6)^(1.5))
1920 PRINT AT 4,6)"Aggro="rd)AT
6,16)"decibels"
1950 RETURN
2000 REM *****return to operate
signals
2002 IF de0 AND LOCK THEN GO B
UB 1900: GO TO 2020
2003 IF de0 AND NOT LOCK THEN
GO TO 2020
2005 LET a0="
2006 IF NOT LOCK THEN PRINT AT
1,3)0): GO TO 2015

```


SPECTRUM SIMULATION

```

2807 GO SUB 1900
2810 PRINT AT 1,3: FLASH 11"
      REM:ROAD TRAFFIC!  "
2815 PRINT AT 8,3:0*1AT 2,3:0*1A
T 3,3:0*1AT 4,3:0*
2820 BEEP 1,45: BEEP 1,45
2830 IF tr1 THEN PRINT BRIGHT
1) OVER 1:1AT x(1),y(1):"Q"
2835 IF tr2 THEN PRINT BRIGHT
1) OVER 1:1AT x(2),y(2):"Q"
2840 RETURN
2100 LET y(1)=y(1)+(INKEY="0")-
(INKEY="5")
2110 LET x(1)=x(1)+(INKEY="0" A
ND pt3)-(INKEY="0" AND pt1)+(IN
KEY="5" AND pt2)-(INKEY="5" AN
D pt4)
2120 RETURN
2200 LET y(2)=y(2)+(INKEY="P")-
(INKEY="R")
2210 LET x(2)=x(2)+(INKEY="P" A
ND vt3)-(INKEY="P" AND vt1)+(IN
KEY="R" AND vt2)-(INKEY="R" AN
D vt4)
2220 RETURN
3000 REM #####train codes for
scheduled arrival times:
1501,1503,1505,1509 hours.,etc.
3010 LET d="1UM01": RETURN
3020 LET d="2UM03": RETURN
3030 LET d="2DM05": RETURN
3040 LET d="3UM09": RETURN
3050 LET d="2UM12": RETURN
3060 LET d="2UM16": RETURN
3070 LET d="4DM20": RETURN
3100 REM open gates-pull off
king lever
3105 IF LOCK=0 THEN GO SUB 1600
: GO SUB 1800: RETURN
3120 PRINT AT 10,22: " "
3130 PRINT AT 21,22: INK 3:"0"
3135 LET KL=0
3140 BEEP .1,45: RETURN
3150 REM close gates-return
king lever
3151 REM first check all signals
set to danger
3152 FOR n=1 TO 14
3153 IF I(n)=0 THEN GO SUB 1600
: GO SUB 1800: RETURN
3154 NEXT n
3170 PRINT AT 21,22: INK 3:" "
3180 PRINT AT 10,22: INK 3:"0"
3185 LET KL=1
3190 BEEP .1,45: RETURN
3200 REM open gates
3201 REM check if KL set to ON.
3205 IF KL=0 THEN GO SUB 1600:
GO SUB 1800: RETURN
3207 PRINT AT 10,23: " "
3200 PRINT AT 21,23: INK 4:"0"
3210 GO SUB 7000
3216 FOR n=1 TO 5
3218 PRINT AT 7,15: INK 2:"I"AT
14,12: INK 2:"J": BEEP .3,30
3219 PRINT AT 7,15: INK 7:"I"AT
14,12: INK 7:"J": BEEP .3,30
3220 NEXT n
3221 PAUSE 20
3222 PRINT AT 9,14:"E"AT 12,13:
"E"
3223 PRINT AT 10,14: " "AT 11,13
:" "
3224 GO SUB 7010
3225 PRINT AT 0,13:"00"AT 13,13
:"31"
3227 LET ot=(FN t())#00000
3230 REM set gate lock to ON
3235 LET LOCK=1
3245 BEEP .3,30: BEEP .3,30: RET
URN
3250 REM close gates
3255 REM check if KL set to ON
3260 IF KL=0 THEN GO SUB 1600:
GO SUB 1800: RETURN
3265 PRINT AT 21,23: " "
3270 PRINT AT 10,23: INK 4:"0"
3273 GO SUB 7000
3276 FOR n=1 TO 5
3277 PRINT AT 7,15: INK 2:"I"AT
14,12: INK 2:"J": BEEP .3,30
3278 PRINT AT 7,15: INK 7:"I"AT
14,12: INK 7:"J": BEEP .3,30
3279 NEXT n
3280 PAUSE 20
3284 PRINT AT 0,13:"00"AT 13,13
:"00"
3285 PRINT AT 9,14:"L"AT 10,14:
"0"
3287 PRINT AT 11,13:"0"AT 12,13
:"0"
3290 LET LOCK=0
3292 BEEP .3,30: BEEP .3,30
3293 GO SUB 7010
3295 LET cuwr="cuwrtrd
3296 LET rd=0
3297 RETURN
3300 REM lever colour
3305 LET ik=2
3310 IF r*(1)="S" THEN LET ik=0
3312 IF r*(2)="D" THEN LET ik=6
3314 IF r*(1)="K" THEN LET ik=3
3316 IF r*(1 TO 2)="CD" THEN LE
T ik=4
3318 IF r*(1)="D" AND r*(2)="J"
THEN LET ik=5
3319 LET x=0
3320 FOR p=1 TO 27 STEP 2

```

SPECTRUM SIMULATION

```

3325 IF a*(p TO p+1)=r*(1 TO 2)
THEN LET x=7+(p+1)/2)
3338 NEXT p
3340 REM abort if no match
3345 IF x=0 THEN RETURN
3350 REM lever to 'on'
3355 IF r*(3)=*1* THEN PRINT AT
21,x) * *
3356 IF r*(3)=*1* THEN PRINT AT
10,x) INK lk) *
3370 REM lever to 'off'
3375 IF r*(3)=*0* THEN PRINT AT
10,x) * *
3376 IF r*(3)=*0* THEN PRINT AT
11,x) INK lk) *
3500 REM signal colour
3510 IF r*(1 TO 2)(>)*DJ* AND r*(
2)(>)*D* AND r*(3)=*1* THEN LET
lk=2
3515 IF r*(1 TO 2)(>)*DJ* AND r*(
1)(>)*G* AND r*(2)(>)*D* AND r*(3)
=*S* THEN LET lk=4
3517 IF r*(1)=*S* AND r*(3)=*0*
THEN LET lk=2
3520 IF r*(1 TO 2)=*DJ* AND r*(3)
)=*1* THEN LET lk=0
3530 IF r*(1 TO 2)=*DJ* AND r*(3)
)=*0* THEN LET lk=5
3535 IF r*(2)=*0* AND r*(3)=*1*
THEN LET lk=6
3540 IF r*(2)=*0* AND r*(3)=*0*
THEN LET lk=4
3600 REM now find position
3610 LET n=1: LET z=0
3620 FOR p=1 TO 27 STEP 2
3630 IF a*(p TO p+1)=r*(1 TO 2)
THEN LET x=VAL p*(n TO n+1): LE
T y=VAL p*(n+2 TO n+3): LET z=p:
LET p=27: GO TO 3650
3640 LET n=n+4
3650 NEXT p
3700 REM now find correct user
graphic
3700 IF x<3 OR x>8 THEN LET u=*
F*
3702 IF x=13 AND y<6 THEN LET
u=*E*
3705 IF (x=10 OR x=11 OR x=14) A
ND r*(3)=*0* THEN LET u=*I*
3709 IF (x=10 OR x=11 OR x=14) A
ND r*(3)=*1* THEN LET u=*H*
3715 IF x=13 AND y=6 THEN LET u
=*G*
3800 REM set signal interlock
3810 IF r*(3)=*1* THEN LET i((z
+1)/2)=1
3820 IF r*(3)=*0* THEN LET i((z
+1)/2)=0
3900 REM now alter signal
3910 IF u=*E* THEN PRINT INK
lk) AT x,y) *E*: BEEP .4,25
3920 IF u=*F* THEN PRINT INK
lk) AT x,y) *F*: BEEP .4,25
3930 IF u=*I* THEN PRINT INK
lk) AT x,y) *I*: BEEP .4,10
3940 IF u=*H* THEN PRINT INK
lk) AT x,y) *H*: BEEP .4,10
3950 IF u=*G* THEN PRINT INK
lk) AT x,y) *G*: BEEP .4,25
3960 REM now alter points
3970 IF r*(3)=*0* THEN LET a=0
3972 IF r*(3)=*1* THEN LET a=1
3975 LET a=r*(1 TO 2)
3980 IF a=*UJ* THEN PLOT OVER
a)50,98: PLOT OVER a)51,103
3990 IF a=*DJ* THEN PLOT OVER
a)27,103: PLOT OVER a)29,101:
PLOT OVER a)26,98: PLOT OVER a
)28,96: PLOT OVER a)50,74: PLOT
OVER a)51,79
4000 IF a=*S1* OR a=*S2* THEN
PLOT OVER a)76,79: PLOT OVER
a)77,74: PLOT OVER a)99,96: PLO
T OVER a)90,101
4010 IF a=*S3* OR a=*S4* THEN
PLOT OVER a)196,96: PLOT OVER
a)197,101: PLOT OVER a)210,74:
PLOT OVER a)219,79
4020 IF a=*S5* THEN PLOT OVER
a)194,77: PLOT OVER a)195,72
4050 RETURN
5000 REM calculate pixel coo'ds.
of train tr1
5020 LET q1=175-(x(1))#0)
5030 LET q2=160-(x(1))#0)
5040 LET p1=4+(y(1))#0)
5050 LET p2=3+(y(1))#0)
5100 REM now record if pixel set
5110 LET pt1=POINT (p1,q1)
5120 LET pt2=POINT (p2,q2)
5130 LET pt3=POINT (p1,q2)
5140 LET pt4=POINT (p2,q1)
5190 RETURN
5200 REM calculate pixel coo'ds.
of train tr2
5260 LET w1=175-(x(2))#0)
5270 LET w2=160-(x(2))#0)
5280 LET v1=4+(y(2))#0)
5290 LET v2=3+(y(2))#0)
5300 REM now record if pixel set
5350 LET vt1=POINT (v1,w1)
5360 LET vt2=POINT (v2,w2)
5370 LET vt3=POINT (v1,w2)
5380 LET vt4=POINT (v2,w1)
5390 RETURN
7000 REM first user graphic set
7005 POKE 23675,00: POKE 23676,2
55: RETURN

```

```

7810 REM second user graphic set
7815 POKE 23675,B: POKE 23676,25
8: RETURN
8888 REM calculate the time
8810 LET hr=INT (FN t1)
8820 LET min=INT ((FN t1)-hr)*60
)
8838 IF min<18 THEN PRINT AT 18
,25;hr:AT 18,27;:B":AT 18,28;min
: BEEP .01,28
8848 IF min)=18 THEN PRINT AT 1
8,25;hr:AT 18,27;min: BEEP .01,2
8
8868 RETURN
9000 REM #####calculate overall
performance
9010 CLG
9020 GO SUB 8888
9040 IF min<28 THEN PRINT AT 8
,81*GOOD RUNNING TO TIMETABLE*:
LET score=100: GO TO 9078
9050 IF min)=48 THEN PRINT AT 8
,81*OVER-RAN TIMETABLE BY >20min
s.": LET score=0: GO TO 9078
9060 LET score=INT (200-(54*min))
9070 PRINT AT 1,81*TRAIN RUNNING
-"|score|"%"
9100 LET norm=148
9110 IF cuard<norm THEN PRINT
AT 3,81*NORMAL ROAD DELAY*: LET
aggr=100: GO TO 9150
9120 LET aggr=INT ((148/cuard)*
100)
9150 PRINT AT 4,81*ROAD TRAFFIC=
"iaggr|"%"
9160 LET total=INT (aggr+score)
/2
9180 PRINT AT 4,81*OVERALL RATIN
G="|total|"%"
9200 PRINT AT 18,111*PROGRAM END
ED: "iAT 18,29;"hrs"
9300 STOP
9500 REM demo mode
9501 LET demo=1
9502 PRINT AT 1,61 INK 2;"DEMO M
ODE"
9503 PRINT AT 2,3;"PRESS 'ENTER'
KEY
"
9504 PRINT AT 3,3;"WATCH CODE AN
D SCREEN"
9505 DIM h=(28)
9506 LET c8=""
9507 REM #####accept UP EXPRESS
PASSENGER,"1UMB1"
9510 LET h8="CORKL08UB0UB08"
9515 LET m=13: LET nt1=1: LET nt
2=0: LET tr1=1: LET tr=1
9517 GO SUB 3008+(tr*18)
9520 INPUT "ACCEPT CODE "(i48);"
?(Y/N) Y"i14
9523 GO SUB 1100
9524 GO SUB 9900
9525 PRINT AT 4,3; FLASH i;"Key
'B'-drive out of section"
9526 GO SUB 1100
9527 REM #strain out of section
9528 REM #close gates
9530 PRINT AT 4,3;0#
9533 LET h8="UB1UH1US1K1LIC01"
9535 GO SUB 9900
9537 REM accept UP BRANCH ORDINA
RY PASSENGER,"20W03"
9540 LET h8="CORKL08UB0UB08"
9542 LET m=10: LET nt1=1: LET tr
1=1: LET tr=2
9545 GO SUB 3008+(tr*18)
9546 INPUT "ACCEPT CODE "(i48);"
?(Y/N) Y"i14
9548 GO SUB 1100: GO SUB 9900
9550 PRINT AT 4,3; FLASH i;"Key
'B'-drive to UP starter"
9551 GO SUB 1100
9552 REM #strain in section
9553 REM #close gates
9554 PRINT AT 4,3;0#
9556 LET h8="UJ1UH1K1LIC01"
9558 GO SUB 9900
9560 REM #accept DOWN ORDINARY
PASSENGER,"20W05"
9564 LET h8="CORKL080H0"
9565 LET m=7: LET nt1=0: LET nt2
=1: LET tr2=1: LET tr=3
9567 GO SUB 3008+(tr*18)
9568 INPUT "ACCEPT CODE "(i48);"
?(Y/N) Y"i14
9570 GO SUB 1100: GO SUB 9900
9573 PRINT AT 4,3; FLASH i;"Key
'B'-drive to DOWN starter"
9575 GO SUB 1100
9580 REM #strain in section
9581 REM #close gates
9582 PRINT AT 4,3;0#
9585 LET h8="DN1K1LIC01"
9587 GO SUB 9900
9589 REM #strain in section
9590 REM # open gates
9591 REM # set route for DOWN
MAIN PASSENGER
9593 LET h8="CORKL08080808"
9595 LET m=18
9597 GO SUB 9900
9600 PRINT AT 4,3; FLASH i;"Key
'B'-drive out of section"
9602 GO SUB 1100
9603 LET nt1=0: LET nt2=0: LET t
r2=0
9605 REM # train in section

```

```

9666 REM ## reset for UP BRANCH
PASSENGER
9688 PRINT AT 4,3:0#
9618 LET h#="0510A1G30US#
9615 GO SUB 9900
9617 PRINT AT 4,3) FLASH 1;"Key'
8'-run to down line-Key 5"
9618 PRINT AT 3,4) INK 2; FLASH
1;"Do NOT drive out of section"
9628 GO SUB 1180
9622 IF tr1=0 THEN CLS : GO TO
9655
9625 REM ## train in section
9626 REM ## reset for DOWN line
9628 PRINT AT 4,3:0#;AT 5,3:0#
9638 LET h#="051531A0#D30B00H#
9632 LET a=10
9633 GO SUB 9920
9635 PRINT AT 4,3) FLASH 1;"Key
'5'-drive out of section"
9638 GO SUB 1180
9648 REM ##trains out of section
9641 REM ##close gates
9645 PRINT AT 4,3:0#
9647 LET h#="0H10S1D1J1DA1K1L1C1"
9650 GO SUB 9900
9655 PRINT AT 1,6:1 INK
2;"END OF DEMO "
9657 REPEAT .5,50

9668 PRINT AT 2,0) FLASH 1;"Key
'5" for performance rating "
9662 PRINT AT 3,0) FLASH 1;"of f
irst 3 trains of timetable."
9665 IF INKEY#="5" THEN GO TO 9
888
9667 GO TO 9657
9920 REM ##nd lever code
9918 FOR e=1 TO a STEP 3
9920 LET r#="b#e TO e+2)
9925 INPUT "ENTER LEVER CODE "I
r#)1;#
9938 IF r#="C08" THEN GO SUB 32
88) GO TO 9972
9948 IF r#="K10" THEN GO SUB 31
88) GO TO 9972
9958 IF r#="C01" THEN GO SUB 32
58) GO TO 9972
9968 IF r#="K11" THEN GO SUB 31
58) GO TO 9972
9970 GO SUB 3300
9972 IF LOCK THEN GO SUB 1980
9973 IF NOT LOCK THEN PRINT AT
4,6:1 "
9975 NEXT e
9988 LET r#="R5"
9995 INPUT "ENTER LEVER CODE "I
r#)1;#
9998 RETURN

```

Tortoise Wise

More lines from a parent who gets left behind.



Some houses don't have chimneys anymore. Ours does. Chimneys can catch fire. Ours did. Last week.

"Don't panic," I screamed, as someone up in the soot an antenna roared. And no one else in the house did. I know that because as I phoned for the Fire Brigade I could not help but be impressed by the way my two sons calmly and quietly made their way past me to go upstairs.

In fact I did not see them again for the next half hour.

"Goodnight and Thank you," said the Fire Chief when it was all over. "I should get the boys in now. It's all safe, and it must be pretty cold out there." Boys? Out? Where?

I started after the happy firemen into the night. Then I saw them. My two sons, the

two heroes, standing together in the front garden, their faces drawn with anxiety. The eldest was clutching the Spectrum under one arm, his cassette recorder under the other and he had a tangle of lead around his neck. His younger brother stood guard over the portable T.V., a box of tapes and a bundle of magazines.

"We saved all the valuables!" they announced as I approached. "Is it safe to take them all back in now?" I didn't sleep too well that night.

One afternoon, a week earlier, our bumbling existence had been livened up by some bright spark a few doors away who had inadvertently done something shocking to the electronics cable supplying our house. We were without electricity for most of that evening

The old Tortoise handled the powerless hours in style. An old lamp, coffee on the camping stove, and a good book.

The hairs went rampant. The Spectrum sat silent and still in front of the dark screen. They settled its keys in vain. They gazed by candlelight. They paced around in the dark fringing and growling. Waiting for their lifeline to be reconnected.

"This is Boring," they moaned with the regularity of the pipe on a digital watch. "What can we do?"

"This has been the worst night of our lives," they wailed as they went to bed in Computerless Darkness. Can't be so easy to throw them off their stride, I wondered? That night I slept quite well, Tortoise wise.

Then there was the invitation to visit some people who had fi-

ed the noisy city to savor the tranquil delights of the country. We decided to go down and see them for a day.

"What will we do all day?" asked number two son from the back seat of the car.

"Play on their Spectrum of course," said his brother. "I remembered to bring some games. Did you?"

"Had on a moment!" I put in. "What makes you two think they will have a micro? Never mind a Spectrum. Not everyone has a computer in their home you know." Their jaws drop open and they turn a little pale. They inch closer to each other on the seat.

"They don't ??????" they gasp.

"They might not even have electricity," I told them.

"Oh no," they croaked in horror. "Not again."

"It's a hard life," I joked.

"It's the end of the world," they squawked. I chuckled quietly to myself and thought, "This balances things up somewhat. One up for the Tortoise in the great Race, it doesn't bother me." And for a while I did not feel as if I was quite so far behind.

De-bugger

Getting a program typed in is often only the start of your problems. Ed to the rescue.

Typing in a program is a useful exercise. Apart from the patience required, techniques learned and the end program to be used, probably the most educational part of it is tracking down the bugs introduced by yourself or occasionally by our publication system.

In debugging you gain a much deeper insight and understanding on how the program actually works than by merely typing it in, but tracking down these errors is an art in itself and needs some skill. So here are some tips to help you in your efforts when faced with that cryptic error report!

1 NEXT without FOR

Look back through the program, either the loop has not been set up — no related FOR 'letter' — No1 TO No2 line, or the letter has been re-used as an ordinary variable within the loop with a LET 'letter' = No.

2 Variable not found

This is one of the most common errors. Again, the problem may not lie in the line where the error was detected and reported. If there is only one variable, which may be one or more letters or a string (S) variable, then that is the problem. There may be more than one variable in the line section reported and you will have to identify the offending one. In a line PRINT AT Y,X:A\$ the output could be Y or X or A\$. To find out which of them is causing the problem (it may be more than one!) type in turn as a direct command:

```
PRINT Y Enter/Newline
PRINT X Enter/Newline
PRINT A$ Enter/Newline
```

Note which produces the error report. Now look back through the program printout for the line which sets it up — usually a LET or FOR command. Did you leave it out? Does the program get there or has a GOTO/GOSUB been wrongly addressed?



3 Subscript wrong

Connected with DIM A(N) or DIM A\$(N). If the number in the brackets on the line where the error is reported is greater than the one in the original DIM statement, is not an integer or is less than 1, then this report is generated. If the subscript — number in brackets — is a number then check and change, however, if it is a variable then follow the procedure for tracing variables. It has probably exceeded the limits, look for lines with the variable being altered with + * / : if necessary add limiting code. For example:

```
IF X > 10 THEN LET X = 10
```

4 Out of memory

As well as for programs which are too big, it may happen if the previous program set RAM:Before disappearing, enter CLEARUSR"";1 on the Spectrum: on the ZX81 SAVE the program, turn the machine off and on, then reload the program.

7 RETURN without GOSUB

Somehow the computer has reached a RETURN command other than via a GOSUB instruction. Check a GOTO hasn't been entered in place of a GOSUB. Check for a missing GOSUB.

8 Integer out of range

An integer (whole number) either as a number of variable is too big or small and you are attempting to do something like PRINT AT D,33 — not allowed! Check any variables involved as per report 2 and trace it back through the program looking for adjustments to it by + * / : Add limiting code if needed — see report 3

8 Out of DATA

A Spectrum problem. Check the number of DATA items match the number of READs, usually one (or more) has been missed out. Attempting to reread a DATA list without first using a RESTORE command will cause

this and it can happen on an auto start program (saved) with a LINE number. Good programming usually RESTOREs to the correct line number before using READ.

1 FOR without NEXT

See report 1 but this time the NEXT is missing!

Note that the letters I have used for examples could by ANY letters not just A\$, X, Y etc and depend on the particular choice of the programmer.

This is by no means a comprehensive list but I have tried to cover many of the most common error reports. Personally, I get almost as much satisfaction from debugging as I do from programming. I do assure you, however, that there is absolutely no truth in the rumour that we deliberately inject bugs into our listings in order to introduce you to the dubious delights of debugging!

Basic Hybrid Stack Queue

Advanced techniques discussed and presented by Frazer Melton of Lincolnshire.

STACKS & QUEUES — IN THEORY

A computer stack stores variables in the same way as a stack in "the real world". For example, if you put a £1 coin on a table, and on top of that a 1p, and on top of the 1p a 50p you will have made a stack of coins.

The first coin onto the stack — the £1 — is on the bottom of the stack. The last — the 50p — is on the top. In computer terms you have PUSHed the coins on to the stack. When it comes to taking the coins off the stack you are forced to do so in reverse order: first the 50p, then the 1p, and finally the £1. The last item onto the stack — in this case the 50p — is always the first off. Because of this, stacks are called LIFO structures (LIFO = "Last In: First Out").

In computer terms you have POPped the coins off the stack. Queues, in contrast to stacks, are FIFO structures (FIFO = "First In: First Out"). This means that the order of items onto a queue is the same as the order off.

Imagine a queue of people at a supermarket checkout. The person at the front of the queue is the first person to join the queue, will be the first to be served and the first to leave the queue. The person at the rear of the queue will have to wait for all those ahead to be served before he/she is served. The same terms (PUSH & POP) are used for movements of items onto (PUSH) and off (POP) a queue.

STACKS & QUEUES — IN PRACTICE

Both stacks and queues require an area of memory to be reserved for their use. In the stack/queue program listed below numerical array U() is set aside for this purpose. The maximum size of U() is set to the value of

LIMIT (Lines 9116 & 9117).

A variable called the Stack Pointer — SP — holds the location of the last item pushed onto the stack. Assuming the stack consists of variables A, B, and C — C being the most recent entry — the stack will look like this:



The line connecting SP to variable C indicates that the contents of SP are to be treated as the address of the top stack element in array U(). C is stored in U(SP-1). A is stored in U(SP-2).

The sequence of operations for a PUSH is as follows:

```
LET SP = SP + 1
LET U(SP) = T
```

— leaving the stack like this:



It is necessary to add one to the stack pointer before the data is written onto the stack because the stack pointer always points to the topmost item on the stack. The next free space is always at U(SP+1).

POP works on similar lines to PUSH, but here the data transfer is from the stack to the temporary variable T:

```
LET T = U(SP)
LET SP = SP - 1
```

which, by reversing the PUSH sequence, returns the stack to its original form:



Pushes and pops to and from a stack must be nested. This means that, in the previous example, A could not be popped off the stack until T, C and B had

been popped off. An example of correct nesting is: PUSH A, PUSH B, PUSH C, POP C, POP B, POP A. An example of incorrect nesting: PUSH A, PUSH B, POP A, POP B. (This fails because the value returned by POP A will be the value pushed on by PUSH B). Stack operations can be complex:

```
PUSH A, PUSH B, PUSH C,
POP C, POP B, PUSH E,
POP D, POP B, POP A
```

but they must always be correctly nested.

Queues need 2 pointers, one to tell the computer where to write data in, and another to tell it where to read data out. In the programs below QP (Queue pointer) is the data-out pointer, and SP (Stack pointer) is the data-in pointer. SP is common to the queue and stack to allow easy transfer of data between them, and to keep demands on computer memory to a minimum.

One consequence of having a common data entry point (through the stack pointer) is that a PUSH to the queue is identical to a PUSH to the stack. A POP from the queue, however, is opposite in effect to a stack POP: it it pops off the first variable to be pushed onto the stack/queue.

Assuming, once more, that variables A, B, and C have been PUSHed onto the stack (and queue), array U() will look like this:



SP points to the items most recently PUSHed onto the stack/queue. QP to the first item PUSHed onto the stack/queue.

A POP from the queue does this:

```
LET T = U(QP)
LET QP = QP + 1
```

leaving the stack/queue like this:



As you can see, both QP and SP move one place to the right (+1) for each item on the queue. To stop the queue running over the end of available memory, array U() is treated as a circular list or rosetack. This means that if at any time QP or SP exceed the upper limit of U() they will automatically have their values changed to 1 to point at the left-most (lowest subscript) element in array U. (Lines 9003 & 9023)

Strings can also be PUSHed and POPped, but, because they cannot be stored in a numerical array, the actual string of characters is dumped in string array US. Pointers to the first and last character are PUSHed onto the stack/queue.

The operations involved are complex but can be summarised:

PUSH String:

- 1) Write string into US
 - 2) PUSH pointer to first character onto stack/queue
 - 3) PUSH pointer to last character onto stack/queue
- POP String (off stack):**
- 1) POP pointer to last character (off stack)
 - 2) POP pointer to first character (off stack)
 - 3) Read string from US
- POP String (off queue):**

- 1) POP pointer to first character (off queue)
- 2) POP pointer to last character (off queue)
- 3) Read string from US in diagonalic form PUSH String might look like:

1) Write string into US



(A, B, and C are on the stack/queue before PUSH string)

2) PUSH pointer to first character onto stack/queue



3) PUSH pointer to last character onto stack/queue



POP (stack) string does the reverse.

1) POP pointer to last character off stack



2) POP pointer to first character off stack



3) Read string from US (into T4)



USING THE SUBROUTINES

All data movements between the stack/queue and your program are through the temporary variables TMP and T4.

PUSH var to Stack/Queue:
LET TMP = var
GOSUB PUSH TMP
POP var from Stack:
GOSUB POP S TMP

LET var = TMP
POP var from Queue:
GOSUB POP Q TMP
LET var = TMP
PUSH string to Stack/Queue

LET T4 = string\$
GOSUB PUSH STRING
POP string\$ from Stack:
GOSUB POP S STRING
LET string\$ = T4
POP string\$ from Queue:
GOSUB POP Q STRING
LET string\$ = T4

Lines 9001, 9002, 9011, 9012, 9021, 9022, 9031, 9032, 9057, 9058, 9067, 9068, 9071, 9076, 9087, 9090-7 detect error conditions (e.g. trying to POP a non-existent item or PUSHing too many items for array U to contain). If you can be certain that no such error conditions will occur they can be omitted.

Lines 9092 to 9097 form a "Jump Table". Whenever an error is detected the program jumps to one of these lines. In sum, they send the program to an error correcting subroutine. One possibility for such a subroutine is to have an alternate memory area for the stack/queue. The exact details are left to the stack/queue user.

Before the stack/queue is used it must be initialised. GOSUB 9070 at the start of your program will do this. Lines 9090 and 9094 dictate the size of the memory area for the stack/queue. You can put your own values in here (LET LIMIT = 50 and DIM U\$(200) are a useful size for a small program).



Stack and queue subroutines

```
9000 REM + + + PUSH TMP + + +
9001 LET COUNT = COUNT + 1
9002 IF COUNT > LIMIT THEN GOSUB STACK ERROR
9003 LET SP = SP + 1
9004 IF SP > LIMIT THEN LET SP = 1
9005 LET U(SP) = TMP
9006 RETURN
```

```
9010 REM + + + POP TMP + + +
9011 LET COUNT = COUNT - 1
9012 IF COUNT < 0 THEN GOSUB STACK ERROR + 1
9013 LET TMP = U(SP)
9014 LET SP = SP - 1
9015 IF SP < 1 THEN LET SP = LIMIT
9016 RETURN
```

```
9020 REM + + + POP Q TMP + + +
9021 LET COUNT = COUNT - 1
9022 IF COUNT < 0 THEN GOSUB STACK ERROR + 2
9023 LET TMP = U(Q)
9024 LET QP = QP + 1
9025 IF QP > LIMIT THEN LET QP = 1
9026 RETURN
```

Stack and queue (string) subroutines

```
9030 REM + + + PUSH STRING + + +
9031 LET OCCUPIED = OCCUPIED + LEN T4
9032 IF OCCUPIED > LEN U$ THEN GOSUB STACK ERROR + 3
```

```
9033 LET SEP = SP + LEN T4 - 1
9034 IF SEP > LEN U$ THEN GOTO 9043
```

```
9035 LET U$(SEP TO SEP + T4) = T4
```

```
9036 LET TMP = SEP
```

```
9037 GOSUB PUSH TMP
```

```
9038 LET TMP = SEP
```

```
9039 GOSUB PUSH TMP
```

```
9040 IF SEP = LEN U$ THEN LET SEP = 0
```

```
9041 LET SEP = SEP + 1
```

```
9042 RETURN
```

```
9043 LET CUT = LEN U$ - SEP + 1
```

```
9044 LET SEP = SEP - LEN U$
```

```
9045 LET U$(SEP TO SEP + T4) = (TO CUT)
```

```
9046 LET U$(1 TO SEP) = T4 (CUT + 1 TO )
```

```
9047 GOTO 9038
```

```
9050 REM + + + POP S STRING + + +
```

```
9051 GOSUB POP S TMP
```

```
9052 LET SEP = TMP
```

```
9053 GOSUB POP S TMP
```

```
9054 LET SEP = TMP
```

```
9055 LET T4 = U$(SEP TO SEP)
```

```
9056 IF SEP < SP + 1 THEN LET T4 = U$(SP TO 1) + U$(TO SEP)
```

```
9057 LET OCCUPIED = OCCUPIED - LEN T4
```

```
9058 IF OCCUPIED < 0 THEN GOSUB STACK ERROR + 4
```

```
9059 RETURN
```



```

9060 REM + + + + POP Q STRING + + + +
9061 GOSUB POP Q TMP
9062 LET QFP = TMP
9063 GOSUB POP Q TMP
9064 LET SEP = TMP
9065 LET TS = US (QFP TO SEP)
9066 IF SEP < QFP - 1 THEN LET TS = US (QFP
TO 1 + US ( TO SEP)
9067 LET OCCUPIED = OCCUPIED + LEN TS
9068 IF OCCUPIED < 0 THEN GOSUB STACK
ERROR + 5
9069 RETURN

```

Stack and queue initialisation routine

```

9070 REM INITIAL + + + + +
9071 LET OCCUPIED = 0
9072 LET PUSH TMP = 9000
9073 LET POP S TMP = 9010
9074 LET POP Q TMP = 9020
9075 LET PUSH STRING = 9030
9076 LET COUNT = 0
9077 LET POP S STRING = 9050
9078 LET POP Q STRING = 9060
? 9080 LET LIMIT = ???
9081 DIM U(LIMIT)
9082 LET SFP = 1
? 9084 DIM U+(???)
9085 LET SP = 0
9086 LET OP = 1
9087 LET STACK ERROR = 9092
9088 RETURN

```

```

9090 REM + + + + ERROR JUMP
TABLE + + + +
? 9092 GOTO 7??? (Stack error +)
? 9093 GOTO 7??? (+ 1)
? 9094 GOTO 7??? (+ 2)
? 9095 GOTO 7??? (+ 3)
? 9096 GOTO 7??? (+ 4)
? 9097 GOTO 7??? (+ 5)

```

LINES USED: 9000 to 9099

Variables used

COUNT	Number of items on stack/queue
LIMIT	Number of memory locations for stack/queue
STACK ERROR	First line of jump table
SP	Stack pointer
U()	Array containing stack/queue
TMP	Temporary variable
QP	Queue pointer
OCCUPIED	Number of characters on stack/queue
SEP	End of string in US
SFP	First free character in US
U#0	String array dump for stack/queue
TS	Temporary variable
PUSH TMP	First line of Sub "PUSH TMP"
CUT	Temporary variable
POP S TMP	First line of Sub "POP S TMP"
POP Q TMP	First line of Sub "POP Q TMP"
QFP	First character of string on queue
PUSH STRING	First line of Sub "PUSH STRING"
POP S STRING	First line of Sub "POP S STRING"
POP Q STRING	First line of Sub "POP Q STRING"

Micronet

Since Prim (the distributors of the VTX5000 modem adaptor for the Spectrum) ceased trading, it has been possible to buy a VTX5000 for discount prices as low as £50. This opens up a whole new world of microcomputer communications for even more Spectrum users. You don't have to call Prestel/Micronet. With the VTX5000, it is possible to call a variety of other services which use the 1200/75 baud asynchronous transmission protocol, such as the British Telecom FSS or Telecom Gold services, or a vast array of private videodata systems and bulletin boards.

Quite a few of these systems require the user to key ENTER (also known as RETURN) at the end of every input line. Normally the VTX5000 converts ENTER to the hash code that Prestel requires at the end of some commands and input message lines. To change your VTX5000 to work with these systems, press

BREAK while looking at one of the menus and type in the following line of BASIC:

```

800 INPUT #1:LET
#1 = # + CHR$ 13:GO SUB
#1:GO TO 2000

```

If you RUN this version of the program it will wait for a line of input. While it is waiting you can telephone the computer you want to use, when that answers with a whistle, switch the line switch from its upper to its lower position and replace the telephone handset. Most services require an initial RETURN code, so press ENTER. When you want to send more characters to the remote computer hold down CAPS SHIFT and press ENTER and the input line quotation marks will reappear. Unfortunately, the VTX5000 cannot receive characters from the remote computer while waiting for you to type in the line, so do not

delay too long before pressing ENTER again. Normally you should wait until the remote computer has finished before pressing CAPS SHIFT ENTER. On Telecom Gold you may need to send the RETURN code several times before the remote computer "wakes up", you may also find it useful to type the command:

TERM TYPE PRESTEL WRAPS

this causes the Telecom Gold computer to gauge at the end of every screenful of information. Of course, if you have one of the VTX5000s with a HomeLink power on screen rather than the standard Micronet power on screen you already know that you don't have to use your VTX5000 exclusively for Micronet or Prestel Microcomputing. HomeLink is a home banking service on Prestel run by the Nottingham Building Society. A Building Society is bound to have problems creating a home banking service, in that to be able to give you a cheque book it needs links

with a clearing bank. Nottingham Building Society overcame their clearing problems through an association with the Bank of Scotland. To confuse the issue, Bank of Scotland have since started their own separate home banking service on Prestel. In many ways the two services are very similar, allowing the VTX5000 user to pay bills and move money between accounts at any time of day or night. In conjunction with a credit card it is thus possible to order and pay for a wide variety of items through Prestel without ever leaving your armchair. The differences between the two home banking services come in the way they are funded. The Bank of Scotland service is openly funded by service charges, whereas the Nottingham Building Society HomeLink service depends on you investing several thousand pounds, for which you receive normal interest — but as this money is effectively tied up, the difference between the normal rate and the high premium rates available from some other Societies is available to NBS to pay for the service.

QL Reviews

John Donovan looks at some of the slowly emerging QL software.



Gumshoe Logic

This is not an adventure game but, a logical reasoning game.

You play the part of a Gumshoe detective in the 1930s, time of Gargansons and molls. Depending upon which difficulty level you select the game sets you an assignment for which you will be paid on completion. The problems take the form of reasoning problems such as "If

Bert is six foot tall and Fred is one foot shorter than Bert how tall is the Empire State building?" The problems are usually slightly easier than the except on level five.

The first assignment is to find out what racketeers each gang boss is involved in and also the name of his moll (girlfriend). The information is obtained by use of informants who all require payment. Each informant has a different price and also a different

degree of reliability. All of this is told to you so the game becomes a process of receiving information, sorting it and then buying more as cheaply as is possible. Once you have collected all the information and have satisfied yourself as to its reliability you may present your findings to your client who will either pay you or tell you that you are wrong. If you have been successful you will then receive another, harder assignment.

Gumshoe is well presented with little pictures of each of your informants on a selection of the appropriate menu. On the whole, Gumshoe is rather good but should not be confused with an adventure game, which it is not.

Megacycal Software, PO Box 6, Beknhead, Merseyside

The Lost Kingdom of Zkul

Zkul (pronounced 'skull') is a standard middle earth adventure scenario, with the usual dwarves, a wizard and a domed city. The adventure starts near a river and you have instructions from your Irons Dwarf to bring any treasures to his house in the forest.

The game combines the two main types of adventure game, the old style Hack & Slay, which had fighting and loads of monsters, and the more modern puzzle type, giving a strange hybrid. Thus, such commands as health and a hit point system are included giving a status for each character in the game that is reduced by fighting and increased by time. As well as this the game contains a number of very advanced puzzles which compare with any classic adventures.

The game vocabulary is very comprehensive allowing such structures as "What is XXX" and also giving hints as to what it understands by its responses. Another novel addition is the hint facility that has the program barking into the game if you get stuck anywhere and offering a hint in return for a reduction in your score, this offer does not have to be accepted but the hints received are usually very useful. Like the Hobbit, action in the game is in real time, however unlike the Hobbit the real time routine is run under interrupts so you can be typing a command in and the computer will interrupt you to tell you that something has happened, this can be very annoying, but does promote prompt responses.

The game is supplied on microdrive which has the ability to back itself up for security, and the allows Zkul to be loaded very quickly. Saves and Restores are also done to microdrive, with a notepad facility. On the whole I was rather disappointed by Zkul which had great promise but didn't really live up to expectations.

Talent Computer Systems, Cuzman Building, 101 St James Rd, Glasgow

Formula 1

Apart from the enjoyment of the game in itself, there is an interesting High-Score routine which can be easily adapted to work within your own programs.

This is really two programs that have been combined to produce one program. The first two lines dimension the arrays required by the high score routine, then there is the game itself, between lines 10 and 250, and finally a high score routine situated from line 3000 to the end. The high score routine requires about 2 1/2 K of memory, and the game needs enough memory for a full display file, i.e. 3 1/2 K. Together they require just 4K of memory.

In the driving skill game a road scrolls up the screen and you must steer your car, an 'H', down the road with the cursor keys 'S' and 'B' avoiding the black road edges and other cars, symbolised by inverse 'H's, which increase as your score increases. Your car leaves a trail of tyre marks behind as it travels. When you crash your score is displayed at the bottom of the road and the program executes the high score routine. If your score was lower than the fifth high score then the routine informs you and prints the five highest scores. If you gain a high score then you are asked to enter your initials and again the high scores are printed. When printing the high scores, if two or more scores are identical then they are given equal placings.

The high score routine could be used with almost any other game provided that the program it is to be used with obeys certain rules. First, the program must not use the arrays B or B\$. The score must be held in the variable S, and lastly line 9230 must contain either a RETURN, if the routine was called by a GOSUB instruction, or a GOTO to return it to the game, but at a line after the arrays mentioned above have been dimensioned.



Get into gear with P. Crighton's version of this ever popular game, driven all the way from Gravesend



Detailed notes about the program

Lines 2-93 dimension the arrays required by the high score routine.
 Lines 10-60 set up the variables used by the driving skill game.
 Lines 70-90 alter the position of the road
 Line 120 peeks the display file at the next position of the car.
 Line 130 increases the score
 Line 140 prints the road end and your car
 Line 150 prints the inverse H's to represent the other cars
 Line 160 jumps back to line 60 if you have not crashed
 Lines 170-190 flash your car when you crash.
 Line 200 prints your score at the bottom of the road.
 Lines 8000-89010 form a pause loop at the beginning of the high score routine
 Line 8030 checks if your score is lower than the fifth high score
 Lines 8040-8070 move the high scores down one place until it reaches the point where your score is to be placed and then jumps to line 8180.
 Line 8180 enters the subroutine to get initials.
 Lines 8190-8200 enter your score as a high score.
 Lines 8210-8310 print the high scores.
 Line 8320 jumps back to the game
 Lines 8400-8470 form a subroutine to save the program and high scores on tape
 Lines 8500-8530 subroutine to print lower score than the fifth high score

Lines 8600-8740 is a subroutine to print equal placings.
 Lines 8800-8830 subroutine to obtain initials.

Variables used for the game

C,D co-ordinates for road
 F for next loops
 S score
 W display file peek for a crash
 X,Y co-ordinates for car
 Z co-ordinates of previous position of car.

Variables used for the high score routine

B(x) High score x.
 B9(x) initials x.
 F for next loops.
 G for next loops
 H current initials
 S current score.
 X for next loops.
 Z save name.

Graphics Notes

Line 140 2 inverse spaces, 4 graphic A's, 2 inverse spaces, 1 graphic H.
 Line 150 1 inverse H.
 Line 160 1 inverse H
 Line 8220 9 inverse spaces, inverse "HIGHEST SCORES", 9 inverse spaces



```

1 REM SET UP ARRAYS
2 DIM B(5)
3 DIM B*(5,4)
5 REM DRIVING SKILL GAME
10 LET C=21
20 LET D=12
30 LET X=8
40 LET Y=16
50 LET S=0
60 LET Z=Y
70 LET D=D+(50N(16-(RND*32)))
80 IF D<0 THEN LET D=0
90 IF D>23 THEN LET D=23
100 SCROLL
110 LET Y=Y-(INKEY#="5")+(INKEY#="B")
120 LET W=PEEK ((PEEK 16396+256

```

```

*PEEK 16397)+265+Y)
130 LET B=B+1
135 REM GRAPHICS IN NEXT LINE
ARE 2 INVERSE SPACES +
4 GRAPHIC KEY "A" +
2 INVERSE SPACES THEN
A GRAPHIC KEY "H"
140 PRINT AT C,D;"",TAB
31;" ";AT X,Y;"H";AT X-1,Z;"B"
150 IF RND>(1.65-B/2000) THEN PR
INT AT C,D+(RND*3+2);"B"
160 IF W<>120 AND W<>173 THEN G
OTO 60
170 FOR F=8 TO 15
180 PRINT AT X,Y;"B";AT X,Y;"H"
;AT X,Y;" "
190 NEXT F

```

ZX81 GAME

```

200 PRINT AT X,Y;"H";AT 21,D;"B
CORE;" ;B
8999 REM HI-SCORE ROUTINE
9000 FOR X=0 TO 100
9010 NEXT X
9020 CLS
9029 REM CHECK IF SCORE IS
      LESS THAN FIFTH
      HI-SCORE
9030 IF B<B(5) THEN GOTO 9500
9040 FOR B=1 TO 5
9049 REM FIND WHICH HI-SCORE
      THE CURRENT SCORE IS
9050 IF B<B(B) THEN NEXT B
9060 IF B=5 THEN GOTO 9100
9070 LET B(5)=B(4)
9080 LET B*(5)=B*(4)
9090 IF B=4 THEN GOTO 9100
9100 LET B(4)=B(3)
9110 LET B*(4)=B*(3)
9120 IF B=3 THEN GOTO 9100
9130 LET B(3)=B(2)
9140 LET B*(3)=B*(2)
9150 IF B=2 THEN GOTO 9100
9160 LET B(2)=B(1)
9170 LET B*(2)=B*(1)
9180 GOSUB 9000
9190 LET B(0)=B
9200 LET B*(0)=I*
9209 REM PRINT HI-SCORES
9210 CLS
9220 PRINT "
9230 PRINT "POSITION SCORE
      INITIALS"
9240 FOR F=1 TO 5
9250 PRINT AT F*2+2,3;F;TAB 14;B
      (F);TAB 25;B*(F)
9260 IF F<5 THEN IF B(F)=B(F+1)
      THEN GOSUB 9000
9270 NEXT F
9280 PRINT AT 19,0;"PRESS B TO S
      AVE",,"OR ANY OTHER KEY TO PLAY
      AGAIN"
9290 IF INKEY#="" THEN GOTO 940
      0
9300 IF INKEY#="" THEN GOTO 9280

9310 CLS
9320 GOTO 10

9399 REM SAVE ROUTINE
9400 CLG
9410 PRINT "SAVE ROUTINE",,"EN
      TER PROGRAM NAME",,"
9420 INPUT I*
9430 PRINT "PRESS ANY KEY TO SAV
      E"
9440 IF INKEY#="" THEN GOTO 9440

9450 SAVE I*
9460 CLS
9470 GOTO 9210
9499 REM PRINT LOWER SCORE
      THAN 5TH HI-SCORE
9500 PRINT "YOU HAVE A LOWER SCO
      RE THAN FIFTH",,"BETTER LU
      CK NEXT TIME"
9510 FOR F=0 TO 60
9520 NEXT F
9530 GOTO 9210
9599 REM PRINTS EQUAL PLACES
9600 PRINT AT F*2+4,3;F;TAB 14;B
      (F+1);TAB 25;B*(F+1)
9610 IF F+2<=5 THEN IF B(F+2)=B(
      F) THEN GOTO 9640
9620 LET F=F+1
9630 RETURN
9640 PRINT AT F*2+6,3;F;TAB 14;B
      (F+2);TAB 25;B*(F+2)
9650 IF F+3<=5 THEN IF B(F+3)=B(
      F) THEN GOTO 9600
9660 LET F=F+2
9670 RETURN
9680 PRINT AT F*2+8,3;F;TAB 14;B
      (F+3);TAB 25;B*(F+3)
9690 IF F+4<=5 THEN IF B(F+4)=B(
      F) THEN GOTO 9720
9700 LET F=F+3
9710 RETURN
9720 PRINT AT F*2+10,3;F;TAB 14;
      B(F+4);TAB 25;B*(F+4)
9730 LET F=F+4
9740 RETURN
9799 REM INPUT INITIALS
9800 PRINT "YOUR POSITION IS ";B
      ,,"INPUT YOUR INITIALS"
9810 INPUT I*
9820 PRINT AT 0,0;"
      "
9830 RETURN

```

QUICKSOFT

Clive Smith, the terror of the software scene, passes judgement on some new software

Space Shuttle Activision Spectrum 48K £4.95

An enterprise based on the American space shuttle will tell you what you have found out to your satisfaction and back. The game you are involved in for each hour becomes available and more than to Earth, making it more difficult as a possible alternative of you.

The game starts with a very simple control system. You will find a control panel with a 4 x 4 grid of buttons. You will find a control panel with a 4 x 4 grid of buttons. You will find a control panel with a 4 x 4 grid of buttons. You will find a control panel with a 4 x 4 grid of buttons.

When I found it to be a very simple control system. You will find a control panel with a 4 x 4 grid of buttons. You will find a control panel with a 4 x 4 grid of buttons. You will find a control panel with a 4 x 4 grid of buttons.

When I found it to be a very simple control system. You will find a control panel with a 4 x 4 grid of buttons. You will find a control panel with a 4 x 4 grid of buttons. You will find a control panel with a 4 x 4 grid of buttons.

The top half of the screen is a display of the shuttle and the bottom half is the control panel. The control panel is a 4 x 4 grid of buttons. You will find a control panel with a 4 x 4 grid of buttons. You will find a control panel with a 4 x 4 grid of buttons.

As the shuttle moves, you will find a control panel with a 4 x 4 grid of buttons. You will find a control panel with a 4 x 4 grid of buttons. You will find a control panel with a 4 x 4 grid of buttons.

When you have finished through the controls, you will find a control panel with a 4 x 4 grid of buttons. You will find a control panel with a 4 x 4 grid of buttons. You will find a control panel with a 4 x 4 grid of buttons.

One of the effects of the game is that you will find a control panel with a 4 x 4 grid of buttons. You will find a control panel with a 4 x 4 grid of buttons. You will find a control panel with a 4 x 4 grid of buttons.

At the point I was hoping to see the controls, you will find a control panel with a 4 x 4 grid of buttons. You will find a control panel with a 4 x 4 grid of buttons. You will find a control panel with a 4 x 4 grid of buttons.

Once before the results you see the control panel with a 4 x 4 grid of buttons. You will find a control panel with a 4 x 4 grid of buttons. You will find a control panel with a 4 x 4 grid of buttons.

To sum up, I thought the game is a very simple control system. You will find a control panel with a 4 x 4 grid of buttons. You will find a control panel with a 4 x 4 grid of buttons. You will find a control panel with a 4 x 4 grid of buttons.

MINI OFFICE Database Software Spectrum 48K £4.95

A package of mini business programs on one tape. Do you still use your old word processor and database and on the other a spreadsheet and graphics program?

These programs do have their own merits and you will find a control panel with a 4 x 4 grid of buttons. You will find a control panel with a 4 x 4 grid of buttons. You will find a control panel with a 4 x 4 grid of buttons.

The last but not least, a word processor with a number of features. You will find a control panel with a 4 x 4 grid of buttons. You will find a control panel with a 4 x 4 grid of buttons. You will find a control panel with a 4 x 4 grid of buttons.

Moving on along the tape is the spreadsheet. You will find a control panel with a 4 x 4 grid of buttons. You will find a control panel with a 4 x 4 grid of buttons. You will find a control panel with a 4 x 4 grid of buttons.

Finally, you will find a control panel with a 4 x 4 grid of buttons. You will find a control panel with a 4 x 4 grid of buttons. You will find a control panel with a 4 x 4 grid of buttons.

It always does the right at the moment. If you find it to be a very simple control system. You will find a control panel with a 4 x 4 grid of buttons. You will find a control panel with a 4 x 4 grid of buttons.

The spreadsheet has 20 columns and 20 rows and can perform most of the functions of a spreadsheet. You will find a control panel with a 4 x 4 grid of buttons. You will find a control panel with a 4 x 4 grid of buttons.

Overall, it is a very simple control system. You will find a control panel with a 4 x 4 grid of buttons. You will find a control panel with a 4 x 4 grid of buttons. You will find a control panel with a 4 x 4 grid of buttons.

KNITLOAD Data View Software Spectrum 48K £4.95

Knitload is the first of its kind. You will find a control panel with a 4 x 4 grid of buttons. You will find a control panel with a 4 x 4 grid of buttons. You will find a control panel with a 4 x 4 grid of buttons.

It is a very simple control system. You will find a control panel with a 4 x 4 grid of buttons. You will find a control panel with a 4 x 4 grid of buttons. You will find a control panel with a 4 x 4 grid of buttons.

For the technical user, you will find a control panel with a 4 x 4 grid of buttons. You will find a control panel with a 4 x 4 grid of buttons. You will find a control panel with a 4 x 4 grid of buttons.

Overall, it is a very simple control system. You will find a control panel with a 4 x 4 grid of buttons. You will find a control panel with a 4 x 4 grid of buttons. You will find a control panel with a 4 x 4 grid of buttons.

FIGURE 3: PRINTING CHARACTERISTICS FOR EACH PRINTING ENGINE

Paper	Characteristics	
	Speed	Quality
10	1	10
15	22	15
18	45	25
20	75	40
25	150	55
30	250	75
35	400	90
40	600	100
45	900	110

Figure 3

Some Tips

A few old-time techniques work just as well today. First, it's no bad idea to make sure you're printing on the right paper. Most computers print on 8.5x11 inch paper, but some older models print on 8.5x14 inch paper. Check the paper size before you print. Second, make sure you're printing on the right paper. Most computers print on 8.5x11 inch paper, but some older models print on 8.5x14 inch paper. Check the paper size before you print. Third, make sure you're printing on the right paper. Most computers print on 8.5x11 inch paper, but some older models print on 8.5x14 inch paper. Check the paper size before you print.

some file are labeled with a .k extension. If you're using a laser printer, you'll need to print on laser paper. Most computers print on 8.5x11 inch paper, but some older models print on 8.5x14 inch paper. Check the paper size before you print.

If you're using a laser printer, you'll need to print on laser paper. Most computers print on 8.5x11 inch paper, but some older models print on 8.5x14 inch paper. Check the paper size before you print. If you're using a laser printer, you'll need to print on laser paper. Most computers print on 8.5x11 inch paper, but some older models print on 8.5x14 inch paper. Check the paper size before you print.



FIGURE 4: PRINTING CHARACTERISTICS FOR EACH PRINTING ENGINE AND QUALITY OF PAPER

Printing Characteristics

Paper	Characteristics				Quality			
	Speed	Quality	Cost	Resolution	Resolution	Resolution	Resolution	Resolution
10	1	10	10	10	10	10	10	10
15	22	15	15	15	15	15	15	15
18	45	25	25	25	25	25	25	25
20	75	40	40	40	40	40	40	40
25	150	55	55	55	55	55	55	55
30	250	75	75	75	75	75	75	75
35	400	90	90	90	90	90	90	90
40	600	100	100	100	100	100	100	100
45	900	110	110	110	110	110	110	110

Figure 4



Problem page

David Nowotnik answers your questions

RAMTOP

Dear David,
I have just read your article on "First Steps in Machine Code". I was confused when you said that:

10 POKE 16388,47
20 POKE 16389,117

lowers RAMTOP on the ZX01 to 29999. Could you explain how changing these addresses affects RAMTOP?

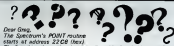
Ken Duda,
Northlake, Illinois, USA

Dear Ken,
Sorry if it wasn't clear, but this is how it works. The ZX01 stores some variables (system variables) which are important to its operation. One of these variables is the position of RAMTOP. This variable is stored in two bytes, at addresses 16388 and 16389. The position of RAMTOP is calculated as the value in 16388 plus 256 times the value in 16389 (47 + 256 x 117 = 29999). The position of RAMTOP is normally set by the computer on power-up, when it determines how much RAM is available. But, you can alter RAMTOP by placing new values in the addresses 16388 and 16389. As I explain elsewhere in this issue, this has to be done with care.

Fill-in

Dear David,
I am attempting to write a machine code program to fill in shapes drawn on the screen. I am having problems because I do not know where the ROM's POINT routine is situated. Could you please tell me where this is, and how to use it?

Greg Woods,
Beyrhore, Lancaster



Dear Greg,
The Spectrum's POINT routine starts at address 22CB (hex). The first thing the routine does is to pull from the calculator stack the x and y coordinates, and place them into registers B and C. In your routine, you could avoid this by placing the x and y values directly into B and C, then calling 22CE. The routine places the value T (for x) or D (for y) into the calculator stack, from where you can retrieve it.

Vertical strings

Dear David,
Before owning a Spectrum, I had a Tandy Model 1. With the Tandy, it was possible to assemble what I called 'vertical strings', e.g.

```
LET @ = "123" + CHR(26)
+ CHR(24) + CHR(24) + "456"
```

where CHR(26) = cursor down, and CHR(24) = cursor left. The command PRINT @ then gives:

```
123
456
```

This doesn't appear to work when using the Spectrum cursor codes (10 and 8) in the same way. The command PRINT @ gives:

```
456
```

where backspace works, but line feed does not, so "123" is overwritten by "456". Can I assemble 'vertical strings' on the Spectrum?

P. V. Bamfield
Bighorn, East Sussex

Dear Mr. Bamfield,
You've spotted an interesting "bug" in the Spectrum, the failure of the up and down cursor control characters to work with PRINT. There are a number of ways of overcoming this, if you want 'vertical strings'. For the simple example you give, you could easily use the 'ENTER' control character (13), that is:

```
LET @ = "123" + CHR(13)
+ "456"
```

This doesn't give you much flexibility, but you can get that with the 'AT' control character (21). If you use PRINT CHR(22), then the Spectrum thinks that the next two characters to be 'PRINTed' are the coordinates used with AT, for example:

```
LET @ = "123" + CHR(22) +
CHR(8) + CHR(4) + "456"
```

then PRINT @, and you'll get '123' at the top left of the screen, and '456' starting at position 6,4.

R.A.T.

Dear David,
I recently purchased a R.A.T. Remote Control Transmitter for use with my 48K Spectrum. I am unable to get any results with the games tapes I already have; apparently they are not Kempston Joystick compatible. Can I overcome this? Can I use game programs from listings in 'ZX Computing' with this device?

J. W. Shaw,
Ashurst, Southampton

Dear Mr. Shaw,
There are a number of joystick systems for the Spectrum, but the two most popular are, the Kempston, and Sinclair's own with their ZX Interface 2. These two are incompatible, so a game written for one cannot work with the other system. Most games following the use of joysticks are written for use with Kempston joysticks, and the R.A.T. device has adopted the system. So, you're unlikely not to have some games which work with R.A.T. Virtually all commercially available games are written in machine code, so the joystick 'standard' is embedded in them, with little opportunity for the average user of changing that standard.

Program listings are a different matter. The R.A.T. is supplied with detailed instructions, including how to write BASIC (and machine code) instructions to 'listen' to your RAT commands. So, you should be able to modify listings according to those instructions.

Tick-Tock

Dear David,
The internal clock on the Sinclair QL is very useful for games in which time is important. However, I'm not too sure how to set it to zero. Can you help?

Robin Miller,
Aylesbury, Bucks

Dear Robin,
If you are not concerned about the date stored by the QL's internal clock, then the simplest way of resetting the clock is the instruction:

```
ADATE (- DATE)
```

This 'zeros' the date, as well as the time.

Conversion tips

A guide to ZX81/Spectrum program conversions from David Nowotnik.

The versions of BASIC offered by the two ZX computers are so similar that many programs for one can be used by the other. The ZX81 has only two commands which are not present on the Spectrum, SCROLL and UNPLOT, and these should cause you few problems when converting ZX81 programs to the Spec-

trum (see Table 1).

There are quite a lot of commands and functions on the Spectrum which are not available on the ZX81. A list of these appears in Table 4. The stars indicate those commands and functions for which there is no simple translation to ZX81 BASIC. Those for colour and sound can be omitted;

but you will have to find some alternative for the high resolution and file I/O commands.

The command PLOT appears on both computers, but the effect is quite different, so beware! Another tip: PEEK and POKE should be used with caution. In conversion, addresses will almost certainly have to be changed. Some of those

changes appear in the tables. A command such as POKE USR "a" . . . on the Spectrum indicates User Defined Graphics; ZX81 users don't have the facility, so you'll have to omit this and use a standard character instead.

ZX81	Spectrum	Comments
SCROLL	RANDOMISE USR 3582 or LET T=USR 3582	If the program uses random numbers, they could become rather predictable with the first option. If so, use the second, using a variable (in this case t) which is otherwise not used.
PLOT Y,X	PRINT AT 21 - Y/2,X/2;	Print the appropriate quarter square graphics character.
UNPLOT Y,X	PRINT AT 21 - Y/2,X/2;	Print a space, or the appropriate quarter square graphics character.

Table 1 ZX81 to Spectrum conversions

Spectrum	ZX81	Comments
BIN eg LET y=BIN 10010101	LET y=(decimal no.) Conversion to decimal: 10010101=149 128 64 32 16 8 4 2 1 Add these numbers together when a 1 appears at the appropriate position in binary.	BIN allows the representation of a number in binary. On the ZX81 use the decimal equivalent, but beware; BIN is often used with User Defined Graphics, which are not available on the ZX81.
READ/DATA eg READ x,y DATA 50,80	LET LET X=60 LET Y=80	READ and DATA are used to store a lot of information in a program. Use LET instead.
DEF FN and FN eg DEF fn(x)=SQR x LET t=FN w1	LET X6="SQR X" LET X=1 LET Y=VAL X#	The defined function can appear in a string. Use the keyword for built-in functions (eg SQRI). The equivalent of FN may need 2 lines, as shown.
PLOT	no equivalent	
SCREEN# eg LET a=SCREEN# x,y	LET A=PEEK(PEEK 16306 +256*PEEK 16307 + 1 + Y + 33*X)	Used in interactive games to detect characters in the display file. Note — this formula only works when a RAM pack is fitted.

Table 2 Spectrum to ZX81 conversions.

ZX81	Spectrum	Comments
1 FRAMES POKE 16436,266 POKE 16437,255	POKE 23672,0:POKE 23673,0	Both computers have a counter which accurately varies by 50 every second. In the example, use the first line to start the 'clock'. The variable T will have the time in seconds after the start. The counter can only be used for 10 minutes.
LET T=(165535-PEEK 16436-266*PEEK 16437) /50	LET T=(PEEK 23672+266* PEEK 23673)/50	
2 Line number zero	POKE 23756,0 (As the start of BASIC can move, eg with microdrives) use with caution.	Converts the first line of a program to line number zero, which cannot be edited, and so is protected.
POKE 16610,0		
3 RAMTOP POKE 16388,X-256*INT (X/256) POKE 16389,INT (X/258)	CLEAR x	Creates a safe area at the top of RAM starting at address x, for storing data, machine code etc.

Table 3 General Interconversion Aids.



BEEP	*	FORMAT	*	ATTR	*
BORDER	*	INK	*	BIN	*
BRIGHT	*	INVERSE	*	FN	*
CAT	*	MERGE	*	N	*
CIRCLE	*	MOVE	*	OVER	*
CLOSE	*	OPEN	*	POINT	*
DATA	*	OUT	*	SCREENS	*
DEF FN	*	PAPER	*	VALS	*
DRAW	*	READ	*		
ERASE	*	RESTORE	*		
FLASH	*	VERIFY	*		

Table 4 Spectrum functions not available on the ZX81.

System Variables Conversion Table.

Variable	ZX81/ T/S1000	Spectrum/ TS2068	LAST X	16421	23580
BREQ	16414	23656	MARGIN	16424	No Equivalent
COFLAG	16443	No Equivalent	MEM	16415	23656
CH ADD	16406	23645	MEMBOTT	16477	23696
COORDS	16430	23677	MODE	16390	23617
COORDS (Byte 2)	16433	23678	NXTLN	16425	23637
DEST	16402	23620	OLDPCC	16427	23662
DF CC	16396	23604	PPC	16381	23621
O FILE	16396	No Equivalent	PROUF	16444	23296
DF SZ	16418	23659	PR CC	16440	23660
E LINE	16404	23641	RAMTOP	16388	23730
ERR NR	16384	23610	SEED	16434	23670
E PPC	16294	23625	S PSN	16441	23680
ERR SP	16385	23613	S POSN (Byte 2)	16442	23689
FLAGS	16355	23611	STKDOT	16410	23651
FLAGX	16429	23665	STKEND	16412	23653
FRAMES	16436	23672	S TOP	16419	23660
			STRLEN	16420	23666
			T-ADDR	16432	23668
			VALS	16400	23627
			VERSN	16383	No Equivalent
			X PTR	16408	23647

Oxo Flavoured Forth

Richard Armstrong of Ayrshire wrote this program in Abersoft Forth and we decided to print it for all addicts of this language!

This program was written using a 48K Spectrum and the FORTH implementation created by Abersoft. It uses around 8K of memory but could probably be used with FORTH systems having fewer than 8 screens (e.g. Artic FORTH) if the screens in the listing were entered and compiled one at a time. All the FORTH is fairly standard except for the graphics routines in screens 1, 3, 4 and 5 but these could easily be replaced with standard graphics available on any system.

The function of the program

is to play a game of noughts and crosses with the player trying to place three X's in a row and the computer trying to do likewise with O's. The reasonably un-complicated nature of this game has enabled me to concentrate on good programming style rather than on designing unglamorous program routines to perform difficult tasks.

To use the program with a Spectrum running Abersoft FORTH, simply type in screens 1-9 as shown in the listing then enter **9 LOAD**. After the 'ok' message is displayed, enter the

word **LOADER** and the text of the program will be compiled to machine code in about 35 seconds after which the message 'READY' will be displayed. When entering the program you should note the following points:

Screen one is used to define graphic characters and so should only be used with Abersoft FORTH.

In lines 1, 2, 4 and 5 of screen 3, lines 1, 2 and 3 of screen 4 and lines 1, 2 and 3 of screen 5 the capital letters inside string quotes should be entered from graphics mode since these are the U.O.G.'s defined in screen 1.

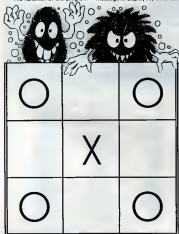
Screen 9 should contain nothing but the definition for the word **LOADER**.

After the message **READY** is displayed, the game can be started by entering **RUN**. A 3x3 grid is then drawn and scores for the player and Spectrum are displayed. A random function is used to determine whether the computer or the player moves

first. When prompted by the message 'Your Move', the player should make a move by pressing the number key on the Spectrum's keyboard corresponding to the number in the square he wishes to move into. For example, to place an X in the square at the centre of the grid press key '5'. The computer will ignore keys outside the range 1-9, or keys corresponding to squares that are already occupied by an X or a O. The game ends when either the player or computer has won or the grid is full. When this happens the player will be asked if he would like another game and should respond by pressing Y (for Yes) or N (for No).

The computer makes its moves by using the following algorithm.

- 1 Look for two O's in a row with a space beside them. If you find this situation then place another O in the space and so win the game.
- 2 If you can't satisfy the above requirements then look for two X's in a row with a space between them. If you come across this situation place a O in the space, so preventing your opponent from winning the game.
- 3 If neither of the above two steps can be carried out then pick a random, empty corner (squares 1, 3, 7 and 9) and put a O in it.
- 4 If no steps have been carried out then search through all the corners and put a O in the first empty corner you come across.
- 5 If none of steps 1-4 can be completed then pick a random square anywhere on the board and put a O in it if it is empty.
- 6 If all the above steps fail search through each square on the grid and place a O in the first empty one you find.



Variables

LINE, COL	Store line and column values used when printing an X or a O.
BOARD	An array of 9 bytes, each byte corresponding to a square on the grid. A byte contains 0 if the corresponding square contains a O, 1 if the square contains an X and 2 if the square is empty.
BOX	Used by various words to store the value of a square.
CORNERS	An array of 4 bytes used to store offsets to be added to the value of BOARD to give the address of a corner.
CHAR	Used by words dealing with both X's and O's (e.g. WINO). If this variable has value 1 then the word is dealing with an X. If the value is 0 then the word is dealing with a O.
PLAYER, COMP	Used to keep the score for the player and the computer.

Forth Words

The words used in the program have the following effects when executed:

DEFINE PICTURE	Used to produce User Defined Graphics. Draws the grid onto the television screen, prints the scores for the player and computer and sets all bytes in the array BOARD to 2 (i.e. empty).
CD-ORDS	Finds the values of LIN and CDL corresponding to the square whose number is on top of the stack.
DRAWX	Draws an X on screen in the square whose top left hand corner is specified by the values of LIN and CDL.
CLEAN	Checks to see if the square indicated by BOX is empty.
HIGH, LOW	Check that the value of BOX is in the range 1-9.
XIN	Accepts a number from the keyboard and prints an X at the corresponding square.
DRAW-0	Draws a 0 in the square specified by BOX.
2ROW	Checks if there are two X's or 0's in a row.
CORNER	Searches for an empty corner.
RANDOM	Produces a random number between 0 and the number on the stack. This word could be of use in other programs.
ANYSQUARE	Chooses a random, empty square.
SYSTEMATIC	Searches the entire grid to find an empty square.
RANDCORNR	Chooses a random, empty corner.
LOOK	Checks to see if a square is empty.
2INROW	Checks the whole grid to find two X's or 0's in a row.
FIND-0	Finds an empty square for 0.
NEWGAME?	Checks to see if Y or N is being pressed in response to the prompt given at the end of a game.
3LINE	Used to check for three X's or 0's in a row.
WIN	Checks to see if the player or computer has won the game.
FULL	Checks to see if there are no empty squares in the grid.
XWINS	Prints a message indicating that the player has won the game.
DWINS	Prints a message indicating that the computer has won.
XMOVE, OMOVE	Lets the player or the computer make a move.
THE	Indicates a draw.
XSTART, OSTART	Lets the player or computer make the first move.
PLAY	Draws the grid and then decides whether the player or computer will move first by using the word RANDOM.
RUN	Starts the game after compiling.

FORTH is a language which is becoming increasingly popular and widely used, especially in industry and schools, so I feel that more FORTH programs should be featured in the popular computing press. I hope that this program will encourage other FORTH enthusiasts to have more of their work published.

As well as being able to use SAVE to save screens to tape, it is also possible to save screens to the ZX Microdrive by using the following commands from FORTH:

```
MON (to re-enter BASIC)
NEW
```

```
CLEAR 50000
SAVE # "M": 1 "DISC".
CODE 53248, 11263
```

The above commands result in the obliteration of the FORTH compiler from memory and so should only be used at the end of a programming session.

To reload FORTH text screens from microdrive switch on the Spectrum and enter:

```
CLEAR 50000
LOAD # "M": 1 "DISC".
CODE 53248
NEW
```

Then load the FORTH compiler from tape as usual

```
SCR # 1
: CD-ORDS
  DO
    DEFINE PICTURE
    LOOP
  DD
  HEX
  CC CC CC CC CC CC CC CC CC CC DE
  LINE
  0 0 FF FF FF FF FF FF 0 1 DEFINE
  CC CC CC FF FF FF FF FF CC CC 2 DE
  END
  FF FF FF FF FF FF FF FF 3 DE
  END
  01 03 07 FF FF FF FF FF FF 4 DE
  END
  0 FF FF FF FF FF FF FF FF 5 DE
  END
  FF FF FF FF FF FF FF FF 6 DE
  END
  1 3 7 F 1F 3F 7F FF 0 DEFINE
  CC CC CC 00 FF 0F 0F 0F 0F 0F 9 DE
  END
  FF FF 3F 1F 0F 07 00 01 6 DE
  END
  DECIMAL
```

```
SCR # 2
: 0 1 VARIABLES
  R 1
  0 VARIABLE LIN
  0 VARIABLE COL
  3 0 VARIABLE BOARD - ALLU
  0 VARIABLE BOX
  4 0 VARIABLE CORNERS - ALLU
  0 2 6 8
  CORNERS
  CORNERS
  CORNERS
  CORNERS
  0 VARIABLE CHAR
  0 VARIABLE PLAYER
  0 VARIABLE COMP
  0 VARIABLE XVAL
  0 VARIABLE YVAL
  10
  11
  12
  13
  14
  15
  K
```

```
SCR # 3
: 0 1 SCREEN INITIATION
  SLAT 0 AT .
  2 STRIPE 6 AT . " 88888888888888888888
  SETUP CLS 10 1 00 1 CLR: L
  0 6 STRIPE 10 STRIPE
  4 NUMS 3 0 AT . " 1 A 2 A
  3 0 0 AT . " A A A A
  6 6 30 0 AT . " A A A A
  PICTURE SETUP NUMS BOARD 0
  FILL 10 0 AT . SPECTRUM
  7 COMP 0 . 10 02 AT . " Player
  PLAYER 0 .
  10 ( PROGRAM ROUTINES
  : CD-ORDS
  CASE 1 OF 1 0 ENDOF
  2 OF 1 12 ENDOF
  3 OF 1 16 ENDOF
  4 OF 7 6 ENDOF
  5 OF 7 12 ENDOF
  6 OF 7 10 ENDOF
  7 OF 7 6 ENDOF
  8 OF 13 12 ENDOF
  9 OF 13 10 ENDOF
  15 ENDCASE
  COL 1 LIN
```

```

SCR # 4
0 1 PROGRAM ROUTINES CONTINUED
1 DRAWX CO-ORDS
2 LIN @ COL @ AT "H K L"
3 LIN @ + COL @ AT "I J M"
4 LIN @ + COL @ AT "N O P"
5 LIN @ + COL @ AT "Q R S"
6 BOX @ 1 - BOARD + C
7 BOARD CHECKING ROUTINES
8 CLEAR BOX @ 1 - BOARD + C
9 HIGH BOX @ 9 NOT
10 LOW BOX @ 9 NOT
11 XIN BEGIN INKEY 43 - BOX
12 HIGH CLEAR AND AND UNTIL
13 BOX @ DRAWX

```

```

SCR # 5
1 FIND A SPACE FOR O
2 DRAW-O BOX @ CO-ORDS
3 LIN @ COL @ AT "P Q R"
4 LIN @ + COL @ AT "S T U"
5 LIN @ + COL @ AT "V W X"
6 LIN @ + COL @ AT "Y Z"
7 BOX @ 1 - BOARD + C
8 2ROW BOARD + C CHAR @ = 5
9 BOARD + C CHAR @ = AND
10 CORNER BOARD @ + C @ 2 - IF
11 THEN
12 BOARD @ + C @ 2 = IF 7 BOX 1
13 BOARD @ + C @ 2 = IF 3 BOX 1
14 BOARD C@ 2 = IF 1 BOX 1 THEN
15 C@ + 255
16 ANYSQUARE 500 @ 00 @ WANDO
17 1UP BOARD + C @ 2 = IF 1
18 1 BOX LEAVE ELSE DROP THEN L
19 2UP
20 SYSTEMATIC @ DO I BOARD
21 C@ 2 = IF I 1 BOX THEN LOOP
22
23 RANDCORN 95 @ 00 3 RANDO
24 CORNERS + C@ DUP BOARD + C @ =
25 IF 1 BOX LEAVE ELSE CRUP
26 4EN LOOP

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SCR # 6
1 BOARD SEARCHING ROUTINES
2 LOOK BOARD + C @ 2 =
3 2INROW
4 LOOK IF 1 @ 2 2ROW 4 @ 2ROW
5 OR OR IF 1 BOX 1 THEN THEN
6 1 LOOK IF 3 @ 2 2ROW 1 7 2ROW
7 OR IF 2 BOX 1 THEN THEN
8 2 LOOK IF 3 @ 1 2ROW 4 @ 2ROW
9 OR OR IF 3 BOX 1 THEN THEN
10 3 LOOK IF 3 @ 6 2ROW 4 @ 2ROW
11 OR IF 4 BOX 1 THEN THEN
12 4 LOOK IF 3 @ 6 2ROW 2 @ 2ROW
13 OR IF 1 7 2ROW 3 @ 2ROW
14 OR OR OR IF 5 BOX 1 THEN THE
15
16 5 LOOK IF 2 @ 8 2ROW 3 4 2ROW
17 OR IF 5 BOX 1 THEN THEN
18 6 LOOK IF 3 @ 3 2ROW 2 4 2ROW
19 OR IF 7 @ 5 2ROW
20
21 OR OR IF 7 BOX 1 THEN THEN
22 7 LOOK IF 1 4 2ROW @ @ 2ROW
23 OR IF 8 BOX 1 THEN THEN

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13 8 LOOK IF 2 @ 2ROW @ 4 2ROW
14 6 7 2ROW
15 OR OR IF 9 BOX 1 THEN THEN
16

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SCR # 7
1 FINDING SPACE FOR U
2 FIND-O BOX 1 @ LMMH 2I
3 THEN BOX @ = IF 1 CHAR 1 2INROW
4 THEN BOX @ = IF RAND C@ 1R
5 THEN BOX @ = IF CORNER THEN 4
6 BOX @ @ = IF AN/SQUARE THEN @
7 @ = IF SYSTEMATIC THEN
8 NEURAGE? BEGIN INKEY DUP 7
9 = DUP @ @ OR UNTIL INKE
10 3LINE DUP C@ 2 - IF DROP @
11 DROP @ ELSE C@ CHAR @ = DUP
12 C@
13 CHAR @ = ROT C@ CHAR @ = AND
14 AND THEN
15 LIN 5 @ DO I BOARD + DUP 3
16 + DUP 3 + 3LINE LOOP OR OR
17 @ 7 @ DO I BOARD + DUP 1 + DUP
18 3LINE 3 + LOOP OR OR
19 BOARD DUP 4 + DUP 4 + 3LINE
20 BOARD 2 + DUP 2 + DUP 2 + 3L
21
22 OR OR OR
23 FULL 1 @ @ DO I BOARD + C@
24 = IF DROP @ THEN LOOP
25 XUNS PLAYER @ 1 + PLAYER
26 2 AT
27 "You Win. Another game ?
28 Y/N"
29

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SCR # 8
1 QUINS 21 3 AT " I Win. An
other game (Y/N) COMP @ 1 + COMP
2
3 XHOVE 20 10 AT " Your mov
4 XIN 20 10 AT "
5 1 CHAR WIN FULL OR NOT
6 OHOVE FIND-O DRAW-O @ CHAR
7 WIN FULL OR NOT
8 TIE 21 2 AT " Ue Draw. An
other game ? (Y/N)"
9 X-START BEGIN XHOVE CUP IF
10 OHOVE THEN NOT UNTIL
11 O-START BEGIN OHOVE CUP IF
12 DROP XHOVE THEN NOT UNTIL
13 @ PLAY PICTURE 10 RANDO @ >
14 IF X-START ELSE O-START THEN
15 FULL IF TIE THEN @ CHAR 1 UI
16 IF QUINS THEN 1 CHAR 1 WIN
17 IF XUNS THEN NEURAGE
18 RUN @ PLAYER 1 @ COMP @ BE
19 GIN PLAY @ = NOT UNTIL
20
21
22
23
24
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SCR # 9
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Club corner

Universal Club

Dear ZX Computing,
Would you be so kind as to publish this letter.

Members of our club, which is world wide, communicate via tapes and letters and exchange programs, programming tips etc.

May I stress the fact that no membership fees are involved, the only cost being the price of postage. All enquiries are welcome, but must contain an SAE.

Yours sincerely,
C. Shaw
Universal ZX Club
1 Swiss Walk, Batley
W. Yorks.

Pen Pal

Dear ZX Computing,
I'm fourteen years old and I would like a pen pal I live in Sweden and own a 48K ZX Spectrum.

Magnus Andersson
Lademeagatah 2
416 79 Göteborg
Sweden

Pen Pal II

Dear ZX Computing,
After buying my first copy of your excellent magazine, I would like to find a pen pal from anywhere on the globe I am fourteen years old, and I would like to hear from anyone who has written any commercial software or software that they have written themselves.

Yours faithfully,
Junior Harris
95 Gardfield Ave.
Heaton, Bradford
W. Yorkshire

Pen Pal Strikes Back

Dear ZX Computing,
I am a regular reader of your magazine and find it a good magazine to read, so good that I make sure that I don't miss a single issue.



So many needs have been helped by your good work that I had to write to you, I own a 48K Spectrum with Sekosha GP 250x printer, interface 1 with microdrive, and Interface 2. I am looking for someone to correspond with as a pen pal, and would be grateful if anyone wishing to help me out would contact me.

Yours sincerely,
Mike de Bruyn
27 Ridge Road
Park Town, Johannesburg
2182
S. Africa.

Toronto

Dear ZX Computing,
I wonder if I could use your Club Corner to acquaint Sinclair users with our club. It is the Toronto Timex-Sinclair Users Club.

We meet twice a month and publish a bimonthly newsletter. Our membership is drawn primarily from the Toronto area, though we have members all across Canada. Our dues are \$20 annually. We are interested in exchanging newsletters with other clubs.

Sincerely,
George Chambers
Pres. Toronto Timex-Sinclair
Users Club
PO Box 7274 Stn A, Toronto
Ontario, Canada M3W 1X8

WA ZX

Dear ZX Computing,
Since your mention of the WA ZX Users Group back in September '84, our membership has doubled, and a lot of the credit is yours. Many new members first read about us in your magazine.

We reckon to be the best, if not the biggest, Spectrum Group in Australia, and though based in one of the least populous cities, have members all over Australia. Interstate members will find our \$5 annual subscription a bargain!

We are at present awaiting the arrival of a Wafadrive for testing and demonstration, after which it will be sold, raffled, or used as a competition prize. Tests of other such accessories will be done as they appear.

The Spectrum could still be a money spinner for an enterprising distributor here. Unfortunately the national distributor is far away, and the Home Computer market is dominated by the most advertised product. I can't remember seeing one local Sinclair advertisement! Naturally we look mostly to the UK for hardware - it is quicker and cheaper to have repairs done in

England too, though when we form a business arrangement with a British supplier the shortage of chips etc will be overcome and the local repairmen will be able to do much better than hitherto.

Our address remains as before.

C/O Gerth Gregson
Hon Secretary
WA ZX Users Group
34 Chester St
South Remantle 6182
PHONE 335 1671

Christian Users

Dear Sir,
We would appreciate your mentioning the newly formed 'Christian Micro Users Association'. We hope to link together a large number of Christian micro users and also to promote the use of micros in Church activities.

There is not only a need to discover the few individuals and companies producing 'Christian' software, but also to share the expertise and ideas of many people who have sought to use micros in their church related activities.

For further details and a sample magazine, send a large SAE to the following address:

Yours sincerely,
P. A. Clark (Secretary)
Christian Micro Users Association
c/o 6 Walkley Street
Sheffield S6 3RD

Dear Mr/PJ Clark,
On the subject of 'Christian' software, it might be worth your while to contact Migration Software, 47 Clifton Road, Newcastle upon Tyne, who, I believe, have plans to produce some programs along those lines.

Finally I would just like to give a plug to Don Bennett of the National Timex-Sinclair Network, PO Box 152214, Red Bank, Tennessee 37415, USA.

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LIBRARIES

Free Spectrum Software loan when you join our Library. Games, educational/utilities available. Full details from: Cygnit Software, 412 Fulbridge Road, Werrington, Peterborough PE4 6SE.

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