

DR. WANG'S PALO ALTO TINY BASIC

By Roger Rauskolb

Tiny Basic was first proposed in Dr. Dobb's Journal. Li-Chen Wang's version of Palo Alto Tiny Basic originally appeared in Issue No. 5, May 1976 of Dr. Dobb's Journal. A complete listing was printed, but Dr. Wang did the assembly on an IBM computer and he defined different mnemonics. In order to assemble with an Intel Compatible Assembler a translation of most mnemonics had to be performed.

I had developed my own system, which consists of two small p.c. boards, one containing the 8080 CPU, 4k of 2708 type EROM and 1K of RAM. The other PCB contained the RS-232 Interface using the Intel 8251. So I wanted to change the I/O section.

If you want to change I/O, all routines are contained in the OUTC and CHKIO routines. My system uses the following configuration:

2708	EROMS	0000H	TO	07FFH
1k	OF RAM	1000H	TO	13FFH
8251	DATA PORT	0FAH		
8251	STATUS PORT			

Command 27H = 2 stop bits parity disabled.
Instruction 8 bit characters.
 Baud Rate Factor of 04.

Mode OCFH = No Hunt Mode. Not (RTS) forced
Instruction to 0. Receive Enabled Data Ter-
 minal Ready Transmit Enabled.

Transmitter Ready Status Bit = Bit 0 (01H)

Receiver Buffer Ready Status Bit = Bit 1 (02H)

The program is contained in locations 0000H to 0768H.

In 1K of RAM 847 bytes are left over for program.

Tiny Basic does not offer much in terms of functions and general mathematical capabilities. But it is great to teach programming basics to children (and adults) and for games, since it has the RND function. It takes up little memory space and executes a lot faster than other basics.

Dr. Wang was very helpful and assisted me all the way. Some errors were eliminated. I appreciate his help and he deserves a lot of credit for his implementation of Tiny Basic.

See Microcomputer Software Depository Program Index for Copies of this program.

THE TINY BASIC LANGUAGE

Numbers

In Tiny Basic, all numbers are integers and must be less than or equal to 32767.

Variables

There are 26 variables denoted by letters A through Z. There is also a single array @(1). The dimension of this array (i.e., the range of value of the index 1) is set automatically to make use of all the memory space that is left unused by the program. (i.e., 0 through SIZE/2, see SIZE function below.)

Functions

For the time being, there are only 3 functions:

ABS(X) gives the absolute value of X.

RND(X) gives a random number between 1 and X (inclusive).

SIZE gives the number of bytes left unused by the program.

Arithmetic and Compare Operators

/ divide. Note that since we have integers only, $\frac{2}{3} = 0$.

* multiply.

- subtract.

+ add.

> compare if greater than.

< compare if less than.

= compare if equal to. Note that to certain versions of Basic "LET A=B=0" means "set both A and B to 0". To this version of Tiny Basic, it means "set A to the result of comparing B with 0".

compare if not equal to.

>= compare if greater than or equal to.

<= compare if less than or equal to.

+, -, *, and / operations result in a value of between -32767 and 32767. All compare operators result in a 1 if true and a 0 if not true.

Expressions

Expressions are formed with numbers, variables, and functions with arithmetic and compare operators between them. + and - signs can also be used at the beginning of an expression. The value of an expression is evaluated from left to right, except that * and / are always done first, and then + and -, and then compare operators. Parentheses can also be used to alter the order of evaluation.

Statements

A Tiny Basic statement consists of a statement

number between 1 and 32767 followed by one or more commands. Commands in the same statement are separated by a semi-colon ";". "GOTO", "STOP", and "RETURN" commands must be the last command in any given statement.

Program

A Tiny Basic program consists of one or more statements. When a direct command "RUN" is issued, the statement with the lowest statement number is executed first, then the one with the next lowest statement number, etc. However, the "GOTO", "GOSUB", "STOP", and "RETURN" commands can alter this normal sequence. Within the statement, execution of the commands is from left to right. The "IF" command can cause the execution of all the commands to its right in the same statement to be skipped over.

Commands

Tiny Basic commands are listed below with examples. Remember that commands can be concatenated with semi-colons. In order to store the statement, you must also have a statement number in front of the commands. The statement number and the concatenation are not shown in the examples.

REM or REMARK Command

REM anything goes

This line will be ignored by TBI.

LET Command

LET A=234-5*6, A=A/2, X=A-100,
@(X+9)=A-1

will set the variable A to the value of the expression 234-5*6 (i.e., 204), set the variable A (again) to the value of the expression A/2 (i.e., 102), set the variable X to the value of the expression A-100 (i.e., 2), and then set the variable @(11) to 101 (where 11 is the value of the expression X+9 and 101 is the value of the expression A-1).

LET U=A#B, V=(A>B)*X+(A<B)*Y

will set the variable U to either 1 or 0 depending on whether A is not equal to or is equal to B; and set the variable V to either X, Y or 0 depending on whether A is greater than, less than, or equal to B.

PRINT Command

PRINT

will cause a carriage-return (CR) and a line-feed (LF) on the output device.

PRINT A*3+1, "ABC 123 !@#", ' CBA '

will print the value of the expression A*3+1 (i.e., 307), the string of characters "ABC 123 !@#", and the string " CBA ", and then a CR-LF. Note that either single or double quotes can be used to quote strings, but pairs must be matched.

PRINT A*3+1, "ABC 123 !@#", ' CBA '

will produce the same output as before, except that there is no CR-LF after the last item is printed. This enables the program to continue printing on the same line with another "PRINT".

PRINT A, B, #3, C, D, E, #10, F, G

will print the values of A and B in 6 spaces, the values of C, D, and E in 3 spaces, and the values of F and G in 10 spaces. If there are not enough spaces specified for a given value to be printed, the value will be printed with enough spaces anyway.

PRINT 'ABC', ←, 'XXX'

will print the string "ABC", a CR without a LF, and then the string "XXX" (over the ABC) followed by a CR-LF.

INPUT Command

INPUT A, B

When this command is executed, Tiny Basic will print "A:" and wait to read in an expression from the input device. The variable A will be set to the value of this expression. Then "B:" is printed and variable B is set to the value of the next expression read from the input device. Note that not only numbers, but also expressions can be read as input.

INPUT 'WHAT IS THE WEIGHT', A, "AND SIZE", B

This is the same as the command above, except the prompt "A:" is replaced by "WHAT IS THE WEIGHT:" and the prompt "B:" is replaced by "AND SIZE:". Again, both single and double quotes can be used as long as they are matched.

INPUT A, 'STRING', ←, "ANOTHER STRING", B

The strings and the ← have the same effect as in "PRINT".

IF Command

IF A<B LET X=3; PRINT 'THIS STRING'

will test the value of the expression A<B. If it is not zero (i.e., if it is true), the commands in the rest of this statement will be executed. If the value of the expression is zero (i.e., if it is not true), the rest of this statement will be skipped over and execution continues at next statement. Note that the word "THEN" is not used.

GOTO Command

GOTO 120

will cause the execution to jump to statement 120. Note that GOTO command cannot be followed by a semi-colon and other commands. It must be ended with a CR.

GOTO A*10+B

will cause the execution to jump to a different statement number as computed from the value of the expression.

GOSUB and RETURN Commands

GOSUB command is similar to GOTO command

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except that: a) the current statement number and position within the statement is remembered; and b) a semi-colon and other commands can follow it in the same statement.

GOSUB 120

will cause the execution to jump to statement 120.

GOSUB A*10+B

will cause the execution to jump to different statements as computed from the value of the expression $A*10+B$.

RETURN

A RETURN command must be the last command in a statement and followed by a CR. When a RETURN command is encountered, it will cause the execution to jump back to the command following the most recent GOSUB command.

GOSUB can be nested. The depth of nesting is limited only by the stack space.

LIST

will print out all the statements in numerical order.

LIST 120

will print out all the statements in numerical order 120.

NEW

will delete all the statements.

Stopping the Execution

The execution of program or listing of program can be stopped by the Control-C key on the input device.

Abbreviation and blanks

You may use blanks freely, except that numbers, command key words, and function names can not have embedded blanks.

You can truncate all command key words and function names and follow each by a period. "P.", "PR.", "PRI.", and "PRIN." all stand for "PRINT." Also the word LET in LET command can be omitted. The "shortest" abbreviation for all the key words are as follows:

A.=ABS	F.=FOR	GOS.=GOSUB	G.=GOTO
IF=IF	IN.=INPUT	L.=LIST	N.=NEW
N.=NEXT	P.=PRINT	REM=REMARK	R.=RETURN
R.=RND	R.=RUN	S.=SIZE	S.=STEP
S.=STOP	TO=TO		

Implied=LET

Control of Output Device

The Control-O key on the input device can be used to turn the output device ON and OFF. This is useful when you want to read in a program punched on paper tape.

To produce such a paper tape, type "LIST" without CR. Turn on the paper tape punch and type a few Control-Shift-P's and then a CR. When listing is finished, type more Control-Shift-P's and turn off the punch.

To read back such a paper tape, type "NEW," CR, and Control-O, then turn on the paper tape reader.

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When the paper tape is finished, turn it off and type a Control-O again.

Control-Shift-P's and turn off the punch.

To read back such a paper tape, type "NEW," CR, and Control-?, then turn on the paper tape reader. When the paper tape is finished, turn it off and type a Control-O. then turn on the paper tape reader. When the paper tape is finished, turn it off and type a Control-O again.

Error Report

There are only three error conditions in TINY BASIC. The statement with the error is printed out with a question mark inserted at the point where the error is detected.

(1) WHAT? means it does not understand you. Example:

WHAT? 210 P?TINT "THIS" where PRINT is mistyped

WHAT? 260 LET A=B+3, C=(3+4), X=4

(2) HOW? means it understands you but does not know how to do it.

HOW? 310LET A=B*C?+2 where B*C is larger than 32767

HOW? 380 GOTO 412? where 412 dose not exist

(3) SORRY means it understands you and knows how to do it but there is not enough memory to do it.

Error Corrections

If you notice an error in typing before you hit the CR, you can delete the last character by the Rub-Out key or delete the entire line by the Alt-Mode key. Tiny basic will echo a back-slash for each Rub-Out. Echo for Alt-Mode consists of a LF, a CR, and an up-arrow.

To correct a statement, you can retype the statement number and the correct commands. Tiny Basic will replace the old statement with the new one.

To delete a statement, type the statement number and a CR only.

Verify the corrections by "LIST nnnn" and hit the Control-C key while the line is being printed.

FOR and NEXT Commands

FOR X=A+1 TO 3*B STEP C-1

The variable X is set to the value of the expression $A+1$. The values of the expressions (not the expressions themselves) $3*B$ and $C-1$ are remembered. The name of the variable X, the statement number and the position of this command within the statement are also remembered. Execution then continues the normal way until a NEXT command is encountered.

The STEP can be positive, negative or even zero. The word STEP and the expression following it can be omitted if the desired STEP is +1.

NEXT X

The name of the variable (X) is checked with that of the most recent FOR command. If they do not agree, that FOR is terminated and the next recent FOR is checked, etc. When a match is found, this variable will be set to its current value plus the value of the STEP expression saved by the FOR command. The updated

value is then compared with the value of the TO expression also saved by the FOR command. If this is within the limit, execution will jump back to the command following the FOR command. If this is outside the limit, execution continues following the NEXT command itself.

FOR can be nested. The depth of nesting is limited only by the stack space. If a new FOR command with the same control variable as that of an old FOR command is encountered, the old FOR will be terminated automatically.

STOP Command

STOP

This command stops the execution of the program and returns control to direct commands from the input device. It can appear many times in a program but must be the last command in any given statement, i.e., it cannot be followed by semi-colon and other commands.

Direct Commands

As defined earlier, a statement consists of a statement number followed by commands. If the statement number is missing, or if it is 0, the commands will be executed after you have typed the CR. All the commands described above can be used as direct commands. There are three more commands that can be used as direct command but not as part of a statement:

RUN

will start to execute the program starting at the lowest statement number.

See Microcomputer Software Depository Program Index for copies of this program.

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*****
/
/      TINY BASIC FOR INTEL 8080
/      VERSION 2.0
/      BY LI-CHEN WANG
/      MODIFIED AND TRANSLATED
/      TO INTEL MNEMONICS
/      BY ROGER RAUSKOLB
/      10 OCTOBER, 1976
/      @COPYLEFT
/      ALL WRONGS RESERVED
/
*****
/
/  *** ZERO PAGE SUBROUTINES ***
/
/  THE 8080 INSTRUCTION SET LETS YOU HAVE 8 ROUTINES IN LOW
/  MEMORY THAT MAY BE CALLED BY RST N, N BEING 0 THROUGH 7.
/  THIS IS A ONE BYTE INSTRUCTION AND HAS THE SAME POWER AS
/  THE THREE BYTE INSTRUCTION CALL LLH. TINY BASIC WILL
/  USE RST 0 AS START AND RST 1 THROUGH RST 7 FOR
/  THE SEVEN MOST FREQUENTLY USED SUBROUTINES.
/  TWO OTHER SUBROUTINES (CRLF AND TSTNUM) ARE ALSO IN THIS
/  SECTION. THEY CAN BE REACHED ONLY BY 3-BYTE CALLS.
/
DWA  MACRO  WHERE
DB      (WHERE SHR 8) +128
DB      WHERE AND 0FFH
ENDM
0000      ORG  0H
/
0000 310014  START:  LXI  SP,STACK ;*** COLD START ***
0002 3E00    MVI  A,0FFH
0005 C34206    JMP  INIT
/
0008 E3      XTHL      ;*** TSTC OR RST 1 ***
0009 EF      RST  5      ;IGNORE BLANKS AND
000A BE      CMP  M      ;TEST CHARACTER
000B C36800    JMP  TC1    ;REST OF THIS IS AT TC1
/
000E 3E00    CRLF:  MVI  A,CR      ;*** CRLF ***
/
0010 F5      PUSH PSW      ;*** OUTC OR RST 2 ***
0011 3A0010  LDR  A,OC34      ;PRINT CHARACTER ONLY
0014 E7      ORA  A      ;IF OC34 SWITCH IS ON
0015 C36C06    JMP  OC2    ;REST OF THIS IS AT OC2
/
0018 C07103  CALL EXPR2 ;*** EXPR OR RST 3 ***
001B E5      PUSH H      ;EVALUATE AN EXPRESSION
001C C32D03    JMP  EXPR1 ;REST OF IT IS AT EXPR1

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001F 57      DB  'W'
/
0020 7C      MOV  A,H      ;*** COMP OR RST 4 ***
0021 BA      CMP  D      ;COMPARE HL WITH DE
0022 C0      RNZ      ;RETURN CORRECT C AND
0023 7D      MOV  A,L      ;Z FLAGS
0024 BB      CMP  E      ;BUT OLD A IS LOST
0025 C9      RET
0026 414E      DB  'AN'
/
0028 1A      LDAX D      ;*** IGBLK/RST 5 ***
0029 FE20    CPI  20H      ;IGNORE BLANKS
002B C0      RNZ      ;IN TEXT (WHERE DE->)
002C 13      INX  D      ;AND RETURN THE FIRST
002D C32800    JMP  SS1    ;NON-BLANK CHAR. IN A
/
0030 F1      POP  PSW      ;*** FINISH/RST 6 ***
0031 C0B204  CALL FIN      ;CHECK END OF COMMAND
0034 C3C604  JMP  WHAT      ;PRINT "WHAT?" IF WRONG
0037 47      DB  'G'
/
0038 EF      RST  5      ;*** TSTV OR RST 7 ***
0039 D640    SUI  40H      ;TEST VARIABLES
003B D8      RC      ;C NOT A VARIABLE
003C C25800    JNZ  TV1    ;NOT "0" ARRAY
003F 13      INX  D      ;IT IS THE "0" ARRAY
0040 C01A04  CALL PARN      ;0 SHOULD BE FOLLOWED
0043 29      DAD  H      ;BY (EXPR) AS ITS INDEX
0044 DA9F00    JC  OHOW    ;IS INDEX TOO BIG?
0047 D5      PUSH D      ;WILL IT OVERWRITE
0048 EB      XCHG      ;TEXT?
0049 C05304  CALL SIZE      ;FIND SIZE OF FREE
004C E7      RST  4      ;AND CHECK THAT
004D DAF404  JC  ASORRY    ;IF SO, SAY "SORRY"
0050 216613  LXI  H,VARBGN ;IF NOT, GET ADDRESS
0053 C07C04  CALL SUBDE ;OF (EXPR) AND PUT IT
0056 D1      POP  D      ;IN HL
0057 C9      RET      ;C FLAG IS CLEARED
0058 FE1B    TV1:  CPI  1BH ;NOT 0. IS IT A TO Z?
005A 3F      CMC      ;IF NOT RETURN C FLAG
005B D8      RC
005C 13      INX  D      ;IF A THROUGH Z
005D 216613  LXI  H,VARBGN ;COMPUTE ADDRESS OF
0059 87      RLC      ;THAT VARIABLE
0061 85      ADD  L      ;AND RETURN IT IN HL
0062 6F      MOV  L,A      ;WITH C FLAG CLEARED
0063 3E00    MVI  A,0
0065 8C      ADC  H
0066 67      MOV  H,A
0067 C9      RET
/
/      TSTC XCH HL (SP) *** TSTC OR RST 1 ***
/      IGBLK      THIS IS AT LOC. 8
/      CMP  M      AND THEN JMP HERE
/
/  TC1:  INX  H      ;COMPARE THE BYTE THAT
/      JZ  TC2      ;FOLLOWS THE RST INST.
/      PUSH B      ;WITH THE TEXT (DE->)
/      MOV  C,M      ;IF NOT =, ADD THE 2ND
/      MVI  B,0      ;BYTE THAT FOLLOWS THE
/      DAD  B      ;RST TO THE OLD PC
/      POP  B      ;I.E., DO A RELATIVE
/      DCX  D      ;JUMP IF NOT =
/      INX  D      ;IF = SKIP THOSE BYTES
/      INX  H      ;AND CONTINUE
/      XTHL
/      RET
/
/  TSTNUM:
/      LXI  H,0      ;*** TSTNUM ***
/      MOV  B,H      ;TEST IF THE TEXT IS
/      RST  5      ;A NUMBER
/      CPI  30H      ;IF NOT, RETURN 0 IN
/      RC      ;B AND HL
/      CPI  3AH      ;IF NUMBERS, CONVERT
/      RNC      ;TO BINARY IN HL AND
/      MVI  A,0F0H    ;SET A TO # OF DIGITS
/      ANA  H      ;IF H>255, THERE IS NO
/      JNZ OHOW      ;ROOM FOR NEXT DIGIT
/      INR  E      ;B COUNTS # OF DIGITS
/      PUSH B      ;
/      MOV  B,H      ;HL=10*HL+(NEW DIGIT)
/      MOV  C,L      ;
/      DAD  H      ;WHERE 10* IS DONE BY
/      DAD  B      ;SHIFT AND ADD
/      DAD  H      ;
/      LDAX D      ;AND (DIGIT) IS FROM
/      INX  D      ;STRIPPING THE ASCII
/      ADD  L      ;CODE
/      MOV  L,A
/      MVI  A,0
/      ADC  H
/      MOV  H,A
/      POP  B
/      LDAX D      ;DO THIS DIGIT AFTER
/      JP  TN1      ;DIGIT 5 SAYS OVERFLOW
/      OHOW:  PUSH D      ;*** ERROR: "HOW?" ***
/      AHOW:  LXI  D,HOW
/      JMP  ERROR
/
00A6 484F573F HOW: DB  'HOW?'
00A8 00      DB  CR
00AB 4F4B      DB  'OK'
00AD 00      DB  CR
00AE 57484154 WHAT: DB  'WHAT?'
00B2 3F      DB  CR
00B3 00      DB  CR
00B4 534F5252 SORRY: DB  'SORRY'
00B8 59      DB  CR
00B9 00      DB  CR
/
/  *****
/
/  *** MAIN ***
/
/  THIS IS THE MAIN LOOP THAT COLLECTS THE TINY BASIC PROGRAM
/  AND STORES IT IN THE MEMORY.
/
/  AT START, IT PRINTS OUT "<CR>OK<CR>", AND INITIALIZES THE
/  STACK AND SOME OTHER INTERNAL VARIABLES. THEN IT PROMPTS
/  "<?>" AND READS A LINE. IF THE LINE STARTS WITH A NON-ZERO
/  NUMBER, THIS NUMBER IS THE LINE NUMBER. THE LINE NUMBER
/  (<IN 16 BIT BINARY>) AND THE REST OF THE LINE (<INCLUDING CR>)
/  IS STORED IN THE MEMORY. IF A LINE WITH THE SAME LINE
/  NUMBER IS ALREADY THERE, IT IS REPLACED BY THE NEW ONE. IF
/  THE REST OF THE LINE CONSISTS OF A CR ONLY, IT IS NOT STORED
/  AND ANY EXISTING LINE WITH THE SAME LINE NUMBER IS DELETED.
/
/  AFTER A LINE IS INSERTED, REPLACED, OR DELETED, THE PROGRAM
/  LOOPS BACK AND ASKS FOR ANOTHER LINE. THIS LOOP WILL BE
/  TERMINATED WHEN IT READS A LINE WITH ZERO OR NO LINE
/  NUMBER: AND CONTROL IS TRANSFERRED TO "DIRECT".
/

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; TINY BASIC PROGRAM SAVE AREA STARTS AT THE MEMORY LOCATION
; LABELED 'TXTBGN' AND ENDS AT 'TXTEND'. WE ALWAYS FILL THIS
; AREA STARTING AT 'TXTBGN', THE UNFILLED PORTION IS POINTED
; BY THE CONTENT OF A MEMORY LOCATION LABELED 'TXTUNF'.

; THE MEMORY LOCATION 'CURRENT' POINTS TO THE LINE NUMBER
; THAT IS CURRENTLY BEING INTERPRETED. WHILE WE ARE IN
; THIS LOOP OR WHILE WE ARE INTERPRETING A DIRECT COMMAND
; (SEE NEXT SECTION), 'CURRENT' SHOULD POINT TO A 0.

RSTART: RSTART LODI SP, STACK

000A 310014 LXI SP, STACK
000B CD0E00 ST1: CALL CRLF ; AND JUMP TO HERE
000C 11A000 LXI D, 0K ; DE->STRING
000D 97 SUB A ; A=0
000E CD6005 CALL PRSTGT ; PRINT STRING UNTIL CR

0007 21CE00 LXI H, ST+1 ; LITERAL 0
000A 220110 SHLD CURRENT ; CURRENT->LINE # = 0
000C 210000 LXI H, 0
000D 220910 SHLD LOPVAR
000E 220110 SHLD STKGOS
000F 2E3E MVI A, 3EH
0010 CDFA04 ST3: CALL GETLN ; READ A LINE
0011 D5 PUSH D ; DE->END OF LINE
0012 119D13 LXI D, BUFFER ; DE->BEGINNING OF LINE
0013 CD7700 CALL TSTNUM ; TEST IF IT IS A NUMBER
0014 EF RST 5
0015 7C MOV A, H ; HL=VALUE OF THE # OR
0016 B5 ORA L ; 0 IF NO # WAS FOUND
0017 C1 POP B ; BC->END OF LINE
0018 CA3807 JZ DIRECT
0019 1B DCX D ; BACKUP DE AND SAVE
001A 7C MOV A, H ; VALUE OF LINE # THERE
001B 12 STAX D
001C 1B DCX D
001D 7D MOV A, L
001E 12 STAX D
001F C5 PUSH B ; BC, DE->BEGIN, END
0020 D5 PUSH D
0021 79 MOV A, C
0022 93 SUB E
0023 F5 PUSH PSW ; A=# OF BYTES IN LINE
0024 CD3805 CALL FNDLN ; FIND THIS LINE IN SAVE
0025 D5 PUSH D ; AREA, DE->SAVE AREA
0026 C20B01 JNZ ST4 ; NZ: NOT FOUND, INSERT
0027 D5 PUSH D ; Z: FOUND, DELETE IT
0028 CD5405 CALL FNDNXT ; FIND NEXT LINE
0029 DE->NEXT LINE
0030 C1 POP B ; BC->LINE TO BE DELETED
0031 2A1510 LHLD TXTUNF ; HL->UNFILLED SAVE AREA
0032 CDE505 CALL MVUP ; MOVE UP TO DELETE
0033 60 MOV H, B ; TXTUNF->UNFILLED AREA
0034 69 MOV L, C
0035 221510 SHLD TXTUNF ; UPDATE
0036 C1 POP B
0037 2A1510 LHLD TXTUNF ; GET READY TO INSERT
0038 F1 POP PSW ; BUT FIRST CHECK IF
0039 E5 PUSH H ; THE LENGTH OF NEW LINE
0040 FE03 CPI 3 ; IS < (LINE # AND CR)
0041 CBA000 JZ RSTART ; THEN DO NOT INSERT
0042 85 ADD L ; MUST CLEAR THE STACK
0043 6F MOV L, A ; COMPUTE NEW TXTUNF
0044 3E00 MVI A, 0
0045 8C MOV H, A ; HL->NEW UNFILLED AREA
0046 57 MOV H, A ; CHECK TO SEE IF THERE
0047 116613 LXI D, TXTEND
0048 E7 RST 4 ; IS ENOUGH SPACE
0049 D2F304 JNC OSORRY ; SORRY, NO ROOM FOR IT
0050 221510 SHLD TXTUNF ; OK, UPDATE TXTUNF
0051 D1 POP D ; DE->OLD UNFILLED AREA
0052 CDEE05 CALL MVDOWN
0053 D1 POP D ; DE->BEGIN, HL->END
0054 E1 POP H
0055 CDE505 CALL MVUP ; MOVE NEW LINE TO SAVE
0056 C3D600 JMP ST3 ; AREA

; *****
; WHAT FOLLOWS IS THE CODE TO EXECUTE DIRECT AND STATEMENT
; COMMANDS. CONTROL IS TRANSFERRED TO THESE POINTS VIA THE
; COMMAND TABLE LOOKUP CODE OF 'DIRECT' AND 'EXEC' IN LAST
; SECTION. AFTER THE COMMAND IS EXECUTED, CONTROL IS
; TRANSFERRED TO OTHER SECTIONS AS FOLLOWS:
;
; FOR 'LIST', 'NEW', AND 'STOP': GO BACK TO 'RSTART'
; FOR 'RUN': GO EXECUTE THE FIRST STORED LINE IF ANY, ELSE
; GO BACK TO 'RSTART'
; FOR 'GOTO' AND 'GOSUB': GO EXECUTE THE TARGET LINE.
; FOR 'RETURN' AND 'NEXT': GO BACK TO SAVED RETURN LINE.
; FOR ALL OTHERS: IF 'CURRENT' -> 0, GO TO 'RSTART', ELSE
; GO EXECUTE NEXT COMMAND. (THIS IS DONE IN 'FINISH').
; *****
; *** NEW *** STOP *** RUN (& FRIENDS) *** & GOTO ***
;
; 'NEW(CR)' SETS 'TXTUNF' TO POINT TO 'TXTBGN'
;
; 'STOP(CR)' GOES BACK TO 'RSTART'
;
; 'RUN(CR)' FINDS THE FIRST STORED LINE. STORE ITS ADDRESS IN
; 'CURRENT', AND START EXECUTE IT. NOTE THAT ONLY THOSE
; COMMANDS IN TAB2 ARE LEGAL FOR STORED PROGRAM.
;
; THERE ARE 3 MORE ENTRIES IN 'RUN':
; 'RUNNXL' FINDS NEXT LINE, STORES ITS ADDR. AND EXECUTES IT.
; 'RUNTSL' STORES THE ADDRESS OF THIS LINE AND EXECUTES IT.
; 'RUNSML' CONTINUES THE EXECUTION ON SAME LINE.
;
; 'GOTO EXPR(CR)' EVALUATES THE EXPRESSION, FIND THE TARGET
; LINE, AND JUMP TO 'RUNTSL' TO DO IT.
;
0132 CDC204 NEW: CALL ENDCHK ; *** NEW(CR) ***
0135 211710 LXI H, TXTBGN
0138 221510 SHLD TXTUNF
0139 CDC204 STOP: CALL ENDCHK ; *** STOP(CR) ***
013E C3BA00 JMP RSTART
0141 CDC204 RUN: CALL ENDCHK ; *** RUN(CR) ***
0144 111710 LXI D, TXTBGN ; FIRST SAVED LINE
;
; RUNNXL:
; LXI H, 0 ; *** RUNNXL ***
; CALL FNDLP ; FIND WHATEVER LINE #
; JC RSTART ; C-PASSED TXTUNF, QUIT
;
; RUNTSL:
; XCHG ; *** RUNTSL ***
; SHLD CURRENT ; SET 'CURRENT'->LINE #
; XCHG
; INX D ; BUMP PASS LINE #
; INX D

0150 EB
0151 220110
0154 EB
0155 13
0156 13

0157 CD8406 RUNSML: CALL CHKIO ; *** RUNSML ***
015A 21B006 LXI H, TAB2-1 ; FIND COMMAND IN TAB2
015D C33B07 JMP EXEC ; AND EXECUTE IT
;
0160 DF
0161 D5 PUSH D
0162 CDC204 GOTO: RST 3 ; *** GOTO EXPR ***
0165 CD3805 ; SAVE FOR ERROR ROUTINE
0168 C2A000 CALL ENDCHK ; MUST FIND A CR
016B F1 POP PSW ; FIND THE TARGET LINE
016C C35001 JNZ AHOW ; NO SUCH LINE #
016D C35001 POP PSW ; CLEAR THE "PUSH DE"
016E C35001 JMP RUNTSL ; GO DO IT
;
; *****
; *** LIST *** & PRINT ***
;
; LIST HAS TWO FORMS:
; 'LIST(CR)' LISTS ALL SAVED LINES
; 'LIST # (CR)' START LIST AT THIS LINE #
; YOU CAN STOP THE LISTING BY CONTROL C KEY
;
; PRINT COMMAND IS 'PRINT ...' OR 'PRINT ... (CR)'
; WHERE ... IS A LIST OF EXPRESSIONS, FORMATS, BACK-
; ARROWS, AND STRINGS. THESE ITEMS ARE SEPERATED BY COMMAS.
;
; A FORMAT IS A FOUND SIGN FOLLOWED BY A NUMBER. IT CONTROLS
; THE NUMBER OF SPACES THE VALUE OF A EXPRESSION IS GOING
; TO BE PRINTED. IT STAYS EFFECTIVE FOR THE REST OF THE PRINT
; COMMAND UNLESS CHANGED BY ANOTHER FORMAT. IF NO FORMAT IS
; SPECIFIED, 6 POSITIONS WILL BE USED.
;
; A STRING IS QUOTED IN A PAIR OF SINGLE QUOTES OR A PAIR OF
; DOUBLE QUOTES.
;
; A BACK-ARROW MEANS GENERATE A (CR) WITHOUT (LF)
;
; A (CR) IS GENERATED AFTER THE ENTIRE LIST HAS BEEN
; PRINTED OR IF THE LIST IS A NULL LIST. HOWEVER IF THE LIST
; ENDED WITH A COMMA, NO (CR) IS GENERATED.
;
016F CD7700 LIST: CALL TSTNUM ; TEST IF THERE IS A #
0172 CDC204 CALL ENDCHK ; IF NO # WE GET A 0
0175 CD3805 CALL FNDLN ; FIND THIS OR NEXT LINE
0178 DABA00 LS1: JC RSTART ; C-PASSED TXTUNF
017B CDD205 CALL PRTLN ; PRINT THE LINE
017E CD8406 CALL CHKIO ; STOP IF HIT CONTROL-C
0181 CD4005 CALL FNDLP ; FIND NEXT LINE
0184 C37801 JMP L51 ; AND LOOP BACK
;
0187 0E06 PRINT: MVI C, 6 ; C = # OF SPACES
0189 CF RST 1 ; IF NULL LIST & ", "
018A 3B DB 3BH
018B 06 DB PR2-#-1
018C CD0E00 CALL CRLF ; GIVE CR-LF AND
018F C35701 JMP RUNSML ; CONTINUE SAME LINE
0192 CF PR2: RST 1 ; IF NULL LIST (CR)
0195 0D DB CR
0194 06 DB PR0-#-1
0195 CD0E00 CALL CRLF ; ALSO GIVE CR-LF AND
0198 C34701 JMP RUNNXL ; GO TO NEXT LINE
019B CF PR0: RST 1 ; ELSE IS IT FORMAT?
019C 23 DB '#'
019D 05 DB PR1-#-1
019E DF RST 3 ; YES, EVALUATE EXPR
019F 4D MOV C, L ; AND SAVE IT IN C
01A0 C3A901 JMP PR2 ; LOOK FOR MORE TO PRINT
01A3 CD6C05 PR1: CALL QTSTG ; OR IS IT A STRING?
01A6 C3B601 JMP PR8 ; IF NOT, MUST BE EXPR
01A9 CF PR3: RST 1 ; IF " ", GO FIND NEXT
01AA 2C DB ' '
01AB 06 DB PR6-#-1
01AC CD6304 CALL FIN ; IN THE LIST.
01AF C39B01 JMP PR0 ; LIST CONTINUES
01B2 CD0E00 PR6: CALL CRLF ; LIST ENDS
01B5 F7 RST 6
01B6 DF PR8: RST 3 ; EVALUATE THE EXPR
01B7 C5 PUSH B
01B8 CD9205 CALL PRTNUM ; PRINT THE VALUE
01BB C1 POP B
01BC C3A901 JMP PR3 ; MORE TO PRINT?
;
; *****
; *** GOSUB *** & RETURN ***
;
; 'GOSUB EXPR' OR 'GOSUB EXPR (CR)' IS LIKE THE 'GOTO'
; COMMAND. EXCEPT THAT THE CURRENT TEXT POINTER
; ETC. ARE SAVED SO THAT EXECUTION CAN BE CONTINUED AFTER THE
; SUBROUTINE 'RETURN' IN ORDER THAT 'GOSUB' CAN BE NESTED
; (AND EVEN RECURSIVE), THE SAVE AREA MUST BE STACKED.
; THE STACK POINTER IS SAVED IN 'STKGOS', THE OLD 'STKGOS' IS
; SAVED IN THE STACK. IF WE ARE IN THE MAIN ROUTINE, 'STKGOS'
; IS ZERO (THIS WAS DONE BY THE "MAIN" SECTION OF THE CODE),
; BUT WE STILL SAVE IT AS A FLAG FOR NO FURTHER 'RETURN's.
;
; 'RETURN(CR)' UNDOES EVERYTHING THAT 'GOSUB' DID, AND THUS
; RETURN THE EXECUTION TO THE COMMAND AFTER THE MOST RECENT
; 'GOSUB'. IF 'STKGOS' IS ZERO, IT INDICATES THAT WE
; NEVER HAD A 'GOSUB' AND IS THUS AN ERROR.
;
01BF CD1906 GOSUB: CALL PUSHA ; SAVE THE CURRENT "FOR"
01C2 DF RST 3 ; PARAMETERS
01C3 D5 PUSH D ; AND TEXT POINTER
01C4 CD3805 CALL FNDLN ; FIND THE TARGET LINE
01C7 C2A000 JNZ AHOW ; NOT THERE, SAY "HOW?"
01CA 2A0110 LHLD CURRENT ; FOUND IT, SAVE OLD
01CD E5 PUSH H ; 'CURRENT' OLD 'STKGOS'
01CE 2A0310 LHLD STKGOS
01D1 E5 PUSH H
01D2 210000 LXI H, 0 ; AND LOAD NEW ONES
01D5 220910 SHLD LOPVAR
01D8 39 DAD SP
01D9 220310 SHLD STKGOS
01DC C35001 JMP RUNTSL ; THEN RUN THAT LINE
;
01DF CDC204 RETURN: CALL ENDCHK ; THERE MUST BE A CR
01E2 2A0310 LHLD STKGOS ; OLD STACK POINTER
01E5 7C MOV A, H ; 0 MEANS NOT EXIST
01E6 B5 ORA L
01E7 CAC604 JZ QWHAT ; SO, WE SAY: "WHAT?"
01EA F9 SPHL ; ELSE, RESTORE IT
01EB E1 POP H
01EC 220310 SHLD STKGOS ; AND THE OLD 'STKGOS'
01EF E1 POP H
01F0 220110 SHLD CURRENT ; AND THE OLD 'CURRENT'
01F3 D1 POP D ; OLD TEXT POINTER
01F4 CDFD05 CALL POPA ; OLD "FOR" PARAMETERS
01F7 F7 RST 6 ; AND WE ARE BACK HOME
;
; *****

```

```

; *** FOR *** & NEXT ***
;
; 'FOR' HAS TWO FORMS:
; 'FOR VAR=EXP1 TO EXP2 STEP EXP3' AND 'FOR VAR=EXP1 TO EXP2'
; THE SECOND FORM MEANS THE SAME THING AS THE FIRST FORM WITH
; EXP3=1. (I.E., WITH A STEP OF +1.)
; TBI WILL FIND THE VARIABLE VAR. AND SET ITS VALUE TO THE
; CURRENT VALUE OF EXP1. IT ALSO EVALUATES EXP2 AND EXP3
; AND SAVE ALL THESE TOGETHER WITH THE TEXT POINTER ETC. IN
; THE 'FOR' SAVE AREA, WHICH CONSISTS OF 'LOPVAR', 'LOPINC',
; 'LOPLMT', 'LOPLN', AND 'LOPPT'. IF THERE IS ALREADY SOME-
; THING IN THE SAVE AREA (THIS IS INDICATED BY A NON-ZERO
; 'LOPVAR'), THEN THE OLD SAVE AREA IS SAVED IN THE STACK
; BEFORE THE NEW ONE OVERWRITES IT.
; TBI WILL THEN DIG IN THE STACK AND FIND OUT IF THIS SAME
; VARIABLE WAS USED IN ANOTHER CURRENTLY ACTIVE 'FOR' LOOP.
; IF THAT IS THE CASE, THEN THE OLD 'FOR' LOOP IS DEACTIVATED.
; (PURGED FROM THE STACK.)
;
; 'NEXT VAR' SERVES AS THE LOGICAL (NOT NECESSARILY PHYSICAL)
; END OF THE 'FOR' LOOP. THE CONTROL VARIABLE VAR. IS CHECKED
; WITH THE 'LOPVAR'. IF THEY ARE NOT THE SAME, TBI DIGS IN
; THE STACK TO FIND THE RIGHT ONE AND PURGES ALL THOSE THAT
; DID NOT MATCH. EITHER WAY, TBI THEN ADDS THE 'STEP' TO
; THAT VARIABLE AND CHECKS THE RESULT WITH THE LIMIT. IF IT
; IS WITHIN THE LIMIT, CONTROL LOOPS BACK TO THE COMMAND
; FOLLOWING THE 'FOR'. IF OUTSIDE THE LIMIT, THE SAVE AREA
; IS PURGED AND EXECUTION CONTINUES.
;
01F8 CD1906 FOR: CALL PUSHA ;SAVE THE OLD SAVE AREA
01FB CDA004 CALL SETVAL ;SET THE CONTROL VAR.
01FE 2B DCX H ;HL IS ITS ADDRESS
01FF 220910 SHLD LOPVAR ;SAVE THAT
0202 211207 LXI H,TAB5-1 ;USE 'EXEC' TO LOOK
0205 C23B07 JMP EXEC ;FOR THE WORD 'TO'
0208 0F RST 3 ;EVALUATE THE LIMIT
0209 220910 SHLD LOPLMT ;SAVE THAT
020C 211907 LXI H,TAB6-1 ;USE 'EXEC' TO LOOK
020F C23B07 JMP EXEC ;FOR THE WORD 'STEP'
0212 0F RST 3 ;FOUND IT, GET STEP
0213 C21902 JMP FR4
0216 210100 LXI H,1H ;NOT FOUND, SET TO 1
0219 220E10 FR4: SHLD LOPINC ;SAVE THAT TOO
021C 2A0110 FR5: LHLD CURRNT ;SAVE CURRENT LINE #
021F 220F10 SHLD LOPLN ;AND TEXT POINTER
0222 EB XCHG
0223 221110 SHLD LOPPT
0226 010A00 LXI B,0AH ;DIG INTO STACK TO
0229 2A0910 LHLD LOPVAR ;FIND 'LOPVAR'
022C EB XCHG
;
022D 60 MOV H,B ;HL=0 NOW
022E 68 MOV L,B ;HERE IS THE STACK
022F 39 DAD SP
0230 3E DB 3EH
0231 09 DAD B ;EACH LEVEL IS 10 DEEP
0232 7E MOV A,M ;GET THAT OLD 'LOPVAR'
0233 22 INX H
0234 B6 ORA M
0235 CA5202 JZ FR8 ;0 SAYS NO MORE IN IT
0238 7E MOV A,M
0239 2B DCX H
023A BA CMP D ;SAME AS THIS ONE?
023B C23102 JNZ FR7
023E 7E MOV A,M ;THE OTHER HALF?
023F BE CMP E
0240 C23102 JNZ FR7
0243 EB XCHG ;YES, FOUND ONE
0244 210000 LXI H,0H
0247 39 DAD SP ;TRY TO MOVE SP
0248 44 MOV B,H
0249 4D MOV C,L
024A 210A00 LXI H,0AH
024D 19 DAD D
024E CDEE05 CALL MVDOWN ;AND PURGE 10 WORDS
0251 F9 SPHL ;IN THE STACK
0252 2A1110 FR8: LHLD LOPPT ;JOB DONE, RESTORE DE
0255 EB XCHG
0256 F7 RST 6 ;AND CONTINUE
;
0257 FF NEXT: RST 7 ;GET ADDRESS OF VAR.
0258 DAC604 JC OMHAT ;NO VARIABLE, "WHAT?"
025B 220510 SHLD VARHXT ;YES, SAVE IT
025E 05 N00: PUSH D ;SAVE TEXT POINTER
025F EB XCHG
0260 2A0910 LHLD LOPVAR ;GET VAR. IN 'FOR'
0263 7C MOV A,H
0264 B5 ORA L ;0 SAYS NEVER HAD ONE
0265 CAC704 JZ AHMAT ;SO WE ASK: "WHAT?"
0268 E7 RST 4 ;ELSE WE CHECK THEM
0269 CA7602 JZ NX3 ;OK, THEY AGREE
026C D1 POP D ;NO, LET'S SEE
026D CDFD05 CALL POPA ;PURGE CURRENT LOOP
0270 2A0510 LHLD VARHXT ;AND POP ONE LEVEL
0273 C35E02 JMP NX0 ;GO CHECK AGAIN
0276 5E NX3: MOV E,M ;COME HERE WHEN AGREED
0277 23 INX H
0278 56 MOV D,M ;DE=VALUE OF VAR.
0279 2A0B10 LHLD LOPINC
027C E5 PUSH H
027D 7C MOV A,H
;
027E AA XRA D
027F 7A MOV A,D
0280 19 DAD D ;ADD ONE STEP
0281 FA8802 JM NX4
0284 AC XRA H
0285 FAAA02 JM NX5
0288 EB XCHG
0289 2A0910 LHLD LOPVAR ;PUT IT BACK
028C 73 MOV M,E
028D 23 INX H
028E 72 MOV M,D
028F 2A0D10 LHLD LOPLMT ;HL=LIMIT
0292 F1 POP PSW ;OLD HL
0293 B7 ORA A
0294 F29802 JP NX1 ;STEP > 0
0297 EB XCHG
0298 CD9804 NX1: CALL OKHLD ;COMPARE WITH LIMIT
029B D1 POP D ;RESTORE TEXT POINTER
029C DAC802 JC NX2 ;OUTSIDE LIMIT
029F 2A0F10 LHLD LOPLN ;WITHIN LIMIT, GO
02A2 220110 SHLD CURRNT ;BACK TO THE SAVED
02A5 2A1110 LHLD LOPPT ;'CURRNT' AND TEXT
02A8 EB XCHG ;POINTER
02A9 F7 RST 6
02AA E1 NX5: POP H
02AB D1 POP D
02AC CDFD05 NX2: CALL POPA ;PURGE THIS LOOP
02AF F7 RST 6
;
; *****
;
; *** REM *** IF *** INPUT *** & LET (& DEFLT) ***
;
; 'REM' CAN BE FOLLOWED BY ANYTHING AND IS IGNORED BY TBI.
; TBI TREATS IT LIKE AN 'IF' WITH A FALSE CONDITION.
;
; 'IF' IS FOLLOWED BY AN EXPR. AS A CONDITION AND ONE OR MORE
; COMMANDS (INCLUDING OTHER 'IF'S) SEPERATED BY SEMI-COLONS.
; NOTE THAT THE WORD 'THEN' IS NOT USED. TBI EVALUATES THE
; EXPR. IF IT IS NON-ZERO, EXECUTION CONTINUES. IF THE
; EXPR. IS ZERO, THE COMMANDS THAT FOLLOWS ARE IGNORED AND
; EXECUTION CONTINUES AT THE NEXT LINE.
;
; 'INPUT' COMMAND IS LIKE THE 'PRINT' COMMAND, AND IS FOLLOWED
; BY A LIST OF ITEMS. IF THE ITEM IS A STRING IN SINGLE OR
; DOUBLE QUOTES, OR IS A BACK-ARROW, IT HAS THE SAME EFFECT AS
; IN 'PRINT'. IF AN ITEM IS A VARIABLE, THIS VARIABLE NAME IS
; PRINTED OUT FOLLOWED BY A COLON. THEN TBI WAITS FOR AN
; EXPR. TO BE TYPED IN. THE VARIABLE IS THEN SET TO THE
; VALUE OF THIS EXPR. IF THE VARIABLE IS PRECEDED BY A STRING
; (AGAIN IN SINGLE OR DOUBLE QUOTES), THE STRING WILL BE
; PRINTED FOLLOWED BY A COLON. TBI THEN WAITS FOR INPUT EXPR.
; AND SET THE VARIABLE TO THE VALUE OF THE EXPR.
;
; IF THE INPUT EXPR. IS INVALID, TBI WILL PRINT "WHAT?",
; "HOW?" OR "SORRY" AND REPRINT THE PROMPT AND REDO THE INPUT.
; THE EXECUTION WILL NOT TERMINATE UNLESS YOU TYPE CONTROL-C.
; THIS IS HANDLED IN 'INPERR'.
;
; 'LET' IS FOLLOWED BY A LIST OF ITEMS SEPERATED BY COMMAS.
; EACH ITEM CONSISTS OF A VARIABLE, AN EQUAL SIGN, AND AN EXPR.
; TBI EVALUATES THE EXPR. AND SET THE VARIABLE TO THAT VALUE.
; TBI WILL ALSO HANDLE 'LET' COMMAND WITHOUT THE WORD 'LET'.
; THIS IS DONE BY 'DEFLT'.
;
02B0 210000 REM: LXI H,0H ;*** REM ***
02B3 3E DB 3EH
;
02B4 0F RST 3 ;*** IF ***
02B5 7C MOV A,H ;IS THE EXPR. =0?
02B6 B5 ORA L
02B7 C25701 JNZ RUNSHL ;NO, CONTINUE
02BA CD5605 CALL FND5KP ;YES, SKIP REST' OF LINE
02BD C25801 JMP RUNSLT
02C0 C3BA00 JNC RSTART
;
02C3 2A0710 INPERR: LHLD STKINP ;*** INPERR ***
02C6 F9 SPHL ;RESTORE OLD SP
02C7 E1 POP H ;AND OLD 'CURRNT'
02C8 220110 SHLD CURRNT ;AND OLD TEXT POINTER
02CB D1 POP D ;REDO INPUT
02CC D1 POP D
;
02CD 05 INPUT: ;*** INPUT ***
02CE CD6C05 IP1: CALL QTSTG ;SAVE IN CASE OF ERROR
02D1 C3DB02 CALL QTSTG ;IS NEXT ITEM A STRING?
02D4 FF RST 7 ;NO
02D5 DA1503 RST 7 ;YES, BUT FOLLOWED BY A
02D8 C3EB02 JC IP4 ;VARIABLE? NO
02DB 05 IP2: JNC IP3 ;YES, INPUT VARIABLE
02DE 05 PUSH D ;SAVE FOR 'PRSTG'
02E0 FF RST 7 ;MUST BE VARIABLE NOW
02E3 DA6C04 JC OMHAT ;"WHAT?" IT IS NOT?
02E6 1A LDAX D ;GET READY FOR 'PRSTG'
02E9 4F MOV C,A
02EA 97 SUB A
02EB 12 STAX D
02EC D1 POP D
02ED C60005 CALL PRSTG ;PRINT STRING AS PROMPT
;
02E8 79 MOV A,C ;RESTORE TEXT
02E9 1B DCX D
02EA 12 STAX D
02EB D5 PUSH D ;SAVE TEXT POINTER
02EC EB XCHG
02ED 2A0110 LHLD CURRNT ;ALSO SAVE 'CURRNT'
02F0 E5 PUSH H
02F1 21CD02 LXI H,IP1 ;A NEGATIVE NUMBER
02F4 220110 SHLD CURRNT ;AS A FLAG
02F7 210000 LXI H,0H ;SAVE SP TOO
02FA 39 DAD SP
02FB 220710 SHLD STKINP
02FE D5 PUSH D ;OLD HL
02FF DE3A MVI A,3AH ;PRINT THIS TOO
0301 CDFB04 CALL GETLN ;AND GET A LINE
0304 119D13 LXI D,BUFFER ;POINTS TO BUFFER
0307 DF RST 3 ;EVALUATE INPUT
0308 00 NOP ;CAN BE 'CALL ENDCHK'
0309 00 NOP
030A 00 NOP
030B D1 POP D ;OK, GET OLD HL
030C EB XCHG
030D 73 MOV M,E ;SAVE VALUE IN VAR.
030E 23 INX H
030F 72 MOV M,D
0310 E1 POP H ;GET OLD 'CURRNT'
0311 220110 SHLD CURRNT ;AND OLD TEXT POINTER
0314 D1 POP D ;PURGE JUNK IN STACK
0315 F1 IP4: RST 1 ;IS NEXT CH. ' '?
0316 CF DB 0F
0317 2C DB 0F
0318 03 DB 0F
0319 C3CD02 JMP IP1 ;YES, MORE ITEMS.
031C F7 RST 6 ;IP5:
;
031D 1A DEFLT: LDAX D ;*** DEFLT ***
031E FE00 CPI CR ;EMPTY LINE IS OK
0320 CA2C03 JZ LT1 ;ELSE IT IS 'LET'
;
0323 CDA004 LET: CALL SETVAL ;*** LET ***
0326 CF RST 1 ;SET VALUE TO VAR.
0327 2C DB 0F
0328 03 DB 0F
0329 C32303 JMP LET ;ITEM BY ITEM
032C F7 LT1: RST 6 ;UNTIL FINISH
;
; *****
;
; *** EXPR ***
;
; 'EXPR' EVALUATES ARITHMETICAL OR LOGICAL EXPRESSIONS.
; <EXPR> ::= <EXPR2>
; <EXPR2> ::= <REL OP> <EXPR2>
; WHERE <REL OP> IS ONE OF THE OPERATORS IN TAB8 AND THE
; RESULT OF THESE OPERATIONS IS 1 IF TRUE AND 0 IF FALSE.
; <EXPR2> ::= (<+> OR <->) <EXPR3> <+> OR <-> <EXPR3> <+> OR <->
; WHERE (<+> ARE OPTIONAL AND (<->) ARE OPTIONAL REPEATS.
; <EXPR3> ::= <EXPR4> <+> OR <-> <EXPR4> <+> OR <->
; <EXPR4> ::= <VARIABLE>

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; <FUNCTION>
; <EXPR>
; <EXPR> IS RECURSIVE SO THAT VARIABLE "0" CAN HAVE AN <EXPR>
; AS INDEX. FUNCTIONS CAN HAVE AN <EXPR> AS ARGUMENTS, AND
; <EXPR> CAN BE AN <EXPR> IN PARENTHESES.
;
; EXPR CALL EXPR2 THIS IS AT LOC. 18
; PUSH HL SAVE <EXPR2> VALUE
0320 212107 EXPR1: LXI H, TAB8-1 ; LOOKUP REL. OP.
0330 C33B07 JMP EXEC ; GO DO IT
0332 CD5C03 XP11: CALL XP18 ; REL. OP. ">="
0336 D8 RC ; NO. RETURN HL=0
0337 6F MOV L, A ; YES. RETURN HL=1
0338 C9 RET
0339 CD5C03 XP12: CALL XP18 ; REL. OP. "="
033C C8 RZ ; FALSE. RETURN HL=0
033D 6F MOV L, A ; TRUE. RETURN HL=1
033E C9 RET
033F CD5C03 XP13: CALL XP18 ; REL. OP. "<="
0342 C8 RZ ; FALSE
0343 D8 RC ; ALSO FALSE. HL=0
0344 6F MOV L, A ; TRUE. HL=1
0345 C9 RET
0346 CD5C03 XP14: CALL XP18 ; REL. OP. "<="
0349 6F MOV L, A ; SET HL=1
034A C8 RZ ; REL. TRUE. RETURN
034B D8 RC
034C 6C MOV L, H ; ELSE SET HL=0
034D C9 RET
034E CD5C03 XP15: CALL XP18 ; REL. OP. ">="
0351 C8 RZ ; FALSE. RETURN HL=0
0352 6F MOV L, A ; ELSE SET HL=1
0353 C9 RET
0354 CD5C03 XP16: CALL XP18 ; REL. OP. "<="
0357 D8 RC ; FALSE. RETURN HL=0
0358 6F MOV L, A ; ELSE SET HL=1
0359 C9 RET
035A E1 POP H ; NOT REL. OP.
035B C9 RET ; RETURN HL=<EXPR2>
035C 79 XP18: MOV A, C ; SUBROUTINE FOR ALL
035D E1 POP H ; REL. OP. 'S
035E C1 POP B
035F E5 PUSH H ; REVERSE TOP OF STACK
0360 C5 PUSH B
0361 4F MOV C, A
0362 CD7103 CALL EXPR2 ; GET 2ND <EXPR2>
0365 EB XCHG ; VALUE IN DE NOW
0366 E3 XTHL ; 1ST <EXPR2> IN HL
0367 CD9804 CALL CKHLDE ; COMPARE 1ST WITH 2ND
036A D1 POP D ; RESTORE TEXT POINTER
036B 210000 LXI H, 00H ; SET HL=0. A=1
036E 3E01 MVI A, 1
0370 C9 RET
;
0371 CF EXPR2: SET 1 ; NEGATIVE SIGN?
0372 20 DB <?>
0373 06 DB XP21-4-1
0374 110000 LXI H, 00H ; YES. FALSE 00H
0377 C39B03 JMP XP26 ; TREAT LIKE SUBTRACT
037A CF XP21: RST 1 ; POSITIVE SIGN? IGNORE
037B 2B DB <?>
037C 00 DB XP22-4-1
037D CD4501 XP22: CALL EXPR3 ; 1ST <EXPR3>
0380 CF XP23: RST 1 ; ADD?
0381 16 DB <?>
0382 15 DB XP25-4-1
0383 E5 PUSH H ; YES. SAVE VALUE
0384 CD4503 CALL EXPR3 ; GET 2ND <EXPR3>
0387 EB XCHG ; 2ND IN DE
0388 E3 XTHL ; 1ST IN HL
0389 7C MOV A, H ; COMPARE SIGN
038A AA XRA D
038B 7A MOV A, D
038C 19 DAD D
038D D1 POP D ; RESTORE TEXT POINTER
038E FA003 JM XP23 ; 1ST 2ND SIGN DIFFER
0391 AC XRA H ; 1ST 2ND SIGN EQUAL
0392 F20003 JP XP23 ; SO IS RESULT
0395 C39F00 JMP 0000H ; ELSE WE HAVE OVERFLOW
0398 CF XP25: RST 1 ; SUBTRACT?
0399 20 DB <?>
039A 86 DB XP42-4-1
039B E5 PUSH H ; YES. SAVE 1ST <EXPR3>
039C CD4503 CALL EXPR3 ; GET 2ND <EXPR3>
039F CD8604 CALL CHGSGN ; NEGATE
03A2 CD8703 JMP XP24 ; AND ADD THEM
;
03A5 CD0504 EXPR3: CALL EXPR4 ; GET 1ST <EXPR4>
03A8 CF XP31: RST 1 ; MULTIPLY?
03A9 2A DB <?>
03AA 20 DB XP34-4-1
03AB E5 PUSH H ; YES. SAVE 1ST
03AC CD0504 CALL EXPR4 ; AND GET 2ND <EXPR4>
03AD 0001 MVI B, 00H ; CLEAR B FOR SIGN
03AE CD8704 CALL CHGSGN ; CHECK SIGN
03B1 E3 XTHL ; 1ST IN HL
03B2 CD8204 CALL CHGSGN ; CHECK SIGN OF 1ST
03B5 EB XCHG
03B6 E3 XTHL
03B7 7C MOV A, H ; IS HL > 255?
03B8 7A ORA A
03B9 7A ORA A
03BA 7C MOV A, H ; YES. HOW ABOUT DE
03BB 7A ORA A
03BC 82 DAD D
03BD EB XCHG ; PUT SMALLER IN HL
03BE C2A000 JNZ AH0W ; ALSO >. WILL OVERFLOW
03C5 7D MOV A, L ; THIS IS DUMB
03C6 210000 LXI H, 00H ; CLEAR RESULT
03C9 B7 ORA A ; ADD AND COUNT
03CA CAF703 JZ XP25
03CB 15 DAD D
03CC D1 JC AH0W ; OVERFLOW
03CD 3D DCR A
03CE C2C003 JNZ XP23
03CF C3F703 JMP XP25 ; FINISHED
03D0 CF XP34: RST 1 ; DIVIDE?
03D1 2F DB <?>
03D2 46 DB XP42-4-1
03D3 E5 PUSH H ; YES. SAVE 1ST <EXPR4>
03D4 CD0504 CALL EXPR4 ; AND GET 2ND ONE
03D5 0001 MVI B, 00H ; CLEAR B FOR SIGN
03D6 CD8704 CALL CHGSGN ; CHECK SIGN OF 2ND
03D9 E3 XTHL ; GET 1ST IN HL
03DA EB XCHG ; CHECK SIGN OF 1ST
03DB E3 XTHL
03DC 7A ORA A ; DIVIDE BY 0?
03DD B3 JC AH0W ; SAY "HOW?"
03DE CAA000 JZ B ; ELSE SAVE SIGN
03DF C5 PUSH B ; USE SUBROUTINE
03E0 F1 CD6604 CALL DIVIDE ; RESULT IN HL NOW
03E1 60 MOV H, B
03E2 69 MOV L, C
03E3 C1 POP B ; GET SIGN BACK

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03F7 D1 XP35: POP D ; AND TEXT POINTER
03F8 7C MOV A, H ; HL MUST BE +
03F9 B7 ORA A
03FA FA9F00 JM 0000H ; ELSE IT IS OVERFLOW
03FD 78 MOV A, B
03FE B7 ORA A
03FF FC8604 CM CHGSGN ; CHANGE SIGN IF NEEDED
0402 C3A803 JMP XP31 ; LOOK FOR MORE TERMS
;
0405 210107 EXPR4: LXI H, TAB4-1 ; FIND FUNCTION IN TAB4
0408 C33B07 JMP EXEC ; AND GO DO IT
040B FF XP40: RST 7 ; NO. NOT A FUNCTION
040C DA1404 JC XP41 ; NOR A VARIABLE
040F 7E MOV A, M ; VARIABLE
0410 23 INX H
0411 66 MOV H, M ; VALUE IN HL
0412 6F MOV L, A
0413 C9 RET
0414 CD7700 XP41: CALL TSTNUM ; OR IS IT A NUMBER
0417 78 MOV A, B ; # OF DIGIT
0418 B7 ORA A
0419 C0 RNZ ; OK
041A CF FARN: RST 1 ; NO DIGIT. MUST BE
041B 28 DB <?>
041C 05 DB XP42-4-1
041D 0F RST 5 ; "<EXPR>"
041E CF RST 1
041F 29 DB <?>
0420 01 DB XP43-4-1
0421 C9 XP42: RET
0422 C3C604 XP43: JMP 0000H ; ELSE SAY: "WHAT?"
;
0425 CD1A04 RND: CALL FARN ; *** RND(<EXPR>) ***
0428 7C MOV A, H ; EXPR MUST BE +
0429 B7 ORA A
042A FA9F00 JM 0000H ; AND NON-ZERO
042D B5 ORA L
042E CA9F00 JZ 0000H
0431 05 PUSH D ; SAVE BOTH
0432 E5 PUSH H
0433 2A1310 LHLD RANPNT ; GET MEMORY AS RANDOM
0436 116907 LXI D, LSTR0H ; NUMBER
0439 E7 RST 4
043A DA4004 JC RA1 ; WRAP AROUND IF LAST
043D 210000 LXI H, START
0440 5E MOV E, M
0441 23 INX H
0442 56 MOV D, M
0443 221310 SHLD RANPNT
0446 E1 POP H
0447 EE XCHG
0448 C5 PUSH B
0449 CD6604 CALL DIVIDE ; RND(N)=MOD(M,N)+1
044C C1 POP B
044D D1 POP D
044E 23 INX H
044F C9 RET
;
0450 CD1A04 ABS: CALL FARN ; *** ABS(<EXPR>) ***
0453 1E DCX D
0454 CD8204 CALL CHKSGN ; CHECK SIGN
0457 17 INX D
0458 C9 RET
0459 2A1510 SIZE: LHLD TXTUNF ; *** SIZE ***
045C D5 PUSH D ; GET THE NUMBER OF FREE
045D EE XCHG ; BYTES BETWEEN 'TXTUNF'
045E 216613 LXI H, VAREGN ; AND 'VAREGN'
0461 CD7C04 CALL SUBDE
0464 D1 POP D
0465 C9 RET
;
; *****
;
; *** DIVIDE *** SUBDE *** CHKSGN *** CHGSGN *** & CKHLDE ***
;
; DIVIDE DIVIDES HL BY DE. RESULT IN BC. REMAINDER IN HL
;
; SUBDE SUBTRACTS DE FROM HL
;
; CHKSGN CHECKS SIGN OF HL. IF +, NO CHANGE. IF -, CHANGE
; SIGN AND FLIP SIGN OF B.
;
; CHGSGN CHANGES SIGN OF HL AND B UNCONDITIONALLY.
;
; CKHLDE CHECKS SIGN OF HL AND DE. IF DIFFERENT, HL AND DE
; ARE INTERCHANGED. IF SAME SIGN, NOT INTERCHANGED. EITHER
; CASE, HL DE ARE THEN COMPARED TO SET THE FLAGS.
;
; DIVIDE:
0466 E5 PUSH H ; *** DIVIDE ***
0467 6C MOV L, H ; DIVIDE H BY DE
0468 2E00 MVI H, 00
0469 CD7104 CALL DV1
046D 41 MOV B, C ; SAVE RESULT IN B
046E 7D MOV L, L ; (REMAINDER+L)/DE
046F E1 POP H
0470 67 MOV H, A
0471 BEFF DV1: MVI C, 0FFH ; RESULT IN C
0473 9C INR C ; DUMB ROUTINE
0474 CD7C04 CALL SUBDE ; DIVIDE BY SUBTRACT
0477 CD7304 JNC DV2 ; AND COUNT
047A 19 DAD D
047B C9 RET
;
047C 7D SUBDE: MOV A, L ; *** SUBDE ***
047D 93 SUB E ; SUBTRACT DE FROM
;
047E 6F MOV L, A ; HL
047F 7C MOV A, H
0480 9A SBB D
0481 67 MOV H, A
0482 C9 RET
;
0483 7C CHKSGN: MOV A, H ; *** CHKSGN ***
0484 B7 ORA A ; CHECK SIGN OF HL
0485 F0 RP ; IF -, CHANGE SIGN
;
0486 7C CHGSGN: MOV A, H ; *** CHGSGN ***
0487 F5 PUSH PSW
0488 3F CMA ; CHANGE SIGN OF HL
0489 67 MOV H, A
048A 7D MOV A, L
048B 3F CMA
048C 6F MOV L, A
048D 23 INX H
048E F1 POP PSW
048F AC XRA H
0490 F29F00 JP 0000H
0492 78 MOV A, B ; AND ALSO FLIP B
0494 EE50 XRI 50H
0495 47 MOV B, A
0497 C9 RET

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0498 7C      MOV  A,H
0499 AA      XRA  D      ;SAME SIGN?
049A F29E04 JP  CK1      ;YES, COMPARE
049D EB      XCHG      ;NO, XCH AND COMP
049E E7      RST  4
049F C9      RET

;*****
; *** SETVAL *** FIN *** ENDCHK *** & ERROR (& FRIENDS) ***
;
; "SETVAL" EXPECTS A VARIABLE, FOLLOWED BY AN EQUAL SIGN AND
; THEN AN EXPR. IT EVALUATES THE EXPR. AND SET THE VARIABLE
; TO THAT VALUE.
;
; "FIN" CHECKS THE END OF A COMMAND. IF IT ENDED WITH ";",
; EXECUTION CONTINUES. IF IT ENDED WITH A CR, IT FINDS THE
; NEXT LINE AND CONTINUE FROM THERE.
;
; "ENDCHK" CHECKS IF A COMMAND IS ENDED WITH CR. THIS IS
; REQUIRED IN CERTAIN COMMANDS. (GOTO, RETURN, AND STOP ETC.)
;
; "ERROR" PRINTS THE STRING POINTED BY DE (&ENDS WITH CR).
; IT THEN PRINTS THE LINE POINTED BY 'CURRENT' WITH A "?"
; INSERTED AT WHERE THE OLD TEXT POINTER (SHOULD BE ON TOP
; OF THE STACK) POINTS TO. EXECUTION OF TB IS STOPPED
; AND TB1 IS RESTARTED. HOWEVER, IF 'CURRENT' -> ZERO
; (INDICATING A DIRECT COMMAND), THE DIRECT COMMAND IS NOT
; PRINTED. AND IF 'CURRENT' -> NEGATIVE # (INDICATING 'INPUT'
; COMMAND), THE INPUT LINE IS NOT PRINTED AND EXECUTION IS
; NOT TERMINATED BUT CONTINUED AT 'INPERR'.
;
; RELATED TO 'ERROR' ARE THE FOLLOWING:
; 'OHAT' SAVES TEXT POINTER IN STACK AND GET MESSAGE "WHAT?"
; 'AHAT' JUST GET MESSAGE "WHAT?" AND JUMP TO 'ERROR'.
; 'OSORRY' AND 'ASORRY' DO SAME KIND OF THING.
; 'OHON' AND 'AHON' IN THE ZERO PAGE SECTION ALSO DO THIS

04A0 FF      RST  7      ;*** SETVAL ***
04A1 D9C604 JC  OHAT      ;"WHAT?" NO VARIABLE
04A4 E5      PUSH H      ;SAVE ADDRESS OF VAR.
04A5 CF      RST  1      ;PASS "=" SIGN
04A6 2D      DB  "/"
04A7 08      DB  SV1-#-1
04A8 DF      RST  2      ;EVALUATE EXPR.
04A9 44      MOV  B,H      ;VALUE IN BC NOW
04AA 4D      MOV  C,L
04AB E1      POP  H      ;GET ADDRESS
04AC 71      MOV  M,C      ;SAVE VALUE
04AD 23      INX  H
04AE 70      MOV  M,B
04AF C9      RET
04B0 C2C604 SV1: JMP  OHAT      ;NO "=" SIGN

04B2 CF      FIN:  RST  1      ;*** FIN ***
04B3 2B      DB  "EH"
04B4 04      DB  F11-#-1
04B5 F1      POP  PSW      ;"/", PURGE RET ADDR.
04B6 F1      JMP  RUNSML    ;CONTINUE SAME LINE
04B7 C25701 F11: RST  1      ;NOT ";", IS IT CR?
04B8 CF      DB  CR
04B9 0C      DB  CR
04BA 04      DB  F12-#-1
04BB F1      POP  PSW      ;YES, PURGE RET ADDR.
04BC F1      JMP  RUNNXL    ;RUN NEXT LINE
04BD C24701 F12: RET      ;ELSE RETURN TO CALLER
04BE C9      RET

ENDCHK:
04C2 EF      RST  5      ;*** ENDCHK ***
04C3 FE0D CPI  CR      ;END WITH CR?
04C5 C8      RZ      ;OK, ELSE SAY: "WHAT?"

04C6 D5      OHAT: PUSH D      ;*** OHAT ***
04C7 11AE00 AHAT: LXI  D,AHAT ;*** AHAT ***
04C8 97      ERROR: SUB  A      ;*** ERROR ***
04C9 CD6005 CALL PRSTG    ;PRINT "WHAT?", "HOW?"
04CA D1      POP  D      ;OR /SORRY/
04CB 1A      LDAX D      ;SAVE THE CHARACTER
04CC E5      PUSH PSW      ;AT WHERE OLD DE ->
04CD 97      SUB  A      ;AND PUT A 0 THERE
04CE 12      STAX D
04CF 2A0110 LHLD CURRENT ;GET CURRENT LINE #
04D0 E5      PUSH H
04D1 7E      MOV  A,M      ;CHECK THE VALUE
04D2 23      INX  H
04D3 B6      ORA  H
04D4 C1      POP  D
04D5 CBA900 JZ  RSTART    ;IF ZERO, JUST RESTART
04D6 7E      MOV  A,M      ;IF NEGATIVE,
04D7 B7      ORA  A
04D8 FAC202 JM  INPERR    ;REDO INPUT
04D9 C0C205 CALL PRTLN    ;ELSE PRINT THE LINE
04DA 18      DCM  D      ;UP TO WHERE THE 0 IS
04DB F1      POP  PSW      ;RESTORE THE CHARACTER
04DC 12      STAX D
04DD 2E2F MVI  A,2FH      ;PRINT A "?"
04DE D7      RST  2
04DF 97      SUB  A      ;AND THE REST OF THE
04E0 CD6005 CALL PRSTG    ;
04E1 C3BA00 JMP  RSTART

OSORRY:
04F2 D5      PUSH D      ;*** OSORRY ***
ASORRY:
04F4 11B400 LXI  D,SORRY ;*** ASORRY ***
04F7 C3CA04 JMP  ERROR

;*****
; *** GETLN *** FNDLN (& FRIENDS) ***
;
; 'GETLN' READS A INPUT LINE INTO 'BUFFER'. IT FIRST PROMPT,
; THE CHARACTER IN A (GIVEN BY THE CALLER), THEN IT FILLS THE
; THE BUFFER AND ECHOS. IT IGNORES LF'S AND NULLS, BUT STILL
; ECHOS THEM BACK. RUB-OUT IS USED TO CAUSE IT TO DELETE
; THE LAST CHARACTER (IF THERE IS ONE), AND ALT-MOD IS USED TO
; CAUSE IT TO DELETE THE WHOLE LINE AND START IT ALL OVER.
; CR SIGNALS THE END OF A LINE, AND CAUSE 'GETLN' TO RETURN.
;
; 'FNDLN' FINDS A LINE WITH A GIVEN LINE # (<IN HL) IN THE
; TEXT SAVE AREA. DE IS USED AS THE TEXT POINTER. IF THE
; LINE IS FOUND, DE WILL POINT TO THE BEGINNING OF THAT LINE
; (I.E., THE LOW BYTE OF THE LINE #), AND FLAGS ARE NC & Z.
; IF THAT LINE IS NOT THERE AND A LINE WITH A HIGHER LINE #
; IS FOUND, DE POINTS TO THERE AND FLAGS ARE NC & NZ. IF
; WE REACHED THE END OF TEXT SAVE ARE AND CANNOT FIND THE
; LINE, FLAGS ARE C & NZ.
; 'FNDLN' WILL INITIALIZE DE TO THE BEGINNING OF THE TEXT SAVE
; AREA TO START THE SEARCH. SOME OTHER ENTRIES OF THIS
; ROUTINE WILL NOT INITIALIZE DE AND DO THE SEARCH.
; 'FNDLNP' WILL START WITH DE AND SEARCH FOR THE LINE #.
; 'FNDNXT' WILL BUMP DE BY 2, FIND A CR AND THEN START SEARCH.
; 'FNDSKP' USE DE TO FIND A CR, AND THEN START SEARCH.

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05A1 05      PUSH D      ;SAVE AS A FLAG
05A2 06      DCR C       ;C=SPACES
05A3 05      PUSH B      ;SAVE SIGN & SPACE
05A4 06604   FN2: CALL DIVIDE ;DEVIDE HL BY 10
05A7 78      MOV A,B     ;RESULT 0?
05A8 B1      ORA C
05A9 0AB405   JZ FN3      ;YES, WE GOT ALL
05AC E2      XTHL        ;NO, SAVE REMAINDER
05AD 20      DCR L       ;AND COUNT SPACE
05AE E5      PUSH H      ;HL IS OLD BC
05AF 60      MOV H,B      ;MOVE RESULT TO BC
05B0 69      MOV L,C      ;AND DIVIDE BY 10
05B1 03A405   JMP FN2     ;WE GOT ALL DIGITS IN
05B4 C1      FN3: POP B    ;THE STACK
05B5 00      DCR C       ;LOOK AT SPACE COUNT
05B6 79      MOV A,C      ;ORA A
05B7 B7      ORA A
05B8 0AC105   JM FN5      ;NO LEADING BLANKS
05B9 2E20     MVI A,20H   ;LEADING BLANKS
05BD 07      RST 2
05BE 03B505   JMP FN4     ;MORE?
05C1 78      MOV A,B      ;PRINT SIGN
05C2 B7      ORA A
05C3 041000   CNZ 10H    ;LAST REMAINDER IN E
05C6 50      MOV A,E      ;CHECK DIGIT IN E
05C7 7B      MOV A,E      ;10 IS FLAG FOR NO MORE
05C8 FE0A     CPI 0AH
05CA D1      POP D
05CB C8      RZ          ;IF 10, RETURN
05CC 0300     ADI 30H     ;ELSE CONVERT TO ASCII
05CE 07      RST 2       ;AND PRINT THE DIGIT
05CF 030705   JMP FN6    ;GO BACK FOR MORE

05D2 1A      PRTLN: LDAX D ;*** PRTLN ***
05D3 6F      MOV L,A      ;LOW ORDER LINE #
05D4 12      INX D
05D5 1A      LDAX D
05D6 67      MOV H,A      ;HIGH ORDER
05D7 12      INX D
05D8 0E04     MVI C,4H    ;PRINT 4 DIGIT LINE #
05DA 0D9205   CALL PRTNUM ;FOLLOWED BY A BLANK
05DB 2E20     MVI A,20H
05DF 07      RST 2
05E0 97      SUB A        ;AND THEN THE TEXT
05E1 0D6005   CALL PRSTG  ;
05E4 C9      RET

; *****
; *** MVUP *** MVDOWN *** POPA *** & PUSHA ***
; 'MVUP' MOVES A BLOCK UP FROM WHERE DE-> TO WHERE BC-> UNTIL
; DE = HL
; 'MVDOWN' MOVES A BLOCK DOWN FROM WHERE DE-> TO WHERE HL->
; UNTIL DE = BC
; 'POPA' RESTORES THE 'FOR' LOOP VARIABLE SAVE AREA FROM THE
; STACK
; 'PUSHA' STACKS THE 'FOR' LOOP VARIABLE SAVE AREA INTO THE
; STACK

05E5 E7      MVUP: RST 4   ;*** MVUP ***
05E6 C8      RZ          ;DE = HL, RETURN
05E7 1A      LDAX D       ;GET ONE BYTE
05E8 02      STAX B       ;MOVE IT
05E9 12      INX D        ;INCREASE BOTH POINTERS
05EA 02      INX B
05EB 03E505   JMP MVUP    ;UNTIL DONE

;
; MVDOWN:
05EE 78      MOV A,B      ;*** MVDOWN ***
05EF 92      SUB D        ;TEST IF DE = BC
05F0 03F505   JNZ MD1     ;NO, GO MOVE
05F1 79      MOV A,C      ;MAYBE, OTHER BYTE?
05F4 92      SUB E
05F5 C8      RZ          ;YES, RETURN
05F6 1B      MD1: DCR D    ;ELSE MOVE A BYTE
05F7 2B      DCR H        ;BUT FIRST DECREASE
05F8 1A      LDAX D       ;BOTH POINTERS AND
05F9 77      MOV M,A      ;THEN DO IT
05FA 03EE05   JMP MVDOWN ;LOOP BACK

05FD C1      POPA: POP B   ;BC = RETURN ADDR.
05FE E1      POP H        ;RESTORE LOPVAR, BUT
05FF 220910   SHLD LOPVAR ;#0 MEANS NO MORE
0600 7C      MOV A,H      ;
0601 05      ORA L
0604 0A1705   JZ PP1      ;YEP, GO RETURN
0607 E1      POP H        ;NOP, RESTORE OTHERS
0608 220E10   SHLD LOPINC
0609 E1      POP H
060C 220D10   SHLD LOPLMT
060F E1      POP H
0610 220F10   SHLD LOPLN
0612 E1      POP H
0614 221110   SHLD LOPPT
0617 C5      PP1: PUSH B   ;BC = RETURN ADDR.
0618 C9      RET

0619 21DE12   PUSHA: LXI H,STKLMT ;*** PUSHA ***
061C 0D8604   CALL CHGSGN

061F C1      POP B        ;BC=RETURN ADDRESS
0620 39      DAD SP       ;IS STACK NEAR THE TOP?
0621 02F204   JNC OSORRY  ;YES, SORRY FOR THAT.
0624 2A0910   LHLD LOPVAR ;ELSE SAVE LOOP VAR. S
0627 7C      MOV A,H      ;BUT IF LOPVAR IS 0
0628 B5      ORA L        ;THAT WILL BE ALL
0629 0A2F0E   JZ PU1      ;ELSE, MORE TO SAVE
062C 2A1110   LHLD LOPPT
062F E5      PUSH H
0630 2A0F10   LHLD LOPLN
0633 E5      PUSH H
0634 2A0D10   LHLD LOPLMT
0637 E5      PUSH H
0638 2A0E10   LHLD LOPINC
063B E5      PUSH H
063C 2A0910   LHLD LOPVAR
063F E5      PUSH H
0640 C5      PU1: PUSH B   ;BC = RETURN ADDR.
0641 C9      RET

; *****
; *** OUTC *** & CHKIO ***
; THESE ARE THE ONLY I/O ROUTINES IN TBI.
; 'OUTC' IS CONTROLLED BY A SOFTWARE SWITCH 'OCSW'. IF OCSW=0
; 'OUTC' WILL JUST RETURN TO THE CALLER. IF OCSW IS NOT 0,
; IT WILL OUTPUT THE BYTE IN A. IF THAT IS A CR, A LF IS ALSO
; SEND OUT. ONLY THE FLAGS MAY BE CHANGED AT RETURN, ALL REG.
; ARE RESTORED.

0642 320010   INIT: STA OCSW ;'CHKIO' CHECKS THE INPUT. IF NO INPUT, IT WILL RETURN TO
0643 3E0F     MVI A,0FH      ;THE CALLER WITH THE Z FLAG SET. IF THERE IS INPUT, Z FLAG
0647 03FB     OUT 0FBH      ;IS CLEARED AND THE INPUT BYTE IS IN A. HOWEVER, IF THE
0649 3E27     MVI A,27H     ;INPUT IS A CONTROL-0, THE 'OCSW' SWITCH IS COMPLIMENTED, AND
064B 03FB     OUT 0FBH      ;Z FLAG IS RETURNED. IF A CONTROL-C IS READ, 'CHKIO' WILL
064D 1619     MVI D,19H     ;RESTART TBI AND DO NOT RETURN TO THE CALLER.

064F 0D0E00   PATLOP: CALL CRLF ;
0652 15      DCR D          ;
0653 02AF0E   JNZ PATLOP ;
0656 97      SUB A          ;
0657 1A20E    LXI D,MSG1    ;
065A 0D0005   CALL PRSTG  ;
065D 210000   LXI H,START  ;
0660 221210   SHLD RANPNT ;
0663 211710   LXI H,TXTBGN ;
0666 221510   SHLD TXTURN ;
0669 03BA00   JMP RSTART  ;
066C 03710E   OC2: JNZ OC3  ;IT IS ON
066F F1      POP PSW       ;IT IS OFF
0670 C9      RET          ;RESTORE AF AND RETURN
0671 0BFE     IN 0FBH      ;COME HERE TO DO OUTPUT
0673 E601     ANI 1H       ;STATUS BIT
0675 0A710E   JZ OC3      ;NOT READY, WAIT
0678 F1      POP PSW       ;READY, GET OLD A BACK
0679 03FA     OUT 0FAH     ;AND SEND IT OUT
067B FE0D     CPI CR       ;WAS IT CR?
067D C0      RNZ          ;NO, FINISHED
067E 3E0A     MVI A,LF     ;SEND LF
0680 07      RST 2         ;THIS IS RECURSIVE
0681 3E0D     MVI A,CR     ;GET CR BACK IN A
0683 C9      RET
0684 0BFB     IN 0FBH      ;*** CHKIO ***
0686 00      NOP          ;STATUS BIT FLIPPED?
0687 E602     ANI 2H       ;MASK STATUS BIT
0689 C8      RZ          ;NOT READY, RETURN "Z"
068A 0BFA     IN 0FAH     ;READY, READ DATA
068C E67F     ANI 7FH      ;MASK BIT 7 OFF
068E FE0F     CPI 0FH      ;IS IT CONTROL-0?
0690 029D0E   JNZ C11     ;NO, MORE CHECKING
0693 3A0010   LDA OCSW    ;CONTROL-0 FLIPS OCSW
0696 2F      CMA          ;ON TO OFF, OFF TO ON
0697 030010   STA OCSW    ;
069A 03840E   JMP CHKIO   ;GET ANOTHER INPUT
069D FE03     CPI 3H       ;IS IT CONTROL-C?
069F C0      RNZ          ;NO, RETURN "NZ"
06A0 03BA00   JMP RSTART  ;YES, RESTART TBI
06A3 54494E59 MSG1: DB 'TINY' ;
06A7 20      DB 20        ;
06A8 42415249 DB 'BASIO' ;
06AC 43      DB 43        ;
06AD 00      DB CR       ;

06AE 4C495254 TAB1: DB 'LIST' ;DIRECT COMMANDS
06B2 81      + DB 0016FH SHR 8)+128 ;DUA LIST
06B3 6F      + DB 0016FH AND 0FFH ;
06B4 52554E   DB 'RUN' ;
06B7 81      + DB 00141H SHR 8)+128 ;DUA RUN
06B8 41      + DB 00141H AND 0FFH ;
06B9 4E4557   DB 'NEW' ;
06BC 81      + DB 00132H SHR 8)+128 ;DUA NEW
06BD 32      + DB 00132H AND 0FFH ;
06BE 4E455854 TAB2: DB 'NEXT' ;DIRECT/STATEMENT
06C2 82      + DB 00257H SHR 8)+128 ;DUA NEXT
06C3 57      + DB 00257H AND 0FFH ;
06C4 4C4554   DB 'LET' ;
06C7 82      + DB 00323H SHR 8)+128 ;DUA LET
06C8 22      + DB 00323H AND 0FFH ;
06C9 4946     DB 'IFF' ;
06CB 82      + DB 002B4H SHR 8)+128 ;DUA IFF
06CC B4      + DB 002B4H AND 0FFH ;
06CD 474F544F DB 'GOTO' ;
06D1 81      + DB 00160H SHR 8)+128 ;DUA GOTO
06D2 60      + DB 00160H AND 0FFH ;
06D3 474F5355 DB 'GOSUB' ;
06D7 42      + DB 001BFH SHR 8)+128 ;DUA GOSUB
06D8 81      + DB 001BFH AND 0FFH ;
06D9 BF      +

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SOFTWARE SECTION

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06D8 52455455 DB 'RETURN'
06DE 524E +
06E0 81 + DB DWA RETURN
06E1 DF + DB DB (001DFH SHR 8) +128
06E2 52454D DB 'REM'
06E5 82 + DB DWA REM
06E6 B0 + DB DB (002B0H SHR 8) +128
06E7 464F52 DB 'FOR'
06EA 81 + DB DWA FOR
06EB F8 + DB DB (001F8H SHR 8) +128
06EC 494E5055 DB 'INPUT'
06F0 54 +
06F1 82 + DB DWA INPUT
06F2 CD + DB DB (002CDH SHR 8) +128
06F3 5052494E DB 'PRINT'
06F7 54 +
06F8 81 + DB DWA PRINT
06F9 87 + DB DB (00187H SHR 8) +128
06FA 53544F50 DB 'STOP'
06FE 81 + DB DWA STOP
06FF 38 + DB DB (00138H SHR 8) +128
0700 93 + DB DWA DEFLT
0701 1D + DB DB (0031DH SHR 8) +128
0702 524E44 TAB4: DB 'RND' ; FUNCTIONS
0705 84 + DB DWA RND
0706 25 + DB DB (00425H SHR 8) +128
0707 414253 DB 'ABS'
070A 84 + DB DWA ABS
070B 50 + DB DB (00450H SHR 8) +128
070C 53495A45 DB 'SIZE'
0710 84 + DB DWA SIZE
0711 59 + DB DB (00459H SHR 8) +128
0712 84 + DB DWA XP40
0713 0B + DB DB (0040BH SHR 8) +128
0714 544F TAB5: DB 'TO' ; "TO" IN "FOR"
0716 82 + DB DWA FR1
0717 0B + DB DB (00208H SHR 8) +128
0718 84 + DB DWA QWHAT
0719 C6 + DB DB (004C6H SHR 8) +128
071A 53544550 TAB6: DB 'STEP' ; "STEP" IN "FOR"
071E 82 + DB DWA FR2
071F 12 + DB DB (00212H SHR 8) +128
0720 82 + DB DWA FR3
0721 16 + DB DB (00216H SHR 8) +128
0722 3E3D TAB8: DB '>=' ; RELATION OPERATORS
0724 83 + DB DWA XP11
0725 33 + DB DB (00333H SHR 8) +128
0726 23 + DB DWA XP12
0727 83 + DB DB (00339H SHR 8) +128
0728 39 + DB DB (00339H SHR 8) +128
0729 3E + DB DWA XP13
072A 83 + DB DB (0033FH SHR 8) +128
072B 2F + DB DB (0033FH SHR 8) +128
072C 3D + DB DWA XP15
072D 83 + DB DB (0034EH SHR 8) +128
072E 4E + DB DB (0034EH SHR 8) +128
072F 3C3D DB '<='
0731 83 + DB DWA XP14
0732 16 + DB DB (00346H SHR 8) +128
0733 3C DB '<'
0734 83 + DB DWA XP16
0735 54 + DB DB (00354H SHR 8) +128
0736 83 + DB DWA XP17
0737 5A + DB DB (0035AH SHR 8) +128
0738 21AD06 DIRECT: LXI H,TAB1-1 ;*** DIRECT ***
073B EF EXEC: RST 5 ;*** EXEC ***
073C 05 EX0: PUSH D ;IGNORE LEADING BLANKS
073D 1A EX1: LDAX D ;SAVE POINTER
073E 12 EX1: INX D ;IF FOUND ' ' IN STRING
073F FE2E EX1: CPI 2EH ;BEFORE ANY MISMATCH
0741 CA5A07 JZ EX3 ;WE DECLARE A MATCH
0741 23 INX H ;HL->TABLE
0745 BE CMP M ;IF MATCH, TEST NEXT
0746 CA2D07 JZ EX1
0749 3E7F MVI A,07FH ;ELSE, SEE IF BIT 7
074B 1B DCX D ;OF TABLE IS SET, WHICH
074C BE CMP M ;IS THE JUMP ADDR. (HI)
074D DA6107 JC EX5 ;C:YES, MATCHED
0750 23 EX2: INX H ;C:NO, FIND JUMP ADDR.
0751 BE CMP M
0752 D25007 JNC EX2
0755 23 INX H ;JUMP TO NEXT TAB. ITEM
0756 01 POP D ;RESTORE STRING POINTER
0757 C32B07 JMP EX0 ;TEST AGAINST NEXT ITEM
075A 3E7F EX0: MVI A,07FH ;PARTIAL MATCH, FIND
075C 03 EX1: INX H ;JUMP ADDR., WHICH IS
075D BE CMP M ;FLAGGED BY BIT 7
075E D25C07 JNC EX4
0761 7E EX5: MOV A,M ;LOAD HL WITH THE JUMP
0762 23 INX H ;ADDRESS FROM THE TABLE
0763 6E MOV L,M
0764 E57F ANI 7FH ;MASK OFF BIT 7
0765 67 MOV H,A
0767 F1 POP PSW ;CLEAN UP THE GARBAGE
0768 E9 PCHL ;AND WE GO DO IT
1000 LSTR0: ORG 1000H ;HERE ON MUST BE RAM
1000 OCSW: DS 1 ;SWITCH FOR OUTPUT
1001 CURPT: DS 2 ;POINTS TO CURRENT LINE
1003 STKG0: DS 2 ;SAVES SP IN 'GOSUB'
1005 VARNX: DS 2 ;TEMP STORAGE
1007 STKINP: DS 2 ;SAVES SP IN 'INPUT'
1009 LOPVAR: DS 2 ;'FOR' LOOP SAVE AREA
100B LOPINC: DS 2 ;INCREMENT
100D LOPLMT: DS 2 ;LIMIT
100F LOPLN: DS 2 ;LINE NUMBER
1011 LOPPT: DS 2 ;TEXT POINTER
1013 RANPT: DS 2 ;RANDOM NUMBER POINTER
1015 TXTNFG: DS 2 ;UNFILLED TEXT AREA
1017 TXTBGN: DS 2 ;TEXT SAVE AREA BEGINS
1019 ORG 1366H
101B TXTEND: DS 0 ;TEXT SAVE AREA ENDS
101D VARGN: DS 55 ;VARIABLE 000
101F BUFFER: DS 64 ;INPUT BUFFER
1021 BUFEND: DS 1 ;BUFFER ENDS
1023 STKLMT: DS 1 ;TOP LIMIT FOR STACK
1025 ORG 1400H
1027 STACK: DS 0 ;STACK STARTS HERE
0000 CR EOU 00H
000A LF EOU 0AH
0000 END
ABS 0450 AHOW 00A0 ASORR 04F4 AWHAT 04C7
BUFEN 13D0 BUFFE 13D0 CHGSG 0486 CHKIO 0684
CHKSG 0483 CII 063D CK1 049E CKHLD 0498
CR 000D CRLF 000E CURRN 1001 DEFLT 031D
DIREC 0738 DIVID 0466 DV1 0471 DV2 0473
DWA 8F78 ENDOCH 04C2 ERROR 04C8 EX0 073B
EX1 073D EX2 0750 EX3 075A EX4 075C
EX5 0761 EXEC 073B EXPR1 032D EXPR2 0371
EXPR3 03A5 EXPR4 0405 FI1 048A FI2 04C1
FIN 0483 FL1 0540 FL2 0555 FNDLN 0538
FNDLP 0540 FNDONX 0554 FNDSK 0556 FOR 01F8
FR1 0208 FR2 0212 FR3 0216 FR4 0219
FR5 021C FR7 0231 FR8 0252 GETLN 04FA
GL1 04FE GL2 0523 GL4 0530 GOSUB 01BF
GOTO 0160 H0W 00A6 IFF 0284 INIT 0642
INPER 02C3 INPUT 02CD IP1 02CD IP2 02DB
IP3 02EB IP4 0315 IP5 031C LET 0323
LF 000A LIST 016F LOPIN 100B LOPLM 100D
LOPLN 100F LOPPT 1011 LOPVA 1009 LS1 0178
LSTRO 0769 LT1 032C MD1 05F6 MSG1 06A3
MYDOW 05EE MYUP 05E5 NEW 0132 NEXT 0257
N00 025E NK1 0298 NK2 02AC NX3 0276
N4 020B NK5 02AA OC2 066C OC3 0671
OCSW 1000 OK 00AB PARN 041A PATLO 064F
PN1 059D PN2 05A4 PN3 05B4 PN4 05B5
PN5 05C1 PN6 05C7 POPA 05FD PP1 0617
PR0 019B PR1 01A3 PR2 0192 PR3 01A9
PR6 01B2 PR8 01B6 PRINT 0187 PRTLN 05D2
PRTNU 0592 PRIST 0560 PS1 0561 PU1 063F
PUSHR 0619 QHOW 009F OSORR 04F3 OT1 0571
OT2 057A OT3 057E OT4 0586 OT5 0591
OTS0 056C QWHAT 04C6 RA1 0440 RANPN 1013
REM 02B0 RETUR 01DF RND 0425 RSTAR 00BA
RUN 0141 RUNNX 0147 RUNSM 0157 RUNTS 0150
SETVA 04A0 SIZE 0459 SORRY 00B4 SS1 0028
S11 00B0 S12 00C0 S13 00B6 ST4 010B
STACK 1400 START 0000 STKG0 1003 STKIN 1007
STKLH 13DE STOP 013B SUBOE 047C SV1 04B0
TAB1 06AE TAB2 06BE TAB4 0702 TAB5 0714
TAB6 071A TAB8 0722 TC1 0068 TC2 0073
TN1 007C TSTNU 0077 TV1 0058 TXTBG 1017
TXTEN 1366 TXTUN 1015 VARGB 1366 VARNX 1005
WHAT 00AE XP11 0333 XP12 0339 XP13 033F
XP14 0346 XP15 034E XP16 0354 XP17 035A
XP18 035C XP21 037A XP22 037D XP23 0380
XP24 0387 XP25 0398 XP26 039B XP21 039B
XP22 03C5 XP23 03CD XP24 03D0 XP25 03F7
XP40 040B XP41 0414 XP42 0421 XP43 0422

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Merry Christmas

Happy New Year