SYNTAX ZX80®

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SINCLAIR DROPS US ZX PRICES AS OF 1 JUNE

Sinclair Research lowers the prices on their ZX products in the US 1 June 1982, according to Margaret Bruzelius of Sinclair. New prices: Assembled ZX81, $99.95; ZX81 kit, $79.95; 16K RAM pack, $49.95.

ZX81 owners will receive a new software brochure this month. ZX80 owners should write to receive a copy.

SPECTRUM SHOWN AT LONDON ZX FAIR

SYNTAX editors saw Sinclair's Spectrum at the 3rd ZX Microfair in London (see May 82). Don't bother writing to friends in England to get one early--Nigel Searle of Sinclair says that the Spectrum now works only with British 50 Hz TVs. But he also suggested that the Spectrum's Dec.82 arrival announced in SYNTAX may well be earlier.

NEW PRICES FROM CAI

CAI Instruments of Midland, MI, announced new prices for their ZX peripherals. The thermal printer is now $119.95. The CAI/O board, formerly the Widget, is $79.95 alone and $69.95 with any other CAI device. The tape drive system is $99.95. Bob Swann of CAI says all products are now available for 30-day delivery. CAI also offers a free software catalog. CAI Instruments, 2559 Arbutus Ct., Midland, MI 48640, 517/835-6145.

BYTE-BACK MODEM SHIPMENTS DELAYED

Byte-Back of Leesville, SC, will ship no modems for 4-6 weeks, according to Helen Minchey of Byte-Back. They are shipping memories. The modem is $99.95 and includes RS-232 port and software. Byte-Back, Rt.3 Box 147, Brodie Rd., Leesville, SC 29070, 803/532-5812.

SYNTAX ERRORS: Using Program 1 in Frank O'Hara's Numbers Held Inexactly, Apr.82, 1E13 gives 172 17 132 231 42.

PROGRAM IMPROVEMENTS

Marty Irons of Goshen, NY, sent this version of Herb Magnus' READ-DATA-RESTORE (Apr.82). It loads an array from a literal string, including decimal places and multipliers. Line 30 sets the decimal point. Use P=0 for integers, P=2 for two decimal places. P=-3 multiplies the value by 10^3. Line 10 sets the numbers of entries in array D. Line 40 sets the characters/number. Line 50 holds data. Line 75 prints results. If A$ is too short for the READ routine (60-80), error code 3 results.

```
 10 LET E=10
 20 DIM D(E)
 30 LET P=2
 40 LET L=3
 50 LET A$="1234567890123456789
01234567890"
 60 FOR N=1 TO E
 70 LET D(N)=(VAL (A$(N*L-L+1 T
O N*L)))/(10**P)
 75 PRINT "D(";N;")","= ";D(N)
 80 NEXT N
SYNTACTIC SUM:  9309, 8K
```

Frank O'Hara of Surrey, UK sent a 16K version of Bill Wentz' Flower Plot (Apr.82). Load points into an array in FAST, then go to SLOW for a moving display, which repeats after a flicker-free pause. This method works for all such displays. For N=99 and 999, try 301 for 601 in line 78.

```
  5 REM HOTHOUSE PLOT (16K)
  6 FAST
  7 DIM X(601)
  8 DIM Y(601)
 10 LET N=456
 20 LET D=2*PI/600
 30 LET P=20
 40 FOR I=0 TO 600
 50 LET T=D*I
 55 LET R=P*SIN (N*T)
 60 LET X(I+1)=R*COS T+31
 70 LET Y(I+1)=R*SIN T+21
 72 NEXT I
 74 SLOW
 76 CLS
 78 FOR I=1 TO 601
 80 PLOT X(I),Y(I)
 90 NEXT I
100 FOR I=1 TO 100
110 NEXT I
120 GOTO 76
SYNTACTIC SUM:  19308, 8K
```

Bill Bruton of N.Olmstead, OH, sent these changes to Lane Lester's Income Tax program (Mar.82 p.8):

The first 3 characters from line 2124 don't clear before line 6000 executes. Change 6000 to PRINT AT 21,0...Change 9006 to REM DIM C$(107,18) to remind you of the direct command to enter during initialization. The 18-character line description will only be 1 character without it.

Line 2220 simply sums the previous 4 lines--a problem for casualty or theft losses. To fix the problem and save entries:

```
2219 LET L(93)=L(91)-L(94)
2220 IF L(93)<0 THEN LET L(93)=0
2221 LET L(94)=L(93)
2222 IF L(94)>100 THEN LET L(94)
=100
2223 LET L(95)=L(93)-L(94)
2224 LET L(98)=L(96)+L(97)
2225 LET L(99)=L(76)
```

A refinement for rounding:

```
2200 LET L(69)=INT (L(31)+.5)/10
0
2201 LET L(70)=L(68)-L(69)
2206 LET L(74)=3*L(69)
```

Line 2160 can cause a problem when reviewing data because of computer precision shortcomings. Part of the display will be overwritten by the message at review end because of lines over 32 characters. Change line 2160 to:

```
2160 LET L(63)=INT (100*X+.5)/10
0
```

NEW PRODUCT ANNOUNCEMENTS

ZX FORTH, a FORTH derivative for 16K ZX81s, is available from SofTek Company, Santa Fe, NM. Package costs $20+$2 postage and includes examples of a fully documented source listing. Contact SofTek, Box 4232, Santa Fe, NM 87502-4232.

Battery back-up units are available from Syncware. BBU-2 ($84.50) runs a ZX81 with 16K RAM for over 2 hours, BBU-1 ($54.50) 1 hour, and Baby BBU ($39.50) up to 15 minutes. Prices include shipping. All three models include LED indicators and on/off switch. BBU-8, running up to 8 hours, will be available early Jul.82. Syncware Co., 4825 Elrovia Ave., El Monte, CA 91732.

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8-16K . . . This section of memory switches in or out in 4K blocks to leave space for memory mapping, holds its contents during cassette loads, allows communication between programs, and can be used to run assembly language routines.
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STX06

LINE RENUMBERING--8K/16K

Here are two approaches to line renumbering, one in BASIC and one in machine code. Neither of them renumbers GOTOs or GOSUBs. Whenever you write a program, load your choice first, then execute it after entering your program to clean up line numbers.

BASIC

This program works on an 8K ZX80 or a ZX81 with 16K RAM. Load the renumbering program (RENO), then write your program. Execute RENO by entering RUN 9965. After renumbering, I save the program with RENO attached in case I want to modify and renumber the program later. RENO begins with a STOP statement to separate it from the program being written, and resides at the end of allowable line numbers. To try it out, enter a few statements with random line numbers and then RUN 9965 to renumber them as you wish.

Larry Lockwood, Yorba Linda, CA

```
9964 STOP
9965 PRINT AT 8,1;"START RENUMBE
RING AT?"
9966 INPUT START
9967 PRINT AT 8,21;" ";START;"."
9968 LET ADDR=16509
9969 LET LINE=256*PEEK (ADDR)+PE
EK (ADDR+1)
9970 IF LINE=START THEN GOTO 997
8
9971 IF LINE=9964 THEN GOTO 9975
9972 LET LENGTH=PEEK (ADDR+2)+25
6*PEEK (ADDR+3)
9973 LET ADDR=ADDR+4+LENGTH
9974 GOTO 9969
9975 PRINT AT 8,1;" STARTING ADD
RESS NOT FOUND."
9976 PAUSE 200
9977 GOTO 9965
9978 PRINT AT 10,1;"RENUMBER BEG
INNING WITH?"
9979 INPUT NEW
9980 PRINT AT 10,24;" ";NEW;"."
9981 PRINT AT 12,1;"INCREMENT LI
NES BY?"
9982 INPUT INC
9983 PRINT AT 12,19;" ";INC;"."
9984 PAUSE 150
9985 CLS
9986 IF PEEK (ADDR)=38 AND PEEK
(ADDR+1)=236 THEN GOTO 9996
9987 IF NEW>=9964 THEN GOTO 9998
9988 LET MSB=INT (NEW/256)
9989 LET LSB=NEW-256*MSB
9990 POKE ADDR,MSB
9991 POKE ADDR+1,LSB
9992 LET LENGTH=PEEK (ADDR+2)+25
6*PEEK (ADDR+3)
9993 LET ADDR=ADDR+4+LENGTH
9994 LET NEW=NEW+INC
9995 GOTO 9986
9996 PRINT AT 10,5;"RENUMBERING
COMPLETED"
9997 STOP
9998 PRINT AT 10,5;"CANNOT COMPL
ETE."
9999 PRINT AT 12,6;"LINE NO. >99
64."
SYNTACTIC SUM:  60543, 8K
```

Machine Code

This program renumbers program lines at any time. It is stored in machine code and safely tucked away behind a new RAMTOP of 32000. It sets the first line to 10 and increments the rest by 10s. No STOP statement is needed to signal the end.

Enter the program as shown, then RUN. Enter the numbers in the table (33,125, etc.). This is the decimal listing for the machine language the Z80 CPU understands.

Now delete lines 20-70 and 150. Note the REM 1234... line is different.

Save the program by entering GOTO 200. It runs automatically when LOADed. You will see a flicker and the K cursor on the screen. To test it, type in a short program with random line numbers. To renumber, enter RAND USR 32000.

To start with a line number other than 10, POKE 16518,X (where X=line number you want). If you want to increment the lines by a number other than 10, POKE 16534,Y (where Y=number to increment by).

Mike V. Mullen, Lawrence, KS

```
  10 REM 12345678901234567890123
4567
  20 FOR X=16514 TO 16540
  30 SCROLL
  40 INPUT I
  50 POKE X,I
  60 PRINT X,PEEK X
  70 NEXT X
  80 LET L=16514
  90 FOR X=32000 TO 32026
 100 POKE X,PEEK L
 110 LET L=L+1
```

```
120 NEXT X
130 POKE 16388,0
140 POKE 16389,125
150 STOP
160 NEW
200 SAVE "RENUM"
210 RUN
```

DECIMAL LISTING

```
33  125   64   17   10    0  114
35  115   35   78   35   70   35
 9  126  214  118  200    1   10
 0  235    9  235   24  235
```

ASSEMBLY LISTING

Dec	Hex	OpCode	Comment
33	21	LD HL,NN	loads 16509
125	7D		into HL
64	40		
17	11	LD DE,NN	loads 10 into DE as 1st line number
10	0A		
0	00		
114	72	LD (HL),D	insert new line number
35	23	INC HL	
115	73	LD (HL),E	
35	23	INC HL	
78	4E	LD C,(HL)	loads length of line text into
35	23	INC HL	BC (B is high
70	46	LD B,(HL)	byte)
35	23	INC HL	
9	09	ADD HL,BC	sets HL pointer
126	7E	LD A,(HL)	to next line of text
214	D6	SUB A,N	check for code 118 (indicates end of program)
118	76		
200	C8	RET Z	return to BASIC if at end
1	01	LD BC,NN	increment line number by 10
10	0A		
0	00		
235	EB	EX DE,HL	
9	09	ADD HL,BC	
235	EB	EX DE,HL	
24	18	JR, DIS	jump to con-
235	EB	EX DE,HL	tinue renum- bering (is shown in 2's complement)

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W.H. Smith & Son Ltd.
124 Holborn
London EC1N 2TD
England

Mr. Finlay informed me that W.H. Smith would happily accept orders from the US <u>if</u> you pay by US travelers checks made out in British pounds sterling (available in larger banks). The printer costs £59.95 plus £6 for airmail postage. Extra paper (you get one roll with a printer) is £11.95 for 5 rolls. <u>Do include postage</u>.

In less than a month, it was here--my ZX printer direct from England! I sat down eagerly to use it, but the power supply sent with the unit was a 230 VAC 50 Hz. What to do now? I hastily put together a 115 to 230 auto-transformer and connected the power supply and printer according to directions. I entered a program onto my 16K ZX80, pressed COPY then NEWLINE (ENTER) and the printer took off. It worked beautifully, printing out the entire screen.

After using the printer and computer for approximately 1/2 hr., I noticed the area above the computer's regulator had become quite hot. I disconnected the new supply and printer and took some voltage and current measurements.

Using the heavy duty 16K RAM power supply and the computer running, VDC at the input connection was 10 and amps were .600 (600 mA). With the printer's power supply, VDC was above 11 and current was above 900 mA. The supplied printer power supply is a 1.2 amp unit.

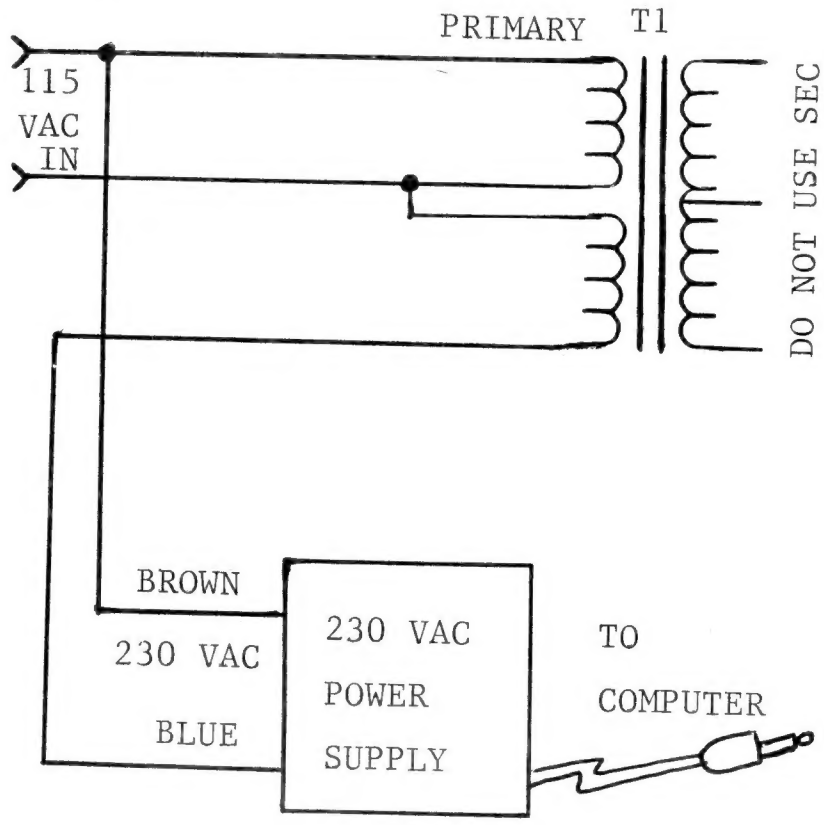
The printer and computer work very well together. DC voltage is slightly above 9 volts and current under 750 mA. My ZX80 with 16K RAM runs cool and the power supply is barely warm to the touch. I don't understand why a 1.2 A supply is required for the printer-computer combo.

Paper is in short supply and may take another month to arrive after your printer. Mr. Finlay said the paper comes from Timex in Waterbury, CT. But when I contacted the Timex people, they said they could not sell any paper to me. When the printer goes on sale here in the fall, there should be paper available for all.

If you're desperate, Radio Shack sells 4 1/2" paper that you could cut to 1-3' lengths and trim to the required 4" width.

If you want to use the 230 VAC supply that comes with the printer, use this scheme. T1 is any small transformer with a split 115VAC-230VAC primary (two windings on the primary, used either for 115 or 230 AC input) and good for 10 watts. Multiply secondary volts by secondary amps to get approximate watts.

Leo Morgan, Peabody, MA



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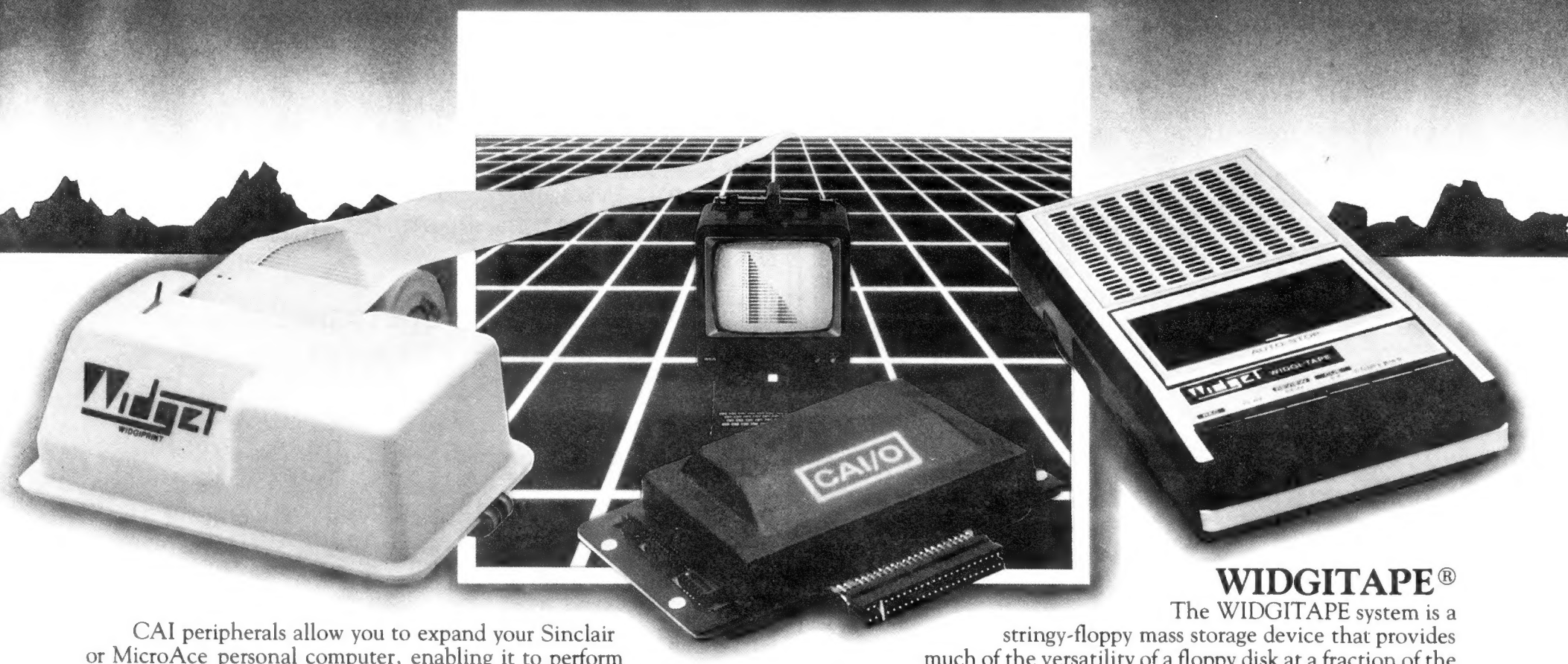

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ZX81

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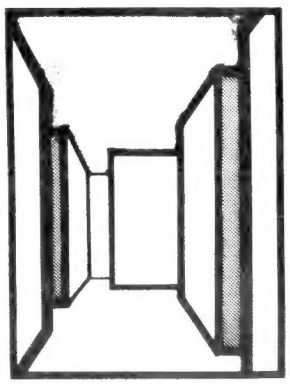
SUPERMAZE is a three-dimensional maze program with extraordinary full screen graphics that challenges you to work your way through a complex labyrinth of corridors. Enter SUPERMAZE at your own risk and carefully choose the right combinations of passageways to reach the end in the fewest possible moves.

This graphically illustrated adventure game is full of hazards to impair your ability to get through it. For example as you wander through the endless corridors, you have to be careful because there are hidden trap doors you can fall through, finding yourself in another part of the maze.

But SUPERMAZE also features some helpful devices to aid your journey. You can have a compass to guide you or stones to drop along the way to let you know if you have already passed through a section of the maze.

Written with many machine code subroutines, SUPERMAZE allows you to choose from ten mazes of increasing difficulty. In addition you can create and store mazes of your own design.



At the beginning of the program, you are given a choice of options to play including:

- A map option to see where you've been but not where you are going.
- An option to find and take with you gold bars in the maze. This helps you to develop skill in maneuvering.
- Stones to drop along the way.
- Optional randomly placed trap doors.
- The compass to guide you.

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3.) Profile By Month indicates how much interest is due that month, total interest paid and the principal balance.

4.) Profile By Year totals the yearly interest payments (Helps you determine your interest deduction so you can calculate your tax savings.) Includes total interest paid to date and remaining balance. A useful tool to help you decide if you can afford the purchase.

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6.) New Data allows you to enter changes or new information.

7.) End allows you to SAVE the program with all your information and reload it at a later date.

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BOOK REVIEW

Title: The Sinclair ZX81 Programming for Real Applications
By: Randle Hurley
Price: $17.95 (162 pgs, paper)
$24.95 (cassette tape)
Published by The MacMillan Press, London, available from Mindware Inc., 70 Boston Post Rd., Wayland, MA, USA 01778.

This book is aptly billed as being for people who want to get down to business with their ZX81s. It provides listings for serious applications--no games here. These programs can be easily used for many situtations you may have thought required a "real" computer.

The book contains these chapters: Programming, Saving Time and Space, Word Juggler (word processing), Money, Personal Finances, Banking, Bulk Storage (saving large amounts of data), Rank Order (sorting), Exam Result Analysis, and Hardware Modifications.

Programming covers how to write, debug and document and "idiot-proof" programs, but is not a beginners' programming course. Saving Time and Space offers excellent tips on efficient programming.

The program listings are quite long (about 3K). I confess that I didn't type any in to test them. Randy told me of one error (if you get this book, check that line 1520 on p.54 reads IF INKEY$="" THEN GOTO 1520). But the listings are not intimidating because they are presented in chunks with excellent documentation describing the purpose and method of each piece. You can buy the programs on cassette.

Hardware tells how to build a power supply, make Sinclair's 3K RAM pack (never available in the US) work, and wire a big keyboard.

The detailed documentation is quite complete and clear. There is life after the ZX81 manual--this book can give you useful routines and an education.--AZ

EXCHANGING REGISTERS

(Part 6 of a series)

In addition to the eight registers A,F,B,C,D,E,H and L covered in an earlier article, the Z80 (central processing unit in your ZX80/81) has a twin set of alternate registers. These registers, named A',F',B',C',D',E', H' and L', can only be accessed in their paired state (ie., AF', BC').

As long as your machine code routines are short, say 100 bytes of code and data, you won't really need to use an alternate register. But sometime in your programming future it may be easier to use one, so let's examine the method of switching information between them.

Without taking the time to examine the register pairs you will use, you can't know whether or not your use of them will destroy vital data. So before using registers, PUSH them onto the stack to save their data. Then POP them off before returning to BASIC. This way you can use these registers during your program, but return them to their original state before exiting machine code. (Ex. PUSH HL...EXX...PUSH HL...for using both HL and HL'. Then POP HL...EXX... POP HL...before RETurning. More on PUSH and POP later.)

Only 6 instructions control exchanging registers and alternates, but only 3 are really useful in short subroutines:

EX AF,AF' exchanges data with the alternate AF pair.

EX DE,HL puts data in HL into DE and data in DE into HL.

EXX exchanges data between BC,DE and HL and their alternate pairs (BC<->BC', DE<->DE', HL<->HL').

For example, suppose you have two blocks of data, block 1 for use in one branch of your subroutine and block 2 for use in the other branch. One solution is to load HL with the starting address of block 1 and DE with block 2. Then, depending on a Test and Branch, HL can contain either HL or, by EXchanging DE,HL, HL can contain "DE" for an INC HL loop.

Exchanging register pairs is handy, but there is an easier way to "save" ethereal data...

Next month: PUSHing and POPping

Jon Bobst, Zeta Software, PO Box 3522, Greenville, SC 29608-3522

Give your ZX81 (or 8K ZX80 with video upgrade) something to do while you're doing something else. RUN this little program in SLOW:

```
 10 PLOT INT (RND*64),INT (RND
*44)
 30 GOTO 10
```

It randomly plots pixels until the screen is totally filled.

Alexander Sloan, Green Bay, WI

To make it run a bit longer, add:

```
 20 UNPLOT INT (RND*64),INT (RN
D*44)
```


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ADDING A JOYSTICK TO YOUR ZX81

The principle behind joysticks is that the computer constantly scans the keyboard. When you press a key, you complete a circuit over the matrix-wired keyboard. Take the bottom off your computer and you'll see two sets of connectors where the keyboard plugs into the computer. Connecting the proper combination of keyboard leads simulates a key depression.

For this project you must use a momentary contact matrix wired joystick, not one using potentiometers. I used an Atari joystick. It is inexpensive and easy to get (ask any dealer who sells Atari game consoles). Unless you have the proper complement connector for your joystick, cut off the end of the cable. The Atari stick gives you 4 directions and a fire button. This results in 6 wires, 1 common and 1 each for each position and the button. Most matrix wired joysticks have only 1 common and fewer than 8 wires.

First, find the common. This is the contact that, when coupled with another contact and the proper direction pushed on the stick, completes a circuit. Use an ohmmeter to check random pairs of wires for their resistance while moving the stick to all locations. When the resistance drops near 0, one of the wires is the common. Locate the common by elimination, then mark it with tape.

Now take the bottom off your computer. With the metallic inside of the bottom panel facing you and the hole for memory expansion at the upper right corner, look at the right edge. At the location marked in Fig. 1 drill a 1/4" hole. Put some wood directly under where you'll drill. From the outside, stick the stripped wires from the joystick through the hole.

With the heat sink in the bottom right corner, look to the left and find the pins shown in Fig. 2. Solder the common to any pin of KBD0-3. Solder the rest of the wires to pins 1-8 (diodes 1-8 on schematic). Avoid solder drips that cause short circuits.

With the bottom still off, plug the computer in and hook it to the TV. You should be able to print characters to the screen by moving the stick around. If you get no response, carefully lift the computer and press some keys. If something appears on the screen, the problem lies in a poor solder joints or a faulty joystick. No keyboard response means the system is locked up from trying to read more than 1 input. You have either a short circuit where you soldered or a faulty joystick.

If you don't have a joystick and want an external control button, you can wire any switch to your computer. One wire must go to KBD0-3 and the other to pins 1-8.

You can use INKEY$ to read these inputs, but this is too slow

for some programs. I use PEEK 16421. This doesn't give the character code; translate it to fit your needs.

This program demonstrates the usefulness of your new stick. First, determine the code for each direction:

```
 10 SLOW
 20 LET A=PEEK 16421
 30 IF A=255 THEN GOTO 20
 40 PRINT AT 19,20;A
 50 SCROLL
 60 GOTO 20
```

Try each position on the stick and button and write down the number produced. Now run this program:

```
 10 CLS
 20 LET X=30
 30 LET Y=20
 40 SLOW
 50 LET A=PEEK 16421
 60 IF A=(CODE FOR UP) THEN LET
Y=Y+1
 70 IF A=(CODE FOR DOWN) THEN L
ET Y=Y-1
 80 IF A=(CODE FOR LEFT) THEN L
ET X=X-1
 90 IF A=(CODE FOR RIGHT) THEN
LET X=X+1
 100 IF A=(CODE FOR BUTTON) THEN
 RUN
 110 PLOT X,Y
 120 GOTO 50
```

Dave Straub, 500 Eastwood,
Petaluma, CA 94952

BASE OF ZX81

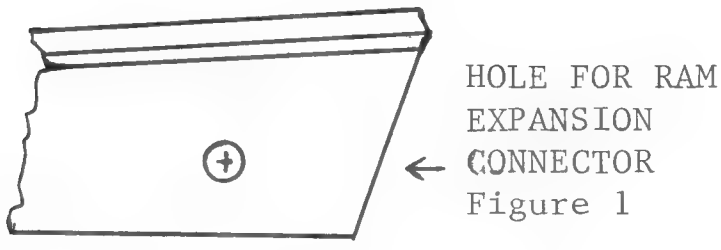

Figure 1

DO NOT SOLDER ABOVE DOTTED LINE
ZX81 BOARD WIRING SIDE

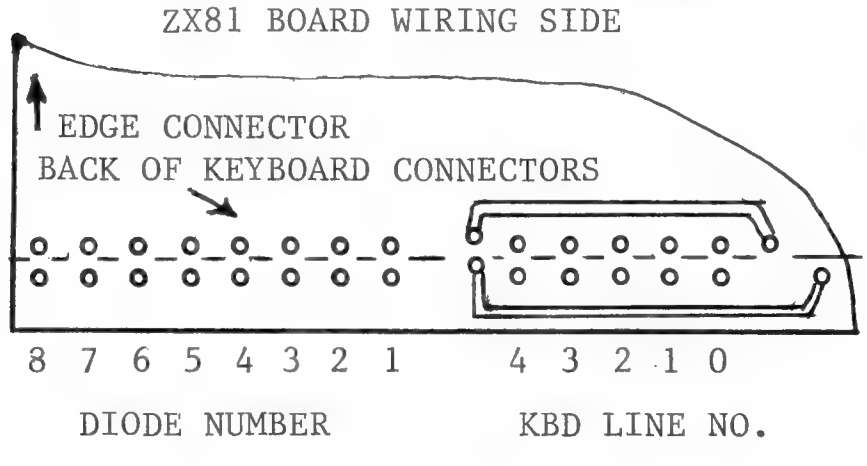

Figure 2

REPORT FROM THE 3RD ZX MICROFAIR

The third ZX Microfair was held 30 April-1 May 1982 in London. Besides Sinclair's new Spectrum, we saw some new ZX81 products.

The 5 1/4" disks promised by Monolith and Macronics are now available, at a hefty £225 price tag. Macronics is now developing a microdrive for ZX81s, probably ready in August for £160.

Compusound showed an add-on to put audio through the TV (currently only for UHF). It adds a second modulator, offsets the frequency to generate a sound sub-carrier, then mixes the two outputs.

Other hardware included joysticks from Micro-Gen (£9.60, 24 Agar Cres., Bracknell, Berks., UK) and Thurnall Electronics (£12.95, 95 Liverpool Rd., Cadishead, Manchester, UK M30 5BG). Micro-Gen also has A/D converter boards. DCP Microdevelopments offers A/D and D/A add-on packs (2 Station Close, Lingwood, Norwich, UK NR13 4AZ).

Many suppliers showed 16K RAMs and big keyboards. RAM suppliers suffered as Sinclair cut prices £10 at the show. Sinclair raised printers to £59.95 as of 3 May, but sold them for £49.95 at the show.

Sophisticated arcade-type and board games abounded, as did new educational software. We saw programs to review history, physics, chemistry and French. Most of these programs are directly tied to England's grade levels and testing. Contact AVC Software, PO Box 415, Birmingham, UK B17 0DH; Rose Cassettes, 148 Widney Ln., Solihull, W. Midlands, UK B91 3LH. Educational users might also contact EZUG (Educational ZX Users Group), c/o Eric Deeson, Highgate School, Birmingham 12, UK.

Two new ZX publications showed up, ZX Computing and Sinclair User. Contact ZX Computing, 145 Charing Cross Rd., London WC2H 0EE or Sinclair User, 30-31 Islington Green, London N1 8BJ for rates.

DEAR EDITOR

In response to a letter, AZ writes that any mini- or micro-cassette recorder should work fine with a ZX80/81. Yes and no. A Sony Walkman-type recorder will probably be no good because of its low output voltage (it operates on 3 VDC). Check the DC operating voltage before you buy--it should be at least 6 VDC. Also, avoid non-capstan drive recorders; generally mini-cassette cheapies are non-capstan drive. Further, micro-cassettes often don't do very well aligning the tape and heads, so treble response and loading programs are touchy. And a recorder that uses a permanent magnet instead of an erase head should be avoided on general principles.

Dave Taber, Menlo Park, CA

Permanent magnet erase heads leave the tape noisier than high-frequency erase heads. This noise might cause loading problems.--KO

Users who install 16K RAM packs may be surprised to find that the ZX81 CLS function works more slowly wih the increased memory. Also, performance of some animation programs becomes unacceptable. The ZX81 manual indicates that the RAM size threshold affecting the display technique (thus the speed of CLS) is 3328 bytes.

To provide the maximum amount of accessable RAM while retaining the fast CLS, adjust RAMTOP before typing or loading programs:

```
POKE 16388,254
POKE 16389,76
NEW
```

Alfred Spencer, Framingham, MA

This technique sets RAMTOP (the address of the last byte of RAM) to 76*256+254, or 19710 (multiply first). You now have 3326 bytes, or about 3.2K to work in.--AZ

A simple suggestion other readers may not have thought of--Say you're entering a long program and you wish to jump backwards or forwards to a far-away line. Even in the FAST mode this takes a lot of time and punching. Just enter a blank line number which you are sure is not already in the program. For example, enter 3501 or 3509 when you want to get to 3510. The line cursor goes there in one shot as it "erases" a non-existent line.

Ken Kenny, Vancouver, BC, Canada

The ZX81 does not handle negative numbers normally. Try this:

```
10 LET A=-5
20 LET B=3
30 PRINT B**A
40 PRINT SQR A
```

Lines 30 and 40 give error A/line number. According to Sinclair, the ZX81 won't raise negative numbers to a power (like -X**B) because it doesn't differentiate between the exponent as an integer and a real number. To assign the value A**B to C where A may be negative and B is integral, instead of LET C=A**B, they suggest using LET C=ABS(A)**B *(1-(B-INT (B/2)*(1-A/ABS(A))).

I use the method in this example program for exponentiation if A might be a negative integer. This routine converts A to ABS A (always positive) and sets a switch SW to 1. The value of SW chooses a PRINT statement reflecting the true effect of -A:

```
 100 LET A=-9
 110 LET SW=0
 120 IF A<0 THEN LET SW=1
 130 IF A<0 THEN LET A=ABS A
 140 LET SQ=A**2
 150 LET CUBED=A**3
 160 IF SW=1 THEN GOTO 190
 170 PRINT "A**2=";SQ,"A**3=";CU
BED
 180 STOP
 190 PRINT "A**2=";SQ,"A**3=-";C
UBED
```

William F. Tracy, Donelson, TN

For do-it-yourselfers, 50-pin gold wirewrap edge connectors are available from Digi-Key Corp., Thief River Falls, MN 56701. Their part no. C6-25, $4.08 in single units. Cut off the ends and pull out the appropriate pins. Use some of the plastic from the ends to make a key and glue it in.

Bob Berch, Rochester, NY

I was spending hours unsuccessfully trying to SAVE and LOAD programs. I traced the problem to the tape jacks on the ZX81. The jacks do not lock the plug firmly into place. I removed the jacks and substituted Radio Shack ones designed for thru-mounting. They are self-enclosed in a small plastic case with rear solder connections. I used a solder lug bent at a right angle to mount the jack. One end of the lug was soldered to the circuit board and the other was used to mount the jack. Take care to position the jack so the plug can be inserted properly. I soldered a short jumper in the rear for the HOT side connection. A ground was not necessary since the ground lug did the job.

Ron DeBalko, Wilkes-Barre, PA

Data names use far less storage than constants in your ZX computer. Thus using the name N0 instead of the number 0 saves five bytes of RAM. One must, of course, take into account the RAM used to hold that variable and the program line which generates it.

Checking through one of my programs, I found the number 0 was used 44 times. Establishing the variable name N0, for example, and setting it equal to 0 saves over 200 bytes of storage even if you include the extra space needed to store the variable. Of all numbers used 3 or more times in this program, putting an "N" before the numeral (thus converting it to a variable name) and then setting that variable to the number it represents saved 1240 bytes. (My program used 34 different numbers occurring 305 times.) At the end of memory, 1.2K looks like a lot.

If storage space was scarce to start with, don't waste your savings on program lines creating these new variables. Rather set values by entering commands such as LET N0=0 with no line number.

John L. La Pin, Germantown, WI

USERS' GROUPS

Here's the list of users' groups that have contacted us this month. To list your group, drop us a line or give us a call at 617-456-3661 and we'll send interested people to you. If you're looking for a group in your area, send a SASE. We'll send what information we have.--AZ

New Orleans, LA: Contact Tom Fussell, 13721 Chef Menteur Hwy., #219, New Orleans, LA 70129, 504/254-4425.

New York, NY: Contact ZX Users America, Michael Wilson, 626 Water St., New York, NY 10002.

North Alabama: North Alabama ZX80/1 Users Group, Bob Boyer, 1103 Rivlin Rd., Huntsville, AL, 883-4354 evenings.

UK PRODUCTS LISTING

Want to know first-hand what's happening with British ZX hardware, software and publications? We have a limited number of official show guides from the 3rd ZX Microfair, held 30 April-1 May in London. This 69-page book lists 79 ZX suppliers with product descriptions and prices, many not available yet in the US. Guide also includes some program listings and tips. Send $2 to SYNTAX Show Guide, RD 2 Box 457, Harvard, MA 01451.

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EXPANDING EXISTING 16K PROGRAMS

If you upgraded to 48K RAM for your ZX81, you may think it simple to add a few program lines and enlarge the variable arrays in existing 16K RAM programs to utilize the increased memory capacity. If you try this by setting RAMTOP to 65280 (for 48K RAM) and entering RUN, you get an error 4--not enough memory.

To understand what happens, refer to the ZX81 manual, chaps. 27&28. Note memory is partitioned into variably sized areas for storing different kinds of information. Before a program is entered, the area called SPARE occupies most of memory. As the program goes in, the area between D FILE and STKEND shifts upward and SPARE becomes smaller. Above SPARE are 3 additional areas, MACHINE stack (whose address is pointed to by ERR SP), GOSUB stack (whose beginning is 1 byte under RAMTOP), and USR routines (of no concern now).

When you enter a 16K program, RAMTOP is set at 32768, unless you choose a different value (see chap. 26 of the manual). ERR SP is set exactly 4 bytes below RAMTOP. The area between ERR SP and RAMTOP is reserved for the GOSUB stack. As the program runs, this area expands and contracts as the program goes to or returns from subroutines.

Since RAMTOP is a normally fixed value representing the first non-existent byte of memory, the first byte of the GOSUB stack is normally the last byte of RAM. Thus no provision is made to adjust the GOSUB stack even if RAMTOP is changed. So LOADing a 16K tape into 48K RAM does not automatically expand the available space.

Fortunately, the situation is easy to fix with a few entries in the immediate mode.

1. To set RAMTOP at the desired value (assumed to be 65280 here):

```
POKE 16388,0
POKE 16389,255
NEW
```

2. Test the RAMTOP value you just entered by:

```
PRINT PEEK 16388+256*PEEK 16389
```

This should give the value 65280.

3. LOAD your taped program in the normal way.

4. Enter in the immediate mode:

```
POKE 65279,62
POKE 65278,0
POKE 65277,6
POKE 65276,118
POKE 65386,252
POKE 65387,254
```

These are the initial values that would exist had the program been entered with RAMTOP set at 65280.

5. Now clear the initial GOSUB stack and the first line of the machine stack. Enter:

```
POKE 32767,0
POKE 32766,0
POKE 32765,0
POKE 32764,0
```

You are now ready to expand that 16K program.

R. Hensley, Riyadh, Saudi Arabia

HARDWARE PREVIEW--RD8100 SYSTEM

Products: RD8100,1 motherboards & RD8110-80 modules for controller applications
From: Mindware, 70 Boston Post Road, Wayland, MA, 01778 USA. (US distributor)
Prices: Super MUM $99.50
Micro MUM $44.95
Modules $74.95-84.95

When you want to try an idea quickly, these modules eliminate hardware problems that get in your way. Every setup I tried worked right away.

SYNTAX doesn't review prototypes, so let's call this a preview. Hardware we saw is not available in the US until the end of June. Module packaging could change, but we expect the motherboards to remain the same. This hardware is now sold in the UK.

RD8100 motherboards and modules are building blocks that plug onto your computer or together to create instant systems. Modules resemble cassette cases with connectors on the long, thin edges. Two-module MUM-boards are flat PCs that plug into your computer's expansion connector. Super-MUMs hold 8 modules and provide an attractive sloping case that fits behind your computer. Super-MUMs fully buffer the expansion bus; both expanders let you connect the ZX printer and memory modules.

Documentation for the system we previewed is small, consisting of typewritten pages reduced to 4" x 6". Despite the difficulty in reading it, the information was complete enough for our tests.

We spent several hours looking at and trying the equipment. We saw everything but the light pen, and tried the On-Offer and the Volt-Catcher.

Mechanically the modules and motherboards look and feel good. The PC boards use low technology--wide traces and large separations. Since the modules are sealed, we couldn't see internal construction, but we could see how the motherboards went together and they seem well done. Modules slip easily onto the Molex KK-type pins of MUM-boards, making all necessary bus and power connections. Sockets at the top accept poke-in wires to connect external devices. My complaint is that the module addresses are on the side of the module where I cannot see them when they are assembled into a system.

Test features built into the module tops simplify testing. LEDs indicate the state of the output port, for example. Most modules flash a green LED when addressed, a major convenience in testing.

We tested the I/O port, and A/D converter functions. In a few minutes, we were able to connect a pot between 5V and 0V and write an 8-line program to read DC volts, convert the 0-255 data to 0-5V for screen printout, test against a half-scale limit, turn on bit 4 of the output port to drive a beeper, and wait for a keypress to turn off the alarm and retest the voltage. Our digital voltmeter read the DC voltage simultaneously and accuracy seemed reasonable though we made no attempt at calibration.

All our tests were run with BASIC PEEK and POKE instructions, so operation was slow. We did not verify RD Lab's claim that machine language would be faster, but I believe it.

Mindware tells us that a real-time clock module is currently being debated. I cast my vote for a 24-hr calendar clock (day, hour, min, sec) with battery-backed timing--useful for business and laboratory applications.

Cost of parts to build anything you would assemble from these modules would be a fraction of the cost of one module. What you really buy with RD8100 components are hassle-free hours when you want the result rather than the building experience.--KO

SOFTWARE REVIEW

Program: Adventure A
Type: Game
ROM/RAM: 8K/16K
Price: $19.95+1.50 post & hand. From Softsync Inc., PO Box 480, Murray Hill Station, New York NY 10156. Written by Artic Computing and published by Melbourne House, England.

Adventure is not for impatient or unimaginative players. It has no bombs, no graphics, and no split-second decisions. It is an intellectual game requiring thought rather than reflexes.

It works like adventure games on bigger micros--the computer describes your situation, and you must tell it how to proceed. You move through fantastic places, acquiring items to protect yourself from hazards while trying to return safely to your spaceship. You direct the computer in simple English sentences. This dialog is part of the game's challenge--deducing the computer's vocabulary--while also making it relatively easy to play.

This self-starting program comes on cassette with an instruction sheet offering hints (but not enough). My copy loaded the first time. I tried to break into it to see the listing, to no avail. I also could not crash it.

I also could not beat it. Fortunately, you can type QUIT at any point and exit. I bailed out of the maze, the pit, the prison cell, and the old house in one sitting, never coming near finding my spaceship.

In short, this game impressed me. The machine's reaction time is quick, the possibilities intriguing and it's tough to beat. It's a good exercise in logic and strategy, though be warned it can be frustrating. Softsync also offers Adventures B and C for the truly masochistic.--AZ

ANNUITY--8K/1K

This 8K ROM/1K RAM program calculates the payments needed to pay off a loan or how many years it takes to pay off a loan at a fixed payment. If the fixed payment would never pay off the loan, an error code A results.

Suppose you wish to finance $50,000 for 30 years with an annual interest rate (APR) of 12%. In response to the prompts, enter 1 for payment, 30 for years to finance, 12 for payments per year, 12 for APR, and 50000 for loan size. Your monthly payments are $514.30.

Or you wish to finance $5000 at 14%. You can afford $200 per month. How long will it take to pay off the loan? Enter 2 for payoff years, 12 for payments per year, 14 for APR, 5000 for loan size, and 200 for payment. You'll need 2.4774869 years.

R. Townsend, West Fork, AR

```
  10 PRINT AT 5,1;"FOR PAYMENT E
NTER 1"
  20 PRINT AT 9,1;"FOR PAYOFF YE
ARS ENTER 2"
  30 INPUT Q
  40 CLS
  50 IF Q=2 THEN GOTO 80
  60 PRINT AT 9,1;"YRS. TO FINAN
CE?"
  70 INPUT Y
  80 PRINT AT 9,1;"HOW MANY PAYM
ENTS PER YEAR?"
  90 INPUT Z
 100 CLS
 110 IF Q=2 THEN GOTO 150
 120 LET N=Z*Y
 130 PRINT AT 9,9;"APR=?"
 140 INPUT A
 150 CLS
 160 LET I=A/(100*Z)
 170 PRINT AT 9,9;"LOAN SIZE?"
 180 INPUT S
 190 CLS
 200 IF Q=2 THEN GOTO 250
 210 LET B=I/(1-(1+I)**-N)
 220 LET P=(INT (S*B*100))/100
 230 PRINT AT 9,1;"EACH PAYMENT=
$";P
 240 STOP
 250 PRINT AT 9,1;"PAYMENT=?"
 260 INPUT R
 270 CLS
 280 LET N=(LN (R/(R-S*I)))/(LN
(1+I))
 290 LET N=N/Z
 300 PRINT AT 9,1;"IT WOULD TAKE
 ";N;" YRS"
 310 STOP
SYNTACTIC SUM:  37820, 8K
```

LOADING HEXADECIMAL LISTINGS--8K

Have you ever skipped a machine code (MC) program because use the BASIC loader program given with it looked hard? Here is a solution. To use a hex MC listing, just type the hex codes into a REM statement. This program converts the hex and stores it into a space explicitly for it.

As an example, look at this MC program to add 10 and 20 in hex:

```
HEX    ASSEMBLY    COMMENTS
3E 10  LD A,10     ;first number
06 20  LD B,20     ;second number
80     ADD A,B     ;A=A+B
06 00  LD B,00     ;B=00
4F     LD C,A      ;BC=00xx
C9     RET         ;return
```

With a listing like this, you'll often find a loader program to help you enter the code. It usually asks you for a start address (where to put the code), then lets you type in hex (or decimal). The lines you enter appear on the screen and scroll. As you type in codes, the computer POKEs the binary equivalents into successive memory locations, usually in a REM statement.

This method has several drawbacks. First, whenever you want to use or test the MC, you must use the loader and type it all in again. Second is the messy REM statement. You often have to type in something like:

```
  1 REM (437 spaces)
```

just to use other loaders.

Third, you must be careful not to LIST the program, or that REM line might crash the system.

To use our example program with the XFER loader (listing follows), type in these two lines, with the XFER program itself:

```
 10 REM ( 3E 10 06 20 80 06 00
4F C9
 20 REM $
```

RUN. After it loads your MC, it will GOTO 1000. The code at 1000 executes your machine code via a USR statement. The way the code runs gives you these features:

1. You can place your MC REM lines anywhere in the program, as long as they each open with a (character, and the set of them is eventually followed by one REM $ statement.
2. Any number of spaces may precede or follow the hex codes. But do not put any spaces before the opening (or the terminating $ after REM.

So these lines are legal:

```
 10 REM (3E    1006 20   80
 20 REM (  06004F   C9
 30 REM $
```

You may also interleave any number of BASIC lines (including standard REMs) with your hex code REMs. The same rule applies to the REM $ statement. The only restrictions are that the lines must appear in a linear order and you must not split the hex codes themselves (ie, inserting spaces between the 2 digits of a single code).

If you make a mistake, just

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edit the REM statement as you would any BASIC line.

XFER fills a string variable, Z$, with binary bytes of MC, converted from hex. Note the LET Z$ at line 110 must be the first assignment (LET) statement executed in the program. Be sure to use the token for REM in line 330. Type 330, then REM (E key), then backspace with the left arrow key and type IF X$..., then move with the right arrow key to finish the line.

```
100 REM XFER
110 LET Z$=""
120 LET A=16513-5
140 LET SA=PEEK 16400+PEEK 1640
1*256+3
200 REM MAIN LOOP
210 GOSUB 300
220 IF X$="(" THEN GOSUB 400
230 IF X$="$" THEN GOTO 1000
240 GOTO 200
300 REM FIND A REM
310 LET A=A+5
320 LET X=PEEK A
325 LET X$=CHR$ X
330 IF X$=" REM " THEN GOTO 370
340 LET A=A+1
350 IF PEEK A=118 THEN GOTO 300
360 GOTO 340
370 LET A=A+1
380 LET X=PEEK A
385 LET X$=CHR$ X
390 RETURN
400 REM PROCESS A LINE
410 GOSUB 500
420 IF EOL=1 THEN RETURN
430 LET H=(X-28)*16+PEEK (A+1)-
28
440 LET A=A+1
450 LET Z$=Z$+CHR$ H
460 GOTO 400
500 REM FIND A NON-SPACE CHAR
505 LET EOL=0
510 LET A=A+1
520 LET X=PEEK A
530 IF X=0 THEN GOTO 510
540 IF X=118 THEN LET EOL=1
550 LET X$=CHR$ X
560 RETURN
1000 REM DONE WITH XFER
1010 LET VALUE=USR SA
SYNTACTIC SUM:  43593, 8K
```

To place machine code in the first line (REM) of the program, make these mods:

```
 delete 450, 140
130 LET D=16514
140 LET SA=D
450 POKE D,H
451 LET D=D+1
```

When you want to call your machine code, use a USR call to SA. This is illustrated in line 1010.

If you enter the example MC program here, change line 1010 to PRINT USR SA. The answer should be 48, which is 10+20 in hex.

David Ornstein, Heuristics,
Newton, MA

NUMBERS HELD INEXACTLY ON THE ZX81

(Part 4 of a series)

The ZX81 doesn't hold simple decimals like .5 & .25 exactly. That is because (1/10) expands as (1/8)x(8/10), ie, as 2^{-3} times .8, or 125 76 204 204 204, ... (where the 76 also stands for 204 as explained earlier.) Use Program 1 to display the 5-byte ZX81 representation of a number:

```
 10 INPUT X
 15 FOR J=1 TO 5
 20 LET V=PEEK 16400+256*PEEK 1
6401
 30 LET I=V+J
 40 PRINT PEEK I;" ";
 50 NEXT J
 60 PRINT
 70 GOTO 10
```

So .1 has no exact representation as a binary number. Its best approximation is 125 76 204 204 204 in 5 bytes. But the ZX81 doesn't round up the quotient after division in a case like this. It holds 0.1 as 125 76 204 204 204. Hence, 0.5 is held as 127 127 255 255 255 instead of the exact result 128 0 0 0 0 and .25 is held as 126 127 255 255 255 instead of 127 0 0 0 0. (why SQR .5 and SQR .25 were affected by the old 8K ROM bug).

To hold these fractions exactly, write them as 1/2 and 1/4 (or 5/10 and 25/100). If all else fails, take a few weeks' holiday and master machine code!

This program gives best results (exact wherever possible) for all these decimal fractions:

```
 10 LET X=0
 20 LET V=PEEK 16400+256*PEEK 1
6401
 30 PRINT "ENTER A NUMBER THAT
STARTS WITH A DECIMAL POINT AND
CONTAINS NO E-FORMAT"
 40 INPUT B$
 50 LET B$=B$(2 TO )
 60 LET L=LEN B$
 70 LET D=1
 80 FOR I=1 TO L
 90 LET D=10*D
100 NEXT I
```

```
110 LET X=VAL B$/D
120 FOR I=V+1 TO V+5
130 IF VAL B$-D*X>=2**32/2 THEN
POKE V+5,PEEK (V+5)+1
140 PRINT PEEK I;" ";
150 NEXT I
160 PRINT
170 GOTO 40
```

With this program, .5 now gives 128 0 0 0 0, an exact answer, .25 gives 127 0 0 0 0, an exact answer, and best 5-byte approximation. A bit surprisingly, .000000000009094947 018 gives 89 0 0 0 0, which is exactly 2^{-40}. The ZX81 is full of pleasant surprises!

Frank O'Hara, Surbiton, Surrey, UK

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You can store this string on tape or in your program as long as you don't type CLEAR or NEW. After running the program, you can delete all the lines and then use the string in another program. For a nice effect, try using an inverse space and then unplotting a line.

Paul Qualls Jr., Amarillo, TX

```
 10 FAST
 20 DIM A$(704)
 30 INPUT A$
 40 FOR F=1 TO 704
 50 LET A$(F)=A$
 60 NEXT F
 70 PRINT AT 0,0;
 80 PRINT A$
 90 PRINT AT 0,0;
SYNTACTIC SUM:  6678, 8K
```

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