```
FFFFFFFFFFFFFFF          333333333
FFFFFFFFFFFFFFF          333333333
FFFFFFFFFFFFFFF          333333333
FFF                  333         333
FFF                  333         333
FFF                  333         333
FFF                              333
FFF                              333
FFF                              333
FFFFFFFFFFFF                 333
FFFFFFFFFFFF                 333
FFFFFFFFFFFF                 333
FFF                              333
FFF                              333
FFF                              333
FFF                  333         333
FFF                  333         333
FFF                  333         333
FFF                     333333333
FFF                     333333333
FFF                     333333333
```

```
LPTSPL VERSION 6(344)  RUNNING ON LPT0
 *START* USER MITS  [6000,6000] JOB  F3 SEQ, 42 DATE 10-SEP-75 08:24:32 MONITOR ALBUQUERQUE SCHOOLS 5076 *START*
REQUEST CREATED: 10-SEP-75  03:16:06
FILE: DSK0:F3[6000,6000] CREATED: 10-SEP-75 03:16:00 PRINTED: 10-SEP-75 08:52:43
QUEUE SWITCHES:  /FILE:ASCII /COPIES:2 /SPACING:1 /LIMIT:1305 /FORMS:NORMAL
FILE WILL BE DELETED AFTER PRINTING
```

```
BASIC MCS 8080  GATES/ALLEN/DAVIDOFF    MACRO 47(113) 03:12 10-SEP-75 PAGE 1
C        6-SEP-64 03:08          COMMON FILE

 1                                00100  SEARCH  MCS800                      ;THE UNIVERSAL FILE
 2                                00200  SUBTTL  COMMON FILE
 3                                00300  SALL
 4                    000002      00400  LENGTH==2                           ; 0 MEANS 4K, 1 MEANS 8K, 2 MEANS 12K
 5                    000001      00500  REALIO==1
 6                    000000      00600  CASSW==0                            ;CASSETTE SWITCH (CSAVE,CLOAD)
 7                    000000      00700  PURE==0                             ;ON FOR PURE CODE
 8                    000000      00800  LPTSW==0
 9                    000000      00900  DSKFUN==0                           ;ON TO READ/WRITE
10                    000000      01000  CONSSW==0
11
12                    000016      01200  CLMWID==^D14                        ;MAKE COMMA COLUMNS FOURTEEN CHARACTERS
13                    020000      01300  RAMBOT=^O20000                      ;BOTTOM LOCATION OF RAM FOR PURE SWITCH
14                    000001      01400  CONTRW==1                           ;ALLOW ^O
15                                01500  IFE     REALIO,<
16                                01600          LPTSW==0                    ;SIMULATOR DEFAULTS
17                                01700          CASSW==0
18                                01800          CONSSW==0
19                                01900          DSKFUN==0
20                                02000          CONTRW==0>
21
22                                02200  IFE     LENGTH,<
23                                02300          EXTFNC==0                   ;ON MEANS EXTENDED FUNCTIONS
24                                02400          MULDIM==0                   ;ON MEANS MULTIPLE DIMENSIONED ARRAYS ALLOWED
25                                02500          STRING==0                   ;ON MEANS STRINGS ALLOWED
26                                02600          CASSW==0
27                                02700          LPTSW==0
28                                02800          DSFFUN==0
29                                02900          CONSSW==0
30                                03000          CONTRW==0>
31
32                                03200  IFE     LENGTH-1,<
33                                03300          EXTFNC==1
34                                03400          MULDIM==1
35                                03500          STRING==1>
36
37                                03700  IFE     LENGTH-2,<
38                    000001      03800          EXTFNC==1
39                    000001      03900          MULDIM==1
40                    000001      04000          STRING==1>
41
42                                04200  DEFINE  SYNCHK(A),<RST  1
43                                04300                     A>
44                                04400  DEFINE  CHRGET,<RST     2>
45                                04500  DEFINE  OUTCHK,<RST     3>
46                                04600  DEFINE  COMPAR,<RST     4>
47                                04700  DEFINE  FSIGN,<RST      5>
48                                04800  DEFINE  PUSHM,<RST      6>
49                                04900  DEFINE  PUSHFM,<PUSHM
50                                05000                  PUSHM>
51                                05100  DEFINE  ACRLF,<
52                                05200          ^D13
53                                05300  IFN     STRING,<^D10>>
```

```
BASIC MCS 8080  GATES/ALLEN/DAVIDOFF     MACRO 47(113) 03:12 10-SEP-75 PAGE 1-1
C          6-SEP-64 03:08          COMMON FILE

                                 05400   DEFINE  PUSHR,<
                                 05500           PUSH    D
                                 05600           PUSH    B>
                                 05700   DEFINE  POPR,<
                                 05800           POP     B
                                 05900           POP     D>
                                 06000   DEFINE  MOVRI(B,C,D,E),<
                                 06100           XWD     ^O1000,^O001    ;; "LXI B"
                                 06200           EXP     C
                                 06300           EXP     B
                                 06400           XWD     ^O1000,^O021    ;; "LXI D"
                                 06500           EXP     E
                                 06600           EXP     D>

                                 06800   IF1,<
                                 06900   IFE     LENGTH,<PRINTX  /SMALL/>
                                 07000   IFE     LENGTH-1,<PRINTX        /MEDIUM/>
                                 07100   IFE     LENGTH-2,<PRINTX        /BIG/>
                                 07200   IFE     REALIO,<PRINTX  /SIMULATE/>
                                 07300   IFN     REALIO,<PRINTX  /ON MACHINE/>
                                 07400   IFN     CASSW,<PRINTX   /CASSETTE/>
                                 07500   IFN     PURE,<PRINTX    /PURE/>
                                 07600   IFN     LPTSW,<PRINTX   /LPT/>
                                 07700   IFN     DSKFUN,<PRINTX  /DISK/>
                                 07800   IFN     CONSSW,<PRINTX  /CONSOLE/>>
                                 07900   PAGE
```

```
BASIC MCS 8080  GATES/ALLEN/DAVIDOFF     MACRO 47(113) 03:12 10-SEP-75 PAGE 1
F3      MAC      6-SEP-64 03:11          VERSION 3.0 -- MORE FEATURES TO GO

                                 00020   SUBTTL  VERSION 3.0 -- MORE FEATURES TO GO
                                 00040   TITLE   BASIC MCS 8080  GATES/ALLEN/DAVIDOFF
                                 00060   IFNDEF  LENGTH,<PRINTX !!! MUST HAVE COM !!!
                                 00080           END>
  000000'                        00100   MCSSIM(START)
                                 00120   COMMENT *

                                 00160   --------- ---- -- ---- ----- --- ---- -----
                                 00180   COPYRIGHT 1975 BY BILL GATES AND PAUL ALLEN
                                 00200   --------- ---- -- ---- ----- --- ---- -----


                                 00260   ORIGINALLY WRITTEN ON THE POP-10 FROM
                                 00280   FEBRUARY 9 TO  APRIL 9

                                 00320   BILL GATES WROTE THE RUNTIME STUFF,
                                 00340   PAUL ALLEN WROTE THE NON-RUNTIME STUFF,
                                 00360   MONTE DAVIDOFF WROTE THE MATH PACKAGE,

                                 00400   THINGS TO DO:
                                 00420   GOSUB / INPUT BUG  (BUF SMASH)
                                 00440   PRINT PUNCTUATION MANDATORY
                                 00460   MULTIPLE LET
                                 00480   RESTART AT 0 SHOULD  GO THROUGH  STKINI
                                 00500   USER DEFINED FUNCTIONS(MULTI-ARG,MULTI-LINE,STRINGS)
                                 00520   MAKE STACK BOUNDARY STUFF EXACT
                                 00540   PUNCH,RENUMBER,,,
                                 00560   INLINE CONSTANT CONVERSION--MAKE IT WORK
                                 00580   *
                                 00600   RADIX 10                        ;THROUGHOUT THE NON-MATH PACKAGE ROUTINES
000000                           00620   .P==0                           ;FOR SIMULATOR FIXUPS
000025                           00640   NUMLEV==17+LENGTH*2             ;NUMBER OF STACK LEVELS RESERVED
                                 00660                                   ;WITH AN EXPLICIT CALL TO GETSTK
000110                           00680   LPTLEN==72                      ;WIDTH OF LINE-PRINTER
000110                           00700   LINLEN==72                      ;TELETYPE LINE LENGTH
000110                           00720   BUFLEN==72                      ;INPUT BUFFER SIZE
000004                           00740   STRSIZ==4
000003                           00760   IFE     LENGTH-2,<STRSIZ==3>
000003                           00780   NUMTMP==3                       ;NUMBER OF STRING TEMPORARIES
000005                           00800   IFE     LENGTH-2,<NUMTMP=5>
000015                           00820   CR==13
000017                           00840   CONT=:15                        ;CHARACTER TO SUPRESS OUTPUT
000200                           00860   DODNE==:128                     ;BIT FOR OUTPUT DONE
000001                           00880   IDONE==:1                       ;BIT FOR INPUT DONE
000001                           00900   TTOCHN==:1                      ;TELETYPE OUTPUT CHANNEL
000001                           00920   TTICHN==:1                      ;TELETYPE INPUT CHANNEL
200000                           00960   LISTEN==:0                      ;ON MEANS LISTEN FOR ^C
000001                           01000   FUNCTS==:1                      ;ON MEANS USER FUNCTIONS ALLOWED
                                 01020                                   ;; CANNOT BE ON WITH LENGTH=0 (SUBFLG)
                                 01040   IFN     REALIO,<
000001                           01060   LISTEN==:1>
                                 01080   IFE     LENGTH,<
                                 01120   FUNCTS==:0>
```

```
01200   INTERNAL        ,C1,BUF,READY,REASON,SNERR,OMERR,REPINI
01220   INTERNAL        STREND,CURLIN,DV0ERR,ERROV
01240   IFN     REALIO,<
01260   INTERNAL        CNLCA1,CNLCA2,CNLCA3>
01280   IFN     EXTFNC,<INTERNAL        ATNFIX,COSFIX,SINFIX,TANFIX
01300   EXTERNAL        FPWR,EXP>
01320   EXTERNAL        QINT,ZERO,MOVE,FOUT,FIN,FCOMP,FADD,PUSHF,INT,INIT
01340   EXTERNAL        MOVFR,MOVRF,MOVRM,INPRT,LINPRT
01360   EXTERNAL        MOVFM,MOVMF,TSTACK,FLOATRI,FADDS
01380   INTERNAL        ILLFUN,FAC,FACLO,TXTTAB,STROUT,SCRTCH
01400   EXTERNAL        INRART,NEG,FLOAT
01420   INTERNAL        OUTDO,STROUI
01440   INTERNAL        STKTOP,ERROR,FCERR
01460   IFN     STRING,<
01462   INTERNAL          VALTYP,TEMPPT
01464   INTERNAL        TEMPST,STRLIT
01466   IFN     LENGTH=2,<
01468   INTERNAL        TMERR>
01480   INTERNAL        MEMSIZ,FRETOP
01500   EXTERNAL        SIGNS>
01520   INTERNAL        FBUFFH,MINUTK,PLUSTK,CRDO,LINGET,INTXT,GINLIN
01540   IFN     MULDIM,<INTERNAL        BSERR>
01560   IFN     MULDIM,<EXTERNAL        UMULT>
01580   IFE     LENGTH,<INTERNAL        RNDFIX,SQRFIX,SINFIX>
01600   INTERNAL        SIGN
01620   EXTERNAL        SIGNC,POPHRT
01640   IFN     CONTRW,<
01660   INTERNAL        CNTWFL>
01680   IFN     LPTSW,<
01700           INTERNAL        LPTPOS,PRTFLG>
01720   IFE     LENGTH=2,<
01730   EXTERNAL        CONSIN,VMOVFA,VMOVAF,ISIGN,FPWRQ,CONIA,GETBCD,VSIGN
01740   EXTERNAL        VMOVMF,VMOVFM,FRCINT,FRCSNG,FRCDBL,VNEG,PUFOUT,DCXBRT,IADD
01760   EXTERNAL        ISUB,IMULT,IDIV,ICOMP,INEG,DADD,DSUB,DMULT,DDIV,DCOMP,VINT
01780   EXTERNAL        TMERR,VMOVE,VALINT,VALSNG,FRCSTR,CHKSTR,MAKINT
01800   INTERNAL        DFACLO,ARG,ARGLO,VALTYP,ERRTM,TEMP2,TEMP3,GETYPE>
01820   PAGE
```



```
01840   SUBTTL  SOME EXPLANATION

01880   COMMENT *

01920   ALTAIR BASIC CONFIGURES MEMORY AS FOLLOWS:

01960   LOW LOCATIONS

02000           RST     SUBROUTINES

02040                   0       STARTUP
02060                           INITIALLY A JMP TO THE INITIALIZATION CODE
02080                           BUT CHANGED TO A JMP TO READY.
02100                           RESTARTING THE MACHINE AT 0 DURING PROGRAM
02120                           EXECUTION CAN LEAVE THINGS MESSED UP.

02160                   1       SYNCHK
02180                           A CHECK IS MADE TO MAKE SURE THE
02200                           CHARACTER POINTER POINTS AT A SPECIFIC
02220                           CHARACTER, IF NOT THE "SYNTAX ERROR"
02240                           ROUTINE IS CALLED. IF SO,
02260                           THE CHRGET RST IS DROPPED INTO SO
02280                           THE CHARACTER AFTER THE MATCHED
02300                           ONE WILL BE PUT IN [A] AND
02320                           THE CONDITION CODES WILL REFLECT THIS
02340                           EXAMPLE: SYNCHK THENTK (THE MATCH CHARACTER IS
02360                           GIVEN IN THE LOCATION AFTER THE RST)
02380                           WOULD CHECK TO MAKE SURE [H,L] POINTED TO A THENTK
02400                           AND IF SO FETCH THE NEXT CHARACTER INTO [A],
02420                           IF NOT, A "SYNTAX ERROR" WOULD BE GIVEN.

02460                   2       CHRGET
02480                           USING [H,L] AS THE TEXT POINTER
02500                           THE TEXT POINTER IS INCREMENTED
02520                           AND THE NEXT CHARACTER IS FETCHED INTO [A]
02540                           IF THE CHARACTER IS A " " IT IS SKIPPED
02560                           OVER AND THE NEXT CHARACTER IS FETCHED.
02580                           THE STATEMENT TERMINATORS ":" AND 0
02600                           LEAVE THE ZERO FLAG SET.
02620                           THE NUMERICS "0" THROUGH "9" LEAVE THE CARRY
02640                           FLAG SET. THE CURRENT CHARACTER CAN BE
02660                           REFETCHED INTO [A] BY DOING A MOV A,M.
02680                           IF THE CONDITION CODES MUST BE SET UP AGAIN
02700                           DCX H,CHRGET WILL WORK. IT IS VERY DIFFICULT
02720                           TO REEXAMINE THE CHARACTER BEFORE THE CURRENT
02740                           ONE SINCE SPACES MAY BE IN-BETWEEN.
02760                           DCX H,DCX H,CHRGET WILL NOT ALWAYS WORK.

02800                   3       OUTCHR
02820                           THE CHARACTER IN [A] IS PRINTED ON
02840                           THE USER'S TERMINAL. [A] AND THE
02860                           CONDITION CODES ARE PRESERVED.
```

```
225                 02900                 4       COMPAR
226                 02920                         [D,E] AND [H,L] ARE COMPARED AS UNSIGNED
227                 02940                         DOUBLE-BYTE INTEGERS, CARRY IS SET IF
228                 02960                         [H,L] IS LESS THAN [D,E], ZERO IS SET IF THEY
229                 02980                         ARE EQUAL, [A] IS SMASHED, THE ONLY DEFINITE
230                 03000                         THING THAT CAN BE SAID ABOUT [A] ON RETURN
231                 03020                         IS THAT IF THE ZERO FLAG IS SET, [A] WILL
232                 03040                         EQUAL 0.
233
234                 03080                 5       FSIGN
235                 03100                         THE FAC (FLOATING ACCUMULATOR)
236                 03120                         WHICH IS USED TO STORE NUMERIC RESULTS
237                 03140                         IS CHECKED TO SEE WHAT SIGN ITS
238                 03160                         VALUE HAS.
239
240                 03200                 6       PUSHM
241                 03220                         A DOUBLE BYTE QUANTITY POINTED
242                 03240                         TO BY [H,L] IS PUSHED ONTO THE
243                 03260                         STACK, [B,C] IS SET EQUAL TO THE
244                 03280                         VALUE PUSHED, [H,L] IS INCREMENTED BY TWO.
245
246                 03320                 7       IN THE 4K VERSION RST 7 IS UNUSED AND THE LOCATIONS
247                 03340                         ASSOCIATED WITH IT ARE USED TO CONTINUE
248                 03360                         THE CODE FOR RST 6, IN THE 8K A JMP IS MADE
249                 03380                         AROUND THE FIRST THREE RST 7 LOCATIONS
250                 03400                         DURING RST 6 EXECUTION, RST 7 INITIALLY
251                 03420                         CONTAINS A RET, BUT THE USER CAN CHANGE IT TO
252                 03440                         A JMP TO AN INTERRUPT SERVICE ROUTINE.
253
254                 03480         FUNCTION DISPATCH ADDRESSES
255                 03500                 FUNDSP CONTAINS THE ADDRESSES OF THE
256                 03520                 FUNCTION ROUTINES IN THE ORDER OF THE
257                 03540                 FUNCTION NAMES IN THE CRUNCH LIST.
258                 03560                 THE FUNCTIONS THAT TAKE MORE THAN ONE ARGUMENT
259                 03580                 ARE AT THE END. SEE THE EXPLANATION AT ISFUN.
260
261                 03620         THE OPERATOR TABLE
262                 03640                 THE OPTAB TABLE CONTAINS AN OPERATORS PRECEDENCE
263                 03660                 FOLLOWED BY THE ADDRESS OF THE ROUTINE TO PERFORM
264                 03680                 THE OPERATION. THE INDEX INTO THE
265                 03700                 OPERATOR TABLE IS MADE BY SUBTRACTING OFF THE CRUNCH VALUE
266                 03720                 OF THE LOWEST NUMBERED OPERATOR. THE ORDER
267                 03740                 OF OPERATORS IN THE CRUNCH LIST AND IN OPTAB IS IDENTICAL.
268                 03760                 THE PRECEDENCES ARE ARBITRARY,EXCEPT FOR THEIR
269                 03780                 COMPARATIVE SIZES. NOTE THAT THE PRECEDENCE FOR
270                 03800                 UNARY OPERATORS SUCH AS NOT AND NEGATION ARE
271                 03820                 SETUP SPECIALLY WITHOUT USING A TABLE.
272
273                 03860         THE RESERVED WORD OR CRUNCH LIST
274                 03880                 WHEN A COMMAND OR PROGRAM LINE IS TYPED IN
275                 03900                 IT IS STORED IN BUF. AS SOON AS THE WHOLE LINE
276                 03920                 HAS BEEN TYPED IN (INLIN RETURNS) CRUNCH IS
277                 03940                 CALLED TO CONVERT ALL RESERVED WORDS TO THEIR
```



```
278                 03960                 CRUNCH VALUES. THIS REDUCES THE SIZE OF THE
279                 03980                 PROGRAM AND SPEEDS UP EXECUTION BY ALLOWING
280                 04000                 TABLE DISPATCHES TO PERFORM FUNCTIONS,STATEMENTS,
281                 04020                 AND OPERATIONS. THIS IS BECAUSE ALL THE STATEMENT
282                 04040                 NAMES ARE STORED CONSECUTIVELY IN THE CRUNCH LIST.
283                 04060                 WHEN A MATCH IS FOUND BETWEEN A STRING
284                 04080                 OF CHARACTERS AND A WORD IN THE CRUNCH LIST
285                 04100                 THE ENTIRE TEXT OF THE MATCHED WORD IS TAKEN OUT OF
286                 04120                 THE INPUT LINE AND A RESERVED WORD TOKEN IS PUT
287                 04140                 IN ITS PLACE. A RESERVED WORD TOKEN IS ALWAYS EQUAL
288                 04160                 TO OCTAL 200 PLUS THE POSITION OF THE MATCHED WORD
289                 04180                 IN THE CRUNCH LIST.
290
291                 04220         STATEMENT DISPATCH ADDRESSES
292                 04240                 WHEN A STATEMENT IS TO BE EXECUTED. THE FIRST
293                 04260                 CHARACTER OF THE STATEMENT IS EXAMINED
294                 04280                 TO SEE IF IT IS LESS THAN THE RESERVED
295                 04300                 WORD TOKEN FOR THE LOWEST NUMBERED STATEMENT NAME.
296                 04320                 IF SO, THE "LET" CODE IS CALLED TO
297                 04340                 TREAT THE STATEMENT AS AN ASSIGNMENT STATEMENT.
298                 04360                 OTHERWISE A CHECK IS MADE TO MAKE SURE THE
299                 04380                 RESERVED WORD NUMBER IS NOT TOO LARGE TO BE A
300                 04400                 STATEMENT TYPE NUMBER. IF NOT THE ADDRESS
301                 04420                 TO DISPATCH TO IS FETCHED FROM STMDSP (THE STATEMENT
302                 04440                 DISPATCH TABLE) USING THE RESERVED WORD
303                 04460                 NUMBER FOR THE STATEMENT TO CALCULATE AN INDEX INTO
304                 04480                 THE TABLE.
305
306                 04520         ERROR MESSAGES
307                 04540                 WHEN AN ERROR CONDITION IS DETECTED
308                 04560                 [E] MUST BE SET UP TO INDICATE WHICH ERROR
309                 04580                 MESSAGE IS APPROPRIATE AND A BRANCH MUST BE MADE
310                 04600                 TO ERROR. THE STACK WILL BE RESET AND ALL
311                 04620                 PROGRAM CONTEXT WILL BE LOST. VARIABLES
312                 04640                 VALUES AND THE ACTUAL PROGRAM REMAIN INTACT.
313                 04660                 ONLY THE VALUE OF [E] IS IMPORTANT WHEN
314                 04680                 THE BRANCH IS MADE TO ERROR. [E] IS USED AS AN
315                 04700                 INDEX INTO ERRTAB WHICH GIVES THE TWO
316                 04720                 CHARACTER ERROR MESSAGE THAT WILL BE PRINTED ON THE
317                 04740                 USER'S TERMINAL.
318
319                 04780         IMPURE STORAGE
320                 04800                 ALL TEMPORARIES,FLAGS,POINTERS, THE BUFFER AREA,
321                 04820                 THE FLOATING ACCUMULATOR,AND ANYTHING ELSE THAT
322                 04840                 IS USED TO STORE A CHANGING VALUE SHOULD BE LOCATED
323                 04860                 IN THIS AREA. CARE MUST BE MADE IN MOVING LOCATIONS
324                 04880                 IN THIS AREA SINCE THE JUXTAPOSITION OF TWO LOCATIONS
325                 04900                 IS OFTEN DEPENDED UPON.
326
327                 04940         TEXTUAL MESSAGES
328                 04960                 CONSTANT MESSAGES ARE STORED HERE. UNLESS
329                 04980                 THE CODE TO CHECK IF A STRING MUST BE COPIED
330                 05000                 IS CHANGED THESE STRINGS MUST BE STORED ABOVE
```

```
05020                   DSCTMP, OR ELSE THEY WILL BE COPIED BEFORE
05040                   THEY ARE PRINTED.

05080           FNDFOR
05100                   MOST SMALL ROUTINES ARE FAIRLY SIMPLE
05120                   AND ARE DOCUMENTED IN PLACE, FNDFOR IS
05140                   USED FOR FINDING "FOR" ENTRIES ON
05160                   THE STACK, WHENEVER A "FOR" IS EXECUTED AN
05180                   18 BYTE ENTRY IS PUSHED ONTO THE STACK.
05200                   BEFORE THIS IS DONE, HOWEVER, A CHECK
05220                   MUST BE MADE TO SEE IF THERE
05240                   ARE ANY "FOR" ENTRIES ALREADY ON THE STACK
05260                   FOR THE SAME LOOP VARIABLE, IF SO, THAT "FOR" ENTRY
05280                   AND ALL OTHER "FOR" ENTRIES THAT WERE MADE AFTER IT
05300                   ARE ELIMINATED FROM THE STACK, THIS IS SO A
05320                   PROGRAM THAT JUMPS OUT OF THE MIDDLE
05340                   OF A "FOR" LOOP AND THEN RESTARTS THE LOOP AGAIN
05360                   AND AGAIN WON'T USE UP 18 BYTES OF STACK
05380                   SPACE EVERY TIME, THE "NEXT" CODE ALSO
05400                   CALLS FNDFOR TO SEARCH FOR A "FOR" ENTRY WITH
05420                   THE LOOP VARIABLE IN
05440                   THE "NEXT", AT WHATEVER POINT A MATCH IS FOUND
05460                   THE STACK IS RESET, IF NO MATCH IS FOUND A
05480                   "NEXT WITHOUT FOR"  ERROR OCCURS, GOSUB EXECUTION
05500                   ALSO PUTS A 6 BYTE ENTRY ON STACK.
05520                   WHEN A RETURN IS EXECUTED FNDFOR IS
05540                   CALLED WITH A VARIABLE POINTER THAT CAN'T
05560                   BE MATCHED, WHEN "FNDFOR" HAS RUN
05580                   THROUGH ALL THE "FOR" ENTRIES ON THE STACK
05600                   IT RETURNS AND THE RETURN CODE MAKES
05620                   SURE THE ENTRY THAT WAS STOPPED
05640                   ON IS A GOSUB ENTRY, THIS ASSURES THAT
05660                   IF YOU GOSUB TO A SECTION OF CODE
05680                   IN WHICH A FOR LOOP IS ENTERED BUT NEVER
05700                   EXITED THE RETURN WILL STILL BE
05720                   ABLE TO FIND THE MOST RECENT
05740                   GOSUB ENTRY. THE "RETURN" CODE ELIMINATES THE
05760                   "GOSUB" ENTRY AND ALL "FOR" ENTRIES MADE AFTER
05780                   THE GOSUB ENTRY.

05820           NON-RUNTIME STUFF
05840                   THE CODE TO INPUT A LINE,CRUNCH IT,GIVE ERRORS,
05860                   FIND A SPECIFIC LINE IN THE PROGRAM,
05880                   PERFORM A "NEW","CLEAR", AND "LIST" ARE
05900                   ALL IN THIS AREA, GIVEN THE EXPLANATION OF
05920                   PROGRAM STORAGE GIVEN BELOW THESE ARE
05940                   ALL STRAIGHTFORWARD.

05980           NEWSTT
06000                   WHENEVER A STATEMENT FINISHES EXECUTION IT
06020                   DOES A "RET" WHICH TAKES
06040                   EXECUTION BACK TO NEWSTT, STATEMENTS THAT
06060                   CREATE OR LOOK AT SEMI-PERMANENT STACK ENTRIES
```



```
06080                   MUST GET RID OF THE RETURN ADDRESS OF NEWSTT AND
06100                   JMP TO NEWSTT WHEN DONE, NEWSTT ALWAYS
06120                   CHRGETS THE FIRST CHARACTER AFTER THE STATEMENT
06140                   NAME BEFORE DISPATCHING, WHEN RETURNING
06160                   BACK TO NEWSTT THE ONLY THING THAT
06180                   MUST BE SET UP IS THE TEXT POINTER IN
06200                   (H,L), NEWSTT WILL CHECK TO MAKE SURE
06220                   (H,L) IS POINTING TO A STATEMENT TERMINATOR,
06240                   IF A STATEMENT SHOULDN'T BE PERFORMED UNLESS
06260                   IT IS PROPERLY FORMATTED (I.E. "NEW") IT CAN
06280                   SIMPLY DO A "RNZ" AFTER READING ALL OF
06300                   ITS ARGUMENTS, SINCE THE ZERO FLAG
06320                   BEING OFF INDICATES THERE IS NOT
06340                   A STATEMENT TERMINATOR NEWSTT WILL
06360                   DO THE JMP TO THE "SYNTAX ERROR"
06380                   ROUTINE, IF A STATEMENT SHOULD BE STARTED
06400                   OVER IT CAN DO LHLD TEMP,RET SINCE THE (H,L)
06420                   AT NEWSTT IS ALWAYS STORED IN TEMP, OF COURSE
06440                   CARE MUST BE TAKEN THAT NO ROUTINE
06460                   THAT SMASHES TEMP HAS BEEN CALLED.
06480                   THE "C CODE STORES TEMP IN OLDTXT AND CURLIN (THE
06500                   CURRENT LINE NUMBER) IN OLDLIN SINCE THE "C CHECK
06520                   IS MADE BEFORE THE STATEMENT POINTED TO IS
06540                   EXECUTED, "STOP" AND "END" STORE THE TEXT POINTER
06560                   IN (H,L) WHICH POINTS AT THEIR TERMINATING
06580                   CHARACTER IN OLDTXT.

06620           STATEMENT CODE
06640                   THE INDIVIDUAL STATEMENT CODE COMES
06660                   NEXT, THE APPROACH USED IN EXECUTING EACH
06680                   STATEMENT IS DOCUMENTED IN THE STATEMENT CODE
06700                   ITSELF.

06740           FRMEVL, THE FORMULA EVALUATOR
06760                   GIVEN AN (H,L) POINTING TO THE STARTING
06780                   CHARACTER OF A FORMULA FRMEVL
06800                   EVALUATES THE FORMULA AND LEAVES
06820                   THE VALUE IN THE FLOATING ACCUMULATOR (FAC),
06840                   (H,L) IS RETURNED POINTING TO THE FIRST CHARACTER
06860                   THAT COULD NOT BE INTERPRETED AS PART OF THE
06880                   FORMULA, THE ALGORITHM USES THE STACK
06900                   TO STORE TEMPORARY RESULTS:

06940                           0. PUT A DUMMY PRECEDENCE OF ZERO ON
06960                                   THE STACK.
06980                           1. READ LEXEME (CONSTANT,FUNCTION,
07000                                   VARIABLE,FORMULA IN PARENS)
07020                                   AND TAKE THE LAST PRECEDENCE VALUE
07040                                   OFF THE STACK.
07060                           2. SEE IF THE NEXT CHARACTER IS AN OPERATOR
07080                                   IF NOT,RETURN. THIS MAY CAUSE
07100                                   OPERATOR APPLICATION OR AN ACTUAL
07120                                   RETURN FROM FRMEVL.
```

```
07140                                   3, IF IT IS, SEE WHAT PRECEDENCE IT HAS
07160                                          AND COMPARE IT TO THE PRECEDENCE
07180                                          OF THE LAST OPERATOR ON THE STACK
07200                                   4, IF = OR LESS REMEMBER THE TEXT
07220                                          POINTER AT THE START OF THIS OPERATOR
07240                                          AND DO A RETURN TO CAUSE
07260                                          APPLICATION OF THE LAST OPERATOR,
07280                                          EVENTUALLY RETURN TO STEP 2
07300                                          BY RETURNING TO RETAOP.
07320                                   5, IF GREATER PUT THE LAST PRECEDENCE
07340                                          BACK ON, SAVE THE CURRENT
07360                                          TEMPORARY RESULT, OPERATOR ADDRESS
07380                                          AND PRECEDENCE AND RETURN TO STEP 1.

07420                           RELATIONAL OPERATORS ARE ALL HANDLED THROUGH
07440                           A COMMON ROUTINE, SPECIAL
07460                           CARE IS TAKEN TO DETECT TYPE MISMATCHES SUCH AS 3+"F"

07500                   EVAL -- THE ROUTINE TO READ A LEXEME
07520                           EVAL CHECKS FOR THE DIFFERENT TYPES OF
07540                           ENTITIES IT IS SUPPOSED TO DETECT,
07560                           LEADING PLUSES ARE IGNORED,
07580                           DIGITS AND "." CAUSE FIN (FLOATING INPUT)
07600                           TO BE CALLED, FUNCTION NAMES CAUSE THE
07620                           FORMULA INSIDE THE PARENTHESES TO BE EVALUATED
07640                           AND THE FUNCTION ROUTINE TO BE CALLED, VARIABLE
07660                           NAMES CAUSE PTRGET TO BE CALLED TO GET A POINTER
07680                           TO THE VALUE, AND THEN THE VALUE IS PUT INTO
07700                           THE FAC, AN OPEN PARENTHESIS CAUSES FRMEVL
07720                           TO BE CALLED (RECURSIVELY), AND THE ")" TO
07740                           BE CHECKED FOR, UNARY OPERATORS (NOT AND
07760                           NEGATION)  PUT THEIR PRECEDENCE ON THE STACK
07780                           AND ENTER FORMULA EVALUATION AT STEP 1, SO
07800                           THAT EVERYTHING UP TO AN OPERATOR GREATER THAN
07820                           THEIR PRECEDENCE OR THE END OF THE FORMULA
07840                           WILL BE EVALUATED, WHEN FRMEVL DOES A RETURN
07860                           BECAUSE IT SEES AN OPERATOR OF HIGHER PRECEDENCE
07880                           IT DOES NOT PASS THE TEXT POINTER IN (H,L), SO
07900                           AFTER THE UNARY OPERATION HAS BEEN PERFORMED
07920                           ON THE FAC THE TEXT POINTER MUST BE FETCHED FROM
07940                           A TEMPORARY LOCATION THAT FRMEVL USES AND
07960                           A RETURN BACK TO FRMEVL DONE.

08000                   DIMENSION AND VARIABLE SEARCHING
08020                           SPACE IS ALLOCATED FOR VARIABLES AS THEY ARE
08040                           ENCOUNTERED, THUS "DIM" STATEMENTS MUST BE
08060                           EXECUTED TO HAVE EFFECT, 6 BYTES ARE ALLOCATED
08080                           FOR EACH SIMPLE VARIABLE, WHETHER IT IS A STRING,
08100                           NUMBER OR USER DEFINED FUNCTION, THE FIRST TWO
08120                           BYTES GIVE THE NAME OF THE VARIABLE AND THE LAST FOUR
08140                           GIVE ITS VALUE, (VARTAB) GIVES THE FIRST LOCATION
08160                           WHERE A SIMPLE VARIABLE NAME IS FOUND AND (ARYTAB)
08180                           GIVES THE LOCATION TO STOP SEARCHING FOR SIMPLE
```



```
08200                           VARIABLES, A "FOR" ENTRY HAS A TEXT POINTER
08220                           AND A POINTER TO A VARIABLE VALUE SO NEITHER
08240                           THE PROGRAM OR THE SIMPLE VARIABLES CAN BE
08260                           MOVED WHILE THERE ARE ACTIVE "FOR" ENTRIES ON THE STACK,
08280                           USER DEFINED FUNCTION VALUES ALSO CONTAIN
08300                           POINTERS INTO SIMPLE VARIABLE SPACE SO NO USER-DEFINED
08320                           FUNCTION VALUES CAN BE RETAINED IF SIMPLE VARIABLES
08340                           ARE MOVED, ADDING A SIMPLE VARIABLE
08360                           ADDING SIX TO ARYTAB AND STREND, BLOCK TRANSFERING
08380                           THE ARRAY VARIABLES UP BY SIX AND MAKING SURE THE
08400                           NEW (STREND) IS NOT TO CLOSE TO THE STACK,
08420                           THIS MOVEMENT OF ARRAY VARIABLES MEANS
08440                           THAT NO POINTER TO AN ARRAY WILL STAY VALID WHEN
08460                           NEW SIMPLE VARIABLES CAN BE ENCOUNTERED, THIS IS
08480                           WHY ARRAY VARIABLES ARE NOT ALLOWED "FOR"
08500                           LOOP VARIABLES, SETING UP ANEW ARRAY VARIABLE
08520                           MERELY INVOLVES BUILDING THE DESCRIPTOR,
08540                           UPDATING STREND, AND MAKING SURE THERE IS
08560                           STILL ENOUGH ROOM BETWEEN STREND AND THE
08580                           STACK, WITHOUT MULTIPLE DIMENSIONS THE FORMAT
08600                           OF AN ARRAY VARIABLE IS SIMPLY:
08620                                   SECOND CHARACTER
08640                                   FIRST CHARACTER
08660                                   NUMBER OF BYTES USED BY VALUES
08680                                   VALUES
08700                           THE FORMAT WHEN MULTIPLY DIMENSIONED VARIABLES
08720                           ARE ALLOWED IS DESCRIBED IN THE "MULDIM" CODE,
08740                           PTRGET, THE ROUTINE WHICH RETURNS A POINTER
08760                           TO A VARIABLE VALUE, HAS TWO IMPORTANT FLAGS, ONE IS
08780                           "DIMFLG" WHICH INDICATED WHETHER "DIM" CALLED PTRGET
08800                           OR NOT, IF SO, NO PRIOR ENTRY FOR THE VARIABLE IN
08820                           QUESTION SHOULD BE FOUND, AND THE INDEX INDICATES
08840                           HOW MUCH SPACE TO SET ASIDE, SIMPLE VARIABLES CAN
08860                           BE "DIMENSIONED", BUT THE ONLY EFFECT WILL BE TO
08880                           SET ASIDE SPACE FOR THE VARIABLE IF IT HASN'T BEEN
08900                           ENCOUNTERED YET, THE OTHER IMPORTANT FLAG IS SUBFLG
08920                           WHICH INDICATES WHETHER A SUBSCRIPTED VARIABLE SHOULD BE
08940                           ALLOWED IN THE CURRENT CONTEXT, IF SUBFLG IS NON-ZERO
08960                           THE OPEN PARENTHESIS FOR A SUBSCRIPTED VARIABLE
08980                           WILL NOT BE SCANNED BY PTRGET, AND PTRGET WILL RETURN
09000                           WITH A TEXT POINTER POINTING TO THE "(", IF
09020                           THERE WAS ONE.
09040                   STRINGS
09060                           IN THE VARIABLE TABLE STRINGS ARE STORED JUST LIKE
09080                           NUMERIC VARIABLES, SIMPLE STRINGS HAVE FOUR VALUE
09100                           BYTES WHICH ARE INITIALIZED TO ALL ZEROS (WHICH
09120                           REPRESENTS THE NULL STRING), THE ONLY DIFFERENCE
09140                           IN HANDLING IS THAT WHEN PTRGET SEES A "$" AFTER THE
09160                           NAME OF A VARIABLE, PTRGET SETS VALTYP TO ONE AND TURNS
09180                           ON THE MSB (MOST-SIGNIFIGANT-BIT) OF THE VALUE OF
09200                           THE FIRST CHARACTER OF THE VARIABLE NAME,
09220                           HAVING THIS BIT ON IN THE NAME OF THE VARIABLE ENSURES
09240                           THAT THE SEARCH ROUTINE WILL NOT MATCH
```

```
09260                   'A' WITH 'AS' OR 'AS' WITH 'A', THE MEANING OF
09280                   THE FOUR VALUE BYTES ARE:
09300                           LOW
09320                                   LENGTH OF THE STRING
09340                                   UNUSED
09360                                   LOW 8 BITS
09380                                   HIGH 8 BITS  OF THE ADDRESS
09400                                           OF THE CHARACTERS IN THE
09420                                           STRING IF LENGTH.NE.0,
09440                                           MEANINGLESS OTHERWISE,
09460                           HIGH
09480                   THE VALUE OF A STRING VARIABLE (THESE 4 BYTES)
09500                   IS CALLED THE STRING DESCRIPTOR TO DISTINGUISH
09520                   IT FROM THE ACTUAL STRING DATA. WHENEVER A
09540                   STRING CONSTANT IS ENCOUNTERED IN A FORMULA OR AS
09560                   PART OF AN INPUT STRING, OR AS PART OF DATA, STRLIT
09580                   IS CALLED, CAUSING A DESCRIPTOR TO BE BUILT FOR
09600                   THE STRING. IF THE STRING CONSTANT IS IN BUF (WHICH
09620                   IT WILL BE IF THE STRING IS BEING "INPUT", OR THE
09640                   STRING IS PART OF SOME FORMULA IN A DIRECT STATEMENT)
09660                   THE VALUE IS COPIED INTO STRING SPACE SINCE BUF
09680                   IS ALWAYS CHANGING, "STRCPY" IS USED TO COPY
09700                   STRINGS.
                
09740                   STRING FUNCTIONS AND THE ONE STRING OPERATOR "+"
09760                   ALWAYS RETURN THEIR VALUES IN STRING SPACE.
09780                   ASSIGNING A STRING A CONSTANT VALUE IN A PROGRAM
09800                   THROUGH A "READ" OR ASSIGNMENT STATEMENT
09820                   WILL NOT USE ANY STRING SPACE SINCE
09840                   THE STRING DESCRIPTOR  WILL POINT INTO THE
09860                   PROGRAM ITSELF. IN GENERAL, COPYING IS DONE
09880                   WHEN A STRING VALUE IS IN BUF, OR IT IS IN STRING
09900                   SPACE AND THERE IS AN ACTIVE POINTER TO IT.
09920                   THUS FS=GS WILL CAUSE COPYING IF GS HAS ITS
09940                   STRING DATA IN STRING SPACE. FS=CHR$(7)
09960                   WILL USE ONE BYTE OF STRING SPACE TO STORE THE
09980                   NEW ONE CHARACTER STRING CREATED BY "CHR$", BUT
10000                   THE ASSIGNMENT ITSELF WILL CAUSE NO COPYING SINCE
10020                   THE ONLY POINTER AT THE NEW STRING IS A
10040                   TEMPORARY DESCRIPTOR CREATED BY FRMEVL WHICH WILL
10060                   GO AWAY AS SOON AS THE ASSIGNMENT IS DONE.
10080                   IT IS THE NATURE OF GARBAGE COLLECTION THAT
10100                   DISALLOWS HAVING TWO STRING DESCRIPTORS POINT TO THE SAME
10120                   AREA IN STRING SPACE. STRING FUNCTIONS AND OPERATORS
10140                   MUST PROCEED AS FOLLOWS:
10160                           1) FIGURE OUT THE LENGTH OF THEIR RESULT
10180                           2) CALL GETSPA TO FIND SPACE FOR THEIR
10200                           RESULT. THE ARGUMENTS TO THE FUNCTION
10220                           OR OPERATOR MAY CHANGE SINCE GARBAGE COLLECTION
10240                           MAY BE INVOKED. THE ONLY THING THAT CAN
10260                           BE SAVED DURING THE CALL TO GETSPA IS A POINTER
10280                           TO THE DESCRIPTORS OF THE ARGUMENTS.
10300                           3) CONSTRUCT THE RESULT DESCRIPTOR IN DSCTMP.
```



```
10320                           GETSPA RETURNS THE LOCATION OF THE AVAILABLE
10340                           SPACE.
10360                           4) CREATE THE NEW VALUE BY COPYING PARTS
10380                           OF THE ARGUMENTS OR WHATEVER.
10400                           5) FREE UP THE ARGUMENTS BY CALLING FRETMP.
10420                           6) JUMP TO PUTNEW TO GET THE DESCRIPTOR IN
10440                           DSCTMP TRANSFERRED INTO A NEW STRING TEMPORARY.
                
10480                   THE REASON FOR STRING TEMPORARIES IS THAT GARBAGE
10500                   COLLECTION HAS TO KNOW ABOUT ALL ACTIVE STRING DESCRIPTORS
10520                   SO IT KNOWS WHAT IS AND ISN'T IN USE. STRING TEMPORARIES ARE
10540                   USED TO STORE THE DESCRIPTORS OF STRING EXPRESSIONS.
                
10580                   INSTEAD OF HAVING AN ACTUAL VALUE STORED IN THE
10600                   FAC, AND HAVING THE VALUE OF A TEMPORARY RESULT
10620                   BEING SAVED ON THE STACK, AS HAPPENS WITH NUMERIC
10640                   VARIABLES, STRINGS HAVE THE POINTER TO A STRING DESCRIPTOR
10660                   STORED IN THE FAC, AND IT IS THIS POINTER
10680                   THAT GETS SAVED ON THE STACK BY FORMULA EVALUATION.
10700                   STRING FUNCTIONS CANNOT FREE THEIR ARGUMENTS UP RIGHT
10720                   AWAY SINCE GETSPA MAY FORCE
10740                   GARBAGE COLLECTION AND THE ARGUMENT STRINGS
10760                   MAY BE OVER-WRITTEN SINCE GARBAGE COLLECTION
10780                   WILL NOT BE ABLE TO FIND AN ACTIVE POINTER TO
10800                   THEM. FUNCTION AND OPERATOR RESULTS ARE BUILT IN
10820                   DSCTMP SINCE STRING TEMPORARIES ARE ALLOCATED
10840                   (PUTNEW) AND DEALLOATED (FRETMP) IN A FIFO ORDERING
10860                   (I.E. A STACK) SO THE NEW TEMPORARY CANNOT
10880                   BE SET UP UNTIL THE OLD ONE(S) ARE FREED. TRYING
10900                   TO BUILD A RESULT IN A TEMPORARY AFTER
10920                   FREEING UP THE ARGUMENT TEMPORARIES COULD RESULT
10940                   IN ONE OF THE ARGUMENT TEMPORARIES BEING OVERWRITTEN
10960                   TOO SOON BY THE NEW RESULT.
                
11000                   STRING SPACE IS ALLOCATED AT THE VERY TOP
11020                   OF MEMORY. MEMSIZ POINTS BEYOND THE LAST LOCATION OF
11040                   STRING SPACE. STRING ARE STORED IN HIGH LOCATIONS
11060                   FIRST. WHENEVER STRING SPACE IS ALLOCATED (GETSPA)
11080                   FRETOP. WHICH IS INITIALIZED TO (MEMSIZ). IS UPDATED
11100                   TO GIVE THE HIGHEST LOCATION IN STRING SPACE
11120                   THAT IS NOT IN USE. THE RESULT IS THAT
11140                   FRETOP GETS SMALLER AND SMALLER. UNTIL SOME
11160                   ALLOCATION WOULD MAKE (FRETOP) LESS THAN OR EQUAL TO
11180                   (STKTOP). THIS MEANS STRING SPACE HAS RUN INTO THE
11200                   STACK AND THAT GARBAGE COLLECTION MUST BE CALLED.
                
11240                   GARBAGE COLLECTION:
11260                           0. MINPTR=(STKTOP)  (FRETOP)=(MEMSIZ)
11280                           1. REMMIN=0
11300                           2. FOR EACH STRING DESCRIPTOR
11320                           (TEMPORARIES. SIMPLE STRINGS. STRING ARRAYS)
11340                           IF THE STRING IS NOT NULL AND ITS POINTER IS
11360                           .GT.MINPTR AND .LT.FRETOP.
```

```
11380                                   MINPTR=THIS STRING DESCRIPTORS POINTER
11400                                   REMMIN=POINTER AT THIS STRING DESCRIPTOR
11420                                   END
11440                                   3. IF REMMIN.NE.0 (WE FOUND AN UNCOLLECTED STRING)
11460                                   BLOCK TRANSFER THE STRING DATA POINTED
11480                                   TO IN THE STRING DESCRIPTOR POINTED TO BY REMMIN
11500                                   SO THAT THE LAST BYTE OF STRING DATA IS AT
11520                                   (FRETOP). UPDATE FRETOP SO THAT IT
11540                                   POINTS TO THE LOCATION JUST BELOW THE ONE
11560                                   THE STRING DATA WAS MOVED INTO. UPDATE
11580                                   THE POINTER IN THE DESCRIPTOR SO IT POINTS
11600                                   TO THE NEW LOCATION OF THE STRING DATA.
11620                                   GO TO STEP 1.

11660                           AFTER CALLING GARBAGE COLLECTION GETSPA AGAIN CHECKS
11680                           TO SEE IF [A] CHARACTERS ARE AVAILABLE BETWEEN
11700                           (STKTOP) AND (FRETOP) , IF NOT AN "OUT OF STRING"
11720                           ERROR IS INVOKED.

11760                   MATH PACKAGE
11780                           THE MATH PACKAGE CONTAINS FLOATING INPUT (FIN),
11800                           FLOATING OUTPUT (FOUT) FLOATING COMPARE (FCOMP)
11820                           ... AND ALL THE NUMERIC OPERATORS AND FUNCTIONS,
11840                           THE FORMATS,CONVENTIONS AND ENTRY POINTS ARE ALL
11860                           DESCRIBED IN THE MATH PACKAGE ITSELF.

11900                   INIT -- THE INITIALIZATION ROUTINE
11920                           INITIALIZATION FIRST LOOKS AT THE SWITCH REGISTER
11940                           TO SEE WHAT TYPE OF I/O SHOULD BE DONE.
11960                           ANY NON-STANDARD I/O CAUSES LOCATIONS IN BASIC
11980                           TO BE CHANGED, THEN THE AMOUNT OF MEMORY,
12000                           TERMINAL WIDTH,AND WHICH FUNCTIONS TO BE RETAINED
12020                           ARE ASCERTAINED FROM THE USER, A ZERO IS PUT DOWN
12040                           AT THE FIRST LOCATION NOT USED BY THE MATH-PACKAGE
12060                           AND TXTTAB IS SET UP TO POINT AT THE NEXT LOCATION.
12080                           THIS DETERMINES WHERE PROGRAM STORAGE WILL START. THE
12100                           HIGHEST MEMORY LOCATION MINUS THE AMOUNT OF DEFAULTED
12120                           STRING SPACE (50) GIVES THE FIRST LOCATION USED BY THE
12140                           STACK. SPECIAL CHECKS ARE MADE TO MAKE SURE
12160                           ALL QUESTIONS IN INIT ARE ANSWERED REASONABLY, SINCE
12180                           ONCE INIT FINISHES THE LOCATIONS IT USES ARE
12200                           USED FOR PROGRAM STORAGE. THE LAST THING INIT DOES IS
12220                           CHANGE LOCATION ZERO TO BE A JUMP TO READY INSTEAD
12240                           OF INIT. ONCE THIS IS DONE THERE IS NO WAY TO RESTART
12260                           INIT.

12300                   STORAGE
12320                                           A ZERO.
12340                           (TXTTAB)        POINTER TO NEXT LINE'S POINTER
12360                                           LINE # OF THIS LINE (2 BYTES)
12380                                           CHARACTERS ON THIS LINE
12400                                           ZERO
12420                                           POINTER AT NEXT LINE'S POINTER
```



```
12440                                                   (POINTED TO BY THE ABOVE POINTER)
12460                                           ... REPEATS ...
12480                           LAST LINE:      POINTER AT ZERO POINTER
12500                                           LINE # OF THIS LINE
12520                                           CHARACTERS ON THIS LINE
12540                                           ZERO
12560                                           DOUBLE ZERO (POINTED TO BY THE ABOVE POINTER)
12580                           (VARTAB)        SIMPLE VARIABLES, 6 BYTES PER VALUE.
12600                                           2 BYTES GIVE THE NAME, 4 BYTES THE VALUE
12620                                           ... REPEATS ...
12640                           (ARYTAB)        ARRAY VARIABLES, 2 BYTES NAME, 2 BYTE
12660                                           LENGTH, VALUE (EXTRA IF MULDIM ON)
12680                                           ... REPEATS ...
12700                           (STREND)        FREE SPACE
12720                                           ... REPEATS ...
12740                                           MOST RECENT STACK ENTRY
12760                                           ... REPEATS ...
12780                           (STKTOP)        FIRST STACK ENTRY
12800                                           FREE STRING SPACE
12820                                           ... REPEATS ...
12840                           (FRETOP)        STRING SPACE IN USE
12860                                           ... REPEATS ...
12880                           (MEMSIZ)        HIGHEST MACHINE LOCATION
12900                                           UNUSED EXCEPT BY THE VAL FUNCTION.
12920                   HIGH LOCATIONS

12960                   *
12980                   PAGE
```

```
                                        13000   SUBTTL  RST ROUTINES
000000'                                 13020   RELOC 0
000000' 001000  000363                  13040   START:  DI                      ;DISENABLE INTERRUPTS
000001' 001000  000303                  13060           JMP     INIT            ;INIT IS THE INTIALIZE ROUTINE
000002' 000000  000000*
000003' 000000  000000
                                        13080                                   ;IT SETS UP CERTAIN
                                        13100                                   ;LOCATIONS DELETES FUNCTIONS IF
                                        13120                                   ;DESIRED AND
                                        13140                                   ;CHANGES THIS TO JMP READY
                                        13160   IFN     LENGTH-2,<
                                        13180           ADR(DEINT)              ;STORE HERE THE ROUTINE
                                        13200                                   ;TO TURN THE FAC INTO
                                        13220                                   ;A TWO-BYTE SIGNED INTEGER
                                        13240           ADR(GIVABF)>            ;STORE HERE THE ADDRESS
                                        13260                                   ;OF THE ROUTINE TO CONVERT (A,B)
                                        13280                                   ;TO A FLOATING POINT NUMBER IN THE FAC
                                        13300   IFE     LENGTH-2,<
000004' 000000  000000*                 13320           ADR(FRCINT)             ;TURN FAC INTO AN INTEGER IN (H,L)
000005' 000000  000000'
000006' 000000  000000*                 13340           ADR(MAKINT)>            ;TURN (H,L) INTO A VALUE IN THE FAC
000007' 000000  000004'
                                        13360                                   ;SET VALTYP FOR INTEGER
000010'                                 13380   RELOC 8
                                        13400   ;
                                        13420   ; SYNCHR LOOKS AT THE CURRENT CHARACTER TO MAKE SURE IT
                                        13440   ; IS A SPECIFIC THING (CONTAINED IN THE LOCATION AFTER THE CALL)
                                        13460   ; IF NOT IT CALLS THE 'SYNTAX ERROR' ROUTINE, OTHERWISE IT GOBBLES
                                        13480   ; THE NEXT CHARACTER AND RETURNS, (BY FALLING INTO CHRGET)
                                        13500   ;
                                        13520   ; ALL REGISTERS ARE PRESERVED EXCEPT (A)=NEW CHAR
                                        13540   ; AND (H,L) ENDS UP POINTING AT THE CHARACTER AFTER THE ONE
                                        13560   ; WHICH WAS CHECKED.
                                        13580   ;
000010' 001000  000176                  13600           MOV     A,M             ;GET THE CURRENT CHARACTER
000011' 001000  000343                  13620           XTHL                    ;GET CALL ADDRESS INTO (H,L)
                                        13640                                   ;PUT TEXT POINTER ON STACK
000012' 001000  000276                  13660           CMP     M               ;SEE IF (A) =CURRENT CHARACTER
                                        13680                                   ;IS THE RIGHT THING,
000013' 001000  000043                  13700           INX     H               ;FIX RETURN ADDRESS,
000014' 001000  000343                  13720           XTHL                    ;PUT RETURN ADDRESS BACK AND RESTORE
                                        13740                                   ;THE TEXT POINTER.
000015' 001000  000302                  13760           JNZ     SNERR           ;IF THE CHARACTER WASN'T RIGHT CALL
000016' 000000  002207'
000017' 000000  000000
                                        13780                                   ;THE 'SYNTAX ERROR' ROUTINE,
                                        13800                                   ;OTHERWISE FALL THROUGH
                                        13820                                   ;AND GET ANOTHER CHARACTER.
                                        13840   ;
                                        13860   ; CHRGET, USING (H,L) AS THE CURRENT TEXT POINTER FETCHES
                                        13880   ; A NEW CHARACTER INTO (A) AFTER INCREMENTING (H,L)
                                        13900   ; AND SETS CONDITION CODES ACCORDING TO WHATS IN (A)
                                        13920   ;       C=      NUMERIC     ("0" THROUGH "9")
```



```
                                        13940   ;       Z=      ":" OR END-OF-LINE (A 0)
                                        13960   ;
                                        13980   ; ALL REGISTERS SAVED EXCEPT (A)=NEW CHAR
                                        14000   ; (H,L)=(H,L)+1
                                        14020   ;
000020'                                 14040   RELOC 16
                                        14060   IFE     LENGTH,<CHRGTR:>
000020' 001000  000043                  14080           INX     H               ;UPDATE THE TEXT POINTER
000021' 001000  000176                  14100           MOV     A,M             ;GET NEW CHARACTER
000022' 001000  000376                  14120           CPI     ":"             ;MAKE ":" HAVE ZERO ON AND
000023' 000000  000007
                                        14140                                   ;CARRY OFF
                                        14160                                   ;ALL ALPHABETICS & RESERVED
                                        14180                                   ;WORDS GET ZERO & CARRY OFF
000024' 001000  000320                  14200           RNC                     ;,GT,":" GO BACK
000025' 001000  000303                  14220           JMP     CHRCON          ;NO ROOM FOR WHOLE ROUTINE
000026' 000000  003433'
000027' 000000  000016'
                                        14240   ;
                                        14260   ; THIS RST ROUTINE OUTPUTS THE CHARACTER IN (A) USING PRTFLG (LPT OR TTY)
                                        14280   ; CNTWFL (SUPRESS OUTPUT OR NOT), TTYPOS (PRINT HEAD POSITION),
                                        14300   ; TIMING ETC., NO REGISTERS OR CONDITION CODES ARE CHANGED.
                                        14320   ;
000030'                                 14340   RELOC 24
000030' 001000  000365                  14360   OUTDO:  PUSH    PSW
                                        14380   IFN     CONTRW,<
000031' 001000  000072                  14400           LDA     CNTWFL          ;GET SUPPRESS FLAG
000032' 000000  001541'
000033' 000000  000026'
000034' 001000  000267                  14420           ORA     A>              ;SEE IF IT IS SET
                                        14440   IFE     LENGTH!CONTRW!LPTSW,<
                                        14460           LDA     TTYPOS>         ;USE RST BYTES, (A)=TTYPOS
000035' 001000  000303                  14480           JMP     OUTCON
000036' 000000  003065'
000037' 000000  000032'
                                        14500   ;
                                        14520   ; COMPAR COMPARES (H,L) WITH (D,E) UNSIGNED
                                        14540   ;
                                        14560   ;               (H,L) LESS THAN (D,E) SET CARRY
                                        14580   ;               (H,L) = (D,E) SET ZERO
                                        14600   ;
                                        14620   ; (A) IS THE ONLY REGISTER USED
                                        14640   ;
000040'                                 14660   RELOC 32
000040' 001000  000174                  14680           MOV     A,H
000041' 001000  000222                  14700           SUB     D
000042' 001000  000300                  14720           RNZ
000043' 001000  000175                  14740           MOV     A,L
000044' 001000  000223                  14760           SUB     E
000045' 001000  000311                  14760           RET
000046' 000000  000001                  14820   NULCNT: 1                       ;STORE HERE THE NUMBER OF NULLS
                                        14840                                   ;TO PRINT AFTER CRLF
```

```
836  000047'                          14860   TTYPOS: BLOCK   1                ;STORE TERMINAL POSITION HERE
837                                   14880   ;
838                                   14900   ;THE FSIGN  RST RETURNS A=-1 IF FAC IS LESS THAN 0
839                                   14920   ;       A=0 IF FAC=0
840                                   14940   ;       A=1 IF FAC GREATER THAN ZERO
841                                   14960   ; THE CONDITION CODES REFLECT THE VALUE OF [A]
842                                   14980   ; AND NO OTHER REGISTERS ARE MODIFIED.
843                                   15000   ; THIS WORKS ONLY WHEN THE FAC IS A SINGLE OR DOUBLE PRECISION NUMBER
844                                   15020   ; THE 'VSIGN' ROUTINE IS MORE GENERAL SINCE
845                                   15040   ; IT WILL TAKE THE SIGN OF INTEGERS AS WELL
846                                   15050   ; AND GIVES "TMERR" ON STRINGS.
847                                   15060   ;
848  000050'                          15080   RELOC   40
849  000050' 001000  000072           15100   SIGN:   LDA     FAC
850  000051' 000000  001642'
851  000052' 000000  000036'
852  000053' 001000  000267           15120           ORA     A
853  000054' 001000  000302           15140           JNZ     SIGNC
854  000055' 000000  000000*
855  000056' 000000  000051'
856  000057' 001000  000311           15160           RET
857                                   15180   ;
858                                   15200   ; THIS IS THE PUSHM RST
859                                   15220   ; EFFECT IS:
860                                   15240   ;       MOV     C,M
861                                   15260   ;       INX     H
862                                   15280   ;       MOV     B,M
863                                   15300   ;       INX     H
864                                   15320   ;       PUSH    B
865                                   15340   ; DIFFICULTY COMES IN BECAUSE OF THE
866                                   15360   ; RETURN ADDRESS.
867                                   15380   ;
868  000060'                          15400   RELOC   48
869  000060' 001000  000343           15420           XTHL                     ;SWITCH [H,L] AND RETURN ADDRESS
870  000061' 001000  000042           15440           SHLD    PUSHMA+1         ;FIXUP JUMP TO PLACE TO GO
871  000062' 000000  000101'
872  000063' 000000  000055'
873  000064' 001000  000341           15460           POP     H                ;REGAIN [H,L]
874                                   15480   IFN     LENGTH,<
875  000065' 001000  000303           15500           JMP     $CODE+59         ;IN 8K ALLOW USER TO HAVE RST 7
876  000066' 000000  000073'
877  000067' 000000  000062'
878                                   15520                                    ;FOR INTERRUPT TRAPPING
879  000070'                          15540   RELOC   56
880  000070' 001000  000311           15560           RET                      ;INITIALLY NO INTERRUPT
881                                   15580                                    ;ROUTINE
882  000071' 001000  000000           15600           NOP
883  000072' 001000  000000           15620           NOP>
884  000073' 001000  000116           15640           MOV     C,M              ;GRAB FROM MEMORY
885  000074' 001000  000043           15660           INX     H
886  000075' 001000  000106           15680           MOV     B,M
887  000076' 001000  000043           15700           INX     H
888  000077' 001000  000305           15720           PUSH    B                ;PUSH [B,C] ONTO THE STACK
```



```
889                                   15740                                    ;SINCE IT CONTAINS [M]
890  000100' 001000  000303           15760   PUSHMA: JMP     PUSHMA           ;RETURN  ADDRESS STORED HERE
891  000101' 000000  000100'
892  000102' 000000  000066'
893
894                                   15800   PAGE
```

```
                                        15820  SUBTTL DISPATCH TABLES,RESERVED WORDS, ERROR TEXT,,, ALL CONSTANT

000103' 000000  000000*                 15860  FUNDSP: ADR(SGN)
000104' 000000  000101'

                                        15880  IFN     LENGTH-2,<
                                        15900          ADR(INT)>
                                        15920  IFE     LENGTH-2,<
000105' 000000  000000*                 15940          ADR(VINT)>
000106' 000000  000103'
000107' 000000  000000*                 15960          ADR(ABS)
000110' 000000  000105'
000111' 000000  010776'                 15980  USRLOC: ADR(ILLFUN)              ;INITIALLY NO USER ROUTINE
000112' 000000  000107'
000113' 000000  007237'                 16000  IFN     LENGTH,<ADR(FRE)
000114' 000000  000111'
000115' 000000  010712'                 16020          ADR(FNINP)
000116' 000000  000113'
                                        16040  IFN     LPTSW,<ADR(LPOS)>
000117' 000000  007406'                 16060          ADR(POS)>
000120' 000000  000115'
000121' 000000  000000*                 16080  SQRFIX: ADR(SQR)
000122' 000000  000117'
000123' 000000  000000*                 16100  RNDFIX: ADR(RND)
000124' 000000  000121'
                                        16120  IFN     EXTFNC,<
000125' 000000  000000*                 16140          ADR(LOG)
000126' 000000  000123'
000127' 000000  000000*                 16160          ADR(EXP)
000130' 000000  000125'
000131' 000000  000000*                 16180  COSFIX: ADR(COS)>
000132' 000000  000127'
000133' 000000  000000*                 16200  SINFIX: ADR(SIN)
000134' 000000  000131'
                                        16220  IFN     EXTFNC,<
000135' 000000  000000*                 16240  TANFIX: ADR(TAN)
000136' 000000  000133'
000137' 000000  000000*                 16260  ATNFIX: ADR(ATN)>
000140' 000000  000135'
                                        16280  IFN     LENGTH,<
000141' 000000  011314'                 16300          ADR(PEEK)>
000142' 000000  000137'
                                        16320  IFN     DSKFUN,<ADR(DSKI$)>
                                        16340  IFN     STRING,<
000143' 000000  010501'                 16360          ADR(LEN)
000144' 000000  000141'
000145' 000000  007564'                 16380          ADR(STR$)
000146' 000000  000143'
000147' 000000  011042'                 16400          ADR(VAL)
000150' 000000  000145'
000151' 000000  010515'                 16420          ADR(ASC)
000152' 000000  000147'
000153' 000000  010532'                 16440          ADR(CHR$)
000154' 000000  000151'
```



```
000155' 000000  010552'                 16460          ADR(LEFT$)
000156' 000000  000153'
000157' 000000  010631'                 16480          ADR(RIGHT$)
000160' 000000  000155'
000161' 000000  010643'                 16500          ADR(MID$)>
000162' 000000  000157'

                                        16540  DEFINE ADRP(X),<ADR(X)>
                                        16560  IFE     LENGTH-2,<
                                        16580  DEFINE ADRP(X),<>>
000163' 000000  000171                  16600  OPTAB:  121                      ;OPERATOR TABLE CONTAINS
                                        16620                                   ;PRECEDENCE FOLLOWED BY
                                        16640                                   ;THE ROUTINE ADDRESS
                                        16660          ADRP(FADDT)
000164' 000000  000171                  16680          121
                                        16700          ADRP(FSUBT)
000165' 000000  000173                  16720          123
                                        16740          ADRP(FMULTT)
000166' 000000  000173                  16760          123
                                        16780          ADRP(FDIVT)
000167' 000000  000177                  16800  IFN     EXTFNC,<127
                                        16820          ADRP(FPWRT)>
                                        16840  IFN     LENGTH,<
000170' 000000  000120                  16860          80
                                        16880          ADRP(AND)
000171' 000000  000106                  16900          70
                                        16920          ADRP(OR)>

                                        16960  ;
                                        16980  ; TOKENS FOR RESERVED WORDS ALWAYS HAVE THE MOST
                                        17000  ; SIGNIFIGANT BIT ON
                                        17020  ; THE LIST OF RESERVED WORDS
                                        17040  ;
                        000177          17060  Q=128-1
                                        17080  DEFINE  DCI(A),<Q=Q+1
                                        17090          XLIST
                                        17100          DC(A)
                                        17110          LIST>
                        000200          17140          ENDTK==Q
                        000201          17160          FORTK==Q
                        000203          17240          DATATK==Q
                        000210          17360          GOTOTK==Q
                        000212          17420          IFTK==Q
                        000214          17480          GOSUTK==Q
                        000216          17540          REMTK=Q
                                        17660  IFE     LENGTH-2,<
                        000220          17700          ELSETK==Q
                                        17780  IFN     DSKFUN,<DCI"DSKOS">
                                        17800  IFN     LPTSW,<DCI"LPRINT">
                                        17820  IFN     LENGTH,<
                        000231          17880          PRINTK==Q
                                        17940  IFE     REALIO,<
                                        17960          DCI"DOT">
```

```
                                  18000   IFN     LPTSW,<DCI"LLIST>
                                  18060   IFN     CASSW,<DCI"CLOAD">
                                  18080           DCI"CSAVE">
                                  18100   IFN     CONSSW,<DCI"CONSOLE">
                        000237    18140           SCRATK=Q
                                  18160   ; END OF COMMAND LIST
000371' 000000  000124            18180           "T"
000372' 000000  000101            18200           "A"
000373' 000000  000102            18220           "B"
000374' 000000  000250            18240           "("+128
                        000240    18260           Q=Q+1
                        000240    18280           TABTK=Q
                        000241    18320           TOTK==Q
                                  18340   IFN     LENGTH,<
000377' 000000  000123            18360           "S"
000400' 000000  000120            18380           "P"
000401' 000000  000103            18400           "C"
000402' 000000  000250            18420           "("+128                 ;MACRO DOESNT LIKE ('S IN ARGUMENTS
                        000242    18440           Q=Q+1
                        000242    18460           SPCTK==Q>
                        000243    18500           FNTK==Q>
                        000244    18540           USINTK==Q>
                        000245    18580           THENTK=Q
                                  18600   IFN     LENGTH,<
                        000246    18640           NOTTK==Q>
                        000247    18680           STEPTK=Q
                        000250    18720           PLUSTK=Q
                        000251    18760           MINUTK=Q
                        000007    18880           LSTOPK==Q+1-PLUSTK      ;CRUNCH # OF HIGHEST OP+1-PLUSTK
000437' 000000  000276            18900           190                     ;A GREATER THAN SIGN
                        000257    18920           Q=Q+1
                        000257    18940           GREATK=Q
                        000260    18980           EQULTK=Q
000441' 000000  000274            19000           188
                        000261    19020           Q=Q+1                   ;A LESS THAN SIGN
                        000261    19040           LESSTK=Q
                                  19060   ;
                                  19080   ; NOTE DANGER OF ONE RESERVED WORD BEING A PART
                                  19100   ; OF ANOTHER
                                  19120   ; IE , . IF 2 GREATER THAN F OR T=5 THEN,,,
                                  19140   ; WILL NOT WORK!!! SINCE "FOR" WILL BE CRUNCHED!!
                                  19160   ; IN ANY CASE MAKE SURE THE SMALLER WORD APPEARS
                                  19180   ; SECOND IN THE RESERVED WORD TABLE ("INP" AND "INPUT")
                                  19190   ; ANOTHER EXAPMLE: IF T OR Q THEN ,,, "TO" IS CRUNCHED
                                  19200   ;
                        000262    19240           ONEFUN=Q
                                  19360   IFN     LPTSW,<DCI"LPOS">
                        000271    19420           SQRTK==Q
                                  19460   IFN     EXTFNC,<
                        000300    19600           ATNTK==Q>
                                  19620   IFN     LENGTH,<
                                  19660   IFN     DSKFUN,<DCI"DSKIS">
                                  19680   IFN     STRING,<
```



```
                        000306    19800   LASNUM==Q                       ;NUMBER OF LAST FUNCTION
                                  19820                                   ;THAT TAKES ONE ARG
000563' 000000  000000            19900           0                       ;MARKS END OF RESERVED WORD LIST

000564' 000000  003474'           19940   STMDSP: ADR(END)
000565' 000000  000161'
000566' 000000  003154'           19960           ADR(FOR)
000567' 000000  000564'
000570' 000000  005225'           19980           ADR(NEXT)
000571' 000000  000566'
000572' 000000  004072'           20000           ADR(DATA)
000573' 000000  000570'
000574' 000000  004711'           20020           ADR(INPUT)
000575' 000000  000572'
000576' 000000  006500'           20040           ADR(DIM)
000577' 000000  000574'
000600' 000000  004760'           20060           ADR(READ)
000601' 000000  000576'
000602' 000000  004131'           20080           ADR(LET)
000603' 000000  000600'
000604' 000000  004010'           20100           ADR(GOTO)
000605' 000000  000602'
000606' 000000  003754'           20120           ADR(RUN)
000607' 000000  000604'
000610' 000000  004325'           20140           ADR(IF)
000611' 000000  000606'
000612' 000000  003446'           20160           ADR(RESTORE)
000613' 000000  000610'
000614' 000000  003770'           20180           ADR(GOSUB)
000615' 000000  000612'
000616' 000000  004044'           20200           ADR(RETURN)
000617' 000000  000614'
000620' 000000  004074'           20220           ADR(REM)
000621' 000000  000616'
000622' 000000  003472'           20240           ADR(STOP)
000623' 000000  000620'
                                  20260   IFE     LENGTH=2,<
000624' 000000  004074'           20280           ADR(ELSE)
000625' 000000  000622'
000626' 000000  003604'           20300           ADR(TON)
000627' 000000  000624'
000630' 000000  003605'           20320           ADR(TOFF)
000631' 000000  000626'
000632' 000000  000000*           20340           ADR(EDIT)>
000633' 000000  000630'
000634' 000000  010725'           20360   IFN     LENGTH,<ADR(FNOUT)
000635' 000000  000632'
000636' 000000  004271'           20380           ADR(ONGOTO)
000637' 000000  000634'
000640' 000000  003566'           20400           ADR(NULL)
000641' 000000  000636'
000642' 000000  010733'           20420           ADR(FNWAIT)>
000643' 000000  000640'
```

```
                                        20440   IFN     DSKFUN,<ADR(DSKOS)>
                                        20460   IFN     LPTSW,<ADR(LPRINT)>
                                        20480   IFN     LENGTH,<
000644' 000000  011323'                 20500           ADR(POKE)>
000645' 000000  000642'
000646' 000000  004411'                 20520           ADR(PRINT)
000647' 000000  000644'
000650' 000000  007411'                 20540   IFN     FUNCTS,<ADR(DEF)>
000651' 000000  000646'

000652' 000000  003542'                 20580   IFN     LENGTH,<ADR(CONT)>
000653' 000000  000650'
                                        20600   IFE     REALIO,<ADR(DDT)>
000654' 000000  011072'                 20620           ADR(LIST)
000655' 000000  000652'

                                        20640   IFN     LPTSW,<ADR(LLIST)>
000656' 000000  011245'                 20660   IFE     LENGTH-2,<ADR(DELETE)>
000657' 000000  000654'
000660' 000000  003703'                 20680           ADR(CLEAR)
000661' 000000  000656'

                                        20700   IFN     CASSW,<ADR(CLOAD)
                                        20720           ADR(CSAVE)>
                                        20740   IFN     CONSSW,<ADR(CONSOLE)>
000662' 000000  002421'                 20760           ADR(SCRATH)
000663' 000000  000660'

                                        20800   IFE     LENGTH-2,<
000664' 000000  000000*                 20820   FRCTBL: ADR(FRCDBL)
000665' 000000  000662'
000666' 000000  000000*                 20840           ADR(FRCINT)
000667' 000000  000664'
000670' 000000  000000*                 20860           ADR(FRCSNG)
000671' 000000  000666'

                                        20880   ;
                                        20900   ; THESE TABLES ARE USED AFTER THE DECISION HAS BEEN MADE
                                        20920   ; TO APPLY AN OPERATOR AND ALL THE NECESSARY CONVERSION HAS
                                        20940   ; BEEN DONE TO MATCH THE TWO ARGUMENT TYPES (APPLOP)
                                        20960   ;
000672' 000000  000000*                 20980   DBLDSP: ADR(DADD)                ;DOUBLE PRECISION ROUTINES
000673' 000000  000670'
000674' 000000  000000*                 21000           ADR(DSUB)
000675' 000000  000672'
000676' 000000  000000*                 21020           ADR(DMULT)
000677' 000000  000674'
000700' 000000  000000*                 21040           ADR(DDIV)
000701' 000000  000676'
000702' 000000  000000*                 21060           ADR(DCOMP)
000703' 000000  000700'
000704' 000000  000000*                 21080   SNGDSP: ADR(FADD)                ;SINGLE PRECISION ROUTINES
000705' 000000  000702'
000706' 000000  000000*                 21100           ADR(FSUB)
000707' 000000  000704'
000710' 000000  000000*                 21120           ADR(FMULT)
```



```
000711' 000000  000706'
000712' 000000  000000*                 21140           ADR(FDIV)
000713' 000000  000710'
000714' 000000  000000*                 21160           ADR(FCOMP)
000715' 000000  000712'
000716' 000000  000000*                 21180   INTDSP: ADR(IADD)                ;INTEGER ROUTINES
000717' 000000  000714'
000720' 000000  000000*                 21200           ADR(ISUB)
000721' 000000  000716'
000722' 000000  000000*                 21220           ADR(IMULT)
000723' 000000  000720'
000724' 000000  000000*                 21240           ADR(IDIV)
000725' 000000  000722'
000726' 000000  000000*                 21260           ADR(ICOMP)>
000727' 000000  000724'

        777777  777776                  21320   Q=-2
                                        21340   DEFINE  DCL(X),<>
                                        21360   DEFINE  DCE(X),<Q=Q+2
                                        21370           XLIST
                                        21380           DC(X)
                                        21390           LIST>

000730'                                 21420   ERRTAB:
                                        21440   IFE     LENGTH-2,<
000730' 000000  000000                  21460           0
                        000000          21480           Q=0
                                        21500           DEFINE  DCE(X),<>
                                        21520           DEFINE  DCL(X),<
                                        21540           Q=Q+1
                                        21560           DC(X)
                                        21580           0>>
                                        21600           DCE"NF"
000731' 000000  000116                  21620           DCL"NEXT WITHOUT FOR"
000732' 000000  000105
000733' 000000  000130
000734' 000000  000124
000735' 000000  000040
000736' 000000  000127
000737' 000000  000111
000740' 000000  000124
000741' 000000  000110
000742' 000000  000117
000743' 000000  000125
000744' 000000  000124
000745' 000000  000040
000746' 000000  000106
000747' 000000  000117
000750' 000000  000122
000751' 000000  000000
                        000001          21640           ERRNF==Q
```

```
1213                                        21660          DCE"SN"
1214  000752' 000000  000123                21680          DCL"SYNTAX ERROR"
1215  000753' 000000  000131
1216  000754' 000000  000116
1217  000755' 000000  000124
1218  000756' 000000  000101
1219  000757' 000000  000130
1220  000760' 000000  000040
1221  000761' 000000  000105
1222  000762' 000000  000122
1223  000763' 000000  000122
1224  000764' 000000  000117
1225  000765' 000000  000122
1226  000765' 000000  000322
1227  000766' 000000  000000
1228                  000002                21700          ERRSN==Q
1229                                        21720          DCE"RG"
1230  000767' 000000  000122                21740          DCL"RETURN WITHOUT GOSUB"
1231  000770' 000000  000105
1232  000771' 000000  000124
1233  000772' 000000  000125
1234  000773' 000000  000122
1235  000774' 000000  000116
1236  000775' 000000  000040
1237  000776' 000000  000127
1238  000777' 000000  000111
1239  001000' 000000  000124
1240  001001' 000000  000110
1241  001002' 000000  000117
1242  001003' 000000  000125
1243  001004' 000000  000124
1244  001005' 000000  000040
1245  001006' 000000  000107
1246  001007' 000000  000117
1247  001010' 000000  000123
1248  001011' 000000  000125
1249  001012' 000000  000102
1250  001013' 000000  000302
1251  001013' 000000  000000
1252                  000003                21760          ERRRG==Q
1253                                        21780          DCE"OD"
1254  001014' 000000  000117                21800          DCL"OUT OF DATA"
1255  001015' 000000  000125
1256  001016' 000000  000124
1257  001017' 000000  000040
1258  001020' 000000  000117
1259  001021' 000000  000106
1260  001022' 000000  000040
1261  001023' 000000  000104
1262  001024' 000000  000101
1263  001025' 000000  000124
1264  001026' 000000  000101
1265  001026' 000000  000301
```



```
1266  001027' 000000  000000
1267                  000004                21820          ERROD==Q
1268                                        21840          DCE"FC"
1269  001030' 000000  000111                21860          DCL"ILLEGAL FUNCTION CALL"
1270  001031' 000000  000114
1271  001032' 000000  000114
1272  001033' 000000  000105
1273  001034' 000000  000107
1274  001035' 000000  000101
1275  001036' 000000  000114
1276  001037' 000000  000040
1277  001040' 000000  000106
1278  001041' 000000  000125
1279  001042' 000000  000116
1280  001043' 000000  000103
1281  001044' 000000  000124
1282  001045' 000000  000111
1283  001046' 000000  000117
1284  001047' 000000  000116
1285  001050' 000000  000040
1286  001051' 000000  000103
1287  001052' 000000  000101
1288  001053' 000000  000114
1289  001054' 000000  000114
1290  001054' 000000  000314
1291  001055' 000000  000000
1292                  000005                21880          ERRFC==Q
1293                                        21900          DCE"OV"
1294  001056' 000000  000117                21920          DCL"OVERFLOW"
1295  001057' 000000  000126
1296  001060' 000000  000105
1297  001061' 000000  000122
1298  001062' 000000  000106
1299  001063' 000000  000114
1300  001064' 000000  000117
1301  001065' 000000  000127
1302  001065' 000000  000327
1303  001066' 000000  000000
1304                  000006                21940          ERROV==Q
1305                                        21960          DCE"OM"
1306  001067' 000000  000117                21980          DCL"OUT OF MEMORY"
1307  001070' 000000  000125
1308  001071' 000000  000124
1309  001072' 000000  000040
1310  001073' 000000  000117
1311  001074' 000000  000106
1312  001075' 000000  000040
1313  001076' 000000  000115
1314  001077' 000000  000105
1315  001100' 000000  000115
1316  001101' 000000  000117
1317  001102' 000000  000122
1318  001103' 000000  000131
```

```
1319  001103' 000000  000331
1320  001104' 000000  000000
1321                  000007          22000          ERROM==Q
1322                                  22020          DCE"US"
1323  001105' 000000  000125          22040          DCL"UNDEFINED STATEMENT"
1324  001106' 000000  000116
1325  001107' 000000  000104
1326  001110' 000000  000105
1327  001111' 000000  000106
1328  001112' 000000  000111
1329  001113' 000000  000116
1330  001114' 000000  000105
1331  001115' 000000  000104
1332  001116' 000000  000040
1333  001117' 000000  000123
1334  001120' 000000  000124
1335  001121' 000000  000101
1336  001122' 000000  000124
1337  001123' 000000  000105
1338  001124' 000000  000115
1339  001125' 000000  000105
1340  001126' 000000  000116
1341  001127' 000000  000124
1342  001127' 000000  000324
1343  001130' 000000  000000
1344                  000010          22060          ERRUS==Q
1345                                  22080          DCE"BS"
1346  001131' 000000  000123          22100          DCL"SUBSCRIPT OUT OF RANGE"
1347  001132' 000000  000125
1348  001133' 000000  000102
1349  001134' 000000  000123
1350  001135' 000000  000103
1351  001136' 000000  000122
1352  001137' 000000  000111
1353  001140' 000000  000120
1354  001141' 000000  000124
1355  001142' 000000  000040
1356  001143' 000000  000117
1357  001144' 000000  000125
1358  001145' 000000  000124
1359  001146' 000000  000040
1360  001147' 000000  000117
1361  001150' 000000  000106
1362  001151' 000000  000040
1363  001152' 000000  000122
1364  001153' 000000  000101
1365  001154' 000000  000116
1366  001155' 000000  000107
1367  001156' 000000  000105
1368  001156' 000000  000305
1369  001157' 000000  000000
1370                  000011          22120          ERRBS==Q
1371                                  22140          DCE"DD"
```



```
1372  001160' 000000  000122          22160          DCL"REDIMENSIONED ARRAY"
1373  001161' 000000  000105
1374  001162' 000000  000104
1375  001163' 000000  000111
1376  001164' 000000  000115
1377  001165' 000000  000105
1378  001166' 000000  000116
1379  001167' 000000  000123
1380  001170' 000000  000111
1381  001171' 000000  000117
1382  001172' 000000  000116
1383  001173' 000000  000105
1384  001174' 000000  000104
1385  001175' 000000  000040
1386  001176' 000000  000101
1387  001177' 000000  000122
1388  001200' 000000  000122
1389  001201' 000000  000101
1390  001202' 000000  000131
1391  001202' 000000  000331
1392  001203' 000000  000000
1393                  000012          22180          ERRDD==Q
1394                                  22200          DCE"/0"
1395  001204' 000000  000104          22220          DCL"DIVISION BY ZERO"
1396  001205' 000000  000111
1397  001206' 000000  000126
1398  001207' 000000  000111
1399  001210' 000000  000123
1400  001211' 000000  000111
1401  001212' 000000  000117
1402  001213' 000000  000116
1403  001214' 000000  000040
1404  001215' 000000  000102
1405  001216' 000000  000131
1406  001217' 000000  000040
1407  001220' 000000  000132
1408  001221' 000000  000105
1409  001222' 000000  000122
1410  001223' 000000  000117
1411  001223' 000000  000317
1412  001224' 000000  000000
1413                  000013          22240          ERRDVO==Q
1414                                  22260          DCE"IO"
1415  001225' 000000  000111          22280          DCL"ILLEGAL DIRECT"
1416  001226' 000000  000114
1417  001227' 000000  000114
1418  001230' 000000  000105
1419  001231' 000000  000107
1420  001232' 000000  000101
1421  001233' 000000  000114
1422  001234' 000000  000040
1423  001235' 000000  000104
1424  001236' 000000  000111
```

```
001237' 000000  000122
001240' 000000  000105
001241' 000000  000103
001242' 000000  000124
001242' 000000  000324
001243' 000000  000000
                000014          22300           ERRID==0
                                22320   IFN     STRING,<
                                22340           DCE"TM"
001244' 000000  000124          22360           DCL"TYPE MISMATCH"
001245' 000000  000131
001246' 000000  000120
001247' 000000  000105
001250' 000000  000040
001251' 000000  000115
001252' 000000  000111
001253' 000000  000123
001254' 000000  000115
001255' 000000  000101
001256' 000000  000124
001257' 000000  000103
001260' 000000  000110
001260' 000000  000310
001261' 000000  000000
                000015          22380           ERRTM==0
                                22400           DCE"OS"
001262' 000000  000117          22420           DCL"OUT OF STRING SPACE"
001263' 000000  000125
001264' 000000  000124
001265' 000000  000040
001266' 000000  000117
001267' 000000  000106
001270' 000000  000040
001271' 000000  000123
001272' 000000  000124
001273' 000000  000122
001274' 000000  000111
001275' 000000  000116
001276' 000000  000107
001277' 000000  000040
001300' 000000  000123
001301' 000000  000120
001302' 000000  000101
001303' 000000  000103
001304' 000000  000105
001304' 000000  000305
001305' 000000  000000
                000016          22440           ERRSO==0
                                22460           DCE"LS"
001306' 000000  000123          22480           DCL"STRING TOO LONG"
001307' 000000  000124
001310' 000000  000122
001311' 000000  000111
```



```
001312' 000000  000116
001313' 000000  000107
001314' 000000  000040
001315' 000000  000124
001316' 000000  000117
001317' 000000  000117
001320' 000000  000040
001321' 000000  000114
001322' 000000  000117
001323' 000000  000116
001324' 000000  000107
001324' 000000  000307
001325' 000000  000000
                000017          22500           ERRLS==0
                                22520           DCE"ST"
001326' 000000  000123          22540           DCL"STRING FORMULA TOO COMPLEX"
001327' 000000  000124
001330' 000000  000122
001331' 000000  000111
001332' 000000  000116
001333' 000000  000107
001334' 000000  000040
001335' 000000  000106
001336' 000000  000117
001337' 000000  000122
001340' 000000  000115
001341' 000000  000125
001342' 000000  000114
001343' 000000  000101
001344' 000000  000040
001345' 000000  000124
001346' 000000  000117
001347' 000000  000117
001350' 000000  000040
001351' 000000  000103
001352' 000000  000117
001353' 000000  000115
001354' 000000  000120
001355' 000000  000114
001356' 000000  000105
001357' 000000  000130
001357' 000000  000330
001360' 000000  000000
                000020          22560           ERRST==0>
                                22580   IFN     LENGTH,<
                                22600           DCE"CN"
001361' 000000  000103          22620           DCL"CAN'T CONTINUE"
001362' 000000  000101
001363' 000000  000116
001364' 000000  000047
001365' 000000  000124
001366' 000000  000040
001367' 000000  000103
```

```
1531  001370' 000000  000117
1532  001371' 000000  000116
1533  001372' 000000  000124
1534  001373' 000000  000111
1535  001374' 000000  000116
1536  001375' 000000  000125
1537  001376' 000000  000105
1538  001376' 000000  000305
1539  001377' 000000  000000
1540                  000021          22640          ERRCN==0>
1541                                  22660   IFN    FUNCTS,<
1542                                  22680          DCE"UF"
1543  001400' 000000  000125          22700          DCL"UNDEFINED USER FUNCTION"
1544  001401' 000000  000116
1545  001402' 000000  000104
1546  001403' 000000  000105
1547  001404' 000000  000106
1548  001405' 000000  000111
1549  001406' 000000  000116
1550  001407' 000000  000105
1551  001410' 000000  000104
1552  001411' 000000  000040
1553  001412' 000000  000125
1554  001413' 000000  000123
1555  001414' 000000  000105
1556  001415' 000000  000122
1557  001416' 000000  000040
1558  001417' 000000  000106
1559  001420' 000000  000125
1560  001421' 000000  000116
1561  001422' 000000  000103
1562  001423' 000000  000124
1563  001424' 000000  000111
1564  001425' 000000  000117
1565  001426' 000000  000116
1566  001426' 000000  000316
1567  001427' 000000  000000
1568                  000022          22720          ERRUF==0>
1569
1570                                  22760   PAGE
```



```
1571                                  22760   SUBTTL  LOW SEGMENT -- RAM -- IE THIS STUFF IS NOT CONSTANT
1572                                  22800   ;
1573                                  22820   ; THIS IS THE "VOLATILE" STORAGE AREA AND NONE OF IT
1574                                  22840   ; CAN BE KEPT IN ROM, ANY CONSTANTS IN THIS AREA CANNOT
1575                                  22860   ; BE KEPT IN A ROM, BUT MUST BE LOADED IN BY THE
1576                                  22880   ; PROGRAM INSTRUCTIONS IN ROM.
1577                                  22900   ;
1578
1579  001430' 000000  000054          22940   BUFMIN: 44                      ;A COMMA (PRELOAD OR ROM)
1580                                  22960                                   ;USED BY INPUT STATEMENT SINCE THE
1581                                  22980                                   ;DATA POINTER ALWAYS STARTS ON A
1582                                  23000                                   ;COMMA OR TERMINATOR
1583  001431'                         23020   BUF:    BLOCK   BUFLEN          ;TYPE IN STORED HERE
1584                                  23040                                   ;DIRECT STATEMENTS EXECUTE OUT OF
1585                                  23060                                   ;HERE, REMEMBER INPUT SMASHES BUF,
1586                                  23080                                   ;MUST BE AT A LOWER ADDRESS
1587                                  23100                                   ;THAN DSCTMP OR ASSIGMENT OF STRING
1588                                  23120                                   ;VALUES IN DIRECT STATEMENTS WON'T COPY
1589                                  23140                                   ;INTO STRING SPACE -- WHICH IT MUST
1590                                  23160   IFN     LPTSW,<
1591                                  23180   LPTPOS: BLOCK   1               ;POSITION OF LPT PRINT HEAD
1592                                  23200   PRTFLG: BLOCK   1>              ;WHETHER OUTPUT GOES TO LPT
1593                                  23220                                   ;NON-ZERO MEANS SEND OUTPUT TO LPT
1594                                  23240   IFN     CONTRW,<
1595  001541'                         23260   CNTWFL: BLOCK   1>              ;SUPRESS OUTPUT FLAG
1596  001542'                         23280   DIMFLG: BLOCK   1               ;IN GETTING A POINTER TO A VARIABLE
1597                                  23300                                   ;IT IS IMPORTANT TO REMEMBER WHETHER IT
1598                                  23320                                   ;IS BEING DONE FOR "DIM" OR NOT
1599                                  23340                                   ;DIMFLG AND VALTYP MUST BE
1600                                  23360                                   ;CONSECUTIVE LOCATIONS
1601                                  23380   IFN     STRING,<
1602  001543'                         23400   VALTYP: BLOCK   1               ;THE TYPE INDICATOR
1603                                  23420                                   ;IN THE 8K 0=NUMERIC 1=STRING
1604  001544'                         23435   OPRTYP:                         ;USED TO STORE OPERATOR NUMBER
1605                                  23436                                   ;IN THE EXTENDED MOMENTARILY BEFORE
1606                                  23437                                   ;OPERATOR APPLICATION
1607  001544'                         23440   DORES:  BLOCK   1               ;WHETHER CAN OR CAN'T CRUNCH RES'D WORDS
1608                                  23460                                   ;TURNED ON IN THE 8K WHEN "DATA"
1609                                  23480                                   ;BEING SCANNED BY CRUNCH SO UNQUOTED
1610                                  23500                                   ;STRINGS WON'T BE CRUNCHED.
1611  001545'                         23520   MEMSIZ: BLOCK   2               ;HIGHEST LOCATION IN MEMORY
1612  001547'                         23540   TEMPPT: BLOCK   2               ;POINTER AT FIRST FREE TEMP DESCRIPTOR
1613                                  23560                                   ;INITIALIZED TO POINT TO TEMPST
1614  001551'                         23580   TEMPST: BLOCK   STRSIZ*NUMTMP   ;STORAGE FOR NUMTMP TEMP DESCRIPTORS
1615  001570'                         23600   DSCTMP: BLOCK   STRSIZ          ;STRING FUNCTIONS BUILD ANSWER DESCRIPTOR HERE
1616  001573'                         23620   FRETOP: BLOCK   2>              ;TOP OF STRING FREE SPACE
1617                                  23640   IFN     LENGTH!STRING,<
1618  001575'                         23660   TEMP3:  BLOCK   2>              ;USED TO HOLD VARB # OF HIGH LOC FOUND
1619                                  23680                                   ;IN GARBAGE COLLECTION
1620                                  23700                                   ;AND USED MOMENTARILY BY FRMEVL
1621                                  23720                                   ;USED IN EXTENDED BY FOUT
1622                                  23740                                   ;ARRAY VARIABLE HANDLING TEMPORARY
1623                                  23760   IFN     LENGTH,<
```

```
1624  001577'                23780  DATLIN: BLOCK   2              ;DATA LINE # -- REMEMBER FOR ERRORS
1625  001601'                23800  SUBFLG: BLOCK   1>             ;FLAG WHETHER SUBSCRIPTED VARIABLE ALLOWED
1626                         23820                                 ;"FOR" AND USER-DEFINED FUNCTION
1627                         23840                                 ;POINTER FETCHING TURN
1628                         23860                                 ;THIS ON BEFORE CALLING PTRGET
1629                         23880                                 ;SO ARRAYS WON'T BE DETECTED,
1630                         23900                                 ;STKINI AND PTRGET CLEAR IT,
1631  001602'                23920  FLGINP: BLOCK   1              ;FLAGS WHETHER WE ARE DOING INPUT
1632                         23940                                 ;OR A READ
1633  001603'                23960  TEMP:   BLOCK   2              ;TEMPORARY FOR STATEMENT CODE
1634                         23980                                 ;NEWSTT SAVES [H,L] HERE FOR INPUT AND ^C
1635                         24000                                 ;"LET" SAVES NUMBERIC VARIABLE
1636                         24020                                 ;POINTERS HERE FOR "FOR"
1637                         24040                                 ;"NEXT" SAVES ITS TEXT POINTER HERE
1638                         24060                                 ;CLEARC SAVE [H,L] HERE
1639  001605'                24080  TEMP2:  BLOCK   2              ;FORMULA EVALUATOR TEMP
1640                         24100                                 ;MUST BE PRESERVED BY OPERATORS
1641                         24120                                 ;USED IN EXTENDED BY FOUT
1642                         24140                                 ;ARRAY VARIABLE HANDLER TEMPORARY
1643  001607'                24160  CURLIN: BLOCK   2              ;CURRENT LINE #
1644                         24180                                 ;SET TO 65535 WHEN DIRECT STATEMENTS EXECUTE
1645                         24200  IFN     LENGTH,<
1646  001611'                24220  OLDLIN: BLOCK   2              ;OLD LINE NUMBER
1647  001613'                24240  OLDTXT: BLOCK   2>             ;OLD TEXT POINTER
1648                         24260                                 ;POINTS AT STATEMENT TO BE EXECUTED NEXT
1649  001615'                24280  STKTOP: BLOCK   2              ;TOP LOCATION TO USE FOR THE STACK
1650                         24300                                 ;INITIALLY SET UP BY INIT
1651                         24320                                 ;ACCORDING TO MEMORY SIZE
1652                         24340                                 ;TO ALLOW FOR 50 BYTES OF STRING SPACE,
1653                         24360                                 ;CHANGED BY A CLEAR COMMAND WITH
1654                         24380                                 ;AN ARGUMENT,
1655  001617'                24400  TXTTAB: BLOCK   2              ;POINTER TO BEGINNING OF TEXT
1656                         24420                                 ;DOESN'T CHANGE AFTER BEING
1657                         24440                                 ;SETUP BY INIT,
1658  001621'                24460  VARTAB: BLOCK   2              ;POINTER TO START OF SIMPLE
1659                         24480                                 ;VARIABLE SPACE
1660                         24500                                 ;UPDATED WHENEVER THE SIZE OF THE
1661                         24520                                 ;PROGRAM CHANGES, SET TO [TXTTAB]
1662                         24540                                 ;BY SCRATCH ("NEW"),
1663  001623'                24560  ARYTAB: BLOCK   2              ;POINTER TO BEGINNING OF ARRAY
1664                         24580                                 ;TABLE
1665                         24600                                 ;INCREMENTED BY 6 WHENEVER
1666                         24620                                 ;A NEW SIMPLE VARIABLE IS FOUND, AND
1667                         24640                                 ;SET TO [VARTAB] BY CLEARC,
1668  001625'                24660  STREND: BLOCK   2              ;END OF STORAGE IN USE
1669                         24680                                 ;INCREASED WHENEVER A NEW ARRAY
1670                         24700                                 ;OR SIMPLE VARIABLE IS ENCOUNTERED
1671                         24720                                 ;SET TO [VARTAB] BY CLEARC,
1672  001627'                24740  DATPTR: BLOCK   2              ;POINTER TO DATA, INITIALIZED TO POINT
1673                         24760                                 ;AT THE ZERO IN FRONT OF [TXTTAB]
1674                         24780  IFE     LENGTH-2,<
1675  001631'                24800  TRCFLG: BLOCK   1>             ;0 MEANS NO TRACE IN PROGRESS
1676
```



```
1677                         24840  ;THE FLOATING ACCUMULATOR
1678                         24860  IFE     LENGTH-2,<
1679  001632'                24880          BLOCK   1              ;[TEMPORARY LEAST SIGNIFICANT BYTE]
1680  001633'                24900  DFACLO: BLOCK   4>             ;[FOUR LOWEST ORDERS FOR DOUBLE PRECISION]
1681  001637'                24920  FACLO:  BLOCK   3              ;[LOW ORDER OF MANTISSA]
1682                         24940                                 ;[MIDDLE ORDER OF MANTISSA]
1683                         24960                                 ;[HIGH ORDER OF MANTISSA]
1684  001642'                24980  FAC:    BLOCK   2              ;[EXPONENT]
1685                         25000                                 ;[TEMPORARY COMPLEMENT OF SIGN IN MSB]
1686                         25020  IFE     LENGTH-2,<
1687  001644'                25030          BLOCK   1              ;[TEMPORARY LEAST SIGNIFICANT BYTE]
1688  001645'                25040  ARGLO:  BLOCK   7              ;[LOCATION OF SECOND ARGUMENT FOR DOUBLE
1689  001654'                25060  ARG:    BLOCK   1>             ; PRECISION]
1690  001655'                25080  FBUFFR: BLOCK   13             ;BUFFER FOR FOUT
1691  001672'                25100  IFE     LENGTH-2,<BLOCK 35-13>
1692                         25120  PAGE
```

```
                                        25140   SUBTTL  TEXT CONSTANTS FOR PRINT OUT
                                        25160   ;
                                        25180   ; NEEDED FOR MESSAGES IN ALL VERSIONS
                                        25200   ; MUST BE STORED ABOVE DSCTMP OR ELSE STRLIT
                                        25220   ; WILL COPY THEM BEFORE STRPRT PRINTS THEM, THIS IS BAD, SINCE IF THE
                                        25240   ; USER IS OUT OF STRING SPACE BASIC WILL LOOP GETTING "OUT OF STRING SPACE"
                                        25260   ; ERRORS,
                                        25280   ;
                                        25300   IFN     LENGTH=2,<
                                        25320   ERR:    DC" ERROR"
                                        25340           0>
  001720' 000000  000040                25360   INTXT:  DC" IN "
  001721' 000000  000111
  001722' 000000  000116
  001723' 000000  000040
  001723' 000000  000240
  001724' 000000  000000                25380           0
  001725' 000000  000015                25400   REDDY:  ACRLF
  001726' 000000  000012
  001727' 000000  000117                25420           DC"OK"
  001730' 000000  000113
  001730' 000000  000213
  001731' 000000  000015                25440           ACRLF
  001732' 000000  000012
  001733' 000000  000000                25460           0
                                        25480   IFN     LENGTH,<
  001734' 000000  000015                25500   BRKTXT: ACRLF
  001735' 000000  000012
  001736' 000000  000102                25520           DC"BREAK"
  001737' 000000  000122
  001740' 000000  000105
  001741' 000000  000101
  001742' 000000  000113
  001742' 000000  000313
  001743' 000000  000000                25540           0>

                                        25580   PAGE
```



```
                                        25600   SUBTTL  GENERAL STORAGE MANAGEMENT ROUTINES
                                        25620   ;
                                        25640   ; FIND A FOR ENTRY ON THE STACK WITH THE VARIABLE POINTER
                                        25660   ; PASSED IN [D,E],
                                        25680   ;
  001744' 001000  000041                25700   FNDFOR: LXI     H,4+$CODE       ;IGNORING EVERYONES "NEWSTT"
  001745' 000000  000004'
  001746' 000000  000026'
                                        25720                                   ;AND THE RETURN ADDRESS OF THIS
  001747' 001000  000071                25740           DAD     SP              ;SUBROUTINE, SET [H,L]=SP
  001750' 001000  000176                25760   LOOPER: MOV     A,M             ;SEE WHAT TYPE OF THING IS ON THE STACK
  001751' 001000  000043                25780           INX     H
  001752' 001000  000376                25800           CPI     FORTK           ;IS THIS STACK ENTRY A FOR?
  001753' 000000  000201
  001754' 001000  000300                25820           RNZ                     ;NO SO OK
                                        25840   IFE     LENGTH,<
                                        25860           PUSHM                   ;GET VARIABLE NAME
                                        25880           XTHL>
                                        25900   IFN     LENGTH,<
  001755' 001000  000116                25920           MOV     C,M
  001756' 001000  000043                25940           INX     H               ;DO EQUIVALENT OF PUSHM / XTHL
  001757' 001000  000106                25960           MOV     B,M
  001760' 001000  000043                25980           INX     H
  001761' 001000  000345                26000           PUSH    H               ;PUT H  ON
  001762' 001000  000151                26020           MOV     L,C             ;PUSH B / XTHL IS SLOWER
  001763' 001000  000140                26040           MOV     M,B
  001764' 001000  000172                26060           MOV     A,D             ;FOR THE "NEXT" STATMENT WITHOUT AN ARGUMENT
  001765' 001000  000263                26080           ORA     E               ;WE MATCH ON ANYTHING
  001766' 001000  000353                26100           XCHG                    ;MAKE SURE WE RETURN [D,E]
  001767' 001000  000312                26120           JZ      POPGOF          ;POINTING TO THE VARIABLE
  001770' 000000  001774'
  001771' 000000  001745'
  001772' 001000  000353                26140           XCHG>
  001773' 001000  000347                26160           COMPAR
  001774' 001000  000001                26180   POPGOF: LXI     B,$CODE+13      ;TO WIPE OUT A FOR ENTRY
  001775' 000000  000015'
  001776' 000000  001770'
  001777' 001000  000341                26200           POP     H
  002000' 001000  000310                26220           RZ                      ;IF FOR MATCHES GOOD
  002001' 001000  000011                26240           DAD     B
  002002' 001000  000303                26260           JMP     LOOPER          ;TRY THE NEXT ONE
  002003' 000000  001750'
  002004' 000000  001775'
                                        26280   ;
                                        26300   ; THIS IS THE BLOCK TRANSFER ROUTINE
                                        26320   ; IT MAKES SPACE BY SHOVING EVERYTHING FORWARD
                                        26340   ;
                                        26360   ; [H,L] = DESTINATION OF HIGH ADDRESS
                                        26380   ; [D,E] = LOW ADDRESS TO BE TRANSFERRED
                                        26400   ; [B,C] = HIGH ADDRESS TO BE TRANSFERRED
                                        26420   ;
                                        26440   ; A CHECK IS MADE TO MAKE SURE A REASONABLE AMOUNT
                                        26460   ; OF SPACE REMAINS BETWEEN THE TOP OF THE STACK AND THE HIGHEST LOCATION
```

```
                                        ; TRANSFERRED INTO
                                        ;
                                        ; ON EXIT [H,L]=[D,E]=LOW [B,C]=LOCATION LOW WAS MOVED INTO
                                        ;

002005' 001000  000315                  BLTU:   CALL    REASON          ;CHECK DESTINATION TO MAKE
002006' 000000  002045'
002007' 000000  002003'
                                                                        ;SURE THE STACK WON'T BE OVERRUN
002010' 001000  000305                  BLTUC:  PUSH    B               ;EXCHANGE [B,C] AND [H,L]
002011' 001000  000343                          XTHL
002012' 001000  000301                          POP     B
002013' 001000  000347                  BLTLOP: COMPAR                  ;SEE IF WE ARE DONE
002014' 001000  000176                          MOV     A,M             ;GET THE WORD TO TRANSFER
002015' 001000  000002                          STAX    B               ;TRANSFER IT
002016' 001000  000310                          RZ
002017' 001000  000013                          DCX     B
002020' 001000  000053                          DCX     H               ;BACKUP FOR NEXT GUY
002021' 001000  000303                          JMP     BLTLOP
002022' 000000  002013'
002023' 000000  002006'
                                        ;
                                        ; THIS ROUTINE IS USED TO MAKE SURE A CERTAIN NUMBER
                                        ; OF LOCATIONS REMAIN AVAILABLE FOR THE
                                        ; STACK, THE CALL IS :
                                        ;       CALL    GETSTK
                                        ;       NUMBER OF 2 BYTE ENTRIES NECESSARY
                                        ;
                                        ; THIS ROUTINE MUST BE CALLED BY ANY ROUTINE WHICH PUTS
                                        ; AN ARBITRARY AMOUNT OF STUFF ON THE STACK
                                        ; (I.E. ANY RECURSIVE ROUTINE LIKE FRMEVL)
                                        ; IT IS ALSO CALLED BY ROUTINES SUCH AS GOSUB AND FOR
                                        ; WHICH MAKE PERMANENT ENTRIES ON THE STACK
                                        ;
                                        ;
                                        ; ROUTINES WHICH MERELY USE AND FREE UP THE GUARANTEED
                                        ; NUMLEV STACK LOCATIONS NEED NOT CALL THIS
                                        ;
002024' 001000  000343                  GETSTK: XTHL
002025' 001000  000116                          MOV     C,M             ;GET ARGUMENT INTO [C]

002026' 001000  000043                          INX     H
002027' 001000  000343                          XTHL                    ;PUT BACK RETURN ADDRESS
002030' 001000  000345                          PUSH    H               ;SAVE [H,L]
002031' 001000  000052                          LHLD    $TREND
002032' 000000  001625'
002033' 000000  002022'
002034' 001000  000006                          MVI     B,0
002035' 000000  000000
002036' 001000  000011                          DAD     B
002037' 001000  000011                          DAD     B               ;SEE IF WE CAN HAVE THIS MANY
002040' 001000  000315                          CALL    REASON
002041' 000000  002045'
```



```
002042' 000000  002032'
002043' 001000  000341                          POP     H               ;RESTORE [H,L]
002044' 001000  000311                          RET

                                        ;
                                        ; [H,L]= SOME ADDRESS
                                        ; [H,L] IS EXAMINED TO MAKE SURE AT LEAST NUMLEV
                                        ; LOCATIONS REMAIN BETWEEN IT AND THE TOP OF THE STACK
                                        ;

002045' 001000  000325                  REASON: PUSH    D               ;SAVE [D,E]
002046' 001000  000353                          XCHG                    ;PUT [H,L] IN [D,E]
002047' 001000  000041                          LXI     H,$CODE+65536-2*NUMLEV  ;SETUP OFFSET OF GUARANTEED
002050' 000000  177726'
002051' 000000  002041'
                                                                        ;LOCATIONS
002052' 001000  000071                          DAD     SP              ;[H,L]=STACK POINTER + OFFSET
002053' 001000  000347                          COMPAR                  ;SEE IF THIS IS .GT. ENTERING [H,L]
002054' 001000  000353                          XCHG                    ;RESTORE [H,L] FROM [D,E]
002055' 001000  000321                          POP     D               ;GET [D,E] BACK
002056' 001000  000320                          RNC                     ;WAS OK?
002057' 001000  000036                  OMERR:  MVI     E,ERROM         ;"OUT OF MEMORY"
002060' 000000  000007
                                        IFE     LENGTH,<
                                                XWD     "01000,1>       ;"LXI B," OVER THE NEXT 2
                                        IFN     LENGTH,<
002061' 001000  000303                          JMP     ERROR>
002062' 000000  002102'
002063' 000000  002050'
                                        PAGE
```

```
                                        27860   SUBTTL ERROR HANDLER, READY, COMPACTIFICATION, NEW, CLEAR, MAIN
                                        27880   IFN     LENGTH,<
002064' 001000  000052                  27900   DATSNE: LHLD    DATLIN          ;GET DATA LINE
002065' 000000  001577'
002066' 000000  002062'
002067' 001000  000042                  27920           SHLD    CURLIN>         ;MAKE IT CURRENT LINE
002070' 000000  001607'
002071' 000000  002665'
002072' 001000  000036                  27940   SNERR:  MVI     E,ERRSN         ;"SYNTAX ERROR"
002073' 000000  000002
002074' 001000  000001                  27960           XWD     "01000,1        ;"LXI B," OVER THE NEXT 2
002075' 001000  000036                  27980   DV0ERR: MVI     E,ERRDV0        ;DIVISION BY ZERO
002076' 000000  000013
                                        28000   IFN     LENGTH,<
002077' 001000  000001                  28020           XWD     "01000,1        ;SKIP NEXT TWO
002100' 001000  000036                  28040   NFERR:  MVI     E,ERRNF>        ;"NEXT WITHOUT FOR" ERROR
002101' 000000  000001
002102' 001000  000315                  28060   ERROR:  CALL    STKINI          ;RESET THE STACK AND FLAGS
002103' 000000  002470'
002104' 000000  002070'
                                        28080   IFN     CONTRW,<
002105' 001000  000257                  28100           XRA     A
002106' 001000  000062                  28120           STA     CNTWFL>         ;FORCE OUTPUT
002107' 000000  001541'
002110' 000000  002103'
002111' 001000  000315                  28140           CALL    CRDO            ;CRLF
002112' 000000  004523'
002113' 000000  002107'
002114' 001000  000041                  28220           LXI     H,ERRTAB        ;GET START OF ERROR TABLE
002115' 000000  000730'
002116' 000000  00211c'
                                        28240   IFE     LENGTH-2,<
002117' 001000  000315                  28260   LEPSKP: CALL    REM             ;SKIP AN ERROR MESSAGE
002120' 000000  004074'
002121' 000000  002115'
002122' 001000  000035                  28280           DCR     E               ;DECREMENT ERROR COUNT
002123' 001000  000043                  28282           INX     H               ;SKIP OVER THIS ERROR MESSAGE
002124' 001000  000530                  28300           JNZ     LEPSKP>         ;SKIP SOME MORE
002125' 000000  002117'
002126' 000000  002120'
                                        28320   IFN     LENGTH-2,<
                                        28322           MOV     D,A             ;GET ZERO INTO D
                                        28324           MVI     A,"?"           ;START OF ERROR MESSAGE
                                        28326           OUTCHR                  ;TYPE IT
                                        28340           DAD     D               ;ADD IN ERROR CODE
                                        28360           MOV     A,M             ;GET FIRST ERROR CHARACTER
                                        28380           OUTCHR                  ;TYPE IT
                                        28400           CHRGET                  ;GET 2ND CHARACTER OF ERROR CODE
                                        28420           OUTCHR                  ;TYPE IT
                                        28440           LXI     H,ERR>          ;GET POINTER TO " ERROR"
002127' 001000  000315                  28460   ERRFIN: CALL    STROUT          ;TYPE IT
002130' 000000  007743'
002131' 000000  002125'
```



```
002132' 001000  000052                  28480           LHLD    CURLIN          ;CURRENT LINE #
002133' 000000  001607'
002134' 000000  002130'
002135' 001000  000174                  28500           MOV     A,H             ;SEE IF IN DIRECT MODE
002136' 001000  000245                  28520           ANA     L
002137' 001000  000074                  28540           INR     A               ;ZERO SAYS DIRECT MODE
002140' 001000  000304                  28560           CNZ     INPRT           ;PRINT LINE NUMBER IN [H,L]
002141' 000000  000000*
002142' 000000  002133'
                                        28580   IFE     LENGTH,<
                                        28600           XWD     "01000,1        ;"LXI B," OVER THE NEXT 2
                                        28620   END:
                                        28640   STOP:   RNZ                     ;MAKE SURE HE TERMINATED IT
                                        28660   STPEND: POP     B               ;GET RID OF "NEWSTT" RETURN ADDRESS
                                        28680   ENDCON:>
                                        28682   IFE     LENGTH-2,<
                                        28684   ;
                                        28686   ; FOR "LIST" COMMAND STOPPING
                                        28688   ;
002143' 001000  000076                  28690           XWD     "01000,"076             ;SKIP THE NEXT BYTE
002144' 001000  000301                  28692   STPRDY: POP     B>
                                        28700   READY:  IFN     LPTSW,<
                                        28720           CALL    FINLPT>         ;PRINT ANY LEFT OVERS
                                        28740   IFN     CONTRW,<
002145' 001000  000257                  28760           XRA     A
002146' 001000  000062                  28780           STA     CNTWFL>         ;FORCE OUTPUT
002147' 000000  001541'
002150' 000000  002141'
002151' 001000  000041                  28800           LXI     H,$CODE+65535
002152' 000000  177777'
002153' 000000  002147'
002154' 001000  000042                  28820           SHLD    CURLIN          ;SETUP CURLIN FOR DIRECT MODE
002155' 000000  001607'
002156' 000000  002152'
002157' 001000  000041                  28840           LXI     H,REDDY         ;"READY" CRLF CRLF
002160' 000000  001725'
002161' 000000  002155'
002162' 001000  000315                  28860   REPINI: CALL    INIT            ;PRINT IT, REPLACED BY CALL STROUT
002163' 000000  000000*
002164' 000000  002160'
                                        28880                                   ;BY THE INIT CODE, THIS IS HERE SO AFTER
                                        28900                                   ;ERRORS DURING INIT, INIT IS RESTARTED
002165' 001000  000315                  28920   MAIN:   CALL    INLIN           ;GET A LINE FROM TTY
002166' 000000  002176'
002167' 000000  002163'
002170' 001000  000327                  28940           CHRGET                  ;GET THE FIRST
002171' 001000  000074                  28960           INR     A               ;SEE IF 0 SAVING THE CARRY FLAG
002172' 001000  000075                  28980           DCR     A
002173' 001000  000312                  29000           JZ      MAIN            ;IF SO, A BLANK LINE WAS INPUT
002174' 000000  002165'
002175' 000000  002166'
002176' 001000  000365                  29020           PUSH    PSW             ;SAVE STATUS INDICATOR FOR 1ST CHARACTER
002177' 001000  000315                  29040           CALL    LINGET          ;READ IN A LINE #
```

```
1972  002200' 000000  003642'
1973  002201' 000000  002174'
1974  002202' 001000  000325          29060          PUSH   D          ;SAVE LINE #
1975  002203' 001000  000315          29080          CALL   CRUNCH     ;CRUNCH THE LINE DOWN
1976  002204' 000000  002533'
1977  002205' 000000  002200'
1978  002206' 001000  000107          29100          MOV    B,A        ;A=0 AFTER CRUNCH, [B,C]=CHAR COUNT FOR NODEL
1979  002207' 001000  000321          29120          POP    D          ;RESTORE LINE #
1980  002210' 001000  000361          29140          POP    PSW        ;WAS THERE A LINE #?
1981  002211' 001000  000322          29160          JNC    GONE       ;IF NOT ITS A DIRECT STATEMENT
1982  002212' 000000  003370'
1983  002213' 000000  002204'
1984  002214' 001000  000325          29180          PUSH   D
1985  002215' 001000  000305          29200          PUSH   B          ;SAVE LINE # AND CHARACTER COUNT
1986  002216' 001000  000327          29220          CHRGET            ;REMEMBER IF THIS LINE IS
1987  002217' 001000  000365          29240          PUSH   PSW        ;BLANK SO WE DON'T INSERT IT
1988  002220' 001000  000315          29260          CALL   FNDLIN     ;GET A POINTER TO THE LINE
1989  002221' 000000  002371'
1990  002222' 000000  002212'
1991  002223' 001000  000305          29280          PUSH   B          ;SAVE THE POINTER
1992                                  29300  IFE     LENGTH=2,<
1993  002224' 001000  000334          29320          CC     DEL>       ;DELETE THE LINE
1994  002225' 000000  011271'
1995  002226' 000000  002221'
1996                                  29340  IFN     LENGTH=2,<
1997                                  29360          JNC    NODEL      ;NO MATCH SO DON'T DELETE
1998                                  29380          XCHG              ;[D,E] NOW HAS THE POINTER TO THE LINE
1999                                  29400                            ;BEYOND THIS ONE
2000                                  29420          LHLD   VARTAB     ;COMPACTIFYING TO VARTAB
2001                                  29440  MLOOP:  LDAX   D
2002                                  29460          STAX   B          ;SHOVING DOWN TO ELIMINATE A LINE
2003                                  29480          INX    B
2004                                  29500          INX    D
2005                                  29520          COMPAR
2006                                  29540          JNC    MLOOP      ;DONE COMPACTIFYING?
2007                                  29560          MOV    M,B
2008                                  29580          MOV    L,C
2009                                  29600          INX    H          ;NEW VARTAB
2010                                  29620          SHLD   VARTAB>
2011  002227' 001000  000321          29640  NODEL:  POP    D          ;POP POINTER AT PLACE TO INSERT
2012  002230' 001000  000361          29660          POP    PSW        ;SEE IF THIS LINE HAD
2013                                  29680                            ;ANYTHING ON IT
2014  002231' 001000  000316          29700          JZ     FINI       ;IF NOT DON'T INSERT
2015  002232' 000000  002276'
2016  002233' 000000  002225'
2017  002234' 001000  000652          29720          LHLD   VARTAB     ;CURRENT END
2018  002235' 000000  001621'
2019  002236' 000000  002232'
2020  002237' 001000  000343          29740          XTHL              ;[H,L]=CHARACTER COUNT, VARTAB
2021                                  29760                            ;ONTO THE STACK
2022  002240' 001000  000301          29780          POP    B          ;[B,C]=OLD VARTAB
2023  002241' 001000  000011          29800          DAD    B
2024  002242' 001000  000345          29820          PUSH   H          ;SAVE NEW VARTAB
```



```
2025  002243' 001000  000315          29840          CALL   BLTU
2026  002244' 000000  002605'
2027  002245' 000000  002235'
2028  002246' 001000  000341          29860          POP    H          ;POP OFF VARTAB
2029  002247' 001000  000042          29880          SHLD   VARTAB     ;UPDATE VARTAB
2030  002250' 000000  001621'
2031  002251' 000000  002244'
2032  002252' 001000  000353          29900          XCHG
2033  002253' 001000  000164          29920          MOV    M,H        ;FOOL CHEAD WITH NON-ZERO LINK
2034  002254' 001000  000043          29940          INX    H          ;SO IT DOESN'T THINK
2035                                  29960                            ;THIS LINK IS THE
2036                                  29980                            ;END OF THE PROGRAM
2037  002255' 001000  000043          30000          INX    H
2038  002256' 001000  000321          30020          POP    D          ;GET LINE # OFF STACK
2039  002257' 001000  000163          30040          MOV    M,E
2040  002260' 001000  000043          30060          INX    H          ;PUT DOWN LINE #
2041  002261' 001000  000162          30080          MOV    M,D
2042  002262' 001000  000043          30100          INX    H
2043
2044  002263' 001000  000021          30140          LXI    D,BUF      ;MOVE LINE FROM BUF TO PROGRAM AREA
2045  002264' 000000  001431'
2046  002265' 000000  002250'
2047  002266' 001000  000032          30160  MLOOPR: LDAX   D          ;NOW TRANSFERING LINE
2048                                  30180                            ;IN FROM BUF
2049  002267' 001000  000167          30200          MOV    M,A
2050  002270' 001000  000043          30220          INX    H
2051  002271' 001000  000023          30240          INX    D
2052  002272' 001000  000267          30260          ORA    A          ;ZERO MARKS THE END
2053  002273' 001000  000302          30280          JNZ    MLOOPR
2054  002274' 000000  002266'
2055  002275' 000000  002264'
2056  002276' 001000  000315          30300  FINI:   CALL   RUNC       ;DO CLEAR & SET UP STACK
2057  002277' 000000  002437'
2058  002300' 000000  002274'
2059                                  30320                            ;ALSO SETS [H,L] TO [TXTTAB]-1
2060  002301' 001000  000043          30340          INX    H
2061                                  30360  ;
2062                                  30380  ; CHEAD GOES THROUGH PROGRAM STORAGE AND FIXES
2063                                  30400  ; UP ALL THE LINKS, THE END OF EACH
2064                                  30420  ; LINE IS FOUND BY SEARCHING FOR THE ZERO AT THE END,
2065                                  30440  ; THE DOUBLE ZERO LINK IS USED TO DETECT THE END OF THE PROGRAM
2066                                  30460  ;
2067  002302' 001000  000124          30480  CHEAD:  MOV    D,H        ;[D,E]=[H,L]
2068  002303' 001000  000135          30500          MOV    E,L
2069  002304' 001000  000176          30520          MOV    A,M        ;SEE IF END OF CHAIN
2070  002305' 001000  000043          30540          INX    H          ;BUMP POINTER
2071  002306' 001000  000266          30560          ORA    M          ;2ND BYTE
2072  002307' 001000  000312          30580          JZ     MAIN       ;DONE
2073  002310' 000000  002165'
2074  002311' 000000  002277'
2075  002312' 001000  000043          30600          INX    H          ;FIX H TO START OF TEXT
2076  002313' 001000  000043          30620          INX    H
2077  002314' 001000  000043          30640          INX    H
```

```
002315' 001000  000257          30660          XRA     A                ;SEARCHING FOR A ZERO IN MEMORY
002316' 001000  000276          30680  CZLOOP: CMP     M                ;TO MARK THE END OF THIS LINE
002317' 001000  000043          30700          INX     H                ;BUMP POINTER
002320' 001000  000302          30720          JNZ     CZLOOP           ;END OF LINE
002321' 000000  002316'
002322' 000000  002310'
002323' 001000  000353          30740          XCHG                     ;SWITCH TEMP
002324' 001000  000163          30760          MOV     M,E              ;DO FIRST BYTE OF FIXUP
002325' 001000  000043          30780          INX     H                ;ADVANCE POINTER
002326' 001000  000162          30800          MOV     M,D              ;2ND BYTE OF FIXUP
002327' 001000  000353          30820          XCHG                     ;AND BACK AGAIN
002330' 001000  000303          30840          JMP     CHEAD            ;KEEP CHAINING TIL DONE
002331' 000000  002302'
002332' 000000  002321'
                                30860  IFE     LENGTH-2,<
                                30880  ;
                                30900  ; SCNLIN SCANS A LINE RANGE OF
                                30920  ; THE FORM  #-# OR # OR #- OR -# OR BLANK
                                30940  ; AND THEN FINDS THE FIRST LINE IN THE RANGE
                                30960  ;
002333' 001000  000021          30980  SCNLIN: LXI     D,$CODE          ;ASSUME START LIST AT ZERO
002334' 000000  000000'
002335' 000000  002331'
002336' 001000  000325          31000          PUSH    D                ;SAVE INITIAL ASSUMPTION
002337' 001000  000312          31020          JZ      ALLLST           ;IF FINISHED, LIST IT ALL
002340' 000000  002354'
002341' 000000  002334'
002342' 001000  000321          31040          POP     D                ;WE ARE GOING TO GRAB A #
002343' 001000  000315          31060          CALL    LINGET           ;GET A LINE #, IF NONE, RETURNS ZERO
002344' 000000  003642'
002345' 000000  002340'
002346' 001000  000325          31080          PUSH    D                ;SAVE FIRST
002347' 001000  000312          31100          JZ      ONELIN           ;IF ONLY # THEN DONE.
002350' 000000  002365'
002351' 000000  002344'
002352' 001000  000317          31120          SYNCHK  MINUTK           ;MUST BE A DASH.
002353' 000000  000051
002354' 001000  000021          31140  ALLLST: LXI     D,$CODE+^D65529 ;ASSUME MAX END OF RANGE
002355' 000000  177771'
002356' 000000  002350'
002357' 001000  000304          31160          CNZ     LINGET           ;GET THE END OF RANGE
002360' 000000  003642'
002361' 000000  002355'
002362' 001000  000302          31180          JNZ     SNERR            ;MUST BE TERMINATOR
002363' 000000  002072'
002364' 000000  002366'
002365' 001000  000353          31200  ONELIN: XCHG                     ;[H,L] = FINAL
002366' 001000  000321          31220          POP     D                ;GET INITIAL IN [D,E]
002367' 001000  000343          31240          XTHL                     ;PUT MAX ON STACK, RETURN ADDR TO [H,L]
002370' 001000  000345          31260          PUSH    H>               ;SAVE RETURN ADDRESS BACK
                                31280  ;
                                31300  ; FNDLIN SEARCHES THE PROGRAM TEXT FOR THE LINE
                                31320  ; WHOSE LINE # IS PASSED IN [D,E]. [D,E] IS PRESERVED.
```



```
                                31340  ; THERE ARE THREE POSSIBLE RETURNS:
                                31360  ;
                                31380  ;       1) ZERO FLAG SET, CARRY NOT SET,  LINE NOT FOUND.
                                31400  ;          NO LINE IN PROGRAM GREATER THAN ONE SOUGHT,
                                31420  ;          [B,C] POINTS TO TWO ZERO BYTES AT END OF PROGRAM.
                                31440  ;          [H,L]=[B,C]
                                31460  ;
                                31480  ;       2) ZERO, CARRY SET,
                                31500  ;          [B,C] POINTS TO THE LINK FIELD IN THE LINE
                                31520  ;          WHICH IS THE LINE SEARCHED FOR,
                                31540  ;          [H,L] POINTS TO THE LINK FIELD IN THE NEXT LINE.
                                31560  ;
                                31580  ;       3) NON-ZERO, CARRY NOT SET,
                                31600  ;          LINE NOT FOUND, [B,C]  POINTS TO LINE IN PROGRAM
                                31620  ;          GREATER THAN ONE SEARCHED FOR,
                                31640  ;          [H,L] POINTS TO THE LINK FIELD IN THE NEXT LINE.
                                31660  ;
002371' 001000  000052          31680  FNDLIN: LHLD    TXTTAB           ;GET POINTER TO START OF TEXT
002372' 000000  001617'
002373' 000000  002363'
002374' 001000  000104          31700  LOOP:   MOV     B,H              ;IF EXITING BECAUSE OF END OF PROGRAM,
                                31720                                   ;SET [B,C] TO POINT TO DOUBLE ZEROES.
002375' 001000  000115          31740          MOV     C,L
002376' 001000  000176          31760          MOV     A,M              ;GET WORD POINTER TO
002377' 001000  000043          31780          INX     H                ;BUMP POINTER
002400' 001000  000266          31800          ORA     M                ;GET 2ND BYTE
002401' 001000  000053          31820          DCX     H                ;GO BACK
002402' 001000  000310          31840          RZ                       ;IF ZERO THEN DONE
002403' 001000  000305          31860          PUSH    B
002404' 001000  000367          31880          PUSHM                    ;PUSH LINK
002405' 001000  000367          31900          PUSHM                    ;PUSH BINARY LINE #
002406' 001000  000341          31920          POP     H                ;POP HERE
002407' 001000  000347          31940          COMPAR                   ;COMPARE [D,E] TO [H,L]
002410' 001000  000341          31960          POP     H                ;GET LINK
002411' 001000  000301          31980          POP     B                ;GET POINTER TO THIS LINE IN [B,C]
002412' 001000  000077          32000          CMC                      ;TURN CARRY ON
002413' 001000  000310          32020          RZ                       ;EQUAL RETURN
002414' 001000  000077          32040          CMC                      ;MAKE CARRY ZERO
002415' 001000  000320          32060          RNC                      ;NO MATCH RETURN (GREATER)
002416' 001000  000303          32080          JMP     LOOP             ;KEEP LOOPING
002417' 000000  002374'
002420' 000000  002372'
                                32100  ;
                                32120  ; THE "NEW" COMMAND CLEARS THE PROGRAM TEXT AS WELL
                                32140  ; AS VARIABLE SPACE
                                32160  ;
002421' 001000  000300          32180  SCRATH: RNZ                      ;MAKE SURE THERE IS A TERMINATOR
002422' 001000  000052          32200  SCRTCH: LHLD    TXTTAB
002423' 000000  001617'
002424' 000000  002417'
                                32220  IFN     LENGTH-2,<
                                32240          XRA     A>
                                32260  IFE     LENGTH-2,<
```

```
2184  002425' 001000  000315  32280          CALL    TUFF>          ;TURN OFF TRACE, SET [A]=0,
2185  002426' 000000  003605'
2186  002427' 000000  002423'
2187  002430' 001000  000167  32300          MOV     M,A            ;SAVE AT END OFF TEXT
2188  002431' 001000  000043  32320          INX     H              ;BUMP POINTER
2189  002432' 001000  000167  32340          MOV     M,A            ;SAVE ZERO
2190  002433' 001000  000043  32360          INX     H              ;BUMP POINTER
2191  002434' 001000  000042  32380          SHLD    VARTAB         ;NEW START OF VARIABLE
2192  002435' 000000  001621'
2193  002436' 000000  002426'
2194                          32400  IFE     LENGTH,<
2195                          32420  RUN:    RNZ>                   ;CHECK FOR A TERMINATOR
2196  002437' 001000  000052  32440  RUNC:   LHLD    TXTTAB         ;POINT AT THE START OF TEXT
2197  002440' 000000  001617'
2198  002441' 000000  002435'
2199  002442' 001000  000053  32460          DCX     H
2200                          32480  ;
2201                          32500  ; CLEARC IS A SUBROUTINE WHICH INITIALIZES THE VARIABLE AND
2202                          32520  ; ARRAY SPACE BY RESETING ARYTAB [THE END OF SIMPLE VARIABLE SPACE]
2203                          32540  ; AND STRENO [THE END OF ARRAY STORAGE]. IT FALLS INTO STKINI
2204                          32560  ; WHICH RESETS THE STACK. [H,L] IS PRESERVED.
2205                          32580  ;
2206                          32600  IFE     STRING,<CLEAR1>
2207  002443' 001000  000042  32620  CLEARC: SHLD    TEMP           ;SAVE [H,L] IN TEMP
2208  002444' 000000  001603'
2209  002445' 000000  002440'
2210                          32640  IFN     STRING,<
2211  002446' 001000  000052  32660          LHLD    MEMSIZ
2212  002447' 000000  001545'
2213  002450' 000000  002444'
2214  002451' 001000  000042  32680          SHLD    FRETOP>        ;FREE UP STRING SPACE
2215  002452' 000000  001573'
2216  002453' 000000  002447'
2217  002454' 001000  000315  32700          CALL    RESTORE        ;RESTORE DATA
2218  002455' 000000  003446'
2219  002456' 000000  002452'
2220  002457' 001000  000052  32720          LHLD    VARTAB         ;GET START OF VARIABLE SPACE
2221  002460' 000000  001621'
2222  002461' 000000  002455'
2223  002462' 001000  000042  32740          SHLD    ARYTAB         ;SAVE IN START OF ARRAY SPACE
2224  002463' 000000  001623'
2225  002464' 000000  002460'
2226  002465' 001000  000042  32760          SHLD    STRENO         ;AND END OF VARIABLE STORAGE
2227  002466' 000000  001625'
2228  002467' 000000  002463'
2229                          32780  ;
2230                          32800  ; STKINI RESETS THE STACK POINTER ELIMINATING
2231                          32820  ; GOSUB & FOR CONTEXT.  STRING TEMPORARIES ARE FREED
2232                          32840  ; UP, SUBFLG IS RESET, CONTINUING IS DISALLOWED,
2233                          32860  ; AND A DUMMY ENTRY IS PUT ON THE STACK, THIS IS SO
2234                          32880  ; FNDFOR WILL ALWAYS FIND A NON-"FOR" ENTRY AT THE BOTTOM
2235                          32900  ; OF THE STACK, [A]=0 AND [D,E] IS PRESERVED.
2236                          32920  ;
```



```
2237  002470' 001000  000301  32940  STKINI: POP     B              ;GET RETURN ADDRESS HERE
2238  002471' 001000  000052  32960          LHLD    STKTOP         ;[H,L] POINTER TO END OF MEMORY
2239  002472' 000000  001615'
2240  002473' 000000  002466'
2241  002474' 001000  000371  32980          SPHL                   ;INITIALIZE STACK
2242                          33000  IFN     STRING,<
2243  002475' 001000  000041  33020          LXI     H,TEMPST
2244  002476' 000000  001551'
2245  002477' 000000  002472'
2246  002500' 001000  000042  33040          SHLD    TEMPPT>        ;INITIALIZE STRING TEMPORARIES
2247  002501' 000000  001547'
2248  002502' 000000  002476'
2249  002503' 001000  000041  33060          LXI     H,$CODE        ;PUT ZERO (NON NEXT, FOR, GOSUB TOKEN)
2250  002504' 000000  000000'
2251  002505' 000000  002501'
2252  002506' 001000  000345  33080          PUSH    H              ;ON STACK
2253  002507' 001000  000042  33100  IFN     LENGTH,<SHLD    OLDTXT> ;MAKE CONTINUING ILLEGAL
2254  002510' 000000  001613'
2255  002511' 000000  002504'
2256                          33120  IFN     LPTSW,<
2257                          33140          CALL    FINLPT>
2258  002512' 001000  000052  33160          LHLD    TEMP           ;GET SAVED [H,L]
2259  002513' 000000  001603'
2260  002514' 000000  002510'
2261                          33180  IFN     LENGTH,<
2262                          33200  IFE     CONTRW,<XRA     A>
2263  002515' 001000  000062  33220          STA     SUBFLG>        ;ALLOW SUBSCRIPTS
2264  002516' 000000  001601'
2265  002517' 000000  002513'
2266  002520' 001000  000305  33240          PUSH    B              ;PUT RETURN ADDRESS BACK ON
2267  002521' 001000  000311  33260          RET                    ;GO BACK
2268
2269  002522' 001000  000076  33300  QINLIN: MVI     A,"?"          ;GET A QMARK
2270  002523' 000000  000077
2271  002524' 001000  000337  33320          OUTCHR                 ;TYPE IT
2272  002525' 001000  000076  33340          MVI     A," "          ;SPACE
2273  002526' 000000  000040
2274  002527' 001000  000337  33360          OUTCHR                 ;TYPE IT TOO
2275                          33380  IFE     STRING,<CALL    INLIN  ;IN THE NON-STRING VERSIONS ALL
2276                          33400                                 ;INPUT IS CRUNCHED
2277                          33420          INX     H>             ;GET A LINE OF INPUT FROM TTY
2278  002530' 001000  000303  33440  IFN     STRING,<JMP     INLIN> ;NO CRUNCHING IN THIS CASE
2279  002531' 000000  002776'
2280  002532' 000000  002516'
2281                          33460  ;
2282                          33520  ; ALL "RESERVED" WORDS ARE TRANSLATED INTO SINGLE
2283                          33540  ; BYTES WITH THE MSB ON, THIS SAVES SPACE AND TIME
2284                          33560  ; BY ALLOWING FOR TABLE DISPATCH DURING EXECUTION,
2285                          33580  ; THEREFORE ALL STATEMENTS APPEAR TOGETHER IN THE
2286                          33600  ; RESERVED WORD LIST IN THE SAME
2287                          33620  ; ORDER THEY APPEAR IN IN STMDSP.
2288                          33640  ;
2289  002533'                 33700  CRUNCH: IFN     STRING,<
```

```
2290  002533' 001000  000257          33720          XRA     A
2291  002534' 001000  000062          33740          STA     DORES>          ;ALLOW CRUNCHING
2292  002535' 000000  001544'
2293  002536' 000000  002531'
2294  002537' 001000  000016          33760          MVI     C,5             ;COUNT OF CHARS AT LEAST 5
2295  002540' 000000  000005
2296  002541' 001000  000021          33780          LXI     D,BUF           ;SETUP DESTINATION POINTER
2297  002542' 000000  001431'
2298  002543' 000000  002535'
2299  002544' 001000  000176          33800  KLOOP:  MOV     A,M             ;GET CHARACTER FROM BUF
2300  002545' 001000  000376          33820          CPI     " "             ;IS IT A SPACE WE WANT TO SAVE
2301  002546' 000000  000040
2302  002547' 001000  000312          33840          JZ      STUFFH          ;YES, STUFF IN DESTINATION LINE,
2303  002550' 000000  002667'
2304  002551' 000000  002542'
2305  002552' 001000  000107          33860          MOV     B,A             ;GET A CHARACTER FROM THE LINE
2306                                  33880                                  ;SETUP B WITH A QUOTE IF IT IS A STRING
2307  002553' 001000  000376          33900          CPI     34              ;QUOTE SIGN?
2308  002554' 000000  000042
2309  002555' 001000  000312          33920          JZ      STRNG           ;YES, GO TO SPECIAL STRING HANDLING
2310  002556' 000000  002727'
2311  002557' 000000  002550'
2312  002560' 001000  000267          33940          ORA     A               ;END OF LINE?
2313  002561' 001000  000312          33960          JZ      CRDONE          ;YES, DONE CRUNCHING
2314  002562' 000000  002753'
2315  002563' 000000  002556'
2316                                  33980  IFN     STRING,<
2317  002564' 001000  000072          34000          LDA     DORES           ;IN DATA STATEMENT AND NO CRUNCH?
2318  002565' 000000  001544'
2319  002566' 000000  002562'
2320  002567' 001000  000267          34020          ORA     A
2321  002570' 001000  000107          34040          MOV     B,A             ;INITIALIZE RESERVED WORD COUNT
2322  002571' 001000  000176          34060          MOV     A,M             ;GET THE CHARACTER AGAIN
2323  002572' 001000  000302          34080          JNZ     STUFFH>         ;IF NO CRUNCHING JUST STORE
2324  002573' 000000  002667'
2325  002574' 000000  002565'
2326                                  34100                                  ;THE CHARACTER
2327                                  34120  IFN     LENGTH,<                ;NOT FOR 4K VERSION
2328  002575' 001000  000376          34140          CPI     "?"             ;A WMARK?
2329  002576' 000000  000077
2330  002577' 001000  000076          34160          MVI     A,PRINTK
2331  002600' 000000  000231
2332  002601' 001000  000312          34180          JZ      STUFFH          ;THEN USE A "PRINT" TOKEN
2333  002602' 000000  002667'
2334  002603' 000000  002573'
2335  002604' 001000  000176          34200          MOV     A,M
2336  002605' 001000  000376          34220          CPI     "0"             ;SKIP NUMERICS
2337  002606' 000000  000060
2338  002607' 001000  000332          34240          JC      MUSTCR          ;SINCE CRUNCHING IS SLOW
2339  002610' 000000  002617'
2340  002611' 000000  002602'
2341  002612' 001000  000376          34260          CPI     60              ;":" ALSO PUT IN QUICKLY
2342  002613' 000000  000074
```



```
2343  002614' 001000  000332          34280          JC      STUFFH
2344  002615' 000000  002667'
2345  002616' 000000  002610'
2346  002617'                         34300  MUSTCR: >
2347  002617' 001000  000325          34320          PUSH    D               ;SAVE STORE POINTER
2348                                  34340  IFE     STRING,<
2349                                  34360          MVI     B,0>            ;INIT RESERVED WORD COUNT
2350  002620' 001000  000021          34380          LXI     D,RESLST-1      ;INIT TO RESERVED WORD LIST
2351  002621' 000000  000171'
2352  002622' 000000  002615'
2353  002623' 001000  000345          34400          PUSH    H               ;SAVE IN BUF POINTER
2354  002624' 001000  000076          34420          XWD     "01000,"076     ;"MVI" AROUND CHRGET
2355  002625' 001000  000327          34440  NXTRES: CHRGET                   ;GET CHAR FROM LINE
2356  002626' 001000  000023          34460          INX     D               ;BUMP DEPOSIT POINTER
2357  002627' 001000  000032          34480  RESER:  LDAX    D               ;GET A BYTE FROM RESERVED WORD LIST
2358  002630' 001000  000346          34500          ANI     127             ;GET RID OF SIGN BIT
2359  002631' 000000  000177
2360  002632' 001000  000312          34520          JZ      TABEND          ;END OF RESERVED WORD TABLE
2361  002633' 000000  002653'
2362  002634' 000000  002621'
2363  002635' 001000  000276          34540          CMP     M               ;TWO CHARS THE SAME?
2364  002636' 001000  000302          34560          JNZ     NTMIS           ;NO, DIFFERENT
2365  002637' 000000  002736'
2366  002640' 000000  002633'
2367  002641' 001000  000032          34580          LDAX    D               ;GET RESERVED WORD BYTE
2368  002642' 001000  000267          34600          ORA     A               ;SET CONDITION CODES
2369  002643' 001000  000362          34620          JP      NXTRES          ;IF SIGN SET, RESERVED WORD FOUND
2370  002644' 000000  002625'
2371  002645' 000000  002637'
2372  002646' 001000  000361          34640  FOUND:  POP     PSW             ;TAKE OFF GARBAGE ORIG POINTER
2373  002647' 001000  000170          34660          MOV     A,B             ;GET RESERVED WORD #
2374  002650' 001000  000366          34680          ORI     128             ;SET MSB TO FLAG AS RESERVED WORD
2375  002651' 000000  000200
2376  002652' 001000  000362          34700          XWD     "01000,"0362    ;"JP" AROUND THE POP H AND MOV A,M
2377  002653' 001000  000341          34720  TABEND: POP     H               ;GET BACK ORIG POINTER
2378  002654' 001000  000176          34740          MOV     A,M             ;GET BACK ORIG CHAR
2379  002655' 001000  000321          34760          POP     D               ;GET STUFF POINTER BACK
2380                                  34780  IFE     LENGTH-2,<
2381  002656' 001000  000353          34800          XCHG                    ;[H,L]=STUFF POINTER
2382  002657' 001000  000376          34820          CPI     ELSETK          ;HAVE TO PUT A HIDDEN
2383  002660' 000000  000220
2384                                  34840                                  ;COLON IN FRONT OF "ELSE"S
2385  002661' 001000  000066          34860          MVI     M,":"           ;STORE IT
2386  002662' 000000  000072
2387  002663' 001000  000314          34880          CZ      INXHRT##        ;ADVANCE POINTER ON "ELSE"
2388  002664' 000000  000000*
2389  002665' 000000  002644'
2390                                  34900                                  ;SO ONLY ON "ELSE" THE COLON IS NOT OVERWRITTEN
2391
2392  002666' 001000  000353          34920          XCHG>                   ;[D,E]=STUFF POINTER
2393  002667' 001000  000043          34940  STUFFH: INX     H               ;ENTRY TO BUMP [H,L]
2394  002670' 001000  000022          34960          STAX    D               ;SAVE CHARACTER IN CRUNCHED LINE
2395  002671' 001000  000023          34980          INX     D               ;BUMP SAVE POINTER
```

```
002672' 001000  000014   35000            INR     C                ;BUMP CRUNCHED CHARACTER COUNT
                         35020   IFN      STRING,<
002673' 001000  000326   35040            SUI     ":"              ;SEE IF IT IS A COLON
002674' 000000  000072
002675' 001000  000312   35060            JZ      COLIS            ;IF SO ALLOW CRUNCHING AGAIN
002676' 000000  002705'
002677' 000000  002664'
002700' 001000  000376   35080            CPI     DATATK-":"
002701' 000000  000111
002702' 001000  000302   35100            JNZ     NODATT           ;SEE IF IT IS A DATA TOKEN
002703' 000000  002710'
002704' 000000  002676'
002705' 001000  000062   35120   COLIS:   STA     DORES            ;SETUP FLAG
002706' 000000  001544'
002707' 000000  002703'
002710' 001000  000326   35140   NODATT:  SUI     REMTK=":">
002711' 000000  000124
                         35160   IFE      STRING,<SUI     REMTK>   ;WAS IT A REM STATEMENT
002712' 001000  000302   35180            JNZ     KLOOP            ;KEEP LOOPING
002713' 000000  002544'
002714' 000000  002706'
002715' 001000  000107   35200            MOV     B,A              ;REM DOESN'T STOP ON ":", ONLY ON A ZERO
002716' 001000  000176   35220   STR1:    MOV     A,M              ;GET A CHAR
002717' 001000  000267   35240            ORA     A                ;SET CONDITION CODES
002720' 001000  000312   35260            JZ      CRDONE           ;IF END OF LINE THEN DONE
002721' 000000  002753'
002722' 000000  002713'
002723' 001000  000270   35280            CMP     B                ;END OF GOBBLE
002724' 001000  000312   35300            JZ      STUFFH           ;IF YES, DONE WITH STRING
002725' 000000  002667'
002726' 000000  002721'
002727' 001000  000043   35320   STRNG:   INX     H                ;INCREMENT TEXT POINTER
002730' 001000  000022   35340            STAX    D                ;STORE CHAR
002731' 001000  000014   35360            INR     C                ;BUMP COUNT
002732' 001000  000023   35380            INX     D                ;AND POINTER
002733' 001000  000303   35400            JMP     STR1             ;KEEP LOOPING
002734' 000000  002716'
002735' 000000  002725'

002736' 001000  000341   35440   NTHIS:   POP     H                ;RESTORE TEXT STRING
002737' 001000  000345   35460            PUSH    H                ;AND SAVE IT BACK
002740' 001000  000004   35480            INR     B                ;INCREMENT RESERVED WORD #
002741' 001000  000353   35500            XCHG                     ;RESLST POINTER INTO [H,L]
002742' 001000  000266   35520   NTHIS1:  ORA     M                ;TEST BITS IN RESERVED WORD LIST
002743' 001000  000043   35540            INX     H
002744' 001000  000362   35560            JP      NTHIS1           ;SKIP MORE
002745' 000000  002742'
002746' 000000  002734'
002747' 001000  000353   35580            XCHG                     ;RESLST POINTER INTO [D,E]
                         35600                                     ;TEXT POINTER INTO [H,L]
002750' 001000  000303   35620            JMP     RESER            ;DONE, MOVE TO NEXT RESERVED WORD
002751' 000000  002627'
002752' 000000  002745'
```



```
002753' 001000  000041   35640   CRDONE: LXI     H,BUFMIN         ;LEAVE WITH [H,L] POINTER TO START OF LINE
002754' 000000  001430'
002755' 000000  002751'
002756' 001000  000022   35660            STAX    D                ;NEED THREE 0'S ON THE END
002757' 001000  000023   35680            INX     D                ;ONE FOR END-OF-LINE
002760' 001000  000022   35700            STAX    D                ;AND 2 FOR A ZERO LINK
002761' 001000  000023   35720            INX     D                ;SINCE IF THIS IS A DIRECT STATEMENT
002762' 001000  000022   35740            STAX    D                ;ITS END MUST LOOK LIKE THE END OF A PROGRAM
002763' 001000  000311   35760            RET                      ;END OF CRUNCHING
                         35780   ;
                         35800   ; THIS IS THE LINE INPUT ROUTINE
                         35820   ; IT READS CHARACTERS INTO BUF USING ↑ AS THE
                         35840   ; CHARACTER DELETE CHARACTER AND @ AS THE LINE DELETE CHARACTER
                         35860   ; IF MORE THAN BUFLEN CHARACTER ARE TYPED, NO ECHOING
                         35880   ; IS DONE UNTIL A ↑ @ OR CARRIAGE-RETURN IS TYPED.
                         35900   ; CONTROL-G WILL BE TYPED FOR EACH EXTRA CHARACTER.
                         35920   ; THE ROUTINE IS ENTERED AT INLIN
                         35940   ;
002764' 001000  000005   35960   LINLIN: DCR     B                ;BACK ARROW SO DECREMENT COUNT
002765' 001000  000053   35980            DCX     H                ;BACK UP POINTER
                         36000   IFN      REALIO,<
002766' 001000  000337   36020            OUTCHR>
002767' 001000  000302   36040            JNZ     INLINC           ;NOT TOO MANY SO CONTINUE
002770' 000000  003003'
002771' 000000  002754'
002772'                  36060   INLINN:  IFN     REALIO,<
002772' 001000  000337   36080            OUTCHR>                  ;PRINT THE @, OR A SECOND ↑ IF THERE
                         36100                                     ;WERE TOO MANY
002773' 001000  000315   36120            CALL    CRDO             ;TYPE A CRLF
002774' 000000  004523'
002775' 000000  002770'
002776' 001000  000041   36140   INLIN:   LXI     H,BUF
002777' 000000  001431'
003000' 000000  002774'
003001' 001000  000006   36160            MVI     B,1              ;CHARACTER COUNT
003002' 000000  000001
003003' 001000  000315   36180   INLINC:  CALL    INCHR            ;GET A CHARACTER
003004' 000000  003126'
003005' 000000  002777'
                         36182   IFN      LENGTH,<
003006' 001000  000376   36184            CPI     7                ;IS IT BOB ALBRECHT RINGING THE BELL
003007' 000000  000007
003010' 001000  000312   36186            JZ      GOODCH>          ;FOR SCHOOL KIDS?
003011' 000000  003044'
003012' 000000  003004'
003013' 001000  000376   36200            CPI     13               ;IS IT A CARRIAGE RETURN?
003014' 000000  000015
003015' 001000  000312   36220            JZ      FININL           ;IF SO FINISH UP
003016' 000000  004516'
003017' 000000  003011'
003020' 001000  000376   36240            CPI     32               ;CHECK FOR FUNNY CHARACTERS
003021' 000000  000040
003022' 001000  000332   36260            JC      INLINC
```

```
2502  003023' 000000  003003'
2503  003024' 000000  003016'
2504  003025' 001000  000376          36280          CPI     125
2505  003026' 000000  000175
2506  003027' 001000  000322          36300          JNC     INLINC          ;BIG ONES BAD TOO
2507  003030' 000000  003003'
2508  003031' 000000  003023'
2509  003032' 001000  000376          36320          CPI     "0"             ;LINE DELETE?
2510  003033' 000000  000100
2511  003034' 001000  000312          36340          JZ      INLINN
2512  003035' 000000  00277F'
2513  003036' 000000  003030'
2514  003037' 001000  000376          36360          CPI     "_"             ;CHARACTER DELETE?
2515  003040' 000000  000137
2516  003041' 001000  000312          36380          JZ      LINLIN
2517  003042' 000000  002764'
2518  003043' 000000  003035'
2519  003044' 001000  000117          36400  GOODCH: MOV     C,A
2520  003045' 001000  000170          36420          MOV     A,B
2521  003046' 001000  000376          36440          CPI     BUFLEN
2522  003047' 000000  000110
2523  003050' 001000  000076          36460          MVI     A,7             ;GET A BELL IN CASE LINE TOO LONG.
2524  003051' 000000  000007
2525  003052' 001000  000322          36480          JNC     OUTBEL          ;LINE TOO LONG, RING BELL.
2526  003053' 000000  003061'
2527  003054' 000000  003042'
2528  003055' 001000  000171          36500          MOV     A,C
2529  003056' 001000  000161          36520          MOV     M,C             ;STORE THIS CHARACTER
2530  003057' 001000  000043          36540          INX     H
2531  003060' 001000  000004          36560          INR     B
2532  003061'                         36580  OUTBEL:
2533                                  36600  IFN     REALIO,<
2534  003061' 001000  000337          36620          OUTCHR>
2535  003062' 001000  000303          36640          JMP     INLINC
2536  003063' 000000  003003'
2537  003064' 000000  003053'
2538  003065'                         36660  OUTCON:
2539                                  36680  IFN     CONTRW,<
2540  003065' 001000  000302          36700          JNZ     PPSWRT>         ;NO, DO OUTPUT
2541  003066' 000000  010024'
2542  003067' 000000  003063'
2543                                  36720  IFN     REALIO,<                ;MITS I/O
2544                                  36740  IFN     LPTSW,<
2545                                  36760          LDA     PRTFLG          ;SEE IF WE WANT TO TALK TO LPT
2546                                  36780          ORA     A               ;TEST BITS
2547                                  36800          JZ      TTYCHK          ;IF ZERO THEN NOT
2548                                  36820          POP     PSW             ;GET CHARACTER WE WANT TO PRINT
2549                                  36840          PUSH    PSW
2550                                  36860          CPI     13              ;IS IT CARRIAGE RETURN?
2551                                  36880          CZ      PRINTW          ;FORCE OUT A LINE
2552                                  36900          JC      PPSWRT          ;IF FUNNY CONTROL CHARACTER (LF) DO NOTHING
2553                                  36920          LDA     LPTPOS          ;WHERE ARE WE?
2554                                  36940          CPI     LPTLEN          ;AT THE END?
```



```
2555                                  36960          CNC     PRINTW          ;YES, START OVER
2556                                  36980          INR     A
2557                                  37000          STA     LPTPOS
2558                                  37020  LPTWAT: IN      2
2559                                  37040          ANI     2
2560                                  37060          JZ      LPTWAT
2561                                  37080          POP     PSW
2562                                  37100          OUT     3               ;SEND OUT CHAR
2563                                  37120          RET                     ;RETURN
2564                                  37140  PATLPT: BLOCK   20
2565                                  37160  FINLPT: XRA     A               ;RESET PRINT FLAG SO OUTPUT
2566                                  37180          STA     PRTFLG          ;GOES TO THE TERMINAL
2567                                  37200          LDA     LPTPOS          ;SEE IF ANY LEFTOVERS MUST BE
2568                                  37220          ORA     A               ;FORCED OUT
2569                                  37240          RZ                      ;BY LOOKING AT LPTPOS
2570                                  37260  PRINTW: IN      2               ;MAKE SURE LAST PRINT
2571                                  37280          ANI     2               ;FINISHED BY TESTING DONE
2572                                  37300          JZ      PRINTW          ;BIT
2573                                  37320  ; SEE IF BUFFER MUST BE EMPTIED
2574                                  37340          LDA     LPTPOS
2575                                  37360          ORA     A               ;CHARACTERS IN THE BUFFER?
2576                                  37380          JNZ     PRINTR          ;IF SO DON'T CLEAR THE BUFFER
2577                                  37400          MVI     A,4             ;OTHERWISE BUFFER MUST BE EMPTIED
2578                                  37420          OUT     2               ;CLEAR THE BUFFER
2579                                  37440                                  ;TO PRINT A BLANK LINE
2580                                  37460  PRINTR: MVI     A,1             ;TELL LPT TO PRINT
2581                                  37480          OUT     2               ;STATUS REG
2582                                  37500          DCR     A               ;[A]=0
2583                                  37520          STA     LPTPOS          ;RESET LINE PRINT POSITION
2584                                  37540          RET>
2585  003070'                         37560  TTYCHR:>
2586                                  37580  IFN     STRING,<
2587  003070' 001000  000361          37600          POP     PSW             ;GET THE CHARACTER
2588  003071' 001000  000365          37620          PUSH    PSW             ;AND SAVE IT AGAIN
2589  003072' 001000  000376          37640          CPI     32              ;IS THIS A MEANINGFUL CHARACTER?
2590  003073' 000000  000040
2591  003074' 001000  000332          37660          JC      TRYOUT>         ;IF IT'S A NON-PRINTING CHARACTER
2592  003075' 000000  003113'
2593  003076' 000000  003066'
2594                                  37680                                  ;DON'T INCLUDE IT IN TTYPOS
2595                                  37700  IFN     LENGTH|CONTRW|LPTSW,<
2596  003077' 001000  000072          37720          LDA     TTYPOS>         ;SEE IF PRINT HEAD IS AT THE END OF THE LINE
2597  003100' 000000  000047'
2598  003101' 000000  003075'
2599                                  37740          CPI     LINLEN          ;MODIFIED BY "TERMINAL WIDTH?" QUESTION IN INIT
2600  003102' 001000  000376
2601  003103' 000000  000110
2602                  003103'         37760  LINPT1==:,-1
2603  003104' 001000  000314          37780          CZ      CRDO            ;TYPE CRLF AND SET TTYPOS AND [A]=0 IF SO
2604  003105' 000000  004523'
2605  003106' 000000  003100'
2606  003107' 001000  000074          37800          INR     A               ;INCREMENT TTYPOS SINCE WE'RE
2607                                  37820                                  ;GOING TO PRINT A CHARACTER.
```

```
2608  003110' 001000  000062                37840          STA     TTYPOS          ;STORE NEW PRINT HEAD POSITION
2609  003111' 000000  000047'
2610  003112' 000000  003105'
2611  003113'                               37860  TRYOUT:
2612                                        37880  IFN     REALIO,<
2613  003113' 001000  000333                37900  NOPRIN: IN      0               ;GET STATUS
2614  003114' 000000  000000
2615                  003114'               37920  CNLCA1==.-1                     ;CONSOLE COMMAND CHANGE LOC
2616  003115' 001000  000346                37940          ANI     ODONE           ;OK TO SEND CHAR
2617  003116' 000000  000200
2618  003117' 001000  000302                37960          JNZ     NOPRIN>         ;KEEP LOOPING
2619  003120' 000000  003113'
2620  003121' 000000  003111'
2621  003122' 001000  000361                37980          POP     PSW             ;GET CHARACTER BACK
2622  003123' 001000  000323                38000          OUT     TTOCHN          ;SEND OUT THE CHAR
2623  003124' 000000  000001
2624                  003124'               38020  CNLCB1==.-1                     ;CONSOLE COMMAND CHANGE LOC
2625  003125' 001000  000311                38040          RET                     ;RETURN FROM OUTCHR
2626
2627
2628  003126'                               38100  INCHR:  IFN     REALIO,<
2629  003126' 001000  000333                38120  TRYIN:  IN      0               ;GET STATUS
2630  003127' 000000  000000
2631                  003127'               38140  CNLCA2==.-1                     ;CONSOLE COMMAND CHANGE LOC
2632  003130' 001000  000346                38160          ANI     IDONE           ;TEST BIT
2633  003131' 000000  000001
2634  003132' 001000  000302                38180          JNZ     TRYIN>          ;GO BACK & DO IT AGAIN
2635  003133' 000000  003126'
2636  003134' 000000  003120'
2637  003135' 001000  000333                38200          IN      TTICHN          ;GET A CHAR
2638  003136' 000000  000001
2639                  003136'               38220  CNLCB2==.-1                     ;CONSOLE COMMAND CHANGE LOC
2640  003137' 001000  000346                38240          ANI     127             ;GET RID OF PARITY BIT
2641  003140' 000000  000177
2642                                        38260  IFN     CONTRW,<
2643  003141' 001000  000376                38280          CPI     CONTW           ;IS IT SUPRESS OUTPUT?
2644  003142' 000000  000017
2645  003143' 001000  000300                38300          RNZ
2646  003144' 001000  000072                38320          LDA     CNTWFL
2647  003145' 000000  001541'
2648  003146' 000000  003133'
2649  003147' 001000  000057                38340          CMA                     ;COMPLEMENT ITS STATE
2650  003150' 001000  000062                38360          STA     CNTWFL>         ;SAVE BACK
2651  003151' 000000  001541'
2652  003152' 000000  003145'
2653  003153' 001000  000311                38380          RET
2654                                        38400  PAGE
```



```
2655                                        38420  SUBTTL  THE "LIST" COMMAND
2656
2657                                        38460  IFN     LENGTH=2,<
2658                                        38480  IFN     LPTSW,<
2659                                        38500  LLIST:  MVI     A,1             ;GET NON ZERO VALUE
2660                                        38520          STA     PRTFLG>         ;SAVE IN I/O FLAG
2661                                        38540  LIST:   CALL    LINGET          ;GET LINE NUMBER INTO [D,E]
2662                                        38560          RNZ                     ;MUST BE A TERMINATOR OR ERROR
2663                                        38580          POP     B               ;GET RID OF NEWSTT RETURN ADDR
2664                                        38600          CALL    FNDLIN          ;FIND LINE GREATER THAN OR EQUAL TO [D,E]
2665                                        38620          PUSH    B               ;SAVE START POINTER
2666                                        38640  LIST4:  POP     H               ;GET POINTER TO LINE
2667                                        38660          PUSHM                   ;PUSH LINK
2668                                        38680          POP     B               ;TAKE OFF FOR A SECOND
2669                                        38700          MOV     A,B             ;SEE IF END OF CHAIN
2670                                        38720          ORA     C
2671                                        38740          JZ      READY
2672                                        38760  IFN     LISTEN,<
2673                                        38780          CALL    ISCNTC>         ;CHECK FOR CONTROL-C
2674                                        38800          PUSH    B               ;PUT BACK ON
2675                                        38820          CALL    CRDO            ;DO CRLF TO START OUT
2676                                        38840          PUSHM                   ;PUSH LINE #
2677                                        38860          XTHL                    ;GET LINE # INTO [H,L]
2678                                        38880                                  ;AND WE WANT [H,L] ON THE STACK
2679                                        38900          CALL    LINPRT          ;PRINT AS INT WITOUT LEADING SPACE
2680                                        38920          MVI     A," "
2681                                        38940  PRIT4:  POP     H               ;RESTORE POINTER TO START OF TEXT
2682                                        38960  PLOOP:  OUTCHR                  ;ALWAYS A SPACE AFTER THE LINE #
2683                                        38980          MOV     A,M             ;GET A CHARACTER FROM LINE.
2684                                        39000          ORA     A               ;IS IT A RESERVED WORD
2685                                        39020          INX     H               ;INCREMENT POINTER INTO TEXT
2686                                        39040          JZ      LIST4           ;ZERO, END OF LINE, GET NEXT LINE
2687                                        39060          JP      PLOOP           ;REGULAR CHAR, JUST PRINT IT
2688                                        39080          SUI     127             ;GET RID OF SIGN BIT AND ADD ONE
2689                                        39100          MOV     C,A             ;GET RESERVED WORD # IN C
2690                                        39120          PUSH    H               ;SAVE CURRRENT POSIT
2691                                        39140          LXI     D,RESLST        ;GET RESLST POINTER.
2692                                        39160  RESRCH: PUSH    D               ;SAVE
2693                                        39180
2694                                        39200  RESCR1: LDAX    D               ;GET CHARACTER FROM RESLST
2695                                        39220          INX     D               ;BUMP RESLST POINTER
2696                                        39240          ORA     A               ;TEST BITS
2697                                        39260          JP      RESCR1          ;NOT AT END OF RESERVED WORD YET
2698                                        39280          DCR     C               ;DECREMENT CHAR
2699                                        39300          POP     H               ;POP START POINTER HERE
2700                                        39320          JNZ     RESRCH          ;NOT AT END OF RESLST YET.
2701                                        39340  ;HERE WHEN FOUND RIGHT RESERVED WORD
2702                                        39360  PRIT3:  MOV     A,M             ;GET A CHARACTER FROM RESERVED WORD
2703                                        39380          ORA     A               ;SET CONDITION CODES
2704                                        39400          JM      PRIT4
2705                                        39420          OUTCHR
2706                                        39440          INX     H               ;BUMP RESLST POINTER
2707                                        39460          JMP     PRIT3>          ;PRINT THE REST
```

```
2708
2709
2710                                39520   PAGE
```



```
2711                                39540   SUBTTL "FOR" STATEMENT
2712                                39560   ;
2713                                39580   ; NOTE:
2714                                39600   ;
2715                                39620   ; A FOR ENTRY ON THE STACK HAS THE FOLLOWING FORMAT:
2716                                39640   ;
2717                                39660   ;
2718                                39700   ; LOW ADDRESS
2719                                39720   ;       TOKEN (FORTK IN HIGH BYTE)  1 BYTE
2720                                39740   ;       A POINTER TO THE LOOP VARIABLE  2 BYTES
2721                                39760   ;       A BYTE REFLECTING THE SIGN OF THE INCREMENT 1 BYTE
2722                                39780   ;       THE STEP 4 BYTES
2723                                39800   ;       THE UPPER VALUE 4 BYTES
2724                                39820   ;       THE LINE # OF THE "FOR" STATEMENT 2 BYTES
2725                                39840   ;       A TEXT POINTER INTO THE "FOR" STATEMENT 2 BYTES
2726                                39860   ; HIGH ADDRESS
2727                                39880   ;
2728                                39900   ; TOTAL 16 BYTES
2729                                39920   ;
2730
2731  003154'                       39960   FOR:    IFN     LENGTH,<
2732  003154' 001000  000076        39980           MVI     A,100
2733  003155' 000000  000144
2734  003156' 001000  000062        40000           STA     SUBFLG>         ;DONT RECOGNIZE SUBSCRIPTED VARIABLES
2735  003157' 000000  001601'
2736  003160' 000000  003151'
2737  003161' 001000  000315        40020           CALL    LET             ;READ THE VARIABLE AND ASSIGN IT
2738  003162' 000000  004131'
2739  003163' 000000  003157'
2740                                40040                                   ;THE CORRECT INTIAL VALUE
2741                                40060                                   ;AND STORE A POINTER
2742                                40080                                   ;TO THE VARIABLE IN [TEMP]
2743  003164' 001000  000343        40100           XTHL                    ;SAVE TEXT PTR ON THE STACK
2744  003165' 001000  000315        40120           CALL    FNDFOR          ;MUST HAVE VARIABLE POINTER IN [D,E]
2745  003166' 000000  001744'
2746  003167' 000000  003162'
2747  003170' 001000  000321        40140           POP     D               ;[D,E]=TEXT POINTER
2748  003171' 001000  000302        40160           JNZ     NOTOL           ;IF NO MATCHING ENTRY, DON'T
2749  003172' 000000  003176'
2750  003173' 000000  003166'
2751                                40180                                   ;ELIMINATE ANYTHING
2752  003174' 001000  000011        40200           DAD     B               ;IN THE CASE OF "FOR"
2753                                40220                                   ;WE ELIMINATE THE MATCHING ENTRY
2754                                40240                                   ;AS WELL AS EVERYTHING AFTER IT
2755  003175' 001000  000371        40260           SPHL                    ;DO THE ELIMINATION
2756                                40280                                   ;SINCE A MATCHING ENTRY WAS FOUND
2757  003176' 001000  000353        40300   NOTOL:  XCHG                    ;[H,L]=TEXT POINTER
2758  003177' 001000  000315        40320           CALL    GETSTK
2759  003200' 000000  002624'
2760  003201' 000000  003172'
2761  003202' 000000  000010        40340           B                       ;MAKE SURE 16 BYTES ARE AVAILABLE
2762                                40360                                   ;OFF OF THE STACK
2763  003203' 001000  000345        40380           PUSH    H               ;REALLY SAVE THE TEXT POINTER
```

```
 2764  003204' 001000  000315          40400          CALL    DATA            ;GET AN [H,L] THAT POINTS
 2765  003205' 000000  004072'
 2766  003206' 000000  003200'
 2767                                  40420                                  ;JUST BEYOND THE TERMINATOR
 2768  003207' 001000  000343          40440          XTHL                    ;PUT [H,L] POINTER TO TERMINATOR ON THE STACK
 2769                                  40460                                  ;AND RESTORE [H,L] AS TEXT POINTER AT
 2770                                  40480                                  ;VARIABLE NAME
 2771  003210' 001000  000345          40500          PUSH    H               ;PUSH THE TEXT POINTER ONTO THE STACK
 2772  003211' 001000  000052          40520          LHLD    CURLIN          ;[H,L] GET THE CURRENT LINE #
 2773  003212' 000000  001607'
 2774  003213' 000000  003205'
 2775  003214' 001000  000343          40540          XTHL                    ;NOW THE CURRENT LINE # IS ON THE STACK AND
 2776                                  40560                                  ;[H,L] IS THE TEXT POINTER
 2777                                  40580  IFN     LENGTH=2,<
 2778                                  40600  IFN     STRING,<CALL    CHKNUM>>
 2779  003215' 001000  000317          40620          SYNCHK  TOTK            ;"TO" IS NECESSARY
 2780  003216' 000000  000241
 2781                                  40640  IFN     LENGTH=2,<
 2782                                  40660          CALL    FRMNUM>         ;READ FINAL VALUE
 2783                                  40680  IFE     LENGTH=2,<
 2784  003217' 001000  000315          40700          CALL    FRMEVL>
 2785  003220' 000000  005336'
 2786  003221' 000000  003212'
 2787  003222' 001000  000345          40720          PUSH    H               ;SAVE THE TEXT POINTER
 2788                                  40740  IFE     LENGTH=2,<
 2789  003223' 001000  000315          40760          CALL    FRCSNG>
 2790  003224' 000000  000670*
 2791  003225' 000000  003220'
 2792  003226' 001000  000315          40780          CALL    MOVRF           ;GET THE STUFF
 2793  003227' 000000  000000*
 2794  003230' 000000  003224'
 2795  003231' 001000  000341          40800          POP     H               ;REGAIN TEXT POINTER
 2796  003232' 001000  000305          40820          PUSH    B               ;OPPOSITE OF PUSHR
 2797  003233' 001000  000325          40840          PUSH    D               ;SAVE THE SIGN OF THE INCREMENT
 2798  003234' 001000  000001          40860          LXI     B,$CODE+^O201*256
 2799  003235' 000000  100400'
 2800  003236' 000000  003227'
 2801  003237' 001000  000121          40880          MOV     D,C
 2802  003240' 001000  000132          40900          MOV     E,D             ;GET 1,0 IN THE REGISTERS
 2803  003241' 001000  000176          40920          MOV     A,M             ;GET TERMINATING CHARACTER
 2804  003242' 001000  000376          40940          CPI     STEPTK          ;DO WE HAVE "STEP" ?
 2805  003243' 000000  000247
 2806  003244' 001000  000076          40960          MVI     A,1             ;SETUP DEFAULT SIGN
 2807  003245' 000000  000001
 2808  003246' 001000  000302          40980          JNZ     ONEON           ;PUSH SOME CONSTANTS ON IF NOT
 2809  003247' 000000  003265'
 2810  003250' 000000  003235'
 2811                                  41000  IFN     LENGTH=2,<
 2812                                  41020  IFN     STRING,<
 2813                                  41040          CHRGET
 2814                                  41060          CALL    FRMNUM>>        ;READ THE STEP
 2815                                  41080  IFE     <LENGTH=2>&STRING,<
 2816  003251' 001000  000315          41100          CALL    FRMCHK>         ;DON'T NEED TO CHECK THE TYPE
```



```
 2817  003252' 000000  005337'
 2818  003253' 000000  003247'
 2819  003254' 001000  000345          41120          PUSH    H
 2820                                  41140  IFE     LENGTH=2,<
 2821  003255' 001000  000315          41160          CALL    FRCSNG>
 2822  003256' 000000  003224*
 2823  003257' 000000  003252'
 2824  003260' 001000  000315          41180          CALL    MOVRF           ;SET UP THE REGISTERS
 2825  003261' 000000  003227*
 2826  003262' 000000  003256'
 2827  003263' 001000  000341          41200          POP     H
 2828  003264' 001000  000357          41220          FSIGN                   ;GET THE SIGN OF THE INCREMENT
 2829  003265' 001000  000305          41240  ONEON:  PUSH    B               ;PUT VALUE ON BACKWARDS
 2830  003266' 001000  000325          41260          PUSH    D               ;OPPOSITE OF PUSHR
 2831  003267' 001000  000365          41280  IFORON: PUSH    PSW             ;SAVE THE SIGN OF THE INCREMENT
 2832  003270' 001000  000063          41300          INX     SP              ;A ONE BYTE ENTRY ONLY
 2833  003271' 001000  000345          41320          PUSH    H
 2834  003272' 001000  000052          41340          LHLD    TEMP            ;GET THE POINTER TO THE VARIABLE BACK
 2835  003273' 000000  001623'
 2836  003274' 000000  003261'
 2837  003275' 001000  000343          41360          XTHL                    ;PUT THE POINTER TO THE VARIABLE
 2838                                  41380                                  ;ONTO THE STACK AND RESTORE THE TEXT POINTER
 2839  003276' 001000  000006          41400  NXTCON: MVI     B,FORTK         ;PUT A "FOR" TOKEN ONTO THE STACK
 2840  003277' 000000  000201
 2841  003300' 001000  000305          41420          PUSH    B
 2842  003301' 001000  000063          41440          INX     SP              ;THE "TOKEN" ONLY TAKES ONE BYTE OF
 2843                                  41460                                  ;STACK SPACE
 2844                                  41480  ;       JMP     NEWSTT          ;ALL DONE
 2845                                  41500  PAGE
```

```
                                        SUBTTL NEW STATEMENT FETCHER
                                        ;
                                        ; BACK HERE FOR NEW STATEMENT, CHARACTER POINTED TO BY [H,L]
                                        ; ":" OR END-OF-LINE, THE ADDRESS OF THIS LOCATION IS
                                        ; LEFT ON THE STACK WHEN A STATEMENT IS EXECUTED SO
                                        ; IT CAN MERELY DO A RETURN WHEN IT IS DONE.
                                        ;
003302'                                 NEWSTT:
                                        IFN     LISTEN,<
                                        IFN     LENGTH,<
003302' 001000  000333                  IN      0               ;CHECK FOR A CHARACTER WITHOUT
003303' 000000  000000
                                                                ;DOING A "CALL" FOR SPEED
                        003303'         CNLCA4==I,-1
003304' 001000  000346                  ANI     IDONE           ;CHARACTER THERE?
003305' 000000  000001
003306' 001000  000314                  CZ      CNTCCN>         ;SEE IF IT'S CONTROL-C
003307' 000000  003465'
003310' 000000  003273'
                                        IFE     LENGTH,<
                                        CALL    ISCNTC>>
                                        IFN     LENGTH,<
003311' 001000  000042                  SHLD    TEMP>           ;USED BY CONTINUE AND INPUT AND CLEAR
003312' 000000  001603'
003313' 000000  003307'
                                                                ;TO REMEMBER HOW TO RESTART THIS
                                                                ;STATEMENT
                                        IFN     LPTSW,<XRA      A       ;FORCE PRINT TO GO TO TTY AFTER LPRINT
                                        STA     PRTFLG>
003314' 001000  000176                  MOV     A,M             ;GET CURRENT CHARACTER
                                                                ;WHICH TERMINATED THE LAST STATEMENT
003315' 001000  000376                  CPI     ":"             ;IS IT A COLON?
003316' 000000  000072
003317' 001000  000312                  JZ      GONE
003320' 000000  003370'
003321' 000000  003312'
003322' 001000  000267                  ORA     A
003323' 001000  000302                  JNZ     SNERR           ;MUST BE A ZERO
003324' 000000  002072'
003325' 000000  003320'
003326' 001000  000043                  INX     H
003327' 001000  000176                  MOV     A,M             ;CHECK POINTER TO SEE IF
                                                                ;IT IS ZERO, IF SO WE ARE AT THE
                                                                ;END OF THE PROGRAM
003330' 001000  000043                  INX     H
003331' 001000  000266                  ORA     M               ;OR IN HIGH PART
003332' 001000  000043                  INX     H
003333' 001000  000312                  JZ      ENDCON          ;RAN OFF THE END -- OK
003334' 000000  003501'
003335' 000000  003324'
003336' 001000  000136                  MOV     E,M
003337' 001000  000043                  INX     H
003340' 001000  000126                  MOV     D,M             ;GET LINE # IN [D,E]
```



```
003341' 001000  000353                  XCHG                    ;[H,L]=LINE #
003342' 001000  000042                  SHLD    CURLIN          ;SETUP CURLIN WITH THE CURRENT LINE #
003343' 000000  001607'
003344' 000000  003334'
                                        IFE     LENGTH-2,<      ;TRACE FEATURE
003345' 001000  000072                  LDA     TRCFLG          ;SEE IF TRACE IS ON
003346' 000000  001631'
003347' 000000  003343'
003350' 001000  000267                  ORA     A               ;NON-ZERO MEANS YES
003351' 001000  000312                  JZ      NOTTRC          ;SKIP THIS PRINTING
003352' 000000  003367'
003353' 000000  003346'
003354' 001000  000325                  PUSH    D               ;SAVE THE TEXT POINTER
003355' 001000  000076                  MVI     A,"["           ;FORMAT THE LINE NUMBER
003356' 000000  000133
003357' 001000  000337                  OUTCHR                  ;OUTPUT IT
003360' 001000  002315                  CALL    LINPRT          ;PRINT THE LINE # IN [H,L]
003361' 000000  000000*
003362' 000000  003352'
003363' 001000  000076                  MVI     A,"]"           ;SOME MORE FORMATING
003364' 000000  000135
003365' 001000  000337                  OUTCHR
003366' 001000  000321                  POP     D               ;[D,E]=TEXT POINTER
003367'                                 NOTTRC:>
003353' 001000  000353                  XCHG                    ;RESTORE THE TEXT POINTER
003370' 001000  000327                  CHRGET                  ;GET THE STATEMENT TYPE
003371' 001000  000021                  LXI     D,NEWSTT        ;PUSH ON A RETURN ADDRESS OF NEWSTT
003372' 000000  003302'
003373' 000000  003361'
003374' 001000  000325                  PUSH    D               ;STATEMENT
003375' 001000  000310                  RZ                      ;IF A TERMINATOR TRY AGAIN
                                                                ;"IF" COMES HERE
003376' 001000  000326                  SUI     ENDTK           ;"ON ... GOTO" AND "ON ... GOSUB" COME HERE
003377' 000000  000200
003400' 001000  000332                  JC      LET             ;MUST BE A LET
003401' 000000  004131'
003402' 000000  003372'
                                        000040
                                        NUMCMD=SCRATK-ENDTK+1
003403' 001000  000376                  CPI     NUMCMD
003404' 000000  000040
003405' 001000  000322                  JNC     SNERR           ;SOME RESERVED WORD,BUT NOT
003406' 000000  002072'
003407' 000000  003401'
                                                                ;A STATEMENT RESERVED WORD
003410' 001000  000007                  RLC                     ;MULTIPLY BY 2
003411' 001000  000117                  MOV     C,A
003412' 001000  000006                  MVI     B,0
003413' 000000  000000
003414' 001000  000353                  XCHG
003415' 001000  000041                  LXI     H,STMDSP        ;STATEMENT DISPATCH TABLE
003416' 000000  000564'
003417' 000000  003406'
003420' 001000  000011                  DAD     B               ;ADD ON OFFSET
```

```
2952  003421' 001000  000116   42960          MOV     C,M          ;PUSH THE ADDRESS TO GO TO ONTO
2953  003422' 001000  000043   42980          INX     H            ;THE STACK
2954  003423' 001000  000106   43000          MOV     B,M          ;PUSHMM SAVES BYTES BUT NOT SPEED
2955  003424' 001000  000305   43020          PUSH    B
2956  003425' 001000  000353   43040          XCHG                 ;RESTORE THE TEXT POINTER
2957                           43060  IFE     LENGTH,<
2958                           43080          CHRGET               ;EAT THE FIRST CHARACTER
2959                           43100          RET>                 ;GO DO THE STATEMENT
2960                           43120  IFN     LENGTH,<
2961  003426' 001000  000043   43140  CHRGTR: INX     H            ;DUPLICATION OF CHRGET RST FOR SPEED
2962  003427' 001000  000176   43160          MOV     A,M          ;SEE CHRGET RST FOR EXPLANATION
2963  003430' 001000  000376   43180          CPI     ":"
2964  003431' 000000  000072
2965  003432' 001000  000320   43200          RNC>
2966                           43220  ;
2967                           43240  ; CHRCON IS THE CONTINUATION OF THE CHRGET RST
2968                           43260  ;
2969  003433' 001000  000376   43280  CHRCON: CPI     " "          ;MUST SKIP SPACES
2970  003434' 000000  000040
2971  003435' 001000  000312   43300          JZ      CHRGTR       ;GET ANOTHER CHARACTER
2972  003436' 000000  003426'
2973  003437' 000000  003416'
2974  003440' 001000  000376   43320          CPI     "0"          ;ALL CHARACTERS GREATER THAN
2975  003441' 000000  000060
2976                           43340                               ;"9" HAVE RETURNED, SO SEE IF NUMERIC
2977  003442' 001000  000077   43360          CMC                  ;MAKE NUMERICS HAVE CARRY ON
2978  003443' 001000  000074   43380          INR     A            ;SET ZERO IF (A)=0
2979  003444' 001000  000075   43400          DCR     A
2980  003445' 001000  000311   43420          RET
2981                           43440  PAGE
```



```
2982                           43460  SUBTTL RESTORE,STOP,END,LINGET,CHRCON
2983
2984  003446' 001000  000353   43500  RESTOR: XCHG                 ;SAVE (H,L) IN (D,E)
2985  003447' 001000  000052   43520          LHLD    TXTTAB
2986  003450' 000000  001617'
2987  003451' 000000  003436'
2988  003452' 001000  000053   43540          DCX     H            ;INITIALIZE DATPTR TO (TXTTAB)-1
2989  003453' 001000  000042   43560  RESFIN: SHLD    DATPTR       ;READ FINISHES COME TO RESFIN
2990  003454' 000000  001627'
2991  003455' 000000  003450'
2992  003456' 001000  000353   43580          XCHG                 ;GET THE TEXT POINTER BACK
2993  003457' 001000  000311   43600          RET
2994
2995                           43640  IFN     LISTEN,<
2996  003460' 001000  000333   43660  ISCNTC: IN      0
2997  003461' 000000  000000
2998                 003461'   43680  CNLCA3==,-1                  ;CONSOLE COMMAND CHANGE LOC
2999  003462' 001000  000346   43700          ANI     IDONE
3000  003463' 000000  000001
3001  003464' 001000  000300   43720          RNZ                  ;IF NO CHARACTERS THEN NO "C
3002  003465' 001000  000315   43740  CNTCCN: CALL    INCHR
3003  003466' 000000  003126'
3004  003467' 000000  003454'
3005  003470' 001000  000376   43760          CPI     3            ;STOP CHARACTER IS "C
3006  003471' 000000  000003
3007                           43780  IFE     LENGTH,<
3008                           43800          JMP     STOP>>
3009                           43820  IFN     LENGTH,<
3010  003472' 001000  000300   43840  STOP:   RNZ                  ;RETURN IF NOT CONTROL-C AND MAKE
3011                           43860                               ;SURE "STOP" STATEMENTS HAVE A TERMINATOR
3012  003473' 001000  000366   43880          XWD     "01000,"0366 ;SETUP (A) AS A FLAG WHETHER
3013                           43900                               ;TO TYPE THE BREAK MESSAGE
3014  003474' 001000  000300   43920  END:    RNZ                  ;MAKE SURE "END" STATEMENTS HAVE A TERMINATOR
3015  003475' 001000  000042   43940          SHLD    TEMP         ;SAVE FOR "CONTINUE"
3016  003476' 000000  001605'
3017  003477' 000000  003466'
3018  003500' 001000  000301   43960  STPEND: POP     B            ;POP OFF NEWSTT ADDRESS
3019  003501' 001000  000365   43980  ENDCON: PUSH    PSW          ;SAVE THE MESSAGE FLAG
3020                           44000                               ;ZERO MEANS DON'T PRINT "BREAK"
3021  003502' 001000  000052   44020          LHLD    CURLIN       ;SAVE CURLIN
3022  003503' 000000  001607'
3023  003504' 000000  003476'
3024  003505' 001000  000175   44040          MOV     A,L
3025  003506' 001000  000244   44060          ANA     M            ;SEE IF IT WAS DIRECT
3026  003507' 001000  000074   44080          INR     A
3027  003510' 001000  000312   44100          JZ      DIRIS        ;IF NOT SET UP FOR CONTINUE
3028  003511' 000000  003524'
3029  003512' 000000  003503'
3030  003513' 001000  000042   44120          SHLD    OLDLIN       ;SAVE OLD LINE #
3031  003514' 000000  001611'
3032  003515' 000000  003511'
3033  003516' 001000  000052   44140          LHLD    TEMP         ;GET POINTER TO START OF STATEMENT
3034  003517' 000000  001603'
```

```
003520' 000000  003514'
003521' 001000  00004E          44160           SHLD    OLDTXT          ;SAVE IT
003522' 000000  001613'
003523' 000000  003517'
003524'                         44180   DIRIS:
                                44200   IFN     CONTRW,<
003524' 001000  000257          44220           XRA     A
003525' 001000  000062          44240           STA     CNTWFL>         ;FORCE OUTPUT
003526' 000000  001541'
003527' 000000  003522'
003530' 001000  000361          44280           POP     PSW             ;GET BACK ^C FLAG
003531' 001000  000041          44300           LXI     H,BRKTXT        ;"BREAK"
003532' 000000  001734'
003533' 000000  003526'
003534' 001000  000302          44320           JNZ     ERRFIN          ;CALL STROUT AND FALL INTO READY
003535' 000000  002127'
003536' 000000  003532'
003537' 001000  000303          44340           JMP     READY>          ;TYPE "READY"
003540' 000000  002145'
003541' 000000  003535'
                                44360   IFE     REALIO,<
                                44380   ODT:    POP     B               ;GET RID OF NEWSTT RETURN
                                44400           HRRZ    14,JOBODT##
                                44420           JRST    0(14)>

                                44460   IFN     LENGTH,<
003542' 001000  000300          44480   CONT:   RNZ                     ;MAKE SURE THERE IS A TERMINATOR
003543' 001000  000036          44500           MVI     E,ERRCN
003544' 000000  000021
003545' 001000  00005E          44520           LHLD    OLDTXT          ;A STORED TEXT POINTER OF
003546' 000000  001613'
003547' 000000  003540'
                                44540                                   ;ZERO IS SETUP BY STKINI
                                44560                                   ;AND INDICATES THERE IS NOTHING
                                44580                                   ;TO CONTINUE
003550' 001000  000174          44600           MOV     A,H             ;"STOP","END",TYPING CRLF
003551' 001000  000265          44620           ORA     L               ;TO "INPUT" AND ^C SETUP OLDTXT
003552' 001000  000312          44640           JZ      ERROR
003553' 000000  002102'
003554' 000000  003546'
003555' 001000  000353          44660           XCHG                    ;SAVE [H,L]
003556' 001000  00005E          44680           LHLD    OLDLIN
003557' 000000  001611'
003560' 000000  003553'
003561' 001000  00004E          44700           SHLD    CURLIN          ;SET UP OLD LINE # AS CURRENT LINE #
003562' 000000  001607'
003563' 000000  003557'
003564' 001000  000353          44720           XCHG                    ;RESTORE [H,L]
003565' 001000  000311          44740           RET>
                                44760   IFN     LENGTH,<
003566' 001000  000315          44780   NULL:   CALL    GETBYT
003567' 000000  011020'
003570' 000000  003562'
```



```
003571' 001000  000300          44800           RNZ                     ;MAKE SURE THERE IS A TERMINATOR
003572' 001000  000074          44820           INR     A
003573' 001000  000376          44840           CPI     LINLEN          ;MAKE SURE THE NUMBER IS REASONABLE
003574' 000000  000110
                                44860                                   ;CRDO WON'T WORK IF IT ISN'T
                        003574' 44880   LINPT2==:.=1                   ;TERMINAL WIDTH CHANGE LOCATION
003575' 001000  000322          44900           JNC     FCERR           ;"FUNCTION CALL" ERROR
003576' 000000  010776'
003577' 000000  003567'
003600' 001000  000062          44920           STA     NULCNT          ;CHANGE NUMBER OF NULLS
003601' 000000  000046'
003602' 000000  003576'
003603' 001000  000311          44940           RET>
                                44960   IFE     LENGTH=2,<
003604' 001000  000076          44980   TON:    XRD     ^O1000,^O76     ;"MVI A," NON-ZERO QUANTITY
003605' 001000  000257          45000   TOFF:   XRA     A               ;MAKE [A]=0 FOR NO TRACE
003606' 001000  000062          45020           STA     TRCFLG          ;UPDATE THE TRACE FLAG
003607' 000000  001631'
003610' 000000  003601'
003611' 001000  000311          45040           RET>
                                45060   ;
                                45080   ;TEST FOR A LETTER / CARRY ON=NOT A LETTER
                                45100   ;                    CARRY OFF=A LETTER
                                45120   ;
003612' 001000  000176          45140   ISLET:  MOV     A,M
003613' 001000  000376          45160           CPI     "A"
003614' 000000  000101
003615' 001000  000330          45180           RC                      ;IF LESS THAN "A", RETURN EARLY
003616' 001000  000376          45200           CPI     91              ;91="Z"+1
003617' 000000  000133
003620' 001000  000077          45220           CMC
003621' 001000  000311          45240           RET
                                45260   ;
                                45280   ; INTIDX READS A FORMULA FROM THE CURRENT POSITION AND
                                45300   ; TURNS IT INTO A POSITIVE INTEGER
                                45320   ; LEAVING THE RESULT IN [D,E],  NEGATIVE ARGUMENTS
                                45340   ; ARE NOT ALLOWED, [H,L] POINTS TO THE TERMINATING
                                45360   ; CHARACTER OF THE FORMULA ON RETURN.
                                45380   ;
                                45400   IFN     LENGTH=2,<
                                45420   INTIDX: CHRGET
                                45440   INTID2: CALL    FRMNUM
                                45460   POSINT: FSIGN
                                45480           JM      FCERR           ;IF NEGATIVE BLOW HIM OUT
                                45500   DEINT:  LDA     FAC             ;SEE IF ARG GREATER THAN 32767
                                45520           CPI     144
                                45540           JC      QINT
                                45560   IFN     LENGTH,<
                                45580           MOVRI   144,128,0,0     ;REGISTERS = FLOATING =32768
                                45600           CALL    FCOMP           ;SEE IF FAC=REGISTERS
                                45620           MOV     D,C             ;SETUP D=200 E=0 FOR =32768
                                45640           RZ>                     ;WAS =32768, [D,E] IS SET UP
                                45660   ILLFUN:
```

```
                                 45680   FCERR:  MVI     E,ERRFC         ;TOO BIG. FUNCTION CALL ERROR
                                 45700           JMP     ERROR>
                                 45720   IFE     LENGTH-2,<
                                 45740   INTIDX: CHRGET
                                 45760   INTID2: CALL    FRMEVL          ;EVALUATE A FORMULA
003622' 001000  000327
003623' 001000  000315
003624' 000000  003536'
003625' 000000  003607'
003626' 001000  000345           45780           PUSH    H               ;SAVE THE TEXT POINTER
003627' 001000  000315           45800           CALL    FRCINT          ;CONVERT THE FAC TO AN INTEGER
003630' 000000  000666'
003631' 000000  003624'
003632' 001000  000174           45820           MOV     A,H             ;SEE IF THE RESULT IS NEGATIVE
003633' 001000  000267           45840           ORA     A               ;BY LOOKING AT (H)'S MSB
003634' 001000  000372           45860           JM      FCERR           ;DON'T ALLOW NEGATIVE NUMBERS
003635' 000000  010776'
003636' 000000  003630'
003637' 001000  000353           45880           XCHG                    ;RETURN THE INTEGER IN (D,E)
003640' 001000  000341           45900           POP     H               ;RESTORE THE TEXT POINTER
003641' 001000  000311           45920           RET>
                                 45960   ;
                                 45980   ; LINGET READS A LINE # FROM THE CURRENT TEXT POSITION
                                 46000   ;
                                 46020   ; LINE NUMBERS RANGE FROM 0 TO 65529
                                 46040   ;
                                 46060   ; (D,E) IS SMASHED.
                                 46080   ;
                                 46100   ; ANSWER RETURNED IN (D,E).
                                 46120   ; (H,L) IS UPDATED TO POINT TO THE TERMINATING CHARACTER
                                 46140   ; AND (A) CONTAINS THE TERMINATING CHARACTER WITH CONDITION
                                 46160   ; CODES SET UP TO REFLECT ITS VALUE.
                                 46180   ;
003642' 001000  000053           46200   LINGET: DCX     H
003643' 001000  000021           46220   LINGT2: LXI     D,$CODE         ;ZERO ACCUMULATED LINE #
003644' 000000  000000'
003645' 000000  003635'
003646' 001000  000327           46240   MORLIN: CHRGET
003647' 001000  000320           46260           RNC                     ;WAS IT A DIGIT
003650' 001000  000345           46280           PUSH    H
003651' 001000  000365           46300           PUSH    PSW
003652' 001000  000041           46320           LXI     H,$CODE+6552    ;SEE IF THE LINE # IS TOO BIG
003653' 000000  014630'
003654' 000000  003644'
003655' 001000  000347           46340           COMPAR
003656' 001000  000332           46360           JC      SNERR           ;YES, SYNTAX ERROR
003657' 000000  002072'
003660' 000000  003653'
003661' 001000  000142           46380           MOV     H,D             ;SAVE (D,E)
003662' 001000  000153           46400           MOV     L,E
003663' 001000  000031           46420           DAD     D
003664' 001000  000051           46440           DAD     H
003665' 001000  000031           46460           DAD     D
003666' 001000  000051           46480           DAD     H               ;PUTTING (D,E)*10 INTO (H,L)
```



```
003667' 001000  000361           46500           POP     PSW
003670' 001000  000326           46520           SUI     "0"
003671' 000000  000060
003672' 001000  000137           46540           MOV     E,A
003673' 001000  000026           46560           MVI     D,0
003674' 000000  000000
003675' 001000  000031           46580           DAD     D               ;ADD THE NEW DIGIT
003676' 001000  000353           46600           XCHG
003677' 001000  000341           46620           POP     H               ;GET BACK TEXT POINTER
003700' 001000  000303           46640           JMP     MORLIN
003701' 000000  003646'
003702' 000000  003657'
                                 46660   IFN     LENGTH,<
003703' 001000  000312           46680   CLEAR:  JZ      CLEARC          ;IF NO FORMULA JUST CLEAR
003704' 000000  002443'
003705' 000000  003701'
003706' 001000  000315           46700           CALL    INTID2          ;GET AN INTEGER INTO (D,E)
003707' 000000  003623'
003711' 001000  000053           46720           DCX     H
003712' 001000  000327           46740           CHRGET                  ;SEE IF ITS THE END
003713' 001000  000300           46760           RNZ                     ;SHOULD FINISH THERE
003714' 001000  000345           46780           PUSH    H               ;SAVE TXTPTR
003715' 001000  000052           46800           LHLD    MEMSIZ          ;GET HIGHEST ADDRESS
003716' 000000  001545'
003717' 000000  003707'
003720' 001000  000175           46820           MOV     A,L             ;SUBTRACT (H,L)-(D,E) INTO (D,E)
003721' 001000  000223           46840           SUB     E
003722' 001000  000137           46860           MOV     E,A
003723' 001000  000174           46880           MOV     A,H
003724' 001000  000232           46900           SBB     D
003725' 001000  000127           46920           MOV     D,A
003726' 001000  000332           46940           JC      SNERR           ;WANTED MORE THAN TOTAL!
003727' 000000  002072'
003730' 000000  003716'
003731' 001000  000052           46960           LHLD    VARTAB          ;TOP LOCATION IN USE
003732' 000000  001621'
003733' 000000  003727'
003734' 001000  000001           46980           LXI     B,$CODE+40      ;LEAVE BREATHING ROOM
003735' 000000  000050'
003736' 000000  003732'
003737' 001000  000011           47000           DAD     B
003740' 001000  000347           47020           COMPAR                  ;ROOM?
003741' 001000  000322           47040           JNC     OMERR           ;NO, DON'T EVEN CLEAR
003742' 000000  002057'
003743' 000000  003735'
003744' 001000  000353           47060           XCHG                    ;NEW STACK LOCATION (H,L)
003745' 001000  000042           47080           SHLD    STKTOP          ;SET UP NEW STACK LOCATION
003746' 000000  001615'
003747' 000000  003742'
003750' 001000  000341           47100           POP     H               ;REGAIN THE TEXT POINTER
003751' 001000  000303           47120           JMP     CLEARC>         ;GO CLEAR
003752' 000000  002443'
```

```
3247  003753' 000000  003746'
3248                                  47140   PAGE
```



```
3249                                  47160   SUBTTL  RUN,GOTO,GOSUB,RETURN
3250                                  47180   IFN     LENGTH,<
3251  003754' 001000  000312         47200   RUN:    JZ      RUNC            ;NO LINE # ARGUMENT
3252  003755' 000000  002437'
3253  003756' 000000  003752'
3254                                  47220                                   ;CLEAN UP,SET [H,L]=[TXTTAB]-1 AND
3255                                  47240                                   ;RETURN TO NEWSTT
3256  003757' 001000  000315         47260           CALL    CLEARC          ;CLEAN UP -- RESET THE STACK
3257  003760' 000000  002443'
3258  003761' 000000  003755'
3259                                  47280                                   ;DATPTR,VARIABLES ...
3260                                  47300                                   ;[H,L] IS THE ONLY THING PRESERVED
3261  003762' 001000  000001         47320           LXI     B,NEWSTT
3262  003763' 000000  003302'
3263  003764' 000000  003760'
3264  003765' 001000  000303         47340           JMP     RUNC2>          ;PUT "NEWSTT" ON AND FALL INTO "GOTO"
3265  003766' 000000  004007'
3266  003767' 000000  003763'
3267                                  47360   ;
3268                                  47380   ; A GOSUB ENTRY ON THE STACK HAS THE FOLLOWING FORMAT
3269                                  47400   ;
3270                                  47420   ; LOW ADDRESS
3271                                  47440   ;
3272                                  47460   ;       A TOKEN EQUAL TO GOSUTK 1 BYTE
3273                                  47480   ;       THE LINE # OF THE THE GOSUB STATEMENT 2 BYTES
3274                                  47500   ;       A POINTER INTO THE TEXT OF THE GOSUB 2 BYTES
3275                                  47520   ;
3276                                  47540   ; HIGH ADDRESS
3277                                  47560   ;
3278                                  47580   ; TOTAL 5 BYTES
3279                                  47600   ;
3280  003770' 001000  000315         47620   GOSUB:  CALL    GETSTK          ;MAKE SURE THERE IS ROOM
3281  003771' 000000  002624'
3282  003772' 000000  003766'
3283  003773' 000000  000003         47640           3
3284  003774' 001000  000301         47660           POP     B               ;POP OFF RETURN ADDRESS OF "NEWSTT"
3285  003775' 001000  000345         47680           PUSH    H               ;REALLY PUSH THE TEXT POINTER
3286  003776' 001000  000345         47700           PUSH    H               ;SAVE TEXT POINTER
3287  003777' 001000  000052         47720           LHLD    CURLIN          ;GET THE CURRENT LINE #
3288  004000' 000000  001607'
3289  004001' 000000  003771'
3290  004002' 001000  000343         47740           XTHL                    ;PUT CURLIN ON THE STACK AND [H,L]=TEXT PTR
3291  004003' 001000  000026         47760           MVI     D,GOSUTK        ;LEAVE A GOSUB TOKEN
3292  004004' 000000  000214
3293                                  47780                                   ;ON THE STACK
3294  004005' 001000  000325         47800           PUSH    D
3295  004006' 001000  000063         47820           INX     SP              ;THE GOSUB TOKEN TAKES ONLY ONE BYTE
3296  004007' 001000  000305         47840   RUNC2:  PUSH    B               ;RESTORE RETURN ADDRESS
3297                                  47860                                   ;OF "NEWSTT"
3298                                  47880   ;
3299                                  47900   ; IN THE 4K VERSION WE START AT THE BEGINNING
3300                                  47920   ; AND SEARCH, IN THE 8K WE START WHERE WE
3301                                  47940   ; ARE IF WE ARE  GOING TO A FORWARD LOCATION,
```

```
                                        47960   ;
3303  004010' 001000  000315            47980   GOTO:   CALL    LINGET          ;PICK UP THE LINE #
3304  004011' 000000  003642'
3305  004012' 000000  004000'
3306                                    48000                                   ;AND PUT IT IN [D,E]
3307                                    48020   IFE     LENGTH,<RNZ             ;SHOULD END WITH A LINE
3308                                    48040                                   ;TERMINATOR -- BLOW HIM UP
3309                                    48060                                   ;IF IT DOESN'T
3310                                    48080                                   ;(ON GOTO MAKES THIS WRONG
3311                                    48100                                   ;IN OTHER VERSONS)
3312                                    48120           CALL    FNDLIN>
3313                                    48140   IFN     LENGTH,<
3314  004013' 001000  000315            48160           CALL    REM             ;SKIP TO THE END OF THIS LINE
3315  004014' 000000  004074'
3316  004015' 000000  004011'
3317  004016' 001000  000345            48180           PUSH    H               ;SAVE THE POINTER
3318  004017' 001000  000052            48200           LHLD    CURLIN          ;GET THE CURRENT LINE #
3319  004020' 000000  001607'
3320  004021' 000000  004014'
3321  004022' 001000  000347            48220           COMPAR                  ;[D,E] CONTAINS WHERE WE ARE GOING
3322                                    48240                                   ;[H,L] CONTAINS THE CURRENT LINE#
3323                                    48260                                   ;SO COMPARING THEM TELL US WHETHER TO
3324                                    48280                                   ;START SEARCHING FROM WHERE WE ARE OR
3325                                    48300                                   ;TO START SEARCHING FROM THE BEGINNING
3326                                    48320                                   ;OF TXTTAB
3327  004023' 001000  000341            48340           POP     H               ;[H,L]=CURRENT POINTER
3328  004024' 001000  000043            48360           INX     H               ;POINT AT THE LINK BEYOND IT
3329  004025' 001000  000334            48380           CC      LOOP            ;SEARCH FROM THIS POINT
3330  004026' 000000  002574'
3331  004027' 000000  004020'
3332  004030' 001000  000324            48400           CNC     FNDLIN>         ;SEARCH FROM THE BEGINNING -- ACTUALLY
3333  004031' 000000  002571'
3334  004032' 000000  004026'
3335                                    48420                                   ;SEARCH AGAIN IF ABOVE SEARCH FAILED
3336  004033' 001000  000140            48440           MOV     H,B
3337  004034' 001000  000151            48460           MOV     L,C
3338  004035' 001000  000053            48480           DCX     H
3339  004036' 001000  000330            48500           RC                      ;IF A MATCH WE ARE DONE
3340  004037' 001000  000036            48520   USERR:  MVI     E,ERRUS
3341  004040' 000000  000010
3342  004041' 001000  000303            48540           JMP     ERROR           ;C=MATCH,SO IF NO MATCH WE
3343  004042' 000000  002102'
3344  004043' 000000  004031'
3345                                    48560                                   ;GIVE A "US" ERROR
3346                                    48580   ;
3347                                    48600   ; SEE "GOSUB" FOR THE FORMAT OF THE STACK ENTRY
3348                                    48620   ; "RETURN" RESTORES THE LINE NUMBER AND TEXT POINTER ON THE STACK
3349                                    48640   ; AFTER ELIMINATING ALL THE "FOR" ENTRIES IN FRONT OF THE "GOSUB"
3350                                    48660   ; ENTRY
3351                                    48680   ;
3352  004044' 001000  000300            48700   RETURN: RNZ                     ;BLOW HIM UP IF THERE ISN'T A TERMINATOR
3353  004045' 001000  000026            48720           MVI     D,255           ;MAKE SURE THIS VARIABLE POINTER
3354  004046' 000000  000377
```



```
3355                                    48740                                   ;IN [D,E] NEVER GETS MATCHED
3356  004047' 001000  000315            48760           CALL    FNDFOR          ;GO PAST ALL THE "FOR" ENTRIES
3357  004050' 000000  001744'
3358  004051' 000000  004042'
3359  004052' 001000  000371            48780           SPHL                    ;UPDATE THE STACK
3360  004053' 001000  000376            48800           CPI     GOSUTK
3361  004054' 000000  000214
3362  004055' 001000  000036            48820           MVI     E,ERRRG         ;ERROR ERRRG IS "RETURN WITHOUT GOSUB"
3363  004056' 000000  000003
3364  004057' 001000  000302            48840           JNZ     ERROR
3365  004060' 000000  002102'
3366  004061' 000000  004050'
3367  004062' 001000  000341            48860           POP     H               ;GET LINE # "GOSUB" WAS FROM
3368  004063' 001000  000042            48880           SHLD    CURLIN          ;PUT IT INTO CURLIN
3369  004064' 000000  001607'
3370  004065' 000000  004060'
3371  004066' 001000  000041            48900           LXI     H,NEWSTT
3372  004067' 000000  003302'
3373  004070' 000000  004064'
3374  004071' 001000  000343            48920           XTHL                    ;PUT RETURN ADDRESS OF "NEWSTT"
3375                                    48940                                   ;BACK ONTO THE STACK, GET TEXT POINTER
3376                                    48960                                   ;FROM "GOSUB"
3377                                    48980                                   ;SKIP OVER SOME CHARACTERS
3378                                    49000                                   ;SINCE WHEN "GOSUB" STUCK THE TEXT POINTER
3379                                    49020                                   ;ONTO THE STACK THE LINE # ARGUMENT HADN'T
3380                                    49040                                   ;BEEN READ IN YET,
3381
3382
3383                                    49100   IFN     STRING,<
3384  004072' 001000  000001            49120   DATA:   XWD     "01000,"01      ;"LXI B," TO PICK UP ":" INTO C AND SKIP
3385  004073' 000000  000072            49140           ":"                     ;"DATA" TERMINATES ON ":"
3386                                    49160                                   ;AND 0, ":" ONLY APPLIES IF
3387                                    49180                                   ;QUOTES HAVE MATCHED UP
3388  004074'                           49200   IFE     LENGTH-2,<ELSE:>        ;EXECUTED "ELSE"S ARE SKIPPED
3389                                    49220   ;
3390                                    49240   ; NOTE: REM MUST PRESERVE [D,E] BECAUSE OF "GO TO" AND ERROR
3391                                    49260   ;
3392  004074' 001000  000016            49280   REM:    XWD     "01000,"016     ;MVI C,   THE ONLY TERMINATOR IS 0
3393  004075' 001000  000000            49300           XWD     "01000,0        ;NO-OPERATION
3394                                    49320                                   ;"DATA" ACTUALLY EXECUTES THIS 0
3395  004076' 001000  000006            49340           MVI     B,0             ;INSIDE QUOTES THE ONLY TERMINATOR IS ZERO
3396  004077' 000000  000000
3397  004100' 001000  000171            49360   EXCHQT: MOV     A,C             ;WHEN A QUOTE IS SEEN THE SECOND
3398  004101' 001000  000110            49380           MOV     C,B             ;TERMINATOR IS TRADED, SO IN "DATA"
3399  004102' 001000  000107            49400           MOV     B,A             ;COLONS INSIDE QUOTATIONS WILL HAVE NO EFFECT
3400  004103' 001000  000176            49420   REMER:  MOV     A,M             ;GET THE CHARACTER
3401  004104' 001000  000267            49440           ORA     A               ;ZERO IS ALWAYS A TERMINATOR
3402  004105' 001000  000310            49460           RZ
3403  004106' 001000  000270            49480           CMP     B               ;TEST FOR THE OTHER TERMINATOR
3404  004107' 001000  000310            49500           RZ
3405  004110' 001000  000043            49520           INX     H
3406  004111' 001000  000376            49540           CPI     34              ;IS IT A QUOTE?
3407  004112' 000000  000042
```

```
3408  004113' 001000  000312   49560          JZ      EXCHQT          ;IF SO TIME TO TRADE
3409  004114' 000000  004100'
3410  004115' 000000  004067'
3411                           49580  IFE     LENGTH=2,<
3412                           49600  ;
3413                           49620  ; WHEN AN "IF" TAKES A FALSE BRANCH IT MUST FIND THE APPROPRIATE "ELSE"
3414                           49640  ; TO START EXECUTION AT, "DATA" COUNTS THE NUMBER OF "IF"S
3415                           49660  ; IT SEES SO THAT THE "ELSE" CODE CAN MATCH "ELSE"S WITH
3416                           49680  ; "IF"S, THE COUNT IS KEPT IN [D]
3417                           49700  ;
3418  004116' 001000  000326   49720          SUI     IFTK            ;IS IT AN "IF"
3419  004117' 000000  000212
3420  004120' 001000  000302   49740          JNZ     REMER           ;IF NOT, CONTINUE ON
3421  004121' 000000  004103'
3422  004122' 000000  004114'
3423  004123' 001000  000270   49760          CMP     B               ;SINCE "REM" CAN'T SMASH
3424                           49780                                  ;[D,E] WE HAVE TO BE CAREFUL
3425                           49800                                  ;SO ONLY IF B DOESN'T EQUAL
3426                           49820                                  ;ZERO WE INCREMENT D, (THE "IF" COUNT)
3427  004124' 001000  000212   49840          ADC     D               ;CARRY ON IF [B] NOT ZERO
3428  004125' 001000  000127   49860          MOV     D,A>            ;UPDATE [D]
3429  004126' 001000  000303   49880          JMP     REMER>
3430  004127' 000000  004103'
3431  004130' 000000  004121'
3432                           49900  ;
3433                           49902  ; WITHOUT STRINGS THERE IS NO NEED TO WATCH QUOTATIONS
3434                           49904  ; SO [B] IS SET UP AS THE SECONDARY TERMINATOR
3435                           49906  ; AND A SCAN IS MADE FOR [B] OR ZERO
3436                           49908  ;
3437                           49920  IFE     STRING,<
3438                           49940  DATA:   XWD     "01000,1        ;MAKE [C]=":" AND SKIP
3439                           49960          ":"
3440                           49980  REM:    XWD     "01000,16       ;MAKE [C]=0
3441                           50000          XWD     "01000,0        ;ZERO AND NO-OPERATION
3442                           50020  LOOPDR: MOV     A,M
3443                           50040          ORA     A               ;ALWAYS STOP ON ZERO
3444                           50060          RZ
3445                           50080          CMP     C               ;CHECK FOR ":" IN DATA
3446                           50100          RZ
3447                           50120          INX     H               ;LOOK AT NEXT CHARACTER
3448                           50140          JMP     LOOPDR>
3449                           50160  PAGE
```



```
3450                           50180  SUBTTL "LET"
3451  004131' 001000  000315   50200  LET:    CALL    PTRGET          ;GET THE POINTER TO THE VARIABLE
3452  004132' 000000  006505'
3453  004133' 000000  004127'
3454                           50220                                  ;NAMED IN TEXT AND PUT
3455                           50240                                  ;IT ON THE STACK, [H,L] REMAINS
3456                           50260                                  ;THE TEXT POINTER AND A,PSW ARE SETUP
3457                           50280                                  ;AS THE TERMINATING CHARACTER,
3458  004134' 001000  000317   50300          SYNCHK  EQULTK          ;CHECK FOR "="
3459  004135' 000000  000260
3460  004136'                  50320  REDINP:
3461                           50340  IFN     STRING,<
3462  004136' 001000  000072   50360          LDA     VALTYP
3463  004137' 000000  001543'
3464  004140' 000000  004132'
3465  004141' 001000  000365   50380          PUSH    PSW>
3466  004142' 001000  000325   50400          PUSH    D
3467  004143' 001000  000315   50420          CALL    FRMEVL          ;GET THE VALUE OF THE FORMULA
3468  004144' 000000  005336'
3469  004145' 000000  004137'
3470                           50440                                  ;INTO FAC
3471  004146' 001000  000343   50460          XTHL                    ;[H,L]=POINTER TO VARIABLE
3472                           50480                                  ;TEXT POINTER TO ON TOP OF STACK
3473  004147' 001000  000042   50500          SHLD    TEMP            ;SAVE VARIABLE POINTER FOR "FOR"
3474  004150' 000000  001603'
3475  004151' 000000  004144'
3476                           50520  IFN     STRING,<
3477  004152' 001000  000321   50540          POP     D               ;GET TEXT POINTER OFF
3478  004153' 001000  000361   50560          POP     PSW             ;GET THE VALTYP OF THE
3479                           50580                                  ;VARIABLE INTO [A]
3480  004154' 001000  000325   50581          PUSH    D               ;RESAVE THE TEXT-POINTER
3481                           50582  IFE     LENGTH=2,<
3482  004155' 001000  000376   50584          CPI     3               ;SEE IF ITS A STRING
3483  004156' 000000  000003
3484  004157' 001000  000345   50586  INPCOM: PUSH    H               ;SAVE THE POINTER AT THE VALUE POSITION
3485  004160' 001000  000302   50588          JNZ     COPNUM          ;NUMERIC, SO FORCE IT AND COPY
3486  004161' 000000  004237'
3487  004162' 000000  004150'
3488  004163' 001000  000315   50590          CALL    CHKSTR>         ;MAKE SURE THE FORMULA WAS A STRING
3489  004164' 000000  000000*
3490  004165' 000000  004161'
3491                           50600  IFN     LENGTH=2,<
3492                           50620          RAR                     ;CARRY SET FOR STRING OFF
3493                           50640                                  ;FOR NUMERIC
3494                           50660          CALL    CHKVAL          ;MAKE SURE VALTYP MATCHES CARRY
3495                           50680                                  ;AND SET THE ZERO FLAG
3496                           50700                                  ;ON A NUMERIC VALTYP
3497                           50860          JZ      COPNUM          ;IF A NUMBER  COPY
3498                           50880  INPCOM: PUSH    H>              ;SAVE POINTER AT VARIABLE
3499  004166' 001000  000052   50900          LHLD    FACLO           ;GET POINTER TO THE DESCRIPTOR OF THE RESULT
3500  004167' 000000  001637'
3501  004170' 000000  004164'
3502  004171' 001000  000345   50920          PUSH    H               ;SAVE THE POINTER AT THE DESCRIPTOR
```

```
3503  004172' 001000  000045   50940          INX     M
3504  004173' 001000  000043   50960          INX     M
3505  004174' 001000  000367   50980          PUSHM
3506  004175' 001000  000321   51000          POP     D
3507  004176' 001000  000052   51020          LHLD    STKTOP          ;SEE IF IT POINTS INTO STRING SPACE
3508  004177' 000000  001615'
3509  004200' 000000  004167'
3510  004201' 001000  000347   51040          COMPAR                  ;IF NOT DON'T COPY
3511  004202' 001000  000321   51060          POP     D               ;GET BACK THE POINTER AT THE DESCRIPTOR
3512  004203' 001000  000322   51080          JNC     DNTCPY          ;DON'T COPY LITERALS
3513  004204' 000000  004217'
3514  004205' 000000  004177'
3515  004206' 001000  000052   51100          LHLD    VARTAB          ;NOW, SEE IF ITS A VARIABLE
3516  004207' 000000  001621'
3517  004210' 000030  004204'
3518  004211' 001000  000347   51120          COMPAR                  ;BY SEEING IF THE  DESCRIPTOR
3519  004212' 001000  000153   51140          MOV     L,E
3520  004213' 001000  000142   51160          MOV     H,D
3521  004214' 001000  000334   51180          CC      STRCPY          ;IS BEYOND [VARTAB], IF SO COPY
3522  004215' 000000  007601'
3523  004216' 000000  004207'
3524  004217' 001000  000032   51200  DNTCPY: LDAX    D               ;GET THE LENGTH AND SAVE IT
3525  004220' 001000  000365   51220          PUSH    PSW             ;SINCE WE ARE GOING TO SET IT TO
3526                           51240                                  ;0 SO FRETMP DOESN'T UPDATE FRETOP
3527  004221' 001000  000257   51260          XRA     A               ;SET IT TO 0 -- ELIMINATING NULL
3528                           51280                                  ;STRING IN FRETMP IS HARMLESS
3529  004222' 001000  000022   51300          STAX    D               ;PUT 0 IN THE LENGTH FIELD
3530  004223' 001000  000315   51320          CALL    FRETMP          ;FREE IT UP
3531  004224' 000000  012440'
3532  004225' 000000  004215'
3533  004226' 001000  000361   51340          POP     PSW             ;GET LENGTH BACK
3534  004227' 001000  000167   51360          MOV     M,A             ;REPLACE IT [ FRETMP RETURNS [D,E] IN [H,L] ]
3535  004230' 001000  000353   51380          XCHG                    ;PUT THE DESCRIPTOR POINTER BACK IN [D,E]
3536  004231' 001000  000341   51400          POP     H               ;GET THE PLACE OF THE NEW VARIABLE
3537                           51420  IFN     LENGTH-2,<
3538                           51440          CALL    MOVE>           ;COPY THE DESCRIPTOR
3539                           51460  IFE     LENGTH-2,<
3540  004232' 001000  000315   51480          CALL    VMOVE>
3541  004233' 000000  000000*
3542  004234' 000000  004224'
3543  004235' 001000  000341   51500          POP     H               ;GET THE TEXT POINTER BACK
3544  004236' 001000  000311   51520          RET>
3545  004237'                  51540  COPNUM:
3546                           51560  IFE     LENGTH-2,<
3547  004237' 001000  000346   51580          ANI     6               ;SETUP DISPATCH TO FORCE
3548  004240' 000000  000006
3549                           51600                                  ;FORMULA TYPE TO CONFORM
3550                           51620                                  ;TO THE VARIABLE ITS BEING ASSIGNED TO
3551  004241' 001000  000041   51640          LXI     H,FRCTBL        ;TABLE OF FORCE ROUTINES
3552  004242' 000000  000664'
3553  004243' 000000  004233'
3554  004244' 001000  000117   51660          MOV     C,A             ;[B,C]=TWO BYTE OFFSET
3555  004245' 001000  000006   51680          MVI     B,0
```



```
3556  004246' 000000  000000
3557  004247' 001000  000011   51700          DAD     B
3558  004250' 001000  000176   51720          MOV     A,M             ;[H,L]=ADDRESS TO GO TO
3559  004251' 001000  000043   51740          INX     H
3560  004252' 001000  000146   51760          MOV     H,M
3561  004253' 001000  000157   51780          MOV     L,A
3562  004254' 001000  000001   51800          LXI     B,PUTVAL        ;RETURN TO PUTVAL
3563  004255' 000000  004261'
3564  004256' 000000  004242'
3565  004257' 001000  000305   51820          PUSH    B
3566  004260' 001000  000351   51840          PCHL                    ;DISPATCH TO FORCE
3567  004261' 001000  000341   51860  PUTVAL: POP     H               ;GET THE POINTER OF WHERE TO STORE
3568                           51880                                  ;THE VALUE
3569  004262' 001000  000345   51900          PUSH    H               ;SAVE IT BACK
3570  004263' 001000  000315   51920          CALL    VMOVMF>         ;MOVE THE VALUE IN
3571  004264' 000000  000000*
3572  004265' 000000  004255'
3573                           51940  IFN     LENGTH-2,<
3574                           51960          PUSH    H               ;SAVE THE VARIABLE POINTER FOR "FOR"
3575                           51980          CALL    MOVMF>          ;TRANSFER THE VALUE
3576  004266' 001000  000321   52000          POP     D               ;"FOR" WANTS VARIABLE POINTER IN
3577                           52020                                  ;[D,E] FOR FNDFOR
3578  004267' 001000  000341   52040          POP     H               ;GET THE TEXT POINTER
3579  004270' 001000  000311   52060          RET
3580                           52080  PAGE
```

```
                                        52100   SUBTTL ON GOTO CODE
                                        52120   IFN     LENGTH,<
                                        52160   ONGOTO: CALL    GETBYT          ;GET VALUE INTO (E)
004271' 001000  000315
004272' 000000  011020'
004273' 000000  004264'
004274' 001000  000176                  52180           MOV     A,M             ;GET THE TERMINATOR BACK
004275' 001000  000107                  52200           MOV     B,A             ;SAVE THIS CHARACTER FOR LATER
004276' 001000  000376                  52220           CPI     GOSUTK          ;AN "ON ... GOSUB" PERHAPS?
004277' 000000  000214
004300' 001000  000312                  52240           JZ      ISGOSU          ;YES, SOME FEATURE USE
004301' 000000  004306'
004302' 000000  004272'
004303' 001000  000317                  52260           SYNCHK  GOTOTK          ;OTHERWISE MUST BE "GOTO"
004304' 000000  000210
004305' 001000  000053                  52280           DCX     H               ;BACK UP CHARACTER POINTER
004306' 001000  000113                  52300   ISGOSU: MOV     C,E             ;GET COUNT INTO  (C)
004307' 001000  000015                  52320   LOOPON: DCR     C               ;SEE IF ENOUGH SKIPS
004310' 001000  000170                  52340           MOV     A,B             ;PUT DISPATCH CHARACTER IN PLACE
004311' 001000  000312                  52360           JZ      GONE2           ;IF DONE, GO OFF
004312' 000000  003376'
004313' 000000  004301'
004314' 001000  000315                  52380           CALL    LINGT2          ;SKIP OVER A LINE #
004315' 000000  003643'
004316' 000000  004312'
004317' 001000  000376                  52400           CPI     44              ;A COMMA
004320' 000000  000054
004321' 001000  000300                  52420           RNZ                     ;IF A COMMA DOESN'T DELIMIT THE END OF
                                        52440                                   ;THE LAST LINE # MUST BE THE END OF THE LINE
004322' 001000  000303                  52460           JMP     LOOPON>         ;CONTINUE GOBBLING LINE #S
004323' 000000  004307'
004324' 000000  004315'

                                        52500   PAGE
```



```
                                        52520   SUBTTL IF ... THEN CODE
004325' 001000  000315                  52540   IF:     CALL    FRMEVL          ;EVALUATE A FORMULA
004326' 000000  003336'
004327' 000000  004323'

                                        52560   IFE     LENGTH,<
                                        52580   IFN     STRING,<
                                        52600           LDA     VALTYP          ;GET VALUE TYPE INTO (A)
                                        52620           PUSH    PSW>>           ;SAVE THE VALUE TYPE ON THE STACK
004330' 001000  000176                  52640           MOV     A,M             ;GET TERMINATING CHARACTER OF FORMULA
                                        52660   IFE     LENGTH,<
                                        52680           CALL    PUSHF           ;ONTO THE STACK
                                        52700           MVI     D,0             ;KEEPS RELATIONAL OPERATOR MEMORIES
                                        52720                                   ;LESS THAN =4
                                        52740                                   ;EQUAL    =2
                                        52760                                   ;GREATER THAN =1
                                        52780   LOOPIF: SUI     GREATK          ;CHECK FOR A RELATIONAL OPERATOR
                                        52800           JC      ENDREL          ;NOPE
                                        52820   NUMREL=LESSTK-GREATK+1          ;NUMBER OF RELATIONAL OPERATORS
                                        52840           CPI     NUMREL          ;IS THIS ONE OF THEM?
                                        52860           JNC     ENDREL          ;NO SEE WHAT WE HAVE
                                        52880           CPI     1               ;SETUP BITS BY MAPPING
                                        52900           RAL                     ;0 TO 1, 1 TO 2 AND 2 TO 4
                                        52920           ORA     D               ;OR WITH EARLIER BITS
                                        52940           MOV     D,A             ;STORE NEW BITS
                                        52960           CHRGET                  ;GET NEW CHARACTER
                                        52980           JMP     LOOPIF          ;SEE IF RELATIONAL
                                        53000   ENDREL: MOV     A,D             ;GET REALTIONAL MEMORIES
                                        53020           ORA     A               ;SEE IF THERE ARE ANY
                                        53040           JZ      SNERR           ;NO RELATIONAL OPERATORS!
                                        53060           PUSH    PSW             ;SAVE RELATIONAL MEMORIES
                                        53080           CALL    FRMEVL>         ;PICK UP FIRST NON-RELATIONAL
                                        53100                                   ;CHARACTER AGAIN AND INTERPRET FORMULA
                                        53120                                   ;ANSWER LEFT IN FAC
004331' 001000  000376                  53140   IFE     LENGTH-2,<CPI   44      ;A COMMA?
004332' 000000  000054
004333' 001000  000314                  53160           CZ      CHRGTR>         ;IF SO SKIP IT
004334' 000000  003426'
004335' 000000  004326'
                                        53180   IFN     LENGTH,<
004336' 001000  000376                  53200           CPI     GOTOTK          ;ALLOW "GOTO" AS WELL
004337' 000000  000210
004340' 001000  000312                  53220           JZ      OKGOTO>
004341' 000000  004346'
004342' 000000  004334'
004343' 001000  000317                  53240           SYNCHK  THENTK          ;MUST HAVE A THEN
004344' 000000  000245
004345' 001000  000053                  53260           DCX     H
004346'                                 53280   OKGOTO:
                                        53300   IFE     LENGTH,<
                                        53320           POP     PSW
                                        53340           POPR                    ;POP OFF NUMBER
                                        53360   IFN     STRING,<
                                        53380           XTHL>                   ;COMPARE FORMULA TYPES
```

```
 3666                                  53400   IFE     STRING,<PUSH    H>      ;SAVE THE TEXT POINTER
 3669                                  53420           PUSH    PSW             ;RESAVE RELATIONAL MEMORIES
 3670                                  53440   IFN     STRING,<
 3671                                  53460           LDA     VALTYP          ;GET VALUE TYPE
 3672                                  53480           CMP     M               ;(M) HAS OLD VALTYP ARE THEY =?
 3673                                  53500           JNZ     TMERR           ;IF NOT ITS A TYPE ERROR
 3674                                  53520           ORA     A               ;SEE WHAT TYPE IT WAS
 3675                                  53540           JZ      NUMCMP          ;ZERO MEANS IT WAS NUMERIC
 3676                                  53560           CALL    STRCMP          ;MUST BE STRING,SO STRING COMPARE
 3677                                  53580           JMP     SKPNCM>         ;SKIP OVER NUMERIC COMPARE
 3678                                  53600   NUMCMP: CALL    FCOMP           ;COMPARE THE 2 SIDE OF THE RELATION STATEMENT
 3679                                  53620   SKPNCM: INR     A               ;BUILD RELATIONAL BITS
 3680                                  53640           RAL                     ;LES$#4 EQUAL#2 GREATER#1
 3681                                  53660                                   ;SINCE CARRY IS ON ONLY IN
 3682                                  53680                                   ;377  CASE (FCOMP & STRCMP)
 3683                                  53700           POP     B               ;POP OFF WHAT RELATIONAL OPERATOR WAS
 3684                                  53720           ANA     B>              ;SEE IF WE MATCHED
 3685                                  53740   IFN     LENGTH,<
 3686                                  53742   IFE     LENGTH=2,<
 3687  004346' 001000  000315          53744           CALL    VSIGN##>
 3688  004347' 000000  000000*
 3689  004350' 000000  004341'
 3690                                  53746   IFN     LENGTH=2,<
 3691                                  53760           FSIGN>>                 ;0#FALSE ALL OTHERS#TRUE
 3692                                  53780   IFE     LENGTH,<
 3693                                  53800           POP     H>              ;POP OFF TEXT POINTER
 3694                                  53820   IFE     LENGTH=2,<
 3695  004351' 001000  000312          53840           JZ      FALSIF>         ;HANDLE POSSIBLE "ELSE"
 3696  004352' 000000  004363'
 3697  004353' 000000  004347'
 3698                                  53860   IFN     LENGTH=2,<
 3699                                  53880           JZ      REM>            ;IF TEST FAILED -- JUST SKIP REST OF THE LINE
 3700  004354' 001000  000327          53900   DOCOND: CHRGET                  ;PICK UP THE FIRST LINE # CHARACTER
 3701  004355' 001000  000332          53920           JC      GOTO            ;LINE NUMBER MEANS "GOTO"
 3702  004356' 000000  004010'
 3703  004357' 000000  004352'
 3704  004360' 001000  000303          53940           JMP     GONE3           ;INTERPRET NEW STATEMENT
 3705  004361' 000000  003375'
 3706  004362' 000000  004356'
 3707                                  53960   IFE     LENGTH=2,<
 3708                                  53980   ;
 3709                                  54000   ; "ELSE" HANDLER, HERE ON FALSE "IF" CONDITION
 3710                                  54020   ;
 3711  004363' 001000  000026          54040   FALSIF: MVI     D,1             ;NUMBER OF "ELSE"S THAT MUST
 3712  004364' 000000  000001
 3713                                  54060                                   ;BE SEEN, "DATA" INCREMENTS THIS
 3714                                  54080                                   ;COUNT EVERY TIME AN "IF" IS SEEN
 3715  004365' 001000  000315          54100   SKPMRF: CALL    DATA            ;SKIP A STATEMENT
 3716  004366' 000000  004072'
 3717  004367' 000000  004361'
 3718                                  54120                                   ;":" IS STUCK IN FRONT OF "ELSE"S
 3719                                  54140                                   ;SO THAT "DATA" WILL STOP BEFORE "ELSE" CLAUSES
 3720
```



```
 3721  004370' 001000  000267          54160           ORA     A               ;END OF LINE?
 3722  004371' 001000  000310          54180           RZ                      ;IF SO, NO "ELSE" CLAUSE
 3723  004372' 001000  000327          54200           CHRGET                  ;SEE IF WE HIT AN "ELSE"
 3724  004373' 001000  000376          54220           CPI     ELSETK
 3725  004374' 000000  000220
 3726  004375' 001000  000302          54240           JNZ     SKPMRF          ;NO, STILL IN THE "THEN" CLAUSE
 3727  004376' 000000  004365'
 3728  004377' 000000  004366'
 3729  004400' 001000  000025          54260           DCR     D               ;DECREMENT THE NUMBER OF "ELSE"S THAT
 3730                                  54280                                   ;MUST BE SEEN
 3731  004401' 001000  000302          54300           JNZ     SKPMRF          ;SKIP MORE IF HAVEN'T SEEN
 3732  004402' 000000  004365'
 3733  004403' 000000  004376'
 3734                                  54320                                   ;ENOUGH
 3735  004404' 001000  000303          54340           JMP     DOCOND>         ;FOUND THE RIGHT "ELSE" -- GO EXECUTE
 3736  004405' 000000  004354'
 3737  004406' 000000  004402'
 3738
 3739                                  54380   PAGE
```

```
                                        54400   SUBTTL PRINT CODE
                                        54440   IFN     LPTSW,<
                                        54460   LPRINT: MVI     A,1             ;SAY NON ZERO
                                        54480           STA     PRTFLG>         ;SAVE AWAY
004407' 001000  000053                  54500   NEWCHR: DCX     H
004410' 001000  000327                  54520   MORPR:  CHRGET                  ;GET ANOTHER CHARACTER
004411' 001000  000312                  54540   PRINT:  JZ      CRDO            ;IF WE SEE A TERMINATOR
004412' 000000  004523'
004413' 000000  004405'
                                        54560                                   ;GO TYPE A CRLF
004414' 001000  000310                  54580   PRINTC: RZ                      ;HERE AFTER SEEING TAB(X) OR , OR ;
                                        54600                                   ;IN WHICH CASE A TERMINATOR DOES NOT
                                        54620                                   ;MEAN WE SHOULD TYPE A CRLF
                                        54640                                   ;BUT JUST RETURN
                                        54660   IFE     STRING,<
                                        54680           CPI     34              ;A TERMINATING QUOTE?
                                        54700           CZ      STROU1
                                        54720           JZ      NEWCHR>         ;A QUOTATION -- JUST PRINT IT
004415' 001000  000376                  54740           CPI     TABTK
004416' 000000  000240
004417' 001000  000312                  54760           JZ      TABER           ;THE TAB FUNCTION?
004420' 000000  004577'
004421' 000000  004412'
                                        54780   IFN     LENGTH,<
004422' 001000  000376                  54800           CPI     SPCTK
004423' 000000  000242
004424' 001000  000312                  54820           JZ      TABER>          ;THE SPC FUNCTION?
004425' 000000  004577'
004426' 000000  004420'
004427' 001000  000345                  54840           PUSH    H               ;SAVE THE TEXT POINTER
004430' 001000  000376                  54860           CPI     44
004431' 000000  000054
004432' 001000  000312                  54880           JZ      COMPRT          ;IS IT A COMMA?
004433' 000000  004553'
004434' 000000  004425'
004435' 001000  000376                  54900           CPI     59              ;IS IT A ";"
004436' 000000  000073
004437' 001000  000312                  54920           JZ      NOTABR
004440' 000000  004637'
004441' 000000  004433'
004442' 001000  000301                  54940           POP     B               ;GET RID OF OLD TEXT POINTER
004443' 001000  000315                  54960           CALL    FRMEVL          ;BACK UP ONE CHARACTER AND READ THAT ONE
004444' 000000  005336'
004445' 000000  004440'
                                        54980                                   ;AGAIN SO THE CONDITION CODES ARE RIGHT
                                        55000                                   ;EVALUATE THE FORMULA
004446' 001000  000053                  55020           DCX     H               ;BACKUP FROM TERMINATOR
004447' 001000  000345                  55040           PUSH    H               ;SAVE TEXT POINTER
                                        55060   IFN     STRING,<
                                        55062   IFE     LENGTH=2,<
004450' 001000  000315                  55064           CALL    GETYPE          ;SEE IF WE HAVE A STRING
004451' 000000  006307'
```



```
004452' 000000  004444'
004453' 001000  000312                  55066           JZ      STRDON>         ;IF SO, PRINT SPECIALY
004454' 000000  004507'
004455' 000000  004451'
                                        55068   IFN     LENGTH=2,<
                                        55080           LDA     VALTYP
                                        55100           ORA     A
                                        55120           JNZ     STRDON>>        ;WAS IT A STRING FORMULA?
004456' 001000  000315                  55140           CALL    FOUT            ;MAKE A NUMBER INTO A STRING
004457' 000000  000000*
004460' 000000  004454'
                                        55160   IFE     STRING,<CALL    STROUT> ;IF STRINGS OFF JUST OUTPUT IT
                                        55180   IFN     STRING,<
004461' 001000  000315                  55200           CALL    STRLIT          ;MAKE IT  A STRING
004462' 000000  007637'
004463' 000000  004457'
004464' 001000  000052                  55220           LHLD    FACLO           ;GET THE POINTER
004465' 000000  001637'
004466' 000000  004462'
                                        55240   IFN     LPTSW,<
                                        55260           LDA     PRTFLG
                                        55280           ORA     A
                                        55300           JZ      ISTTY           ;LPT OR TTY?
                                        55320           LDA     LPTPOS
                                        55340           ADD     M
                                        55360           CPI     LPTLEN          ;WILL THIS NUMBER OVERLAP?
                                        55380           JMP     LINCHK
                                        55400   ISTTY:>
004467' 001000  000072                  55420           LDA     TTYPOS          ;SEE WHERE WE ARE
004470' 000000  000047'
004471' 000000  004465'
004472' 001000  000206                  55440           ADD     M               ;ADD THIS LENGTH
004473' 001000  000376                  55460           CPI     LINLEN          ;SEE IF GREATER THAN THE LINE LENGTH
004474' 000000  000110
                                        55480   LINPT3==:,=1
004475' 001000  000324                  55500   LINCHK: CNC     CRDO            ;IF SO CRLF
004476' 000000  004523'
004477' 000000  004470'
004500' 001000  000315                  55520           CALL    STRPRT>         ;PRINT THE NUMBER
004501' 000000  007746'
004502' 000000  004476'
004503' 001000  000076                  55540           MVI     A," "           ;ALWAYS END WITH A SPACE
004504' 000000  000040
004505' 001000  000337                  55560           OUTCHR
                                        55580   IFN     STRING,<
                                        55590   IFE     LENGTH=2,<
004506' 001000  000267                  55595           ORA     A               ;TURN OFF THE ZERO FLAG
004507' 001000  000314                  55597   STRDON: CZ      STRPRT>
004510' 000000  007746'
004511' 000000  004501'
                                        55598   IFN     LENGTH=2,<
                                        55599           XRA     A
                                        55600   STRDON: CNZ     STRPRT>>        ;JUST PRINT STRINGS
```

```
3846  004512' 001000  000341   55620          POP     H
3847  004513' 001000  000303   55640          JMP     MORPR           ;PRINT SOME MORE
3848  004514' 000000  004410'
3849  004515' 000000  004510'
3850  004516' 001000  000066   55660  FININL: MVI     M,0             ;PUT A ZERO AT THE END OF BUF
3851  004517' 000000  000000
3852  004520' 001000  000041   55680          LXI     H,BUFMIN        ;SETUP POINTER
3853  004521' 000000  001430'
3854  004522' 000000  004514'
3855                           55700  CRDO:   IFN      LPTSW,<
3856                           55720          LDA     PRTFLG
3857                           55740          ORA     A
3858                           55760          JNZ     PRINTW>
3859  004523' 001000  000076   55780          MVI     A,13
3860  004524' 000000  000015
3861  004525' 001000  000062   55800          STA     TTYPOS          ;MAKE TTYPOS LESS THAN LINE LENGTH
3862  004526' 000000  000047'
3863  004527' 000000  004521'
3864                           55820                                  ;SO CRDO DOESN'T GET CALLED AGAIN
3865  004530' 001000  000337   55840          OUTCHR
3866  004531' 001000  000076   55860          MVI     A,10
3867  004532' 000000  000012
3868  004533' 001000  000337   55880          OUTCHR
3869  004534' 001000  000072   55900  CRFIN:  LDA     NULCNT          ;GET NUMBER OF NULLS
3870  004535' 000000  000046'
3871  004536' 000000  004526'
3872  004537' 001000  000075   55920  PRTNUL: DCR     A
3873  004540' 001000  000062   55940          STA     TTYPOS          ;EVENTUALLY SETUP TTYPOS=0
3874  004541' 000000  000047'
3875  004542' 000000  004535'
3876  004543' 001000  000310   55960          RZ                      ;ALL NULLS DONE (A)=0
3877                           55980                                  ;SOME ROUTINES DEPEND ON CRDO
3878                           56000                                  ;AND CRFINS RETURN (A)=0 AND Z  TRUE
3879  004544' 001000  000365   56020          PUSH    PSW             ;SAVE THE COUNT
3880  004545' 001000  000257   56040          XRA     A               ;(A)= A NULL
3881  004546' 001000  000337   56060          OUTCHR                  ;SEND IT OUT
3882  004547' 001000  000361   56080          POP     PSW             ;RESTORE THE COUNT
3883  004550' 001000  000303   56100          JMP     PRTNUL          ;LOOP PRINTING NULLS
3884  004551' 000000  004537'
3885  004552' 000000  004541'
3886                           56120  IFE     STRING,<
3887                           56140  STROUI: INX     H
3888                           56160  STROUT: MOV     A,M
3889                           56180          ORA     A               ;CHECK FOR END OF LINE
3890                           56200          RZ                      ;LET IT END THAT WAY
3891                           56220          INX     H
3892                           56240          CPI     34              ;A TERMINATING QUOTE?
3893                           56260          RZ                      ;DONE IF SO
3894                           56280          OUTCHR                  ;PRINT THE CHARACTER IN (A)
3895                           56300          CPI     CR              ;IF IT'S A CARRIAGE RETURN
3896                           56320          CZ      CRDO            ;TYPE LINE-FEED AND SET (TTYPOS)=0
3897                           56340          JMP     STROUT>         ;PRINT MORE CHARACTERS
3898
```



```
3899                           56380  COMPRT: IFN     LPTSW,<
3900                           56400          LDA     PRTFLG          ;OUTPUT TO THE LINE PRINTER?
3901                           56420          ORA     A               ;NON-ZERO MEANS YES
3902                           56440          JZ      ISCTTY          ;NO, DO TELETYPE COMMA
3903                           56460          LDA     LPTPOS          ;GET LINE PRINTER POSITION
3904                           56480  NLPPOS==<<<LPTLEN/CLMWID>-1>*CLMWID>;POSITION BEYOND WHICH THERE ARE
3905                           56500                                  ;NO MORE COMMA FIELDS, SO
3906                           56520          CPI     NLPPOS          ;COMMA JUST DOES A "CRDO"
3907                           56540          JMP     CHKCOM          ;USE TELETYPE CHECK
3908                           56560  ISCTTY:>
3909  004553' 001000  000072   56580          LDA     TTYPOS          ;GET TELETYPE POSITION
3910  004554' 000000  000047'
3911  004555' 000000  004551'
3912                  000070   56600  NUTPOS==<<<LINLEN/CLMWID>-1>*CLMWID>;POSITION BEYOND WHICH THERE ARE
3913                           56620                                  ;NO MORE COMMA FIELDS
3914  004556' 001000  000376   56640          CPI     NUTPOS          ;SO ALL COMMA DOES IS A "CRDO"
3915  004557' 000000  000070
3916                  004557'  56660  LINPT4==1,=1                    ;FIXED UP BY "TERMINAL WIDTH" QUESTION
3917  004560' 001000  000324   56680  CHKCOM: CNC     CRDO            ;TYPE CRLF
3918  004561' 000000  004523'
3919  004562' 000000  004554'
3920  004563' 001000  000322   56700          JNC     NOTABR          ;AND QUIT IF BEYOND THE LAST COMMA FIELD
3921  004564' 000000  004637'
3922  004565' 000000  004561'
3923  004566' 001000  000326   56720  MORCOM: SUI     CLMWID          ;GET (A) MODULUS CLMWID
3924  004567' 000000  000016
3925  004570' 001000  000322   56740          JNC     MORCOM
3926  004571' 000000  004566'
3927  004572' 000000  004564'
3928  004573' 001000  000057   56760          CMA                     ;WE WANT TO  FILL
3929                           56780                                  ;THE PRINT POSITION OUT
3930                           56800                                  ;TO AN EVEN CLMWID, SO
3931                           56820                                  ;WE PRINT CLMWID-(A) MOD CLMWID SPACES
3932  004574' 001000  000303   56840          JMP     ASPA2           ;GO PRINT (A)+1 SPACES
3933  004575' 000000  004626'
3934  004576' 000000  004571'
3935
3936  004577'                  56880  TABER:
3937  004577' 001000  000365   56900  IFN     LENGTH,<PUSH    PSW>    ;REMEMBER IF (A)=SPCTK OR TABTK
3938                           56920  IFE     LENGTH,<
3939                           56940          CALL    INTIDX>         ;INTEGERIZE A FORMULA INTO (D,E)
3940                           56960  IFN     LENGTH,<
3941  004600' 001000  000315   56980          CALL    GTBYTC>         ;GET VALUE INTO (E)
3942  004601' 000000  011017'
3943  004602' 000000  004575'
3944  004603' 001000  000317   57000          SYNCHK  ")"
3945  004604' 000000  000051
3946  004605' 001000  000053   57020          DCX     H
3947                           57040  IFN     LENGTH,<
3948  004606' 001000  000361   57060          POP     PSW             ;GET BACK SPCTK OR TABTK
3949  004607' 001000  000376   57080          CPI     SPCTK>          ;WAS IT SPCTK?
3950  004610' 000000  000242
3951  004611' 001000  000345   57100          PUSH    H               ;SAVE THE TEXT POINTER
```

```
3952                                    57120   IFN     LENGTH,<
3953  004612' 001000  000173            57140           MOV     A,E             ;FOR "SPC" PUT THE FORMULA
3954  004613' 001000  000312            57160           JZ      ASPAC>          ;VALUE IN [A]
3955  004614' 000000  004627'
3956  004615' 000000  004601'
3957                                    57180   IFN     LPTSW,<
3958                                    57200           LDA     PRTFLG          ;LINE PRINTER OR TTY?
3959                                    57220           ORA     A               ;NON-ZERO MEANS LPT
3960                                    57240           JZ      TTYIST
3961                                    57260           LDA     LPTPOS          ;GET LINE PRINTER POSITION
3962                                    57280           JMP     DOSIZT>
3963  004616' 001000  000072            57300   TTYIST: LDA     TTYPOS          ;GET TELETYPE PRINT POSITION
3964  004617' 000000  000047'
3965  004620' 000000  004614'
3966  004621' 001000  000057            57320   DOSIZT: CMA                     ;PRINT [E]-[A] SPACES
3967  004622' 001000  000203            57340           ADD     E
3968  004623' 001000  000322            57360           JNC     NOTABR          ;IF NEGATIVE, DON'T PRINT ANY
3969  004624' 000000  004637'
3970  004625' 000000  004617'
3971                                    57380                                   ;SPACES
3972  004626' 001000  000074            57400   ASPA2:  INR     A
3973  004627' 001000  000107            57420   ASPAC:  MOV     B,A             ;[B]=NUMBER OF SPACES TO PRINT
3974  004630' 001000  000076            57440           MVI     A," "           ;[A]=SPACE
3975  004631' 000000  000040
3976  004632' 001000  000337            57460   REPOUT: OUTCHR                  ;PRINT [A]
3977  004633' 001000  000005            57480           DCR     B               ;DECREMENT THE COUNT
3978  004634' 001000  000302            57500           JNZ     REPOUT
3979  004635' 000000  004632'
3980  004636' 000000  004624'
3981  004637' 001000  000341            57520   NOTABR: POP     H               ;PICK UP TEXT POINTER
3982  004640' 001000  000327            57540           CHRGET                  ;AND THE NEXT CHARACTER
3983  004641' 001000  000303            57560           JMP     PRINTC          ;AND SINCE WE JUST PRINTED
3984  004642' 000000  004414'
3985  004643' 000000  004635'
3986                                    57580                                   ;SPACES, DON'T CALL CRDO
3987                                    57600                                   ;IF IT'S THE END OF THE LINE
3988                                    57620   PAGE
```



```
3989                                    57640   SUBTTL INPUT AND READ CODE
3990                                    57660   IFN     LENGTH,<
3991  004644' 000000  000077            57680   TRYAGN: DC"?REDO FROM START"
3992  004645' 000000  000122
3993  004646' 000000  000105
3994  004647' 000000  000104
3995  004650' 000000  000117
3996  004651' 000000  000040
3997  004652' 000000  000106
3998  004653' 000000  000122
3999  004654' 000000  000117
4000  004655' 000000  000115
4001  004656' 000000  000040
4002  004657' 000000  000123
4003  004660' 000000  000124
4004  004661' 000000  000101
4005  004662' 000000  000122
4006  004663' 000000  000124
4007  004663' 000000  000324
4008  004664' 000000  000015            57700           ACRLF
4009  004665' 000000  000012
4010  004666' 000000  000000            57720           0
4011                                    57740   ;
4012                                    57760   ; HERE WHEN THE DATA THAT WAS TYPED IN OR IN "DATA" STATEMENTS
4013                                    57780   ; IS IMPROPERLY FORMATTED, FOR "INPUT" WE START AGAIN,
4014                                    57800   ; FOR "DATA" WE GIVE A SYNTAX ERROR AT THE DATA LINE
4015                                    57820   ;
4016  004667' 001000  000072            57840   TRMNOK: LDA     FLGINP          ;WAS IT READ OR INPUT?
4017  004670' 000000  001602'
4018  004671' 000000  004642'
4019  004672' 001000  000267            57860           ORA     A               ;ZERO=INPUT
4020  004673' 001000  000302            57880           JNZ     DATSNE          ;GIVE ERROR AT DATA LINE
4021  004674' 000000  002064'
4022  004675' 000000  004670'
4023                                    57900           POP     B               ;GET RID OF THE POINTER INTO THE VARIABLE LIST
4024  004676' 001000  000301
4025  004677' 001000  000041            57920           LXI     H,TRYAGN
4026  004700' 000000  004644'
4027  004701' 000000  004674'
4028  004702' 001000  000315            57940           CALL    STROUT          ;PRINT "?REDO FROM START"
4029  004703' 000000  007743'
4030  004704' 000000  004700'
4031  004705' 001000  000052            57960           LHLD    TEMP            ;START ALL OVER BY GOING BACK
4032  004706' 000000  001603'
4033  004707' 000000  004703'
4034  004710' 001000  000311            57980           RET>                    ;TO NEWSTT POINTING AT THE START OF
4035                                    57982                                   ;OF THE "INPUT" STATEMENT
4036  004711'                           58000   INPUT:
4037                                    58020   IFN     LENGTH,<
4038  004711' 001000  000376            58040           CPI     34              ;IS IT A QUOTE?
4039  004712' 000000  000042
4040                                    58060   IFN     CONTRW,<
4041  004713' 001000  000076            58080           MVI     A,0             ;BE TALKATIVE
```

```
004714' 000000  000000
004715' 001000  000062          58100           STA     CNTWFL>         ;FORCE OUTPUT
004716' 000000  001541'
004717' 000000  004706'
004720' 001000  000302          58120           JNZ     NOTQTI          ;IF NOT NO MESSAGE
004721' 000000  004735'
004722' 000000  004716'
                                58140   IFN     STRING,<
004723' 001000  000315          58160           CALL    STRLTI          ;MAKE THE MESSAGE A STRING
004724' 000000  007640'
004725' 000000  004721'
004726' 001000  000317          58180           SYNCHK  59              ;MUST END WITH SEMI-COLON
004727' 000000  000073
004730' 001000  000345          58200           PUSH    H               ;REMEMBER WHERE IT ENDED
004731' 001000  000315          58220           CALL    STRPRT          ;PRINT IT OUT
004732' 000000  007746'
004733' 000000  004724'
004734' 001000  000341          58240           POP     H>
                                58260   IFE     STRING,<
                                58280           CALL    STROUI
                                58300           SYNCHK  59>>            ;ENDS WITH SEMI-COLON
004735' 001000  000345          58320   NOTQTI: PUSH    H
                                58340   IFE     FUNCTS,<
                                58360           LHLD    CURLIN          ;IS IT DIRECT?
                                58380           MVI     E,ERRID         ;IF SO "ILLEGAL DIRECT" ERROR
                                58400           INX     H               ;DIRECT MEANS THAT
                                58420           MOV     A,L             ;CURLIN=65535
                                58440           ORA     H               ;ADDED ONE AND GOT 0?
                                58460           JZ      ERROR>          ;IF SO,GO COMPLAIN
                                58480   IFN     FUNCTS,<
004736' 001000  000315          58500           CALL    ERRDIR>         ;USE COMMON ROUTINE SINCE DEF
004737' 000000  007532'
004740' 000000  004732'
                                58520                                   ;DIRECT IS ALSO ILLEGAL
004741' 001000  000315          58540   GETAGN: CALL    QINLIN          ;TYPE '?' AND INPUT A LINE OF TEXT
004742' 000000  002522'
004743' 000000  004737'
004744' 001000  000043          58560   IFN     LENGTH,<INX     H       ;IF NO INPUT WE QUIT
004745' 001000  000176          58580           MOV     A,M
004746' 001000  000267          58600           ORA     A
004747' 001000  000053          58620           DCX     H
004750' 001000  000301          58640           POP     B               ;TAKE OFF SINCE MAYBE LEAVING
004751' 001000  000312          58660           JZ      STPEND          ;IF EMPTY LEAVE
004752' 000000  003500'
004753' 000000  004742'
004754' 001000  000305          58680           PUSH    B>              ;PUT BACK  SINCE DION'T LEAVE
004755' 001000  000303          58700           JMP     INPCON
004756' 000000  004765'
004757' 000000  004752'
004760' 001000  000345          58720   READ:   PUSH    H               ;SAVE THE TEXT POINTER
004761' 001000  000052          58740           LHLD    DATPTR          ;GET LAST DATA LOCATION
004762' 000000  001627'
004763' 000000  004756'
```



```
004764' 001000  000366          58760           XWD     "01000,"0366    ;"ORI" TO SET [A] NON-ZERO
004765' 001000  000257          58780   INPCON: XRA     A               ;SET FLAG THAT THIS IS AN INPUT
004766' 001000  000062          58800           STA     FLGINP          ;STORE THE FLAG
004767' 000000  001602'
004770' 000000  004762'
                                58820   ;
                                58840   ; IN THE PROCESSING OF DATA AND READ STATEMENTS:
                                58860   ; ONE POINTER POINTS TO THE DATA (IE THE NUMBERS BEING FETCHED)
                                58880   ; AND ANOTHER POINTS TO THE LIST OF VARIABLES
                                58900   ;
                                58920   ; THE POINTER INTO THE DATA ALWAYS STARTS POINTING TO A
                                58940   ; TERMINATOR -- A , : OR END-OF-LINE
                                58960   ;
004771' 001000  000343          58980           XTHL                    ;[H,L]=VARIABLE LIST POINTER
                                58982                                   ;DATA POINTER GOES ON THE STACK
004772' 001000  000001          59000           XWD     "01000,1        ;"LXI B," OVER THIS CHECK
004773' 001000  000317          59020   LOPDT2: SYNCHK  44              ;MAKE SURE THERE IS A ","
004774' 000000  000054
004775' 001000  000315          59040           CALL    PTRGET          ;READ THE VARIABLE LIST
004776' 000000  006505'
004777' 000000  004767'
                                59060                                   ;AND GET THE POINTER TO A VARIABLE INTO [D,E]
005000' 001000  000343          59080           XTHL                    ;PUT THE VARIABLE LIST POINTER ONTO THE
                                59100                                   ;STACK AND TAKE THE
                                59120                                   ;DATA LIST POINTER OFF
                                59140   ;
                                59160   ; NOTE AT THIS POINT WE HAVE A VARIABLE WHICH WANTS DATA
                                59180   ; AND SO WE MUST GET DATA OR COMPLAIN
                                59200   ;
005001' 001000  000325          59220           PUSH    D               ;SAVE THE POINTER TO THE VARIABLE WE
                                59240                                   ;ARE ABOUT TO SET UP WITH A VALUE
005002' 001000  000176          59260           MOV     A,M             ;SINCE THE DATA LIST POINTER ALWAYS POINTS
                                59280                                   ;AT A TERMINATOR LETS READ THE
                                59300                                   ;TERMINATOR INTO [A] AND SEE WHAT
                                59320                                   ;IT IS
005003' 001000  000376          59340           CPI     44
005004' 000000  000054
005005' 001000  000312          59360           JZ      DATBK           ;A COMMA SO A VALUE MUST FOLLOW
005006' 000000  005025'
005007' 000000  004776'
                                59380   IFE     LENGTH,<
                                59400           ORA     A               ;IN THE 4K VERSION
                                59420           JNZ     SNERR>          ;DATA MUST BE ALONE ON A LINE
005010' 001000  000072          59440           LDA     FLGINP          ;SEE WHAT TYPE OF STATEMENT THIS WAS
005011' 000000  001602'
005012' 000000  005006'
005013' 001000  000267          59460           ORA     A
                                59480   IFE     LENGTH,<
                                59500           INX     H               ;POINT AT POINTER TO NEXT LINE
                                59520           JNZ     DATFND>         ;IF IT IS A READ GO
                                59540                                   ;SEARCH FOR ANOTHER DATA STATEMENT
005014' 001000  000302          59560   IFN     LENGTH,<JNZ     DATLOP>
005015' 000000  005163'
```

```
 4148  005016' 000000  005011'
 4149  005017' 001000  000076          59580          MVI     A,"?"
 4150  005020' 000000  000077
 4151  005021' 001000  000337          59600          OUTCHR                          ;DOUBLE PROMPT WHEN WE NEED MORE INPUT
 4152  005022' 001000  000315          59620          CALL    QINLIN                  ;GET A WHOLE LINE AFTER TYPING "?"
 4153  005023' 000000  002522'
 4154  005024' 000000  005015'
 4155                                  59640                                          ;THE DATA NOW STARTS AT THE BEGINNING
 4156                                  59660                                          ;OF THE BUFFER
 4157                                  59680                                          ;AND QINLIN LEAVES [H,L]=BUF
 4158  005025'                         59700  DATBK:
 4159                                  59720  IFE     LENGTH,<POP     D               ;POP OFF POINTER TO THE VARIABLE
 4160                                  59740          INX     H                       ;FUDGE CHARACTER POINTER
 4161                                  59760          CALL    REDINP>                 ;READ A VALUE USING "LET" CODE
 4162                                  59780  IFN     LENGTH,<
 4163                                  59800  IFN     STRING,<
 4164  005025' 001000  000072          59820          LDA     VALTYP                  ;SEE IF ITS NUMERIC OR STRING
 4165  005026' 000000  001543'
 4166  005027' 000000  005023'
 4167                                  59840  IFE     LENGTH=2,<
 4168  005030' 001000  000376          59860          CPI     3                       ;IS IT A STRING ?
 4169  005031' 000000  000003
 4170  005032' 001000  000365          59880          PUSH    PSW                     ;SAVE THE TYPE INFORMATION
 4171  005033' 001000  000302          59900          JNZ     NUMINS>                 ;IF NUMERIC,USE FIN TO GET IT
 4172  005034' 000000  005070'
 4173  005035' 000000  005026'
 4174                                  59920  IFN     LENGTH=2,<
 4175                                  59940          ORA     A
 4176  005036' 001000  000327          59960          JZ      NUMINS>                 ;INPUT A NUMBER IF NUMERIC
 4177                                  59980                                          ;ONLY THE VARAIBLE TYPE IS
 4178                                  60000                                          ;CHECKED SO AN UNQUOTED STRING
 4179                                  60020                                          ;CAN BE ALL DIGITS
 4180  005036' 001000  000327          60040          CHRGET
 4181  005037' 001000  000127          60060          MOV     D,A                     ;ASSUME QUOTED STRING
 4182  005040' 001000  000107          60080          MOV     B,A                     ;SETUP TERMINATORS
 4183  005041' 001000  000376          60100          CPI     34                      ;QUOTE ?
 4184  005042' 000000  000042
 4185  005043' 001000  000312          60120          JZ      NOWGET                  ;TERMINATORS OK
 4186  005044' 000000  005053'
 4187  005045' 000000  005034'
 4188  005046' 001000  000026          60140          MVI     D,":"                   ;UNQUOTED STRING TERMINATORS
 4189  005047' 000000  000072
 4190  005050' 001000  000006          60160          MVI     B,44                    ;ARE COLON AND COMMA
 4191  005051' 000000  000054
 4192                                  60180          DCX     H                       ;BACKUP SINCE START CHARACTER MUST BE INCLUDED
 4193  005052' 001000  000053
 4194                                  60200                                          ;IN THE QUOTED STRING CASE WE DON'T WANT TO
 4195                                  60220                                          ;INCLUDE THE STARTING OR ENDING QUOTE
 4196  005053' 001000  000315          60240  NOWGET: CALL    STRLT2                  ;MAKE A STRING DESCRIPTOR FOR THE VALUE
 4197  005054' 000000  007643'
 4198  005055' 000000  005044'
 4199                                  60242                                          ;AND COPY IF NECESSARY
 4200                                  60260  IFE     LENGTH=2,<
```



```
 4201  005056' 001000  000361          60280  DOASIG: POP     PSW>                    ;POP OFF THE TYPE INFORMATION
 4202  005057' 001000  000353          60320          XCHG                            ;[D,E]=TEXT POINTER
 4203  005060' 001000  000041          60340          LXI     H,STRDN2                ;RETURN LOC
 4204  005061' 000000  005077'
 4205  005062' 000000  005054'
 4206  005063' 001000  000343          60360          XTHL                            ;[H,L]=PLACE TO STORE VARIABLE VALUE
 4207  005064' 001000  000325          60380          PUSH    D                       ;TEXT POINTER GOES ON
 4208  005065' 001000  000303          60400          JMP     INPCOM>                 ;DO ASSIGNMENT
 4209  005066' 000000  004157'
 4210  005067' 000000  005061'
 4211  005070' 001000  000327          60420  NUMINS: CHRGET
 4212  005071' 001000  000315          60440          CALL    FIN
 4213  005072' 000000  000000*
 4214  005073' 000000  005066'
 4215                                  60460  IFE     LENGTH=2,<
 4216  005074' 001000  000303          60480          JMP     DOASIG>                 ;ASSIGNMENT IS COMPLICATED
 4217  005075' 000000  005056'
 4218  005076' 000000  005072'
 4219                                  60500                                          ;EVEN FOR NUMERICS SO USE THE "LET" CODE
 4220                                  60520  IFN     LENGTH=2,<
 4221                                  60540          XTHL                            ;[H,L] GET POINTER AT VARIABLE
 4222                                  60560          CALL    MOVMF                   ;DO THE ASSIGNMENT
 4223                                  60580          POP     H>>                     ;GET BACK THE TEXT POINTER
 4224  005077'                         60600  STRDN2:
 4225                                  60620  IFN     LENGTH,<
 4226  005077' 001000  000053          60640          DCX     H
 4227  005100' 001000  000327          60660          CHRGET
 4228  005101' 001000  000312          60660          JZ      TRMOK
 4229  005102' 000000  005111'
 4230  005103' 000000  005075'
 4231  005104' 001000  000376          60700          CPI     44
 4232  005105' 000000  000054
 4233  005106' 001000  000302          60720          JNZ     TRMNOK>                 ;ENDED PROPERLY?
 4234  005107' 000000  004667'
 4235  005110' 000000  005102'
 4236  005111' 001000  000343          60740  TRMOK:  XTHL
 4237  005112' 001000  000053          60760          DCX     H                       ;LOOK AT TERMINATOR
 4238  005113' 001000  000327          60780          CHRGET                          ;AND SET UP CONDITION CODES
 4239  005114' 001000  000302          60800          JNZ     LOPDT2                  ;NOT ENDING, CHECK FOR COMMA
 4240  005115' 000000  004773'
 4241  005116' 000000  005107'
 4242                                  60820                                          ;AND GET ANOTHER VARIABLE
 4243                                  60840                                          ;TO FILL WITH DATA
 4244
 4245  005117' 001000  000321          60880          POP     D                       ;POP OFF THE POINTER INTO DATA
 4246  005120' 001000  000072          60900          LDA     FLGINP                  ;FETCH THE STATEMENT TYPE FLAG
 4247  005121' 000000  001602'
 4248  005122' 000000  005115'
 4249  005123' 001000  000267          60920          ORA     A
 4250                                  60940  IFE     LENGTH,<RZ>                     ;DON'T UPDATE DATPTR IF IT WAS AN
 4251                                  60960                                          ;INPUT STATEMENT
 4252  005124' 001000  000353          60980          XCHG
 4253  005125' 001000  000302          61000          JNZ     RESFIN                  ;UPDATE DATPTR
```

```
4254  005126' 000000  003453'
4255  005127' 000000  005121'
4256                                  61020   IFN     LENGTH,<
4257  005130' 001000  000266          61040           ORA     M                       ;COULD HAVE ENDED WITH COMMA OR
4258                                  61060                                           ;COLON, BUT SHOULD BE A ZERO
4259  005131' 001000  000041          61080           LXI     H,EXIGNT                ;TEXT FOR "EXTRA"
4260  005132' 000000  005142'
4261  005133' 000000  005126'
4262  005134' 001000  000325          61100           PUSH    D                       ;SAVE THE TEXT POINTER
4263  005135' 001000  000304          61120           CNZ     STROUT                  ;IF WASN'T REAL END SAY SOMETHING
4264  005136' 000000  007743'
4265  005137' 000000  005132'
4266  005140' 001000  000341          61140           POP     H                       ;GET BACK THE TEXT POINTER
4267  005141' 001000  000311          61160           RET
4268  005142' 000000  000077          61180   EXIGNT: DC"?EXTRA IGNORED"
4269  005143' 000000  000105
4270  005144' 000000  000130
4271  005145' 000000  000124
4272  005146' 000000  000122
4273  005147' 000000  000101
4274  005150' 000000  000040
4275  005151' 000000  000111
4276  005152' 000000  000107
4277  005153' 000000  000116
4278  005154' 000000  000117
4279  005155' 000000  000122
4280  005156' 000000  000105
4281  005157' 000000  000104
4282  005157' 000000  000304
4283  005160' 000000  000015          61200           ACRLF
4284  005161' 000000  000012
4285  005162' 000000  000000          61220           0>
4286                                  61240   ;
4287                                  61260   ; SUBROUTINE TO FIND DATA
4288                                  61280   ; IN THE 4K "DATA" MUST BE AT THE START OF THE LINE
4289                                  61300   ; SO THE SEARCH IS MADE USING THE LINKS AT THE START OF EACH LINE.
4290                                  61320   ;
4291                                  61340   ; IN THE 8K AND EXTENDED THE SEARCH IS MADE BY USING THE EXECUTION CODE
4292                                  61360   ; FOR DATA TO SKIP OVER STATEMENTS, THE START WORD OF EACH STATEMENT
4293                                  61380   ; IS COMPARED WITH DATATK, EACH NEW LINE NUMBER
4294                                  61400   ; IS STORED IN DATLIN SO THAT IF AN ERROR OCCURS WHILE READING
4295                                  61420   ; DATA THE ERROR MESSAGE WILL GIVE THE LINE NUMBER OF THE
4296                                  61440   ; ILL-FORMATTED DATA
4297                                  61460   ;
4298  005163' 001000  000315          61480   DATLOP: IFN     LENGTH,<CALL    DATA>
4299  005164' 000000  004072'
4300  005165' 000000  005136'
4301                                  61500           IFE     LENGTH,<POP     H>
4302  005166'                         61520   DATFND: IFN     LENGTH,<
4303  005166' 001000  000267          61540           ORA     A
4304  005167' 001000  000302          61560           JNZ     NOWLIN>
4305  005170' 000000  005214'
4306  005171' 000000  005164'
```



```
4307                                  61580   IFN     LENGTH,<
4308  005172' 001000  000043          61600           INX     H>
4309  005173' 001000  000367          61620           PUSHM                           ;SAVE POINTER TO THE NEXT STATEMENT
4310  005174' 001000  000171          61640           MOV     A,C                     ;SEE IF WE ARE AT THE END
4311  005175' 001000  000260          61660           ORA     B
4312  005176' 001000  000036          61680           MVI     E,ERROD                 ;NO DATA IS ERROR ERROD
4313  005177' 000000  000004
4314  005200' 001000  000312          61700           JZ      ERROR                   ;IF SO COMPLAIN
4315  005201' 000000  002102'
4316  005202' 000000  005170'
4317                                  61720   IFE     LENGTH,<INX     H>              ;SKIP PAST LINE #
4318  005203' 001000  000301          61740   IFN     LENGTH,<POP     B
4319  005204' 001000  000136          61760           MOV     E,M                     ;GET DATA LINE #
4320  005205' 001000  000043          61780           INX     H
4321  005206' 001000  000126          61800           MOV     D,M
4322  005207' 001000  000353          61820           XCHG
4323  005210' 001000  000042          61840           SHLD    DATLIN
4324  005211' 000000  001577'
4325  005212' 000000  005201'
4326  005213' 001000  000353          61860           XCHG>                           ;RESTORE TEXT POINTER
4327  005214' 001000  000327          61880   NOWLIN: CHRGET                          ;GET THE STATEMENT TYPE
4328  005215' 001000  000376          61900           CPI     DATATK                  ;IS IS "DATA"?
4329  005216' 000000  000203
4330  005217' 001000  000302          61920           JNZ     DATLOP                  ;NOT DATA SO LOOK SOME MORE
4331  005220' 000000  005163'
4332  005221' 000000  005211'
4333                                  61940   IFE     LENGTH,<POP     B>
4334  005222' 001000  000303          61960           JMP     DATBK                   ;CONTINUE READING
4335  005223' 000000  005025'
4336  005224' 000000  005220'
4337
4338
4339
4340                                  62040   PAGE
```

```
                                        62060   SUBTTL NEXT CODE
                                        62080   ;
                                        62100   ; NOTE:
                                        62120   ;
                                        62140   ;
                                        62160   ; A FOR ENTRY ON THE STACK HAS THE FOLLOWING FORMAT:
                                        62180   ;
                                        62200   ;
                                        62220   ; LOW ADDRESS
                                        62240   ;       TOKEN (FORTK IN HIGH BYTE)  1 BYTES
                                        62260   ;       A POINTER TO THE LOOP VARIABLE  2 BYTES
                                        62280   ;       A BYTE REFLECTING THE SIGN OF THE INCREMENT 1 BYTE
                                        62300   ;       THE STEP 4 BYTES
                                        62320   ;       THE UPPER VALUE 4 BYTES
                                        62340   ;       THE LINE # OF THE "FOR" STATEMENT 2 BYTES
                                        62360   ;       A TEXT POINTER INTO THE "FOR" STATEMENT 2 BYTES
                                        62380   ; HIGH ADDRESS
                                        62400   ;
                                        62420   ; TOTAL 16 BYTES
                                        62440   ;
  005225'                               62460   NEXT:
  005225' 001000  000021                62480   IFN     LENGTH,<LXI     D,$CODE>;FOR THE "NEXT"
  005226' 000000  000000'
  005227' 000000  005223'
                                        62500                                   ;STATEMENT WITHOUT ANY ARGS
                                        62520                                   ;WE CALL FNDFOR WITH (D,E)=0
  005230'                               62540   NEXTC:
                                        62560   IFE     LENGTH,<
                                        62580           CALL    PTRGET>         ;MUST HAVE A VARIABLE
                                        62600   IFN     LENGTH,<
  005230' 001000  000304                62620           CNZ     PTRGET>         ;GET A POINTER TO THE
  005231' 000000  006505'
  005232' 000000  005226'
                                        62640                                   ;LOOP VARIABLE INTO (D,E)
  005233' 001000  000042                62660           SHLD    TEMP            ;PUT THE TEXT POINTER
  005234' 000000  001603'
  005235' 000000  005231'
                                        62680                                   ;IN A TEMP LOCATION
                                        62700                                   ;IN CASE THE LOOP TERMINATES
  005236' 001000  000315                62720           CALL    FNDFOR          ;TRY TO FIND A FOR ENTRY
  005237' 000000  001744'
  005240' 000000  005234'
                                        62740                                   ;ON THE STACK WHOSE VARIABLE NAME
                                        62760                                   ;MATCHES THIS ONES
                                        62780   IFN     LENGTH,<
  005241' 001000  000302                62800           JNZ     NFERR>          ;"NEXT WITHOUT FOR"
  005242' 000000  002100'
  005243' 000000  005237'
  005244' 001000  000371                62820           SPHL                    ;SETUP STACK POINTER BY CHOPPING
                                        62840                                   ;AT THIS POINT
  005245' 001000  000325                62860           PUSH    D               ;PUT THE VARIABLE PTR BACK ON
  005246' 001000  000176                62880           MOV     A,M             ;STEP ONTO THE STACK
  005247' 001000  000043                62900           INX     H
```



```
  005250' 001000  000365                62920           PUSH    PSW
  005251' 001000  000325                62940           PUSH    D               ;PUT THE POINTER TO THE LOOP
                                        62960                                   ;VARIABLE ONTO THE STACK
                                        62980   IFE     LENGTH,<
                                        63000           MVI     E,ERRNF
                                        63020           JNZ     ERROR>
  005252' 001000  000315                63040           CALL    MOVFM           ;STEP VALUE INTO THE FAC
  005253' 000000  000000*
  005254' 000000  005242'
  005255' 001000  000343                63060           XTHL                    ;PUT THE POINTER INTO THE
                                        63080                                   ;FOR ENTRY ONTO THE STACK
  005256' 001000  000345                63100           PUSH    H               ;PUT THE POINTER TO THE LOOP
                                        63120                                   ;VARIABLE BACK ONTO THE STACK
  005257' 001000  000315                63140           CALL    FADDS           ;ADD THE STEP AND LOOP VARIABLE
  005260' 000000  000000*
  005261' 000000  005253'
  005262' 001000  000341                63160           POP     H               ;POP OFF THE POINTER TO
                                        63180                                   ;THE LOOP VARIABLE
  005263' 001000  000315                63200           CALL    MOVMF           ;MOV FAC INTO LOOP VARIABLE
  005264' 000000  000000*
  005265' 000000  005260'
  005266' 001000  000341                63220           POP     H               ;GET THE ENTRY POINTER
  005267' 001000  000315                63240           CALL    MOVRM           ;GET THE FINAL INTO THE REGISTERS
  005270' 000000  000000*
  005271' 000000  005264'
  005272' 001000  000345                63260           PUSH    H               ;SAVE THE ENTRY POINTER
  005273' 001000  000315                63280           CALL    FCOMP           ;COMPARE THE NUMBERS
  005274' 000000  000714*
  005275' 000000  005270'
  005276' 001000  000341                63300           POP     H               ;STILL POINTING TO THE FINAL VALUE
  005277' 001000  000301                63320           POP     B               ;GET THE SIGN  OF THE INCREMENT
  005300' 001000  000220                63340           SUB     B               ;SUBTRACT THE INCREMENTS SIGN FROM THAT
                                        63360                                   ;OF (CURRENT VALUE-FINAL VALUE)
  005301' 001000  000315                63380           CALL    MOVRM           ;GET LINE # OF "FOR" INTO (D,E)
  005302' 000000  005270*
  005303' 000000  005274'
                                        63400                                   ;GET TEXT POINTER OF "FOR" INTO (B,C)
  005304' 001000  000312                63420           JZ      LOOPDN          ;IF SIGN(FINAL-CURRENT)+SIGN(STEP)=0
  005305' 000000  005320'
  005306' 000000  005302'
                                        63440                                   ;THEN THE LOOP IS FINISHED
  005307' 001000  000353                63460           XCHG
  005310' 001000  000042                63480           SHLD    CURLIN          ;STORE THE LINE #
  005311' 000000  001607'
  005312' 000000  005305'
  005313' 001000  000151                63500           MOV     L,C             ;SETUP THE TEXT POINTER
  005314' 001000  000140                63520           MOV     H,B
  005315' 001000  000303                63540           JMP     NXTCON
  005316' 000000  003276'
  005317' 000000  005311'

  005320' 001000  000371                63580   LOOPDN: SPHL                    ;ELIMINATE THE FOR ENTRY
                                        63600                                   ;SINCE (H,L) MOVED ALL
```

```
                                        63620                                   ;THE WAY DOWN THE ENTRY
005321' 001000  000052                  63640          LHLD    TEMP             ;RESTORE THE TEXT POINTER
005322' 000000  001603'
005323' 000000  005316'
                                        63660   IFE    LENGTH,<JMP     NEWSTT>
                                        63680   IFN    LENGTH,<
005324' 001000  000176                  63700          MOV     A,M              ;IS THERE A COMMA AT THE END
005325' 001000  000376                  63720          CPI     44               ;IF SO LOOK AT ANOTHER
005326' 000000  000054
005327' 001000  000302                  63740          JNZ     NEWSTT           ;VARIABLE NAME TO "NEXT"
005330' 000000  003302'
005331' 000000  005322'
005332' 001000  000327                  63760          CHRGET                   ;READ FIRST CHARCTER
005333' 001000  000315                  63780          CALL    NEXTC>           ;DO NEXT, BUT DON'T ALLOW
005334' 000000  005230'
005335' 000000  005330'
                                        63800                                   ;BLANK VARIABLE NAME (D,E)=STK PTR
                                        63820                                   ;AND WILL NEVER MATCH ANY VARPTR
                                        63840                                   ;USE CALL TO PUT DUMMY "NEWSTT" ENTRY ON

                                        63880   PAGE
```

```
                                        00020   SUBTTL FORMULA EVALUATION CODE
                                        00060   IFN     LENGTH-2,<
                                        00080   IFN     STRING,<
                                        00100   ;
                                        00120   ; THESE ROUTINES CHECK FOR A CERTAIN VALTYP
                                        00140   ; (A) IS NOT PRESERVED
                                        00160   ;
                                        00180   FRMNUM: CALL    FRMEVL          ;EVALUATE A FORMULA
                                        00200   CHKNUM: XWD     "01000,"0366    ;TURN CARRY OFF WITH ORI
                                        00220   CHKSTR: STC                     ;SET CARRY
                                        00240   CHKVAL: LDA     VALTYP          ;0 MEANS NUMERIC 1 MEANS STRING
                                        00260           ADC     A               ;RESULT SHOULD BE 0 OR 3
                                        00280                                   ;BAD RESULTS ARE 2 AND 1
                                        00300           RPE                     ;RETURN IF CORRECT RESULT
                                        00320   TMERR:  MVI     E,ERRTM         ;"TYPE MISMATCH ERROR"
                                        00340           JMP     ERROR>>
                                        00360   ;
                                        00380   ; THE FORMULA EVALUATOR STARTS WITH
                                        00400   ; (H,L) POINTING TO THE FIRST CHARACTER OF THE FORMULA,
                                        00420   ; AT THE END (H,L) POINTS TO THE TERMINATOR,
                                        00440   ; THE RESULT IS LEFT IN THE FAC,
                                        00460   ;
                                        00480   ; THE FORMULA EVALUATOR USES THE OPERATOR TABLE (OPTAB)
                                        00500   ; TO DETERMINE PRECEDENCE AND DISPATCH ADDRESSES FOR
                                        00520   ; EACH OPERATOR,
                                        00540   ; A TEMPORARY RESULT ON THE STACK HAS THE FOLLOWING FORMAT
                                        00560   ;
                                        00580   ; THE ADDRESS OF 'RETAOP' -- THE PLACE TO RETURN ON COMPLETION
                                        00600   ; OF OPERATOR APPLICATION
                                        00620   ;
                                        00640   ; THE FLOATING POINT TEMPORARY RESULT
                                        00660   ;
                                        00680   ; THE ADDRESS OF THE OPERATOR ROUNTINE
                                        00700   ;
                                        00720   ; THE PRECEDENCE OF THE OPERATOR
                                        00740   ;
                                        00760   ; TOTAL 10 BYTES
                                        00780   ;
                                        00800   IFE     STRING,<FRMNUM:>
005336' 001000  000053                  00820   FRMEVL: DCX     H               ;BACK UP CHARACTER POINTER
005337' 001000  000026                  00840   FRMCHK: MVI     D,0             ;INITIAL DUMMY PRECEDENCE IS 0
005340' 000000  000000
005341' 001000  000325                  00860   LPOPER: PUSH    D               ;SAVE PRECEDENCE
005342' 001000  000315                  00880           CALL    GETSTK          ;MAKE SURE THERE IS ROOM FOR RECURSIVE CALLS
005343' 000000  002024'
005344' 000000  005334'
005345' 000000  000001                  00900           1
005346' 001000  000315                  00920           CALL    EVAL            ;EVALUATE SOMETHING
005347' 000000  006061'
005350' 000000  005343'
005351' 001000  000042                  00940           SHLD    TEMP2           ;SAVE TEXT POINTER
005352' 000000  001605'
```



```
005353' 000000  005347'
005354' 001000  000052                  00960   RETAOP: LHLD    TEMP2           ;RESTORE TEXT PTR
005355' 000000  001605'
005356' 000000  005352'
005357' 001000  000301                  00980   TSTOP:  POP     B               ;POP OFF THE PRECEDENCE OF OLDOP
                                        01000   IFN     LENGTH-2,<
                                        01020   IFN     STRING,<
                                        01040           MOV     A,B             ;LOOK AT PRECEDENCE
                                        01060           CPI     120             ;IF ITS SOME ARITHMETIC
                                        01080                                   ;TYPE THING WE SHOULDN'T
                                        01100                                   ;SEE STRINGS
                                        01120           CNC     CHKNUM>>        ;TYPE MISMATCH ERROR IF NOT NUMERIC
005360' 001000  000176                  01140   NOTSTV: MOV     A,M             ;GET NEXT CHARACTER
                                        01160   IFN     LENGTH,<
005361' 001000  000026                  01180           MVI     D,0             ;ASSUME NO RELATION OPS
005362' 000000  000000
005363' 001000  000326                  01200   LOPREL: SUI     GREATK          ;IS THIS ONE RELATION?
005364' 000000  000257
005365' 001000  000332                  01220           JC      ENDREL          ;RELATIONS ALL THROUGH
005366' 000000  005415'
005367' 000000  005355'
                        000003                  01240   NMREL==LESSTK-GREATK+1
005370' 001000  000376                  01260           CPI     NMREL           ;IS IT REALLY RELATIONAL?
005371' 000000  000003
005372' 001000  000322                  01280           JNC     ENDREL          ;NO JUST BIG
005373' 000000  005415'
005374' 000000  005366'
005375' 001000  000376                  01300           CPI     1               ;SET UP BITS BY MAPPING
005376' 000000  000001
005377' 001000  000027                  01320           RAL                     ;0 TO 1 1 TO 2 AND 2 TO 4
005400' 001000  000252                  01340           XRA     D               ;BRING IN THE OLD BITS
005401' 001000  000272                  01360           CMP     D               ;MAKE SURE RESULT IS BIGGER
005402' 001000  000127                  01380           MOV     D,A             ;SAVE THE MASK
005403' 001000  000332                  01400           JC      SNERR           ;DON'T ALLOW TWO OF THE SAME
005404' 000000  002072'
005405' 000000  005373'
005406' 001000  000042                  01420           SHLD    TEMP3           ;SAVE CHARACTER POINTER
005407' 000000  001575'
005410' 000000  005404'
005411' 001000  000327                  01440           CHRGET                  ;GET THE NEXT CANDIDATE
005412' 001000  000303                  01460           JMP     LOPREL
005413' 000000  005363'
005414' 000000  005407'
005415' 001000  000172                  01480   ENDREL: MOV     A,D             ;GET THE MASK
005416' 001000  000267                  01500           ORA     A               ;WERE THERE ANY?
005417' 001000  000302                  01520           JNZ     FINREL          ;IF SO, HANDLE AS SPECIAL OP
005420' 000000  005605'
005421' 000000  005413'
005422' 001000  000176                  01540           MOV     A,M             ;GET THE CHARACTER AGAIN
005423' 001000  000042                  01560           SHLD    TEMP3>          ;SAVE UPDATED CHARACTER POINTER
005424' 000000  001575'
005425' 000000  005420'
005426' 001000  000326                  01580           SUI     PLUSTK          ;AN OPERATOR?
```

```
4576  005427' 000000  000250
4577  005430' 001000  000330   01600          RC                      ;RETURN IF NOT
4578                           01620                                  ;THIS CAN RESULT IN OPERATOR
4579                           01640                                  ;APPLICATION OR ACTUAL RETURN
4580  005431' 001000  000376   01660          CPI     LSTOPK          ;HIGHER THAN THE LAST OP?
4581  005432' 000000  000007
4582  005433' 001000  000320   01680          RNC
4583  005434' 001000  000137   01700          MOV     E,A             ;MUST MUTIPLY BY 3 SINCE
4584                           01720                                  ;OPTAB ENTRIES ARE 3 LONG
4585                           01740  IFN      STRING,<
4586  005435' 001000  000072   01760          LDA     VALTYP          ;SEE IF LEFT PART IS STRING
4587  005436' 000000  001543'
4588  005437' 000000  005424'
4589                           01780  IFE      LENGTH=2,<
4590  005440' 001000  000376   01800          CPI     3>              ;SEE IF ITS A STRING
4591  005441' 000000  000003
4592                           01820  IFN      LENGTH=2,<
4593                           01840          DCR     A>
4594  005442' 001000  000263   01860          ORA     E               ;SET CONDITION CODES
4595                           01880  IFN      LENGTH=2,<
4596                           01900          MOV     A,E>            ;REFETCH OP-VALUE
4597  005443' 001000  000312   01920          JZ      CAT>            ;MUST BE CAT
4598  005444' 000000  010320'
4599  005445' 000000  005436'
4600                           01940  IFN      LENGTH=2,<
4601                           01960          RLC                     ;A= ORIGINAL A*2
4602                           01980          ADD     E               ;ADD IN ORIGINAL A
4603                           02000          MOV     E,A>            ;CREATE TWO BYTE VALUE
4604                           02020  IFE      LENGTH,<
4605                           02040          MVI     D,0>            ;HIGH ORDER =0
4606  005446' 001000  000041   02060          LXI     H,OPTAB         ;CREATE INDEX INTO OPTAB
4607  005447' 000000  000163'
4608  005450' 000000  005444'
4609  005451' 001000  000031   02080          DAD     D               ;ADD IN CALCULATED OFFSET
4610  005452' 001000  000170   02100          MOV     A,B             ;(A) GETS OLD PRECEDENCE
4611  005453' 001000  000126   02120          MOV     D,M             ;REMEMBER NEW PRECEDENCE
4612  005454' 001000  000272   02140          CMP     D               ;OLD-NEW
4613  005455' 001000  000320   02160          RNC                     ;MUST APPLY OLD OP
4614                           02180                                  ;IF HAS GREATER OR = PRECEDENCE
4615                           02200  IFN      LENGTH=2,<
4616                           02220          INX     H               ;NOW POINTING AT ROUTINE ADDRESS
4617                           02240  IFN      STRING,<CALL    CHKNUM> ;CAN'T BE STRING HERE
4618                           02260                                  ;SINCE THE ONLY STRING OPERATOR
4619                           02280                                  ;IS PLUS AND RELATIONALS
4620                           02300                                  ;DON'T COME THROUGH HERE
4621                           02320  DOPREC: PUSH    B               ;SAVE OLD PRECEDENCE
4622                           02340          LXI     B,RETAOP        ;OPERATOR RETURN ADDRESS
4623                           02360          PUSH    B               ;FIRST PART OF "TEMP" ENTRY
4624                           02380  IFN      LENGTH,<
4625                           02400          MOV     B,E>            ;SAVE SECOND BYTE OF PRECEDENCE
4626                           02420                                  ;SINCE FOR RELATIONAL OPERATORS
4627                           02440                                  ;IT GIVES THE VALUE TYPE OF
4628                           02460                                  ;THE LEFT SIDE AND IT TELLS
```



```
4629                           02480                                  ;WHICH RELATIONAL-OPERATOR
4630                           02500                                  ;IT WAS
4631                           02520          MOV     C,D
4632                           02540          CALL    PUSHF
4633                           02560  IFN      LENGTH,<
4634                           02580          MOV     E,B>            ;GET SECOND BYTE OF PRECEDENCE AGAIN
4635                           02600          MOV     D,C             ;(D) GETS PRECEDENCE
4636                           02620          PUSHM                   ;PUT ROUTINE ADDRESS ON THE STACK
4637                           02640  IFN      LENGTH,<
4638                           02660          LHLD    TEMP3>
4639                           02680  IFE      LENGTH,<
4640                           02700          LHLD    TEMP2>          ;IF WE DONT HAVE "LENGTH"
4641                           02720                                  ;ON OPERATORS CAN ONLY
4642                           02740                                  ;BE ONE CHARACTER SO TO "REREAD"
4643                           02760                                  ;AN OPERATOR THAT WE LOOKED
4644                           02780                                  ;AT BEFORE AND DECIDED NOT TO
4645                           02800                                  ;APPLY WE JUST "DCX H"
4646                           02820                                  ;IF LENGTH IS ON WE HAVE TO
4647                           02840                                  ;REMEMBER THE TEXT POINTER BEFORE
4648                           02860                                  ;THE OPERATOR AND AFTER SO WE CAN
4649                           02880                                  ;EITHER RESCAN THE OPERATOR
4650                           02900                                  ;LATER IF IT DOESN'T GET APPLIED
4651                           02920                                  ;OR GO BEYOND IT WHEN IT DOES
4652                           02940          JMP     LPOPER>         ;PUT ON PRECEDENCE AND LOOK AT A
4653                           02960                                  ;NEW OPERATOR
4654
4655                           03000  IFE      LENGTH=2,<
4656  005456' 001000  000305   03020          PUSH    B               ;SAVE THE OLD PRECEDENCE
4657  005457' 001000  000001   03040          LXI     B,RETAOP        ;PUT ON THE ADDRESS OF THE
4658  005460' 000000  005354'
4659  005461' 000000  005447'
4660                           03060          PUSH    B               ;PLACE TO RETURN TO AFTER OPERATOR APPLICATION
4661  005462' 001000  000305
4662  005463' 001000  000172   03080          MOV     A,D             ;SEE IF THE OPERATOR IS EXPONENTIATION
4663  005464' 001000  000376   03100          CPI     127             ;WHICH HAS PRECEDENCE 127
4664  005465' 000000  000177
4665                           03120          JZ      EXPSTK          ;IF SO, "FRCSNG" AND MAKE A SPECIAL STACK ENTRY
4666  005466' 001000  000312
4667  005467' 000000  005553'
4668  005470' 000000  005460'
4669  005471' 001000  000376   03140          CPI     81              ;SEE IF THE OPERATOR IS "AND" OR "OR"
4670  005472' 000000  000121
4671  005473' 001000  000332   03160          JC      ANDORD          ;AND IF SO "FRCINT" AND
4672  005474' 000000  005571'
4673  005475' 000000  005467'
4674                           03162                                  ;MAKE A SPECIAL STACK ENTRY
4675                           03200  ;
4676                           03220  ; THIS CODE PUSHES THE CURRENT VALUE IN THE FAC
4677                           03240  ; ONTO THE STACK, EXCEPT IN THE CASE OF STRINGS IN WHICH IT CALLS
4678                           03260  ; TYPE MISMATCH ERROR, (D) AND (E) ARE PRESERVED.
4679                           03280  ;
4680  005476' 001000  000072   03300  NUMREL: LDA     VALTYP          ;GET THE VALUE TYPE
4681  005477' 000000  001543'
```

```
 4682  005500' 000000  005474'
 4683  005501' 001000  000376   03302          CPI     3              ;AND SET THE CONDITION CODES BASED ON IT
 4684  005502' 000000  000003
 4685  005503' 001000  000312   03320          JZ      TMERR          ;BLOW UP ON STRINGS
 4686  005504' 000000  000000*
 4687  005505' 000000  005477'
 4688  005506' 001000  000041   03340          LXI     H,FACLO        ;GET POINTER TO LO IN FAC
 4689  005507' 000000  001637'
 4690  005510' 000000  005504'
 4691  005511' 001000  000116   03342          MOV     C,M
 4692  005512' 001000  000043   03344          INX     H
 4693  005513' 001000  000106   03346          MOV     B,M
 4694  005514' 001000  000043   03348          INX     H
 4695  005515' 001000  000305   03360          PUSH    B              ;PUSH FACLO+0,1 ON THE STACK
 4696  005516' 001000  000372   03380          JM      VPUSHD         ;ALL DONE IF THE DATA WAS AN INTEGER
 4697  005517' 000000  005536'
 4698  005520' 000000  005507'
 4699  005521' 001000  000116   03382          MOV     C,M
 4700  005522' 001000  000043   03384          INX     H
 4701  005523' 001000  000106   03386          MOV     B,M
 4702  005524' 001000  000043   03388          INX     H
 4703  005525' 001000  000305   03400          PUSH    B              ;PUSH FAC-1,0 ON THE STACK
 4704  005526' 001000  000342   03420          JPO     VPUSHD         ;ALL DONE IF WE HAD A SNG
 4705  005527' 000000  005536'
 4706  005530' 000000  005517'
 4707  005531' 001000  000041   03440          LXI     H,DFACLO       ;WE HAVE A DOUBLE PRECISON NUMBER
 4708  005532' 000000  001633'
 4709  005533' 000000  005527'
 4710  005534' 001000  000367   03460          PUSHM                  ;PUSH ITS 4 LO BYTES ON THE STACK
 4711  005535' 001000  000367   03480          PUSHM
 4712  005536' 001000  000113   03520  VPUSHD: MOV     C,E            ;(C)=OPERATOR NUMBER
 4713  005537' 001000  000107   03560          MOV     B,A            ;(B)=TYPE OF VALUE ON THE STACK
 4714  005540' 001000  000305   03580          PUSH    B              ;SAVE THESE THINGS FOR APPLOP
 4715  005541' 001000  000001   03600          LXI     B,APPLOP       ;GENERAL OPERATOR APPLICATION
 4716  005542' 000000  005642'
 4717  005543' 000000  005532'
 4718                            03620                                 ;ROUTINE -- DOES TYPE CONVERSIONS
 4719  005544' 001000  000305   03640  FINTMP: PUSH    B              ;SAVE PLACE TO GO
 4720  005545' 001000  000052   03660          LHLD    TEMP3          ;REGET THE TEXT POINTER
 4721  005546' 000000  001575'
 4722  005547' 000000  005542'
 4723  005550' 001000  000303   03680          JMP     LPOPER         ;PUSH ON THE PRECEDENCE AND READ MORE
 4724  005551' 000000  005341'
 4725  005552' 000000  005546'
 4726                            03700                                 ;FORMULA
 4727                            03720  ;
 4728                            03740  ; FOR EXPONENTIATION WE WANT TO FORCE THE CURRENT VALUE IN THE FAC
 4729                            03760  ; TO BE SINGLE PRECISION, WHEN APPLICATION TIME COMES WE FORCE
 4730                            03780  ; THE RIGHT HAND OPERAND TO SINGLE PRECISION AS WELL
 4731                            03800  ;
 4732  005553' 001000  000315   03820  EXPSTK: CALL    FRCSNG         ;COERCE LEFT HAND OPERAND
 4733  005554' 000000  003256*
 4734  005555' 000000  005551'
```



```
 4735  005556' 001000  000315   03840          CALL    PUSHF          ;PUT IT ON THE STACK
 4736  005557' 000000  000000*
 4737  005560' 000000  005554'
 4738  005561' 001000  000001   03860          LXI     B,FPWRQ##      ;PLACE TO COERCE RIGHT HAND
 4739  005562' 000000  000000*
 4740  005563' 000000  005557'
 4741                            03880                                 ;OPERAND AND DO EXPONENTIATION
 4742  005564' 001000  000026   03900          MVI     D,127          ;RESTORE THE PRECEDENCE
 4743  005565' 000000  000177
 4744  005566' 001000  000303   03920          JMP     FINTMP         ;FINISH ENTRY AND EVALUATE MORE FORMULA
 4745  005567' 000000  005544'
 4746  005570' 000000  005562'
 4747                            03940  ;
 4748                            03960  ; FOR "AND" AND "OR" WE WANT TO FORCE THE CURRENT VALUE IN THE
 4749                            03980  ; FAC TO BE AN INTEGER, AND AT APPLICATION TIME FORCE THE RIGHT
 4750                            04000  ; HAND OPERAND TO BE AN INTEGER
 4751                            04020  ;
 4752  005571' 001000  000325   04040  ANDORD: PUSH    D              ;SAVE THE PRECEDENCE (70 OR 80)
 4753  005572' 001000  000315   04060          CALL    FRCINT
 4754  005573' 000000  003630*
 4755  005574' 000000  005567'
 4756  005575' 001000  000321   04080          POP     D              ;(D)=PRECEDENCE
 4757  005576' 001000  000345   04100          PUSH    H              ;PUSH THE LEFT HAND OPERAND
 4758  005577' 001000  000021   04120          LXI     B,DANDOR       ;"AND" AND "OR" DOER
 4759  005600' 000000  006437'
 4760  005601' 000000  005573'
 4761  005602' 001000  000303   04140          JMP     FINTMP         ;PUSH ON THIS ADDRESS,PRECEDENCE
 4762  005603' 000000  005544'
 4763  005604' 000000  005600'
 4764                            04160                                 ;AND CONTINUE EVALUATION
 4765                            04180  ;
 4766                            04200  ; HERE TO BUILD AN ENTRY FOR A RELATIONAL OPERATOR
 4767                            04220  ; STRINGS ARE TREATED SPECIALLY, NUMERIC COMPARES ARE DIFFERENT
 4768                            04240  ; FROM MOST OPERATOR ENTRIES ONLY IN THE FACT THAT AT THE
 4769                            04260  ; BOTTOM INSTEAD OF HAVING RETAUP, DOCMP AND THE RELATIONAL
 4770                            04280  ; BITS ARE STORED, STRINGS HAVE STRCMP,THE POINTER AT THE STRING DESCRIPTOR,
 4771                            04300  ; DOCMP AND THE RELATIONAL BITS.
 4772                            04320  ;
 4773  005605' 001000  000170   04340  FINREL: MOV     A,B            ;(A)=OLD PRECEDENCE
 4774  005606' 001000  000376   04360          CPI     100            ;RELATIONALS HAVE PRECEDENCE 100
 4775  005607' 000000  000144
 4776  005610' 001000  000320   04380          RNC                    ;APPLY EARLIER OPERATOR IF IT HAS
 4777                            04400                                 ;HIGHER PRECEDENCE
 4778  005611' 001000  000305   04420          PUSH    B              ;SAVE THE OLD PRECEDENCE
 4779  005612' 001000  000325   04440          PUSH    D              ;SAVE (D)=RELATIONAL BITS
 4780  005613' 001000  000021   04460          LXI     D,$CODE+25604  ;(D)=PRECEDENCE=100
 4781  005614' 000000  262004'
 4782  005615' 000000  005603'
 4783                            04480                                 ;(E)=DISPATCH OFFSET FOR
 4784                            04500                                 ;COMPARES IN APPLOP=4
 4785                            04520                                 ;IN CASE THIS IS A NUMERIC COMPARE
 4786  005616' 001000  000041   04540          LXI     H,DOCMP        ;ROUTINE TO TAKE COMPARE ROUTINE RESULT
 4787  005617' 000000  006375'
```

```
 4788  005620' 000000  005614'
 4789                                  04560                                   ;AND RELATIONAL BITS AND RETURN THE ANSWER
 4790  005621' 001000  000345          04580          PUSH    H                ;DOES A JMP TO RETADP WHEN DONE
 4791  005622' 001000  000315          04600          CALL    GETYPE           ;SEE IF WE HAVE A NUMERIC COMPARE
 4792  005623' 000000  006307'
 4793  005624' 000000  005617'
 4794  005625' 001000  000302          04620          JNZ     NUMREL           ;YES, BUILD AN APPLOP ENTRY
 4795  005626' 000000  005476'
 4796  005627' 000000  005623'
 4797  005630' 001000  000052          04640          LHLD    FACLO            ;GET THE POINTER AT THE STRING DESCRIPTOR
 4798  005631' 000000  001637'
 4799  005632' 000000  005626'
 4800  005633' 001000  000345          04660          PUSH    H                ;SAVE IT FOR STRCMP
 4801  005634' 001000  000001          04680          LXI     B,STRCMP         ;STRING COMPARE ROUTINE
 4802  005635' 000000  006320'
 4803  005636' 000000  005631'
 4804  005637' 001000  000303          04700          JMP     FINTMP           ;PUSH THE ADDRESS, REGET THE TEXT POINTER
 4805  005640' 000000  005544'
 4806  005641' 000000  005635'
 4807                                  04720                                   ;SAVE THE PRECEDENCE AND SCAN
 4808                                  04722                                   ;MORE OF THE FORMULA
 4809                                  04740   ;
 4810                                  04760   ; APPLOP IS RETURNED TO WHEN IT IS TIME TO APPLY AN ARITHMETIC
 4811                                  04762   ; OR NUMERIC COMPARISON OPERATION,
 4812                                  04764   ; THE STACK HAS A DOUBLE BYTE ENTRY WITH THE OPERATOR
 4813                                  04766   ; NUMBER AND THE VALTYP OF THE VALUE ON THE STACK,
 4814                                  04768   ; APPLOP DECIDES WHAT VALUE LEVEL THE OPERATION
 4815                                  04770   ; WILL OCCUR AT, AND CONVERTS THE ARGUMENTS, APPLOP
 4816                                  04772   ; USES DIFFERENT CALLING CONVENTIONS FOR EACH VALUE TYPE,
 4817                                  04776   ; INTEGERS: LEFT IN [D,E] RIGHT IN [M,L]
 4818                                  04778   ; SINGLES:  LEFT IN [B,C,D,E] RIGHT IN THE FAC
 4819                                  04780   ; DOUBLES:  LEFT IN FAC   RIGHT IN ARG
 4820                                  04798   ;
 4821  005642' 001000  000301          04800   APPLOP: POP    B                ;[B]=STACK OPERAND VALUE TYPE
 4822                                  04820                                   ;[C]=OPERATOR OFFSET
 4823  005643' 001000  000171          04840          MOV     A,C              ;SAVE IN MEMORY SINCE THE STACK WILL BE BUSY
 4824  005644' 001000  000062          04860          STA     OPRTYP           ;A RAM LOCATION
 4825  005645' 000000  001544'
 4826  005646' 000000  005640'
 4827  005647' 001000  000170          04880          MOV     A,B              ;CHECK FOR DOUBLE
 4828  005650' 001000  000376          04900          CPI     8                ;PRECISION ENTRY ON THE STACK
 4829  005651' 000000  000010
 4830  005652' 001000  000312          04920          JZ      STKDBL           ;FORCE FAC TO DOUBLE
 4831  005653' 000000  005725'
 4832  005654' 000000  005645'
 4833  005655' 001000  000072          04940          LDA     VALTYP           ;SEE IF THE FAC IS DOUBLE PRECISION
 4834  005656' 000000  001543'
 4835  005657' 000000  005653'
 4836  005660' 001000  000376          04960          CPI     8                ;AND IF SO, CONVERT THE STACK OPERAND
 4837  005661' 000000  000010
 4838  005662' 001000  000312          04980          JZ      FACDBL           ;TO DOUBLE PRECISION
 4839  005663' 000000  005775'
 4840  005664' 000000  005656'
```



```
 4841  005665' 001000  000127          05000          MOV     D,A              ;SAVE THE VALUE TYPE OF THE FAC
 4842  005666' 001000  000170          05020          MOV     A,B              ;SEE IF THE STACK ENTRY IS SINGLE
 4843  005667' 001000  000376          05040          CPI     4                ;PRECISION AND IF SO, CONVERT
 4844  005670' 000000  000004
 4845  005671' 001000  000312          05060          JZ      STKSNG           ;THE FAC TO SINGLE PRECISION
 4846  005672' 000000  006021'
 4847  005673' 000000  005663'
 4848  005674' 001000  000172          05080          MOV     A,D              ;SEE IF THE FAC IS SINGLE PRECISION
 4849  005675' 001000  000376          05100          CPI     3                ;AND IF SO CONVERT THE STACK TO SINGLE
 4850  005676' 000000  000003
 4851  005677' 001000  000322          05120          JNC     FACSNG           ;PRECISION
 4852  005700' 000000  006034'
 4853  005701' 000000  005672'
 4854                                  05140                                   ;NOTE: THE STACK MUST BE INTEGER AT THIS POINT
 4855  005702' 001000  000312          05160          JZ      TMERR            ;BLOW UP ON RIGHT HAND STRING OPERAND
 4856  005703' 000000  005504*
 4857  005704' 000000  005700'
 4858  005705' 001000  000041          05180          LXI     H,INTDSP         ;INTEGER INTEGER CASE
 4859  005706' 000000  000716'
 4860  005707' 000000  005703'
 4861  005710' 001000  000006          05200          MVI     B,0              ;SPECIAL DISPATCH FOR SPEED
 4862  005711' 000000  000000
 4863  005712' 001000  000011          05220          DAD     B                ;[H,L] POINTS TO THE ADDRESS TO GO TO
 4864  005713' 001000  000011          05240          DAD     B
 4865  005714' 001000  000116          05260          MOV     C,M              ;[B,C]=ROUTINE ADDRESS
 4866  005715' 001000  000043          05280          INX     H
 4867  005716' 001000  000106          05300          MOV     B,M
 4868  005717' 001000  000321          05320          POP     D                ;[D,E]=LEFT HAND OPERAND
 4869  005720' 001000  000052          05340          LHLD    FACLO            ;[H,L]=RIGHT HAND OPERAND
 4870  005721' 000000  001637'
 4871  005722' 000000  005706'
 4872  005723' 001000  000305          05360          PUSH    B                ;DISPATCH
 4873  005724' 001000  000311          05380          RET
 4874                                  05400   ;
 4875                                  05420   ; THE STACK OPERAND IS DOUBLE PRECISION, SO
 4876                                  05440   ; THE FAC MUST BE FORCED TO DOUBLE PRECISION, MOVED INTO ARG
 4877                                  05460   ; AND THE STACK VALUE POPED INTO THE FAC
 4878                                  05480   ;
 4879  005725' 001000  000315          05500   STKDBL: CALL   FRCDBL           ;MAKE THE FAC DOUBLE PRECISION
 4880  005726' 000000  000664*
 4881  005727' 000000  005721'
 4882  005730' 001000  000315          05520          CALL    VMOVAF           ;MOVE THE FAC INTO ARG
 4883  005731' 000000  000000*
 4884  005732' 000000  005726'
 4885  005733' 001000  000341          05540          POP     H                ;POP OFF THE STACK OPERAND INTO THE FAC
 4886  005734' 001000  000042          05560          SHLD    DFACLO+2
 4887  005735' 000000  001635'
 4888  005736' 000000  005731'
 4889  005737' 001000  000341          05580          POP     H
 4890  005740' 001000  000042          05600          SHLD    DFACLO           ;STORE LOW BYTES AWAY
 4891  005741' 000000  001633'
 4892  005742' 000000  005735'
 4893  005743' 001000  000301          05620   SNGDBL: POPR                     ;POP OFF A FOUR BYTE VALUE
```

```
4894  005744' 001000  000321
4895  005745' 001000  000315          05640          CALL    MOVFR          ;INTO THE FAC
4896  005746' 000000  000000*
4897  005747' 000000  005741'
4898  005750' 001000  000315          05660   SETDBL: CALL    FRCDBL         ;MAKE SURE THE LEFT OPERAND IS
4899  005751' 000000  005726*
4900  005752' 000000  005746'
4901                                  05680                                  ;DOUBLE PRECISION
4902  005753' 001000  000041          05700          LXI     H,DBLDSP       ;DISPATCH TO A DOUBLE PRECISION ROUTINE
4903  005754' 000000  000672'
4904  005755' 000000  005751'
4905  005756' 001000  000072          05720   DODSP:  LDA     OPRTYP         ;RECALL WHICH OPERAND IT WAS
4906  005757' 000000  001544'
4907  005760' 000000  005754'
4908  005761' 001000  000007          05740          RLC                    ;CREATE A DISPATCH OFFSET, SINCE
4909                                  05760                                  ;TABLE ADDRESSES ARE TWO BYTES
4910  005762' 001000  000305          05780          PUSH    B              ;SAVE (B,C) FOR SINGLE PRECISION
4911  005763' 001000  000117          05800          MOV     C,A            ;DOUBLE BYTE OFFSET
4912  005764' 001000  000006          05820          MVI     B,0            ;INTO (B,C)
4913  005765' 000000  000000
4914  005766' 001000  000011          05840          DAD     B              ;CALCULATE LOCATION OF ROUTINE TO GO TO
4915  005767' 001000  000301          05860          POP     B              ;GET BACK (B,C) FOR SINGLE PRECISION
4916  005770' 001000  000176          05880          MOV     A,M            ;GET THE ADDRESS
4917  005771' 001000  000043          05900          INX     H
4918  005772' 001000  000146          05920          MOV     H,M
4919  005773' 001000  000157          05940          MOV     L,A
4920  005774' 001000  000351          05960          PCHL                   ;AND PERFORM THE OPERATION, RETURNING
4921                                  05980                                  ;TO RETADP, EXCEPT FOR COMPARES WHICH
4922                                  06000                                  ;RETURN TO DOCMP
4923                                  06020   ;
4924                                  06040   ; THE FAC IS DOUBLE PRECISION AND THE STACK IS EITHER
4925                                  06060   ; INTEGER OR SINGLE PRECISION AND MUST BE CONVERTED
4926                                  06080   ;
4927  005775' 001000  000305          06100   FACDBL: PUSH    B              ;SAVE THE STACK VALUE TYPE
4928  005776' 001000  000315          06120          CALL    VMOVAF         ;MOVE THE FAC INTO ARG
4929  005777' 000000  005731*
4930  006000' 000000  005757'
4931  006001' 001000  000361          06140          POP     PSW            ;POP THE STACK VALUE TYPE INTO (A)
4932  006002' 001000  000062          06160          STA     VALTYP         ;PUT IT IN VALTYP FOR THE FORCE
4933  006003' 000000  001543'
4934  006004' 000000  005777'
4935                                  06180                                  ;ROUTINE
4936  006005' 001000  000376          06200          CPI     4              ;SEE IF ITS SINGLE, SO WE KNOW
4937  006006' 000000  000004
4938                                  06220                                  ;HOW TO POP THE VALUE OFF
4939  006007' 001000  000312          06240          JZ      SNGDBL         ;IT'S SINGLE PRECISION
4940  006010' 000000  005743'
4941  006011' 000000  006003'
4942                                  06260                                  ;SO DO A POPR / CALL MOVFR
4943  006012' 001000  000341          06280          POP     H              ;POP OFF THE INTEGER VALUE
4944  006013' 001000  000042          06300          SHLD    FACLO          ;SAVE IT FOR CONVERSION
4945  006014' 000000  001637'
4946  006015' 000000  006010'
```



```
4947  006016' 001000  000303          06320          JMP     SETDBL         ;SET IT UP
4948  006017' 000000  005750'
4949  006020' 000000  006014'
4950                                  06340   ;
4951                                  06360   ; THIS IS THE CASE WHERE THE STACK IS SINGLE PRECISION
4952                                  06380   ; AND THE FAC IS EITHER SINGLE PRECISION OR INTEGER
4953                                  06400   ;
4954  006021' 001000  000315          06420   STKSNG: CALL    FRCSNG         ;CONVERT THE FAC IF NECESSARY
4955  006022' 000000  005554*
4956  006023' 000000  006017'
4957  006024' 001000  000301          06440          POPR                   ;PUT THE LEFT HAND OPERAND IN THE REGISTERS
4958  006025' 001000  000321
4959  006026' 001000  000041          06460   SNGDD:  LXI     H,SNGDSP       ;SETUP THE DISPATCH ADDRESS
4960  006027' 000000  000704'
4961  006030' 000000  006022'
4962                                  06480                                  ;FOR THE SINGLE PRECISION OPERATOR ROUTINES
4963  006031' 001000  000303          06500          JMP     DODSP          ;DISPATCH
4964  006032' 000000  005756'
4965  006033' 000000  006027'
4966                                  06520   ;
4967                                  06540   ; THIS IS THE CASE WHERE THE FAC IS SINGLE PRECISION AND THE STACK
4968                                  06560   ; IS AN INTEGER.
4969                                  06580   ;
4970  006034' 001000  000341          06600   FACSNG: POP     H              ;POP OFF THE INTEGER ON THE STACK
4971  006035' 001000  000315          06620          CALL    PUSHF          ;SAVE THE FAC ON THE STACK
4972  006036' 000000  005557*
4973  006037' 000000  006032'
4974  006040' 001000  000315          06640          CALL    CONSIM         ;CONVERT (M,L) TO A SINGLE PRECISION
4975  006041' 000000  000000*
4976  006042' 000000  006036'
4977                                  06660                                  ;NUMBER IN THE FAC
4978  006043' 001000  000315          06680          CALL    MOVRF          ;PUT THE LEFT HAND OPERAND IN THE REGISTERS
4979  006044' 000000  003261*
4980  006045' 000000  006041'
4981  006046' 001000  000341          06700          POP     H              ;RESTORE THE FAC
4982  006047' 001000  000042          06720          SHLD    FAC=1          ;FROM THE STACK
4983  006050' 000000  001641'
4984  006051' 000000  006044'
4985  006052' 001000  000341          06740          POP     H
4986  006053' 001000  000042          06760          SHLD    FACLO
4987  006054' 000000  001637'
4988  006055' 000000  006050'
4989  006056' 001000  000303          06780          JMP     SNGDD>         ;PERFORM THE OPERATION
4990  006057' 000000  006026'
4991  006060' 000000  006054'
4992
4993  006061'                         06820   EVAL:
4994                                  06840   IFN     LENGTH-2,<
4995                                  06860   IFN     STRING,<
4996                                  06880           XRA     A
4997                                  06900           STA     VALTYP>>       ;ASSUME THE VALUE WILL BE NUMERIC
4998  006061' 001000  000327          06920           CHRGET
4999  006062' 001000  000332          06940           JC      FIN            ;IF NUMERIC, INTERPRET CONSTANT
```

```
006063' 000000  005072*
006064' 000000  006057'
006065' 001000  000315      06960          CALL    ISLET          ;VARIABLE NAME?
006066' 000000  003612'
006067' 000000  006063'
006070' 001000  000322      06980          JNC     ISVAR          ;AN ALPHABETIC CHARACTER MEANS YES
006071' 000000  006164'
006072' 000000  006066'
006073' 001000  000376      07000          CPI     PLUSTK         ;IGNORE "+"
006074' 000000  000250
006075' 001000  000312      07020          JZ      EVAL
006076' 000000  006061'
006077' 000000  006071'
006100' 001000  000376      07040          CPI     "."            ;"." AS LEADING CHARACTER OF A
006101' 000000  000056
                            07060                                 ;CONSTANT?
006102' 001000  000312      07080          JZ      FIN
006103' 000000  006063*
006104' 000000  006076'
006105' 001000  000376      07100          CPI     MINUTK         ;NEGATION?
006106' 000000  000251
006107' 001000  000312      07120          JZ      DOMIN
006110' 000000  006146'
006111' 000000  006103'
                            07140   IFN    STRING,<
006112' 001000  000376      07160          CPI     34             ;STRING CONSTANT?
006113' 000000  000042
006114' 001000  000312      07180          JZ      STRLTI>        ;IF SO BUILD A DESCRIPTOR IN A TEMPORARY
006115' 000000  007640'
006116' 000000  006110'
                            07200                                 ;DESCRIPTOR LOCATION AND PUT A POINTER TO THE
                            07220                                 ;DESCRIPTOR IN FACLO.
                            07240   IFN    LENGTH,<
006117' 001000  000376      07260          CPI     NOTTK          ;CHECK FOR "NOT" OPERATOR
006120' 000000  000240
006121' 001000  000312      07280          JZ      NOTER>
006122' 000000  006412'
006123' 000000  006115'
                            07300   IFN    FUNCTS,<
006124' 001000  000376      07320          CPI     FNTK           ;USER-DEFINED FUNCTION?
006125' 000000  000243
006126' 001000  000312      07340          JZ      FNDDER>
006127' 000000  007443'
006130' 000000  006122'
006131' 001000  000326      07360          SUI     ONEFUN         ;IS IT A FUNCTION NAME?
006132' 000000  000262
006133' 001000  000322      07380          JNC     ISFUN          ;FUNCTIONS ARE THE HIGHEST
006134' 000000  006204'
006135' 000000  006127'
                            07400                                 ;NUMBERED CHARACTERS ALLOWED
                            07420                                 ;SO THERE IS NO NEED TO CHECK
                            07440                                 ;THE UPPER BOUND
006136' 001000  000317      07460   PARCHK: SYNCHK  "("           ;ONLY POSSIBILITY LEFT
```



```
006137' 000000  000050
                            07480                                 ;IS A FORMULA IN PARENTHESES
006140' 001000  000315      07500          CALL    FRMEVL         ;RECURSIVELY EVALUATE THE FORMULA
006141' 000000  005336'
006142' 000000  006134'
006143' 001000  000317      07520          SYNCHK  ")"
006144' 000000  000051
006145' 001000  000311      07540          RET
006146'                     07560   DOMIN:
                            07580   IFE    EXTFNC,<
                            07600          CALL    EVAL>          ;NO " OPERATOR IN THIS CASE
                            07620   IFN    EXTFNC,<
006146' 001000  000026      07640          MVI     D,125          ;A PRECEDENCE BELOW "
006147' 000000  000175
                            07660                                 ;BUT ABOVE ALL ELSE
006150' 001000  000315      07680          CALL    LPOPER         ;SO " GREATER THAN UNARY MINUS
006151' 000000  005341'
006152' 000000  006141'
006153' 001000  000052      07700          LHLD    TEMP2>         ;GET TEXT POINTER
006154' 000000  001605'
006155' 000000  006151'
006156' 001000  000345      07720          PUSH    H
                            07740   IFE    LENGTH=2,<
006157' 001000  000315      07760          CALL    VNEG>
006160' 000000  000000*
006161' 000000  006154'
                            07780   IFN    LENGTH=2,<
                            07800          CALL    NEG>           ;NEGATE THE FAC.
006162'                     07820   LABBCK:                       ;FUNCTIONS THAT DON'T RETURN
                            07840                                 ;STRING VALUES COME BACK HERE
                            07860   IFN    LENGTH=2,<
                            07880   IFN    STRING,<
                            07900          CALL    CHKNUM>>
006162' 001000  000341      07920          POP     H
006163' 001000  000311      07940          RET
006164' 001000  000315      07960   ISVAR: CALL    PTRGET         ;GET A POINTER TO THE
006165' 000000  006505'
006166' 000000  006160'
                            07980                                 ;VARIABLE IN [D,E]
006167' 001000  000345      08000          PUSH    H              ;SAVE THE TEXT POINTER
                            08020   IFE    STRING,<
                            08040          XCHG                   ;TRANSFER THE POINTER AT THE VALUE
                            08060                                 ;INTO [H,L]
                            08080          CALL    MOVFM>         ;SETUP FAC WITH VARIABLE VALUE
                            08100   IFN    STRING,<
006170' 001000  000353      08120          XCHG                   ;PUT THE POINTER TO THE VARIABLE VALUE
                            08140                                 ;INTO [H,L], IN THE CASE OF A STRING
                            08160                                 ;THIS IS A POINTER TO A DESCRIPTOR AND NOT
                            08180                                 ;AN ACTUAL VALUE
006171' 001000  000042      08200          SHLD    FACLO          ;IN CASE IT'S STRING STORE THE POINTER
006172' 000000  001637'
006173' 000000  006165'
                            08220                                 ;TO THE DESCRIPTOR IN FACLO.
```

```
                                        08240   IFE     LENGTH=2,<
5107  006174' 001000  000315            08260           CALL    GETYPE          ;FOR STRINGS WE JUST LEAVE
5108  006175' 000000  006307'
5109  006176' 000000  006172'
5110  006177' 001000  000304            08280           CNZ     VMOVFM>         ;A POINTER IN THE FAC
5111  006200' 000000  000000*
5112  006201' 000000  006175'
5113                                    08300   IFN     LENGTH=2,<
5114                                    08320           LDA     VALTYP
5115                                    08340           ORA     A
5116                                    08360           CZ      MOVFM>>         ;IF NOT,ACTUALLY TRANSFER THE VALUE INTO
5117                                    08380                                   ;THE FAC USING [H,L] AS THE POINTER.
5118  006202' 001000  000341            08400           POP     H               ;RESTORE THE TEXT POINTER
5119  006203' 001000  000311            08420           RET
5120  006204' 001000  000006            08440   ISFUN:  MVI     B,0
5121  006205' 000000  000000
5122  006206' 001000  000007            08460           RLC                     ;MULTIPLY BY 2
5123  006207' 001000  000117            08480           MOV     C,A
5124  006210' 001000  000305            08500           PUSH    B               ;SAVE THE FUNCTION # ON THE STACK
5125  006211' 001000  000327            08520           CHRGET
5126                                    08540   IFN     STRING,<
5127  006212' 001000  000171            08560           MOV     A,C             ;LOOK AT FUNCTION #
5128                  000051            08580   NUMGFN==2*LASNUM-2*ONEFUN+1
5129  006213' 001000  000376            08600           CPI     NUMGFN          ;IS IT PAST LASNUM?
5130  006214' 000000  000051
5131  006215' 001000  000332            08620           JC      OKNORM          ;NO,MUST BE NORMAL FUNCTION
5132  006216' 000000  006251'
5133  006217' 000000  006200'
5134                                    08640   ;
5135                                    08660   ; MOST FUNCTIONS TAKE A SINGLE ARGUMENT,
5136                                    08680   ; THE RETURN ADDRESS OF THESE FUNCTIONS IS A SMALL ROUTINE
5137                                    08700   ; THAT CHECKS TO MAKE SURE VALTYP IS 0 (NUMERIC) AND POPS OFF
5138                                    08720   ; THE TEXT POINTER, SO NORMAL FUNCTIONS THAT RETURN STRING RESULTS (I,E, CHR$)
5139                                    08740   ; MUST POP OFF THE RETURN ADDRESS OF LABBCK, AND POP OFF THE
5140                                    08760   ; TEXT POINTER AND THEN RETURN TO FRMEVL.
5141                                    08780   ;
5142                                    08800   ; THE SO CALLED "FUNNY" FUNCTIONS CAN TAKE MORE THAN ONE ARGUMENT,
5143                                    08820   ; THE FIRST OF WHICH MUST BE STRING AND THE SECOND OF WHICH
5144                                    08840   ; MUST BE A NUMBER BETWEEN 0 AND 256, THE TEXT POINTER IS
5145                                    08860   ; PASSED TO THESE FUNCTIONS SO ADDITIONAL ARGUMENTS
5146                                    08880   ; CAN BE READ, THE TEXT POINTER IS PASSED IN [D,E],
5147                                    08900   ; THE CLOSE PARENTHESIS MUST BE CHECKED AND RETURN IS DIRECTLY
5148                                    08920   ; TO FRMEVL WITH [H,L] SETUP AS THE TEXT POINTER POINTING BEYOND THE ")",
5149                                    08940   ; THE POINTER TO THE DESCRIPTOR OF THE STRING ARGUMENT
5150                                    08960   ; IS STORED ON THE STACK UNDERNEATH THE VALUE OF THE INTEGER
5151                                    08980   ; ARGUMENT (2 BYTES)
5152                                    09000   ;
5153  006220' 001000  000317            09020           SYNCHK  "("             ;FIRST ARGUMENT ALWAYS
5154  006221' 000000  000050
5155                                    09040                                   ;STRING -- SECOND INTEGER
5156  006222' 001000  000315            09060           CALL    FRMEVL          ;EAT OPEN PAREN AND FIRST ARG
5157  006223' 000000  005336'
5158  006224' 000000  006216'
```



```
5159  006225' 001000  000317            09080           SYNCHK  44              ;TWO ARGS SO COMMA MUST DELIMIT
5160  006226' 000000  000054
5161  006227' 001000  000315            09100           CALL    CHKSTR          ;MAKE SURE THE FIRST ONE WAS STRING
5162  006230' 000000  004164*
5163  006231' 000000  006223'
5164  006232' 001000  000353            09120           XCHG                    ;[D,E]=TXTPTR
5165  006233' 001000  000052            09140           LHLD    FACLO           ;GET PTR AT STRING DESCRIPTOR
5166  006234' 000000  001637'
5167  006235' 000000  006230'
5168  006236' 001000  000343            09160           XTHL                    ;GET FUNCTION #
5169                                    09180                                   ;SAVE THE STRING PTR
5170  006237' 001000  000345            09200           PUSH    H               ;PUT THE FUNCTION # ON
5171  006240' 001000  000353            09220           XCHG                    ;[H,L]=TXTPTR
5172  006241' 001000  000315            09240           CALL    GETBYT          ;[E]=VALUE OF FORMULA
5173  006242' 000000  011020'
5174  006243' 000000  006234'
5175  006244' 001000  000353            09260           XCHG                    ;TEXT POINTER INTO [D,E]
5176                                    09280                                   ;[H,L]=INT VALUE OF SECOND ARGUMENT
5177  006245' 001000  000343            09300           XTHL                    ;SAVE INT VALUE OF SECOND ARG
5178                                    09320                                   ;[H,L]=FUNCTION NUMBER
5179  006246' 001000  000303            09340           JMP     FINGO>          ;DISPATCH TO FUNCTION
5180  006247' 000000  006276'
5181  006250' 000000  006242'
5182  006251' 001000  000315            09360   OKNORM: CALL    PARCHK          ;MAKE SURE ITS THERE,
5183  006252' 000000  006136'
5184  006253' 000000  006247'
5185                                    09380                                   ;READ THE FORMULA INSIDE
5186                                    09400                                   ;AND MAKE SURE ITS FOLLOWED BY ")"
5187  006254' 001000  000343            09420           XTHL                    ;[H,L]=FUNCTION # AND SAVE TEXT POINTER
5188                                    09440   IFE     LENGTH=2,<
5189                                    09460   ;
5190                                    09480   ; CHECK IF SPECIAL COERCION MUST BE DONE FOR ONE OF THE TRANSCENDENTAL
5191                                    09500   ; FUNCTIONS (RND, SQR, COS, SIN, TAN, ATN, LOG, AND EXP)
5192                                    09520   ;
5193  006255' 001000  000175            09540           MOV     A,L             ;[A]=FUNCTION NUMBER
5194                  000016            09550   BOTCON==<SQRTK-ONEFUN>**2
5195  006256' 001000  000376            09560           CPI     BOTCON          ;LESS THAN SQUARE ROOT?
5196  006257' 000000  000016
5197  006260' 001000  000332            09580           JC      NOTFRF          ;DON'T FORCE THE ARGUMENT
5198  006261' 000000  006272'
5199  006262' 000000  006252'
5200                  000035            09590   TOPCON==<ATNTK-ONEFUN>**2+1
5201  006263' 001000  000376            09600           CPI     TOPCON          ;BIGGER THAN ARC-TANGENT?
5202  006264' 000000  000035
5203  006265' 001000  000345            09620           PUSH    H               ;SAVE THE FUNCTION NUMBER
5204  006266' 001000  000334            09640           CC      FRCSNG          ;IF NOT, FORCE FAC TO SINGLE-PRECISION
5205  006267' 000000  006022*
5206  006270' 000000  006261'
5207  006271' 001000  000341            09660           POP     H               ;RESTORE THE FUNCTION NUMBER
5208  006272'                           09680   NOTFRF: >
5209  006272' 001000  000021            09700           LXI     D,LABBCK        ;RETURN ADDRESS
5210  006273' 000000  006162'
5211  006274' 000000  006267'
```

```
5212  006275' 001000  000325   09720          PUSH    D                ;MAKE THEM REALLY COME BACK
5213  006276' 001000  000001   09740  FINGO:  LXI     B,FUNDSP         ;FUNCTION DISPATCH TABLE
5214  006277' 000000  000103'
5215  006300' 000000  006275'
5216  006301' 001000  000011   09760          DAD     B                ;ADD ON THE OFFSET
5217                           09780  IFE     LENGTH,<
5218                           09800          PUSHM
5219                           09820          RET>                     ;GO TO THE ADDRESS POINTED TO BY (H,L)
5220                           09840  IFN     LENGTH,<
5221  006302' 001000  000116   09860          MOV     C,M              ;FASTER THAN PUSHM
5222  006303' 001000  000043   09880          INX     H
5223  006304' 001000  000146   09900          MOV     M,M
5224  006305' 001000  000151   09920          MOV     L,C
5225  006306' 001000  000351   09940          PCHL>                    ;GO PERFORM THE FUNCTION
5226                           09960  IFE     LENGTH=2,<
5227                           09980  ;
5228                           10000  ; GET THE VALTYP AND SET CONDITION CODES AS FOLLOWS:
5229                           10020  ; CONDITION CODE        TRUE SET        FALSE SET
5230                           10030  ;
5231                           10040  ; SIGN                  INT=2           STR,SNG,DBL
5232                           10060  ; ZERO                  STR=3           INT,SNG,DBL
5233                           10080  ; ODD PARITY            SNG=4           INT,STR,DBL
5234                           10100  ; NO CARRY              DBL=10          INT,STR,SNG
5235                           10120  ;
5236  006307' 001000  000072   10140  GETYPE: LDA     VALTYP           ;GET THE VALTYP
5237  006310' 000000  001543'
5238  006311' 000000  006277'
5239  006312' 001000  000376   10160          CPI     8                ;SET CARRY CORRECTLY
5240  006313' 000000  000010
5241  006314' 001000  000075   10180          DCR     A                ;SET THE OTHER CONDITION CODES CORRECTLY
5242  006315' 001000  000075   10200          DCR     A                ; WITHOUT AFFECTING CARRY
5243  006316' 001000  000075   10220          DCR     A
5244  006317' 001000  000311   10240          RET>
5245
5246                           10260  IFN     LENGTH=2,<
5247                           10300  IFN     LENGTH,<
5248                           10320  OR:     XWD     "01000,"0366     ;"ORI" , FLAG AS "OR"
5249                           10340                                   ;AND USE COMMON "AND" CODE
5250                           10360  AND:    XRA     A                ;FLAG AS "AND"
5251                           10380  ANDCON:
5252                           10400          PUSH    PSW
5253                           10420  IFN     STRING,<CALL    CHKNUM>
5254                           10440          CALL    DEINT            ;GET (D,E)=INT VALUE AND CHECK SIZE
5255                           10460          POP     PSW
5256                           10480          XCHG                     ;(H,L)=INT VALUE
5257                           10500          POP     B                ;GET HIGH ORDER OFF
5258                           10520          XTHL                     ;PUT INT VALUE ON
5259                           10540                                   ;GET LOW OF SECOND ARG OFF
5260                           10560          XCHG                     ;(D,E)=LOW OF SECOND ARG
5261                           10580          CALL    MOVFR
5262                           10600          PUSH    PSW
5263                           10620          CALL    DEINT            ;GET (D,E)=INT VALUE
5264                           10640          POP     PSW
```



```
5265                           10660                                   ;OF FIRST ARG AND CHECK SIZE
5266                           10680          POP     B                ;(B,C)=INT VALUE OF SECOND ARG
5267                           10700          MOV     A,C              ;(A)=LOW OF SECOND ARG
5268                           10720          LXI     H,GIVACF         ;SETUP JUMP ADDRESS
5269                           10740          JNZ     ORFIN            ;IT WAS "OR" SO FINISH UP
5270                           10760          ANA     E                ;AND TWO LOW ORDERS
5271                           10780          MOV     C,A              ;SAVE ANSWER IN (C)
5272                           10800          MOV     A,B              ;(A)=HIGH ORDER SECOND ARG
5273                           10820          ANA     D                ;(A)=HIGH ORDER OF ANSWER
5274                           10840          PCHL                     ;FLOAT (A,C) AS ANSWER
5275                           10860  ORFIN:  ORA     E                ;OR TWO LOW ORDERS
5276                           10880          MOV     C,A              ;SAVE ANSWER LOW ORDER IN (C)
5277                           10900          MOV     A,B              ;(A)=HIGH ORDER SECOND ARG
5278                           10920          ORA     D                ;OR TWO HIGH ORDERS
5279                           10940                                   ;(A)=HIGH ORDER OF ANSWER
5280                           10960          PCHL                     ;FLOAT (A,C) AS ANSWER
5281                           10980  FINREL: LXI     H,PTDORL         ;MAKE (H,L) POINT AT OPERATOR ADDRESS
5282                           11000  IFN     STRING,<
5283                           11020          LDA     VALTYP           ;STORE VALUE TYPE AS LOW
5284                           11040          RAR                      ;ORDER BIT OF (E)
5285                           11060          MOV     A,D              ;GET RELATIONAL MEMORIES IN (A)
5286                           11080          RAL                      ;MOVE CARRY BIT IN
5287                           11100          MOV     E,A>             ;KEEP THIS BYTE IN (E)
5288                           11120  IFE     STRING,<MOV     E,D>
5289                           11140          MVI     D,100            ;PRECEDENCE OF ALL RELATIONAL
5290                           11160                                   ;OPERATORS IS 100
5291                           11180          MOV     A,B              ;(A)=PRECEDENCE OF OLD OPERATOR
5292                           11200          CMP     D                ;SEE WHETHER TO APPLY OLD OPERATOR
5293                           11220          RNC                      ;IF OLD OPERATOR HAS EQUAL OR GREATER
5294                           11240                                   ;PRECEDENCE THAN IT MUST BE APPLIED
5295                           11260          JMP     DOPREC           ;SEE IF TIME TO APPLY
5296                           11280                                   ;AND IF NOT SAVE INFO ON THE STACK
5297                           11300
5298                           11320  PTDORL: ADR(DOREL)               ;ADDRESS OF RELATIONAL
5299                           11340                                   ;OPERATOR APPLICATION
5300                           11360                                   ;ROUTINE
5301                           11380  ;
5302                           11400  ; TIME TO PERFORM A RELATIONAL OPERATOR
5303                           11420  ; (C) CONTAINS THE BITS AS TO WHICH RELATIONAL
5304                           11440  ; OPERATOR IT WAS (IF STRINGS ON
5305                           11460  ; LOW ORDER BIT SAYS WHETHER IT WAS STRING OR NOT)
5306                           11480  ;
5307                           11500  DOREL:  MOV     A,C              ;GET MEMORIES INTO (A)
5308                           11520  IFN     STRING,<
5309                           11540          ORA     A
5310                           11560          RAR>                     ;CARRY=WHETHER WAS STRING OR NOT
5311                           11580          POPR                     ;POP OFF LEFT RESULT
5312                           11600          PUSH    PSW              ;SAVE WHICH OPERATOR IT WAS
5313                           11620  IFE     STRING,<
5314                           11640          CALL    FCOMP>           ;DO A NUMERIC COMPARE
5315                           11660  IFN     STRING,<
5316                           11680          CALL    CHKVAL           ;SEE IF VALTYP MATCHES
5317                           11700                                   ;CARRY AND SET ZERO IN THE
```

```
                                        11720                                   ;NUMERIC CASE
                                        11740           LXI     H,DOCMP         ;COME BACK TO COMPARE
                                        11760           PUSH    H
                                        11780           JZ      FCOMP           ;DO NUMERIC COMPARE
                                        11800           XRA     A               ;SET VALUE TYPE AS NUMERIC
                                        11820           STA     VALTYP>>>
                                        11840   IFN     STRING,<
                                        11860   ;
                                        11880   ; THE FOLLOWING ROUTINE COMPARES TWO STRINGS
                                        11900   ; ONE WITH DESC IN [D,E] OTHER WITH DESC, IN [FACLO, FACLO+1]
                                        11920   ; A=0 IF STRINGS EQUAL
                                        11940   ; A=377 IF B,C,D,E POINTER FACLO
                                        11960   ; A=1 IF B,C,D,E ,LT, FACLO
                                        11980   ;
                                        12000   IFN     LENGTH=2,<
                                        12020   STRCMP: PUSH    D               ;SAVE DESC, POINTER TO FIRST STR,
                                        12040           CALL    FREFAC          ;FREE THE FACLO STR
                                        12060           POP     D               ;RESTORE 1ST DESC, POINTER
                                        12080           PUSHM                   ;SAVE LENGTH
                                        12100           PUSHM                   ;SAVE POINTER
                                        12120           CALL    FRETMP          ;FREES 1ST DESC, POINTER
                                        12140           CALL    MOVRM           ;[B,C] POINT AT FIRST CHAR
                                        12160                                   ;[E] HAS THE LENGTH
                                        12180           POP     H               ;GET 2ND CHARACTER POINTER IN H
                                        12200           XTHL                    ;GET 2ND CHARACTER COUNTER IN L
                                        12220           MOV     D,L>            ;SAVE IN D
                                        12240   IFE     LENGTH=2,<
006320' 001000  000315                  12260   STRCMP: CALL    FRESTR          ;FREE UP THE FAC STRING, AND GET THE
006321' 000000  010431'
006322' 000000  006310'
                                        12280                                   ;POINTER TO THE FAC DESCRIPTOR IN [H,L]
006323' 001000  000176                  12300           MOV     A,M             ;SAVE THE LENGTH OF THE FAC STRING IN [A]
006324' 001000  000043                  12320           INX     H
006325' 001000  000116                  12340           MOV     C,M             ;SAVE THE POINTER AT THE FAC STRING
                                        12342                                   ;DATA IN [B,C]
006326' 001000  000043                  12360           INX     H
006327' 001000  000106                  12380           MOV     B,M
006330' 001000  000321                  12400           POP     D               ;GET THE STACK STRING POINTER
006331' 001000  000305                  12420           PUSH    B               ;SAVE THE POINTER AT THE FAC STRING DATA
006332' 001000  000365                  12440           PUSH    PSW             ;SAVE THE FAC STRING LENGTH
006333' 001000  000315                  12460           CALL    FRETMP          ;FREE UP THE STACK STRING AND RETURN
006334' 000000  010440'
006335' 000000  006321'
                                        12480                                   ;THE POINTER TO THE STACK STRING DESCRIPTOR
                                        12500                                   ;IN [H,L]
006336' 001000  000321                  12520           POP     D               ;[D]=LENGTH OF FAC STRING
006337' 001000  000136                  12540           MOV     E,M             ;[E]=LENGTH OF STACK STRING
006340' 001000  000043                  12560           INX     H
006341' 001000  000116                  12580           MOV     C,M             ;[B,C]=POINTER AT STACK STRING
006342' 001000  000043                  12600           INX     H
006343' 001000  000106                  12620           MOV     B,M>
006344' 001000  000341                  12640           POP     H               ;GET BACK 2ND CHARACTER POINTER
006345' 001000  000173                  12660   CSLOOP: MOV     A,E             ;BOTH STRINGS ENDED
```



```
006346' 001000  000262                  12680           ORA     D               ;TEST BY OR'ING THE LENGTHS TOGETHER
006347' 001000  000310                  12700           RZ                      ;IF SO, RETURN WITH A ZERO
006350' 001000  000172                  12720           MOV     A,D             ;GET FACLO STRING LENGTH
006351' 001000  000267                  12740           ORA     A               ;IF IT ENDED, OTHER MUST NOT HAVE
006352' 001000  000057                  12760           CMA                     ;MAKE =1
006353' 001000  000310                  12780           RZ                      ;TEST
006354' 001000  000257                  12800           XRA     A               ;MUST NOT HAVE BEEN ZERO, TEST CASE
006355' 001000  000273                  12820           CMP     E               ;OF B,C,D,E STRING HAVING ENDED FIRST
006356' 001000  000074                  12840           INR     A               ;RETURN WITH A=1
006357' 001000  000320                  12860           RNC                     ;TEST THE CONDITION
                                        12880   ;HERE WHEN NEITHER STRING ENDED
006360' 001000  000025                  12900           DCR     D               ;DECREMENT BOTH CHARACTER COUNTS
006361' 001000  000035                  12920           DCR     E
006362' 001000  000012                  12940           LDAX    B               ;GET CHARACTER FROM B,C,D,E STRING
006363' 001000  000276                  12960           CMP     M               ;COMPARE WITH FACLO STRING
006364' 001000  000043                  12980           INX     H               ;BUMP POINTERS (INX DOESNT CLOBBER CC'S)
006365' 001000  000003                  13000           INX     B
006366' 001000  000312                  13020           JZ      CSLOOP          ;IF BOTH THE SAME, MUST BE MORE TO STRINGS
006367' 000000  006345'
006370' 000000  006334'
006371' 001000  000077                  13040           CMC                     ;HERE WHEN STRINGS DIFFER
006372' 001000  000303                  13060           JMP     SIGNS>          ;SET [A] ACCORDING TO CARRY
006373' 000000  000000*
006374' 000000  006367'
                                        13080   IFN     LENGTH,<
006375' 001000  000074                  13100   DOCMP:  INR     A               ;SETUP BITS
006376' 001000  000217                  13120           ADC     A               ;A=LESS 2=EQUAL 1=GREATER
006377' 001000  000321                  13140           POP     B               ;WHAT DID HE WANT?
006400' 001000  000240                  13160           ANA     B               ;ANY BITS MATCH?
006401' 001000  000306                  13180           ADI     255             ;MAP 0 TO 0
006402' 000000  000377
006403' 001000  000237                  13200           SBB     A               ;AND ALL OTHERS TO 377
                                        13220   IFE     LENGTH=2,<
006404' 001000  000315                  13240           CALL    CONIA##         ;CONVERT [A] TO AN INTEGER SIGNED
006405' 000000  000000*
006406' 000000  006373'
006407' 001000  000303                  13260           JMP     RETAOP>         ;RETURN FROM OPERATOR APPLICATION
006410' 000000  005354'
006411' 000000  006405'
                                        13280   IFN     LENGTH=2,<
                                        13300           JMP     FLOAT           ;MAKE FAC=[A] SIGNED
                                        13320                                   ;COULD FALL INTO FLOAT BUT MESSY [SAVES
                                        13340                                   ;TWO BYTES]
                                        13360
                                        13380   NOTER:  MVI     D,90            ;"NOT" HAS PRECEDENCE 90
                                        13400           CALL    LPOPER          ;GO PERFORM
                                        13420   IFN     STRING,<CALL    CHKNUM> ;MAKE SURE ITS INT
                                        13440           CALL    DEINT           ;GET VALUE IN [D,E]
                                        13460           MOV     A,E
                                        13480           CMA                     ;COMPLEMENT
                                        13500           MOV     C,A             ;[C] LOW ORDER OF ANSWER
                                        13520           MOV     A,D
                                        13540           CMA                     ;COMPLEMENT HIGH ORDER TOO
```

```
5424                                    13560          CALL    GIVACF          ;FLOAT [A,C] AS RESULT
5425                                    13580          POP     B               ;TAKE RETURN ADDRESS OF FRMEVL
5426                                    13600          JMP     RETAOP>>        ;OFF AND RETURN TO THE RIGHT
5427                                    13620                                  ;PLACE SO THE TEXT POINTER
5428                                    13640                                  ;WILL GET SET UP TO WHAT IT WAS
5429                                    13660                                  ;WHEN LPOPER RETURNED.
5430                                    13680  IFE     LENGTH-2,<
5431  006412' 001000  000026            13700  NOTER:  MVI     D,90            ;"NOT" HAS PRECEDENCE 90, SO
5432  006413' 000000  000132
5433  006414' 001000  000315            13720          CALL    LPOPER          ;FORMULA EVALUATION IS ENTERED WITH A DUMMY
5434  006415' 000000  005341'
5435  006416' 000000  006410'
5436                                    13730                                  ;ENTRY OF 90 ON THE STACK
5437  006417' 001000  000315            13740          CALL    FRCINT          ;COERCE THE ARGUMENT TO INTEGER
5438  006420' 000000  005573*
5439  006421' 000000  006415'
5440  006422' 001000  000175            13760          MOV     A,L             ;COMPLEMENT [H,L]
5441  006423' 001000  000057            13780          CMA
5442  006424' 001000  000157            13800          MOV     L,A
5443  006425' 001000  000174            13820          MOV     A,H
5444  006426' 001000  000057            13840          CMA
5445  006427' 001000  000147            13860          MOV     H,A
5446  006430' 001000  000042            13880          SHLD    FACLO           ;UPDATE THE FAC
5447  006431' 000000  001637'
5448  006432' 000000  006420'
5449  006433' 001000  000301            13900          POP     B               ;FRMEVL, AFTER SEEING THE PRECEDENCE
5450                                    13910                                  ;OF 90 THINKS IT IS APPLYING AN OPERATOR
5451                                    13915                                  ;SO IT HAS THE TEXT POINTER IN TEMP2 SO
5452
5453  006434' 001000  000303            13920          JMP     RETAOP          ;RETURN TO REFETCH IT
5454  006435' 000000  005354'
5455  006436' 000000  006431'
5456                                    14042  ;
5457                                    14044  ; DANDOR APPLIES THE "AND" AND "OR" OPERATORS
5458                                    14046  ; AND SHOULD BE USED TO IMPLEMENT ALL LOGICAL OPERATORS.
5459                                    14048  ; WHENEVER AN OPERATOR IS APPLIED, ITS PRECEDENCE IS IN [B].
5460                                    14050  ; THIS FACT IS USED TO DISTINGUISH BETWEEN "AND" AND "OR".
5461                                    14052  ; THE RIGHT HAND ARGUMENT IS COERCED TO INTEGER, JUST AS
5462                                    14054  ; THE LEFT HAND ONE WAS WHEN IT WAS PUSHED ON THE STACK.
5463                                    14056  ;
5464  006437' 001000  000305            14060  DANDOR: PUSH    B               ;SAVE THE PRECEDENCE "OR"=70
5465  006440' 001000  000315            14080          CALL    FRCINT          ;COERCE RIGHT HAND ARGUMENT TO INTEGER
5466  006441' 000000  006420*
5467  006442' 000000  006435'
5468  006443' 001000  000361            14100          POP     PSW             ;GET BACK THE PRECEDENCE TO DISTINGUISH
5469                                    14120                                  ;"AND" AND "OR"
5470  006444' 001000  000321            14140          POP     D               ;POP OFF THE LEFT HAND ARGUMENT
5471  006445' 001000  000376            14160          CPI     70              ;SET ZERO FOR "OR"
5472  006446' 000000  000106
5473  006447' 001000  000173            14180          MOV     A,E             ;SETUP LOW IN [A]
5474  006450' 001000  000312            14200          JZ      ORFIN           ;DO "OR" IF PRECEDENCE WAS 70
5475  006451' 000000  006465'
5476  006452' 000000  006441'
```



```
5477  006453' 001000  000245            14220          ANA     L
5478  006454' 001000  000157            14240          MOV     L,A
5479  006455' 001000  000174            14260          MOV     A,H
5480  006456' 001000  000242            14280          ANA     D
5481  006457' 001000  000147            14300          MOV     H,A
5482  006460' 001000  000303            14320          JMP     MAKINT          ;RETURN THE INTEGER [H,L]
5483  006461' 000000  000006*
5484  006462' 000000  006451'
5485                                    14322                                  ; AS THE "AND"ED RESULT
5486  006463' 001000  000265            14324  ORFIN:  ORA     L
5487  006464' 001000  000157            14326          MOV     L,A
5488  006465' 001000  000174            14328          MOV     A,H
5489  006466' 001000  000262            14330          ORA     D
5490  006467' 001000  000147            14332          MOV     H,A
5491  006470' 001000  000303            14334          JMP     MAKINT>         ;RETURN THE INTEGER [H,L]
5492  006471' 000000  006461*
5493  006472' 000000  006461'
5494                                    14336                                  ; AS THE "OR"ED RESULT
5495                                    14340  PAGE
```

```
 5496                                          14360   SUBTTL  DIMENSION & VARIABLE SEARCHING
 5497  006473' 001000  000053                  14380   DIMCON: DCX     H               ;SEE IF COMMA ENDED THIS VARIABLE
 5498  006474' 001000  000327                  14400           CHRGET
 5499  006475' 001000  000310                  14420           RZ                      ;IF TERMINATOR, GOOD BYE
 5500  006476' 001000  000317                  14440           SYNCHK  44              ;MUST BE COMMA
 5501  006477' 000000  000054
 5502                                          14442   ;
 5503                                          14444   ; THE "DIM" CODE SETS DIMFLG AND THEN FALLS INTO THE VARIABLE
 5504                                          14446   ; SEARCH ROUTINE. THE VARIABLE SEARCH ROUTINE LOOKS AT
 5505                                          14448   ; DIMFLG AT THREE DIFFERENT POINTS:
 5506                                          14450   ;
 5507                                          14452   ;       1) IF AN ENTRY IS FOUND, DIMFLG BEING ON INDICATES
 5508                                          14454   ;               A "DOUBLY DIMENSIONED" VARIABLE
 5509                                          14456   ;       2) WHEN A NEW ENTRY IS BEING BUILT DIMFLG'S BEING ON
 5510                                          14458   ;               INDICATES THE INDICES SHOULD BE USED FOR
 5511                                          14460   ;               THE SIZE OF EACH INDICE, OTHERWISE THE DEFAULT
 5512                                          14462   ;               OF TEN IS USED.
 5513                                          14464   ;       3) WHEN THE BUILD ENTRY CODE FINISHES, ONLY IF DIMFLG IS
 5514                                          14466   ;               OFF WILL INDEXING BE DONE
 5515                                          14468   ;
 5516  006500' 001000  000001                  14470   DIM:    LXI     B,DIMCON        ;PLACE TO COME BACK TO
 5517  006501' 000000  006473'
 5518  006502' 000000  006471'
 5519  006503' 001000  000305                  14480           PUSH    B
 5520  006504' 001000  000366                  14500           XWD     "01000,"0366    ;"ORI" NON ZERO THING
 5521                                          14520   ;
 5522                                          14540   ; ROUTINE TO READ THE VARIABLE NAME AT THE CURRENT TEXT POSITION
 5523                                          14560   ; AND PUT A POINTER TO ITS VALUE IN [D,E]. [M,L] IS UPDATED
 5524                                          14580   ; TO POINT TO THE CHARACTER AFTER THE VARIABLE NAME.
 5525                                          14600   ; VALTYP IS SETUP. NOTE THAT EVALUATING SUBSCRIPTS IN
 5526                                          14620   ; A VARIABLE NAME CAN CAUSE RECURSIVE CALLS TO PTRGET SO AT
 5527                                          14640   ; THAT POINT ALL VALUES MUST BE STORED ON THE STACK.
 5528                                          14660   ;
 5529  006505' 001000  000257                  14680   PTRGET: XRA     A               ;MAKE [A]=0
 5530  006506' 001000  000062                  14700           STA     DIMFLG          ;FLAG IT AS SUCH
 5531  006507' 000000  001542'
 5532  006510' 000000  006501'
 5533  006511' 001000  000106                  14720           MOV     B,M             ;GET FIRST CHARACTER IN [B]
 5534  006512' 001000  000315                  14740   PTRGT2: CALL    ISLET           ;CHECK FOR LETTER
 5535  006513' 000000  003612'
 5536  006514' 000000  006507'
 5537  006515' 001000  000332                  14760           JC      SNERR           ;MUST HAVE A LETTER
 5538  006516' 000000  002072'
 5539  006517' 000000  006513'
 5540  006520' 001000  000257                  14780           XRA     A
 5541  006521' 001000  000117                  14800           MOV     C,A             ;ASSUME NO SECOND CHARACTER
 5542                                          14820   IFN     LENGTH=2,<
 5543                                          14840   IFN     STRING,<
 5544                                          14860           STA     VALTYP>>        ;DEFAULT IS ZERO (NUMERIC)
 5545  006522' 001000  000327                  14880           CHRGET          ;GET THE FOLLOWING CHARACTER
 5546                                          14900   IFE     LENGTH,<
 5547                                          14920           JNC     NOSEC>          ;ONLY NUMBERS ALLOWED
 5548                                          14940   IFN     LENGTH,<
```



```
 5549  006523' 001000  000332                  14960           JC      ISSEC           ;CARRY SET BY CHRGET IF CHARACTER IS
 5550  006524' 000000  006534'
 5551  006525' 000000  006516'
 5552                                          14980                                   ;NUMERIC
 5553  006526' 001000  000315                  15000           CALL    ISLET           ;SET CARRY IF NOT ALPHABETIC
 5554  006527' 000000  003612'
 5555  006530' 000000  006524'
 5556  006531' 001000  000332                  15020           JC      NOSEC>          ;ALLOW ALPHABETICS
 5557  006532' 000000  006547'
 5558  006533' 000000  006527'
 5559  006534' 001000  000117                  15040   ISSEC:  MOV     C,A             ;IT IS A NUMBER--SAVE IN C
 5560  006535' 001000  000327                  15060   EATEM:  CHRGET                  ;LOOK AT NEXT CHARACTER
 5561                                          15080   IFN LENGTH,<
 5562  006536' 001000  000332                  15100           JC      EATEM           ;SKIP NUMERICS
 5563  006537' 000000  006535'
 5564  006540' 000000  006532'
 5565  006541' 001000  000315                  15120           CALL    ISLET
 5566  006542' 000000  003612'
 5567  006543' 000000  006537'
 5568  006544' 001000  000322                  15140           JNC     EATEM>          ;SKIP ALPHABETICS
 5569  006545' 000000  006535'
 5570  006546' 000000  006542'
 5571  006547'                                 15160   NOSEC:
 5572                                          15180   IFE     LENGTH-2,<
 5573  006547' 001000  000021                  15200           LXI     D,HAVTYP        ;SAVE JUMPS BY USING RETURN ADDRESS
 5574  006550' 000000  006574'
 5575  006551' 000000  006545'
 5576  006552' 001000  000325                  15220           PUSH    D
 5577  006553' 001000  000026                  15240           MVI     D,8             ;ASSUME ITS DOUBLE PRECISION
 5578  006554' 000000  000010
 5579  006555' 001000  000376                  15260           CPI     "#"             ;CHECK THE CHARACTER
 5580  006556' 000000  000043
 5581  006557' 001000  000310                  15280           RZ                      ;WHEN WE MATCH, SETUP VALTYP
 5582  006560' 001000  000026                  15300           MVI     D,2             ;CHECK FOR INTEGER
 5583  006561' 000000  000002
 5584  006562' 001000  000376                  15320           CPI     "%"
 5585  006563' 000000  000045
 5586  006564' 001000  000310                  15340           RZ
 5587  006565' 001000  000024                  15360           INR     D               ;CHECK FOR STRING
 5588  006566' 001000  000376                  15380           CPI     "$"
 5589  006567' 000000  000044
 5590  006570' 001000  000310                  15400           RZ
 5591  006571' 001000  000024                  15420           INR     D               ;SINGLE PRECISION IS THE DEFAULT
 5592  006572' 001000  000053                  15440           DCX     H               ;NO MARKING CHARACTER
 5593  006573' 001000  000311                  15460           RET                     ;GET RID OF RETURN ADDRESS
 5594  006574' 001000  000172                  15480   HAVTYP: MOV     A,D             ;SETUP VALTYP
 5595  006575' 001000  000062                  15500           STA     VALTYP
 5596  006576' 000000  001543'
 5597  006577' 000000  006550'
 5598  006600' 001000  000327                  15520           CHRGET>                 ;READ PAST TYPE MARKER
 5599                                          15540   IFN     LENGTH=2,<
 5600                                          15560   IFN     STRING,<
 5601                                          15580           SUI     "$"             ;IS IT A STRING?
```

```
                                        15600          JNZ     NOTSTR          ;IF NOT VALTYP ALREADY=0
                                        15620          INR     A               ;[A]=1
                                        15640          STA     VALTYP          ;FLAG THIS AS A STRING
                                        15660          RRC                     ;MAKE [A]=128
                                        15680          ADD     C               ;MAKE [A]=SECOND CHARACTER
                                        15700          MOV     C,A             ;BACK INTO [C] WITH STRING BIT ON
                                        15720          CHRGET                  ;GET CHARACTER AFTER "S"
                                        15740  NOTSTR: >>
                                        15760  IFN     LENGTH,<
006601' 001000  000072                  15780          LDA     SUBFLG          ;GET FLAG WHETHER TO ALLOW ARRAYS
006602' 000000  001601'
006603' 000000  006576'
006604' 001000  000026                  15800          ADD     M>              ;ADD ONTO CHARACTER
                                        15820          CPI     "("             ;ARRAY PERHAPS (IF SUBFLG SET NEVER WILL MATCH)
006605' 001000  000376
006606' 000000  000050
006607' 001000  000312                  15840          JZ      ISARY           ;IT IS!
006610' 000000  006745'
006611' 000000  006602'
                                        15860  IFN     LENGTH,<
006612' 001000  000257                  15880          XRA     A               ;ALLOW PARENS AGAIN
006613' 001000  000062                  15900          STA     SUBFLG>         ;SAVE IN FLAG LOCATION
006614' 000000  001601'
006615' 000000  006610'
006616' 001000  000345                  15920          PUSH    H               ;SAVE THE TEXT POINTER
                                        15960  IFE     LENGTH=2,<
006617' 001000  000172                  15980          MOV     A,D             ;VALUE TYPE INTO [A]
006620' 001000  000052                  15990          LHLD    VARTAB          ;[H,L]=PLACE TO START THE SEARCH
006621' 000000  001621'
006622' 000000  006614'
006623' 001000  000365                  16000  LOPFND: PUSH    PSW             ;SAVE THE VALUE TYPE
006624' 001000  000353                  16020          XCHG                    ;[D,E]=POINTER INTO SIMPLE VARIABLES
006625' 001000  000052                  16040          LHLD    ARYTAB          ;[H,L]=END OF SIMPLE VARIABLES
006626' 000000  001623'
006627' 000000  006621'
006630' 001000  000347                  16060          COMPAR                  ;SEE IF THE END HAS BEEN REACHED
006631' 001000  000341                  16080          POP     H               ;[H]=VALTYP
006632' 001000  000312                  16100          JZ      NOTFNS          ;COULDN'T FIND IT, SO MAKE A NEW ENTRY
006633' 000000  006671'
006634' 000000  006626'
006635' 001000  000032                  16120          LDAX    D               ;GET THE VALTYP OF THIS SIMPLE VARIABLE
006636' 001000  000157                  16140          MOV     L,A             ;SAVE SO WE KNOW HOW MUCH TO SKIP
006637' 001000  000274                  16160          CMP     H               ;COMPARE WITH OUR VALTYP
006640' 001000  000023                  16180          INX     D
006641' 001000  000302                  16200          JNZ     NOTIT1          ;NOT RIGHT KIND -- SKIP IT
006642' 000000  006660'
006643' 000000  006633'
006644' 001000  000032                  16220          LDAX    D               ;[A]=FIRST CHARACTER OF THIS VARIABLE
006645' 001000  000271                  16240          CMP     C               ;SEE IF OUR VARIABLE MATCHES
006646' 001000  000302                  16260          JNZ     NOTIT1
006647' 000000  006660'
006650' 000000  006642'
006651' 001000  000023                  16280          INX     D
```



```
006652' 001000  000032                  16300          LDAX    D               ;SEE IF SECOND CHACRACTER MATCHES
006653' 001000  000270                  16320          CMP     B
006654' 001000  000312                  16340          JZ      FINPTR          ;THAT WAS IT, ALL DONE
006655' 000000  006742'
006656' 000000  006647'
006657' 001000  000076                  16360          XRD     "01000,"076     ;"MVI A," AROUND THIS INX SINCE THE POINTER
                                        16380                                  ;IS ALREADY INCREMENTED
006660' 001000  000023                  16400  NOTIT1: INX     D
006661' 001000  000023                  16420          INX     D
006662' 001000  000174                  16440          MOV     A,M             ;SKIP OVER THE
                                        16460                                  ;CURRENT VARIABLE SINCE WE DIDN'T MATCH
                                        16480                                  ;SAVE THE VALTYP IN [A]
006663' 001000  000046                  16500          MVI     M,0             ;[M,L]=NUMBER OF BYTES TO SKIP
006664' 000000  000000
006665' 001000  000031                  16520          DAD     D               ;ADD ON THE POINTER
006666' 001000  000303                  16540          JMP     LOPFND          ;AND SEARCH SOME MORE
006667' 000000  006623'
006670' 000000  006655'
006671' 001000  000305                  16560  NOTFNS: PUSH    B               ;SAVE THE LOOKS
006672' 001000  000114                  16580          MOV     C,M             ;[B,C]=LENGTH OF THIS VARIABLE
006673' 001000  000107                  16600          MOV     B,A             ;[B]=0
006674' 001000  000305                  16620          PUSH    B               ;SAVE THE VALTYP ON THE STACK
006675' 001000  000023                  16640          INX     B               ;MAKE THE LENGTH INCLUDE
                                        16660                                  ;THE LOOKS TOO
006676' 001000  000023                  16680          INX     B
006677' 001000  000023                  16700          INX     B>
                                        16720  IFN     LENGTH=2,<
                                        16730          LHLD    ARYTAB          ;PLACE TO STOP SEARCHING
                                        16740          XCHG
                                        16760          LHLD    VARTAB          ;GET THE PLACE TO START
                                        16780  LOPFND: COMPAR                  ;SEE IF WE ARE THERE
                                        16800          JZ      NOTFNS          ;COULDN'T FIND THIS VARIABLE
                                        16820                                  ;SO MAKE ROOM FOR IT
                                        16840          MOV     A,C
                                        16860          SUB     M               ;IS THIS VARIABLE THE ONE?
                                        16880          INX     M
                                        16900          JNZ     NOTIT           ;NOPE
                                        16920          MOV     A,B
                                        16940          SUB     M               ;TRY SECOND CHARACTER MATCHING
                                        16960  NOTIT:  INX     M
                                        16980          JZ      FINPTR          ;THAT WAS IT!
                                        17000          INX     M               ;SKIP OVER THAT ONE--NOT IT
                                        17020          INX     M
                                        17040          INX     M
                                        17060          INX     M
                                        17080          JMP     LOPFND          ;TRY AGAIN
                                        17100  NOTFNS: PUSH    B               ;REMEMBER WHAT THIS
                                        17120                                  ;VARIABLE LOOKS LIKE
                                        17140          LXI     B,6+$CODE>      ;THE AMOUNT TO SHOVE
                                        17160                                  ;EVERYTHING UP BY
006700' 001000  000052                  17180          LHLD    STREND          ;THE CURRENT END OF STORAGE
006701' 000000  001625'
006702' 000000  006667'
```

```
5708  006703' 001000  000345   17200          PUSH    H          ;SAVE THIS #
5709  006704' 001000  000011   17220          DAD     B          ;ADD ON THE AMOUNT OF SPACE
5710                           17240                             ;EXTRA NOW BEING USED
5711  006705' 001000  000301   17260          POP     B          ;POP OFF HIGH ADDRESS TO MOVE
5712  006706' 001000  000345   17280          PUSH    H          ;SAVE NEW CANDIDATE FOR STREND
5713  006707' 001000  000315   17300          CALL    BLTU       ;BLOCK TRANSFER AND MAKE SURE
5714  006710' 000000  002005'
5715  006711' 000000  006701'
5716                           17320                             ;WE ARE NOT OVERFLOWING THE
5717                           17340                             ;STACK SPACE
5718  006712' 001000  000341   17360          POP     H          ;[H,L]=NEW STREND
5719  006713' 001000  000042   17380          SHLD    STREND     ;STORE SINCE WAS OK
5720  006714' 000000  001625'
5721  006715' 000000  006710'
5722                           17400                             ;THERE WAS ROOM, AND BLOCK TRANSFER
5723                           17420                             ;WAS DONE, SO UPDATE POINTERS
5724  006716' 001000  000140   17440          MOV     H,B        ;GET BACK [H,L] POINTING AT THE END
5725  006717' 001000  000151   17460          MOV     L,C        ;OF THE NEW VARIABLE
5726  006720' 001000  000042   17480          SHLD    ARYTAB     ;UPDATE THE ARRAY TABLE POINTER
5727  006721' 000000  001623'
5728  006722' 000000  006714'
5729  006723' 001000  000053   17500  ZEROEK: DCX     H          ;[H,L] IS RETURNED POINTING TO THE
5730  006724' 001000  000066   17520          MVI     M,0        ;END OF THE VARIABLE SO WE
5731  006725' 000000  000000
5732  006726' 001000  000347   17540          COMPAR             ;ZERO BACKWARDS TO [D,E] WHICH
5733  006727' 001000  000302   17560          JNZ     ZEROEK     ;POINTS TO THE START OF THE VARIABLE
5734  006730' 000000  006723'
5735  006731' 000000  006721'
5736                           17580  IFE     LENGTH-2,<
5737  006732' 001000  000321   17600          POP     D          ;[E]=VALTYP
5738  006733' 001000  000163   17620          MOV     M,E        ;STORE AS PART OF THE LOOKS
5739  006734' 001000  000043   17640          INX     H>
5740  006735' 001000  000321   17660          POP     D
5741  006736' 001000  000163   17680          MOV     M,E        ;PUT DESCRIPTION
5742  006737' 001000  000043   17700          INX     H
5743  006740' 001000  000162   17720          MOV     M,D        ;OF THIS VARIABLE
5744                           17740                             ;INTO MEMORY
5745                           17760  IFE     LENGTH-2,<
5746  006741' 001000  000353   17780          XCHG               ;POINTER AT VARIABLE INTO [D,E]
5747  006742' 001000  000023   17800  FINPTR: INX     D>         ;POINT AT THE VALUE
5748                           17820  IFN     LENGTH-2,<
5749                           17840          INX     H
5750                           17860  FINPTR: XCHG>              ;VARIABLE POINTER INTO [D,E]
5751  006743' 001000  000341   17880          POP     H          ;RESTORE THE TEXT POINTER
5752  006744' 001000  000311   17900          RET
5753
5754                           17940  IFE     MULDIM,<
5755                           17960  ISARY:  PUSH    B          ;REMEMBER WHAT VARIABLE LOOKS
5756                           17980                             ;LIKE
5757                           18000  IFN     STRING,<
5758                           18020          PUSH    H          ;SAVE THE TXTPTR
5759                           18040          LHLD    DIMFLG     ;[L]=DIMFLG [H]=VALTYP
5760                           18060          XTHL>              ;PUT VALTYP AND DIMFLG ON THE STACK
```



```
5761                           18080                             ;AND RESTORE THE TEXT POINTER
5762                           18100  IFE     STRING,<
5763                           18120          LDA     DIMFLG     ;SINCE THIS CALL IS RECURSIVE
5764                           18140          PUSH    PSW>       ;DIMFLG MUST BE SAVED ON THE STACK
5765                           18160          CALL    INTIDX     ;EVALUATE THE INDEX INTO [D,E]
5766                           18180          SYNCHK  ")"        ;MAKE SURE HE CLOSED IT
5767                           18200  IFN     STRING,<
5768                           18220          XTHL               ;[L]=DIMFLG [H]=VALTYP
5769                           18240                             ;TEXT POINTER ONTO THE STACK
5770                           18260          SHLD    DIMFLG     ;SAVE BOTH VALUES BACK
5771                           18280          POP     H>         ;RESTORE THE TEXT POINTER
5772                           18300  IFE     STRING,<
5773                           18320          POP     PSW        ;GET DIMFLG OFF THE STACK
5774                           18340          STA     DIMFLG>    ;RESTORE IT
5775                           18360          XTHL               ;[H,L] GET VARIABLE DESCRIPTOR
5776                           18380                             ;TEXT POINTER IS PUT ONTO
5777                           18400                             ;THE STACK
5778                           18420          XCHG               ;[D,E]=DESCRIPTOR
5779                           18440                             ;[H,L]=INDEX
5780                           18460          DAD     H          ;MULTIPLY BY 4 TO GET
5781                           18480          DAD     H          ;BYTE OFFSET
5782                           18500          PUSH    H          ;SAVE THE INDEX
5783                           18520          LHLD    ARYTAB     ;PLACE TO START SEARCH
5784                           18540          XWD     "D1000,1   ;"LXI B," OVER THE NEXT 2
5785                           18560  LOPFD2: POP     B          ;[B,C]=LENGTH OF LAST VARIABLE
5786                           18580          DAD     B          ;SKIP OVER LAST VARIABLE BY ADDING ITS
5787                           18600                             ;LENGTH ONTO [H,L]
5788                           18620          XCHG               ;[D,E] GET CURRENT SEARCH POINT
5789                           18640          PUSH    H          ;SAVE THE VARIABLE LOOK
5790                           18660          LHLD    STREND     ;GET PLACE TO STOP
5791                           18680          COMPAR             ;SEE IF WE ARE THERE
5792                           18700          XCHG               ;[H,L] GETS SEARCH POINT
5793                           18720          POP     D          ;POP OFF VARIABLE LOOKS
5794                           18740          JZ      NOTFDO     ;COULDN'T FIND IT
5795                           18760          PUSHM              ;PUT ON LOOKS OF VARIABLE
5796                           18780                             ;WE ARE EXAMINING
5797                           18800          XTHL               ;PUT [H,L] ON THE STACK AND
5798                           18820                             ;LOOKS OF VARIABLE WE ARE
5799                           18840                             ;EXAMINING INTO [H,L]
5800                           18860          COMPAR             ;IS THIS THE VARIABLE
5801                           18880          POP     H          ;POP OFF SEARCH POINTER
5802                           18900          PUSHM              ;PUSH LENGTH OF VARIABLE
5803                           18920                             ;BEING EXAMINED ONTO THE STACK
5804                           18940          JNZ     LOPFD2     ;IF NO MATCH,GO LOOK SOMEMORE
5805                           18960          LDA     DIMFLG     ;IS THIS VARIABLE TRYING TO BE
5806                           18980                             ;DIMENSIONED AND ALREADY
5807                           19000          ORA     A          ;EXISTS?
5808                           19020          MVI     E,ERROD    ;THATS ERROR ERROD
5809                           19040          JNZ     ERROR
5810                           19060  MAKDFN: POP     D          ;POP OFF LENGTH OF THIS VARIABLE
5811                           19080          DCX     D          ;DECREMENT LENGTH SO WE CAN
5812                           19100                             ;JUST LOOK AT 'CARRY' AFTER
5813                           19120                             ;CALLING COMPAR
```

```
                                19140          XTHL                    ;TRADE POINTER AT VARIABLE WITH
                                19160                                  ;INDEX INTO THE VARIABLE
                                19180          COMPAR                  ;SEE IF INDEX IS TOO BIG
                                19200          MVI     E,ERRBS         ;THATS ERROR ERRBS
                                19220          JNC     ERROR           ;SINCE LENGTH REALLY HAS AN
                                19240                                  ;EXTRA ONE ADDED TO IT
                                19260                                  ;IF INDEX-LENGTH DOESN'T CARRY
                                19280                                  ;HE IS IN TROUBLE
                                19300          POP     D               ;POP OFF POINTER AT VARIABLE
                                19320          DAD     D               ;ADD IT TO THE INDEX
                                19340          POP     D               ;POP OFF TEXT POINTER
                                19360          XCHG                    ;TEXT POINTER INTO [H,L]
                                19380          RET                     ;VARIABLE POINTER INTO [D,E]
                                19400
                                19420  NOTFOD: MOV     M,E             ;PUT LOOKS DOWN
                                19440          INX     H
                                19460          MOV     M,D
                                19480          INX     H
                                19500          LXI     D,$CODE+44      ;DEFAULT SIZE IS 10
                                19520          LDA     DIMFLG          ;ARE WE DIMENSIONING
                                19540          ORA     A
                                19560          JZ      NOTDIM
                                19580          POP     D               ;POP OFF INDEX
                                19600          PUSH    D               ;PUT INDEX BACK ON
                                19620          INX     D
                                19640          INX     D
                                19660          INX     D
                                19680          INX     D
                                19700  NOTDIM: PUSH    D
                                19720          MOV     M,E             ;PUT LENGTH DOWN
                                19740          INX     H
                                19760          MOV     M,D
                                19780          INX     H
                                19800          PUSH    H
                                19820          DAD     D
                                19840          CALL    REASON          ;MAKE SURE WE'RE NOT RUNNING
                                19860                                  ;INTO THE STACK
                                19880          SHLD    STREND          ;SETUP NEW STORAGE END
                                19900          POP     D
                                19920  ZERIT2: DCX     H
                                19940          MVI     M,0
                                19960          COMPAR
                                19980          JNZ     ZERIT2
                                20000          JMP     MAKOFN>         ;FINISH UP

                                20040  PAGE
```



```
                                20060  SUBTTL  MULTIPLE DIMENSION CODE

                                20100  IFN     MULDIM,<
                                20120  ;
                                20140  ; FORMAT OF ARRAYS IN CORE
                                20160  ;
                                20180  ; DESCRIPTOR
                                20200  ;       LOW BYTE = SECOND CHARCTER (200 BIT IS STRING FLAG)
                                20220  ;       HIGH BYTE = FIRST CHARACTER
                                20240  ; LENGTH OF ARRAY IN CORE IN BYTES (DOES NOT INCLUDE DESCRIPTOR)
                                20260  ; NUMBER OF DIMENSIONS 1 BYTE
                                20280  ; FOR EACH DIMENSION STARTING WITH THE FIRST A LIST
                                20300  ; (2 BYTES EACH) OF THE MAX INDICE+1
                                20320  ; THE VALUES
                                20340  ;
006745' 001000  000345          20360  ISARY:  PUSH    H               ;SAVE DIMFLG AND VALTYP FOR RECURSION
006746' 001000  000052          20380          LHLD    DIMFLG
006747' 000000  001542'
006750' 000000  006730'
006751' 001000  000343          20400          XTHL                    ;TEXT POINTER BACK INTO [H,L]
006752' 001000  000026          20420          MVI     D,0             ;SET # DIMENSIONS =0
006753' 000000  000000
006754' 001000  000325          20440  INDLOP: PUSH    D               ;SAVE NUMBER OF DIMENSIONS
006755' 001000  000325          20460          PUSH    B               ;SAVE LOOKS
006756' 001000  000315          20480          CALL    INTIOX          ;EVALUATE INDICE INTO [D,E]
006757' 000000  003622'
006760' 000000  006747'
006761' 001000  000301          20500          POP     B               ;POP OFF THE LOOKS
006762' 001000  000361          20520          POP     PSW             ;[A] = NUMBER OF DIMENSIONS SO FAR
006763' 001000  000353          20540          XCHG                    ;[D,E]=TEXT POINTER
                                20560                                  ;[H,L]=INDICE
006764' 001000  000343          20580          XTHL                    ;PUT THE INDICE ON THE STACK
                                20600                                  ;[H,L]=VALTYP & DIMFLG
006765' 001000  000345          20620          PUSH    H               ;RESAVE VALTYP AND DIMFLG
006766' 001000  000353          20640          XCHG                    ;[H,L]=TEXT POINTER
006767' 001000  000074          20660          INR     A               ;INCREMENT # OF DIMENSIONS
006770' 001000  000127          20680          MOV     D,A             ;[D]=NUMBER OF DIMENSIONS
006771' 001000  000176          20700          MOV     A,M             ;GET TERMINATING CHARACTER
006772' 001000  000376          20720          CPI     44              ;A COMMA SO MORE INDICES FOLLOW?
006773' 000000  000054
006774' 001000  000312          20740          JZ      INDLOP          ;IF SO, READ MORE
006775' 000000  006754'
006776' 000000  006757'
006777' 001000  000317          20760          SYNCHK  ")"             ;MAKE SURE IT ENDED PROPERLY
007000' 000000  000051
007001' 001000  000042          20780          SHLD    TEMP2           ;SAVE THE TEXT POINTER
007002' 000000  001605'
007003' 000000  006775'
007004' 001000  000341          20800          POP     H               ;[H,L]= VALTYP & DIMFLG
007005' 001000  000042          20820          SHLD    DIMFLG          ;SAVE VALTYP AND DIMFLG
007006' 000000  001542'
007007' 000000  007002'
007010' 001000  000325          20840          PUSH    D               ;SAVE NUMBER OF DIMENSIONS
```

```
                                        20860   ;
                                        20880   ; AT THIS POINT [B,C]=LOOKS, THE TEXT POINTER IS IN TEMP2.
                                        20900   ; THE INDICES ARE ALL ON THE STACK, FOLLOWED BY THE NUMBER OF DIMENSIONS.
                                        20920   ;
007011' 001000  000052                  20940           LHLD    ARYTAB          ;[H,L]=PLACE TO START THE SEARCH
007012' 000000  001623'
007013' 000000  007006'
007014' 001000  000076                  20960           XWD     ^O1000,^O76     ;"MVI A," AROUND THE NEXT BYTE
007015' 001000  000031                  20980   LOPFDA: DAD     D               ;SKIP OVER THIS ARRAY SINCE IT'S
                                        21000                                   ;NOT THE ONE
007016' 001000  000353                  21020           XCHG                    ;[D,E]=CURRENT SEARCH POINT
007017' 001000  000052                  21040           LHLD    STRENO          ;GET THE PLACE TO STOP INTO [H,L]
007020' 000000  001625'
007021' 000000  007012'
007022' 001000  000353                  21050           XCHG                    ;[H,L]=SEARCH POINT
007023' 001000  000347                  21060           COMPAR                  ;STOPPING TIME?
                                        21080   IFE     LENGTH=2,<
007024' 001000  000072                  21100           LDA     VALTYP>
007025' 000000  001543'
007026' 000000  007020'
007027' 001000  000312                  21120           JZ      NOTFDO          ;YES,COULDN'T FIND THIS ARRAY
007030' 000000  007104'
007031' 000000  007025'
                                        21140   IFE     LENGTH=2,<
007032' 001000  000276                  21160           CMP     M               ;SEE IF THE VALTYPS ARE THE SAME
007033' 001000  000043                  21180           INX     H
007034' 001000  000302                  21200           JNZ     NMARY2>
007035' 000000  007050'
007036' 000000  007030'
007037' 001000  000176                  21240           MOV     A,M             ;GET FIRST CHARACTER
007040' 001000  000271                  21260           CMP     C               ;SEE IF IT MATCHES
007041' 001000  000043                  21280           INX     H
007042' 001000  000302                  21300           JNZ     NMARY1          ;NOT THIS ONE
007043' 000000  007051'
007044' 000000  007035'
007045' 001000  000176                  21320           MOV     A,M             ;GET SECOND CHARACTER
007046' 001000  000270                  21340           CMP     B               ;ANOTHER MATCH?
                                        21360   IFE     LENGTH=2,<
007047' 001000  000076                  21380           XWD     ^O1000,^O76     ;SKIP THIS INCREMENT WITH "MVI A,"
007050' 001000  000043                  21400   NMARY2: INX     H>
007051' 001000  000043                  21420   NMARY1: INX     H               ;POINT TO SIZE ENTRY
007052' 001000  000136                  21440           MOV     E,M             ;[D,E]=LENGTH
007053' 001000  000043                  21460           INX     H               ;OF THE ARRAY BEING LOOKED AT
007054' 001000  000126                  21480           MOV     D,M
007055' 001000  000043                  21500           INX     H
007056' 001000  000302                  21520           JNZ     LOPFDA          ;IF NO MATCH, SKIP THIS ONE
007057' 000000  007015'
007060' 000000  007043'
                                        21540                                   ;AND TRY AGAIN
007061' 001000  000072                  21560           LDA     DIMFLG          ;SEE IF CALLED BY "DIM"
007062' 000000  001542'
007063' 000000  007057'
007064' 001000  000267                  21580           ORA     A               ;ZERO MEANS NO
```



```
007065' 001000  000036                  21600           MVI     E,ERRDD         ;"DOUBLY DIMENSIONED" ERROR
007066' 000000  000012
007067' 001000  000302                  21620           JNZ     ERROR
007070' 000000  002102'
007071' 000000  007062'
                                        21640   ;
                                        21660   ; TEMP2=THE TEXT POINTER
                                        21680   ; WE HAVE LOCATED THE VARIABLE WE WERE LOOKING FOR
                                        21700   ; AT THIS POINT [M,L] POINTS BEYOND THE SIZE TO THE NUMBER OF DIMENSIONS
                                        21720   ; THE INDICES ARE ON THE STACK FOLLOWED BY THE NUMBER OF DIMENSIONS
                                        21740   ;
007072' 001000  000361                  21760           POP     PSW             ;[A]=NUMBER OF DIMENSIONS
007073' 001000  000276                  21780           CMP     M               ;MAKE SURE THE NUMBER GIVEN NOW AND
                                        21800                                   ;AND WHEN THE ARRAY WAS SET UP ARE THE
                                        21820                                   ;SAME
007074' 001000  000312                  21840           JZ      GETDEF          ;JUMP OFF AND READ
007075' 000000  007245'
007076' 000000  007070'
                                        21860                                   ;THE INDICES....
007077' 001000  000036                  21880   BSERR:  MVI     E,ERRBS         ;"SUBSCRIPT OUT OF RANGE"
007100' 000000  000011
007101' 001000  000303                  21900           JMP     ERROR
007102' 000000  002102'
007103' 000000  007075'
                                        21920   ;
                                        21940   ; HERE WHEN VARIABLE IS NOT FOUND IN THE ARRAY TABLE
                                        21960   ;
                                        21980   ; BUILDING AN ENTRY:
                                        22000   ;
                                        22020   ;       PUT DOWN THE DESCRIPTOR
                                        22040   ;       SETUP NUMER OF DIMENSIONS
                                        22060   ;       MAKE SURE THERE IS ROOM FOR THE NEW ENTRY
                                        22080   ;       REMEMBER VARPTR
                                        22100   ;       TALLY=0 (VALTYP FOR THE EXTENDED)
                                        22120   ;       SKIP 2 LOCS FOR LATER FILL IN -- THE SIZE
                                        22140   ; LOOP: GET AN INDICE
                                        22160   ;       PUT NUMBER +1 DOWN AT VARPTR AND INCREMENT VARPTR
                                        22180   ;       TALLY= TALLY * NUMBER+1
                                        22200   ;       DECREMENT NUMBER-DIMS
                                        22220   ;       JNZ     LOOP
                                        22240   ;       CALL REASON WITH [M,L] REFLECTING LAST LOC OF VARIABLE
                                        22260   ;       UPDATE STRENO
                                        22280   ;       ZERO BACKWARDS
                                        22300   ;       MAKE TALLY INCLUDE MAXDIMS
                                        22320   ;       PUT DOWN TALLY
                                        22340   ;       IF CALLED BY DIMENSION, RETURN
                                        22360   ;       OTHERWISE INDEX INTO THE VARIABLE AS IF IT
                                        22380   ;       WERE FOUND ON THE INITIAL SEARCH
                                        22400   ;
007104'                                 22420   NOTFDO:
                                        22440   IFE     LENGTH=2,<
007104' 001000  000167                  22460           MOV     M,A             ;PUT DOWN THE VARIABLE TYPE
007105' 001000  000043                  22480           INX     H
```

```
6019  007106' 001000  000137          22500          MOV    E,A
6020  007107' 001000  000026          22520          MVI    D,0>          ;[D,E]=SIZE OF ONE VALUE (VALTYP)
6021  007110' 000000  000000
6022                                  22540  IFN     LENGTH-2,<
6023                                  22560          LXI    D,$CODE+4>    ;INITIALIZE TALLY TO FOUR
6024  007111' 001000  000161          22580          MOV    M,C           ;PUT DOWN THE DESCRIPTOR
6025  007112' 001000  000043          22600          INX    H
6026  007113' 001000  000160          22620          MOV    M,B
6027  007114' 001000  000043          22640          INX    H
6028  007115' 001000  000361          22660          POP    PSW           ;[A]=NUMBER OF DIMENSIONS
6029  007116' 001000  000062          22680          STA    TEMP6         ;SETUP GETSTK CALL
6030  007117' 000000  007124'
6031  007120' 000000  007102'
6032  007121' 001000  000315          22700          CALL   GETSTK        ;GET SPACE FOR DIMENSION ENTRIES
6033  007122' 000000  002024'
6034  007123' 000000  007117'
6035  007124' 001000  000351          22720  TEMP6:  PCHL                 ;PLACE TO STORE NUMBER OF DIMENSIONS
6036                                  22740                                ;FOR GETSTK AND LATER RECALL
6037                                  22760                                ;!!!IMPURE!! PCHL TO CONFUSE DISASSEMBLY
6038  007125' 001000  000042          22780          SHLD   TEMP3         ;SAVE THE LOCATION TO PUT THE SIZE
6039  007126' 000000  001575'
6040  007127' 000000  007122'
6041                                  22800                               ;IN
6042  007130' 001000  000043          22820          INX    H             ;SKIP OVER THE SIZE LOCATIONS
6043  007131' 001000  000043          22840          INX    H
6044  007132' 001000  000101          22860          MOV    B,C           ;[B]=NUMBER OF DIMENSIONS
6045                                  22880                                ;THIS DEPENDS ON THE FACT THAT GETSTK
6046                                  22900                                ;RETURNS ITS ARGUMENT IN [C]
6047  007133' 001000  000160          22920          MOV    M,B           ;STORE THE NUMBER OF DIMENSIONS
6048  007134' 001000  000043          22940          INX    H
6049  007135' 001000  000072          22960  LOPPTA: LDA    DIMFLG        ;CALLED BY DIMENSION?
6050  007136' 000000  001542'
6051  007137' 000000  007126'
6052  007140' 001000  000267          22980          ORA    A
6053  007141' 001000  000170          23000          MOV    A,B           ;[A]=NUMBER OF DIMENSIONS
6054  007142' 001000  000001          23020          LXI    B,$CODE+11    ;ASSUME ITS NOT "DIM"
6055  007143' 000000  000013'
6056  007144' 000000  007136'
6057  007145' 001000  000312          23040          JZ     NOTDIM        ;DEFAULT DIMENSIONS TO TEN
6058  007146' 000000  007152'
6059  007147' 000000  007143'
6060  007150' 001000  000301          23060          POP    B             ;POP OFF AN INDICE INTO [B,C]
6061  007151' 001000  000003          23080          INX    B             ;ADD ONE TO IT FOR THE ZERO ENTRY
6062  007152' 001000  000161          23100  NOTDIM: MOV    M,C           ;PUT THE MAXIMUM DOWN
6063  007153' 001000  000043          23120          INX    H
6064  007154' 001000  000160          23140          MOV    M,B
6065  007155' 001000  000043          23160          INX    H
6066  007156' 001000  000365          23180          PUSH   PSW           ;SAVE THE NUMBER OF DIMENSIONS
6067  007157' 001000  000345          23200          PUSH   H             ;SAVE THE POINTER INTO THE NEW ENTRY
6068  007160' 001000  000315          23220          CALL   UMULT         ;MULTIPLY [B,C]=NEWMAX BY CURTOL=[D,E]
6069  007161' 000000  000000*
6070  007162' 000000  007146'
6071  007163' 001000  000353          23240          XCHG                 ;[D,E]=NEW CURTOL
```



```
6072  007164' 001000  000341          23260          POP    H             ;GET THE POINTER INTO THE ENTRY BACK
6073  007165' 001000  000301          23280          POP    B             ;GET THE NUMBER OF DIMENSIONS BACK
6074  007166' 001000  000005          23300          DCR    B             ;DECREMENT THE NUMBER OF DIMENSIONS LEFT
6075  007167' 001000  000302          23320          JNZ    LOPPTA        ;HANDLE THE OTHER INDICES
6076  007170' 000000  007135'
6077  007171' 000000  007161'
6078  007172' 001000  000102          23340          MOV    B,D           ;[B,C]=SIZE
6079  007173' 001000  000113          23360          MOV    C,E
6080  007174' 001000  000353          23380          XCHG                 ;[D,E]=START OF VALUES
6081  007175' 001000  000031          23400          DAD    D             ;[H,L]=END OF VALUES
6082  007176' 001000  000332          23420          JC     BSERR         ;OUT OF MEMORY POINTER BEING GENERATED?
6083  007177' 000000  007077'
6084  007200' 000000  007170'
6085  007201' 001000  000315          23440          CALL   REASON        ;SEE IF THERE IS ROOM FOR THE VALUES
6086  007202' 000000  002045'
6087  007203' 000000  007177'
6088  007204' 001000  000042          23460          SHLD   STREND        ;UPDATE THE END OF STORAGE
6089  007205' 000000  001625'
6090  007206' 000000  007202'
6091  007207' 001000  000053          23480  ZERITA: DCX    H             ;ZERO THE NEW ARRAY
6092  007210' 001000  000066          23500          MVI    M,0
6093  007211' 000000  000000
6094  007212' 001000  000347          23520          COMPAR               ;BACK AT THE BEGINNING?
6095  007213' 001000  000302          23540          JNZ    ZERITA        ;NO,ZERO MORE
6096  007214' 000000  007207'
6097  007215' 000000  007205'
6098  007216' 001000  000003          23560          INX    B             ;ADD ONE TO THE SIZE TO INCLUDE
6099                                  23580                                ;THE BYTE FOR THE NUMBER OF DIMENSIONS
6100  007217' 001000  000147          23600          MOV    M,A           ;[M]=ZERO
6101  007220' 001000  000072          23620          LDA    DIMFLG
6102  007221' 000000  001542'
6103  007222' 000000  007214'
6104  007223' 001000  000267          23640          ORA    A             ;ARE WE DIMENSIONING ?
6105  007224' 001000  000072          23660          LDA    TEMP6         ;GET THE NUMBER OF DIMENSIONS
6106  007225' 000000  007124'
6107  007226' 000000  007221'
6108  007227' 001000  000157          23680          MOV    L,A           ;[L]=NUMBER OF DIMENSIONS
6109  007230' 001000  000051          23700          DAD    H             ;[H,L]=NUMBER OF DIMENSIONS TIMES TWO
6110  007231' 001000  000011          23720          DAD    B             ;ADD ON THE SIZE
6111                                  23740                                ;TO GET THE TOTAL NUMBER OF BYTES USED
6112  007232' 001000  000353          23760          XCHG                 ;[D,E]=TOTAL SIZE
6113  007233' 001000  000052          23780          LHLD   TEMP3         ;PLACE TO STORE SIZE
6114  007234' 000000  001575'
6115  007235' 000000  007225'
6116  007236' 001000  000163          23800          MOV    M,E           ;PUT DOWN THE SIZE
6117  007237' 001000  000043          23820          INX    H
6118  007240' 001000  000162          23840          MOV    M,D
6119  007241' 001000  000043          23860          INX    H
6120  007242' 001000  000302          23880          JNZ    FINNOW
6121  007243' 000000  007331'
6122  007244' 000000  007234'
6123                                  23900  ;
6124                                  23920  ; AT THIS POINT [M,L] POINTS BEYOND THE SIZE TO THE NUMBER OF DIMENSIONS
```

```
                                  23940   ; STRATEGY:
                                  23960   ;       NUMDIM=NUMBER OF DIMENSIONS
                                  23980   ;       CURTOL=0
                                  24000   ; INLPNM:GET A NEW INDICE
                                  24020   ;       POP NEW MAX INTO CURMAX
                                  24040   ;       MAKE SURE INDICE IS NOT TOO BIG
                                  24060   ;       MUTLIPLY CURTOL BY CURMAX
                                  24080   ;       ADD INDICE TO CURTOL
                                  24100   ;       NUMDIM=NUMDIM-1
                                  24120   ;       JNZ     INLPNM
                                  24140   ;       USE CURTOL*4 (VALTYP FOR EXTENDED) AS OFFSET
                                  24160   ;
007245' 001000  000043            24180   GETDEF: INX     H               ;POINT PAST THE NUMBER OF DIMENSIONS
007246' 001000  000001            24200           LXI     B,$CODE         ;CURTOL=ZERO
007247' 000000  000000'
007250' 000000  007243'
007251' 001000  000026            24220           XWD     ^U1000,^O26     ;"MVI D," AROUND THE NEXT BYTE
007252' 001000  000341            24240   INLPNM: POP     H               ;[H,L]= POINTER INTO VARIABLE ENTRY
007253' 001000  000136            24260           MOV     E,M             ;[D,E]=MAXIMUM FOR THE CURRENT INDICE
007254' 001000  000043            24280           INX     H
007255' 001000  000126            24300           MOV     D,M
007256' 001000  000043            24320           INX     H
007257' 001000  000343            24340           XTHL                    ;[H,L]=CURRENT INDICE
                                  24360                                   ;POINTER INTO THE VARIABLE GOES ON THE STACK
007260' 001000  000365            24380           PUSH    PSW             ;SAVE THE NUMBER OF DIMENSIONS
007261' 001000  000347            24400           COMPAR                  ;SEE IF THE CURRENT INDICE IS TOO BIG
007262' 001000  000322            24420           JNC     BSERR           ;IF SO "BAD SUBSCRIPT" ERROR
007263' 000000  007077'
007264' 000000  007247'
007265' 001000  000345            24440           PUSH    H               ;SAVE THE CURRENT INDICE
007266' 001000  000315            24460           CALL    UMULT           ;CURTOL=CURTOL*CURRENT MAXIMUM
007267' 000000  007161*
007270' 000000  007263'
007271' 001000  000321            24480           POP     D               ;INDICE INTO [D,E]
007272' 001000  000031            24500           DAD     D               ;ADD THE INDICETO CURTOL
007273' 001000  000361            24520           POP     PSW             ;GET THE NUMBER OF DIMENSIONS IN [A]
007274' 001000  000075            24540           DCR     A               ;SEE IF ALL THE INDICES HAVE BEEN PROCESSED
007275' 001000  000104            24560           MOV     B,H             ;[B,C]=CURTOL IN CASE WE LOOP BACK
007276' 001000  000115            24580           MOV     C,L
007277' 001000  000302            24600           JNZ     INLPNM          ;PROCESS THE REST OF THE INDICES
007300' 000000  007252'
007301' 000000  007267'
                                  24620   IFE     LENGTH-2,<
007302' 001000  000072            24640           LDA     VALTYP          ;SEE HOW BIG THE VALUES ARE
007303' 000000  001543'
007304' 000000  007300'
                                  24660                                   ;AND MULTIPLY BY THAT SIZE
007305' 001000  000104            24680           MOV     B,H             ;SAVE THE ORIGINAL VALUE FOR MULTIPLYING
007306' 001000  000115            24700           MOV     C,L             ;BY THREE
007307' 001000  000051            24720           DAD     H               ;MULTIPLY BY TWO AT LEAST
007310' 001000  000326            24740           SUI     4               ;FOR INTEGERS AND STRINGS
007311' 000000  000004
                                  24760                                   ;NO MORE MULTIPLYING BY TWO
```



```
007312' 001000  000332            24760           JC      SMLVAL
007313' 000000  007322'
007314' 000000  007303'
007315' 001000  000051            24800           DAD     H               ;NOW MULTIPLIED BY FOUR
007316' 001000  000312            24820           JZ      DONMUL          ;IF SINGLE ALL DONE
007317' 000000  007326'
007320' 000000  007313'
007321' 001000  000051            24840           DAD     H               ;BY EIGHT FOR DOUBLES
007322' 001000  000342            24860   SMLVAL: JPO     DONMUL          ;FOR STRINGS
007323' 000000  007326'
007324' 000000  007317'
007325' 001000  000011            24880           DAD     B               ;ADD IN THE ORIGINAL
007326'                           24900   DONMUL:>
                                  24920   IFN     LENGTH-2,<
                                  24940           DAD     H               ;MULTIPLY CURTOL BY FOUR
                                  24960           DAD     H>
007326' 001000  000301            24980           POP     B               ;POP OFF THE ADDRESS OF WHERE THE VALUES
                                  25000                                   ;BEGIN
007327' 001000  000011            25020           DAD     B               ;ADD IT ONTO CURTOL TO GET THE
                                  25040                                   ;PLACE THE VALUE IS STORED
007330' 001000  000353            25060           XCHG                    ;RETURN THE POINTER IN [D,E]
007331' 001000  000052            25080   FINNOW: LHLD    TEMP2           ;REGET THE TEXT POINTER
007332' 000000  001605'
007333' 000000  007323'
007334' 001000  000053            25100           DCX     H               ;REREAD THE TERMINATING CHARACTER
007335' 001000  000327            25120           CHRGET
007336' 001000  000311            25140           RET>

                                  25180   PAGE
```

```
  6207                                  25200   SUBTTL FRE  FUNCTION AND INTEGER TO FLOATING  ROUTINES
  6208                                  25220   IFN     LENGTH,<
  6209  007337' 001000  000052          25240   FRE:    LHLD    STREND          ;GET END OF VARIABLE AND TEXT SPACE
  6210  007340' 000000  001625'
  6211  007341' 000000  007332'
  6212  007342' 001000  000353          25260           XCHG                    ;PUT IT IN [D,E] FOR SUBTRACTION
  6213  007343' 001000  000041          25280           LXI     H,$CODE         ;ZERO [H,L]
  6214  007344' 000000  000000'
  6215  007345' 000000  007340'
  6216  007346' 001000  000071          25300           DAD     SP              ;PUT THE STACK POINTER IN [H,L]
  6217                                  25320   IFN     STRING,<
  6218                                  25340   IFE     LENGTH=2,<
  6219  007347' 001000  000315          25360           CALL    GETYPE
  6220  007350' 000000  006307'
  6221  007351' 000000  007344'
  6222  007352' 001000  000302          25370           JNZ     GIVDBL>
  6223  007353' 000000  007372'
  6224  007354' 000000  007350'
  6225                                  25380   IFN     LENGTH=2,<
  6226                                  25400           LDA     VALTYP          ;WAS THE ARGUMENT A STRING?
  6227                                  25420           ORA     A
  6228                                  25440           JZ      GIVDBL>         ;NO, GIVE FREE VARIABLE SPACE
  6229  007355' 001000  000315          25460           CALL    FREFAC          ;FREE UP ARGUMENT AND SETUP
  6230  007356' 000000  010434'
  6231  007357' 000000  007353'
  6232                                  25480                                   ;TO GIVE FREE STRING SPACE
  6233  007360' 001000  000315          25500           CALL    GARBA2          ;DO GARBAGE COLLECTION
  6234  007361' 000000  010042'
  6235  007362' 000000  007356'
  6236  007363' 001000  000052          25520           LHLD    STKTOP          ;BOTTOM OF FREE AREA
  6237  007364' 000000  001615'
  6238  007365' 000000  007361'
  6239  007366' 001000  000353          25540           XCHG
  6240  007367' 001000  000052          25560           LHLD    FRETOP>>        ;TOP OF FREE AREA
  6241  007370' 000000  001573'
  6242  007371' 000000  007364'
  6243                                  25580   ;
  6244                                  25600   ; THIS ROUTINE SUBTRACTS [D,E] FROM [H,L]
  6245                                  25620   ; AND FLOATS THE RESULT LEAVING IT IN FAC.
  6246                                  25640   ;
  6247                                  25660   IFE     LENGTH=1,<
  6248                                  25680   GIVDBL: MOV     A,L             ;DO THE SUBTRACTION
  6249                                  25700           SUB     E
  6250                                  25720           MOV     C,A
  6251                                  25740           MOV     A,H
  6252                                  25760           SBB     D
  6253                                  25780   GIVACF: MOV     B,C>
  6254                                  25790   IFN     LENGTH=2,<
  6255                                  25800   GIVABF: MOV     D,B
  6256                                  25820           MVI     E,0             ;GET ZERO IN LOW
  6257                                  25840   IFN     STRING,<
  6258                                  25860           LXI     H,VALTYP        ;FLAG VALUE TYPE AS NUMERIC
  6259                                  25880           MOV     M,E>
```



```
  6260                                  25900           MVI     B,144           ;SETUP TO FLOAT [B,C]
  6261                                  25920           JMP     FLOATR>
  6262                                  26120   IFE     LENGTH=2,<
  6263  007372' 001000  000175          26140   GIVDBL: MOV     A,L             ;[H,L]=[H,L]-[D,E]
  6264  007373' 001000  000223          26160           SUB     E
  6265  007374' 001000  000157          26180           MOV     L,A
  6266  007375' 001000  000174          26200           MOV     A,H
  6267  007376' 001000  000232          26220           SBB     D
  6268  007377' 001000  000021          26240           XWD     ^O1000,^O21     ;SKIP THE NEXT TWO BYTES WITH "LXI D,"
  6269  007400' 001000  000157          26260   SNGFLT: MOV     L,A             ;MAKE [A] AN UNSIGNED INTEGER
  6270  007401' 001000  000257          26280           XRA     A
  6271  007402' 001000  000147          26300   GIVINT: MOV     H,A
  6272  007403' 001000  000303          26320           JMP     MAKINT>
  6273  007404' 000000  006471*
  6274  007405' 000000  007370'
  6275                                  26322   IFN     LENGTH,<
  6276                                  26324   IFN     LPTSW,<
  6277                                  26326   LPOS:   LDA     LPTPOS
  6278                                  26328           JMP     SNGFLT>
  6279  007406' 001000  000072          26330   POS:    LDA     TTYPOS          ;GET TELETYPE POSITION
  6280  007407' 000000  000047'
  6281  007410' 000000  007404'
  6282                                  26332   IFN     LENGTH=2,<
  6283                                  26334   SNGFLT: MOV     B,A             ;RETURN FLOATING 1 BYTE
  6284                                  26336           XRA     A               ;UNSIGNED FROM A
  6285                                  26338           JMP     GIVABF>>        ;GIVING 0-255
  6286
  6287                                  26360   PAGE
```

```
6288                                    26380   SUBTTL  SIMPLE-USER-DEFINED-FUNCTION CODE
6289                                    26390   IFN     FUNCTS,<
6290                                    26400   ;
6291                                    26420   ; NOTE ONLY SINGLE ARGUMENTS ARE ALLOWED TO FUNCTIONS
6292                                    26440   ; AND FUNCTIONS MUST BE OF THE SINGLE LINE FORM:
6293                                    26460   ; DEF FNA(X)=X^2+X+2
6294                                    26480   ; NO STRINGS CAN BE INVOLVED WITH THESE FUNCTIONS
6295
6296                                    26520   ; IDEA: CREATE A FUNNY SIMPLE VARIABLE ENTRY
6297                                    26540   ; WHOSE FIRST CHARACTER (SECOND WORD IN MEMORY)
6298                                    26560   ; HAS THE 200 BIT SET,
6299                                    26580   ; THE VALUE WILL BE:
6300                                    26600   ;
6301                                    26620   ;       A TXTPTR TO THE FORMULA
6302                                    26640   ;       A PTR TO THE ARGUMENT VARIABLE
6303                                    26660   ;
6304                                    26680   ; FUNCTION NAMES CAN BE LIKE "FNA4"
6305                                    26700   ;
6306
6307  007411' 001000  000315            26780   DEF:    CALL    GETFNM          ;GET A POINTER TO THE
6308  007412' 000000  007550'
6309  007413' 000000  007407'
6310                                    26800                                   ;FUNCTION VARAIBLE
6311  007414' 001000  000001            26820           LXI     B,DATA          ;EVENTUALLY RETURN TO "DATA"
6312  007415' 000000  004072'
6313  007416' 000000  007412'
6314  007417' 001000  000305            26840           PUSH    B               ;AND SKIP THE FORMULA
6315  007420' 001000  000325            26860           PUSH    D               ;SAVE A POINTER TO IT
6316  007421' 001000  000315            26880           CALL    ERRDIR          ;DEF IS "ILLEGAL DIRECT"
6317  007422' 000000  007532'
6318  007423' 000000  007415'
6319  007424' 001000  000317            26900           SYNCHK  "("             ;MUST HAVE "("
6320  007425' 000000  000050
6321                                    26920                                   ;SINCE WE STORE A TEXT POINTER
6322  007426' 001000  000315            26940           CALL    PTRGET          ;GET POINTER TO ARGUMENT
6323  007427' 000000  006505'
6324  007430' 000000  007422'
6325                                    26960   IFN     LENGTH=2,<
6326                                    26980   IFN     STRING,<CALL    CHKNUM>>;STRINGS ILLEGAL
6327  007431' 001000  000317            27000           SYNCHK  ")"             ;MUST CLOSE IT WITH ")"
6328  007432' 000000  000051
6329  007433' 001000  000317            27020           SYNCHK  EQULTK          ;MUST HAVE EQUAL
6330  007434' 000000  000060
6331  007435' 001000  000104            27040           MOV     B,H
6332  007436' 001000  000115            27060           MOV     C,L
6333  007437' 001000  000343            27080           XTHL                    ;PUT THE TXTPTR ON THE STACK
6334                                    27100                                   ;(H,L)=PTR TO FUNCTION VARIABLE
6335                                    27120                                   ;(B,C)=TXTPTR
6336  007440' 001000  000303            27140           JMP     DEFFIN          ;PUT DOWN THE TEXT-POINTER
6337  007441' 000000  007521'
6338  007442' 000000  007427'
6339                                    27160                                   ;AND ARGUMENT POINTER IN
6340                                    27180                                   ;MEMORY, RESTORE THE TXTPTR
```



```
6341                                    27200                                   ;AND GO TO "DATA" SKIPPING THE
6342                                    27220                                   ;REST OF THE FORMULA
6343
6344  007443' 001000  000315            27260   FNDDER: CALL    GETFNM          ;GET A POINTER TO
6345  007444' 000000  007550'
6346  007445' 000000  007441'
6347                                    27280                                   ;THE FUNCTON DEFINITION IN (D,E)
6348  007446' 001000  000325            27300           PUSH    D               ;SAVE THE POINTER
6349  007447' 001000  000315            27320           CALL    PARCHK          ;EVALUATE THE VALUE TO BE PASSED
6350  007450' 000000  006136'
6351  007451' 000000  007444'
6352                                    27340   IFN     LENGTH=2,<
6353                                    27360   IFN     STRING,<CALL    CHKNUM>> ;ARG CANNOT BE STRING
6354  007452' 001000  000343            27380           XTHL                    ;(H,L)=POINTER TO FUNCTION DEF
6355                                    27400                                   ;TEXT POINTER GOES ON THE STACK
6356  007453' 001000  000367            27420           PUSHM                   ;PUSH THE POINTER AT THE FORMULA
6357                                    27440                                   ;ONTO THE STACK
6358  007454' 001000  000321            27460           POP     D               ;(D,E)=PTR TO FORMULA
6359  007455' 001000  000367            27480           PUSHM                   ;PUT A POINTER TO THE
6360                                    27500                                   ;ARGUMENT ON THE STACK
6361  007456' 001000  000341            27520           POP     H               ;(H,L)=POINTER TO ARG
6362  007457' 001000  000367            27540           PUSHFM                  ;SAVE ARGS OLD VALUE ON THE STACK
6363  007460' 001000  000367
6364  007461' 001000  000053            27560           DCX     H
6365  007462' 001000  000053            27580           DCX     H
6366  007463' 001000  000053            27600           DCX     H               ;POINT TO FRONT OF ARG AGAIN
6367  007464' 001000  000053            27620           DCX     H
6368  007465' 001000  000345            27640           PUSH    H               ;SAVE IT
6369  007466' 001000  000347            27660           COMPAR                  ;SHOULDN'T BE EQUAL UNLESS
6370                                    27680                                   ;FUNCTION WAS NEVER DEFINED
6371  007467' 001000  000325            27700           PUSH    D               ;SAVE FORMULA TEXT POINTER
6372  007470' 001000  000036            27720           MVI     E,ERRUF         ;NOW (D,E) FREE SO CHECK IF (ZERO) SET
6373  007471' 000000  000022
6374  007472' 001000  000312            27740           JZ      ERROR
6375  007473' 000000  002102'
6376  007474' 000000  007450'
6377  007475' 001000  000315            27760           CALL    MOVMF           ;PUT CURRENT FAC INTO OUR ARG VARIABLE
6378  007476' 000000  005264*
6379  007477' 000000  007473'
6380                                    27780                                   ;OUT OF FAC INTO (H,L) LOCATION
6381  007500' 001000  000341            27800           POP     H               ;POP OFF FORMULA TXTPTR
6382                                    27810   IFN     LENGTH=2,<
6383                                    27820           CALL    FRMNUM>         ;EVALUATE IT AND MUST SURE ITS NUMERIC
6384                                    27822   IFE     LENGTH=2,<
6385  007501' 001000  000315            27824           CALL    FRMEVL
6386  007502' 000000  005336'
6387  007503' 000000  007476'
6388  007504' 001000  000345            27826           PUSH    H
6389  007505' 001000  000315            27828           CALL    FRCSNG
6390  007506' 000000  006667*
6391  007507' 000000  007502'
6392  007510' 001000  000341            27830           POP     H>
6393  007511' 001000  000053            27840           DCX     H
```

```
6394  007512' 001000  000327  27860          CHRGET                  ;SEE IF TERMINATED
6395  007513' 001000  000302  27880          JNZ     SNERR           ;IF NOT SYNTAX ERROR
6396  007514' 000000  002072'
6397  007515' 000000  007506'
6398                          27900                                  ;TO BE NICE SHOULD HAVE NEW CURLIN
6399                          27920                                  ;BUT VERY MESSY
6400  007516' 001000  000341  27940          POP     H               ;POP OFF POINTER AT ARG VARIABLE
6401  007517' 001000  000321  27960          POP     D
6402  007520' 001000  000301  27980          POP     B>              ;POP OFF OLD VALUE
6403                          28000  IFN     MULDIMSTRINGIFUNCTS,<
6404  007521' 001000  000161  28020  DEFFIN: MOV     M,C
6405  007522' 001000  000043  28040          INX     H               ;STORE THE OLD VALUE
6406  007523' 001000  000160  28060          MOV     M,B
6407  007524' 001000  000043  28080  PUTDEI: INX     H
6408  007525' 001000  000163  28100          MOV     M,E
6409  007526' 001000  000043  28120          INX     H
6410  007527' 001000  000162  28140          MOV     M,D
6411  007530' 001000  000341  28160          POP     H               ;POP OFF OLD TXTPTR
6412  007531' 001000  000311  28180          RET>                    ;VALUE IS IN FAC -- ALL DONE
6413                          28200  IFN     FUNCTS,<
6414                          28220  ;
6415                          28240  ; SUBROUTINE TO SEE IF WE ARE IN DIRECT MODE AND
6416                          28260  ; COMPLAIN IF SO
6417                          28280  ;
6418  007532' 001000  000345  28300  ERRDIR: PUSH    H               ;SAVE THEIR [H,L]
6419  007533' 001000  000052  28320          LHLD    CURLIN          ;SEE WHAT THE CURRENT LINE IS
6420  007534' 000000  001607'
6421  007535' 000000  007514'
6422  007536' 001000  000043  28340          INX     H               ;DIRECT IS 65,535 SO NOW 0
6423  007537' 001000  000174  28360          MOV     A,H
6424  007540' 001000  000265  28380          ORA     L               ;IS IT ZERO NOW?
6425  007541' 001000  000341  28400          POP     H
6426  007542' 001000  000300  28420          RNZ                     ;RETURN IF NOT
6427  007543' 001000  000036  28440          MVI     E,ERRID         ;"ILLEGAL DIRECT" ERROR
6428  007544' 000000  000014
6429  007545' 001000  000303  28460          JMP     ERROR
6430  007546' 000000  002102'
6431  007547' 000000  007534'
6432                          28480  ;
6433                          28500  ; SUBROUTINE TO GET A POINTER TO A FUNCTION NAME
6434                          28520  ;
6435  007550' 001000  000317  28540  GETFNM: SYNCHK  FNTK            ;MUST START WITH "FN"
6436  007551' 000000  000243
6437  007552' 001000  000076  28560          MVI     A,128           ;DONT ALLOW AN ARRAY
6438  007553' 000000  000200
6439  007554' 001000  000062  28580          STA     SUBFLG          ;DON'T RECOGNIZE THE "(" AS
6440  007555' 000000  001601'
6441  007556' 000000  007546'
6442                          28600                                  ;THE START OF AN ARRAY REFEREENCE
6443  007557' 001000  000266  28620          ORA     M               ;PUT FUNCTION BIT ON
6444  007560' 001000  000107  28640          MOV     B,A             ;GET FIRST CHARACTER INTO [B]
6445                          28660  IFN     LENGTH-2,<
6446                          28680  IFN     STRING,<CALL    PTRGT2  ;REALLY GET THE POINTER
```



```
6447                          28700          JMP     CHKNUM>>        ;MAKE SURE ITS NOT A STRING NAME
6448  007561' 001000  000303  28720  IFE     STRING&<LENGTH-2>,<JMP  PTRGT2>>
6449  007562' 000000  006512'
6450  007563' 000000  007555'
6451                          28740  PAGE
```

```
                                        28760   SUBTTL  STRING FUNCTIONS
                                        28780   IFN     STRING,<                ;STRING HANDLING SUBROUTINES
                                        28800   ;
                                        28820   ; THE STR$ FUNCTION TAKES A NUMBER AND GIVES
                                        28840   ; A STRING WITH THE CHARACTERS THE OUTPUT OF THE NUMBER
                                        28860   ; WOULD HAVE GIVEN
                                        28880   ;
007564'                                 28900   STR$:
                                        28920   IFN     LENGTH=2,<
                                        28940           CALL    CHKNUM>         ;MAKE SURE THE ARGUMENT
                                        28960                                   ;IS A NUMERIC
007564' 001000  000315                  28980           CALL    FOUT            ;DO ITS OUTPUT
007565' 000000  004457*
007566' 000000  007562'
007567' 001000  000315                  29000           CALL    STRLIT          ;SCAN IT AND TURN IT INTO A STRING
007570' 000000  007637'
007571' 000000  007565'
007572' 001000  000315                  29020           CALL    FREFAC          ;FREE UP THE TEMP
007573' 000000  010434'
007574' 000000  007570'
007575' 001000  000001                  29040           LXI     B,FINBCK
007576' 000000  010546'
007577' 000000  007573'
007600' 001000  000305                  29060           PUSH    B               ;SET UP ANSWER IN NEW TEMP
                                        29080   ;
                                        29100   ; STRCPY CREATES A COPY OF THE STRING
                                        29120   ; WHOSE DESCRIPTOR IS POINTED TO BY (H,L),
                                        29140   ; ON RETURN (D,E) POINTS TO DSCTMP
                                        29160   ; WHICH HAS THE STRING INFO (LENGTH,WHERE COPIED TO)
                                        29180   ;
007601' 001000  000176                  29200   STRCPY: MOV     A,M             ;GET LENGTH
007602' 001000  000043                  29220           INX     H               ;MOVE UP TO THE POINTER
                                        29240   IFN     LENGTH=2,<
                                        29260           INX     H>
007603' 001000  000345                  29280           PUSH    H               ;GET POINTER TO POINTER OF ARG
007604' 001000  000315                  29300           CALL    GETSPA          ;GET THE SPACE
007605' 000000  007772'
007606' 000000  007576'
007607' 001000  000341                  29320           POP     H               ;FIND OUT WHERE STRING TO COPY
007610' 001000  000367                  29340           PUSHM                   ;REALLY IS IN (B,C)
007611' 001000  000301                  29360           POP     B
007612' 001000  000315                  29380           CALL    STRAD2          ;SETUP DSCTMP
007613' 000000  007627'
007614' 000000  007605'
007615' 001000  000345                  29400           PUSH    H               ;SAVE POINTER TO DSCTMP
007616' 001000  000157                  29420           MOV     L,A             ;GET CHARACTER COUNT INTO (L)
007617' 001000  000315                  29440           CALL    MOVSTR          ;MOVE THE CHARS IN
007620' 000000  010417'
007621' 000000  007613'
007622' 001000  000321                  29460           POP     D               ;RESTORE POINTER TO DSCTMP
007623' 001000  000311                  29480           RET                     ;RETURN
                                        29500
007624' 001000  000315                  29520   STRINI: CALL    GETSPA          ;GET SOME STRING SPACE (A) CHARS)
```



```
007625' 000000  007772'
007626' 000000  007620'
007627' 001000  000041                  29540   STRAD2: LXI     H,DSCTMP        ;GET DESC. TEMP
007630' 000000  001570'
007631' 000000  007625'
007632' 001000  000345                  29560   STRAD1: PUSH    H               ;SAVE DESC. POINTER
007633' 001000  000167                  29580           MOV     M,A             ;SAVE CHARACTER COUNT
                                        29600   IFN     LENGTH=2,<
                                        29620           INX     H>              ;MOVE TO ADDRESS FIELD
007634' 001000  000303                  29640           JMP     PUTDEI          ;USE COMMON CODE TO
007635' 000000  007524'
007636' 000000  007630'
                                        29660                                   ;STORE (D,E)=POINTER TO FREE SPACE
                                        29680                                   ;AND RESTORE (H,L) AS THE DESCRIPTOR POINTER
                                        29682   ;
                                        29684   ; STRLT2 TAKES THE STRING LITERAL WHOSE FIRST CHARACTER
                                        29686   ; IS POINTED BY (H,L)+1 AND BUILDS A DESCRIPTOR FOR IT,
                                        29688   ; THE DESCRIPTOR IS INITIALLY BUILT IN DSCTMP, BUT PUTNEW
                                        29690   ; TRANSFERS IT INTO A TEMPORARY AND LEAVES A POINTER
                                        29692   ; AT THE TEMPORARY IN FACLO, THE CHARACTERS OTHER THAN
                                        29694   ; ZERO THAT TERMINATE THE STRING SHOULD BE SET UP IN (B)
                                        29696   ; AND (D), IT THE TERMINATOR IS A QUOTE, THE QUOTE IS SKIPPED
                                        29697   ; OVER, LEADING QUOTES SHOULD BE SKIPPED BEFORE CALL, ON RETURN
                                        29698   ; THE CHARACTER AFTER THE STRING LITERAL IS POINTED TO
                                        29700   ; BY (H,L) AND IS IN (A), BUT THE CONDITION CODES ARE
                                        29702   ; NOT SET UP.
                                        29704   ;
007637' 001000  000053                  29720   STRLIT: DCX     H
007640' 001000  000006                  29740   STRLTI: MVI     B,34            ;ASSUME STR ENDS ON QUOTE
007641' 000000  000042
007642' 001000  000120                  29760   STRLT3: MOV     D,B
007643' 001000  000345                  29780   STRLT2: PUSH    H               ;SAVE POINTER TO START OF LITERAL
007644' 001000  000016                  29800           MVI     C,255           ;INITIALIZE CHARACTER COUNT
007645' 000000  000377
007646' 001000  000043                  29820   STRGET: INX     H
007647' 001000  000176                  29840           MOV     A,M             ;GET CHAR
007650' 001000  000014                  29860           INR     C               ;BUMP CHARACTER COUNT
007651' 001000  000267                  29880           ORA     A               ;IF 0, (END OF LINE) DONE
007652' 001000  000312                  29900           JZ      STRFIN          ;TEST
007653' 000000  007665'
007654' 000000  007635'
007655' 001000  000272                  29920           CMP     D
007656' 001000  000312                  29940           JZ      STRFIN
007657' 000000  007665'
007660' 000000  007653'
007661' 001000  000270                  29960           CMP     B               ;CLOSING QUOTE
007662' 001000  000302                  29980           JNZ     STRGET          ;NO, GO BACK FOR MORE
007663' 000000  007646'
007664' 000000  007657'
007665' 001000  000376                  30000   STRFIN: CPI     34              ;IF QUOTE TERMINATES THE STRING
007666' 000000  000042
007667' 001000  000314                  30020           CZ      CHRGTR          ;SKIP OVER THE QUOTE
007670' 000000  003426'
```

```
6558  007671' 000000  007663'
6559  007672' 001000  000343          30040          XTHL
6560  007673' 001000  000043          30060          INX     H
6561  007674' 001000  000353          30080          XCHG                    ;GET POINTER TO TEMP
6562  007675' 001000  000171          30100          MOV     A,C             ;GET CHARACTER COUNT IN A
6563  007676' 001000  000315          30120          CALL    STRAD2          ;SAVE STR INFO
6564  007677' 000000  007627'
6565  007700' 000000  007670'
6566                                  30140                                  ;COMPARE DESC. POINTER & STR POINTER
6567  007701' 001000  000347          30160          COMPAR                  ;TO SEE IF STR IN BUF
6568  007702' 001000  000324          30180          CNC     STRCPY          ;IF IN BUF, MUST COPY IT.
6569  007703' 000000  007601'
6570  007704' 000000  007677'
6571                                  30200                                  ;OTHERWISE STR IN PROGRAM.
6572                                  30220  ;
6573                                  30240  ; SOME STRING FUNCTION IS RETURNING A RESULT IN DSCTMP
6574                                  30260  ; WE WANT TO SETUP A TEMP DESCRIPTOR WITH DCSTMP IN IT
6575                                  30280  ; PUT A POINTER TO THE DESCRIPTOR IN FACLO AND FLAG THE
6576                                  30300  ; RESULT AS TYPE STRING
6577                                  30320  ;
6578  007705' 001000  000021          30340  PUTNEW: LXI     D,DSCTMP        ;[D,E] POINT AT RESULT DESCRIPTOR
6579  007706' 000000  001570'
6580  007707' 000000  007703'
6581  007710' 001000  000052          30360          LHLD    TEMPPT          ;[H,L]=POINTER TO FIRST FREE TEMP
6582  007711' 000000  001547'
6583  007712' 000000  007706'
6584  007713' 001000  000042          30380          SHLD    FACLO           ;POINTER AT WHERE RESULT DESCRIPTOR WILL BE
6585  007714' 000000  001637'
6586  007715' 000000  007711'
6587                                  30400  IFE     LENGTH=2,<
6588  007716' 001000  000076          30420          MVI     A,3
6589  007717' 000000  000003
6590  007720' 001000  000062          30440          STA     VALTYP          ;FLAG THIS AS A STRING
6591  007721' 000000  001543'
6592  007722' 000000  007714'
6593  007723' 001000  000315          30460          CALL    VMOVE>          ;AND MOVE THE VALUE INTO A TEMPORARY
6594  007724' 000000  004233*
6595  007725' 000000  007721'
6596                                  30480  IFN     LENGTH=2,<
6597                                  30500          MVI     A,1             ;FLAG RESULT AS STRING
6598                                  30520          STA     VALTYP          ;STORE IN "VALUE=TYPE" LOCATION
6599                                  30540          CALL    MOVE>           ;TRANSFER THE DESCRIPTOR IN
6600  007726' 001000  000347          30560          COMPAR                  ;DSCTMP IS JUST BEYOND THE TEMPS
6601                                  30580                                  ;AND IF TEMPPT POINTS AT IT THERE
6602                                  30600                                  ;ARE NO FREE TEMPS
6603  007727' 001000  000036          30620          MVI     E,ERRST         ;"STRING TEMPORARY" ERROR
6604  007730' 000000  000020
6605  007731' 001000  000312          30640          JZ      ERROR           ;GO TELL HIM
6606  007732' 000000  002102'
6607  007733' 000000  007724'
6608  007734' 001000  000042          30660          SHLD    TEMPPT          ;SAVE NEW TEMPORARY POINTER
6609  007735' 000000  001547'
6610  007736' 000000  007732'
```



```
6611  007737' 001000  000341          30680          POP     H               ;GET THE TEXT POINTER
6612  007740' 001000  000176          30700          MOV     A,M             ;GET CURRENT CHARACTER INTO [A]
6613  007741' 001000  000311          30720          RET
6614                                  30740  ;
6615                                  30760  ; PRINT THE STRING POINTED TO BY [H,L] WHICH ENDS WITH A ZERO
6616                                  30780  ; IF THE STRING IS BELOW DSCTMP IT WILL BE COPIED INTO STRING SPACE
6617                                  30800  ;
6618  007742' 001000  000043          30820  STROUI: INX     H               ;POINT AT NEXT CHARACTER
6619  007743' 001000  000315          30840  STROUT: CALL    STRLIT          ;GET A STRING LITERAL
6620  007744' 000000  007637'
6621  007745' 000000  007735'
6622                                  30860  ;
6623                                  30880  ; PRINT THE STRING WHOSE DESCRIPTOR IS POINTED TO BY FACLO.
6624                                  30900  ;
6625  007746' 001000  000315          30920  STRPRT: CALL    FREFAC          ;RETURN TEMP POINTER BY FACLO
6626  007747' 000000  010434'
6627  007750' 000000  007744'
6628                                  30940  IFE     LENGTH=2,<
6629  007751' 001000  000315          30960          CALL    GETBCD          ;[D]=LENGTH [B,C]=POINTER AT DATA
6630  007752' 000000  000000*
6631  007753' 000000  007747'
6632  007754' 001000  000024          30970          INR     D               ;INCREMENT AND DECREMENT EARLY
6633                                  30980                                  ;TO CHECK FOR NULL STRING
6634  007755' 001000  000025          30990  STRPR2: DCR     D>              ;DECREMENT THE LENGTH
6635                                  31060  IFN     LENGTH=2,<
6636                                  31080          CALL    MOVRM           ;GET LENGTH IN [E]
6637                                  31100          INR     E               ;AND POINTER TO CHARACTERS IN [B,C]
6638                                  31120  STRPR2: DCR     E>
6639  007756' 001000  000310          31140          RZ                      ;ALL DONE
6640  007757' 001000  000012          31160          LDAX    B               ;GET CHARACTER TO PRINT
6641  007760' 001000  000337          31180          OUTCHR
6642  007761' 001000  000376          31200          CPI     CR
6643  007762' 000000  000015
6644  007763' 001000  000314          31220          CZ      CRFIN
6645  007764' 000000  004534'
6646  007765' 000000  007752'
6647  007766' 001000  000003          31240          INX     B               ;POINT TO THE NEXT CHARACTER
6648  007767' 001000  000303          31260          JMP     STRPR2          ;AND PRINT IT...
6649  007770' 000000  007755'
6650  007771' 000000  007764'
6651                                  31280  ;
6652                                  31300  ; GETSPA = GET SPACE FOR CHARACTER STRING
6653                                  31320  ; MAY FORCE GARBAGE COLLECTION.
6654                                  31340  ;
6655                                  31360  ; # OF CHARS (BYTES) IN [A]
6656                                  31380  ; RETURNS WITH POINTER IN [D,E] OTHERWISE IF CANT GET SPACE
6657                                  31400  ; BLOWS OFF TO "OUT OF STRING SPACE" TYPE ERROR.
6658                                  31420  ;
6659  007772' 001000  000267          31440  GETSPA: ORA     A               ;MUST BE NON ZERO, SIGNAL NO GARBAG YET
6660  007773' 001000  000016          31460          XWD     "01000,"0016    ;"MVI C" AROUND THE NEXT
6661  007774' 001000  000361          31480  TRYGI2: POP     PSW             ;IN CASE COLLECTED WHAT WAS LENGTH?
6662  007775' 001000  000365          31500          PUSH    PSW             ;SAVE IT BACK
6663  007776' 001000  000052          31520          LHLD    STKTOP          ;GET BOTTOM OF STRING SPACE
```

```
6664  007777' 000000  001615'
6665  010000' 000000  007770'
6666  010001' 001000  000353          31540          XCHG                    ;IN [D,E]
6667  010002' 001000  000052          31560          LHLD    FRETOP          ;GET TOP OF FREE SPACE IN [H,L]
6668  010003' 000000  001573'
6669  010004' 000000  007777'
6670  010005' 001000  000057          31580          CMA                     ;-# OF CHARS
6671  010006' 001000  000117          31600          MOV     C,A             ;IN [B,C]
6672  010007' 001000  000006          31620          MVI     B,255
6673  010010' 000000  000377
6674  010011' 001000  000011          31640          DAD     B               ;SUBTRACT FROM TOP OF FREE
6675  010012' 001000  000043          31660          INX     H
6676  010013' 001000  000347          31660          COMPAR                  ;COMPARE THE TWO
6677  010014' 001000  000332          31700          JC      GARBAG          ;NOT ENOUGH ROOM FOR STRING, OFFAL TIME
6678  010015' 000000  010026'
6679  010016' 000000  010003'
6680  010017' 001000  000042          31720          SHLD    FRETOP          ;SAVE NEW BOTTOM OF MEMORY
6681  010020' 000000  001573'
6682  010021' 000000  010015'
6683  010022' 001000  000043          31740          INX     H               ;MOVE BACK TO POINT TO STRING
6684  010023' 001000  000353          31760          XCHG                    ;RETURN WITH POINTER IN [D,E]
6685  010024' 001000  000361          31780  PPSWRT:  POP     PSW             ;GET CHARACTER COUNT
6686  010025' 001000  000311          31800          RET                     ;RETURN FROM GETSPA
6687
6688  010026' 001000  000361          31840  GARBAG: POP     PSW             ;HAVE WE COLLECTED BEFORE?
6689  010027' 001000  000036          31860          MVI     E,ERRSO         ;GET READY FOR OUT OF STRING SPACE ERROR
6690  010030' 000000  000016
6691  010031' 001000  000312          31880          JZ      ERROR           ;GO TELL USER HE LOST
6692  010032' 000000  002102'
6693  010033' 000000  010020'
6694  010034' 001000  000277          31900          CMP     A               ;SET ZERO FLAG TO SAY WEVE GARBAGED
6695  010035' 001000  000365          31920          PUSH    PSW             ;SAVE FLAG BACK ON STACK
6696  010036' 001000  000001          31940          LXI     B,TRYG12        ;PLACE FOR GARBAG TO RETURN TO.
6697  010037' 000000  007774'
6698  010040' 000000  010032'
6699  010041' 001000  000305          31960          PUSH    B               ;SAVE ON STACK
6700  010042' 001000  000052          31980  GARBA2: LHLD    MEMSIZ          ;START FROM TOP DOWN
6701  010043' 000000  001545'
6702  010044' 000000  010037'
6703                                   32000  IFE     REALIO,<
6704                                   32020          MVI     A,7             ;RING THE BELL ON GARBAGE COLLECTION
6705                                   32040          OUTCHR>
6706  010045' 001000  000042          32060  FNDVAR: SHLD    FRETOP          ;LIKE SO
6707  010046' 000000  001573'
6708  010047' 000000  010043'
6709  010050' 001000  000041          32080          LXI     H,$CODE         ;GET DOUBLE ZERO
6710  010051' 000000  000000'
6711  010052' 000000  010046'
6712  010053' 001000  000345          32100          PUSH    H               ;SAY DIDNT SEE VARS THIS PASS
6713  010054' 001000  000052          32120          LHLD    STKTOP          ;FORCE DVARS TO IGNORE STRINGS
6714  010055' 000000  001615'
6715  010056' 000000  010051'
6716                                   32140                                  ;IN THE PROGRAM TEXT (LITERALS, DATA)
```



```
6717  010057' 001000  000345          32160          PUSH    H               ;FORCE FIND HIGH ADDRESS
6718  010060' 001000  000041          32180          LXI     H,TEMPST        ;GET START OF STRING TEMPS
6719  010061' 000000  001551'
6720  010062' 000000  010055'
6721  010063' 001000  000353          32200  TVAR:   XCHG                    ;SAVE IN [D,E]
6722  010064' 001000  000052          32220          LHLD    TEMPPT          ;SEE IF DONE
6723  010065' 000000  001547'
6724  010066' 000000  010061'
6725  010067' 001000  000353          32240          XCHG                    ;FLIP
6726  010070' 001000  000347          32260          COMPAR                  ;TEST
6727  010071' 001000  000001          32280          LXI     B,TVAR          ;FORCE JUMP TO TVAR
6728  010072' 000000  010063'
6729  010073' 000000  010065'
6730  010074' 001000  000302          32300          JNZ     DVAR2           ;DO TEMP VAR GARBAGE COLLECT
6731  010075' 000000  010213'
6732  010076' 000000  010072'
6733
6734  010077' 001000  000052          32340  SVARS:  LHLD    VARTAB          ;GET START OF SIMPLE VARIABLES
6735  010100' 000000  001621'
6736  010101' 000000  010075'
6737  010102' 001000  000353          32360  SVAR:   XCHG                    ;GET IN [D,E]
6738  010103' 001000  000052          32380          LHLD    ARYTAB          ;GET END OF SIMPS
6739  010104' 000000  001623'
6740  010105' 000000  010100'
6741  010106' 001000  000353          32400          XCHG                    ;FLIP
6742  010107' 001000  000347          32420          COMPAR                  ;SEE IF AT END OF SIMPS
6743  010110' 001000  000312          32440          JZ      ARYVAR          ;IF YES, DO ARRAY TYPE STRINGS
6744  010111' 000000  010140'
6745  010112' 000000  010104'
6746  010113' 001000  000176          32460          MOV     A,M             ;GET 2ND CHARACTER OF VARIABLE
6747  010114' 001000  000043          32480          INX     H               ;BUMP POINTER TWICE
6748  010115' 001000  000043          32500          INX     H               ;
6749                                   32520  IFE     LENGTH=2,<
6750  010116' 001000  000043          32540          INX     H               ;POINT AT THE VALUE
6751  010117' 001000  000376          32560          CPI     3               ;SEE IF ITS A STRING
6752  010120' 000000  000003
6753  010121' 001000  000302          32580          JNZ     SKPVAR          ;IF NOT, JUST SKIP AROUND IT
6754  010122' 000000  010130'
6755  010123' 000000  010111'
6756  010124' 001000  000315          32600          CALL    DVARS           ;COLLECT IT
6757  010125' 000000  010214'
6758  010126' 000000  010122'
6759  010127' 001000  000257          32620          XRA     A               ;AND DON'T SKIP ANYTHING MORE
6760  010130' 001000  000137          32640  SKPVAR: MOV     E,A
6761  010131' 001000  000026          32660          MVI     D,0             ;[D,E]=AMOUNT TO SKIP
6762  010132' 000000  000000
6763  010133' 001000  000031          32680          DAD     D>
6764                                   32700  IFN     LENGTH=2,<
6765                                   32720          ORA     A               ;SET CC'S
6766                                   32740          CALL    DVARS>          ;CALL THE VARIABLE GARB ROUT.
6767  010134' 001000  000303          32760          JMP     SVAR            ;GET NEXT ONE
6768  010135' 000000  010102'
6769  010136' 000000  010125'
```

```
                                                 32800  ARYVA2: POP     B                ;GET RID OF STACK GARBAGE
010137' 001000  000301                           32820  ARYVAR: XCHG                     ;SAVE ARYVAR IN [D,E]
010140' 001000  000353                           32840          LHLD    STREND           ;GET END OF ARRAYS
010141' 001000  000052
010142' 000000  001625'
010143' 000000  010135'
010144' 001000  000353                           32860          XCHG                     ;FLIP BACK
010145' 001000  000347                           32880          COMPAR                   ;SEE IF DONE WITH ARRAYS
010146' 001000  000312                           32900          JZ      GRBPAS           ;YES, SEE IF DONE COLLECTING
010147' 000000  010254'
010150' 000000  010142'
                                                 32920  IFE     LENGTH=2,<
010151' 001000  000176                           32940          MOV     A,M              ;GET THE VALUE TYPE INTO [A]
010152' 001000  000043                           32960          INX     H>
010153' 001000  000315                           32980          CALL    MOVRM            ;GET LENGTH OF ARRAY IN [B,C]
010154' 000000  005302*
010155' 000000  010147'
                                                 33000  IFN     LENGTH=2,<
                                                 33020          MOV     A,E>             ;GET 2ND CHAR OF VAR NAME IN A
010156' 001000  000345                           33040          PUSH    H                ;SAVE POINTER TO DIMS
010157' 001000  000011                           33060          DAD     B                ;ADD TO CURRENT POINTER POSITION
                                                 33080  IFE     LENGTH=2,<
010160' 001000  000376                           33100          CPI     3                ;SEE IF ITS A STRING
010161' 000000  000003
010162' 001000  000302                           33120          JNZ     ARYVA2>          ;IF NOT JUST SKIP IT
010163' 000000  010137'
010164' 000000  010154'
                                                 33140  IFN     LENGTH=2,<
                                                 33160          ORA     A                ;SEE IF STRING VAR
                                                 33180          JP      ARYVA2>          ;NO, KEEP ON TRUCKIN
010165' 001000  000042                           33200          SHLD    TEMP3            ;SAVE END OF ARRAY
010166' 000000  001575'
010167' 000000  010163'
010170' 001000  000341                           33220          POP     H                ;GET BACK CURRENT POSITION
010171' 001000  000116                           33240          MOV     C,M              ;PICK UP NUMBER OF DIMS
010172' 001000  000006                           33260          MVI     B,0              ;MAKE DOUBLE WITH HIGH ZERO
010173' 000000  000000
010174' 001000  000011                           33280          DAD     B                ;GO PAST DIMS
010175' 001000  000011                           33300          DAD     B                ;BY ADDING ON TWICE #DIMS (2 BYTE GUYS)
010176' 001000  000043                           33320          INX     H                ;ONE MORE TO ACCOUNT FOR #DIMS,
010177' 001000  000353                           33340  ARYSTR: XCHG                     ;SAVE CURRENT POSIT IN [D,E]
010200' 001000  000052                           33360          LHLD    TEMP3            ;GET END OF ARRAY
010201' 000000  001575'
010202' 000000  010166'
010203' 001000  000353                           33380          XCHG                     ;FIX [H,L] BACK TO CURRENT
010204' 001000  000347                           33400          COMPAR                   ;SEE IF AT END OF ARRAY
010205' 001000  000312                           33420          JZ      ARYVAR           ;END OF ARRAY, TRY NEXT ARRAY
010206' 000000  010140'
010207' 000000  010201'
010210' 001000  000001                           33440          LXI     B,ARYSTR         ;ADDR OF WHERE TO RETURN TO
010211' 000000  010177'
010212' 000000  010206'
010213' 001000  000305                           33460  DVAR2:  PUSH    B                ;GOES ON STACK
```



```
                                                 33480  IFE     LENGTH=2,<
010214'                                          33500  DVAR:
010214' 001000  000257                           33520  DVARS:  XRA     A
010215' 001000  000266                           33540          ORA     M                ;SEE IF ITS THE NULL STRING
010216' 001000  000043                           33560          INX     H
010217' 001000  000136                           33580          MOV     E,M
010220' 001000  000043                           33600          INX     H
010221' 001000  000126                           33620          MOV     D,M
010222' 001000  000043                           33640          INX     H>               ;[D,E]=POINTER AT THE VALUE
                                                 33660  IFN     LENGTH=2,<
                                                 33680  DVAR:   ORI     128              ;FORCE DVAR TO CALL GRBVAR
                                                 33700  DVARS:  PUSHM                    ;SAVE LENGTH
                                                 33720          PUSHM                    ;SKIP NEXT TWO BYTES
                                                 33740          POP     D                ;GET POINTER IN [D,E]
                                                 33760          POP     B                ;POP OF STRING LENGTH
                                                 33780          RP                       ;IF WASNT A STR, RETURN
                                                 33800          MOV     A,C              ;GET LENGTH OF STRING
                                                 33820          ORA     A>               ;SET CONDITION CODES
010223' 001000  000310                           33840          RZ                       ;NULL STRING, RETURN
010224' 001000  000104                           33860          MOV     B,H              ;MOVE [H,L] TO [B,C]
010225' 001000  000115                           33880          MOV     C,L
010226' 001000  000052                           33900          LHLD    FRETOP           ;GET POINTER TO TOP OF STRING FREE SPACE
010227' 000000  001573'
010230' 000000  010211'
010231' 001000  000347                           33920          COMPAR                   ;IS THIS STRINGS POINTER ,LT, FRETOP
010232' 001000  000140                           33940          MOV     H,B              ;MOVE [B,C] BACK TO [H,L]
010233' 001000  000151                           33960          MOV     L,C
010234' 001000  000330                           33980          RC                       ;IF NOT, NO NEED TO MESS WITH IT FURTHUR
010235' 001000  000341                           34000          POP     H                ;GET RETURN ADDRESS OFF STACK
010236' 001000  000343                           34020          XTHL                     ;GET MAX SEEN SO FAR & SAVE RETURN ADDRESS
010237' 001000  000347                           34040          COMPAR                   ;LETS SEE
010240' 001000  000343                           34060          XTHL                     ;SAVE MAX SEEN & GET RETURN ADDRESS OFF STACK
010241' 001000  000345                           34080          PUSH    H                ;SAVE RETURN ADDRESS BACK
010242' 001000  000140                           34100          MOV     H,B              ;MOVE [B,C] BACK TO [H,L]
010243' 001000  000151                           34120          MOV     L,C
010244' 001000  000320                           34140          RNC                      ;IF NOT, LETS LOOK AT NEXT VAR
010245' 001000  000301                           34160          POP     B                ;GET RETURN ADDR OFF STACK
010246' 001000  000361                           34180          POP     PSW              ;POP OFF MAX SEEN
010247' 001000  000361                           34200          POP     PSW              ;AND VARIABLE POINTER
010250' 001000  000345                           34220          PUSH    H                ;SAVE NEW VARIABLE POINTER
010251' 001000  000325                           34240          PUSH    D                ;AND NEW MAX POINTER
010252' 001000  000305                           34260          PUSH    B                ;SAVE RETURN ADDRESS BACK
010253' 001000  000311                           34280          RET                      ;AND RETURN
                                                 34300  ;
                                                 34320  ; HERE WHEN MADE ONE COMPLETE PASS THRU STRING VARS
                                                 34340  ;
010254' 001000  000321                           34360  GRBPAS: POP     D                ;POP OFF MAX POINTER
010255' 001000  000341                           34380          POP     H                ;AND GET VARIABLE POINTER
010256' 001000  000175                           34400          MOV     A,L              ;GET LOW IN
010257' 001000  000264                           34420          ORA     H                ;SEE IF ZERO POINTER
010260' 001000  000310                           34440          RZ                       ;IF END OF COLLECTION,
                                                 34460                                   ;THEN MAYBE RETURN TO GETSPA
010261' 001000  000053                           34480          DCX     H                ;CURRENTLY JUST PAST THE DESCRIPTOR
```

```
010262' 001000  000106   34500          MOV     B,M          ;[B]=HIGH BYTE OF DATA POINTER
010263' 001000  000053   34520          DCX     H
010264' 001000  000116   34540          MOV     C,M          ;[B,C]=POINTER AT STRING DATA
010265' 001000  000345   34550          PUSH    H            ;SAVE THIS LOCATION SO THE POINTER
                         34552                               ;CAN BE UPDATED AFTER THE STRING IS
                         34554                               ;MOVED
010266' 001000  000053   34560          DCX     H
                         34580  IFN     LENGTH=2,<
                         34600          DCX     H>
010267' 001000  000156   34620          MOV     L,M          ;[L]=STRING LENGTH
010270' 001000  000046   34640          MVI     M,0          ;[M,L] GET CHARACTER COUNT
010271' 000000  000000
010272' 001000  000011   34660          DAD     B            ;[M,L]=POINTER BEYOND STRING
010273' 001000  000120   34680          MOV     D,B
010274' 001000  000131   34700          MOV     E,C          ;[D,E]=ORIGINAL POINTER
010275' 001000  000053   34720          DCX     H            ;DON'T MOVE ONE BEYOND STRING
010276' 001000  000104   34740          MOV     B,M          ;GET TOP OF STRING IN [B,C]
010277' 001000  000115   34760          MOV     C,L
010300' 001000  000052   34780          LHLD    FRETOP       ;GET TOP OF FREE SPACE
010301' 000000  001575'
010302' 000000  010227'
010303' 001000  000315   34800          CALL    BLTUC        ;MOVE STRING
010304' 000000  002010'
010305' 000000  010301'
010306' 001000  000341   34820          POP     H            ;GET BACK POINTER TO DESC.
010307' 001000  000161   34840          MOV     M,C          ;SAVE FIXED ADDR
010310' 001000  000043   34860          INX     M            ;MOVE POINTER
010311' 001000  000160   34880          MOV     M,B          ;HIGH PART
010312' 001000  000151   34900          MOV     L,C
010313' 001000  000140   34920          MOV     M,B          ;[M,L]=NEW POINTER
010314' 001000  000053   34940          DCX     H            ;FIX UP FRETOP
010315' 001000  000303   34960          JMP     FNOVAR       ;AND TRY TO FIND HIGH AGAIN
010316' 000000  010045'
010317' 000000  010304'

                         35000  ;
                         35020  ; THE FOLLOWING ROUTINE CONCATENATES TWO STRINGS
                         35040  ; THE FACLO CONTAINS THE FIRST ONE AT THIS POINT,
                         35060  ; [M,L] POINTS BEYOND THE + SIGN AFTER IT
                         35080  ;
010320' 001000  000305   35100  CAT:    PUSH    B            ;PUT OLD PRECEDENCE BACK ON
010321' 001000  000345   35120          PUSH    H            ;SAVE TEXT POINTER
010322' 001000  000052   35140          LHLD    FACLO        ;GET POINTER TO STRING DESC.
010323' 000000  001637'
010324' 000000  010316'
010325' 001000  000343   35160          XTHL                 ;SAVE ON STACK & GET TEXT POINTER BACK
010326' 001000  000315   35180          CALL    EVAL         ;EVALUATE REST OF FORMULA
010327' 000000  006661'
010330' 000000  010323'
010331' 001000  000343   35200          XTHL                 ;SAVE TEXT POINTER, GET BACK DESC.
010332' 001000  000315   35220          CALL    CHKSTR
010333' 000000  006230*
010334' 000000  010327'
```



```
010335' 001000  000176   35240          MOV     A,M
010336' 001000  000345   35260          PUSH    H            ;SAVE DESC. POINTER.
010337' 001000  000052   35280          LHLD    FACLO        ;GET POINTER TO 2ND DESC.
010340' 000000  001637'
010341' 000000  010333'
010342' 001000  000345   35300          PUSH    H            ;SAVE IT
010343' 001000  000206   35320          ADD     M            ;ADD TWO LENGTHS TOGETHER
010344' 001000  000036   35340          MVI     E,ERRLS      ;SEE IF RESULT .LT. 256
010345' 000000  000017
010346' 001000  000332   35360          JC      ERROR        ;ERROR "LONG STRING"
010347' 000000  002102'
010350' 000000  010340'
010351' 001000  000315   35380          CALL    STRINI       ;GET INITIAL STRING
010352' 000000  007624'
010353' 000000  010347'
010354' 001000  000321   35400          POP     D            ;GET 2ND DESC.
010355' 001000  000315   35420          CALL    FRETMP
010356' 000000  010440'
010357' 000000  010352'
010360' 001000  000343   35440          XTHL                 ;SAVE POINTER TO IT
010361' 001000  000315   35460          CALL    FRETM2       ;FREE UP 1ST TEMP
010362' 000000  010437'
010363' 000000  010356'
010364' 001000  000345   35480          PUSH    H            ;SAVE DESC. POINTER (FIRST)
010365' 001000  000052   35500          LHLD    DSCTMP+2     ;GET POINTER TO FIRST
010366' 000000  001572'
010367' 000000  010362'
010370' 001000  000353   35520          XCHG                 ;IN [D,E]
010371' 001000  000315   35540          CALL    MOVINS       ;MOVE IN THE FIRST STRING
010372' 000000  010407'
010373' 000000  010366'
010374' 001000  000315   35560          CALL    MOVINS       ;AND THE SECOND
010375' 000000  010407'
010376' 000000  010372'
010377' 001000  000041   35580          LXI     H,TSTOP      ;CAT REENTERS FORMULA EVALUATION AT TSTOP
010400' 000000  005357'
010401' 000000  010375'
010402' 001000  000343   35600          XTHL
010403' 001000  000345   35620          PUSH    H            ;TEXT POINTER OFF FIRST
010404' 001000  000303   35640          JMP     PUTNEW       ;THEN RETURN ADDRESS OF TSTOP
010405' 000000  007705'
010406' 000000  010400'

010407' 001000  000341   35700  MOVINS: POP     H            ;GET RETURN ADDR
010410' 001000  000343   35720          XTHL                 ;PUT BACK, BUT GET DESC.
                         35740  IFE     LENGTH=2,<
010411' 001000  000176   35760          MOV     A,M          ;[A]=STRING LENGTH
010412' 001000  000043   35780          INX     H
010413' 001000  000116   35800          MOV     C,M          ;[B,C]=POINTER AT STRING DATA
010414' 001000  000043   35820          INX     H
010415' 001000  000106   35840          MOV     B,M
010416' 001000  000157   35860          MOV     L,A>         ;[L]=STRING LENGTH
```

```
                                        35880   IFN     LENGTH=2,<
                                        35900           PUSHM                   ;GET LENGTH ON STACK
                                        35920           PUSHM                   ;AND POINTER
                                        35940           POP     B               ;TEXT POINTER HERE
                                        35960           POP     H>              ;CHARACTER COUNT HERE
010417' 001000  000054                  35980   MOVSTR: INR     L
010420' 001000  000055                  36000   MOVLP:  DCR     L               ;SET CC'S
010421' 001000  000310                  36020           RZ                      ;0, NO BYTE TO MOVE
010422' 001000  000012                  36040           LDAX    B               ;GET CHAR
010423' 001000  000022                  36060           STAX    D               ;SAVE IT
010424' 001000  000003                  36080           INX     B               ;MOVE POINTERS
010425' 001000  000023                  36100           INX     D
010426' 001000  000303                  36120           JMP     MOVLP           ;KEEP DOING IT
010427' 000000  010420'
010430' 000000  010405'
                                        36140   ;
                                        36160   ; FRETMP IS PASSED A POINTER TO A STRING DESCRIPTOR IN [D,E]
                                        36180   ; THIS VALUE IS RETURNED IN [H,L], ALL THE OTHER REGISTERS ARE MODIFIED,
                                        36200   ; A CHECK TO IS MADE TO SEE IF THE STRING DESCRIPTOR [D,E] POINTS
                                        36220   ; TO IS THE LAST TEMPORARY DESCRIPTOR ALLOCATED BY PUTNEW,
                                        36240   ; IF SO, THE TEMPORARY IS FREED UP BY THE UPDATING OF TEMPPT,
                                        36260   ; IF A TEMPORARY IS FREED UP, A FURTHER CHECK IS MADE TO SEE IF THE
                                        36280   ; STRING DATA THAT THAT STRING TEMPORARY POINTED TO IS THE
                                        36300   ; THE LOWEST PART OF STRING SPACE IN USE,
                                        36320   ; IF SO, FRETMP IS UPDATED TO REFLECT THE FACT THAT THAT SPACE IS NO
                                        36340   ; LONGER IS USE, THIS CAUSES DIFFICULTY FOR ASSIGNMENT ("LET") BECAUSE
                                        36360   ; THOUGH A TEMPORARY IS BEING FREED UP, NAMELY THE VALUE TO THE RIGHT
                                        36380   ; OF THE EQUAL SIGN IN THE "LET", THE ACTUAL DATA
                                        36400   ; IS STILL ACTIVE DATA SINCE A VARIABLE IS BEING SET UP TO POINT
                                        36420   ; AT IT, "LET" FOOLS FRETMP BY SETTING THE LENGTH OF THE
                                        36440   ; TEMPORARY TO ZERO TEMPORARILY,
                                        36460   ;
010431' 001000  000315                  36480   FRESTR: CALL    CHKSTR          ;MAKE SURE ITS A STRING
010432' 000000  010333*
010433' 000000  010427'
010434' 001000  000052                  36500   FREFAC: LHLD    FACLO
010435' 000000  001637'
010436' 000000  010432'
010437' 001000  000353                  36520   FRETM2: XCHG                    ;FREE UP THE TEMP IN THE FACLO
010440' 001000  000052                  36540   FRETMP: LHLD    TEMPPT          ;GET TEMP POINTER
010441' 000000  001547'
010442' 000000  010435'
010443' 001000  000053                  36560           DCX     H               ;LOOK AT WHAT IS IN THE LAST TEMP
010444' 001000  000106                  36580           MOV     B,M             ;[B,C]=POINTER AT STRING
010445' 001000  000053                  36600           DCX     H               ;DECREMENT TEMPPT BY STRSIZ
010446' 001000  000116                  36620           MOV     C,M
010447' 001000  000053                  36640           DCX     H
                                        36660   IFN     LENGTH=2,<
                                        36680           DCX     H>
010450' 001000  000347                  36700           COMPAR                  ;SEE IF [D,E] POINT AT THE LAST
010451' 001000  000353                  36720           XCHG                    ;RETURN WITH [H,L]
                                        36740                                   ;POINTING AT CURRENT DESCRIPTOR
010452' 001000  000300                  36760           RNZ                     ;RETURN NOW IF NOW FREEING DONE
```



```
010453' 001000  000042                  36780           SHLD    TEMPPT          ;UPDATE THE TEMP POINTER SINCE
010454' 000000  001547'
010455' 000000  010441'
                                        36800                                   ;ITS BEEN DECREMENTED BY 4
010456' 001000  000325                  36820           PUSH    D               ;SAVE [D,E] TO RETURN IN [H,L]
010457' 001000  000120                  36840           MOV     D,B             ;[D,E]=POINTER AT STRING
010460' 001000  000131                  36860           MOV     E,C
010461' 001000  000033                  36880           DCX     D               ;SUBTRACT ONE
010462' 001000  000116                  36900           MOV     C,M             ;[C]=LENGTH OF THE STRING FREED UP
010463' 001000  000052                  36920           LHLD    FRETOP          ;SEE IF ITS THE FIRST
010464' 000000  001573'
010465' 000000  010454'
                                        36940                                   ;ONE IN STRING SPACE
010466' 001000  000347                  36960           COMPAR
010467' 001000  000302                  36980           JNZ     NOTLST          ;NO SO DON'T ADD
010470' 000000  010477'
010471' 000000  010464'
010472' 001000  000107                  37000           MOV     B,A             ;MAKE [B]=0
010473' 001000  000011                  37020           DAD     B               ;ADD
010474' 001000  000042                  37040           SHLD    FRETOP          ;AND UPDATE FRETOP
010475' 000000  001573'
010476' 000000  010470'
010477' 001000  000341                  37060   NOTLST: POP     H               ;GET POINTER AT CURRENT DESCRIPTOR
010500' 001000  000311                  37080           RET
                                        37100   ;
                                        37120   ; THE FUNCTION LEN($) RETURNS THE LENGTH OF THE
                                        37140   ; STRING PASSED AS AN ARGUMENT
                                        37160   ;
010501' 001000  000001                  37180   LEN:    LXI     B,SNGFLT        ;CALL SNGFLT WHEN DONE
010502' 000000  007400'
010503' 000000  010475'
010504' 001000  000305                  37200           PUSH    B               ;LIKE SO
010505' 001000  000315                  37220   LEN1:   CALL    FRESTR          ;FREE UP TEMP POINTED TO BY FACLO
010506' 000000  010431'
010507' 000000  010502'
010510' 001000  000257                  37240           XRA     A               ;FORCE NUMERIC FLAG
010511' 001000  000127                  37260           MOV     D,A             ;SET HIGH OF [D,E] TO ZERO FOR VAL
                                        37280   IFN     LENGTH=2,<
                                        37300           STA     VALTYP>
010512' 001000  000176                  37320           MOV     A,M
010513' 001000  000267                  37340           ORA     A               ;SET CONDITION CODES ON LENGTH
010514' 001000  000311                  37360           RET                     ;RETURN
                                        37380   ;
                                        37400   ; THE FOLLOWING IS THE ASC($) FUNCTION, IT RETURNS AN INTEGER
                                        37420   ; WHICH IS THE DECIMAL ASCII EQUIVALENT
                                        37440   ;
010515' 001000  000315                  37460   ASC:    CALL    LEN1            ;SET UP ORIGINAL STR
010516' 000000  010505'
010517' 000000  010506'
010520' 001000  000312                  37480           JZ      FCERR           ;NULL STR, BAD ARG.
010521' 000000  010776'
010522' 000000  010516'
010523' 001000  000043                  37500           INX     H               ;BUMP POINTER
```

```
7088                                    37520  IFN     LENGTH=2,<
7089                                    37540          INX     H>              ;BUMP POINTER
7090  010524' 001000  000367            37560          PUSHM                   ;GET ADDRESS
7091  010525' 001000  000341            37580          POP     H               ;GET ADDR IN (H,L)
7092  010526' 001000  000176            37600          MOV     A,M             ;GET FIRST CHAR
7093  010527' 001000  000303            37620          JMP     SNGFLT          ;SNGFLT IT
7094  010530' 000000  007400'
7095  010531' 000000  010521'
7096                                    37640  ;
7097                                    37660  ; CHRS(#) CREATES A STRING WHICH CONTAINS AS ITS ONLY
7098                                    37680  ; CHARACTER THE ASCII EQUIVALENT OF THE INTEGER ARG (#)
7099                                    37700  ; WHICH MUST BE .LT. 255.
7100                                    37720  ;
7101  010532' 001000  000076            37740  CHRS:   MVI     A,1             ;ONE CHARACTER STR
7102  010533' 000000  000001
7103  010534' 001000  000315            37760          CALL    STRINI          ;GET STRING IN DSCTMP
7104  010535' 000000  007624'
7105  010536' 000000  010530'
7106  010537' 001000  000315            37780          CALL    CONINT          ;GET INTEGER IN RANGE
7107  010540' 000000  011023'
7108  010541' 000000  010535'
7109  010542' 001000  000052            37800          LHLD    DSCTMP+2        ;GET ADDR OF STR
7110  010543' 000000  001572'
7111  010544' 000000  010540'
7112  010545' 001000  000163            37820          MOV     M,E             ;SAVE ASCII BYTE
7113  010546' 001000  000301            37840  FINBCK: POP     B               ;RETURN TO HIGHER LEVEL &
7114                                    37860                                  ;SKIP THE CHKNUM CALL.
7115  010547' 001000  000303            37880          JMP     PUTNEW          ;GO CALL PUTNEW
7116  010550' 000000  007705'
7117  010551' 000000  010543'
7118                                    37900  ;
7119                                    37920  ; THE FOLLOWING IS THE LEFTS(S,#) FUNCTION.
7120                                    37940  ; IT TAKES THE LEFTMOST # CHARS OF THE STR,
7121                                    37960  ; IF # IS .GT. THAN THE LEN OF THE STR, IT RETURNS THE WHOLE STR.
7122                                    37980  ;
7123  010552' 001000  000315            38000  LEFTS:  CALL    PREAM           ;TEST THE PARAMETERS
7124  010553' 000000  010764'
7125  010554' 000000  010550'
7126  010555' 001000  000257            38020          XRA     A               ;LEFT NEVER CHANGES STRING POINTER
7127  010556' 001000  000343            38040  LEFT3:  XTHL                    ;SAVE TEXT POINTER
7128  010557' 001000  000117            38060          MOV     C,A             ;OFFSET NOW IN (C)
7129  010560' 001000  000345            38080  LEFT2:  PUSH    H               ;SAVE DESC, FOR  FRETMP
7130  010561' 001000  000176            38100          MOV     A,M             ;GET STRING LENGTH
7131  010562' 001000  000270            38120          CMP     B               ;ENTIRE STRING WANTED?
7132  010563' 001000  000332            38140          JC      ALLSTR          ;IF #CHARS ASKED FOR.GE.LENGTH.YES
7133  010564' 000000  010570'
7134  010565' 000000  010553'
7135  010566' 001000  000170            38160          MOV     A,B             ;GET TRUNCATED LENGTH OF STRING
7136  010567' 001000  000021            38180          XWD     "01000,"021     ;SKIP OVER MVI USING "LXI D,"
7137  010570' 001000  000016            38200  ALLSTR: MVI     C,0             ;MAKE OFFSET ZERO
7138  010571' 000000  000000
7139  010572' 001000  000305            38220          PUSH    B               ;SAVE OFFSET ON STACK
7140  010573' 001000  000315            38240          CALL    GETSPA          ;GET SPACE FOR NEW STRING
```



```
7141  010574' 000000  007772'
7142  010575' 000000  010564'
7143  010576' 001000  000301            38260          POP     B               ;GET BACK OFFSET
7144  010577' 001000  000341            38280          POP     H               ;GET BACK DESC POINTER.
7145  010600' 001000  000345            38300          PUSH    H               ;BUT KEEP ON STACK
7146  010601' 001000  000043            38320          INX     H               ;MOVE TO STRING POINTER FIELD
7147                                    38340  IFN     LENGTH=2,<
7148                                    38360          INX     H>
7149  010602' 001000  000106            38380          MOV     B,M             ;GET POINTER LOW
7150  010603' 001000  000043            38400          INX     H               ;
7151  010604' 001000  000146            38420          MOV     H,M             ;POINTER HIGH
7152  010605' 001000  000150            38440          MOV     L,B             ;GET LOW IN  L
7153  010606' 001000  000006            38460          MVI     B,0             ;GET READY TO ADD OFFSET TO POINTER
7154  010607' 000000  000000
7155  010610' 001000  000011            38480          DAD     B               ;ADD  IT
7156  010611' 001000  000104            38500          MOV     B,H             ;GET OFFSET POINTER IN (B,C)
7157  010612' 001000  000115            38520          MOV     C,L
7158  010613' 001000  000315            38540          CALL    STRAD2          ;SAVE INFO IN DSCTMP
7159  010614' 000000  007627'
7160  010615' 000000  010574'
7161  010616' 001000  000157            38560          MOV     L,A             ;GET#  OF CHARS TO  MOVE IN L
7162  010617' 001000  000315            38580          CALL    MOVSTR          ;MOVE THEM IN
7163  010620' 000000  010417'
7164  010621' 000000  010614'
7165  010622' 001000  000321            38600          POP     D               ;GET BACK DESC. POINTER
7166  010623' 001000  000315            38620          CALL    FRETMP          ;FREE IT UP.
7167  010624' 000000  010440'
7168  010625' 000000  010620'
7169  010626' 001000  000303            38640          JMP     PUTNEW          ;PUT TEMP IN TEMP LIST
7170  010627' 000000  007705'
7171  010630' 000000  010624'
7172
7173  010631' 001000  000315            38660  RIGHTS: CALL    PREAM           ;CHECK ARG
7174  010632' 000000  010764'
7175  010633' 000000  010627'
7176  010634' 001000  000321            38700          POP     D               ;GET DESC. POINTER
7177  010635' 001000  000325            38720          PUSH    D               ;SAVE BACK FOR LEFT
7178  010636' 001000  000052            38740          LDAX    D               ;GET PRESENT LEN OF STR
7179  010637' 001000  000220            38760          SUB     B               ;SUBTRACT 2ND PARM
7180  010640' 001000  000303            38780          JMP     LEFT3           ;CONTINUE WITH LEFT CODE
7181  010641' 000000  010556'
7182  010642' 000000  010632'
7183                                    38800  ;
7184                                    38820  ; MID (S,#) RETURNS STR WITH CHARS FROM # POSITION
7185                                    38840  ; ONWARD, IF # IS GT LEN(S) THEN RETURN NULL STRING.
7186                                    38860  ; MID (S,#,#) RETURNS STR WITH CHARS FROM # POSITION
7187                                    38880  ; FOR #2 CHARS, IF #2 GOES PAST END OF STRING, RETURN
7188                                    38900  ; AS MUCH AS POSSIBLE.
7189                                    38920  ;
7190  010643' 001000  000353            38940  MID$:   XCHG                    ;PUT THE TEXT POINTER IN (H,L)
7191  010644' 001000  000176            38960          MOV     A,M             ;GET THE FIRST CHARACTER
7192  010645' 001000  000315            38980          CALL    PREAM2          ;GET OFFSET OFF STACK AND MAKE
7193  010646' 000000  010767'
```

```
010647' 000000  010641'
                                39000                           ;SURE DOES NOT = 0,
010650' 001000  000305          39020           PUSH    B       ;PUT OFFSET ON TO THE STACK
010651' 001000  000036          39040           MVI     E,255   ;IF TWO ARG GUY, TRUNCATE,
010652' 000000  000377
010653' 001000  000376          39060           CPI     ")"
010654' 000000  000051
010655' 001000  000312          39080           JZ      MID2    ;(E) SAYS USE ALL CHARS
010656' 000000  010665'
010657' 000000  010646'
                                39100                           ;IF ONE ARGUMENT THIS IS CORRECT
010660' 001000  000317          39120           SYNCHK  44      ;COMMA? MUST DELINEATE 3RD ARG,
010661' 000000  000054
010662' 001000  000315          39140           CALL    GETBYT  ;GET ARGUMENT  IN  (E)
010663' 000000  011020'
010664' 000000  010656'
010665' 001000  000317          39160   MID2:   SYNCHK  ")"    ;MUST BE FOLLOWED BY )
010666' 000000  000051
010667' 001000  000361          39180           POP     PSW     ;GET OFFSET BACK IN A
010670' 001000  000343          39200           XTHL            ;SAVE TEXT POINTER, GET DESC,
010671' 001000  000001          39220           LXI     B,LEFT2 ;WHERE TO RETURN TO,
010672' 000000  010560'
010673' 000000  010663'
010674' 001000  000305          39240           PUSH    B       ;GOES ON STACK
010675' 001000  000075          39260           DCR     A       ;SUB ONE FROM OFFSET
010676' 001000  000276          39280           CMP     M       ;POINTER PAST END OF STR?
010677' 001000  000006          39300           MVI     B,0     ;ASSUME NULL LENGTH STR
010700' 000000  000000
010701' 001000  000320          39320           RNC             ;YES, JUST USE NULL STR
010702' 001000  000117          39340           MOV     C,A     ;SAVE OFFSET OF CHARACTER POINTER
010703' 001000  000176          39360           MOV     A,M     ;GET PRESENT LEN OF STR
010704' 001000  000221          39380           SUB     C       ;SUBTRACT INDEX (2ND ARG)
010705' 001000  000273          39400           CMP     E       ;IS IT TRUNCATION
010706' 001000  000107          39420           MOV     B,A     ;GET CALCED LENGTH IN B
010707' 001000  000330          39440           RC              ;IF NOT USE PARTIAL STR
010710' 001000  000103          39460           MOV     B,E     ;USE TRUNCATED LENGTH
010711' 001000  000311          39480           RET>            ;RETURN TO LEFT2
                                39500   IFN LENGTH,<
                                39520   ;
                                39540   ; THE FOLLOWING FUNCTIONS ALLOW THE
                                39560   ; USER FULL ACCESS TO THE ALTAIR I/O PORTS
                                39580   ; INP(CHANNEL#) RETURNS AN INTEGER WHICH IS THE STATUS
                                39600   ; OF THE CHANNEL, OUT CHANNEL#,VALUE PUTS OUT THE INTEGER
                                39620   ; VALUE ON CHANNEL #, IT IS A STATEMENT, NOT A FUNCTION,
                                39640   ;
010712' 001000  000315          39660   FNINP:  CALL    CONINT  ;GET INTEGER CHANNEL #
010713' 000000  011023'
010714' 000000  010672'
010715' 001000  000062          39680           STA     INPWRD+1        ;GEN INP INSTR
010716' 000000  010721'
010717' 000000  010713'
010720' 001000  000333          39700   INPWRD: IN      0       ;THE INP INSTR
010721' 000000  000000
```



```
010722' 001000  000303          39720           JMP     SNGFLT  ;SNGFLT RESULT
010723' 000000  007400'
010724' 000000  010716'

010725' 001000  000315          39760   FNOUT:  CALL    SETIO   ;GET READY
010726' 000000  011003'
010727' 000000  010723'
010730' 001000  000323          39780   OUTWRD: OUT     0       ;DO IT
010731' 000000  000000
010732' 001000  000311          39800           RET             ;AND THATS ALL
                                39820   ;
                                39840   ; THE WAIT CHANNEL#,MASK,MASK2 WAITS UNTIL THE STATUS
                                39860   ; RETURNED BY CHANNEL# IS NON ZERO WHEN XORED WITH MASK2
                                39880   ; AND THEN ANDED WITH MASK, IF MASK2 IS NOT PRESENT IT IS ASSUMED
                                39900   ; TO BE ZERO,
                                39920   ;
010733' 001000  000315          39940   FNWAIT: CALL    SETIO   ;SET UP FOR WAIT
010734' 000000  011003'
010735' 000000  010726'
010736' 001000  000365          39960           PUSH    PSW     ;SAVE THE MASK
010737' 001000  000036          39980           MVI     E,0     ;DEFAULT MASK2 TO ZERO
010740' 000000  000000
010741' 001000  000053          40000           DCX     H
010742' 001000  000327          40020           CHRGET          ;SEE IF THE STATEMENT ENDED
010743' 001000  000312          40040           JZ      NOTTHR  ;IF NO THIRD ARGUMENT SKIP THIS
010744' 000000  010753'
010745' 000000  010734'
010746' 001000  000317          40060           SYNCHK  44      ;MAKE SURE THERE IS A ","
010747' 000000  000054
010750' 001000  000315          40080           CALL    GETBYT
010751' 000000  011020'
010752' 000000  010744'
010753' 001000  000301          40100   NOTTHR: POP     B       ;REGET THE "AND" MASK
010754' 001000  000333          40120   STAINP: IN      0       ;THE INPUT INSTR
010755' 000000  000000
010756' 001000  000253          40140           XRA     E       ;XOR WITH MASK2
010757' 001000  000240          40160           ANA     B       ;AND WITH MASK
010760' 001000  000312          40180           JZ      STAINP  ;LOOP UNTIL RESULT IS NON-ZERO
010761' 000000  010754'
010762' 000000  010751'
                                40200                           ;NOTE: THIS LOOP CANNOT BE CONTROL-C'ED
                                40220                           ;UNLESS THE WAIT IS BEING DONE ON CHANNEL
                                40240                           ;ZERO, HOWEVER A RESTART AT 0 IS OK,
010763' 001000  000311          40260           RET>
                                40280   IFN     STRING,<
                                40300   ;USED BY RIGHT$ AND LEFT$ FOR PARAMETER CHECKING AND SETUP
010764' 001000  000353          40320   PREAM:  XCHG            ;PUT THE TEXT POINTER IN (H,L)
010765' 001000  000317          40340           SYNCHK  ")"     ;PARAM LIST SHOULD END
010766' 000000  000051
                                40360   ;USED BY MID$ FOR PARAMETER CHECKING AND SETUP
010767' 001000  000301          40380   PREAM2: POP     B       ;GET RETURN ADDR OFF STACK
010770' 001000  000321          40400           POP     D       ;GET LENGTH OF ARG OFF STACK
010771' 001000  000305          40420           PUSH    B       ;SAVE RETURN ADDR BACK ON
```

```
 7300  010772' 001000  000103          40440            MOV     B,E              ;SAVE INIT LENGTH
 7301  010773' 001000  000004          40460            INR     B
 7302  010774' 001000  000005          40480            DCR     B                ;SEE IF EQUAL TO ZERO
 7303                                  40500    IFE     LENGTH=2,<
 7304  010775' 001000  000300          40520            RNZ
 7305  010776'                         40536    ILLFUN:
 7306  010776' 001000  000036          40540    FCERR:  MVI     E,ERRFC
 7307  010777' 000000  000005
 7308  011000' 001000  000303          40560            JMP     ERROR>
 7309  011001' 000000  002102'
 7310  011002' 000000  010761'
 7311                                  40580    IFN     LENGTH=2,<
 7312                                  40600            JZ      FCERR            ;IT MUST NOT BE 0
 7313                                  40620            RET>
 7314                                  40640    IFN     LENGTH,<
 7315  011003' 001000  000315          40660    SETIO:  CALL    GETBYT           ;GET INTEGER CHANNEL NUMBER IN [A]
 7316  011004' 000000  011020'
 7317  011005' 000000  011001'
 7318  011006' 001000  000066          40680            STA     STAINP+1         ;SETUP "WAIT"
 7319  011007' 000000  010755'
 7320  011010' 000000  011004'
 7321  011011' 001000  000062          40700            STA     OUTWRD+1         ;SETUP "OUT"
 7322  011012' 000000  010731'
 7323  011013' 000000  011007'
 7324  011014' 001000  000317          40720            SYNCHK  44               ;MAKE SURE THERE IS A COMMA
 7325  011015' 000000  000054
 7326  011016' 001000  000006          40740            XWD     "01000,6>        ;"MVI B," AROUND THE CHRGET
 7327                                  40760    IFN     STRING|LENGTH,<
 7328  011017' 001000  000327          40780    GTBYTC: CHRGET
 7329                                  40800    IFE     LENGTH=2,<
 7330  011020' 001000  000315          40820    GETBYT: CALL    FRMEVL
 7331  011021' 000000  005336'
 7332  011022' 000000  011012'
 7333  011023' 001000  000345          40840    CONINT: PUSH    H
 7334  011024' 001000  000315          40860            CALL    FRCINT
 7335  011025' 000000  006441*
 7336  011026' 000000  011021'
 7337  011027' 001000  000353          40880            XCHG
 7338  011030' 001000  000341          40900            POP     H>
 7339                                  40920    IFN     LENGTH=2,<
 7340                                  40940    GETBYT: CALL    FRMNUM           ;READ FORMULA INTO THE FAC,
 7341                                  40960    CONINT: CALL    POSINT>          ;CONVERT THE FAC TO A SINGLE BYTE INTEGER
 7342  011031' 001000  000172          40980            MOV     A,D              ;SHOULD BE ,LT, 255
 7343  011032' 001000  000267          41000            ORA     A                ;SET CC'S
 7344  011033' 001000  000302          41020            JNZ     FCERR            ;WASN'T ERROR
 7345  011034' 000000  010776'
 7346  011035' 000000  011025'
 7347  011036' 001000  000053          41040            DCX     H                ;ACTUALLY FUNCTIONS CAN GET HERE
 7348                                  41060                                     ;WITH BAD [H,L] BUT NOT SERIOUS
 7349                                  41080                                     ;SET CONDITION CODES ON TERMINATOR
 7350  011037' 001000  000327          41100            CHRGET
 7351  011040' 001000  000173          41120            MOV     A,E              ;RETURN THE RESULT IN [A] AND [E]
 7352  011041' 001000  000311          41140            RET>
```



```
 7353
 7354                                  41160    IFN     STRING,<
 7355                                  41200    ;
 7356                                  41202    ; THE VAL FUNCTION TAKES A STRING AND TURN IT INTO
 7357                                  41204    ; A NUMBER BY INTERPRETING THE ASCII DIGITS, ETC.,
 7358                                  41206    ; EXCEPT FOR THE PROBLEM THAT A TERMINATOR MUST BE SUPPLIED
 7359                                  41208    ; BY REPLACING THE CHARACTER BEYOND THE STRING, VAL
 7360                                  41210    ; IS MERELY A CALL TO FLOATING INPUT (FIN),
 7361                                  41212    ;
 7362  011042' 001000  000315          41220    VAL:    CALL    LEN1             ;DO SETUP, SET RESULT=REAL
 7363  011043' 000000  010505'
 7364  011044' 000000  011034'
 7365  011045' 001000  000312          41240            JZ      ZERO             ;RETURN ZERO IF NULL
 7366  011046' 000000  000000*
 7367  011047' 000000  011043'
 7368  011050' 001000  000137          41260            MOV     E,A              ;GET LENGTH OF STR
 7369                                  41270    IFN     LENGTH=2,<
 7370                                  41280            INX     H>               ;THIS IS ALL A KLUDGE
 7371  011051' 001000  000043          41300            INX     H                ;TO HANDLE THE FACT THE IF
 7372  011052' 001000  000367          41320            PUSHM                    ;TWO STRINGS "1" AND "2"
 7373  011053' 001000  000140          41340            MOV     H,B              ;ARE STORED NEXT TO EACH OTHER
 7374  011054' 001000  000151          41360            MOV     L,C              ;AND FIN IS CALLED POINTING TO
 7375  011055' 001000  000031          41380            DAD     D                ;THE FIRST TWELVE WILL BE RETURNED
 7376  011056' 001000  000106          41400            MOV     B,M              ;THE IDEA IS TO STORE 0 IN THE
 7377  011057' 001000  000162          41420            MOV     M,D              ;STRING BEYOND THE ONE VAL
 7378  011060' 001000  000343          41440            XTHL                     ;IS BEING CALLED ON
 7379  011061' 001000  000305          41460            PUSH    B                ;THE FIRST CHARACTER OF THE NEXT STRING
 7380  011062' 001000  000176          41480            MOV     A,M              ;GET FIRST CHARACTER OF ARGUMENT
 7381  011063' 001000  000315          41500            CALL    FIN              ;TURN IT INTO A NUMBER IN THE FAC
 7382  011064' 000000  006103*
 7383  011065' 000000  011046'
 7384  011066' 001000  000301          41520            POP     B                ;GET THE MODIFIED CHARACTER OF THE NEXT
 7385                                  41540                                     ;STRING INTO [B]
 7386  011067' 001000  000341          41560            POP     H                ;GET THE POINTER TO THE MODIFIED CHARACTER
 7387  011070' 001000  000160          41580            MOV     M,B              ;RESTORE THE CHARACTER
 7388                                  41600                                     ;IF STRING IS HIGHEST IN STRING SPACE
 7389                                  41620                                     ;WE ARE MODIFYING [MEMSIZ] AND
 7390                                  41640                                     ;THIS IS WHY [MEMSIZ] CAN'T BE USED TO STORE
 7391                                  41660                                     ;STRING DATA BECAUSE WHAT IF THE
 7392                                  41680                                     ;USER TOOK VAL OFF THAT HIGH STRING
 7393  011071' 001000  000311          41700            RET>
 7394
 7395                                  41740    PAGE
```

```
                                 41760   SUBTTL  FANCY LIST,DELETE,EDIT,LLIST
                                 41780   IFE     LENGTH-2,<
                                 41800   IFN     LPTSW,<
                                 41820   LLIST:  MVI     A,1             ;GET NON ZERO VALUE
                                 41840           STA     PHTFLG>         ;SAVE IN I/O FLAG
011072' 001000  000301           41860   LIST:   POP     B               ;GET RID OF NEWSTT RETURN ADDR
011073' 001000  000315           41880           CALL    SCNLIN          ;SCAN LINE RANGE
011074' 000000  002333'
011075' 000000  011064'
011076' 001000  000305           41900           PUSH    B               ;SAVE POINTER TO 1ST LINE
011077' 001000  000341           41920   LIST4:  POP     H               ;GET POINTER TO LINE
011100' 001000  000321           41940           POP     D               ;GET MAX LINE # OFF STACK
011101' 001000  000367           41960           PUSHM                   ;PUSH LINK
011102' 001000  000170           41980           MOV     A,B             ;SEE IF END OF CHAIN
011103' 001000  000261           42000           ORA     C
011104' 001000  000301           42020           POP     B               ;GET LINK OFF STACK FOR ISCNTC
011105' 001000  000312           42040           JZ      READY           ;LAST LINE, STOP.
011106' 000000  002145'
011107' 000000  011074'
                                 42060   IFN     LISTEN,<
011110' 001000  000315           42080           CALL    ISCNTC>         ;CHECK FOR CONTROL-C
011111' 000000  003460'
011112' 000000  011106'
011113' 001000  000305           42100           PUSH    B               ;SAVE LINK BACK ON
011114' 001000  000367           42120           PUSHM                   ;PUSH LINE #
011115' 001000  000343           42140           XTHL                    ;GET LINE # INTO (H,L)
011116' 001000  000353           42160           XCHG                    ;GET MAX LINE IN (H,L)
011117' 001000  000347           42180           COMPAR                  ;PAST LAST LINE IN RANGE?
011120' 001000  000301           42200           POP     B               ;TEXT POINTER TO (B,C)
011121' 001000  000332           42260           JC      STPRDY          ;IF PAST, THEN DONE LISTING.
011122' 000000  002144'
011123' 000000  011111'
011124' 001000  000343           42280           XTHL                    ;SAVE MAX ON BOTTOM OF STACK
011125' 001000  000345           42300           PUSH    H               ;SAVE LINK ON TOP
011126' 001000  000305           42320           PUSH    B               ;SAVE TEXT POINTER BACK
011127' 001000  000353           42340           XCHG                    ;GET LINE # IN (H,L)
011130' 001000  000315           42360           CALL    CRDO            ;DO CRLF TO START OUT
011131' 000000  004523'
011132' 000000  011122'
                                 42380                                   ;AND WE WANT (H,L) ON THE STACK
011133' 001000  000315           42400           CALL    LINPRT          ;PRINT AS INT WITHOUT LEADING SPACE
011134' 000000  003361*
011135' 000000  011131'
011136' 001000  000076           42420           MVI     A," "
011137' 000000  000040
011140' 001000  000341           42440           POP     H
011141' 001000  000337           42460           OUTCHR                  ;PRINT A SPACE AFTER THE LINE #
011142' 001000  000315           42480           CALL    BUFLIN          ;UNPACK THE LINE INTO BUF
011143' 000000  011163'
011144' 000000  011134'
011145' 001000  000041           42500           LXI     H,BUF-1         ;POINT AT THE START OF THE UNPACKED CHARACTERS
011146' 000000  001430'
011147' 000000  011143'
```



```
011150' 001000  000006           42520           MVI     B,0             ;STOP ON ZERO ONLY
011151' 000000  000000
011152' 001000  000315           42540           CALL    STRLTS          ;LITERALIZE THE LINE STRING
011153' 000000  007642'
011154' 000000  011146'
011155' 001000  000315           42560           CALL    STRPRT          ;PRINT OUT THE CHARACTERS
011156' 000000  007746'
011157' 000000  011153'
011160' 001000  000305           42580           JMP     LIST4           ;PRINT ANOTHER LINE
011161' 000000  011077'
011162' 000000  011156'
011163' 001000  000001           42600   BUFLIN: LXI     B,BUF-1
011164' 000000  001430'
011165' 000000  011161'
011166' 001000  000026           42620           XWD     "01000,"026     ;"MVI   D," AROUND THE NEXT BYTE
011167' 001000  000341           42640   PRIT4:  POP     H               ;RESTORE POINTER TO START OF TEXT
011170' 001000  000176           42660   PLOOP:  MOV     A,M             ;GET A CHARACTER FROM LINE.
011171' 001000  000003           42680           INX     B               ;ADVANCE STUFF COUNT
011172' 001000  000267           42700           ORA     A               ;IS IT A RESERVED WORD
011173' 001000  000043           42720           INX     H               ;INCREMENT POINTER INTO TEXT
011174' 001000  000002           42740           STAX    B               ;STORE A ZERO IF THE END
011175' 001000  000310           42760           RZ                      ;ZERO, END OF LINE.
011176' 001000  000362           42780           JP      PLOOP           ;REGULAR CHAR, JUST PRINT IT
011177' 000000  011170'
011200' 000000  011164'
011201' 001000  000376           42800           CPI     ELSETK          ;IF ITS "ELSE" DON'T PRINT THE COLON
011202' 000000  000220
                                 42820                                   ;IN FRONT OF IT
011203' 001000  000314           42840           CZ      DCXBRT##        ;BACKUP STUFF COUNT TO ELIMINATE
011204' 000000  000000*
011205' 000000  011177'
011206' 001000  000326           42860           SUI     127             ;GET RID OF SIGN BIT AND ADD ONE
011207' 000000  000177
011210' 001000  000345           42880           PUSH    H               ;SAVE CURRENT POSIT
011211' 001000  000021           42900           LXI     D,RESLST        ;GET RESLST POINTER.
011212' 000000  000172'
011213' 000000  011204'
011214' 001000  000325           42920   RESRCH: PUSH    D
011215' 001000  000365           42940           PUSH    PSW             ;SAVE THE RESERVED WORD NUMBER
011216' 001000  000063           42960   RESCR1: LDAX    D               ;GET CHARACTER FROM RESLST
011217' 001000  000023           42980           INX     D               ;BUMP RESLST POINTER
011220' 001000  000267           43000           ORA     A               ;TEST BITS
011221' 001000  000362           43020           JP      RESCR1          ;NOT AT END OF RESERVED WORD YET
011222' 000000  011216'
011223' 000000  011212'
011224' 001000  000361           43040           POP     PSW
011225' 001000  000075           43060           DCR     A               ;DECREMENT CHAR
011226' 001000  000341           43080           POP     H               ;POP START POINTER HERE
011227' 001000  000302           43100           JNZ     RESRCH          ;NOT AT END OF RESLST YET.
011230' 000000  011214'
011231' 000000  011222'
                                 43120   ;HERE WHEN FOUND RIGHT RESERVED WORD
011232' 001000  000176           43140   PRIT3:  MOV     A,M             ;GET A CHARACTER FROM RESERVED WORD
```

```
011233' 001000  000267   43160          ORA     A              ;SET CONDITION CODES
011234' 001000  000002   43180          STAX    B
011235' 001000  000372   43200          JM      PRIT4
011236' 000000  011167'
011237' 000000  011230'
011240' 001000  000003   43220          INX     B
011241' 001000  000043   43240          INX     H              ;BUMP RESLST POINTER
011242' 001000  000303   43260          JMP     PRIT3          ;PRINT THE REST
011243' 000000  011232'
011244' 000000  011236'
                         43280   ;
                         43300   ; THE FOLLOWING CODE IS FOR THE DELETE RANGE
                         43320   ; COMMAND, BEFORE THE LINES ARE DELETED, 'OK'
                         43340   ; IS TYPED,
                         43360   ;
011245' 001000  000315   43380   DELETE: CALL    SCNLIN         ;SCAN LINE RANGE
011246' 000000  002333'
011247' 000000  011245'
011250' 001000  000321   43400          POP     D              ;POP MAX LINE OFF STACK
011251' 001000  000305   43420          PUSH    B              ;SAVE POINTER TO START OF 1ST LINE
011252' 001000  000315   43440          CALL    FNDLIN         ;FIND THE LAST LINE
011253' 000000  002371'
011254' 000000  011246'
011255' 001000  000301   43460          POP     B              ;GET POINTER TO FIRST IN (B,C)
011256' 001000  000345   43480          PUSH    H              ;SAVE THE POINTER TO THE NEXT LINE
011257' 001000  000041   43500          LXI     H,READY        ;PRINT "OK" PREMATURELY
011260' 000000  001725'
011261' 000000  011253'
011262' 001000  000315   43520          CALL    STROUT
011263' 000000  007743'
011264' 000000  011260'
011265' 001000  000041   43540          LXI     H,FINI         ;GO BACK TO FINI WHEN DONE
011266' 000000  002276'
011267' 000000  011263'
011270' 001000  000343   43560          XTHL                   ;(H,L)=POINTER TO THE NEXT LINE
011271' 001000  000353   43580   DEL:   XCHG                   ;(D,E) NOW HAVE THE POINTER TO THE LINE
                         43600                                  ;BEYOND THIS ONE
011272' 001000  000052   43620          LHLD    VARTAB         ;COMPACTIFYING TO VARTAB
011273' 000000  001621'
011274' 000000  011266'
011275' 001000  000032   43640   MLOOP: LDAX    D
011276' 001000  000002   43660          STAX    B              ;SHOVING DOWN TO ELIMINATE A LINE
011277' 001000  000003   43680          INX     B
011300' 001000  000023   43700          INX     D
011301' 001000  000347   43720          COMPAR
011302' 001000  000322   43740          JNC     MLOOP          ;DONE COMPACTIFYING?
011303' 000000  011275'
011304' 000000  011273'
011305' 001000  000140   43760          MOV     H,B
011306' 001000  000151   43780          MOV     L,C
011307' 001000  000043   43800          INX     H              ;NEW VARTAB
011310' 001000  000042   43820          SHLD    VARTAB
011311' 000000  001621'
```



```
011312' 000000  011303'
011313' 001000  000311   43840          RET>
                         43860   PAGE
```

```
43880   SUBTTL  DISK CODE
43900   IFN     DSKFUN,<
43920   ;
43940   ; THE STATEMENT DSKOS STRING,SECTOR WRITES
43960   ; THE STRING (UP TO 132 DECIMAL CHARS
43980   ; ON THE SECTOR SPECIFIED.
44000   ; DSKIS (SECTOR) IS A STRING FUNCTION THAT
44020   ; RETURNS THE 133 BYTE STRING STORED ON SECTOR.
44040   ;
44060   DSKOS:  CALL    FRMEVL          ;EVALUATE FORMULA
44080           SYNCHK  44              ;FOLLOWED BY COMMA
44100           PUSH    H               ;SAVE TEXT POINTER
44120           CALL    FRESTR          ;FREE UP THE FACLO
44140           XTHL                    ;(H,L)=TXTPTR SAVE POINTER AT
44160                                   ;STRING DESCRIPTOR ON THE STACK
44180           CALL    GETBYT          ;EVALUATE 2ND ARG(SECTOR) IN (E)
44200           XTHL                    ;SAVE TEXT POINTER, GET DESC.
44220           PUSHM                   ;(C)=LENGTH (H,L)=POINTER
44240           PUSHM
44260           POP     H               ;(H,L) GET STRING POINTER
44280           POP     B
44300           MOV     B,A             ;SECTOR NUMBER INTO (B)
44320           MVI     A,^O137
44340           SUB     C
44360           JC      FCERR           ;STRING TOO LONG
44380           INR     A
44400           MOV     E,A             ;NUMBER OF ZEROS+1
44420           MVI     D,64            ;SETUP A MASK
44440           INR     C
44460           MVI     A,4             ;LOAD THE HEAD
44480           OUT     9               ;TO DISK STATUS
44500   SECLP:  IN      ^O11            ;GET SECTOR STATUS
44520           RAR                     ;TEST FOR START OF SECTOR
44540           JNC     SECLP           ;KEEP WAITING
44560           ANI     63              ;START OF SECTOR, RIGHT ONE
44580           CMP     B               ;COMPARE TO FIND OUT
44600           JNZ     SECLP           ;IF NOT
44620           MVI     A,128           ;WRITE ENABLE DISK
44640           OUT     9
44660           MVI     B,255           ;ALL ONE'S ALWAYS WRITTEN FIRST
44680   WRITOK: IN      8               ;GET STATUS
44700           ANA     D               ;WRITE OK
44720           JZ      WRITOK          ;NO, MORE LOOPING.
44740           MOV     A,B             ;GET CHARACTER TO WRITE
44760           OUT     10              ;SEND IT OUT
44780           DCR     C               ;TEST FOR NULL
44800           JZ      ZRLOP
44820   NOTYTO: IN      8               ;POLL
44840           ANA     D               ;MASK TEST
44860           JZ      NOTYTO          ;WAITING
44880           MOV     A,M             ;GET CHARACTER
44900           OUT     10
44920           DCR     C               ;DECREMENT CHARACTER COUNT
```



```
44940           INX     H
44960           JNZ     NOTYTO
44980   ZRLOP:  IN      8
45000           ANA     D
45020           JZ      ZRLOP
45040           XRA     A               ;PUT OUT A ZERO
45060           OUT     10
45080           DCR     E
45100           JNZ     ZRLOP
45120   TRUFIN: MVI     A,8             ;UNLOAD THE HEAD
45140           OUT     9
45160           POP     H
45180           RET                     ;DONE
45200
45220   DSKIS:  MVI     A,137           ;A LOT OF CHARACTERS ARE COMING
45240           CALL    STRINI          ;MAKE ROOM!
45260           CALL    CONINT          ;WHERE ARE THEY?
45280                                   ;SECTOR NOW IN (E)
45300           LHLD    DSCTMP+2        ;PLACE TO STORE THEM
45320           MVI     A,4             ;LOAD THE HEAD
45340           OUT     9
45360   SECLP2: IN      9               ;GET SECTOR INFO
45380           ORA     A               ;SEE IF BEGINNING OF SECTOR(READ)
45400           JP      SECLP2          ;IF NOT, KEEP WAITING
45420           RAR                     ;FIX UP SECTOR #
45440           ANI     63              ;GET SECTOR #
45460           CMP     E               ;IS IT THE ONE WE WANTED
45480           JNZ     SECLP2          ;TRY TO FIND IT
45500           MVI     C,137           ;GET # OF CHARS TO READ
45520   READOK: IN      8               ;GET DISK STATUS
45540           ORA     A               ;READY TO READ BYTE
45560           JP      READOK
45580           IN      10              ;READ THE STUFF
45600           MOV     M,A             ;SAVE IN STR
45620           INX     H               ;BUMP DEST POINTER
45640           DCR     C               ;LESS CHARS
45660           JNZ     READOK
45680           MVI     A,8             ;UNLOAD HEAD
45700           OUT     9
45720           JMP     FINBCK          ;USE CHRS TO FINISH UP
45740
45760   PATCH:  BLOCK   20>
45780   PAGE
```

```
                                45800   SUBTTL  CLOAD,CSAVE,CONSOLE
                                45820   ;
                                45840   ; THE CONSOLE COMMAND ALLOWS THE USER TO CHANGE THE I/O CHANNEL
                                45860   ; THAT THE USER TERMINAL IS ON, BY GIVING THE COMMAND CONSOLE X
                                45880   ; WHERE X IS SOME INTEGER THE TERMINAL DEVICE WILL BE POLLED FROM
                                45900   ; CHANNELS X AND X+1. RESTARTING AT LOCATION ZERO FORCES THE TERMINAL
                                45920   ; TO BE ON CHANNEL ZERO AGAIN.
                                45940   ;
                                45960   IFN     CONSSW,<
                                45980   INTERNAL        CONSDO
                                46000   CONSDO: XRA     A               ;FORCE A CHANNEL ZERO CONSOLE
                                46020           CALL    CONS2           ;ON RESTART AT ZERO
                                46040           JMP     READY           ;TYPE "OK" AND ACCEPT INPUT
                                46060   CONSOL: CALL    GETBYT          ;FETCH AN INTEGER INTO [A]
                                46080           RNZ                     ;CHECK FOR A TERMINATOR
                                46100   CONS2:
                                46120   IFN     REALIO,<
                                46140           STA     CNLCA1          ;CHANGE ALL THE FLAG INPUT CHANNEL REFERENCES
                                46160           STA     CNLCA2
                                46180           STA     CNLCA3>
                                46200   IFN     LENGTH,<
                                46220           STA     CNLCA4>
                                46240           INR     A               ;[A]=DATA INPUT CHANNEL
                                46260           STA     CNLCB1          ;CHANGE ALL THE DATA INPUT CHANNEL REFERENCES
                                46280           STA     CNLCB2
                                46300           RET>
                                46320   IFN     CASSW,<
                                46340   ;
                                46360   ; CASIN READS A CHARACTER FROM THE CASSETTE
                                46380   ; INTO [A] WITHOUT MODIFYING ANYTHING BUT [A] AND THE CONDITION
                                46400   ; CODES
                                46420   ;
                                46440   CASIN:  IN      6               ;ROUTINE TO READ A CHARACTER
                                46460           ANI     IDONE           ;FROM THE CASSETTE INTO [A]
                                46480           JNZ     CASIN
                                46500           IN      7               ;READ THE DATA
                                46520           RET
                                46540   ;
                                46560   ; CASOUT OUTPUTS THE CHARACTER IN [A] TO THE CASSETTE
                                46580   ; WITHOUT MODIFYING ANYTHING
                                46600   ;
                                46620   TWOCSO: CALL    CASOUT          ;DOUBLE OUT OF [A]
                                46640   CASOUT: PUSH    PSW             ;ROUTINE TO WRITE A CHARACTER IN [A]
                                46660   CASLK:  IN      6               ;ONTO THE CASSETTE
                                46680           ANI     ODONE
                                46700           JNZ     CASLK           ;WAIT TILL CASSETTE IS READY
                                46720           POP     PSW             ;GET THE CHARACTER BACK
                                46740           OUT     7               ;OUTPUT THE CHARACTER
                                46760           RET
                                46780   ;
                                46800   ; THE CSAVE COMMAND WRITES A PROGRAM ONTO CASSETTE BY DUMPING
                                46820   ; BASICS CORE. THE HEADER IS THREE 211'S FOLLOWED BY A ONE
                                46840   ; CHARACTER FILE NAME. THE END IS THREE ZEROS IN A ROW.
```



```
                                46860   ;
                                46880   CSAVE:  PUSH    H
                                46900           MVI     A,211
                                46920           CALL    CASOUT          ;PUT OUT THE START BYTES
                                46940           CALL    TWOCSO          ;TWO MORE TIMES
                                46960           MOV     A,M             ;GET FILENAME
                                46980           CALL    CASOUT          ;STORE AFTER 211'S
                                47000           LHLD    TXTTAB          ;START OF PROGRAM
                                47020           XCHG
                                47040           LHLD    VARTAB          ;END OF PROGRAM
                                47060   LOPCSO: LDAX    D               ;GET A BYTE FROM THE PROGRAM
                                47080           INX     D
                                47100           CALL    CASOUT          ;SEND IT OUT TO THE CASSETTE
                                47120           COMPAR                  ;THE END?
                                47140           JNZ     LOPCSO          ;IF NOT,OUTPUT MORE
                                47160           CALL    TWOCSO          ;TWO MORE 0'S TO MARK THE END
                                47180           POP     H               ;RESTORE THE TEXT POINTER
                                47200           CHRGET                  ;GO PAST THE FILE NAME
                                47220           RET
                                47240   ;
                                47260   ; THE CLOAD COMMAND CLEARS CORE AND THEN READS A PROGRAM
                                47280   ; FROM CASSETTE, SINCE THE LINKS OF THE FILE ON CASSETTE
                                47300   ; WILL BE WRONG IF THE FILE WAS SAVED WITH A DIFFERENT VERSION OF
                                47320   ; BASIC FINI IS JUMPED TO, A SCRATCH IS DONE AT THE START SO RESTARTS
                                47340   ; AT 0 WON'T LEAVE THINGS IN A GARBAGE STATE.
                                47360   ;
                                47380   CLOAD:  STA     FACLO           ;SAVE THE FILENAME
                                47400           CALL    SCRTCH          ;RESET EVERYTHING
                                47420   LOPCLK: MVI     B,3             ;NUMBER OF START CHARACTERS
                                47440   LOPCL2: CALL    CASIN           ;GET A CHARACTER
                                47460           CPI     211             ;START CHARACTER?
                                47480           JNZ     LOPCLK          ;NO, RESET COUNT AND LOOK SOME MORE
                                47500           DCR     B               ;DECREMENT THE COUNT
                                47520           JNZ     LOPCL2          ;SEEN THREE YET?
                                47540           LXI     H,FACLO         ;POINT AT THE FILENAME
                                47560           CALL    CASIN           ;READ THIS FILENAME
                                47580           CMP     M               ;THE RIGHT FILE?
                                47600           JNZ     LOPCLK          ;IF NOT,START COMPLETELY OVER
                                47620           LHLD    TXTTAB          ;PLACE TO STORE THE PROGRAM
                                47640   DOCKS:  MVI     B,4             ;NUMBER OF ZEROS TO GET
                                47660                                   ;BEFORE STOPPING
                                47680   DOCSMR: CALL    CASIN           ;GET A CHARACTER
                                47700           MOV     M,A             ;STORE IT
                                47720           CALL    REASON          ;MAKE SURE THERE IS ROOM
                                47740           MOV     A,M             ;REGET THE CHARACTER
                                47760           ORA     A               ;A ZERO?
                                47780           INX     H
                                47800           JNZ     DOCKS           ;RESET # OF ZEROS SEEN
                                47820           DCR     B               ;DECREMENT NUMBER OF ZEROS
                                47840           JNZ     DOCSMR          ;SEEN FOUR?
                                47860           SHLD    VARTAB          ;SETUP END OF PROGRAM
                                47880           LXI     H,READY         ;TYPE "OK" PREMATURELY
                                47900           CALL    STROUT
```

```
                                        47920          JMP     FINI>          ;FIX UP THE LINKS AND GO BACK TO MAIN
                                        47940   PAGE
```



```
                                        47960   SUBTTL PEEK AND POKE
                                        47980   IFN     LENGTH,<
                                        48000   IFE     LENGTH-2,<
011314' 001000  000315                  48020   PEEK:   CALL    FRCINT         ;GET AN INTEGER IN [H,L]
011315' 000000  011025*
011316' 000000  011311'
011317' 001000  000176                  48040           MOV     A,M>           ;GET THE VALUE TO RETURN
                                        48060   IFN     LENGTH-2,<
                                        48080   PEEK:   CALL    POSINT         ;GET THE VALUE OF FACLO INTO [D,E]
                                        48100           LDAX    D>             ;READ THE VALUE
011320' 001000  000303                  48120           JMP     SNGFLT         ;AND FLOAT IT
011321' 000000  007400'
011322' 000000  011315'
                                        48140   IFE     LENGTH-2,<
011323' 001000  000315                  48160   POKE:   CALL    FRMEVL
011324' 000000  005336'
011325' 000000  011321'
011326' 001000  000345                  48180           PUSH    H              ;SAVE THE TEXT POINTER
011327' 001000  000315                  48200           CALL    FRCINT         ;GET INTEGER VALUE OF FAC IN [H,L]
011330' 000000  011315*
011331' 000000  011324'
011332' 001000  000343                  48220           XTHL>                  ;GET BACK THE TEXT POINTER
                                        48240   IFN     LENGTH-2,<
                                        48260   POKE:   CALL    INTI02         ;READ LOCATION TO POKE
                                        48280           PUSH    D>             ;SAVE THE LOCATION
011333' 001000  000317                  48300           SYNCHK  44             ;CHECK FOR A COMMA
011334' 000000  000054
011335' 001000  000315                  48320           CALL    GETBYT
011336' 000000  011020'
011337' 000000  011330'
011340' 001000  000321                  48340           POP     D              ;GET THE ADDRESS BACK
011341' 001000  000022                  48360           STAX    D              ;STORE IT AWAY
011342' 001000  000311                  48380           RET>                   ;SCANNED EVERYTHING
                                        48400   ;
                                        48420   ; NOTE: IN THE 8K PEEK ONLY ACCEPTS POSITIVE NUMBERS UP TO 32767
                                        48440   ; POKE WILL ONLY TAKE AN ADDRESS UP TO 32767 , NO
                                        48460   ; FUDGING ALLOWED, THE VALUE IS UNSIGNED.
                                        48480   ;
                        011336'         48500   .C1=.P
                                        48520   END

NO ERRORS DETECTED

PROGRAM BREAK IS 011343

10K CORE USED
```

A	000007		CNLCA1	003114'	SIN	DCOMP	000702' EXT
ABS	000107'	EXT	CNLCA2	003127'	SIN	DCXBRT	011204' EXT
AFFP	000104		CNLCA3	003461'	SIN	DDIV	000700' EXT
ALLLST	002354'		CNLCA4	003303'	SIN	DEF	007411'
ALLSTR	010570'		CNLCB1	003124'	SPD	DEFFIN	007521'
ANDORD	005571'		CNLCB2	003136'	SPD	DEL	011271'
APPLOP	005642'		CNTCON	003465'		DELETE	011245'
ARG	001654'	INT	CNTWFL	001541'	INT	DFACLO	001633' INT
ARGLO	001645'	INT	COLIS	002705'		DIM	006500'
ARYSTR	010177'		COMPRT	004553'		DIMCON	006473'
ARYTAB	001623'		CONIA	006405'	EXT	DIMFLG	001542'
ARYVA2	010137'		CONINT	011023'		DIMIS	003524'
ARYVAR	010140'		CONSIM	006041'	EXT	DMULT	000676' EXT
ASC	010515'		CONSSW	000000	SPD	DNTCPY	004217'
ASPA2	004626'		CONT	003542'		DOASIG	005056'
ASPAC	004627'		CONTRW	000001	SPD	DOCMP	006375'
ATN	000137'	EXT	CONTW	000017		DOCOND	004354'
ATNFIX	000137'	INT	COPNUM	004237'		DODSP	005756'
ATNTK	000300	SPD	COS	000131'	EXT	DOMIN	006146'
B	000000		COSFIX	000131'	INT	DONMUL	007326'
BLTLOP	002013'		CR	000015	SPD	DORES	001544'
BLTU	002005'		CRDO	004523'	INT	DOSIZT	004621'
BLTUC	002010'		CRDONE	002753'		DSCTMP	001570'
BOTCON	000016	SPD	CRFIN	004534'		DSKFUN	000000 SPD
BRKTXT	001734'		CRUNCH	002533'		DSUB	000674' EXT
BSERR	007077'	INT	CSLOOP	006345'		DVBERR	002675' INT
BUF	001431'	INT	CURLIN	001607'	INT	DVAR	010214'
BUFLEN	000110	SPD	CZLOOP	002316'		DVAR2	010213'
BUFLIN	011163'		D	000002		DVARS	010214'
BUFMIN	001430'		DADD	000672'	EXT	E	000003
C	000001		DANDOR	006437'		EATEM	006535'
CASSW	000000	SPD	DATA	004072'		EDIT	000632' EXT
CAT	010320'		DATATK	000203	SPD	ELSE	004074'
CHEAD	002302'		DATBK	005025'		ELSETK	000220 SPD
CHKCOM	004560'		DATFND	005166'		END	003474'
CHKSTR	010432'	EXT	DATLIN	001577'		ENDCON	003501'
CHRS	010532'		DATLOP	005163'		ENDREL	005415'
CHRCON	003433'		DATPTK	001627'		ENDTK	000200 SPD
CHRGTR	003426'		DATSNE	002064'		EQULTK	000260
CLEAR	003703'		DBLDSP	000672'		ERR8S	000011 SPD
CLEARC	002443'					ERRCN	000021 SPD
CLMWID	000016	SPD				ERRDD	000012 SPD
						ERRDIR	007532'
						ERRDV0	000013 SPD
						ERRFC	000005 SPD
						ERRFIN	002127'
						ERRID	000014 SPD
						ERRLS	000017 SPD
						ERRNF	000001 SPD
						ERROD	000004 SPD

ERROM	000007	SPD	FPWR	000000	EXT	INCHR	003126'
ERROR	002102'	INT	FPWRQ	005562'	EXT	INDLOP	006754'
ERROV	000006	SIN	FRCDBL	005751'	EXT	INEG	000000 EXT
ERRRG	000003	SPD	FRCINT	011330'	EXT	INIT	002163' EXT
ERRSN	000002	SPD	FRCSNG	007506'	EXT	INLIN	002776'
ERRSO	000016	SPD	FRCSTR	000000	EXT	INLINC	003003'
ERRST	000020	SPD	FRCTBL	000664'		INLINN	002772'
ERRTAB	000730'		FRE	007337'		INLPNM	007252'
ERRTM	000015	SIN	FREFAC	010434'		INPCON	004157'
ERRUF	000022	SPD	FRESTR	010431'		INPCON	004765'
ERRUS	000010	SPD	FRETM2	010437'		INPRT	002141' EXT
EVAL	006061'		FRETMP	010440'		INPUT	004711'
EXCHGT	004100'		FRETOP	001573'	INT	INPWRD	010720'
EXIGNT	005142'		FRMCHK	005337'		INRART	000000 EXT
EXP	000127'	EXT	FRMEVL	005336'		INT	000000 EXT
EXPSTK	005553'		FSUB	000706'	EXT	INTDSP	000716'
EXTFNC	000001	SPD	FUNCTS	000001	SPD	INTIO2	003623'
FAC	001642'	INT	FUNDSP	000103'		INTIOX	003622'
FACDBL	005775'		GARBA2	010042'		INTXT	001720' INT
FACLO	001637'	INT	GARBAG	010026'		INXHRT	002664' EXT
FACSNG	006034'		GETAGN	004741'		ISARY	006745'
FADD	000704'	EXT	GETBCD	007752'	EXT	ISCNTC	003460'
FADDS	005260'	EXT	GETBYT	011020'		ISFUN	006204'
FALSIF	004363'		GETDEF	007245'		ISGOSU	004306'
FBUFFR	001655'	INT	GETFNM	007550'		ISLGN	000000 EXT
FCERR	010776'	INT	GETSPA	007772'		ISLET	003612'
FCOMP	005274'	EXT	GETSTK	002024'		ISSEC	006534'
FDIV	000712'	EXT	GETYPE	006307'	INT	ISUB	000720' EXT
FIN	011064'	EXT	GIVDBL	007372'		ISVAR	006164'
FINBCK	010546'		GIVINT	007402'		KLOOP	002544'
FINGO	006276'		GONE	003370'		L	000005
FINI	002276'		GONE2	003376'		LABBCK	006162'
FININL	004516'		GONE3	003375'		LASNUM	002306 SPD
FINNOW	007331'		GOODCH	003044'		LEFTS	010552'
FINPTR	006742'		GOSUB	003770'		LEFT2	010560'
FINREL	005605'		GOSUTK	000214		LEFT3	010556'
FINTMP	005544'		GOTO	004010'		LEN	010501'
FLGINP	001602'		GOTOTK	000210	SPD	LEN1	010505'
FLOAT	000000	EXT	GRBPAS	010254'		LENGTH	000002 SPD
FLOATR	000000	EXT	GREATK	000257		LEPSKP	002117'
FMULT	000710'	EXT	GTBYTC	011017'			
FNDFOR	001744'		H	000004			
FNDLIN	002371'		HAVTYP	006574'			
FNDOER	007443'		IADD	000716'	EXT		
FNDVAR	010045'		ICOMP	000726'	EXT		
FNINP	010712'		IDIV	000724'	EXT		
FNOUT	010725'		IDONE	000001	SPD		
FNTK	000243	SPD	IF	004325'			
FNWAIT	010733'		IFORDN	003267'			
FOR	003154'		IFTK	000212	SPD		
FORTK	000201	SPD	ILLFUN	010776'	INT		
FOUND	002646'		IMULT	000722'	EXT		
FOUT	007565'	EXT					

LESSTK	000261		MOVMM	010154'	EXT	OMERR	002057'	INT	
LET	004131'		MOVSTR	010417'		ONEFUN	000262		
LINCHK	004475'		MULDIM	000001	SPD	ONELIN	002365'		
LINGET	003642'	INT	MUSTCR	002617'		ONEON	003265'		
LINGT2	003643'		NEG	000000	EXT	ONGOTO	004271'		
LINLEN	000110	SPD	NEWCHR	004407'		OPRTYP	001544'		
LINLIN	002764'		NEWSTT	003302'		OPTAB	000163'		
LINPRT	011134'	EXT	NEXT	005225'		ORFIN	006463'		
LINPT1	003103'	SIN	NEXTC	005230'		OUTBEL	003061'		
LINPT2	003574'	SIN	NFERR	002100'		OUTCON	003065'		
LINPT3	004474'	SIN	NMARY1	007051'		OUTDO	000030'	INT	
LINPT4	004557'	SIN	NMARY2	007050'		OUTWRD	010730'		
LIST	011072'		NMREL	000003	SPD	PARCHK	006136'		
LIST4	011077'		NODATT	002710'		PEEK	011314'		
LISTEN	000001	SPD	NODEL	002227'		PLOOP	011170'		
LOG	000125'	EXT	NOPRIN	003113'		PLUSTK	000250	INT	
LOOP	002374'		NOSEC	006547'		POKE	011323'		
LOOPDN	005320'		NOTABR	004637'		POPGOF	001774'		
LOOPER	001750'		NOTDIM	007152'		POPHRT	000000	EXT	
LOOPON	004507'		NOTER	006412'		POS	007406'		
LOPDT2	004773'		NOTFDD	007104'		PPSWRT	010024'		
LOPFDA	007015'		NOTFNS	006671'		PREAM	010764'		
LOPFND	006623'		NOTFRF	006272'		PREAM2	010767'		
LOPPTA	007135'		NOTITI	006660'		PRINT	004411'		
LOPREL	005363'		NOTLST	010477'		PRINTC	004414'		
LPOPER	005341'		NOTOL	003176'		PRINTK	000231	SPD	
LPTLEN	000110	SPD	NOTQTI	004755'		PRIT3	011232'		
LPTSW	000000	SPD	NOTSTV	005360'		PRIT4	011167'		
LSTOPK	000007	SPD	NOTTHR	010753'		PRTNUL	004537'		
M	000006	SPD	NOTTK	000246	SPD	PSW	000006	SPD	
MAIN	002165'		NOTTRC	003367'		PTRGET	006505'		
MAKINT	007404'	EXT	NOWGET	005053'		PTRGT2	006512'		
MEMSIZ	001545'	INT	NOWLIN	005214'		PUFOUT	000000	EXT	
MID5	010643'		NTHIS	002736'		PURE	000000	SPD	
MID2	010665'		NTHIS1	002742'		PUSHF	006036'	EXT	
MINUTK	000231	INT	NULCNT	000046'		PUSHMA	000100'		
MLOOP	011275'		NULL	003566'		PUTDEI	007524'		
MLOOPR	002266'		NUMCMD	000040		PUTNEW	007705'		
MORCOM	004566'		NUMGFN	000051	SPD	PUTVAL	004261'		
MORLIN	003646'		NUMINS	005070'		Q	000022		
MORPR	004410'		NUMLEV	000025	SPD	QINLIN	002522'	INT	
MOVE	000000	EXT	NUMREL	005476'		QINT	000000	EXT	
MOVFM	005253'	EXT	NUMTMP	000005	SPD				
MOVFR	005746'	EXT	NUTPOS	000070	SPD				
MOVINS	010407'		NXTCON	003276'					
MOVLP	010420'		NXTRES	002625'					
MOVMF	007476'	EXT	ODONE	000220	SPD				
MOVRF	006044'	EXT	OKGOTO	004346'					
			OKNORM	006251'					
			OLDLIN	001611'					
			OLDTXT	001613'					

RAMBOT	020000		SNGOO	006026'		TABER	004577'		
READ	004700'		SNGOSP	000704'		TABTK	000240		
READY	002145'	INT	SNGFLT	007400'		TAN	000135'	EXT	
REALIO	000001	SPD	SP	000006		TANFIX	000135'	INT	
REASON	002045'	INT	SPCTK	000242	SPD	TEMP	001603'		
REDDY	001725'		SQR	000121'	EXT	TEMP2	001605'	INT	
REDINP	004136'		SQRFIX	000121'		TEMP3	001575'	INT	
REM	004074'		SQRTK	000271	SPD	TEMP6	007124'		
REMER	004103'		STAINP	010754'		TEMPPT	001547'	INT	
REMTK	000216		START	000000'		TEMPST	001551'	INT	
REPINI	002162'	INT	STEPTK	000247		THENTK	000245		
REPOUT	004632'		STKOBL	005725'		TMERR	005703'	EXT	
RESCR1	011216'		STKINI	002470'		TOFF	003605'		
RESER	002627'		STKSNG	006021'		TON	003604'		
RESFIN	003453'		STKTOP	001615'	INT	TOPCON	000035	SPD	
RESLST	000172'		STMOSP	000564'		TOTK	000241	SPD	
RESRCH	011214'		STOP	003472'		TRCFLG	001631'		
RESTOR	003446'		STPEND	003500'		TRMNOK	004667'		
RETADP	005354'		STPRDY	002144'		TRMOK	005111'		
RETURN	004044'		STR$	007564'		TRYAGN	004644'		
RIGHT$	010631'		STR1	002716'		TRYGI2	007774'		
RND	000123'	EXT	STRAD1	007632'		TRYIN	003126'		
RNDFIX	000123'		STRAD2	007627'		TRYOUT	003113'		
RUN	003754'		STRCMP	006320'		TSTACK	000000	EXT	
RUNC	002437'		STRCPY	007601'		TSTOP	005357'		
RUNC2	004087'		STRUN2	005077'		TTICHN	000001	SPD	
SCNLIN	002333'		STRUON	004507'		TTOCHN	000001	SPD	
SCRATH	002421'		STREND	001625'	INT	TTYCHK	003070'		
SCRATK	000237		STRFIN	007665'		TTYIST	004616'		
SCRTCH	002422'	INT	STRGET	007646'		TTYPOS	000047'		
SETDBL	005750'		STRING	000001	SPD	TVAR	010063'		
SETIO	011003'		STRINI	007624'		TXTTAB	001617'	INT	
SGN	000103'	EXT	STRLII	007637'	INT	UMULT	007267'	EXT	
SIGN	000050'	INT	STRLT2	007643'		USERR	004037'		
SIGNC	000055'	EXT	STRLT3	007642'		USINTK	000244	SPD	
SIGN$	006373'	EXT	STRLTI	007640'		USRLOC	000111'		
SIN	000133'	EXT	STRNG	002727'		VAL	011042'		
SINFIX	000133'	INT	STROUI	007742'	INT	VALINT	000000	EXT	
SKPMRF	004365'		STROUT	007743'	INT	VALSNG	000000	EXT	
SKPVAR	010130'		STRPR2	007755'		VALTYP	001543'	INT	
SMLVAL	007322'		STRPRT	007746'		VARTAB	001621'		
SNERR	002072'	INT	STRSIZ	000003	SPD	VINT	000105'	EXT	
SNGDBL	005743'		STUFFM	002667'		VMOVAF	005777'	EXT	
			SUBFLG	001601'		VMOVE	007724'	EXT	
			SVAR	010102'		VMOVFA	000000	EXT	
			SVARS	010077'		VMOVFM	006200'	EXT	
			TABEND	002653'		VMOVMF	004264'	EXT	
						VNEG	006160'	EXT	
						VPUSHD	005536'		
						VSIGN	004347'	EXT	

```
ZERITA          007207'
ZERO            011046' EXT
ZEROER          006723'
$CODE           000000' INT
```

```
A          764   791   812   827   830   852  1740  1756  1796  1887  1922  1924  1943  1965
          1966  1978  2049  2052  2069  2078  2154  2187  2189  2269  2272  2290  2299  2305
          2312  2320  2321  2322  2330  2335  2368  2373  2378  2417  2418  2419  2519  2520
          2523  2528  2606  2732  2603  2806  2875  2882  2887  2907  2912  2918  2944  2962
          2970  2979  3024  3026  3041  3070  3089  3103  3112  3152  3153  3197  3220  3222
          3223  3225  3397  3399  3400  3401  3428  3527  3534  3554  3558  3561  3587  3588
          3599  3623  3721  3834  3839  3859  3866  3872  3880  3953  3972  3973  3974  4019
          4041  4080  4081  4096  4126  4141  4149  4181  4182  4249  4303  4310  4392  4453
          4535  4555  4566  4567  4571  4583  4610  4662  4713  4773  4823  4827  4841  4842
          4848  4911  4916  4919  5123  5127  5193  5241  5242  5243  5349  5370  5373  5374
          5377  5379  5396  5397  5402  5440  5442  5443  5445  5473  5478  5479  5481  5487
          5486  5490  5529  5540  5541  5559  5594  5622  5628  5643  5664  5675  5895  5896
          5897  5942  5948  5965  6017  6019  6052  6053  6100  6104  6108  6161  6263  6265
          6266  6269  6270  6271  6423  6437  6444  6482  6497  6511  6540  6542  6562  6588
          6612  6659  6671  6694  6746  6759  6760  6782  6825  6871  6929  6976  6981  7052
          7070  7071  7074  7075  7092  7101  7126  7128  7130  7135  7161  7191  7218  7223
          7224  7227  7342  7343  7351  7368  7380  7409  7439  7465  7467  7490  7495  7501
          7502  7768
ABS        904   904#
AFFF       986#  986   987#  987   988#  988   989#  989   990#  990   991#  991   992#  992
           993#  993   994#  994   995#  995   998#  998   999#  999   1001# 1001  1002# 1002
           1005# 1005  1013# 1013  1021# 1021  1022# 1022  1023# 1023  1025# 1025  1026# 1026
           1027# 1027  1028# 1028  1029# 1029  1033# 1033  1046# 1046  1047# 1047  1048# 1048
           1049# 1049  1050# 1050  1052# 1052  1054# 1054  1056# 1056  1195# 1196# 1197# 1198#
           1199# 1200# 1201# 1202# 1203# 1204# 1205# 1206# 1207# 1208# 1209# 1210# 1210  1215#
           1216# 1217# 1218# 1219# 1220# 1221# 1222# 1223# 1224# 1225# 1226# 1226  1231# 1232#
           1233# 1234# 1235# 1236# 1237# 1238# 1239# 1240# 1241# 1242# 1243# 1244# 1245# 1246#
           1247# 1248# 1249# 1250# 1250  1255# 1256# 1257# 1258# 1259# 1260# 1261# 1262# 1263#
           1264# 1265# 1265  1276# 1271# 1272# 1273# 1274# 1275# 1276# 1277# 1278# 1279# 1280#
           1281# 1282# 1283# 1284# 1285# 1286# 1287# 1288# 1289# 1290# 1290  1295# 1296# 1297#
           1298# 1299# 1300# 1301# 1302# 1302  1307# 1308# 1309# 1310# 1311# 1312# 1313# 1314#
           1315# 1316# 1317# 1318# 1319# 1319  1324# 1325# 1326# 1327# 1328# 1329# 1330# 1331#
           1332# 1333# 1334# 1335# 1336# 1337# 1338# 1339# 1340# 1341# 1342# 1342  1347# 1348#
           1349# 1350# 1351# 1352# 1353# 1354# 1355# 1356# 1357# 1358# 1359# 1360# 1361# 1362#
           1363# 1364# 1365# 1366# 1367# 1368# 1368  1373# 1374# 1375# 1376# 1377# 1378# 1379#
           1380# 1381# 1382# 1383# 1384# 1385# 1386# 1387# 1388# 1389# 1390# 1391# 1391  1396#
           1397# 1398# 1399# 1400# 1401# 1402# 1403# 1404# 1405# 1406# 1407# 1408# 1409# 1410#
           1411  1411  1416# 1417# 1418# 1419# 1420# 1421# 1422# 1423# 1424# 1425# 1426# 1427#
           1428# 1429# 1429  1435# 1436# 1437# 1438# 1439# 1440# 1441# 1442# 1443# 1444# 1445#
           1446# 1447# 1447  1452# 1453# 1454# 1455# 1456# 1457# 1458# 1459# 1460# 1461# 1462#
           1463# 1464# 1465# 1466# 1467# 1468# 1469# 1470# 1470  1475# 1476# 1477# 1478# 1479#
           1480# 1481# 1482# 1483# 1484# 1485# 1486# 1487# 1488# 1489# 1489  1494# 1495# 1496#
           1497# 1498# 1499# 1500# 1501# 1502# 1503# 1504# 1505# 1506# 1507# 1508# 1509# 1510#
           1511# 1512# 1513# 1514# 1515# 1516# 1517# 1518# 1519# 1519  1525# 1526# 1527# 1528#
           1529# 1530# 1531# 1532# 1533# 1534# 1535# 1536# 1537# 1538# 1538  1544# 1545# 1546#
           1547# 1548# 1549# 1550# 1551# 1552# 1553# 1554# 1555# 1556# 1557# 1558# 1559# 1560#
           1561# 1562# 1563# 1564# 1565# 1566# 1566  1705# 1706# 1707# 1708# 1708  1713# 1714#
           1714  1722# 1723# 1724# 1725# 1726# 1726  3992# 3993# 3994# 3995# 3996# 3997# 3998#
           3999# 4000# 4001# 4002# 4003# 4004# 4005# 4006# 4007# 4007  4269# 4270# 4271# 4272#
           4273# 4274# 4275# 4276# 4277# 4278# 4279# 4280# 4281# 4282# 4282
ALLLST     2103  2115#
ALLSTR     7135  7137#
ANDORD     4672  4752#
```

APPLOP	4716	4821#												
ARG	170	1689#												
ARGLO	170	1688#												
ARYSTR	6610#	6820												
ARYTAB	1663#	2224	5635	5727	5918	6739								
ARYVA2	6771#	6795												
ARYVAR	6744	6772#	6817											
ASC	944	7081#												
ASPA2	3933	3972#												
ASPAC	3955	3973#												
ATN	931	931#												
ATNFIX	139	931#												
ATNTK	1050#	5200												
B	886	888	1751	1755	1764	1769	1792	1794	1797	1799	1830	1832	1833	1939
	1978	1985	1991	2022	2023	2151	2159	2165	2237	2266	2305	2321	2373	2417
	2423	2437	2467	2483	2520	2531	2752	2796	2798	2829	2839	2841	2945	2951
	2954	2955	3018	3232	3235	3261	3284	3296	3336	3395	3398	3399	3403	3423
	3555	3557	3562	3565	3588	3599	3781	3973	3977	4023	4083	4087	4182	4190
	4311	4318	4424	4425	4440	4527	4610	4656	4657	4660	4693	4695	4701	4703
	4713	4714	4715	4719	4738	4758	4773	4778	4801	4821	4827	4842	4861	4863
	4864	4867	4872	4893	4910	4912	4914	4915	4927	4957	5120	5124	5213	5216
	5354	5356	5368	5384	5387	5398	5399	5449	5464	5516	5519	5533	5656	5673
	5675	5676	5677	5679	5680	5709	5711	5724	5883	5887	5949	6026	6044	6047
	6053	6054	6060	6061	6064	6073	6074	6078	6098	6110	6138	6162	6172	6189
	6194	6196	6311	6314	6331	6402	6406	6444	6472	6475	6492	6533	6535	6550
	6640	6647	6672	6674	6696	6699	6727	6771	6790	6805	6807	6808	6819	6822
	6842	6848	6856	6859	6864	6876	6888	6889	6892	6903	6905	6916	6980	6990
	6992	7025	7040	7052	7053	7063	7066	7113	7131	7135	7139	7143	7149	7152
	7153	7155	7156	7179	7196	7214	7217	7220	7227	7229	7279	7283	7297	7299
	7300	7301	7302	7373	7376	7379	7384	7387	7401	7405	7409	7411	7419	7424
	7430	7449	7460	7466	7469	7503	7507	7521	7525	7543	7544	7550		
BLTLOP	1795#	1802												
BLTU	1788#	2026	5714											
BLTUC	1792#	6898												
BOTCON	5194#	5196												
BRKTXT	1719#	3047												
BSERR	156	5985#	6083	6152										
BUF	135	1583#	2045	2297	2481	7447	7461							
BUFLEN	115#	1583	2522											
BUFLIN	7444	7460#												
BUFMIN	1579#	2450	3853											
C	884	1749	1754	1822	2153	2294	2396	2429	2519	2528	2529	2801	2944	2952
	3337	3397	3398	3554	3597	3598	4310	4439	4691	4699	4712	4823	4865	4911
	5123	5127	5221	5224	5351	5366	5541	5559	5650	5674	5725	5943	6024	6044
	6062	6079	6163	6173	6332	6404	6537	6541	6562	6671	6804	6843	6849	6857
	6876	6890	6893	6901	6904	6978	7027	7041	7043	7128	7137	7157	7223	7225
	7374	7410	7551											
CASSW	66	1002	1127	7680										
CAT	4598	6916#												
CHEAD	2067#	2090												
CHKCOM	3917#													
CHKSTR	169#	3489	5162	6927	7015									
CHRS	946	7101#												

CHRCON	799	2969#												
CHRGTR	2961#	2972	3651	6557										
CLEAR	1125	3207#												
CLEARC	2207#	3208	3246	3257										
CLMKID	1##	3912	3924											
CNLCA1	138	2615#												
CNLCA2	138	2631#												
CNLCA3	138	2998#												
CNLCA4	2859#													
CNLCB1	2624#													
CNLCB2	2639#													
CNTCON	2863	3002#												
CNTNFL	162	810	1595#	1889	1945	2647	2651	3043	4044					
COLIS	2401	2408#												
COMPRT	3774	3899#												
CONIA	166#	5405#	5405											
CONINT	7107	7240	7333#											
CONSIH	166#	4975												
CONSSW	1##	1004	1129	7662										
CONT	1117	3061#												
CONTRW	14#	161	808	813	1594	1886	1942	2262	2539	2595	2642	3040	4040	
CONTW	121#	2644												
COPNUM	3486	3545#												
COS	924	924#												
COSFIX	139	924#												
CR	120#	6643												
CRDO	155	1892	2476	2604	3748	3829	3855#	3918	7433					
CRDONE	2314	2421	2449#											
CRFIN	3669#	6645												
CRUNCH	1976	2269#												
CSLOOP	5370#	5389												
CURLIN	136	1643#	1872	1920	1951	2773	2901	3022	3080	3288	3319	3369	4437	6420
CZLOOP	2079#	2082												
D	828	1756	1846	1855	1974	1979	1984	2011	2038	2041	2044	2047	2051	2067
	2087	2098	2101	2105	2109	2115	2125	2296	2347	2350	2356	2357	2367	2379
	2394	2395	2426	2430	2452	2453	2454	2455	2456	2747	2797	2801	2802	2830
	2898	2911	2921	2929	2928	3174	3188	3190	3192	3198	3200	3224	3225	3291
	3294	3353	3427	3428	3466	3477	3480	3506	3511	3520	3524	3529	3576	3711
	3729	4124	4181	4188	4207	4245	4262	4321	4362	4391	4395	4511	4513	4537
	4553	4554	4555	4566	4609	4611	4612	4662	4742	4752	4756	4779	4780	4841
	4846	4868	4894	4956	5065	5209	5212	5355	5363	5371	5373	5382	5431	5470
	5480	5489	5573	5576	5577	5582	5587	5591	5594	5628	5642	5645	5649	5654
	5655	5662	5663	5669	5737	5740	5743	5747	5880	5882	5896	5912	5921	5956
	6020	6078	6081	6118	6145	6158	6159	6267	6315	6348	6358	6371	6401	6410
	6501	6535	6546	6578	6632	6634	6761	6763	6830	6863	6869	6889	6944	6991
	6993	7039	7040	7042	7071	7165	7176	7177	7178	7298	7342	7375	7377	7407
	7483	7486	7488	7489	7520	7542	7545	7792	7793					
DADD	166#	1145												
DANDOR	4759	5464#												
DATA	1064	2765	3384#	3716	4299	6312								
DATATK	988#	2404	4329											
DATBK	4133	4158#	4335											
DATEND	4302#													

DATLIN	1624#	1869	4324											
DATLOP	4147	4298#	4331											
DATPTR	1672#	2990	4093											
DATSNE	1866#	4021												
DBLDSP	1145#	4903												
DCOMP	168#	1153												
DCXBRT	167#	7478#	7478											
DDIV	168#	1151												
DEF	1114	6307#												
DEFFIN	6337	6404#												
DEL	1994	7537#												
DELETE	1123	7517#												
DFACLO	170	1680#	4708	4887	4891									
DIM	1068	5516#												
DIMCON	5497#	5517												
DIMFLG	1596#	5531	5877	5910	5963	6050	6102							
DIRIS	3028	3039#												
DMULT	168#	1149												
DNTCPY	3513	3524#												
DOASIG	4201#	4217												
DOCMP	4787	5396#												
DOCOND	3700#	3736												
DODSP	4905#	4964												
DOMIN	5022	5061#												
DONMUL	6183	6187	6190#											
DORES	1607#	2292	2318	2409										
DOSIZT	3966#													
DSCIMP	1615#	6508	6579	6954	7110									
DSKFUN	98	936	995	1052	1107	7559								
DSUB	168#	1147												
DV0ERR	136	1877#												
DVAR	6824#													
DVAR2	6731	6822#												
DVARS	6757	6825#												
E	831	1757	1857	1874	1877	1881	1901	2039	2068	2085	2802	2896	3062	3189
	3197	3221	3222	3340	3362	3519	3597	3953	3967	4312	4319	4583	4594	4712
	5364	5370	5376	5383	5473	5738	5741	5954	5966	5985	6019	6079	6116	6143
	6264	6372	6400	6427	6603	6689	6760	6828	6890	6936	7041	7112	7197	7226
	7229	7267	7282	7300	7306	7351	7368							
EATEM	5560#	5563	5569											
EDIT	1097	1097#												
ELSE	1091	3388#												
ELSETK	994#	2383	3725	7475										
END	1058	3014#												
ENDCON	2894	3019#												
ENDREL	4542	4548	4566#											
ENDTK	986#	2932	2936											
EQULTK	1033#	3459	6330											
ERRBS	1370#	5986												
ERRCN	1540#	3063												
ERRDD	1393#	5967												
ERRDIR	4073	6317	6418#											
ERRDV0	1413#	1878												

ERRFC	1292#	7307												
ERRFIN	1916#	3050												
ERRID	1431#	6428												
ERRLS	1491#	6937												
ERRNF	1212#	1882												
ERROD	1267#	4313												
ERROM	1321#	1858												
ERROR	147	1863	1883#	3073	3343	3365	4315	5969	5988	6375	6430	6606	6692	6939
	7309													
ERROV	136	1304#												
ERRRG	1252#	3363												
ERRSN	1220#	1875												
ERRSQ	1472#	6690												
ERRST	1521#	6604												
ERRTAB	1184#	1895												
ERRTM	170	1449#												
ERRUF	1566#	6373												
ERRUS	1344#	3341												
EVAL	4519	4993#	5011	6923										
EXCMOT	3397#	3409												
EXIGNT	4260	4268#												
EXP	140#	922												
EXPSTK	4667	4732#												
EXTFNC	38#	139	919	928	968	1029	1049	1050	5062	5064				
FAC	144	850	1684#	4983										
FACDBL	4839	4927#												
FACLO	144	1681#	3500	3810	4689	4798	4870	4945	4987	5103	5166	5447	6585	6919
	6932	7018												
FACSNG	4652	4970#												
FADD	141#	1155												
FADDS	143#	4408												
FALSIF	3696	3711#												
FBUFFR	155	1690#												
FCERR	147	3095	3155	7085	7306#	7345								
FCOMP	141#	1163	4421											
FDIV	1161	1161#												
FIN	141#	4213	5000	5017	7382									
FINBCK	6473	7113#												
FINGO	5180	5213#												
FINI	2015	2056#	7534											
FININL	2497	3850#												
FINNOW	6121	6199#												
FINPTR	5656	5747#												
FINREL	4569	4773#												
FINTMP	4719#	4745	4762	4805										
FLGINP	1631#	4017	4098	4139	4247									
FLOAT	145#													
FLOATR	143#													
FMULT	1159	1159#												
FNDFOR	1735#	2745	3357	4381										
FNDLIN	1989	2148#	3333	7523										
FNDUER	5042	6344#												
FNDVAR	6706#	6908												

FORMULA EVALUATOR

FNINP	910	7239#												
FNOUT	1099	7251#												
FNTK	1021#	5040	6436											
FNWAIT	1105	7263#												
FOR	1060	2731#												
FORTK	987#	1743	2640											
FOUND	2372#													
FOUT	141#	3802	6464											
FPWR	140#													
FPWRQ	166#	4739#	4739											
FRCDBL	167#	1134	4880	4899										
FRCINT	167#	748	1136	3150	4754	5438	5466	7335	7766	7781				
FRCSNG	167#	1138	2790	2822	4733	4955	5205	6390						
FRCSTR	169#													
FRCTBL	1134#	3552												
FRE	908	6209#												
FREFAC	6230	6470	6626	7017#										
FRESTR	5346	7014#	7068											
FRETM2	6950	7020#												
FRETMP	3531	5359	6946	7021#	7167									
FRETOP	153	1616#	2215	6241	6660	6681	6707	6845	6895	7045	7055			
FRMCHK	2817	4511#												
FRMEVL	2785	3146	3468	3617	3783	4510#	5056	5157	6386	7331	7777			
FSUB	1157	1157#												
FUNCTS	127#	999	1021	1114	1541	4064	4071	5038	6289	6403	6413			
FUNDSP	897#	5214												
GARBA2	6234	6700#												
GARBAG	6678	6688#												
GETAGN	4076#													
GETBCD	168#	6630												
GETBYT	3086	3585	5173	7208	7277	7316	7330#	7790						
GETDEF	5982	6137#												
GETFNM	6308	6345	6435#											
GETSPA	6488	6505	6659#	7141										
GETSTK	1821#	2759	3281	4515	6033									
GETYPE	170	3792	4792	5108	5236#	6220								
GIVDBL	6223	6263#												
GIVINT	6271#													
GONE	1982	2880	2924#											
GONE2	2931#	3601												
GONE3	2929#	3705												
GOODCH	2492	2519#												
GOSUB	1082	3280#												
GOSUTK	991#	3292	3361	3590										
GOTO	1074	3303#	3702											
GOTOTK	989#	3595	3655											
GRBPAS	6779	6869#												
GREATK	1032#	4540	4544											
GTBYTC	3942	7328#												
H	769	790	827	873	885	887	1735	1741	1750	1752	1753	1755	1767	1800
	1824	1826	1837	1848	1894	1902	1922	1947	1953	2024	2028	2033	2034	2037
	2040	2042	2050	2060	2067	2070	2075	2076	2077	2080	2086	2127	2151	2155
	2157	2162	2164	2188	2190	2199	2243	2249	2252	2353	2377	2393	2427	2435
	2436	2440	2449	2468	2480	2530	2763	2771	2787	2795	2819	2827	2833	2886
	2890	2892	2897	2948	2953	2961	2988	3025	3046	3070	3148	3152	3158	3173
	3179	3181	3188	3191	3193	3202	3213	3216	3223	3244	3285	3286	3317	3327
	3328	3336	3338	3367	3371	3405	3484	3502	3503	3504	3520	3536	3543	3551
	3559	3560	3567	3569	3578	3596	3661	3745	3770	3787	3788	3846	3852	3946
	3951	3981	4025	4055	4059	4063	4079	4082	4091	4192	4203	4226	4237	4259
	4266	4308	4320	4393	4405	4410	4415	4419	4423	4440	4510	4606	4688	4692
	4694	4700	4702	4707	4757	4786	4790	4800	4858	4866	4885	4889	4902	4917
	4918	4943	4959	4970	4981	4985	5074	5086	5092	5118	5170	5203	5207	5222
	5223	5350	5353	5365	5367	5369	5386	5443	5445	5479	5481	5488	5490	5497
	5592	5626	5638	5644	5664	5667	5674	5708	5712	5718	5724	5729	5739	5742
	5751	5875	5893	5906	5938	5944	5952	5953	5955	5957	6018	6025	6027	6042
	6043	6048	6063	6065	6067	6072	6091	6100	6109	6117	6119	6137	6142	6144
	6146	6154	6162	6172	6174	6181	6185	6202	6213	6266	6271	6331	6361	6364
	6365	6366	6367	6368	6381	6388	6392	6393	6400	6405	6407	6409	6411	6418
	6422	6423	6425	6483	6486	6490	6496	6507	6510	6532	6536	6539	6560	6611
	6616	6675	6683	6709	6712	6717	6718	6747	6748	6750	6783	6789	6803	6809
	6827	6829	6831	6842	6848	6851	6855	6856	6862	6870	6872	6875	6877	6879
	6882	6886	6891	6892	6900	6902	6905	6906	6917	6930	6934	6952	6963	6967
	6973	6977	6979	7024	7026	7028	7057	7087	7091	7129	7144	7145	7146	7150
	7151	7156	7269	7333	7338	7347	7371	7373	7386	7406	7429	7441	7446	7464
	7468	7482	7496	7508	7526	7527	7533	7550	7552	7779				
HAVTYP	5574	5594#												
IADD	167#	1165												
ICOMP	168#	1173												
IDIV	168#	1171												
IDONE	123#	2633	2861	3000										
IF	1078	3616#												
IFORDN	2831#													
IFTK	990#	3419												
ILLFUN	144	906	7305#											
IMULT	168#	1169												
INCHR	2486	2628#	3003											
INDLOP	5882#	5901												
INEG	168#													
INIT	141#	734	1957											
INLIN	1962	2279	2480#											
INLINC	2472	2485#	2502	2507	2536									
INLINN	2474#	2512												
INLPNM	6142#	6165												
INPCOM	3484#	4209												
INPCON	4089	4096#												
INPRT	142#	1926												
INPUT	1066	4036#												
INPWRD	7243	7245#												
INRART	145#													
INT	141#													
INTDSP	1165#	4859												
INTID2	3145#	3211												
INTIDX	3144#	5885												
INTXT	155	1704#												
INXHRT	2388#	2388												
ISARY	5619	5875#												

ISCNTC	2996#	7417												
ISFUN	5047	5120#												
ISGOSU	3592	3597#												
ISIGN	166#													
ISLET	3112#	5003	5535	5554	5566									
ISSEC	5550	5559#												
ISUB	168#	1167												
ISVAR	5006	5008#												
KLOUP	2294#	2415												
L	830	1754	1923	2066	2153	3024	3071	3189	3220	3337	3519	3561	4439	4919
	5193	5224	5440	5442	5477	5478	5486	5487	5643	5725	6108	6163	6173	6263
	6265	6269	6332	6424	6497	6843	6849	6857	6871	6885	6893	6904	6981	6987
	6988	7152	7157	7161	7374	7551								
LABBCK	5081#	5210												
LASNUM	1054#	5128												
LEFT3	948	7123#												
LEFT2	7129#	7215												
LEFT3	7127#	7181												
LEN	938	7063#												
LEN1	7067#	7082	7363											
LENGTH	4#	22	32	37	82	111	117	119	131	151	158	165	740	747
	789	813	874	899	901	908	933	956	970	993	995	997	999	1002
	1014	1022	1024	1029	1047	1051	1090	1099	1109	1117	1123	1133	1185	1522
	1617	1623	1645	1674	1678	1686	1691	1701	1718	1745	1748	1859	1861	1867
	1879	1897	1906	1928	1934	1992	1996	2092	2181	2183	2194	2253	2261	2327
	2380	2488	2595	2657	2731	2777	2781	2783	2788	2811	2815	2820	2855	2865
	2867	2903	2957	2960	3007	3009	3060	3084	3101	3127	3143	3206	3250	3307
	3313	3388	3411	3481	3491	3537	3539	3546	3573	3582	3619	3624	3648	3653
	3663	3685	3686	3690	3692	3694	3698	3707	3764	3790	3797	3838	3843	3937
	3938	3940	3947	3952	3990	4037	4079	4135	4142	4146	4159	4162	4167	4174
	4200	4215	4220	4225	4250	4256	4298	4301	4302	4307	4317	4318	4333	4362
	4368	4370	4385	4397	4451	4452	4472	4528	4536	4589	4592	4595	4600	4604
	4615	4655	4994	5032	5075	5079	5083	5106	5113	5188	5217	5220	5226	5246
	5332	5344	5395	5403	5410	5430	5542	5546	5548	5561	5572	5599	5610	5621
	5627	5681	5736	5745	5748	5929	5936	5950	6016	6022	6167	6191	6208	6218
	6225	6247	6254	6262	6275	6282	6325	6352	6382	6384	6445	6448	6460	6484
	6512	6587	6596	6628	6635	6749	6764	6781	6787	6791	6797	6823	6832	6883
	6975	6982	7029	7072	7088	7147	7231	7303	7311	7314	7327	7329	7339	7369
	7397	7763	7764	7769	7775	7784								
LEPSKP	1896#	1904												
LESSTK	1036#	4544												
LET	1072	2738	2934	3451#										
LINCHK	3828#													
LINGET	155	1972	2107	2119	3173#	3304								
LINGT2	3174#	3624												
LINLEN	114#	2601	3091	3826	3912									
LINLIN	2467#	2517												
LINPRT	142#	2916	7437											
LINPT1	2602#													
LINPT2	3093#													
LINPT3	3827#													
LINPT4	3916#													
LIST	1120	7401#												
LIST4	7406#	7458												
LISTEN	126#	130#	2854	2995	7415									
LOG	920	920#												
LOOP	2151#	2171	3330											
LOOPDN	4432	4445#												
LOOPER	1740#	1771												
LOOPON	3598#	3611												
LOPOT2	4111#	4240												
LOPFDA	5921#	5959												
LOPFND	5632#	5671												
LOPPTA	6049#	6076												
LOPREL	4539#	4564												
LPOPER	4513#	4724	5069	5434										
LPTLEN	113#													
LPTSW	8#	163	813	912	996	1001	1047	1108	1122	1590	1940	2256	2544	2595
	2873	3742	3812	3855	3899	3957	6276	7398						
LSTOPR	1029#	4581												
M	764	767	791	884	886	1740	1749	1751	1796	1822	2033	2039	2041	2049
	2069	2071	2079	2085	2087	2154	2156	2187	2189	2299	2322	2335	2363	2378
	2385	2416	2439	2529	2803	2875	2887	2891	2896	2898	2952	2954	2962	3112
	3400	3534	3556	3560	3587	3623	3824	3850	4080	4126	4257	4319	4321	4392
	4453	4535	4571	4611	4691	4693	4699	4701	4865	4867	4916	4918	5221	5223
	5349	5351	5354	5364	5366	5368	5385	5533	5614	5730	5738	5741	5743	5897
	5937	5942	5948	5954	5956	5978	6017	6024	6026	6047	6062	6064	6092	6116
	6118	6143	6145	6404	6406	6408	6410	6443	6482	6511	6540	6612	6746	6782
	6804	6826	6828	6830	6876	6878	6885	6901	6903	6929	6935	6976	6978	6980
	7025	7027	7043	7074	7092	7112	7130	7149	7151	7191	7219	7224	7376	7377
	7380	7387	7465	7501	7768									
MAIN	1961#	1968	2073											
MAKINT	169#	750	5483	5492	6273									
MEMSIZ	153	1611#	2212	3218	6701									
MID$	952	7190#												
MID2	7202	7210#												
MINUTK	155	1028#	2114	5020										
MLOOP	7542#	7548												
MLOOPR	2047#	2054												
MORCOM	3923#	3926												
MORLIN	3177#	3204												
MORPR	3746#	3848												
MOVE	141#													
MOVFM	143#	4401												
MOVFR	142#	4896												
MOVINS	6956	6961	6973#											
MOVLF	6980#	6995												
MOVMF	143#	4413	6378											
MOVRF	142#	2793	2825	4979										
MOVRM	142#	4417	4428	6785										
MOVSTR	6499	6987#	7163											
MULDIN	39#	156	157	5754	5862	6403								
MUSTCR	2339	2346#												
NEG	145#													
NEWCHR	3745#													
NEWSTT	2853#	2926	3262	3372	4457									

NEXT	1062	4361#												
NEXTC	4367#	4461												
NFERR	1881#	4387												
NMARY1	5946	5953#												
NMARY2	5940	5952#												
NMREL	4544#	4546												
NODATT	2406	2411#												
NODEL	2011#													
NOPRIN	2613#	2619												
NOSEC	5557	5571#												
NOTABR	3779	3921	3969	3981#										
NOTDIM	6058	6062#												
NOTER	5036	5431#												
NOTFDD	5934	6015#												
NOTFNS	5640	5673#												
NOTFRF	5198	5208#												
NOTIT1	5647	5652	5662#											
NOTLST	7050	7057#												
NOTOL	2749	2757#												
NOTQTI	4047	4063#												
NOTSTV	4535#													
NOTTHR	7272	7279#												
NOTTK	1025#	5034												
NOTIRC	2909	2922#												
NOWGET	4186	4196#												
NOWLIN	4305	4327#												
NTHIS	2365	2435#												
NTHIS1	2439#	2442												
NULCNT	834#	3098	3870											
NULL	1103	3085#												
NUMCMD	2936#	2938												
NUMGFN	5128#	5130												
NUMINS	4172	4211#												
NUMLEV	111#	1649												
NUMREL	4680#	4795												
NUMTMP	116#	119#	1614											
NUTPOS	3912#	3915												
NXTCON	2839#	4442												
NXTRES	2355#	2370												
ODONE	122#	2617												
OKGOTO	3657	3662#												
OKNORM	5132	5182#												
OLDLIN	1646#	3031	3077											
OLDTXT	1647#	2254	3037	3065										
OMERR	135	1857#	3238											
ONEFUN	1046#	5045	5128	5194	5200									
ONELIN	2111	2124#												
ONEUN	2809	2829#												
ONGOTO	1101	3584#												
OPRTYP	1604#	4825	4906											
OPTAB	958#	4607												
ORFIN	5475	5486#												
OUTBEL	2526	2532#												

OUTCON	816	2538#												
OUTOO	146	807#												
OUTWRD	7254#	7322												
PARCHK	5052#	5183	6350											
PEEK	934	7765#												
PLOUP	7465#	7472												
PLUSTK	155	1027#	1029	4576	5009									
POKE	1110	7776#												
POPGOF	1760	1764#												
POPHRT	160#													
POS	913	6279#												
PPSWRT	2541	6685#												
PREAM	7124	7174	7293#											
PREAM2	7193	7297#												
PRINT	1112	3747#												
PRINTC	3751#	3984												
PRINTK	998#	2331												
PRIT3	7501#	7510												
PRIT4	7464#	7505												
PRTNUL	3872#	3884												
PSW	807	1970	1980	1987	2012	2372	2587	2588	2621	2831	3019	3045	3180	3194
	3465	3478	3525	3533	3879	3882	3937	3948	4170	4201	4394	4931	5357	5468
	5632	5868	5977	6028	6066	6149	6160	6661	6662	6685	6688	6695	6860	6861
	7212	7266	7487	7494										
PTRGET	3452	4114	4372	5089	5529#	6323								
PTRGT2	5534#	6449												
PUFOUT	167#													
PURE	7#													
PUSHF	141#	4736	4972											
PUSHMA	871	890#	891											
PUTDEI	6407#	6515												
PUTNEW	6578#	6969	7116	7170										
PUTVAL	3563	3567#												
Q	981#	986	986#	987	987#	988	988#	989	989#	990	990#	991	991#	992
	992#	993	993#	994	994#	995	995#	998	998#	999	999#	1001	1001#	1002
	1002#	1005	1005#	1011	1011#	1012	1013	1013#	1019	1019#	1020	1021	1021#	1022
	1022#	1023	1023#	1025	1025#	1026	1026#	1027	1027#	1028	1028#	1029	1029#	1031
	1031#	1032	1032	1033#	1035	1035#	1036	1046	1046#	1047	1047#	1048	1048#	1049
	1049#	1050	1050#	1052	1052#	1054	1054#	1056	1056#	1177#	1187#	1194	1194#	1212
	1214	1214#	1228	1230	1230#	1252	1254	1254#	1267	1269	1269#	1292	1294	1294#
	1304	1306	1306#	1321	1323	1323#	1344	1346	1346#	1370	1372	1372#	1393	1395
	1395#	1413	1415	1415#	1431	1434	1434#	1449	1451	1451#	1472	1474	1474#	1491
	1493	1493#	1521	1524	1524#	1540	1543	1543#	1568					
QINLIN	155	2269#	4077	4153										
QINT	141#													
RAMBOT	13#													
READ	1070	4091#												
READY	135	1940#	3053	7413										
REALIO	5#	15	129	137	999	1119	2469	2474	2533	2543	2612	2628	3055	6703
REASON	135	1789	1835	1846#	6086									
REDDY	1710#	1954	7528											
REDINP	3460#													
REM	1086	1899	3315	3392#										

REMER	3400#	3421	3430											
REMTK	992#	2412												
REPINI	135	1956#												
REPOUT	3976#	3979												
RESCR1	7486#	7492												
RESER	2357#	2447												
RESFIN	2989#	4254												
RESLST	986#	2351	7484											
RESRCH	7486#	7498												
RESTOR	1080	2218	2984#											
RETAOP	4524#	4658	5408	5454										
RETURN	1084	3352#												
RIGHTS	950	7173#												
RND	917	917#												
RNDFIX	917#													
RUN	1076	3251#												
RUNC	2057	2196#	3252											
RUNC2	3265	3296#												
SCNLIN	2098#	7403	7518											
SCRATH	1130	2177#												
SCRATK	1005#	2936												
SCRTCH	144	2178#												
SETDBL	4898#	4948												
SETIO	7252	7264	7315#											
SGN	897	897#												
SIGN	159	849#												
SIGNC	160#	854												
SIGNS	154#	5393												
SIN	926	926#												
SINFIX	139	926#												
SKPMRF	3715#	3727	3732											
SKPVAR	6754	6760#												
SMLVAL	6179	6186#												
SNERR	135	773	1674#	2122	2884	2940	3186	3227	4557	5538	6396			
SNGDBL	4893#	4940												
SNGDO	4959#	4990												
SNGDSP	1159#	4960												
SNGFLT	6269#	7064	7094	7248	7773									
SP	1739	1852	2832	2842	3295	6216								
SPCTK	1020#	3766	3950											
SQR	915	915#												
SQRFIX	915#													
SQRTK	1048#	5194												
STAINP	7280#	7285	7319											
START	84	732#												
STEPTK	1026#	2805												
STKDBL	4831	4879#												
STKINI	1884	2237#												
STKSNG	4846	4954#												
STKTOP	147	1649#	2239	3242	3508	6237	6664	6714						
STMDSP	1058#	2949												
STOP	1088	3010#												
STPEND	3016#	4065												

STPRDY	1939#	7426												
STRS	940	6459#												
STR1	2418#	2432												
STRAD1	6510#													
STRAD2	6494	6507#	6564	7159										
STRCMP	4802	5345#												
STRCPY	3522	6482#	6569											
STRDN2	4204	4224#												
STRDON	3795	3840#												
STREND	136	1668#	1828	2227	5706	5720	5925	6089	6210	6774				
STRFIN	6544	6548	6554#											
STRGET	6539#	6552												
STRING	40#	148	937	1053	1432	1601	1617	1711	1716	1720	2206	2210	2242	2275
	2278	2289	2316	2348	2397	2413	2586	2815	3383	3437	3461	3476	3755	3789
	3804	3805	3837	3886	4009	4049	4060	4163	4284	4509	4585	5024	5093	5097
	5126	5324	6217	6403	6446	6453	7291	7327	7354					
STRIN1	6504#	6942	7104											
STRLIT	150	3807	6467	6532#	6620									
STRLT2	4197	6536#												
STRLT3	6535#	7452												
STRLTI	4051	5028	6533#											
STRNG	2310	2427#												
STROUI	146	6618#												
STROUT	144	1917	4029	4264	6619#	7531								
STRPR2	6634#	6649												
STRPRT	3832	3841	4057	6625#	7455									
STRSIZ	110#	117#	1614	1615										
STUFFH	2303	2324	2333	2344	2393#	2425								
SUBFLG	1625#	2264	2735	5612	5624	6440								
SVAR	6737#	6768												
SVARS	6734#													
TABEND	2361	2377#												
TABER	3762	3768	3936#											
TABTK	1012#	3760												
TAN	929	929#												
TANFIX	139	929#												
TEMP	1653#	2208	2259	2835	2869	3016	3034	3474	4032	4376	4449			
TEMP2	170	1639#	4522	4525	5072	5906	6200							
TEMP3	170	1618#	4560	4573	4721	6039	6114	6801	6812					
TEMP6	6030	6035#	6106											
TEMPPT	149	1612#	2247	6582	6609	6723	7022	7036						
TEMPST	150	1614#	2244	6719										
THENTK	1023#	3660												
THERR	169#	4686	4856											
TOFF	1093	2185	3103#											
TON	1093	3102#												
TOPCON	5200#	5202												
TOTK	1013#	2780												
TRCFLG	1675#	2905	3105											
TRMNOK	4016#	4234												
TRMOK	4229	4236#												
TRYAGN	3991#	4026												
TRYGI2	6661#	6697												

TRYIN	2629#	2635												
TRYOUT	2592	2611#												
TSTACK	143#													
TSTOP	4527#	6964												
TTICHN	125#	2638												
TTOCHN	124#	2623												
TTYCHR	2585#													
TTYIST	3963#													
TTYPOS	836#	2597	2609	3822	3862	3874	3910	3964	6280					
TVAR	6721#	6728												
TXTTAB	144	1655#	2149	2179	2197	2986								
UMULT	157#	6069	6156											
USERR	3340#													
USINTK	1022#													
USRLOC	906#													
VAL	942	7362#												
VALINT	169#													
VALSNG	169#													
VALTYP	149	170	1602#	3463	4165	4587	4681	4834	4933	5237	5596	5931	6169	6591
VARTAB	1656#	2018	2030	2192	2221	3230	3516	5630	6735	7540	7554			
VINT	168#	902												
VMOVAF	166#	4883	4929											
VMOVE	169#	3541	6594											
VMOVFA	166#													
VMOVFM	167#	5111												
VMOVMF	167#	3571												
VNEG	167#	5077												
VPUSHD	4697	4705	4712#											
VSIGN	166#	3688#	3688											
ZERITA	6091#	6096												
ZERO	141#	7366												
ZEROER	5729#	5734												
$CODE	84	84#	676	1736	1765	1849	1948	2099	2116	2250	2799	3175	3182	3233
	4363	4781	6055	6139	6214	6710								
$START	84#	84												
.C1	135	7600#												
.P	110#	735	736#	749	750#	751	752#	774	775#	800	801#	811	812#	817
	818#	851	852#	855	856#	872	873#	877	878#	892	893#	898	899#	903
	904#	905	906#	907	908#	909	910#	911	912#	914	915#	916	917#	918
	919#	921	922#	923	924#	925	926#	927	928#	930	931#	932	933#	935
	936#	939	940#	941	942#	943	944#	945	946#	947	948#	949	950#	951
	952#	953	954#	1059	1060#	1061	1062#	1063	1064#	1065	1066#	1067	1068#	1069
	1070#	1071	1072#	1073	1074#	1075	1076#	1077	1078#	1079	1080#	1081	1082#	1083
	1084#	1085	1086#	1087	1088#	1089	1090#	1092	1093#	1094	1095#	1096	1097#	1098
	1099#	1100	1101#	1102	1103#	1104	1105#	1106	1107#	1111	1112#	1113	1114#	1115
	1116#	1118	1119#	1121	1122#	1124	1125#	1126	1127#	1131	1132#	1135	1136#	1137
	1138#	1139	1140#	1146	1147#	1148	1149#	1150	1151#	1152	1153#	1154	1155#	1156
	1157#	1158	1159#	1160	1161#	1162	1163#	1164	1165#	1166	1167#	1168	1169#	1170
	1171#	1172	1173#	1174	1175#	1737	1738#	1761	1762#	1766	1767#	1772	1773#	1790
	1791#	1803	1804#	1829	1830#	1836	1837#	1850	1851#	1864	1865#	1870	1871#	1873
	1874#	1885	1886#	1890	1891#	1893	1894#	1896	1897#	1900	1901#	1905	1906#	1918
	1919#	1921	1922#	1927	1928#	1946	1947#	1949	1950#	1952	1953#	1955	1956#	1958
	1959#	1963	1964#	1969	1970#	1973	1974#	1977	1978#	1983	1984#	1990	1991#	1995

	1996#	2016	2017#	2019	2020#	2027	2028#	2031	2032#	2046	2047#	2055	2056#	2058
	2059#	2074	2075#	2083	2084#	2091	2092#	2100	2101#	2104	2105#	2108	2109#	2112
	2113#	2117	2118#	2120	2121#	2123	2124#	2150	2151#	2172	2173#	2180	2181#	2186
	2187#	2193	2194#	2198	2199#	2209	2210#	2213	2214#	2216	2217#	2219	2220#	2222
	2223#	2225	2226#	2228	2229#	2240	2241#	2245	2246#	2248	2249#	2251	2252#	2255
	2256#	2260	2261#	2265	2266#	2280	2281#	2293	2294#	2298	2299#	2304	2305#	2311
	2312#	2315	2316#	2319	2320#	2325	2326#	2334	2335#	2340	2341#	2345	2346#	2352
	2353#	2362	2363#	2366	2367#	2371	2372#	2389	2390#	2402	2403#	2407	2408#	2410
	2411#	2416	2417#	2422	2423#	2426	2427#	2433	2434#	2443	2444#	2448	2449#	2451
	2452#	2473	2474#	2479	2480#	2482	2483#	2487	2488#	2493	2494#	2498	2499#	2503
	2504#	2508	2509#	2513	2514#	2518	2519#	2527	2528#	2537	2538#	2542	2543#	2593
	2594#	2598	2599#	2605	2606#	2610	2611#	2620	2621#	2636	2637#	2648	2649#	2652
	2653#	2736	2737#	2739	2740#	2746	2747#	2750	2751#	2760	2761#	2766	2767#	2774
	2775#	2786	2787#	2791	2792#	2794	2795#	2800	2801#	2810	2811#	2818	2819#	2823
	2824#	2826	2827#	2836	2837#	2864	2865#	2870	2871#	2881	2882#	2885	2886#	2895
	2896#	2902	2903#	2906	2907#	2910	2911#	2917	2918#	2927	2928#	2935	2936#	2941
	2942#	2950	2951#	2973	2974#	2987	2988#	2991	2992#	3004	3005#	3017	3018#	3023
	3024#	3029	3030#	3032	3033#	3035	3036#	3038	3039#	3044	3045#	3048	3049#	3051
	3052#	3054	3055#	3066	3067#	3074	3075#	3078	3079#	3081	3082#	3087	3088#	3096
	3097#	3099	3100#	3106	3107#	3147	3148#	3151	3152#	3156	3157#	3176	3177#	3183
	3184#	3187	3188#	3205	3206#	3209	3210#	3212	3213#	3219	3220#	3228	3229#	3231
	3232#	3234	3235#	3239	3240#	3243	3244#	3247	3248#	3253	3254#	3258	3259#	3263
	3264#	3266	3267#	3282	3283#	3289	3290#	3305	3306#	3316	3317#	3320	3321#	3331
	3332#	3334	3335#	3344	3345#	3358	3359#	3366	3367#	3370	3371#	3373	3374#	3410
	3411#	3422	3423#	3431	3432#	3453	3454#	3464	3465#	3469	3470#	3475	3476#	3487
	3488#	3490	3491#	3501	3502#	3509	3510#	3514	3515#	3517	3518#	3523	3524#	3532
	3533#	3542	3543#	3553	3554#	3564	3565#	3572	3573#	3586	3587#	3593	3594#	3602
	3603#	3605	3606#	3612	3613#	3618	3619#	3652	3653#	3658	3659#	3689	3690#	3697
	3690#	3703	3704#	3706	3707#	3717	3718#	3728	3729#	3733	3734#	3737	3738#	3749
	3750#	3763	3764#	3769	3770#	3775	3776#	3780	3781#	3784	3785#	3793	3794#	3796
	3797#	3803	3804#	3808	3809#	3811	3812#	3823	3824#	3830	3831#	3833	3834#	3842
	3843#	3849	3850#	3854	3855#	3863	3864#	3871	3872#	3875	3876#	3885	3886#	3911
	3912#	3919	3920#	3922	3923#	3927	3928#	3934	3935#	3943	3944#	3956	3957#	3965
	3966#	3970	3971#	3980	3981#	3985	3986#	4018	4019#	4022	4023#	4027	4028#	4030
	4031#	4033	4034#	4045	4046#	4048	4049#	4052	4053#	4058	4059#	4074	4075#	4078
	4079#	4086	4087#	4090	4091#	4094	4095#	4099	4100#	4115	4116#	4134	4135#	4140
	4141#	4148	4149#	4154	4155#	4166	4167#	4173	4174#	4187	4188#	4198	4199#	4205
	4206#	4210	4211#	4214	4215#	4218	4219#	4230	4231#	4235	4236#	4241	4242#	4248
	4249#	4255	4256#	4261	4262#	4265	4266#	4300	4301#	4306	4307#	4316	4317#	4325
	4326#	4332	4333#	4336	4337#	4364	4365#	4373	4374#	4377	4378#	4382	4383#	4388
	4389#	4402	4403#	4409	4410#	4414	4415#	4418	4419#	4422	4423#	4429	4430#	4433
	4434#	4438	4439#	4443	4444#	4450	4451#	4458	4459#	4462	4463#	4516	4517#	4520
	4521#	4523	4524#	4526	4527#	4543	4544#	4549	4550#	4558	4559#	4561	4562#	4565
	4566#	4570	4571#	4574	4575#	4588	4589#	4599	4600#	4608	4609#	4659	4660#	4668
	4669#	4673	4674#	4682	4683#	4687	4688#	4690	4691#	4698	4699#	4706	4707#	4709
	4710#	4717	4718#	4722	4723#	4725	4726#	4734	4735#	4737	4738#	4740	4741#	4746
	4747#	4755	4756#	4760	4761#	4763	4764#	4782	4783#	4788	4789#	4793	4794#	4796
	4797#	4799	4800#	4803	4804#	4806	4807#	4826	4827#	4832	4833#	4835	4836#	4840
	4841#	4847	4848#	4853	4854#	4857	4858#	4860	4861#	4871	4872#	4881	4882#	4884
	4885#	4888	4889#	4892	4893#	4897	4898#	4900	4901#	4904	4905#	4907	4908#	4930
	4931#	4934	4935#	4941	4942#	4946	4947#	4949	4950#	4956	4957#	4961	4962#	4965
	4966#	4973	4974#	4976	4977#	4980	4981#	4984	4985#	4988	4989#	4991	4992#	5001
	5002#	5004	5005#	5007	5008#	5012	5013#	5016	5019#	5023	5024#	5029	5030#	5037

	5038#	5043	5044#	5048	5049#	5057	5058#	5070	5071#	5073	5074#	5078	5079#	5090
	5091#	5104	5105#	5109	5110#	5112	5113#	5133	5134#	5158	5159#	5163	5164#	5167
	5168#	5174	5175#	5181	5182#	5184	5185#	5199	5200#	5206	5207#	5211	5212#	5215
	5216#	5238	5239#	5347	5348#	5360	5361#	5390	5391#	5394	5395#	5406	5407#	5409
	5410#	5435	5436#	5439	5440#	5448	5449#	5455	5456#	5467	5468#	5476	5477#	5484
	5485#	5493	5494#	5518	5519#	5532	5533#	5536	5537#	5539	5540#	5551	5552#	5555
	5556#	5558	5559#	5564	5565#	5567	5568#	5570	5571#	5575	5576#	5597	5598#	5613
	5614#	5620	5621#	5625	5626#	5631	5632#	5636	5637#	5641	5642#	5648	5649#	5653
	5654#	5659	5660#	5672	5673#	5707	5708#	5715	5716#	5721	5722#	5728	5729#	5735
	5736#	5878	5879#	5886	5887#	5902	5903#	5907	5908#	5911	5912#	5919	5920#	5926
	5927#	5932	5933#	5935	5936#	5941	5942#	5947	5948#	5960	5961#	5964	5965#	5970
	5971#	5983	5984#	5989	5990#	6031	6032#	6034	6035#	6040	6041#	6051	6052#	6056
	6057#	6059	6060#	6070	6071#	6077	6078#	6084	6085#	6087	6088#	6090	6091#	6097
	6098#	6103	6104#	6107	6108#	6115	6116#	6122	6123#	6140	6141#	6153	6154#	6157
	6158#	6166	6167#	6170	6171#	6180	6181#	6184	6185#	6188	6189#	6201	6202#	6211
	6212#	6215	6216#	6221	6222#	6224	6225#	6231	6232#	6235	6236#	6238	6239#	6242
	6243#	6274	6275#	6281	6282#	6309	6310#	6313	6314#	6316	6319#	6324	6325#	6338
	6339#	6346	6347#	6351	6352#	6376	6377#	6379	6380#	6387	6388#	6391	6392#	6397
	6398#	6421	6422#	6431	6432#	6441	6442#	6450	6451#	6465	6466#	6468	6469#	6471
	6472#	6474	6475#	6489	6490#	6495	6496#	6500	6501#	6506	6507#	6509	6510#	6516
	6517#	6545	6546#	6549	6550#	6553	6554#	6558	6559#	6565	6566#	6570	6571#	6580
	6581#	6583	6584#	6586	6587#	6592	6593#	6595	6596#	6607	6608#	6610	6611#	6621
	6622#	6627	6628#	6631	6632#	6646	6647#	6650	6651#	6665	6666#	6669	6670#	6679
	6680#	6682	6683#	6693	6694#	6698	6699#	6702	6703#	6708	6709#	6711	6712#	6715
	6716#	6720	6721#	6724	6725#	6729	6730#	6732	6733#	6736	6737#	6740	6741#	6745
	6746#	6755	6756#	6758	6759#	6769	6770#	6775	6776#	6780	6781#	6786	6787#	6796
	6797#	6802	6803#	6813	6814#	6818	6819#	6821	6822#	6846	6847#	6896	6897#	6899
	6900#	6909	6910#	6920	6921#	6924	6925#	6928	6929#	6933	6934#	6940	6941#	6943
	6944#	6947	6948#	6951	6952#	6955	6956#	6959	6960#	6962	6963#	6965	6966#	6970
	6971#	6996	6997#	7016	7017#	7019	7020#	7023	7024#	7037	7038#	7046	7047#	7051
	7052#	7056	7057#	7065	7066#	7069	7070#	7083	7084#	7086	7087#	7095	7096#	7105
	7106#	7108	7109#	7111	7112#	7117	7118#	7125	7126#	7134	7135#	7142	7143#	7160
	7161#	7164	7165#	7168	7169#	7171	7172#	7175	7176#	7182	7183#	7194	7195#	7203
	7204#	7209	7210#	7216	7217#	7241	7242#	7244	7245#	7249	7250#	7253	7254#	7265
	7266#	7273	7274#	7278	7279#	7286	7287#	7310	7311#	7317	7318#	7320	7321#	7323
	7324#	7332	7333#	7336	7337#	7346	7347#	7364	7365#	7367	7368#	7383	7384#	7404
	7405#	7414	7415#	7418	7419#	7427	7428#	7434	7435#	7438	7439#	7445	7446#	7448
	7449#	7453	7454#	7456	7457#	7459	7460#	7462	7463#	7473	7474#	7479	7480#	7485
	7486#	7493	7494#	7499	7500#	7506	7507#	7511	7512#	7519	7520#	7524	7525#	7529
	7530#	7532	7533#	7535	7536#	7541	7542#	7549	7550#	7555	7556#	7767	7768#	7774
	7775#	7778	7779#	7782	7783#	7791	7792#	7800						

ACRLF	51#	1710	1715	1719	4008	4283								
ADC	3427	5397												
ADD	3824	3967	5614	6935										
ADI	5400													
ADR	748	750	897	902	924	926	928	910	913	915	917	920	922	924
	926	929	931	934	938	940	942	944	946	948	950	952	1058	1060
	1062	1064	1066	1068	1070	1072	1074	1076	1078	1080	1082	1084	1086	1088
	1091	1093	1095	1097	1099	1101	1103	1105	1110	1112	1114	1117	1120	1123
	1125	1130	1134	1136	1138	1145	1147	1149	1151	1153	1155	1157	1159	1161
	1163	1165	1167	1169	1171	1173								
ADRP	955#	957#	961	963	965	967	969	972	974					
ANA	1923	3025	5399	5477	5480	7283								
ANI	2358	2616	2632	2640	2660	2999	3547							
CALL	1788	1834	1883	1891	1898	1916	1956	1961	1971	1975	1988	2025	2056	2106
	2184	2217	2477	2485	2737	2744	2758	2764	2784	2789	2792	2816	2821	2824
	2915	3002	3085	3145	3149	3210	3256	3280	3303	3314	3356	3451	3467	3488
	3530	3540	3570	3584	3603	3616	3687	3715	3782	3791	3801	3806	3831	3941
	4028	4050	4056	4072	4076	4113	4152	4196	4212	4298	4380	4400	4407	4412
	4416	4420	4427	4460	4514	4518	4732	4735	4753	4791	4879	4882	4895	4898
	4928	4954	4971	4974	4978	5002	5055	5068	5076	5088	5107	5156	5161	5172
	5182	5345	5356	5404	5433	5437	5465	5534	5553	5565	5713	5884	6032	6068
	6085	6155	6219	6229	6233	6307	6316	6322	6344	6349	6377	6385	6389	6463
	6466	6469	6487	6493	6498	6504	6563	6593	6619	6625	6629	6756	6784	6897
	6922	6926	6941	6945	6949	6957	6960	7014	7067	7081	7103	7106	7123	7140
	7158	7162	7166	7173	7192	7207	7239	7251	7263	7276	7315	7330	7334	7362
	7381	7402	7416	7432	7436	7443	7451	7454	7517	7522	7530	7765	7776	7788
	7789													
CC	1993	3329	3521	5204										
CHRGET	44#	1964	1986	2355	2924	3144	3177	3214	3700	3723	3746	3982	4180	4211
	4227	4238	4327	4459	4562	4998	5125	5498	5545	5560	5598	6203	6394	7270
	7328	7350												
CMA	2649	3928	3966	5375	5441	5444	6670							
CMC	2166	2168	2977	3118	5391									
CMP	767	2079	2363	2423	3403	3423	4554	4612	5378	5385	5644	5650	5656	5937
	5943	5949	5978	6546	6550	6694	7131	7219	7226					
CNC	3332	3828	3917	6568										
CNZ	1925	2118	4263	4371	5110									
COMPAR	46#	1763	1795	1853	2163	3184	3236	3321	3510	3518	5637	5732	5928	6094
	6150	6369	6567	6600	6676	6726	6742	6777	6815	6847	6853	7031	7048	7423
	7546													
CPI	792	1742	2300	2307	2328	2336	2341	2382	2403	2489	2494	2499	2504	2509
	2514	2521	2589	2599	2643	2804	2877	2937	2963	2969	2974	3005	3090	3113
	3116	3360	3406	3482	3589	3606	3648	3654	3724	3759	3765	3771	3776	3825
	3914	3949	4038	4150	4168	4183	4231	4328	4454	4545	4550	4580	4590	4663
	4669	4683	4774	4828	4836	4843	4849	4936	5008	5013	5019	5025	5033	5039
	5129	5195	5201	5239	5471	5579	5584	5588	5615	5698	6554	6642	6751	6792
	7199	7474												
CZ	2387	2603	2862	3650	3840	6556	6644	7477						
DAD	1739	1769	1832	1833	1852	2023	2752	2951	3190	3191	3192	3193	3200	3235
	3557	4609	4863	4864	4914	5216	5669	5709	5921	6081	6109	6110	6159	6174
	6181	6185	6189	6196	6216	6674	6763	6790	6807	6808	6888	7053	7155	7375
DC	986	987	988	989	990	991	992	993	994	995	998	999	1001	1002
	1003	1013	1021	1022	1023	1025	1026	1027	1028	1029	1033	1046	1047	1048

	1049	1050	1052	1054	1056	1194	1214	1230	1254	1269	1294	1306	1323	1346	
	1372	1395	1415	1434	1451	1474	1493	1524	1543	1704	1712	1721	3991	4268	
OCE	1179#	1188#	1193	1213	1229	1253	1268	1293	1305	1322	1345	1371	1394	1414	
	1433	1450	1473	1492	1523	1542									
OCI	982#	986	987	988	989	990	991	992	993	994	995	998	999	1001	
	1002	1005	1013	1021	1022	1023	1025	1026	1027	1028	1029	1033	1046	1047	
	1048	1049	1050	1052	1054	1056									
OCL	1178#	1189#	1194	1214	1230	1254	1269	1294	1306	1323	1346	1372	1395	1415	
	1434	1451	1474	1493	1524	1543									
OCR	1901	1966	2467	2979	3598	3729	3872	3977	5241	5242	5243	5382	5383	6074	
	6161	6634	6988	7218	7302	7495									
OCX	1799	1800	2157	2199	2468	2988	3173	3213	3338	3596	3661	3745	3787	3946	
	4082	4192	4226	4237	4510	5497	5592	5729	6091	6202	6364	6365	6366	6367	
	6393	6532	6875	6877	6882	6891	6906	7024	7026	7028	7042	7269	7347		
OI	732														
FSIGN	47#	2828													
IN	2613	2629	2637	2856	2996	7245	7280								
INR	1924	1965	2396	2429	2437	2531	2606	2978	3026	3089	3972	5379	5396	5587	
	5591	5695	6541	6632	6987	7301									
INX	769	790	885	887	1741	1750	1752	1824	1902	2034	2037	2040	2042	2050	
	2051	2060	2070	2075	2076	2077	2080	2086	2155	2188	2190	2356	2393	2395	
	2427	2430	2440	2453	2455	2530	2632	2642	2886	2890	2892	2897	2953	2961	
	3295	3328	3405	3503	3504	3559	4079	4308	4320	4393	4692	4694	4700	4702	
	4866	4917	5222	5350	5353	5365	5367	5386	5387	5645	5654	5662	5663	5677	
	5679	5680	5759	5742	5747	5938	5944	5952	5953	5955	5957	6018	6025	6027	
	6042	6043	6048	6061	6063	6065	6098	6117	6119	6137	6144	6146	6405	6407	
	6409	6422	6483	6539	6560	6618	6647	6675	6683	6747	6748	6750	6783	6809	
	6827	6829	6831	6902	6977	6979	6992	6993	7087	7146	7150	7371	7466	7468	
	7489	7507	7508	7544	7545	7552									
JC	2338	2343	2501	2591	2933	3185	3226	3701	4541	4556	4671	4999	5131	5197	
	5537	5549	5556	5562	6082	6178	6677	6938	7132	7425					
JM	3154	4696	7504												
JMP	733	798	815	875	890	1770	1801	1862	2089	2170	2278	2431	2446	2535	
	3052	3203	3245	3264	3342	3429	3610	3704	3735	3847	3883	3932	3983	4088	
	4208	4216	4334	4441	4563	4723	4744	4761	4804	4947	4963	4989	5179	5392	
	5407	5453	5482	5491	5670	5987	6272	6336	6429	6448	6514	6648	6767	6907	
	6968	6994	7093	7115	7169	7180	7247	7308	7457	7509	7772				
JNC	1981	2506	2525	2939	3094	3237	3512	3920	3925	3968	4547	4851	5005	5046	
	5568	6151	7547												
JNZ	772	853	1903	2053	2081	2121	2323	2364	2405	2414	2471	2540	2618	2634	
	2748	2808	2883	3049	3364	3420	3485	3726	3731	3978	4020	4046	4146	4171	
	4233	4239	4253	4304	4330	4386	4456	4568	4794	5646	5651	5733	5939	5945	
	5958	5968	6075	6095	6120	6164	6222	6395	6551	6730	6753	6794	7049	7344	
	7497														
JP	2369	2441	7471	7491											
JPO	4704	6186													
JZ	1759	1967	2014	2072	2102	2110	2302	2309	2313	2332	2360	2400	2420	2424	
	2491	2496	2511	2516	2879	2893	2908	2971	3027	3072	3207	3251	3408	3591	
	3600	3656	3695	3747	3761	3767	3773	3778	3794	3954	4084	4132	4185	4228	
	4314	4431	4597	4665	4685	4830	4838	4845	4855	4939	5010	5016	5021	5027	
	5035	5041	5388	5474	5618	5639	5657	5900	5933	5981	6057	6182	6374	6543	
	6547	6605	6691	6743	6778	6816	7084	7201	7271	7284	7365	7412			
LDA	809	849	2317	2596	2646	2904	3462	3821	3869	3909	3963	4016	4138	4164	

	4246	4586	4680	4833	4905	5236	5611	5930	5962	6049	6101	6105	6168	6279	
LDAX	2047	2357	2367	3524	5384	5642	5649	5655	6640	6990	7178	7488	7542		
LHLD	1827	1868	1919	2017	2148	2178	2196	2211	2220	2238	2256	2772	2834	2985	
	3021	3033	3064	3076	3217	3229	3287	3318	3499	3507	3515	3809	4031	4092	
	4448	4524	4720	4797	4869	5071	5165	5629	5634	5705	5876	5917	5924	6113	
	6199	6209	6236	6240	6419	6581	6663	6667	6700	6713	6722	6734	6738	6773	
	6811	6844	6894	6918	6931	6953	7017	7021	7044	7109	7539				
LXI	1735	1764	1848	1894	1947	1953	2044	2098	2115	2243	2249	2296	2350	2449	
	2480	2798	2925	2948	3046	3174	3181	3232	3261	3371	3551	3562	3852	4025	
	4203	4259	4362	4606	4657	4688	4707	4715	4738	4758	4780	4786	4801	4858	
	4902	4959	5209	5213	5516	5573	6054	6138	6213	6311	6472	6507	6578	6696	
	6709	6718	6727	6819	6963	7063	7214	7446	7460	7483	7527	7533			
	84														
MCSSIM															
MOV	764	791	827	830	884	886	1740	1749	1751	1754	1755	1756	1796	1822	
	1922	1978	2033	2039	2041	2049	2067	2068	2069	2085	2087	2151	2153	2154	
	2187	2189	2299	2305	2321	2322	2335	2373	2378	2417	2418	2519	2520	2528	
	2529	2801	2802	2803	2875	2887	2896	2898	2944	2952	2954	2962	3024	3070	
	3112	3152	3188	3189	3197	3220	3222	3223	3225	3336	3337	3397	3398	3399	
	3400	3428	3519	3520	3534	3554	3558	3560	3561	3587	3588	3597	3599	3623	
	3953	3973	4080	4126	4181	4182	4310	4319	4321	4392	4439	4440	4453	4535	
	4555	4566	4571	4583	4610	4611	4662	4691	4693	4699	4701	4712	4713	4773	
	4823	4827	4841	4842	4846	4865	4867	4911	4916	4918	4919	5123	5127	5193	
	5221	5223	5224	5349	5351	5354	5364	5366	5368	5370	5373	5440	5442	5443	
	5445	5473	5478	5479	5481	5487	5488	5490	5533	5541	5559	5594	5628	5643	
	5664	5674	5675	5724	5725	5738	5741	5743	5896	5897	5942	5948	5954	5956	
	6017	6019	6024	6026	6044	6047	6053	6062	6064	6078	6079	6100	6108	6116	
	6118	6143	6145	6162	6163	6172	6173	6263	6265	6266	6269	6271	6331	6332	
	6424	6406	6408	6410	6423	6444	6482	6497	6511	6535	6540	6562	6612	6671	
	6746	6760	6782	6804	6828	6830	6842	6843	6848	6849	6856	6857	6871	6876	
	6878	6885	6889	6890	6892	6893	6901	6903	6904	6905	6929	6976	6978	6980	
	6981	7025	7027	7040	7041	7043	7052	7071	7074	7092	7112	7128	7130	7135	
	7149	7151	7152	7156	7157	7161	7191	7223	7224	7227	7229	7300	7342	7351	
	7368	7373	7374	7376	7377	7380	7387	7409	7465	7501	7550	7551	7768		
MOVRI	60#														
MVI	1830	1857	1874	1877	1881	2269	2272	2294	2330	2385	2483	2523	2732	2806	
	2839	2912	2918	2945	3062	3198	3291	3340	3353	3362	3395	3555	3711	3834	
	3850	3859	3866	3974	4041	4149	4188	4190	4312	4511	4537	4742	4861	4912	
	5065	5120	5431	5577	5582	5667	5730	5880	5966	5985	6020	6092	6372	6427	
	6437	6533	6537	6588	6603	6672	6689	6761	6805	6886	6936	7101	7137	7153	
	7197	7220	7267	7306	7439	7449									
NOP	882	883													
ORA	812	852	1757	2052	2071	2156	2312	2320	2368	2419	2439	2882	2891	2907	
	3071	3153	3401	3721	3839	4019	4081	4141	4249	4257	4303	4311	4567	4594	
	5371	5374	5486	5489	5965	6052	6124	6424	6443	6542	6659	6826	6872	7075	
	7363	7410	7467	7490	7502										
ORI	2374														
OUT	2622	7254													
OUTCHR	45#	2271	2274	2470	2475	2534	2914	2920	3836	3865	3868	3881	3976	4151	
	6641	7442													
PCHL	3566	4920	5225	6035											
POP	873	1767	1794	1837	1855	1939	1979	1980	2011	2012	2022	2028	2038	2105	
	2125	2162	2164	2165	2237	2372	2377	2379	2435	2587	2621	2747	2795	2827	
	2921	3018	3045	3150	3194	3202	3244	3284	3327	3367	3477	3478	3506	3511	

	3533	3536	3543	3567	3576	3578	3781	3846	3882	3948	3981	4023	4059	4083
	4201	4245	4266	4316	4410	4415	4423	4424	4527	4756	4821	4868	4885	4889
	4893	4894	4915	4931	4943	4957	4958	4970	4981	4985	5086	5118	5207	5355
	5363	5369	5398	5449	5468	5470	5638	5711	5718	5737	5740	5751	5887	5888
	5908	5977	6028	6060	6072	6073	6142	6158	6160	6194	6358	6361	6381	6392
	6400	6401	6402	6411	6425	6490	6492	6501	6611	6661	6685	6688	6771	6803
	6851	6859	6860	6861	6869	6870	6900	6944	6973	7057	7091	7113	7143	7144
	7163	7176	7212	7279	7297	7298	7338	7384	7386	7401	7406	7407	7411	7424
	7441	7464	7494	7496	7520	7525	7792							
POPR	57#	4893	4957											
PUSH	807	888	1753	1792	1826	1846	1970	1974	1984	1985	1987	1991	2024	2101
	2109	2127	2159	2252	2266	2347	2353	2436	2588	2763	2771	2787	2796	2797
	2819	2829	2830	2831	2833	2841	2911	2928						

2955	3019	3148	3179	3180	3216									
	3285	3286	3294	3296	3317	3465	3466	3480	3484	3502	3525	3565	3569	3770
	3788	3879	3937	3951	4055	4063	4087	4091	4124	4170	4207	4262	4391	4394
	4395	4405	4419	4513	4656	4660	4695	4703	4714	4719	4752	4757	4778	4779
	4790	4800	4872	4910	4927	5074	5092	5124	5170	5203	5212	5356	5357	5464
	5519	5576	5626	5632	5673	5676	5708	5712	5875	5882	5883	5893	5912	6066
	6067	6149	6154	6314	6315	6348	6368	6371	6388	6418	6475	6486	6496	6510
	6536	6662	6695	6699	6712	6717	6789	6822	6855	6862	6863	6864	6879	6916
	6917	6930	6934	6952	6967	7039	7066	7129	7139	7145	7177	7196	7217	7266
	7299	7333	7379	7405	7419	7429	7430	7482	7486	7487	7521	7526	7779	
PUSHFM	496	6362												
PUSHM	48#	2160	2161	3505	4309	4710	4711	6356	6359	6362	6363	6491	7090	7372
	7408	7420												
PUSHR	54#													
RAL	4552													
RC	3115	3339	4577	6850	7228									
RET	832	856	880	1838	2267	2457	2625	2653	2980	2993	3083	3100	3107	3119
	3159	3544	3579	4034	4267	4873	5060	5087	5119	5244	5593	5752	6204	6412
	6506	6613	6686	6865	7058	7076	7230	7256	7290	7352	7393	7556	7794	
RLC	2943	4908	5122											
RNC	797	1856	2169	2965	3178	4582	4613	4776	5380	6858	7222			
RNZ	829	1744	2177	2645	3001	3010	3014	3061	3088	3215	3352	3608	6426	7034
	7304													
RST	1763	1795	1853	1964	1986	2113	2160	2161	2163	2271	2274	2355	2470	2475
	2534	2779	2826	2914	2920	2924	3144	3177	3184	3214	3236	3321	3458	3505
	3510	3518	3594	3659	3700	3723	3746	3836	3865	3868	3881	3944	3976	3982
	4053	4111	4151	4180	4211	4227	4238	4309	4327	4459	4562	4710	4711	4998
	5052	5058	5125	5153	5159	5498	5500	5545	5560	5598	5637	5732	5903	5928
	6094	6150	6203	6319	6327	6329	6356	6359	6362	6363	6369	6394	6435	6491
	6567	6600	6641	6676	6726	6742	6777	6815	6847	6853	7031	7048	7090	7205
	7210	7270	7274	7294	7324	7328	7350	7372	7408	7420	7423	7442	7546	7787
RZ	1768	1798	2158	2167	2929	3402	3404	3722	3751	3876	5372	5376	5499	5581
	5586	5590	6639	6841	6873	6989	7470							
SBB	3224	5402	6667											
SHLD	870	1871	1950	2029	2191	2207	2214	2223	2226	2246	2253	2868	2900	2989
	3015	3030	3036	3079	3241	3368	3473	4323	4375	4436	4521	4559	4572	4886
	4890	4944	4982	4986	5102	5446	5719	5726	5905	5909	6038	6088	6584	6608
	6680	6706	6800	7035	7054	7553								
SPHL	2241	2755	3359	4389	4445									
STA	1886	1944	2263	2291	2408	2608	2650	2734	3042	3097	3104	3861	3873	4043
	4097	4624	4932	5530	5595	5623	6029	6439	6590	7242	7318	7321		

STAX	1797	2394	2428	2452	2454	2456	3529	6991	7469	7503	7543	7793		
SUB	828	831	3221	4425	6264	7179	7225							
SUI	2398	2411	2931	3195	3418	3923	4539	4575	5044	6175	7480			
SYNCHK	42#	2113	2779	3458	3594	3659	3944	4053	4111	5052	5058	5153	5159	5500
	5903	6319	6327	6329	6435	7205	7210	7274	7294	7324	7787			
XCHG	1758	1762	1847	1854	2032	2084	2088	2124	2381	2392	2438	2444	2757	2899
	2923	2947	2956	2984	2992	3075	3082	3157	3201	3240	3535	4202	4252	4322
	4326	4435	5098	5164	5171	5175	5633	5746	5889	5894	5923	5927	6071	6080
	6112	6198	6212	6239	6561	6666	6684	6721	6725	6737	6741	6772	6776	6810
	6814	6956	7020	7032	7190	7293	7337	7422	7431	7537				
XRA	1887	1943	2078	2290	3041	3103	3527	3880	4096	4553	5377	5529	5540	5622
	6270	6759	6825	7070	7126	7282								
XTHL	765	770	869	1793	1821	1825	2020	2126	2743	2768	2775	2837	3290	3374
	3471	4108	4117	4206	4236	4403	5168	5177	5187	5879	5891	6147	6333	6354
	6559	6652	6854	6921	6925	6948	6966	6974	7127	7213	7378	7421	7428	7536
	7783													

```
SPOOLER RUNTIME 48 SECONDS, 310 KCS, 1637 DISK READS, 123 DISK WRITES, 386 PAGES
 **END** USER MITS  [6000,6000] JOB  F3 SEQ, 42 DATE 10-SEP-75 09:22:31 MONITOR ALBUQUERQUE SCHOOLS 507B **END**
```

Confirm plane reservation on Tue Sept. 2 or Wed Sept. 3

Make sure recieved payment in good order

Prompt?

check if more than 1 person (TOUT) calls VSIGN after doing a LDA VARTYP

see if a lot of people would save if I only preserved B, C, D, R or just B, C

GETTYP

subr that does LDA VARTYP
CPI 4
RET
? (Likely Yes)

Look at after BASICA - see if it makes stuff

slot of CPI FINDIV 3V on loops?

```
LPTSPL VERSION 6(344)  RUNNING ON LPT0
 *START* USER HITS  [6000,6000] JOB  F4 SEQ. 205 DATE 27-AUG-75 07:23:23 MONITOR ALBUQUERQUE SCHOOLS 507A *START*
REQUEST CREATED: 27-AUG-75  06:11:25
FILE: DSK00:F4[6000,6000] CREATED: 27-AUG-75 06:10:00 PRINTED: 27-AUG-75 07:23:30
QUEUE SWITCHES:  /FILE:ASCII /COPIES:1 /SPACING:1 /LIMIT:468 /FORMS:NORMAL
FILE WILL BE DELETED AFTER PRINTING
```

```
/MEDIUM/
/ON MACHINE/
/CASSETTE/
```

2955	3019	3148	3179	3180	3216										
	3285	3286	3294	3296	3317	3465	3466	3480	3484	3502	3525	3565	3569	3770	
	3788	3879	3937	3951	4055	4063	4087	4091	4124	4170	4207	4262	4391	4394	
	4395	4405	4419	4513	4656	4660	4695	4703	4714	4719	4752	4757	4778	4779	
	4790	4800	4872	4910	4927	5074	5092	5124	5170	5203	5212	5356	5357	5464	
	5519	5576	5626	5632	5673	5676	5708	5712	5875	5882	5883	5893	5912	6066	
	6067	6149	6154	6314	6315	6348	6368	6371	6388	6418	6475	6486	6496	6510	
	6530	6662	6693	6699	6712	6717	6789	6822	6855	6862	6863	6864	6879	6916	
	6917	6930	6934	6952	6967	7039	7066	7129	7139	7145	7177	7196	7217	7266	
	7299	7333	7379	7405	7419	7429	7430	7482	7486	7487	7521	7526	7779		
PUSHFM	49#	6362													
PUSHM	48#	2160	2161	3505	4309	4710	4711	6356	6359	6362	6363	6491	7090	7372	
	7406	7420													
PUSHR	54#														
RAL	4552														
RC	3115	3339	4577	6850	7228										
RET	832	856	880	1838	2267	2457	2625	2653	2980	2993	3083	3100	3107	3119	
	3159	3544	3579	4034	4267	4873	5060	5087	5119	5244	5593	5752	6204	6412	
	6502	6613	6686	6865	7058	7076	7230	7256	7290	7352	7393	7556	7794		
RLC	2943	4908	5122												
RNC	797	1856	2169	2965	3178	4582	4613	4776	5380	6858	7222				
RNZ	829	1744	2177	2645	3001	3010	3014	3061	3088	3215	3352	3608	6426	7034	
	7304														
RST	1763	1795	1853	1964	1986	2113	2160	2161	2163	2271	2274	2355	2470	2475	
	2534	2779	2828	2914	2920	2924	3144	3177	3184	3214	3236	3321	3458	3505	
	3510	3518	3594	3659	3700	3723	3746	3836	3865	3868	3881	3944	3976	3982	
	4053	4111	4151	4180	4211	4227	4238	4309	4327	4459	4562	4710	4711	4998	
	5052	5058	5125	5153	5159	5498	5500	5545	5560	5598	5637	5732	5903	5928	
	6094	6150	6203	6319	6327	6329	6356	6359	6362	6363	6369	6394	6435	6491	
	6567	6600	6641	6676	6726	6742	6777	6815	6847	6853	7031	7048	7090	7205	
	7210	7270	7274	7294	7324	7328	7350	7372	7408	7420	7423	7442	7546	7787	
RZ	1766	1798	2158	2167	2929	3402	3404	3722	3751	3876	5372	5376	5499	5581	
	5586	5590	6639	6841	6873	6989	7470								
SBB	3224	5402	6267												
SHLD	870	1671	1950	2029	2191	2207	2214	2223	2226	2246	2253	2868	2900	2989	
	3015	3030	3036	3079	3241	3368	3473	4323	4375	4436	4521	4559	4572	4886	
	4890	4944	4982	4986	5102	5446	5719	5726	5905	5909	6038	6088	6584	6608	
	6680	6706	6800	7035	7054	7553									
SPHL	2241	2755	3359	4389	4445										
STA	1888	1944	2263	2291	2408	2608	2650	2734	3042	3097	3104	3861	3873	4043	
	4097	4624	4932	5530	5595	5623	6029	6439	6590	7242	7318	7321			

STAX	1797	2394	2428	2452	2454	2456	3529	6991	7469	7503	7543	7793			
SUB	826	831	3221	4425	6264	7179	7225								
SUI	2398	2411	2931	3195	3418	3923	4539	4575	5044	6175	7480				
SYNCHK	42#	2113	2179	3458	3594	3659	3944	4053	4111	5052	5058	5153	5159	5500	
	5903	6319	6327	6329	6435	7205	7210	7274	7294	7324	7787				
XCHG	1758	1762	1847	1854	2032	2084	2088	2124	2381	2392	2438	2444	2757	2899	
	2923	2947	2956	2984	2992	3075	3082	3157	3201	3240	3535	4202	4252	4322	
	4326	4435	5098	5164	5171	5175	5633	5746	5889	5894	5923	5927	6071	6080	
	6112	6198	6212	6239	6561	6666	6684	6721	6725	6737	6741	6772	6776	6810	
	6814	6956	7020	7032	7190	7293	7337	7422	7431	7537					
XRA	1887	1943	2078	2290	3041	3103	3527	3880	4096	4553	5377	5529	5540	5622	
	6270	6759	6825	7070	7126	7282									
XTHL	765	770	869	1793	1821	1825	2020	2126	2743	2768	2775	2837	3290	3374	
	3471	4108	4117	4206	4236	4403	5168	5177	5187	5879	5891	6147	6333	6354	
	6559	6852	6854	6921	6925	6948	6966	6974	7127	7213	7378	7421	7428	7536	
	7783														

```
                                00100   SEARCH  MCS808                  ;THE UNIVERSAL FILE
                                00200   SUBTTL  COMMON FILE
                                00300   SALL
                 000001         00400   LENGTH==1                       ; 0 MEANS 4K, 1 MEANS 8K, 2 MEANS 12K
                 000001         00500   REALIO==1
                 000001         00600   CASSW==1                        ;CASSETTE SWITCH (CSAVE,CLOAD)
                 000000         00700   LPTSW==0
                 000000         00800   DSKFUN==0                       ;ON TO READ/WRITE
                 000000         00900   CONSSW==0
                 000001         01100   CONTRW==1                       ;ALLOW "O
                                01200   IFE     REALIO,<
                                01300           LPTSW==0                ;SIMULATOR DEFAULTS
                                01400           CASSW==0
                                01500           CONSSW==0
                                01600           DSKFUN==0
                                01700           CONTRW==0>

                                01900   IFE     LENGTH,<
                                02000           EXTFNC==0               ; ON MEANS EXTENDED FUNCTIONS
                                02100           MULDIM==0               ; ON MEANS MULTIPLE DIMENSIONED ARRAYS ALLOWED
                                02200           STRING==0               ; ON MEANS STRINGS ALLOWED
                                02300           CASSW==0
                                02400           LPTSW==0
                                02500           DSKFUN==0
                                02600           CONSSW==0
                                02700           CONTRW==0>

                                02900   IFE     LENGTH-1,<
                 000001         03000           EXTFNC==1
                 000001         03100           MULDIM==1
                 000001         03200           STRING==1>

                                03400   IFE     LENGTH-2,<
                                03500           EXTFNC==1
                                03600           MULDIM==1
                                03700           STRING==1>

                                03900   DEFINE  SYNCHK(A),<RST  1
                                04000                   A>
                                04100   DEFINE  CHRGET,<RST     2>
                                04200   DEFINE  OUTCHR,<RST     3>
                                04300   DEFINE  COMPAR,<RST     4>
                                04400   DEFINE  FSIGN,<RST      5>
                                04500   DEFINE  PUSHM,<RST      6>
                                04600   DEFINE  PUSHFN,<PUSHM
                                04700                   PUSHM>
                                04800   DEFINE  ACRLF,<
                                04900           "D13
                                05000   IFN     STRING,<"D10>>
                                05100   DEFINE  PUSHR,<
                                05200           PUSH    D
                                05300           PUSH    B>
```



```
                                05400   DEFINE  POPR,<
                                05500           POP     B
                                05600           POP     D>
                                05700   DEFINE  MOVRI(B,C,D,E),<
                                05800           XWD     "D1000,"D001    ;; "LXI B"
                                05900           EXP     C
                                06000           EXP     B
                                06100           XWD     "D1000,"D021    ;; "LXI D"
                                06200           EXP     E
                                06300           EXP     D>

                                06500   IF1,<
                                06600   IFE     LENGTH,<PRINTX  /SMALL/>
                                06700   IFE     LENGTH-1,<PRINTX        /MEDIUM/>
                                06800   IFE     LENGTH-2,<PRINTX        /BIG/>
                                06900   IFE     REALIO,<PRINTX  /SIMULATE/>
                                07000   IFN     REALIO,<PRINTX  /ON MACHINE/>
                                07100   IFN     CASSW,<PRINTX   /CASSETTE/>
                                07200   IFN     LPTSW,<PRINTX   /LPT/>
                                07300   IFN     DSKFUN,<PRINTX  /DISK/>
                                07400   IFN     CONSSW,<PRINTX  /CONSOLE/>>
                                07500   PAGE
```

```
                                00100   SUBTTL  FLOATING POINT MATH PACKAGE CONFIGURATION
                                00120   TITLE   MATHPK FOR BASIC MCS 8080  GATES/ALLEN/DAVIDOFF

                                00160   IFNDEF  LENGTH,<
                                00180           PRINTX  !!! MUST HAVE COM !!!
                                00200           END>

                                00240   RADIX   8                       ;!!!! ALERT !!!!
                                00260                                   ;THROUGHOUT THE MATHPACKAGE!!

                000000          00300           .P==0

                                00340   INTERNAL        ZERO,FLOAT,FLOATR,MOVE,FADD,FADDS,FSUB,FMULT,FDIV,FIN,FOUT
                                00360   INTERNAL        PUSHF,ABS,INT,QINT,SGN,SQR,RND,SIN,FCOMP,SIGNC,OVERR
                                00380   INTERNAL        INPRT,LINPRT,MOVFM,MOVMF,MOVFR,MOVRF,MOVRM,NEG,INRART,INXHRT
                                00400   IFN     EXTFNC,<
                                00420   INTERNAL        FPWR,EXP,LOG,COS,TAN,ATN,FONE>
                                00440   IFN     MULDIM&<LENGTH-2>,<
                                00460   INTERNAL        DMULT>
                                00480   IFN     STRING,<
                                00500   INTERNAL        SIGNS>
                                00520   IFN     LENGTH-2,<
                                00540   INTERNAL        FADDT,FSUBT,FMULTT,FDIVT>
                                00560   IFE     LENGTH-1,<
                                00580   INTERNAL        FPWRT>
                                00600   IFE     LENGTH-2,<
                                00620   INTERNAL        VMOVMF,VMOVFM,FRCINT,FRCSNG,FRCDBL,VNEG,PUFOUT,DCXBRT,IADD
                                00640   INTERNAL        ISUB,IMULT,IDIV,ICOMP,INEG,DADD,DSUB,DMULT,DDIV,DCOMP,INTFNC>


                                00700   EXTERNAL        FAC,FACLO,FBUFFR,MINUTK,PLUSTK,ERROR,DV0ERR,ERROV,FCERR,SIGN
                                00720   EXTERNAL        $CODE
                                00740   IFE     LENGTH-2,<
                                00760   EXTERNAL        DFACLO,ARG,ARGLO,VALTYP,TMERR,TEMP2,TEMP3>


                                00820   COMMENT %
                                00840           EXTERNAL LOCATIONS USED BY THE MATH-PACKAGE
                                00860           ;THE FLOATING ACCUMULATOR
                                00880   IFE     LENGTH-2,<
                                00900           BLOCK   1               ;[TEMPORARY LEAST SIGNIFICANT BYTE]
                                00920   DFACLO: BLOCK   4>              ;[FOUR LOWEST ORDERS FOR DOUBLE PRECISION]
                                00940   FACLO:  BLOCK   3               ;[LOW ORDER OF MANTISSA (LO)]
                                00960                                   ;[MIDDLE ORDER OF MANTISSA (MO)]
                                00980                                   ;[HIGH ORDER OF MANTISSA (MO)]
                                01000   FAC:    BLOCK   2               ;[EXPONENT]
                                01020                                   ;[TEMPORARY COMPLEMENT OF SIGN IN MSB]
                                01040   IFE     LENGTH-2,<
                                01060   ARGLO:  BLOCK   7               ;[LOCATION OF SECOND ARGUMENT FOR DOUBLE
                                01080   ARG:    BLOCK   1>              ; PRECISION]
                                01100   FBUFFR: BLOCK   ^D13           ;BUFFER FOR FOUT
                                01120   IFE     LENGTH-2,<BLOCK ^D<30-13>>
```

change in P3

5


```
                                01180   THE FLOATING POINT FORMAT IS AS FOLLOWS:

                                01220   THE SIGN IS THE FIRST BIT OF THE MANTISSA
                                01240   THE MANTISSA IS 24 BITS LONG
                                01260   THE BINARY POINT IS TO THE LEFT OF THE MSB
                                01280   NUMBER = MANTISSA * 2 ^ EXPONENT
                                01300   THE MANTISSA IS POSITIVE, WITH A ONE ASSUMED TO BE WHERE THE SIGN BIT IS
                                01320   THE SIGN OF THE EXPONENT IS THE FIRST BIT OF THE EXPONENT
                                01340   THE EXPONENT IS STORED IN EXCESS 200 I.E. WITH A BIAS OF 200
                                01360   SO, THE EXPONENT IS A SIGNED 8-BIT NUMBER WITH 200 ADDED TO IT
                                01380   AN EXPONENT OF ZERO MEANS THE NUMBER IS ZERO, THE OTHER BYTES ARE IGNORED
                                01400   TO KEEP THE SAME NUMBER IN THE FAC WHILE SHIFTING:
                                01420           TO SHIFT RIGHT, EXP:=EXP+1
                                01440           TO SHIFT LEFT,  EXP:=EXP-1

                                01480   SO, IN MEMORY THE NUMBER LOOKS LIKE THIS:
                                01500           (BITS 17-24 OF THE MANTISSA)
                                01520           (BITS 9-16 OF THE MANTISSA)
                                01540           (THE SIGN IN BIT 7, BITS 2-8 OF THE MANTISSA ARE IN BITS 6-0)
                                01560           (THE EXPONENT AS A SIGNED NUMBER + 200)
                                01580   (REMEMBER THAT BIT 1 OF THE MANTISSA IS ALWAYS A ONE)

                                01620   ARITHMETIC ROUTINE CALLING CONVENTIONS:

                                01660   FOR ONE ARGUMENT FUNCTIONS:
                                01680           THE ARGUMENT IS IN THE FAC, THE RESULT IS LEFT IN THE FAC
                                01700   FOR TWO ARGUMENT OPERATIONS:
                                01720           THE FIRST ARGUMENT IS IN B,C,D,E I.E. THE "REGISTERS"
                                01740           THE SECOND ARGUMENT IS IN THE FAC
                                01760           THE RESULT IS LEFT IN THE FAC

                                01800   THE "S" ENTRY POINTS TO THE TWO ARGUMENT OPERATIONS HAVE (HL) POINTING TO
                                01820   THE FIRST ARGUMENT INSTEAD OF THE FIRST ARGUMENT BEING IN THE REGISTERS.
                                01840   MOVRM IS CALLED TO GET THE ARGUMENT IN THE REGISTERS.
                                01860   THE "I" ENTRY POINTS ASSUME THE FIRST ARGUMENT IS ON THE STACK.
                                01880   POPR IS USED TO GET THE ARGUMENT IN THE REGISTERS.
                                01900   NOTE: THE "I" ENTRY POINTS SHOULD ALWAYS BE JUMPED TO AND NEVER CALLED
                                01920   BECAUSE THE RETURN ADDRESS ON THE STACK WILL BE CONFUSED WITH THE NUMBER.

                                01960   ON THE STACK, THE TWO LO'S ARE PUSHED ON FIRST AND THEN THE MO AND SIGN.
                                01980   THIS IS DONE SO IF A NUMBER IS STORED IN MEMORY, IT CAN BE PUSHED ON THE
                                02000   STACK WITH TWO PUSHM'S.  THE LOWER BYTE OF EACH PART IS IN THE LOWER
                                02020   MEMORY ADDRESS SO WHEN THE NUMBER IS POPPED INTO THE REGISTERS, THE HIGHER
                                02040   ORDER BYTE WILL BE IN THE HIGHER ORDER REGISTER OF THE REGISTER PAIR, I.E.
                                02060   THE HIGHER ORDER BYTE WILL BE POPPED INTO B, D OR H.
                                02080   %
                                02100   PAGE
```

```
                                        FLOATING POINT ADDITION AND SUBTRACTION

                                        SUBTTL FLOATING POINT ADDITION AND SUBTRACTION
                                                ;ENTRY TO FADD WITH POINTER TO ARG IN (HL)
000000' 001000  000041          FADDH:  LXI     H,FHALF         ;ENTRY TO ADD 1/2
000001' 000000  002312'
000002' 000000  000000
000003' 001000  000315          FADDS:  CALL    MOVRM           ;GET ARGUMENT INTO THE REGISTERS
000004' 000000  001243'
000005' 000000  000001'
000006' 001000  000303                  JMP     FADD            ;DO THE ADDITION
000007' 000000  000025'
000010' 000000  000004'


                                        ;SUBTRACTION    FAC:=ARG-FAC
                                IFN     EXTFNC,<
000011' 001000  000315          FSUBS:  CALL    MOVRM>          ;ENTRY IF POINTER TO ARG IS IN (HL)
000012' 000000  001243'
000013' 000000  000007'

                                IFE     LENGTH-1,<
000014' 001000  000041                  XWD     1000,041>       ;"LXI   H" AROUND NEXT 2 BYTES
                                IFN     LENGTH-2,<
000015' 001000  000301          FSUBT:  POPR>                   ;ENTRY IF ARGUMENT IS ON THE STACK
000016' 001000  000321
000017' 001000  000315                  CALL    NEG             ;NEGATE SECOND ARGUMENT
000020' 000000  001175'
000021' 000000  000012'

                                                                ;FALL INTO FADD


                                        ;ADDITION       FAC:=ARG+FAC
                                        ;ALTERS A,B,C,D,E,H,L
                                IFN     LENGTH-2,<
000022' 001000  000041          FADDT:  XWD     1000,041        ;"LXI   H" AROUND NEXT 2 BYTES
000023' 001000  000301                  POPR>                   ;ENTRY IF ARGUMENT IS ON THE STACK
000024' 001000  000321
000025' 001000  000170          FADD:   MOV     A,B             ;CHECK IF FIRST ARGUMENT IS ZERO
000026' 001000  000267                  ORA     A               ;GET EXPONENT
000027' 001000  000310                  RZ                      ;IT IS, RESULT IS NUMBER IN FAC
000030' 001000  000072                  LDA     FAC             ;GET EXPONENT
000031' 000000  000008*
000032' 000000  000020'
000033' 001000  000267                  ORA     A               ;SEE IF THE NUMBER IS ZERO
000034' 001000  000312                  JZ      MOVFR           ;IT IS, ANSWER IS IN REGISTERS
000035' 000000  001225'
000036' 000000  000031'


                                        ;WE WANT TO GET THE SMALLER NUMBER IN THE REGISTERS SO WE CAN SHIFT IT RIGHT
                                        ;AND ALIGN THE BINARY POINTS OF THE TWO NUMBERS,  THEN WE CAN JUST ADD OR
                                        ;SUBTRACT THEM (DEPENDING ON THEIR SIGNS) BYTEWISE,
000037' 001000  000220                  SUB     B               ;CHECK RELATIVE SIZES
000040' 001000  000322                  JNC     FADD1           ;IS FAC SMALLER?
000041' 000002  000057'
000042' 000000  000035'
```



```
000043' 001000  000057                  CMA                     ;YES, NEGATE SHIFT COUNT
000044' 001000  000074                  INR     A
000045' 001000  000353                  XCHG                    ;SWITCH FAC AND REGISTERS, SAVE (DE)
000046' 001000  000315                  CALL    PUSHF           ;PUT FAC ON STACK
000047' 000000  001205'
000050' 000000  000041'
000051' 001000  000353                  XCHG                    ;GET (DE) BACK WHERE IT BELONGS
000052' 001000  000315                  CALL    MOVFR           ;PUT REGISTERS IN THE FAC
000053' 000000  001225'
000054' 000000  000047'
000055' 001000  000301                  POPR                    ;GET THE OLD FAC IN THE REGISTERS
000056' 001000  000321
000057'                         FADD1:
                                IFN     LENGTH,<
000057' 001000  000376                  CPI     31              ;ARE WE WITHIN 24 BITS?
000060' 000000  000031
000061' 001000  000320                  RNC>                    ;NO, ALL DONE
000062' 001000  000365                  PUSH    PSW             ;SAVE SHIFT COUNT
000063' 001000  000315                  CALL    UNPACK          ;UNPACK THE NUMBERS
000064' 000000  001272'
000065' 000000  000053'
000066' 001000  000147                  MOV     M,A             ;SAVE SUBTRACTION FLAG
000067' 001000  000361                  POP     PSW             ;GET SHIFT COUNT BACK
000070' 001000  000315                  CALL    SHIFTR          ;SHIFT REGISTERS RIGHT THE RIGHT AMOUNT
000071' 000000  000334'
000072' 000000  000064'


                                        ;IF THE NUMBERS HAVE THE SAME SIGN, THEN WE ADD THEM,  IF THE SIGNS ARE
                                        ;DIFFERENT, THEN WE HAVE TO SUBTRACT THEM,  WE HAVE TO DO THIS BECAUSE THE
                                        ;MANTISSAS ARE POSITIVE,  JUDGING BY THE EXPONENTS, THE LARGER NUMBER IS IN
                                        ;THE FAC, SO IF WE SUBTRACT, THE SIGN OF THE RESULT SHOULD BE THE SIGN OF THE
                                        ;FAC; HOWEVER, IF THE EXPONENTS ARE THE SAME, THE NUMBER IN THE REGISTERS
                                        ;COULD BE BIGGER, SO AFTER WE SUBTRACT THEM, WE HAVE TO CHECK IF THE RESULT
                                        ;WAS NEGATIVE,  IF IT WAS, WE NEGATE THE NUMBER IN THE REGISTERS AND
                                        ;COMPLEMENT THE SIGN OF THE FAC,  (HERE THE FAC IS UNPACKED)
                                        ;IF WE HAVE TO ADD THE NUMBERS, THE SIGN OF THE RESULT IS THE SIGN OF THE
                                        ;FAC,  SO, IN EITHER CASE, WHEN WE ARE ALL DONE, THE SIGN OF THE RESULT
                                        ;WILL BE THE SIGN OF THE FAC,
000073' 001000  000264                  ORA     H               ;GET SUBTRACTION FLAG
000074' 001000  000041                  LXI     H,FACLO         ;SET POINTER TO LO'S
000075' 000000  000006*
000076' 000000  000071'
000077' 001000  000362                  JP      FADD3           ;SUBTRACT IF THE SIGNS WERE DIFFERENT
000100' 000000  000125'
000101' 000000  000075'
000102' 001000  000315                  CALL    FADDA           ;ADD THE NUMBERS
000103' 000000  000274'
000104' 000000  000100'
000105' 001000  000322                  JNC     ROUND           ;ROUND RESULT IF THERE WAS NO OVERFLOW
000106' 000000  000033'
000107' 000000  000103'


                                        ;THE MOST IT CAN OVERFLOW IS ONE BIT
000110' 001000  000043                  INX     H               ;THERE WAS OVERFLOW
```

```
283  000111' 001000  000064          03520          INR     M               ;INCREMENT EXPONENT
284  000112' 001000  000312          03540          JZ      OVERR           ;CHECK FOR OVERFLOW
285  000113' 000000  000267'
286  000114' 000000  000106'
287                                  03560  IFE     LENGTH,<
288                                  03580          CALL    SHFTRO>         ;SHIFT RESULT RIGHT ONE, SHIFT CARRY IN
289                                  03600  IFN     LENGTH,<
290  000115' 001000  000056          03620          MVI     L,1             ;SHIFT RESULT RIGHT ONE, SHIFT CARRY IN
291  000116' 000000  000001
292  000117' 001000  000315          03640          CALL    SHRADD>
293  000120' 000000  000362'
294  000121' 000000  000113'
295  000122' 001000  000303          03660          JMP     ROUND           ;ROUND RESULT AND WE ARE DONE
296  000123' 000000  000233'
297  000124' 000000  000120'
298                                  03680          ;HERE TO SUBTRACT C,D,E,B FROM ((HL)+0,1,2),0
299  000125' 001000  000257          03700  FADD3:  XRA     A               ;SUBTRACT NUMBERS, NEGATE UNDERFLOW BYTE
300  000126' 001000  000220          03720          SUB     B
301  000127' 001000  000107          03740          MOV     B,A             ;SAVE IT
302  000130' 001000  000176          03760          MOV     A,M             ;SUBTRACT LOW ORDERS
303  000131' 001000  000233          03780          SBB     E
304  000132' 001000  000137          03800          MOV     E,A
305  000133' 001000  000043          03820          INX     H               ;UPDATE POINTER TO NEXT BYTE
306  000134' 001000  000176          03840          MOV     A,M             ;SUBTRACT MIDDLE ORDERS
307  000135' 001000  000232          03860          SBB     D
308  000136' 001000  000127          03880          MOV     D,A
309  000137' 001000  000043          03900          INX     H               ;UPDATE POINTER TO HIGH ORDERS
310  000140' 001000  000176          03920          MOV     A,M             ;SUBTRACT HIGH ORDERS
311  000141' 001000  000231          03940          SBB     C
312  000142' 001000  000117          03960          MOV     C,A
313                                  03980          ;BECAUSE WE WANT A POSITIVE MANTISSA, CHECK IF WE HAVE TO NEGATE THE
314                                  04000          ; NUMBER
315  000143' 001000  000334          04020  FADFLT: CC      NEGR            ;ENTRY FROM FLOATR, INT: NEGATE NUMBER IF IT
316  000144' 000000  000310'
317  000145' 000000  000123'
318                                  04040                                  ; WAS NEGATIVE, FALL INTO NORMALIZE
319
320
321                                  04100          ;NORMALIZE C,D,E,B
322                                  04120          ;ALTERS A,B,C,D,E,M,L
323                                  04140          ;HERE WE SHIFT THE MANTISSA LEFT UNTIL THE MSB IS A ONE,
324                                  04160          ;EXCEPT IN 4K, THE IDEA IS TO SHIFT LEFT BY 8 AS MANY TIMES AS
325                                  04180          ;POSSIBLE.
326  000146'                         04200  NORMAL:
327                                  04220  IFE     LENGTH,<
328                                  04240          MVI     M,0             ;CLEAR SHIFT COUNT
329                                  04260          MOV     A,C             ;IS THE NUMBER NORMALIZED?
330                                  04280          ORA     A
331                                  04300          JM      ROUND           ;YES, WE ARE DONE
332                                  04320  NORM2:  CPI     340             ;IS THE RESULT ZERO?
333                                  04340          JZ      ZERO            ;YES, ZERO THE FAC
334                                  04360          DCR     M               ;NO, DECREMENT SHIFT COUNT
335                                  04380          MOV     A,B             ;SHIFT THE LO LEFT
```



```
336                                  04400          ADD     A               ;SHIFT IN A ZERO
337                                  04420          MOV     B,A
338                                  04440          CALL    SHFTLO          ;SHIFT THE REST OF THE NUMBER LEFT ONE
339                                  04460          MOV     A,M             ;GET THE SHIFT COUNT
340                                  04480          JP      NORM2>          ;CONTINUE IF NUMBER IS NOT NORMALIZED
341                                  04500  IFN     LENGTH,<
342  000146' 001000  000150          04520          MOV     L,B             ;PUT LOWEST 2 BYTES IN (HL)
343  000147' 001000  000143          04540          MOV     H,E
344  000150' 001000  000257          04560          XRA     A               ;ZERO SHIFT COUNT
345  000151' 001000  000107          04580  NORM1:  MOV     B,A             ;SAVE SHIFT COUNT
346  000152' 001000  000171          04600          MOV     A,C             ;DO WE HAVE 1 BYTE OF ZEROS
347  000153' 001000  000267          04620          ORA     A
348  000154' 001000  000302          04640          JNZ     NORM3           ;NO, SHIFT ONE PLACE AT A TIME
349  000155' 000000  000210'
350  000156' 000000  000144'
351                                  04660          ;THIS LOOP SPEEDS THINGS UP BY SHIFTING 8 PLACES AT ONE TIME
352  000157' 001000  000112          04680          MOV     C,D             ;YES, SHIFT OVER 1 BYTE
353  000160' 001000  000124          04700          MOV     D,M
354  000161' 001000  000145          04720          MOV     H,L
355  000162' 001000  000157          04740          MOV     L,A             ;SHIFT IN 8 ZEROS FOR THE LOW ORDER
356  000163' 001000  000170          04760          MOV     A,B             ;UPDATE SHIFT COUNT
357  000164' 001000  000326          04780          SUI     10
358  000165' 000000  000010
359  000166' 001000  000376          04800          CPI     340             ;DID WE SHIFT IN 4 BYTES OF ZEROS?
360  000167' 000000  000340
361  000170' 001000  000302          04820          JNZ     NORM1           ;NO, TRY TO SHIFT OVER 8 MORE
362  000171' 000000  000151'
363  000172' 000000  000155'
364                                  04840                                  ;YES, NUMBER WAS ZERO,  FALL INTO ZERO
365
366
367                                  04900          ;ZERO FAC
368                                  04920          ;ALTERS A ONLY
369                                  04940          ;EXITS WITH A=0
370                                  04960          ;BY OUR FLOATING POINT FORMAT, THE NUMBER IS ZERO IF THE EXPONENT IS
371                                  04980          ; ZERO
372  000173' 001000  000257          05000  ZERO:   XRA     A               ;ZERO A
373  000174' 001000  000062          05020  ZERO0:  STA     FAC             ;ZERO THE FAC'S EXPONENT, ENTRY IF A=0
374  000175' 000000  000031*
375  000176' 000000  000171'
376  000177' 001000  000311          05040          RET                     ;ALL DONE
377
378
379  000200' 001000  000005          05100  NORM2:  DCR     B               ;DECREMENT SHIFT COUNT
380  000201' 001000  000051          05120          DAD     H               ;ROTATE (HL) LEFT ONE, SHIFT IN A ZERO
381  000202' 001000  000172          05140          MOV     A,D             ;ROTATE NEXT HIGHER ORDER LEFT ONE
382  000203' 001000  000027          05160          RAL
383  000204' 001000  000127          05180          MOV     D,A
384  000205' 001000  000171          05200          MOV     A,C             ;ROTATE HIGH ORDER LEFT ONE
385  000206' 001000  000217          05220          ADC     A               ;SET CONDITION CODES
386  000207' 001000  000117          05240          MOV     C,A
387  000210' 001000  000362          05260  NORM3:  JP      NORM2           ;WE HAVE MORE NORMALIZATION TO DO
388  000211' 000000  000200'
```

```
000212' 000000  000175'
000213' 001000  000170          05280           MOV     A,B             ;ALL NORMALIZED, GET SHIFT COUNT
000214' 001000  000134          05300           MOV     E,M             ;PUT LO'S BACK IN E,B
000215' 001000  000105          05320           MOV     B,L
000216' 001000  000267          05340           ORA     A               ;CHECK IF WE DID NO SHIFTING
000217' 001000  000312          05360           JZ      ROUND>
000220' 000000  000233'
000221' 000000  000211'
000222' 001000  000041          05380           LXI     M,FAC           ;LOOK AT FAC'S EXPONENT
000223' 000000  000175*
000224' 000000  000220'
000225' 001000  000206          05400           ADD     M               ;UPDATE EXPONENT
000226' 001000  000167          05420           MOV     M,A
000227' 001000  000322          05440           JNC     ZERO            ;CHECK FOR UNDERFLOW
000230' 000000  000173'
000231' 000000  000223'
000232' 001000  000310          05460           RZ                      ;NUMBER IS ZERO, ALL DONE
                                05480                                   ;FALL INTO ROUND AND WE ARE DONE


                                05540           ;ROUND RESULT IN C,D,E,B AND PUT NUMBER IN THE FAC
                                05560           ;ALTERS A,B,C,D,E,H,L
                                05580           ;WE ROUND C,D,E UP OR DOWN DEPENDING UPON THE MSB OF B
000233' 001000  000170          05600   ROUND:  MOV     A,B             ;SEE IF WE SHOULD ROUND UP
000234' 001000  000041          05620   ROUNDB: LXI     M,FAC           ;ENTRY FROM FDIV, GET POINTER TO EXPONENT
000235' 000000  000223*
000236' 000000  000230'
000237' 001000  000267          05640           ORA     A
000240' 001000  000374          05660           CM      ROUNDA          ;DO IT IF NECESSARY
000241' 000000  000255'
000242' 000000  000235'
000243' 001000  000106          05680           MOV     B,M             ;PUT EXPONENT IN B
                                05700           ;HERE WE PACK THE MO AND SIGN
000244' 001000  000043          05720           INX     H               ;POINT TO SIGN
000245' 001000  000176          05740           MOV     A,M             ;GET SIGN
000246' 001000  000346          05760           ANI     200             ;GET RID OF UNWANTED BITS
000247' 000000  000200
000250' 001000  000251          05780           XRA     C               ;PACK SIGN AND MO
000251' 001000  000117          05800           MOV     C,A             ;SAVE IT IN C
000252' 001000  000303          05820           JMP     MOVFR           ;SAVE NUMBER IN FAC
000253' 000000  001225'
000254' 000000  000241'


                                05880   IFE     LENGTH,<
                                05900           ;SHIFT C,D,E LEFT ONE
                                05920           ;THIS IS USED BY NORMAL, FDIV
                                05940           ;ALTERS A,C,D,E
                                05960   SHFTLO: MOV     A,E             ;GET THE LO
                                05980           RAL                     ;SHIFT IT
                                06000           MOV     E,A             ;SAVE IT
                                06020           MOV     A,D             ;SHIFT THE NEXT HIGHER ORDER
                                06040           RAL
```



```
                                06060           MOV     D,A
                                06080           MOV     A,C             ;SHIFT THE HIGHEST ORDER
                                06100           ADC     A               ;ROTATE A LEFT AND SET CONDITION CODES
                                06120           MOV     C,A
                                06140           RET>                    ;ALL DONE


                                06200           ;SUBROUTNE FOR ROUND:  ADD ONE TO C,D,E
000255' 001000  000034          06220   ROUNDA: INR     E               ;ADD ONE TO THE LOW ORDER, ENTRY FROM QINT
000256' 001000  000300          06240           RNZ                     ;ALL DONE IF IT IS NOT ZERO
000257' 001000  000024          06260           INR     D               ;ADD ONE TO NEXT HIGHER ORDER
000260' 001000  000300          06280           RNZ                     ;ALL DONE IF NO OVERFLOW
000261' 001000  000014          06300           INR     C               ;ADD ONE TO THE HIGHEST ORDER
000262' 001000  000300          06320           RNZ                     ;RETURN IF NO OVEFLOW
000263' 001000  000016          06340           MVI     C,200           ;THE NUMBER OVERFLOWED, SET NEW HIGH ORDER
000264' 000000  000220
000265' 001000  000064          06360           INR     M               ;UPDATE EXPONENT
000266' 001000  000300          06380           RNZ                     ;RETURN IF IT DID NOT OVERFLOW
                                06400                                   ;IT DID, FALL INTO OVERR


                                06440           ;OVERFLOW ERROR
000267' 001000  000036          06460   OVERR:  MVI     E,ERROV         ;SET OVERFLOW ERROR CODE
000270' 000000  000000*
000271' 001000  000303          06480           JMP     ERROR           ;GO TO IT!!
000272' 000000  000000*
000273' 000000  000253'


                                06540           ;ADD (HL)+2,1,0 TO C,D,E
                                06560           ;THIS CODE IS USED BY FADD, FOUT
000274' 001000  000176          06580   FADDA:  MOV     A,M             ;GET LOWEST ORDER
000275' 001000  000203          06600           ADD     E               ;ADD IN OTHER LOWEST ORDER
000276' 001000  000137          06620           MOV     E,A             ;SAVE IT
000277' 001000  000043          06640           INX     H               ;UPDATE POINTER TO NEXT BYTE
000300' 001000  000176          06660           MOV     A,M             ;ADD MIDDLE ORDERS
000301' 001000  000212          06680           ADC     D
000302' 001000  000127          06700           MOV     D,A
000303' 001000  000043          06720           INX     H               ;UPDATE POINTER TO HIGH ORDER
000304' 001000  000176          06740           MOV     A,M             ;ADD HIGH ORDERS
000305' 001000  000211          06760           ADC     C
000306' 001000  000117          06780           MOV     C,A
000307' 001000  000311          06800           RET                     ;ALL DONE


                                06860           ;NEGATE NUMBER IN C,D,E,B
                                06880           ;THIS CODE IS USED BY FADD, QINT
                                06900           ;ALTERS A,B,C,D,E,L
000310' 001000  000041          06920   NEGR:   LXI     M,FAC+1         ;NEGATE FAC
000311' 000000  000001*
000312' 000000  000272'
000313' 001000  000176          06940           MOV     A,M             ;GET SIGN
000314' 001000  000057          06960           CMA                     ;COMPLEMENT IT
000315' 001000  000167          06980           MOV     M,A             ;SAVE IT AGAIN
```

```
000316' 001000  000257          07000          XRA     A              ;ZERO A
000317' 001000  000157          07020          MOV     L,A            ;SAVE ZERO IN L
000320' 001000  000220          07040          SUB     B              ;NEGATE LOWEST ORDER
000321' 001000  000107          07060          MOV     B,A            ;SAVE IT
000322' 001000  000175          07080          MOV     A,L            ;GET A ZERO
000323' 001000  000233          07100          SBB     E              ;NEGATE NEXT HIGHEST ORDER
000324' 001000  000137          07120          MOV     E,A            ;SAVE IT
000325' 001000  000175          07140          MOV     A,L            ;GET A ZERO
000326' 001000  000232          07160          SBB     D              ;NEGATE NEXT HIGHEST ORDER
000327' 001000  000127          07180          MOV     D,A            ;SAVE IT
000330' 001000  000175          07200          MOV     A,L            ;GET ZERO BACK
000331' 001000  000231          07220          SBB     C              ;NEGATE HIGHEST ORDER
000332' 001000  000117          07240          MOV     C,A            ;SAVE IT
000333' 001000  000311          07260          RET                    ;ALL DONE

                                07320          ;SHIFT C,D,E RIGHT
                                07340          ;A = SHIFT COUNT
                                07360          ;ALTERS A,B,C,D,E,L
                                07380          ;THE IDEA (EXCEPT IN 4K) IS TO SHIFT RIGHT 8 PLACES AS MANY TIMES AS
                                07400          ; POSSIBLE
000334' 001000  000006          07420  SHFTR:  MVI     B,0            ;ZERO OVERFLOW BYTE
000335' 000000  000000
                                07440  IFE     LENGTH,<
                                07460          INR     A>             ;ADD ONE TO SHIFT COUNT
                                07480  IFN     LENGTH,<
000336' 001000  000326          07500  SHFTR1: SUI     10             ;CAN WE SHIFT IT 8 RIGHT?
000337' 000000  000010
000340' 001000  000332          07520          JC      SHFTR2         ;NO, SHIFT IT ONE PLACE AT A TIME
000341' 000000  000353'
000342' 000000  000311'
                                07540          ;THIS LOOP SPEEDS THINGS UP BY SHIFTING 8 PLACES AT ONE TIME
000343' 001000  000183          07560          MOV     B,E            ;SHIFT NUMBER 1 BYTE RIGHT
000344' 001000  000132          07580          MOV     E,D
000345' 001000  000121          07600          MOV     D,C
000346' 001000  000016          07620          MVI     C,0            ;PUT 0 IN HO
000347' 000000  000000
000350' 001000  000303          07640          JMP     SHFTR1         ;TRY TO SHIFT 8 RIGHT AGAIN
000351' 000000  000336'
000352' 000000  000341'
000353' 001000  000306          07660  SHFTR2: ADI     11>            ;CORRECT SHIFT COUNT
000354' 000000  000011
000355' 001000  000157          07680          MOV     L,A            ;SAVE SHIFT COUNT
000356' 001000  000257          07720  SHFTR3: XRA     A              ;CLEAR CARRY
000357' 001000  000055          07720          DCR     L              ;ARE WE DONE SHIFTING?
000360' 001000  000310          07740          RZ                     ;RETURN IF WE ARE
                                07760  IFE     LENGTH,<
                                07780  SHRADD: CALL    SHFTRO>        ;SHIFT THE NUMBER RIGHT ONE
                                07800  IFN     LENGTH,<
000361' 001000  000171          07820          MOV     A,C            ;GET HO
000362' 001000  000037          07840  SHRADD: RAR                    ;ENTRY FROM FADD, SHIFT IT RIGHT
000363' 001000  000117          07860          MOV     C,A            ;SAVE IT
000364' 001000  000172          07880          MOV     A,D            ;SHIFT NEXT BYTE RIGHT
```



```
000365' 001000  000037          07900          RAR
000366' 001000  000127          07920          MOV     D,A
000367' 001000  000173          07940          MOV     A,E            ;SHIFT LOW ORDER RIGHT
000370' 001000  000037          07960          RAR
000371' 001000  000137          07980          MOV     E,A
000372' 001000  000170          08000          MOV     A,B            ;SHIFT OVERFLOW BYTE RIGHT
000373' 001000  000037          08020          RAR
000374' 001000  000107          08040          MOV     B,A>
000375' 001000  000303          08060          JMP     SHFTR3         ;SEE IF WE ARE DONE
000376' 000000  000356'
000377' 000000  000351'

                                08120  IFE     LENGTH,<
                                08140          ;SHIFT C,D,E,B RIGHT ONE
                                08160          ;THIS IS USED BY SHIFTR, FMULT, FADD
                                08180          ;ALTERS A,B,C,D,E
                                08200  SHFTRO: MOV     A,C            ;GET THE HO
                                08220  SHFROA: RAR                    ;SHIFT IT RIGHT, ENTRY FROM FMULT
                                08240          MOV     C,A
                                08260          MOV     A,D            ;SHIFT THE MO RIGHT
                                08280          RAR
                                08300          MOV     D,A
                                08320          MOV     A,E            ;SHIFT THE LO
                                08340          RAR
                                08360          MOV     E,A
                                08380          MOV     A,B            ;SHIFT THE EXTRA LO BYTE
                                08400          RAR
                                08420          MOV     B,A
                                08440          RET>                   ;ALL DONE
                                08460  PAGE
```

```
                                        08480   SUBTTL  NATURAL LOG FUNCTION
                                        08500   IFN     EXTFNC,<
                                        08520           ;CALCULATION IS BY:
                                        08540           ; LN(F*2**N)=(N+LOG2(F))*LN(2)
                                        08560           ;AN APPROXIMATION POLYNOMIAL IS USED TO CALCULATE LOG2(F)

                                        08600           ;CONSTANTS USED BY LOG
000400' 000000  000000                  08620   FONE:   000     ; 1
000401' 000000  000000                  08640           000
000402' 000000  000000                  08660           000
000403' 000000  000201                  08680           201
000404' 000000  000003                  08700   LOGCN2: 3       ;DEGREE+1
000405' 000000  000252                  08720           252     ; 0.598978650
000406' 000000  000126                  08740           126
000407' 000000  000031                  08760           031
000410' 000000  000200                  08780           200
000411' 000000  000361                  08800           361     ; 0.961470632
000412' 000000  000042                  08820           042
000413' 000000  000166                  08840           166
000414' 000000  000200                  08860           200
000415' 000000  000105                  08880           105     ; 2.88539129
000416' 000000  000252                  08900           252     ; NOTE: THE REFERENCE FOR THIS CONSTANT HAS 100 NOT 105
000417' 000000  000070                  08920           070     ; IN THE LOW ORDER BYTE.
000420' 000000  000202                  08940           202

000421' 001000  000357                  08980   LOG:    FSIGN                   ;CHECK FOR A NEGATIVE OR ZERO ARGUMENT
000422' 001000  000352                  09000           JPE     FCERR           ;FAC .LE. 0, BLOW HIM OUT OF THE WATER
000423' 000000  000000*
000424' 000000  000376'
                                        09020                                   ;FSIGN ONLY RETURNS 0,1 OR 377 IN A
                                        09040                                   ;THE PARITY WILL BE EVEN IF A HAS 0 OR 377
000425' 001000  000041                  09060           LXI     H,FAC           ;GET POINTER TO EXPONENT
000426' 000000  000235*
000427' 000000  000423'
000430' 001000  000176                  09080           MOV     A,M             ;GET EXPONENT IN A
000431' 001000  000001                  09100           MOVRI   200,065,004,363 ;GET SQR(,5)
000432' 000000  000065
000433' 000000  000200
000434' 001000  000021
000435' 000000  000363
000436' 000000  000004
000437' 001000  000220                  09120           SUB     B               ;REMOVE EXCESS 200
000440' 001000  000365                  09140           PUSH    PSW             ;SAVE EXPONENT FOR LATER
000441' 001000  000160                  09160           MOV     M,B             ;SET EXP TO 200, RESULT IS NUM IN (,5,1)
000442' 001000  000325                  09180           PUSHR                   ;SAVE SQR(,5)
000443' 001000  000305
000444' 001000  000315                  09200           CALL    FADD            ;CALCULATE (F-SQR(,5))/(F+SQR(,5))
000445' 000000  000025'
000446' 000000  000426'
000447' 001000  000301                  09220           POPR                    ;GET SQR(,5) BACK
000450' 001000  000321
000451' 001000  000004                  09240           INR     B               ;GET SQR(2)
000452' 001000  000315                  09260           CALL    FDIV            ;WHERE F=NUMBER LEFT IN FAC
```



```
000453' 000000  000655'
000454' 000000  000445'
000455' 001000  000041                  09280           LXI     H,FONE          ;THE CALCULATION IS EQUIVALENT TO THE ABOVE,
000456' 000000  000400'
000457' 000000  000453'
000460' 001000  000315                  09300           CALL    FSUBS           ; BUT DONE IN A DIFFERENT ORDER
000461' 000000  000011'
000462' 000000  000456'
000463' 001000  000041                  09320           LXI     H,LOGCN2        ;EVALUATE APPROXIMATION POLYNOMIAL
000464' 000000  000404'
000465' 000000  000461'
000466' 001000  000315                  09340           CALL    POLYX
000467' 000000  002615'
000470' 000000  000464'
000471' 001000  000001                  09360           MOVRI   200,200,000,000 ;GET -1/2
000472' 000000  000200
000473' 000000  000200
000474' 001000  000021
000475' 000000  000000
000476' 000000  000000
000477' 001000  000315                  09380           CALL    FADD            ;ADD IN LAST CONSTANT
000500' 000000  000025'
000501' 000000  000467'
000502' 001000  000361                  09400           POP     PSW             ;RETRIEVE ORIGINAL EXPONENT
000503' 001000  000315                  09420           CALL    FINLOG          ;ADD IT TO ORIGINAL NUMBER
000504' 000000  001731'
000505' 000000  000500'
000506' 001000  000001                  09440   MULLN2: MOVRI   200,061,162,030>;GET LN(2)
000507' 000000  000061
000510' 000000  000200
000511' 001000  000021
000512' 000000  000030
000513' 000000  000162
                                        09460   ;       JMP     FMULT           ;MULTIPLY BY LN(2)
                                        09480   PAGE
```

```
                                        09500   SUBTTL  FLOATING MULTIPLICATION AND DIVISION
                                        09520           ;MULTIPLICATION         FAC:=ARG*FAC
                                        09540           ;ALTERS A,B,C,D,E,M,L
                                        09560   IFE     EXTFNC,<
                                        09580   FMULTS: CALL    MOVRM>          ;ENTRY WITH POINTER TO ARG IN (HL)
                                        09600   IFN     LENGTH=2,<
000514' 001000  000041                  09620           XWD     1000,041        ;"LXI   H" AROUND NEXT 2 BYTES
000515' 001000  000301                  09640   FMULTT: POPR>                   ;ENTRY IF ARGUMENT IS ON THE STACK
000516' 001000  000321
000517' 001000  000357                  09660   FMULT:  FSIGN                   ;CHECK IF FAC IS ZERO
000520' 001000  000310                  09680           RZ                      ;IF IT IS, RESULT IS ZERO
000521' 001000  000056                  09700           MVI     L,0             ;ADD THE TWO EXPONENTS, L IS A FLAG
000522' 000000  000000
000523' 001000  000315                  09720           CALL    MULDIV          ;FIX UP THE EXPONENTS
000524' 000000  001035'
000525' 000000  000504'
                                        09740           ;SAVE THE NUMBER IN THE REGISTERS SO WE CAN ADD IT FAST
000526' 001000  000171                  09760           MOV     A,C             ;GET HO
000527' 001000  000062                  09780           STA     FMULTA+1        ;STORE HO OF REGISTERS
000530' 000000  000606'
000531' 000000  000524'
000532' 001000  000353                  09800           XCHG                    ;STORE THE TWO LO'S OF THE REGISTERS
000533' 001000  000042                  09820           SHLD    FMULTB+1
000534' 000000  000601'
000535' 000000  000530'
000536' 001000  000001                  09840           LXI     B,$CODE         ;ZERO THE PRODUCT REGISTERS
000537' 000000  000000*
000540' 000000  000534'
000541' 001000  000120                  09860           MOV     D,B
000542' 001000  000130                  09880           MOV     E,B
000543' 001000  000041                  09900           LXI     H,NORMAL        ;PUT ADDRESS OF NORMAL, WERE WE FINISH UP,
000544' 000000  000146'
000545' 000000  000537'
000546' 001000  000345                  09920           PUSH    H               ; ON THE STACK
000547' 001000  000041                  09940           LXI     H,FMULT2        ;PUT FMULT2 ON THE STACK TWICE, SO AFTER
000550' 000000  000557'
000551' 000000  000544'
000552' 001000  000345                  09960           PUSH    H               ; WE MULTIPLY BY THE LO BYTE, WE WILL
000553' 001000  000345                  09980           PUSH    H               ; MULTIPLY BY THE MO AND HO
000554' 001000  000041                  10000           LXI     H,FACLO         ;GET ADDRESS OF LO OF FAC
000555' 000000  000075*
000556' 000000  000550'
000557' 001000  000176                  10020   FMULT2: MOV     A,M             ;GET BYTE TO MULTIPLY BY
000560' 001000  000043                  10040           INX     H               ;MOVE POINTER TO NEXT BYTE
                                        10060   IFN     LENGTH,<
000561' 001000  000267                  10080           ORA     A
000562' 001000  000312                  10100           JZ      FMULT3>         ;ARE WE MULTIPLYING BY ZERO?
000563' 000000  000632'
000564' 000000  000555'
000565' 001000  000345                  10120           PUSH    H               ;SAVE POINTER
                                        10140   IFE     LENGTH,<
                                        10160           MVI     L,10>           ;SET UP A COUNT
                                        10180   IFN     LENGTH,<
```



```
000566' 001000  000353                  10200           XCHG                    ;GET LO'S IN (HL)
000567' 001000  000036                  10220           MVI     E,10>           ;SET UP A COUNT
000570' 000000  000010
                                        10260   ;THE PRODUCT WILL BE FORMED IN C,D,E,B, THIS WILL BE IN C,H,L,B PART OF THE
                                        10280   ;TIME IN ORDER TO USE THE "DAD" INSTRUCTION,  AT FMULT2, WE GET THE NEXT
                                        10300   ;BYTE OF THE MANTISSA IN THE FAC TO MULTIPLY BY,  ((HL) POINTS TO IT)
                                        10320   ;(THE FMULT2 SUBROUTINE PRESERVES (HL))  IN 8K, IF THE BYTE IS ZERO, WE JUST
                                        10340   ;SHIFT THE PRODUCT 8 RIGHT,  THIS BYTE IS THEN SHIFTED RIGHT AND SAVED IN D
                                        10360   ;(H IN 4K),  THE CARRY DETERMINES IF WE SHOULD ADD IN THE SECOND FACTOR
                                        10380   ;IF WE DO, WE ADD IT TO C,H,L,  B IS ONLY USED TO DETERMINE WHICH WAY WE
                                        10400   ;ROUND,  WE THEN SHIFT C,H,L,B (C,D,E,B) IN 4K RIGHT ONE TO GET READY FOR THE
                                        10420   ;NEXT TIME THROUGH THE LOOP,  NOTE THAT THE CARRY IS SHIFTED INTO THE MSB OF
                                        10440   ;C,  E HAS A COUNT (L IN 4K) TO DETERMINE WHEN WE HAVE LOOKED AT ALL THE BITS
                                        10460   ;OF D (H IN 4K).
000571' 001000  000037                  10480   FMULT4: RAR                     ;ROTATE BYTE RIGHT
                                        10500   IFE     LENGTH,<
                                        10520           MOV     M,A>            ;SAVE THE COUNT
                                        10540   IFN     LENGTH,<
000572' 001000  000127                  10560           MOV     D,A>            ;SAVE IT
000573' 001000  000171                  10580           MOV     A,C             ;GET HO
000574' 001000  000322                  10600           JNC     FMULT5          ;DON'T ADD IN NUMBER IF BIT WAS ZERO
000575' 000000  000627'
000576' 000000  000563'
                                        10620   IFE     LENGTH,<
                                        10640           XCHG>                   ;PUT THE LO'S IN (HL)
000577' 001000  000325                  10660           PUSH    D               ;SAVE COUNTERS
000600' 001000  000021                  10680   FMULTB: LXI     D,$CODE         ;GET LO'S OF NUMBER TO ADD, THIS IS SET ABOVE
000601' 000000  000537'*
000602' 000000  000575'
000603' 001000  000031                  10700           DAD     D               ;ADD THEM IN
000604' 001000  000321                  10720           POP     D               ;GET COUNTERS BACK
000605' 001000  000316                  10740   FMULTA: ACI     0               ;ADD IN HO, THIS IS SET UP ABOVE
000606' 000000  000000
                                        10760   IFE     LENGTH,<
                                        10780           XCHG                    ;PUT THE LO'S BACK IN (DE)
                                        10800   FMULTS: CALL    SHFRDA          ;SHIFT THE RESULT RIGHT ONE
                                        10820           DCR     L               ;ARE WE DONE?
                                        10840           MOV     A,M>            ;GET NUMBER WE ARE MULTIPLYING BY
                                        10860   IFN     LENGTH,<
000607' 001000  000037                  10880   FMULTS: RAR                     ;ROTATE RESULT RIGHT ONE
000610' 001000  000117                  10900           MOV     C,A
000611' 001000  000174                  10920           MOV     A,M             ;ROTATE NEXT BYTE
000612' 001000  000037                  10940           RAR
000613' 001000  000147                  10960           MOV     M,A
000614' 001000  000175                  10980           MOV     A,L             ;ROTATE NEXT LOWER ORDER
000615' 001000  000037                  11000           RAR
000616' 001000  000157                  11020           MOV     L,A
000617' 001000  000170                  11040           MOV     A,B             ;ROTATE LO
000620' 001000  000037                  11060           RAR
000621' 001000  000107                  11080           MOV     B,A
000622' 001000  000035                  11100           DCR     E               ;ARE WE DONE?
000623' 001000  000172                  11120           MOV     A,D>            ;GET NUMBER WE ARE MULTIPLYING BY
```

```
773  000624' 001000  000302          11140          JNZ     FMULT4          ;MULTIPLY AGAIN IF WE ARE NOT DONE
774  000625' 000000  000571'
775  000626' 000000  000601'
776                                  11160  IFN     LENGTH,<
777  000627' 001000  000353          11180          XCHG>                   ;GET LO'S IN (HL)
778  000630' 001000  000341          11200  POPMRT: POP     H               ;GET POINTER TO NUMBER TO MULTIPLY BY
779  000631' 001000  000311          11220          RET                     ;ALL DONE
780                                  11240  IFN     LENGTH,<
781  000632' 001000  000103          11260  FMULT3: MOV     B,E             ;MULTIPLY BY ZERO: SHIFT EVERYTHING 8 RIGHT
782  000633' 001000  000132          11280          MOV     E,D
783  000634' 001000  000121          11300          MOV     D,C
784  000635' 001000  000117          11320          MOV     C,A             ;SHIFT IN 8 ZEROS ON THE LEFT
785  000636' 001000  000311          11340          RET>                    ;ALL DONE
786
787
788                                  11400          ;DIVIDE FAC BY 10
789                                  11420          ;ALTERS A,B,C,D,E,M,L
790  000637' 001000  000315          11440  DIV10:  CALL    PUSHF           ;SAVE NUMBER
791  000640' 000000  001205'
792  000641' 000000  000625'
793                                  11460  IFN     LENGTH=2,<
794  000642' 001000  000001          11480          MOVRI   204,040,000,000 ;LOAD CONSTANT '10' INTO REGISTERS
795  000643' 000000  000040
796  000644' 000000  000204
797  000645' 001000  000021
798  000646' 000000  000000
799  000647' 000000  000000
800  000650' 001000  000315          11500          CALL    MOVFR>          ;MOVE THE CONSTANT TO THE FAC
801  000651' 000000  001225'
802  000652' 000000  000648'
803                                  11520  IFE     LENGTH=2,<
804                                  11540          LXI     H,FTEN          ;GET POINTER TO THE CONSTANT '10'
805                                  11560          CALL    MOVFM>          ;MOVE TEN INTO THE FAC
806  000653' 001000  000301          11580  FDIVT:  POPR                    ;GET NUMBER BACK IN REGISTERS
807  000654' 001000  000321
808                                  11600                                  ;FALL INTO DIVIDE AND WE ARE DONE
809
810
811                                  11660          ;DIVISION       FAC:=ARG/FAC
812                                  11680          ;ALTERS A,B,C,D,E,M,L
813  000655' 001000  000357          11700  FDIV:   FSIGN                   ;CHECK FOR DIVISION BY ZERO
814  000656' 001000  000312          11720          JZ      DVOERR          ;HE IS TRYING TO GET AWAY WITH IT
815  000657' 000000  000000*
816  000660' 000000  000651'
817  000661' 001000  000056          11740          MVI     L,377           ;SUBTRACT THE TWO EXPONENTS, L IS A FLAG
818  000662' 000000  000377
819  000663' 001000  000315          11760          CALL    MULDIV          ;FIX UP THE EXPONENTS AND THINGS
820  000664' 000000  001035'
821  000665' 000000  000657'
822  000666' 001000  000064          11780          INR     M               ;ADD 2 TO EXPONENT TO CORRECT SCALING
823  000667' 001000  000064          11800          INR     M
824                                  11820          ;HERE WE SAVE THE FAC IN MEMORY SO WE CAN SUBTRACT IT FROM THE NUMBER
825                                  11840          ;IN THE REGISTERS QUICKLY.
```



```
826  000670' 001000  000053          11860          DCX     H               ;POINT TO HO
827  000671' 001000  000176          11880          MOV     A,M             ;GET HO
828  000672' 001000  000062          11900          STA     FDIVA+1         ;SAVE IT
829  000673' 000000  000734'
830  000674' 000000  000664'
831  000675' 001000  000053          11920          DCX     H               ;SAVE MIDDLE ORDER
832  000676' 001000  000176          11940          MOV     A,M
833  000677' 001000  000062          11960          STA     FDIVB+1         ;PUT IT WHERE NOTHING WILL HURT IT
834  000700' 000000  000730'
835  000701' 000000  000673'
836  000702' 001000  000053          11980          DCX     H               ;SAVE LO
837  000703' 001000  000176          12000          MOV     A,M
838  000704' 001000  000062          12020          STA     FDIVC+1
839  000705' 000000  000724'
840  000706' 000000  000700'
841
842                                  12060  ;THE NUMERATOR WILL BE KEPT IN B,H,L.  THE QUOTIENT WILL BE FORMED IN C,D,E.
843                                  12080  ;TO GET A BIT OF THE QUOTIENT, WE FIRST SAVE B,H,L ON THE STACK, THEN
844                                  12100  ;SUBTRACT THE DENOMINATOR THAT WE SAVED IN MEMORY.  THE CARRY INDICATES
845                                  12120  ;WHETHER OR NOT B,H,L WAS BIGGER THAN THE DENOMINATOR.  IF B,H,L WAS BIGGER,
846                                  12140  ;THE NEXT BIT OF THE QUOTIENT IS A ONE.  TO GET THE OLD B,H,L OFF THE STACK,
847                                  12160  ;WE POP THEM INTO THE PSW.  IF THE DENOMINATOR WAS BIGGER, THE NEXT BIT OF
848                                  12180  ;THE QUOTIENT IS ZERO, AND WE GET THE OLD B,H,L BACK BY POPPING IT OFF THE
849                                  12200  ;STACK.  WE HAVE TO KEEP AN EXTRA BIT OF THE QUOTIENT IN FDIVG+1 IN CASE THE
850                                  12220  ;DENOMINATOR WAS BIGGER.  THEN B,H,L WILL GET SHIFTED LEFT.  IF THE MSB OF
851                                  12240  ;B WAS ONE, IT HAS TO BE STORED SOMEWHERE, SO WE STORE IT IN FDIVG+1.  THEN
852                                  12260  ;THE NEXT TIME THROUGH THE LOOP B,H,L WILL LOOK BIGGER BECAUSE IT HAS AN
853                                  12280  ;EXTRA HO BIT IN FDIVG+1. WE ARE DONE DIVIDING WHEN THE MSB OF C IS A ONE.
854                                  12300  ;THIS OCCURS WHEN WE HAVE CALCULATED 24 BITS OF THE QUOTIENT.  WHEN WE JUMP
855                                  12320  ;TO ROUND, THE 25TH BIT OF THE QUOTIENT DETERMINES WHETHER WE ROUND OR NOT.
856                                  12340  ;IT IS IN THE MSB OF A.  IF INITIALLY THE DENOMINATOR IS BIGGER THAN THE
857                                  12360  ;NUMERATOR, THE FIRST BIT OF THE QUOTIENT WILL BE ZERO.  THIS MEANS WE
858                                  12380  ;WILL GO THROUGH THE DIVIDE LOOP 26 TIMES, SINCE IT STOPS ON THE 25TH BIT
859                                  12400  ;AFTER THE FIRST NON-ZERO BIT OF THE EXPONENT.  SO, THIS QUOTIENT WILL LOOK
860                                  12420  ;SHIFTED LEFT ONE FROM THE QUOTIENT OF TWO NUMBERS IN WHICH THE NUMERATOR IS
861                                  12440  ;BIGGER.  THIS CAN ONLY OCCUR ON THE FIRST TIME THROUGH THE LOOP, SO C,D,E
862                                  12460  ;ARE ALL ZERO.  SO, IF WE FINISH THE LOOP AND C,D,E ARE ALL ZERO, THEN WE
863                                  12480  ;MUST DECREMENT THE EXPONENT TO CORRECT FOR THIS.
864  000707' 001000  000101          12500          MOV     B,C             ;GET NUMBER IN B,H,L
865  000710' 001000  000353          12520          XCHG
866  000711' 001000  000257          12540          XRA     A               ;ZERO C,D,E AND HIGHEST ORDER
867  000712' 001000  000117          12560          MOV     C,A
868  000713' 001000  000127          12580          MOV     D,A
869  000714' 001000  000137          12600          MOV     E,A
870  000715' 001000  000062          12620          STA     FDIVG+1
871  000716' 000000  000737'
872  000717' 000000  000705'
873  000720' 001000  000345          12640  FDIV1:  PUSH    H               ;SAVE LO'S OF NUMBER
874  000721' 001000  000305          12660          PUSH    B               ;SAVE HO OF NUMBER
875  000722' 001000  000175          12680          MOV     A,L             ;SUBTRACT NUMBER THAT WAS IN FAC
876  000723' 001000  000326          12700  FDIVC:  SUI     0               ;SUBTRACT LO
877  000724' 000000  000000
878  000725' 001000  000157          12720          MOV     L,A             ;SAVE IT
```

```
879  000726' 001000  000174   12740          MOV    A,H          ;SUBTRACT MIDDLE ORDER
880  000727' 001000  000336   12760  FDIV8:  SBI    0
881  000730' 000000  000000
882  000731' 001000  000147   12780          MOV    H,A
883  000732' 001000  000170   12800          MOV    A,B          ;SUBTRACT HO
884  000733' 001000  000336   12820  FDIVA:  SBI    0
885  000734' 000000  000000
886  000735' 001000  000107   12840          MOV    B,A
887  000736' 001000  000076   12860  FDIVG:  MVI    A,0          ;GET HIGHEST ORDER
888  000737' 000000  000000
889  000740' 001000  000336   12880          SBI    0            ;SUBTRACT THE CARRY FROM IT
890  000741' 000000  000000
891  000742' 001000  000077   12900          CMC                 ;SET CARRY TO CORESPOND TO NEXT QUOTIENT BIT
892  000743' 001000  000322   12920          JNC    FDIV2        ;GET OLD NUMBER BACK IF WE SUBTRACTED TOO MUCH
893  000744' 000000  000755'
894  000745' 000000  000716'
895  000746' 001000  000062   12940          STA    FDIVG+1      ;UPDATE HIGHEST ORDER
896  000747' 000000  000737'
897  000750' 000000  000744'
898  000751' 001000  000361   12960          POP    PSW          ;THE SUBTRACTION WAS GOOD
899  000752' 001000  000361   12980          POP    PSW          ;GET PREVIOUS NUMBER OFF STACK
900  000753' 001000  000067   13000          STC                 ;NEXT BIT IN QUOTIENT IS A ONE
901  000754' 001000  000322   13020          XWD    1000,322     ;"JNC" AROUND NEXT 2 BYTES
902  000755' 001000  000301   13040  FDIV2:  POP    B            ;WE SUBTRACTED TOO MUCH
903  000756' 001000  000341   13060          POP    H            ;GET OLD NUMBER BACK
904  000757' 001000  000171   13080          MOV    A,C          ;ARE WE DONE?
905  000760' 001000  000074   13100          INR    A            ;SET SIGN FLAG WITHOUT AFFECTING CARRY
906  000761' 001000  000075   13120          DCR    A
907  000762' 001000  000037   13140          RAR                 ;PUT CARRY IN MSB
908  000763' 001000  000372   13160          JM     ROUNDB       ;WE ARE DONE
909  000764' 000000  000234'
910  000765' 000000  000747'
911  000766' 001000  000027   13180          RAL                 ;WE AREN'T, GET OLD CARRY BACK
912                           13200  IFE     LENGTH,<
913                           13220          CALL   SHFTLO>      ;ROTATE EVERYTHING LEFT ONE
914                           13240  IFN     LENGTH,<
915  000767' 001000  000173   13260          MOV    A,E          ;ROTATE EVERYTHING LEFT ONE
916  000770' 001000  000027   13280          RAL                 ;ROTATE NEXT BIT OF QUOTIENT IN
917  000771' 001000  000137   13300          MOV    E,A
918  000772' 001000  000172   13320          MOV    A,D
919  000773' 001000  000027   13340          RAL
920  000774' 001000  000127   13360          MOV    D,A
921  000775' 001000  000171   13380          MOV    A,C
922  000776' 001000  000027   13400          RAL
923  000777' 001000  000117   13420          MOV    C,A>
924  001000' 001000  000651   13440          DAD    M            ;ROTATE A ZERO INTO RIGHT END OF NUMBER
925  001001' 001000  000170   13460          MOV    A,B          ;THE HO BYTE, FINALLY!
926  001002' 001000  000027   13480          RAL
927  001003' 001000  000107   13500          MOV    B,A
928  001004' 001000  000072   13520          LDA    FDIVG+1      ;ROTATE THE HIGHEST ORDER
929  001005' 000000  000737'
930  001006' 000000  000764'
931  001007' 001000  000027   13540          RAL
```



```
932  001010' 001000  000062   13560          STA    FDIVG+1
933  001011' 000000  000737'
934  001012' 000000  001005'
935  001013' 001000  000171   13580          MOV    A,C          ;ADD ONE TO EXPONENT IF THE FIRST SUBTRACTION
936  001014' 001000  000262   13600          ORA    D            ; DID NOT WORK
937  001015' 001000  000263   13620          ORA    E
938  001016' 001000  000302   13640          JNZ    FDIV1        ;THIS ISN'T THE CASE
939  001017' 000000  000720'
940  001020' 000000  001011'
941  001021' 001000  000345   13660          PUSH   M            ;SAVE PART OF NUMBER
942  001022' 001000  000641   13680          LXI    M,FAC        ;GET POINTER TO FAC
943  001023' 000000  000426*
944  001024' 000000  001017'
945  001025' 001000  000065   13700          DCR    M            ;DECREMENT EXPONENT
946  001026' 001000  000341   13720          POP    M            ;GET NUMBER BACK
947  001027' 001000  000302   13740          JNZ    FDIV1        ;DIVIDE MORE IF NO OVERFLOW OCCURED
948  001030' 000000  000720'
949  001031' 000000  001023'
950  001032' 001000  000303   13760          JMP    OVERR        ;OVERFLOW!!
951  001033' 000000  000267'
952  001034' 000000  001030'
953
954
955                           13820          ;CHECK SPECIAL CASES AND ADD EXPONENTS FOR FMULT, FDIV
956                           13840          ;ALTERS A,B,H,L
957                           13860  IFE     LENGTH=2,<
958                           13880  MULDVS: MVI    A,377        ;ENTRY FROM DDIV, SUBTRACT EXPONENTS
959                           13900          XWD    1000,056     ;"MVI  L" AROUND NEXT BYTE
960                           13920  MULDVA: XRA    A            ;ENTRY FROM DMULT, ADD EXPONENTS
961                           13940          LXI    H,ARG-1      ;GET POINTER TO SIGN AND HO OF ARG
962                           13960          MOV    C,M          ;GET HO AND SIGN FOR UNPACKING
963                           13980          INX    H            ;INCREMENT POINTER TO EXPONENT
964                           14000          MOV    B,M          ;GET EXPONENT FOR BELOW
965                           14020          MOV    L,A>         ;SAVE ADD OR SUBTRACT FLAG
966  001035' 001000  000170   14040  MULDIV: MOV    A,B          ;IS NUMBER IN REGISTERS ZERO?
967  001036' 001000  000267   14060          ORA    A
968  001037' 001000  000312   14080          JZ     MULDV2       ;IT IS, ZERO FAC AND WE ARE DONE
969  001040' 000000  001077'
970  001041' 000000  001033'
971  001042' 001000  000175   14100          MOV    A,L          ;GET ADD OR SUBTRACT FLAG
972  001043' 001000  000041   14120          LXI    H,FAC        ;GET POINTER TO EXPONENT
973  001044' 000000  001023*
974  001045' 000000  001040'
975  001046' 001000  000256   14140          XRA    M            ;GET EXPONENT
976  001047' 001000  000200   14160          ADD    B            ;ADD IN REGISTER EXPONENT
977  001050' 001000  000107   14180          MOV    B,A          ;SAVE IT
978  001051' 001000  000037   14200          RAR                 ;CHECK FOR OVERFLOW
979  001052' 001000  000250   14220          XRA    B            ;OVERFLOW IF SIGN IS THE SAME AS CARRY
980  001053' 001000  000170   14240          MOV    A,B          ;GET SUM
981  001054' 001000  000362   14260          JP     MULDV1       ;WE HAVE OVERFLOW!!
982  001055' 000000  001076'
983  001056' 000000  001044'
984  001057' 001000  000306   14280          ADI    200          ;PUT EXPONENT IN EXCESS 200
```

```
001060' 000000  000200
001061' 001000  000167          14300          MOV     M,A            ;SAVE IT IN THE FAC
001062' 001000  000316          14320          JZ      POPHRT         ;WE HAVE UNDEFLOW!! RETURN.
001063' 000000  000630'
001064' 000000  001055'
001065' 001000  000315          14340          CALL    UNPACK         ;UNPACK THE ARGUMENTS
001066' 000000  001272'
001067' 000000  001063'
001070' 001000  000167          14360          MOV     M,A            ;SAVE THE NEW SIGN
001071' 001000  000053          14380          DCX     H              ;POINT TO EXPONENT
001072' 001000  000311          14400          RET                    ;ALL DONE, LEAVE HO IN A
                                14420  IFN     EXTFNC,<
001073' 001000  000357          14440  MLOVEX: FSIGN                  ;ENTRY FROM EXP, PICK UNDERFLOW IF NEGATIVE
001074' 001000  000057          14460          CMA                    ;PICK OVERFLOW IF POSITIVE
001075' 001000  000341          14480          POP     H>             ;DON'T SCREW UP STACK
001076' 001000  000267          14500  MULOV1: ORA     A              ;IS ERROR OVERFLOW OR UNDEFLOW?
001077' 001000  000341          14520  MULOV2: POP     H              ;GET OLD RETURN ADDRESS OFF STACK
                                14540  IFE     LENGTH,<
                                14560          JM      OVERR          ;OVERFLOW
                                14580                                 ;UNDERFLOW -- FALL INTO ZERO
                                14600
                                14620
                                14640          ;ZERO FAC
                                14660          ;ALTERS A ONLY
                                14680          ;EXITS WITH A=0
                                14700  ZERO:   XRA     A              ;ZERO A
                                14720          STA     FAC            ;ZERO FAC
                                14740          RET>                   ;ALL DONE
                                14800  IFN     LENGTH,<
001100' 001000  000362          14820          JP      ZERO           ;UNDERFLOW
001101' 000000  000173'
001102' 000000  001066'
001103' 001000  000303          14840          JMP     OVERR>         ;OVERFLOW
001104' 000000  000267'
001105' 000000  001101'
                                14900          ;MULTIPLY FAC BY 10
                                14920          ;ALTERS A,B,C,D,E,M,L
001106' 001000  000315          14940  MUL10:  CALL    MOVRF          ;GET NUMBER IN REGISTERS
001127' 000000  001240'
001110' 000000  001104'
001111' 001000  000170          14960          MOV     A,B            ;GET EXPONENT
001112' 001000  000267          14980          ORA     A              ;RESULT IS ZERO IF ARG IS ZERO
001113' 001000  000310          15000          RZ                     ;IT IS
001114' 001000  000306          15020          ADI     2              ;MULTIPLY BY 4 BY ADDING 2 TO EXPONENT
001115' 000000  000002
001116' 001000  000332          15040          JC      OVERR          ;OVERFLOW!!
001117' 000000  000267'
001120' 000000  001107'
001121' 001000  000107          15060          MOV     B,A            ;RESTORE EXPONENT
```



```
001122' 001000  000315          15080          CALL    FADD           ;ADD IN ORIGINAL NUMBER TO GET 5 TIMES IT
001123' 000000  000025'
001124' 000000  001117'
001125' 001000  000041          15100          LXI     H,FAC          ;ADD 1 TO EXPONENT TO MULTIPLY NUMBER BY
001126' 000000  001044*
001127' 000000  001125'
001130' 001000  000064          15120          INR     M              ; 2 TO GET 10 TIMES ORIGINAL NUMBER
001131' 001000  000300          15140          RNZ                    ;ALL DONE IF NO OVERFLOW
001132' 001000  000303          15160          JMP     OVERR          ;OVERFLOW!!
001133' 000000  000267'
001134' 000000  001126'
                                15180  PAGE
```

```
                                        15200   SUBTTL  SIGN, SGN, FLOAT, NEG AND ABS
                                        15220           ;PUT SIGN OF FAC IN A
                                        15240           ;ALTERS A ONLY
                                        15260           ;LEAVES FAC ALONE
                                        15280           ;NOTE: TO TAKE ADVANTAGE OF THE RST INSTRUCTIONS TO SAVE BYTES,
                                        15300           ;FSIGN IS DEFINED TO BE AN RST.  "FSIGN" IS EQUIVALENT TO "CALL SIGN"
                                        15320           ;THE FIRST FEW INSTRUCTIONS OF SIGN (THE ONES BEFORE SIGNC) ARE DONE
                                        15340           ;IN THE 8 BYTES AT THE RST LOCATION.
                                        15360   REPEAT  0,<                          ;FSIGN IS ALWAYS AN RST
                                        15380   SIGN:   LDA     FAC                 ;CHECK IF THE NUMBER IS ZERO
                                        15400           ORA     A
                                        15420           RZ>                         ;IT IS, A IS ZERO
001135' 001000  000072                  15440   SIGNC:  LDA     FAC-1               ;GET SIGN OF FAC, IT IS NON-ZERO
001136' 777777  777777*
001137' 000000  001133'
001140' 001000  000376                  15460           XWD     1000,376            ;"CPI" AROUND NEXT BYTE
001141' 001000  000057                  15480   FCOMPS: CMA                         ;ENTRY FROM FCOMP, COMPLEMENT SIGN
001142' 001000  000027                  15500   ICOMPS: RAL                         ;ENTRY FROM ICOMP, PUT SIGN BIT IN CARRY
001143' 001000  000237                  15520   SIGNS:  SBB     A                   ;A=0 IF CARRY WAS 0, A=377 IF CARRY WAS 1
001144' 001000  000300                  15540           RNZ                         ;RETURN IF NUMBER WAS NEGATIVE
001145' 001000  000074                  15560   INRART: INR     A                   ;PUT ONE IN A IF NUMBER WAS POSITIVE
001146' 001000  000311                  15580           RET                         ;ALL DONE


                                        15640           ;SGN FUNCTION
                                        15660           ;ALTERS A,B,C,D,E,H,L
                                        15680   IFN     LENGTH=2,<
001147' 001000  000357                  15700   SGN:    FSIGN>                      ;GET SIGN OF FAC IN A
                                        15720                                       ;FALL INTO FLOAT


                                        15780           ;FLOAT THE SIGNED INTEGER IN A
                                        15800           ;ALTERS A,B,C,D,E,H,L
001150' 001000  000006                  15820   FLOAT:  MVI     B,210               ;SET EXPONENT CORRECTLY
001151' 000000  000210
001152' 001000  000021                  15840           LXI     D,$CODE             ;ZERO D,E
001153' 000000  000601*
001154' 000000  001136'
                                        15860                                       ;FALL INTO FLOATR


                                        15920           ;FLOAT THE SIGNED NUMBER IN B,A,D,E
                                        15940           ;ALTERS A,B,C,D,E,H,L
001155' 001000  000041                  15960   FLOATR: LXI     H,FAC               ;GET POINTER TO FAC
001156' 000000  001126*
001157' 000000  001153'
001160' 001000  000117                  15980           MOV     C,A                 ;PUT HO IN C
001161' 001000  000160                  16000           MOV     M,B                 ;PUT EXPONENT IN THE FAC
001162' 001000  000006                  16020           MVI     B,0                 ;ZERO OVERFLOW BYTE
001163' 000000  000000
001164' 001000  000043                  16040           INX     H                   ;POINT TO SIGN
001165' 001000  000066                  16060           MVI     M,200               ;ASSUME A POSITIVE NUMBER
001166' 000000  000200
```



```
001167' 001000  000027                  16080           RAL                         ;PUT SIGN IN CARRY
001170' 001000  000303                  16100           JMP     FADFLT              ;GO AND FLOAT THE NUMBER
001171' 000000  000143'
001172' 000000  001156'


                                        16160           ;ABSOLUTE VALUE OF FAC
                                        16180           ;ALTERS A,H,L
001173'                                 16200   ABS:
                                        16220   IFE     LENGTH=2,<
                                        16240           CPI     2                   ;IS THE ARGUMENT AN INTEGER?
                                        16260           JZ      IABS>               ;YES, USE THE INTEGER ABSOLUTE VALUE
001173' 001000  000357                  16280           FSIGN                       ;GET THE SIGN OF FAC
001174' 001000  000360                  16300           RP                          ;ALL DONE IF IT IS POSITIVE
                                        16320                                       ;FALL INTO NEG


                                        16380           ;NEGATE NUMBER IN THE FAC
                                        16400           ;ALTERS A,H,L
                                        16420           ;NOTE: THE NUMBER MUST BE PACKED
001175' 001000  000041                  16440   NEG:    LXI     H,FAC-1             ;GET POINTER TO SIGN
001176' 777777  777777*
001177' 000000  001171'
001200' 001000  000176                  16460           MOV     A,M                 ;GET SIGN
001201' 001000  000356                  16480           XRI     200                 ;COMPLEMENT SIGN BIT
001202' 000000  000200
001203' 001000  000167                  16500           MOV     M,A                 ;SAVE IT
001204' 001000  000311                  16520           RET                         ;ALL DONE


                                        16580   IFE     LENGTH=2,<
                                        16600           ;NEGATE ANY TYPE VALUE IN THE FAC
                                        16620           ;ALTERS A,B,C,D,E,H,L
                                        16640   VNEG:   LDA     VALTYP              ;SEE WHAT KIND OF NUMBER WE HAVE
                                        16660           CPI     2
                                        16680           JZ      INEG                ;WE HAVE AN INTEGER, NEGATE IT THAT WAY
                                        16700           JM      TMERR               ;BLOW UP ON STRINGS
                                        16720           JMP     NEG                 ;NEGATE SNG AND DBL THE SAME
                                        16740
                                        16760
                                        16780           ;SGN FUNCTION
                                        16800           ;ALTERS A,H,L
                                        16820   SGN:    CALL    VSIGN               ;GET THE SIGN OF THE FAC IN A
                                        16840           MOV     L,A                 ;PUT IT IN THE LO POSITION
                                        16860           RAL                         ;EXTEND THE SIGN TO THE HO
                                        16880           SBB     A
                                        16900           MOV     H,A
                                        16920           JMP     CONISS              ;RETURN THE RESULT AND SET VALTYP
                                        16940
                                        16960
                                        16980           ;GET THE SIGN OF THE VALUE IN THE FAC IN A
                                        17000           ;ASSUMES A HAS THE VALTYP WHEN CALLED
                                        17020           ;ALTERS A,H,L
```

```
                                        17040   VSIGN:  CPI     2               ;IS THE ARGUMENT AN INTEGER?
                                        17060           JNZ     SIGN            ;NO, SINGLE AND DOUBLE PREC, WORK THE SAME
                                        17080           LHLD    FACLO           ;GET THE INTEGER ARGUMENT
                                        17100           MOV     A,H             ;GET ITS SIGN
                                        17120           ORA     L               ;CHECK IF THE NUMBER IS ZERO
                                        17140           RZ                      ;IT IS, WE ARE DONE
                                        17160           MOV     A,H             ;IT ISN'T, SIGN IS THE SIGN OF H
                                        17180           JMP     ICOMPS>         ;GO SET A CORRECTLY
                                        17200   PAGE
```



```
                                        17220   SUBTTL  FLOATING POINT MOVEMENT ROUTINES
                                        17240           ;PUT FAC ON STACK
                                        17260           ;ALTERS D,E
001205' 001000  000353                  17280   PUSHF:  XCHG                    ;SAVE (HL)
001206' 001000  000052                  17300           LHLD    FACLO           ;GET LO'S
001207' 000000  000555*
001210' 000000  001176'
001211' 001000  000343                  17320           XTHL                    ;SWITCH LO'S AND RET ADDR
001212' 001000  000345                  17340           PUSH    H               ;PUT RET ADDR BACK ON STACK
001213' 001000  000052                  17360           LHLD    FAC-1           ;GET HO'S
001214' 777777  777777*
001215' 000000  001207'
001216' 001000  000343                  17380           XTHL                    ;SWITCH HO'S AND RET ADDR
001217' 001000  000345                  17400           PUSH    H               ;PUT RET ADDR BACK ON STACK
001220' 001000  000353                  17420           XCHG                    ;GET OLD (HL) BACK
001221' 001000  000311                  17440           RET                     ;ALL DONE


                                        17500           ;MOVE NUMBER FROM MEMORY [(HL)] TO FAC
                                        17520           ;ALTERS B,C,D,E,H,L
                                        17540           ;AT EXIT NUMBER IS IN B,C,D,E
                                        17560           ;AT EXIT (HL):=(HL)+4
001222' 001000  000315                  17580   MOVFM:  CALL    MOVRM           ;GET NUMBER IN REGISTERS
001223' 000000  001243'
001224' 000000  001214'
                                        17600                                   ;FALL INTO MOVFR AND PUT IT IN FAC


                                        17660           ;MOVE REGISTERS (B,C,D,E) TO FAC
                                        17680           ;ALTERS D,E
001225' 001000  000353                  17700   MOVFR:  XCHG                    ;GET LO'S IN (HL)
001226' 001000  000042                  17720           SHLD    FACLO           ;PUT THEM WHERE THEY BELONG
001227' 000000  001207*
001230' 000000  001223'
001231' 001000  000140                  17740           MOV     M,B             ;GET HO'S IN (HL)
001232' 001000  000151                  17760           MOV     L,C
001233' 001000  000042                  17780           SHLD    FAC-1           ;PUT HO'S WHERE THEY BELONG
001234' 777777  777777*
001235' 000000  001227'
001236' 001000  000353                  17800           XCHG                    ;GET OLD (HL) BACK
001237' 001000  000311                  17820           RET                     ;ALL DONE


                                        17880           ;MOVE FAC TO REGISTERS (B,C,D,E)
                                        17900           ;ALTERS B,C,D,E,H,L
001240' 001000  000041                  17920   MOVRF:  LXI     H,FACLO         ;GET POINTER TO FAC
001241' 000000  001227*
001242' 000000  001234'
                                        17940                                   ;FALL INTO MOVRM


                                        18000           ;GET NUMBER IN REGISTERS (B,C,D,E) FROM MEMORY [(HL)]
                                        18020           ;ALTERS B,C,D,E,H,L
```

```
                                        18040          ;AT EXIT (HL):=(HL)+4
001243' 001000  000136                  18060  MOVRM:  MOV     E,M            ;GET LO
001244' 001000  000043                  18080          INX     H              ;POINT TO MO
001245' 001000  000126                  18100          MOV     D,M            ;GET MO
001246' 001000  000043                  18120          INX     H              ;POINT TO MO
001247' 001000  000116                  18140          MOV     C,M            ;GET HO
001250' 001000  000043                  18160          INX     H              ;POINT TO EXPONENT
001251' 001000  000106                  18180          MOV     B,M            ;GET EXPONENT
001252' 001000  000043                  18200  INXHRT: INX     H              ;INC POINTER TO BEGINNING OF NEXT NUMBER
001253' 001000  000311                  18220          RET                    ;ALL DONE


                                        18280          ;MOVE NUMBER FROM FAC TO MEMORY [(HL)]
                                        18300          ;ALTERS A,B,D,E,H,L
001254' 001000  000021                  18320  MOVMF:  LXI     D,FACLO        ;GET POINTER TO FAC
001255' 000000  001241*
001256' 000000  001241'
                                        18340                                 ;FALL INTO MOVE


                                        18400          ;MOVE NUMBER FROM (DE) TO (HL)
                                        18420          ;ALTERS A,B,D,E,H,L
                                        18440          ;EXITS WITH (DE):=(DE)+4, (HL):=(HL)+4
001257' 001000  000006                  18460  MOVE:   MVI     B,4            ;SET COUNTER
001260' 000000  000004
                                        18480  IFE     LENGTH=2,<
                                        18500          XWD     1000,076       ;"MVI   A" OVER NEXT BYTE
                                        18520  MOVVFM: XCHG>                  ;MOVE NUMBERS INTO THE FAC
001261' 001000  000032                  18540  MOVE1:  LDAX    D              ;GET WORD, ENTRY FROM VMOVMF
001262' 001000  000167                  18560          MOV     M,A            ;PUT IT WHERE IT BELONGS
001263' 001000  000023                  18580          INX     D              ;INCREMENT POINTERS TO NEXT WORD
001264' 001000  000043                  18600          INX     H
001265' 001000  000005                  18620          DCR     B              ;SEE IF DONE
001266' 001000  000302                  18640          JNZ     MOVE1
001267' 000000  001261'
001270' 000000  001255'
001271' 001000  000311                  18660          RET


                                        18720          ;UNPACK THE FAC AND THE REGISTERS
                                        18740          ;ALTERS A,C,H,L
                                        18760          ;WHEN THE NUMBER IN THE FAC IS UNACKED, THE ASSUMED ONE IN THE
                                        18780          ;MANTISSA IS RESTORED, AND THE COMPLEMENT OF THE SIGN IS PLACED
                                        18800          ;IN FAC+1
001272' 001000  000041                  18820  UNPACK: LXI     H,FAC-1        ;POINT TO HO AND SIGN
001273' 777777  777777*
001274' 000000  001267'
001275' 001000  000176                  18840          MOV     A,M            ;GET HO AND SIGN
001276' 001000  000365                  18860          PUSH    PSW            ;SAVE SIGN
001277' 001000  000366                  18880          ORI     200            ;RESTORE THE HIDDEN ONE
001300' 000000  000200
001301' 001000  000167                  18900          MOV     M,A            ;SAVE HO
001302' 001000  000361                  18920          POP     PSW            ;GET SIGN
```



```
001303' 001000  000256                  18940          XRA     M              ;GET COMPLEMENT OF SIGN IN MSB
001304' 001000  000043                  18960          INX     H              ;POINT TO TEMPORARY SIGN BYTE
001305' 001000  000043                  18980          INX     H
001306' 001000  000167                  19000          MOV     M,A            ;SAVE COMPLEMENT OF SIGN
001307' 001000  000171                  19020          MOV     A,C            ;GET HO AND SIGN OF THE REGISTERS
001310' 001000  000365                  19040          PUSH    PSW            ;SAVE SIGN
001311' 001000  000366                  19060          ORI     200            ;RESTORE THE HIDDEN ONE
001312' 000000  000200
001313' 001000  000117                  19080          MOV     C,A            ;SAVE THE HO
001314' 001000  000361                  19100          POP     PSW            ;GET THE SIGN BACK
001315' 001000  000256                  19120          XRA     M              ;COMPARE SIGN OF FAC AND SIGN OF REGISTERS
001316' 001000  000311                  19140          RET                    ;ALL DONE


                                        19200  IFE     LENGTH=2,<
                                        19220  REPEAT  0,<                    ;VPUSHF WILL BE IN-LINE IN F3
                                        19240          ;PUT ANY TYPE VALUE ON THE STACK FROM THE FAC
                                        19260          ;STRINGS ARE TREATED AS INTEGERS
                                        19280          ;ALTERS A,B,C,H,L
                                        19300  VPUSHF: LDA     VALTYP         ;GET THE VALUE TYPE
                                        19320          CPI     4              ;SET FLAGS ACCORDING TO VALTYP
                                        19340          LXI     H,FACLO        ;GET POINTER TO LO IN FAC
                                        19360          PUSHM                  ;PUSH FACLO+0,1 ON THE STACK
                                        19380          JM      VPUSHD         ;RETURN IF THE DATA WAS AN INTEGER OR A STRING
                                        19400          PUSHM                  ;PUSH FAC+1,0 ON THE STACK
                                        19420          JZ      VPUSHD         ;RETURN IF WE HAD A SINGLE PRECISION NUMBER
                                        19440          LXI     D,DFACLO       ;WE HAVE A DOUBLE PRECISON NUMBER
                                        19460          PUSHM                  ;PUSH ITS 4 LO BYTES ON THE STACK
                                        19480          PUSHM
                                        19500  VPUSHD:>                       ;ALL DONE


                                        19560          ;MOVE ANY TYPE VALUE FROM MEMORY [(HL)] TO FAC
                                        19580          ;ALTERS A,B,D,E,H,L
                                        19600  VMOVFA: LXI     H,ARGLO        ;ENTRY FROM DADD, MOVE ARG TO FAC
                                        19620  VMOVFM: LXI     D,MOVVFM       ;GET ADDRESS OF LOCATION THAT DOES
                                        19640          JMP     VMVVFM         ; AN "XCHG" AND FALLS INTO MOVE1


                                        19700          ;MOVE ANY TYPE VALUE FROM FAC TO MEMORY [(HL)]
                                        19720          ;ALTERS A,B,D,E,H,L
                                        19740  VMOVAF: LXI     H,ARGLO        ;ENTRY FROM FIN, DMUL10, DDIV10
                                        19760                                 ;MOVE FAC TO ARG
                                        19780  VMOVMF: LXI     D,MOVE1        ;GET ADDRESS OF MOVE SUBROUTINE
                                        19800  VMVVFM: PUSH    D              ;SHOVE IT ON THE STACK
                                        19820          LXI     D,FACLO        ;GET FIRST ADDRESS FOR INT, SNG
                                        19840          LDA     VALTYP         ;GET THE VALUE TYPE
                                        19860          ANI     177            ;STRINGS LOOK LIKE REALS
                                        19880          MOV     B,A            ;SET UP THE COUNT
                                        19900          CPI     10             ;DO WE HAVE DBL?
                                        19920          RNZ                    ;WE DO NOT, GO DO THE MOVE
                                        19940          LXI     D,DFACLO       ;WE DO, GET LO ADDR OF THE DBL NUMBER
                                        19960          RET>                   ;GO DO THE MOVE
```

```
 1324                                   19980   PAGE
```



```
 1325                                   20000   SUBTTL  COMPARE TWO NUMBERS
 1326                                   20020           ;COMPARE TWO SINGLE PRECISION NUMBERS
 1327                                   20040           ;A=1 IF ARG .LT. FAC
 1328                                   20060           ;A=0 IF ARG=FAC
 1329                                   20080           ;A=-1 IF ARG .GT. FAC
 1330                                   20100           ;DOREL DEPENDS UPON THE FACT THAT FCOMP RETURNS WITH CARRY ON
 1331                                   20120           ; IFF A HAS 377
 1332                                   20140           ;ALTERS A,H,L
 1333  001317' 001000  000170          20160   FCOMP:  MOV     A,B             ;CHECK IF ARG IS ZERO
 1334  001320' 001000  000267          20180           ORA     A
 1335  001321' 001000  000512          20200           JZ      SIGN
 1336  001322' 000000  000000*
 1337  001323' 000000  001273'
 1338  001324' 001000  000041          20220           LXI     H,FCOMPS        ;WE JUMP TO FCOMPS WHEN WE ARE DONE
 1339  001325' 000000  001141'
 1340  001326' 000000  001322'
 1341  001327' 001000  000345          20240           PUSH    H               ;PUT THE ADDRESS ON THE STACK
 1342  001330' 001000  000357          20260           FSIGN                   ;CHECK IF FAC IS ZERO
 1343  001331' 001000  000171          20280           MOV     A,C             ;IF IT IS, RESULT IS MINUS THE SIGN OF ARG
 1344  001332' 001000  000510          20300           RZ                      ;IT IS
 1345  001333' 001000  000041          20320           LXI     H,FAC-1         ;POINT TO SIGN OF FAC
 1346  001334' 777777  777777*
 1347  001335' 000000  001325'
 1348  001336' 001000  000256          20340           XRA     M               ;SEE IF THE SIGNS ARE THE SAME
 1349  001337' 001000  000171          20360           MOV     A,C             ;IF THEY ARE DIFFERENT, RESULT IS SIGN OF ARG
 1350  001340' 001000  000370          20380           RM                      ;THEY ARE DIFFERENT
 1351  001341' 001000  000315          20400           CALL    FCOMP2          ;CHECK THE REST OF THE NUMBER
 1352  001342' 000000  001347'
 1353  001343' 000000  001334'
 1354  001344' 001000  000037          20420   FCOMPD: RAR                     ;NUMBERS ARE DIFFERENT, CHANGE SIGN IF
 1355  001345' 001000  000251          20440           XRA     C               ; BOTH NUMBERS ARE NEGATIVE
 1356  001346' 001000  000311          20460           RET                     ;GO SET UP A
 1357
 1358  001347' 001000  000043          20500   FCOMP2: INX     H               ;POINT TO EXPONENT
 1359  001350' 001000  000170          20520           MOV     A,B             ;GET EXPONENT OF ARG
 1360  001351' 001000  000276          20540           CMP     M               ;COMPARE THE TWO
 1361  001352' 001000  000300          20560           RNZ                     ;NUMBERS ARE DIFFERENT
 1362  001353' 001000  000053          20580           DCX     H               ;POINT TO HO
 1363  001354' 001000  000171          20600           MOV     A,C             ;GET HO OF ARG
 1364  001355' 001000  000276          20620           CMP     M               ;COMPARE WITH HO OF FAC
 1365  001356' 001000  000300          20640           RNZ                     ;THEY ARE DIFFERENT
 1366  001357' 001000  000053          20660           DCX     H               ;POINT TO MO OF FAC
 1367  001360' 001000  000172          20680           MOV     A,D             ;GET MO OF ARG
 1368  001361' 001000  000276          20700           CMP     M               ;COMPARE WITH MO OF FAC
 1369  001362' 001000  000300          20720           RNZ                     ;THE NUMBERS ARE DIFFERENT
 1370  001363' 001000  000053          20740           DCX     H               ;POINT TO LO OF FAC
 1371  001364' 001000  000173          20760           MOV     A,E             ;GET LO OF ARG
 1372  001365' 001000  000226          20780           SUB     M               ;SUBTRACT LO OF FAC
 1373  001366' 001000  000300          20800           RNZ                     ;NUMBERS ARE DIFFERENT
 1374  001367' 001000  000341          20820           POP     H               ;NUMBERS ARE THE SAME, DON'T SCREW UP STACK
 1375  001370' 001000  000341          20840           POP     H
 1376  001371' 001000  000311          20860           RET                     ;ALL DONE
 1377
```

```
20920   IFE     LENGTH-2,<
20940           ;COMPARE TWO INTEGERS
20960           ;A=1 IF (DE) ,LT, (HL)
20980           ;A=0 IF (DE)=(HL)
21000           ;A=-1 IF (DE) ,GT, (HL)
21020           ;ALTERS A ONLY
21040   ICOMP:  MOV     A,D             ;ARE THE SIGNS THE SAME?
21060           XRA     H
21080           MOV     A,H             ;IF NOT, ANSWER IS THE SIGN OF (HL)
21100           JM      ICOMPS          ;THEY ARE DIFFERENT
21120           CMP     D               ;THEY ARE THE SAME, COMPARE THE HO'S
21140           JNZ     SIGNS           ;GO SET UP A
21160           MOV     A,L             ;COMPARE THE LO'S
21180           SUB     E
21200           JNZ     SIGNS           ;GO SET UP A
21220           RET                     ;ALL DONE, THEY ARE THE SAME
21240
21260
21280           ;COMPARE TWO DOUBLE PRECISION NUMBERS
21300           ;A=1 IF ARG ,LT, FAC
21320           ;A=0 IF ARG=FAC
21340           ;A=-1 IF ARG ,GT, FAC
21360           ;ALTERS A,B,C,D,E,H,L
21380   DCOMPD: LXI     H,ARGLO         ;ENTRY WITH POINTER TO ARG IN (DE)
21400           MVI     B,10            ;SET UP COUNT TO MOVE DBL NUMBERS
21420           CALL    MOVE1           ;MOVE THE ARGUMENT INTO ARG
21440   DCOMP:  LXI     D,ARG           ;GET POINTER TO ARG
21460           LDAX    D               ;SEE IF ARG=0
21480           ORA     A
21500           JZ      SIGN            ;ARG=0, GO SET UP A
21520           LXI     H,FCOMPS        ;PUSH FCOMPS ON STACK SO WE WILL RETURN TO
21540           PUSH    H               ; TO IT AND SET UP A
21560           FSIGN                   ;SEE IF FAC=0
21580           DCX     D               ;POINT TO SIGN OF ARG
21600           LDAX    D               ;GET SIGN OF ARG
21620           MOV     C,A             ;SAVE IT FOR LATER
21640           RZ                      ;FAC=0, SIGN OF RESULT IS SIGN OF ARG
21660           LXI     H,FAC-1         ;POINT TO SIGN OF FAC
21680           XRA     M               ;SEE IF THE SIGNS ARE THE SAME
21700           MOV     A,C             ;IF THEY ARE, GET THE SIGN OF THE NUMBERS
21720           RM                      ;THE SIGNS ARE DIFFERENT, GO SET A
21740           INX     D               ;POINT BACK TO EXPONENT OF ARG
21760           INX     H               ;POINT TO EXPONENT OF FAC
21780           MVI     B,10            ;SET UP A COUNT
21800   DCOMP1: LDAX    D               ;GET A BYTE FROM ARG
21820           SUB     M               ;COMPARE IT WITH THE FAC
21840           JNZ     FCOMPD          ;THEY ARE DIFFERENT, GO SET UP A
21860           DCX     D               ;THEY ARE THE SAME, EXAMINE THE NEXT LOWER
21880           DCX     H               ; ORDER BYTES
21900           DCR     B               ;ARE WE DONE?
21920           JNZ     DCOMP1          ;NO, COMPARE THE NEXT BYTES
21940           POP     B               ;THEY ARE THE SAME, GET FCOMPS OFF STACK
```



```
21960           RET>                    ;ALL DONE
21980   PAGE
```

```
22000  SUBTTL  CONVERSION ROUTINES BETWEEN INTEGER, SINGLE AND DOUBLE PRECISION
22020  IFE     LENGTH-2,<
22040          ;FORCE THE FAC TO BE AN INTEGER
22060          ;ALTERS A,B,C,D,E,H,L
22080  FRCINT: LDA     VALTYP          ;SEE WHAT WE HAVE
22100          CPI     4
22120          LHLD    FACLO           ;GET FACLO+0,1 IN CASE WE HAVE AN INTEGER
22140          RC                      ;WE HAVE AN INTEGER, ALL DONE
22160          JM      TMERR           ;WE HAVE A STRING, THAT IS A "NO-NO"
22180          CNZ     CONSD           ;IF WE HAVE A DBL, CONVERT IT TO A SNG
22200          LXI     H,OVERR         ;PUT OVERR ON THE STACK SO WE WILL GET ERROR
22220          PUSH    H               ; IF NUMBER IS TOO BIG
22240                                  ;FALL INTO CONIS
22260
22280
22300          ;CONVERT SINGLE PRECISION NUMBER TO INTEGER
22320          ;ALTERS A,B,C,D,E,H,L
22340  CONIS:  LDA     FAC             ;GET THE EXPONENT
22360          CPI     220             ;SEE IF IT IS TOO BIG
22380          JNC     CONIS2          ;IT IS, BUT IT MIGHT BE -32768
22400          CALL    QINT            ;IT ISN'T, CONVERT IT TO AN INTEGER
22420          XCHG                    ;PUT IT IN (HL)
22440  CONIS1: POP     D               ;GET ERROR ADDRESS OFF STACK
22460          ;ENTRY FROM SGN, FIN, LINPRT
22480  CONISS: SHLD    FACLO           ;STORE THE NUMBER IN FACLO
22500          MVI     A,2             ;SET VALTYP TO "INTEGER"
22520  CONISD: STA     VALTYP          ;ENTRY FROM CONDS
22540          RET                     ;ALL DONE
22560  CONIS2: MOVRI   220,200,000,000 ;CHECK IF NUMBER IS -32768, ENTRY FROM FIN
22580          CALL    FCOMP
22600          RNZ                     ;ERROR!  IT CAN'T BE CONVERTED TO AN INTEGER
22620          MOV     H,C             ;IT IS -32768, PUT IT IN (HL)
22640          MOV     L,D
22660          JMP     CONIS1          ;STORE IT IN THE FAC AND SET VALTYP
22680
22700
22720          ;FORCE THE FAC TO BE A SINGLE PRECISION NUMBER
22740          ;ALTERS A,B,C,D,E,H,L
22760  FRCSNG: LDA     VALTYP          ;SEE WHAT KIND OF NUMBER WE HAVE
22780          CPI     4
22800          RZ                      ;WE ALREADY HAVE AN INTEGER, ALL DONE
22820          JC      CONSI           ;WE HAVE AN INTEGER, CONVERT IT
22840          JM      TMERR           ;STRINGS!! -- ERROR!!
22860                                  ;DBL PREC -- FALL INTO CONSD
22880
22900
22920          ;CONVERT DOUBLE PRECISION NUMBER TO A SINGLE PRECISON ONE
22940          ;ALTERS A,B,C,D,E,H,L
22960  CONSD:  CALL    MOVRF           ;GET THE HO'S IN THE REGISTERS
22980          MVI     A,4             ;SET VALTYP TO "SINGLE PRECISON"
23000          STA     VALTYP
23020          MOV     A,B             ;CHECK IF THE NUMBER IS ZERO
23040          ORA     A
```



```
23060          RZ                      ;IF IT IS, WE ARE DONE
23080          CALL    UNPACK          ;UNPACK THE NUMBER
23100          LXI     H,FACLO-1       ;GET FIRST BYTE BELOW A SNG NUMBER
23120          MOV     B,M             ;PUT IT IN B FOR ROUND
23140          JMP     ROUND           ;ROUND THE DBL NUMBER UP AND WE ARE DONE
23160
23180
23200          ;CONVERT AN INTEGER TO A SINGLE PRECISION NUMBER
23220          ;ALTERS A,B,C,D,E,H,L
23240  CONSI:  LHLD    FACLO           ;GET THE INTEGER
23260  CONSIM: MVI     A,4             ;SET VALTYP TO "SINGLE PRECISION"
23280          STA     VALTYP
23300          MOV     A,H             ;SET UP REGISTERS FOR FLOATR
23320          MOV     D,L
23340          MVI     E,0
23360          MVI     B,220
23380          JMP     FLOATR          ;GO FLOAT THE NUMBER
23400
23420
23440          ;FORCE THE FAC TO BE A DOUBLE PRECISION NUMBER
23460          ;ALTERS A,B,C,D,E,H,L
23480  FRCDBL: LDA     VALTYP          ;SEE WHAT KIND OF NUMBER WE HAVE
23500          CPI     10
23520          RZ                      ;WE ALREADY HAVE A DBL, WE ARE DONE
23540          JNC     TMERR           ;GIVE AN ERROR IF WE HAVE A STRING
23560          CPI     2               ;SEE IF WE HAVE A SNG OR INT
23580          CZ      CONSI           ;CONVERT TO SNG IF WE HAVE AN INT
23600                                  ;FALL INTO CONDS AND CONVERT TO DBL
23620
23640
23660          ;CONVERT A SINGLE PRECISION NUMBER TO A DOUBLE PRECISION ONE
23680          ;ALTERS A,H,L
23700  CONDS:  LXI     H,$CODE         ;ZERO H,L
23720          SHLD    DFACLO          ;CLEAR THE FOUR LOWER BYTES IN THE DOUBLE
23740          SHLD    DFACLO+2        ; PRECISION NUMBER
23760          MVI     A,10            ;SET VALTYP TO "DOUBLE PRECISION"
23780          JMP     CONISD>         ;GO TO IT
23800  PAGE
```

```
                                        23820   SUBTTL  GREATEST INTEGER FUNCTION
                                        23840           ;QUICK GREATEST INTEGER FUNCTION
                                        23860           ;LEAVES INT(FAC) IN C,D,E (SIGNED)
                                        23880           ;ASSUMES FAC .LT. 2**23 = 8388608
                                        23900           ;ASSUMES THE EXPONENT OF FAC IS IN A
                                        23920           ;ALTERS A,B,C,D,E
001372' 001000  000107                  23940   QINT:   MOV     B,A             ;ZERO B,C,D,E IN CASE THE NUMBER IS ZERO
001373' 001000  000117                  23960           MOV     C,A
001374' 001000  000127                  23980           MOV     D,A
001375' 001000  000137                  24000           MOV     E,A
001376' 001000  000267                  24020           ORA     A               ;SET CONDITION CODES
001377' 001000  000310                  24040           RZ                      ;IT IS ZERO, WE ARE DONE

                                        24080   ;THE HARD CASE IN QINT IS NEGATIVE NON-INTEGERS.  TO HANDLE THIS, IF THE
                                        24100   ;NUMBER IS NEGATIVE, WE REGARD THE 3-BYTE MANTISSA AS A 3-BYTE INTEGER AND
                                        24120   ;SUBTRACT ONE.  THEN ALL THE FRACTIONAL BITS ARE SHIFTED OUT BY SHIFTING THE
                                        24140   ;MANTISSA RIGHT.  THEN, IF THE NUMBER WAS NEGATIVE, WE ADD ONE.  SO, IF WE
                                        24160   ;HAD A NEGATIVE INTEGER, ALL THE BITS TO THE RIGHT OF THE BINARY POINT WERE
                                        24180   ;ZERO.  SO THE NET EFFECT IS WE HAVE THE ORIGINAL NUMBER IN C,D,E.  IF THE
                                        24200   ;NUMBER WAS A NEGATIVE NON-INTEGER, THERE IS AT LEAST ONE NON-ZERO BIT TO THE
                                        24220   ;RIGHT OF THE BINARY POINT.  SO THE NET EFFECT IS THAT WE GET THE ABSOLUTE
                                        24240   ;VALUE OF INT(FAC) IN C,D,E.  C,D,E IS THEN NEGATED IF THE ORIGINAL NUMBER WAS
                                        24260   ;NEGATIVE SO THE RESULT WILL BE SIGNED.
001400' 001000  000345                  24280           PUSH    H               ;SAVE (HL)
001401' 001000  000315                  24300           CALL    MOVRF           ;GET NUMBER IN THE REGISTERS
001402' 000000  001240'
001403' 000000  001342'
001404' 001000  000315                  24320           CALL    UNPACK          ;UNPACK THE NUMBER
001405' 000000  001272'
001406' 000000  001402'
001407' 001000  000256                  24340           XRA     M               ;GET SIGN OF NUMBER
001410' 001000  000147                  24360           MOV     M,A             ;DON'T LOSE IT
001411' 001000  000374                  24380           CM      QINTA           ;SUBTRACT 1 FROM LO IF NUMBER IS NEGATIVE
001412' 000000  001436'
001413' 000000  001425'
001414' 001000  000076                  24400           MVI     A,230           ;SEE HOW MANY WE HAVE TO SHIFT TO CHANGE
001415' 000000  000230
001416' 001000  000220                  24420           SUB     B               ; NUMBER TO AN INTEGER
001417' 001000  000315                  24440           CALL    SHIFTR          ;SHIFT NUMBER TO GET RID OF FRACTIONAL BITS
001420' 000000  000334'
001421' 000000  001412'
001422' 001000  000174                  24460           MOV     A,H             ;GET SIGN
001423' 001000  000027                  24480           RAL                     ;PUT SIGN IN CARRY SO IT WILL NOT BE CHANGED
001424' 001000  000334                  24500           CC      ROUNDA          ;IF NUMBER WAS NEGATIVE, ADD ONE
001425' 000000  000255'
001426' 000000  001420'
001427' 001000  000006                  24520           MVI     B,0             ;FORGET THE BITS WE SHIFTED OUT
001430' 000000  000000
001431' 001000  000334                  24540           CC      NEGR            ;NEGATE NUMBER IF IT WAS NEGATIVE BECAUSE WE
001432' 000000  000310'
001433' 000000  001425'
                                        24560                                   ; WANT A SIGNED MANTISSA
001434' 001000  000341                  24580           POP     H               ;GET OLD (HL) BACK
```



```
001435' 001000  000311                  24600           RET                     ;ALL DONE

001436' 001000  000033                  24640   QINTA:  DCX     D               ;SUBTRACT ONE FROM C,D,E
001437' 001000  000172                  24660           MOV     A,D             ;WE HAVE TO SUBTRACT ONE FROM C IF
001440' 001000  000243                  24680           ANA     E               ; D AND E ARE BOTH ALL ONES
001441' 001000  000074                  24700           INR     A               ;SEE IF BOTH WERE -1
001442' 001000  000300                  24720           RNZ                     ;THEY WERE NOT, WE ARE DONE
                                        24740   IFN     LENGTH=2,<
001443' 001000  000015                  24760           DCR     C>              ;THEY WERE, SUBTRACT ONE FROM C
                                        24780   IFE     LENGTH=2,<
                                        24800   DCXBRT: DCX     B>              ;THIS IS FOR BILL.  C WILL NEVER BE ZERO
                                        24820                                   ; (THE MSB WILL ALWAYS BE ONE) SO "DCX  B"
                                        24840                                   ; AND "DCR      C" ARE FUNCTIONALLY EQUIVALENT
001444' 001000  000311                  24860           RET                     ;ALL DONE


                                        24920           ;GREATEST INTEGER FUNCTION
                                        24940           ;ALTERS A,B,C,D,E,M,L
                                        24960   IFE     LENGTH=2,<
                                        24980   INTFNC: CPI     4               ;SEE WHAT KIND OF NUMBER WE HAVE
                                        25000           RC                      ;IT IS AN INTEGER, ALL DONE
                                        25020           JNZ     DINT            ;CONVERT THE DOUBLE PRECISION NUMBER
                                        25040           CALL    CONIS>          ;TRY TO CONVERT THE NUMBER TO AN INTEGER
                                        25060                                   ;IF WE CAN'T, WE WILL RETURN HERE TO GIVE A
                                        25080                                   ; SINGLE PRECISION RESULT
001445' 001000  000041                  25100   INT:    LXI     H,FAC           ;GET EXPONENT
001446' 000000  001156*
001447' 000000  001432'
001450' 001000  000176                  25120           MOV     A,M
001451' 001000  000376                  25140           CPI     230             ;SEE IF NUMBER HAS ANY FRACTIONAL BITS
001452' 000000  000230
                                        25160   IFN     EXTFNC,<                ;THE ONLY GUY WHO NEEDS THIS DOESN'T CARE
001453' 001000  000072                  25180           LDA     FACLO>          ; ABOUT THE SIGN
001454' 000000  001255*
001455' 000000  001446'
001456' 001000  000320                  25200           RNC                     ;IT DOES NOT
                                        25220   IFN     EXTFNC,<
001457' 001000  000176                  25240           MOV     A,M>            ;GET EXPONENT BACK
001460' 001000  000315                  25260           CALL    QINT            ;IT DOES, SHIFT THEM OUT
001461' 000000  001372'
001462' 000000  001454'
001463' 001000  000066                  25280           MVI     M,230           ;CHANGE EXPONENT SO IT WILL BE CORRECT
001464' 000000  000230
                                        25300                                   ; AFTER NORMALIZATION
                                        25320   IFN     EXTFNC,<
001465' 001000  000173                  25340           MOV     A,E             ;GET LO
001466' 001000  000365                  25360           PUSH    PSW>            ;SAVE IT
001467' 001000  000171                  25380           MOV     A,C             ;NEGATE NUMBER IF IT IS NEGATIVE
001470' 001000  000027                  25400           RAL                     ;PUT SIGN IN CARRY
                                        25420   IFE     EXTFNC,<
                                        25440           JMP     FADFLT>         ;REFLOAT NUMBER
                                        25460   IFN     EXTFNC,<
001471' 001000  000315                  25480           CALL    FADFLT          ;REFLOAT NUMBER
```

```
1630  001472' 000000  000143'
1631  001473' 000000  001461'
1632  001474' 001000  000361          25500  POPPRT: POP     PSW             ;GET LO BACK
1633  001475' 001000  000311          25520          RET>                    ;ALL DONE
1634
1635
1636                                   25580  IFE     LENGTH=2,<
1637                                   25600         ;GREATEST INTEGER FUNCTION FOR DOUBLE PRECISION NUMBERS
1638                                   25620         ;ALTERS A,B,C,D,E,H,L
1639                                   25640  DINT:   LXI     H,FAC           ;GET POINTER TO FAC
1640                                   25660         MOV     A,M             ;GET EXPONENT
1641                                   25680         CPI     220             ;CAN WE CONVERT IT TO AN INTEGER?
1642                                   25700         JC      FRCINT          ;THEN DO SO
1643                                   25720         JNZ     DINT2           ;CHECK FOR -32768
1644                                   25740         MOV     C,A             ;SAVE EXPONENT IN C
1645                                   25760         DCX     H               ;GET POINTER TO SIGN AND MO
1646                                   25780         MOV     A,M             ;GET SIGN AND MO
1647                                   25800         XRI     200             ;CHECK IF IT IS 200
1648                                   25820         MVI     B,6             ;SET UP A COUNT TO CHECK IF THE REST OF
1649                                   25840  DINT1:  DCX     H               ; THE NUMBER IS ZERO, POINT TO NEXT BYTE
1650                                   25860         ORA     M               ;IF ANY BITS ARE NON-ZERO, A WILL BE NON-ZERO
1651                                   25880         DCR     B               ;ARE WE DONE?
1652                                   25900         JNZ     DINT1           ;NO, CHECK THE NEXT LOWER ORDER BYTE
1653                                   25920         ORA     A               ;IS A NOW ZERO?
1654                                   25940         LXI     H,200*400+$CODE ;GET -32768 JUST IN CASE
1655                                   25960         JZ      CONISS          ;A IS ZERO SO WE HAVE -32768
1656                                   25980         MOV     A,C             ;GET EXPONENT
1657                                   26000  DINT2:  CPI     270             ;ARE THERE ANY FRACTIONAL BITS?
1658                                   26020         RNC                     ;NO, THE NUMBER IS ALREADY AN INTEGER
1659                                   26040  DINTFO: PUSH    PSW             ;ENTRY FROM FOUT, CARRY IS ZERO IF WE COME
1660                                   26060                                 ; HERE FROM FOUT
1661                                   26080         CALL    MOVRF           ;GET HO'S OF NUMBER IN REGISTERS FOR UNPACKING
1662                                   26100         CALL    UNPACK          ;UNPACK IT
1663                                   26120         XRA     M               ;GET ITS SIGN BACK
1664                                   26140         DCX     H               ;SET THE EXPONENT TO NORMALIZE CORRECTLY
1665                                   26160         MVI     M,270
1666                                   26180         PUSH    PSW             ;SAVE THE SIGN
1667                                   26200         CM      DINTA           ;SUBTRACT 1 FROM LO IF NUMBER IS NEGATIVE
1668                                   26220         MVI     A,270           ;GET HOW MANY BITS WE HAVE TO SHIFT OUT
1669                                   26240         SUB     B
1670                                   26260         CALL    DSHFTR          ;SHIFT THEM OUT!!
1671                                   26280         POP     PSW             ;GET THE SIGN BACK
1672                                   26300         CM      DROUNA          ;IF NUMBER WAS NEGATIVE, ADD ONE
1673                                   26320         XRA     A               ;PUT A ZERO IN THE EXTRA LO BYTE SO WHEN
1674                                   26340         STA     DFACLO-1        ; WE NORMALIZE, WE WILL SHIFT IN ZEROS
1675                                   26360         POP     PSW             ;IF WE WERE CALLED FROM FOUT, DON'T NORMALIZE,
1676                                   26380         RNC                     ; JUST RETURN
1677                                   26400         JMP     DNORML          ;RE-FLOAT THE INTEGER
1678                                   26420
1679                                   26440  DINTA:  LXI     H,DFACLO        ;SUBTRACT ONE FROM FAC, GET POINTER TO LO
1680                                   26460  DINTA1: MOV     A,M             ;GET A BYTE OF FAC
1681                                   26480         DCR     M               ;SUBTRACT ONE FROM IT
1682                                   26500         ORA     A               ;CONTINUE ONLY IF THE BYTE USED TO BE ZERO
```



```
1683                                   26520         INX     H               ;INCREMENT POINTER TO NEXT BYTE
1684                                   26540         JZ      DINTA1          ;CONTINUE IF NECESSARY
1685                                   26560         RET>                    ;ALL DONE
1686                                   26580  PAGE
```

```
                                        26600   SUBTTL  INTEGER ARITHMETIC ROUTINES
                                        26620   IFN     MULDIM&<LENGTH-2>,<
                                        26640           ;TWO BYTE UNSIGNED INTEGER MULTIPLY
                                        26660           ; (HL):=(BC)*(DE)
                                        26680           ;A,D,E,H,L ARE CHANGED
001476' 001000  000041                  26700   DMULT:  LXI     H,$CODE         ;ZERO PRODUCT REGISTERS
001477' 000000  001153*
001500' 000000  001472'
001501' 001000  000170                  26720           MOV     A,B             ;CHECK IF (BC) IS ZERO
001502' 001000  000261                  26740           ORA     C               ;IF SO, JUST RETURN, (HL) IS ALREADY ZERO
001503' 001000  000310                  26760           RZ                      ;THIS IS DONE FOR SPEED
001504' 001000  000076                  26780           MVI     A,20            ;SET UP A COUNT
001505' 000000  000020
001506' 001000  000051                  26800   DMULT1: DAD     H               ;ROTATE (HL) LEFT ONE
001507' 001000  000332                  26820           JC      BSERR##         ;CHECK FOR OVERFLOW, IF SO,
001510' 000000  000000*
001511' 000000  001477'
001512' 001000  000353                  26840           XCHG                    ; BAD SUBSCRIPT (BS) ERROR
001513' 001000  000051                  26860           DAD     H               ;ROTATE (DE) LEFT ONE
001514' 001000  000353                  26880           XCHG
001515' 001000  000322                  26900           JNC     DMULT2          ;ADD IN (BC) IF HO WAS 1
001516' 000000  001524'
001517' 000000  001510'
001520' 001000  000011                  26920           DAD     B
001521' 001000  000332                  26940           JC      BSERR           ;CHECK FOR OVERFLOW
001522' 000000  001510*
001523' 000000  001516'
001524' 001000  000075                  26960   DMULT2: DCR     A               ;SEE IF DONE
001525' 001000  000302                  26980           JNZ     DMULT1
001526' 000000  001506'
001527' 000000  001522'
001530' 001000  000311                  27000           RET>                    ;ALL DONE
                                        27060   IFE     LENGTH-2,<
                                        27080   COMMENT %
                                        27100           INTEGER ARITHMETIC CONVENTIONS
                                        27140   INTEGER VARIABLES ARE 2 BYTE, SIGNED NUMBERS
                                        27160           THE LO BYTE COMES FIRST IN MEMORY
                                        27200   CALLING CONVENTIONS:
                                        27220   FOR ONE ARGUMENT FUNCTIONS:
                                        27240           THE ARGUMENT IS IN (HL), THE RESULT IS LEFT IN (HL)
                                        27260   FOR TWO ARGUMENT OPERATIONS:
                                        27280           THE FIRST ARGUMENT IS IN (DE)
                                        27300           THE SECOND ARGUMENT IS IN (HL)
                                        27320           THE RESULT IS LEFT IN (HL)
                                        27340   IF OVERFLOW OCCURS, THE ARGUMENTS ARE CONVERTED TO SINGLE PRECISION
                                        27360   WHEN INTEGERS ARE STORED IN THE FAC, THEY ARE STORED AT FACLO+0,1
                                        27380   VALTYP(INTEGER)=2
                                        27400   %
```



```
                                        27440
                                        27460           ;INTEGER SUBTRTACTION   (HL):=(DE)-(HL)
                                        27480           ;ALTERS A,B,C,D,E,H,L
                                        27500   ISUB:   MOV     A,H             ;EXTEND THE SIGN OF (HL) TO B
                                        27520           RAL                     ;GET SIGN IN CARRY
                                        27540           SBB     A
                                        27560           MOV     B,A
                                        27580           CALL    INEGHL          ;NEGATE (HL)
                                        27600           MOV     A,C             ;GET A ZERO
                                        27620           SBB     B               ;NEGATE SIGN
                                        27640           JMP     IADDS           ;GO ADD THE NUMBERS
                                        27660
                                        27680
                                        27700           ;INTEGER ADDITION       (HL):=(DE)+(HL)
                                        27720           ;ALTERS A,B,C,D,E,H,L
                                        27740   IADD:   MOV     A,H             ;EXTEND THE SIGN OF (HL) TO B
                                        27760           RAL                     ;GET SIGN IN CARRY
                                        27780           SBB     A
                                        27800   IADDS:  MOV     B,A             ;SAVE THE SIGN
                                        27820           PUSH    H               ;SAVE THE SECOND ARGUMENT IN CASE OF OVERFLOW
                                        27840           MOV     A,D             ;EXTEND THE SIGN OF (DE) TO A
                                        27860           RAL                     ;GET SIGN IN CARRY
                                        27880           SBB     A
                                        27900           DAD     D               ;ADD THE TWO LO'S
                                        27920           ADC     B               ;ADD THE EXTRA HO
                                        27940           RRC                     ;IF THE LSB OF A IS DIFFERENT FROM THE MSB OF
                                        27960           XRA     H               ; H, THEN OVERFLOW OCCURED
                                        27980           JP      POPPRT          ;NO OVERFLOW, GET OLD (HL) OFF STACK AND WE
                                        28000                                   ; ARE DONE
                                        28020           PUSH    B               ;OVERFLOW -- SAVE EXTENDED SIGN OF (HL)
                                        28040           XCHG                    ;GET (DE) IN (HL)
                                        28060           CALL    CONSIM          ;FLOAT IT
                                        28080           POP     PSW             ;GET SIGN OF (HL) IN A
                                        28100           POP     H               ;GET OLD (HL) BACK
                                        28120           CALL    PUSHF           ;PUT FIRST ARGUMENT ON STACK
                                        28140           XCHG                    ;PUT SECOND ARGUMENT IN (DE) FOR FLOATR
                                        28160           CALL    INEGAD          ;FLOAT IT
                                        28180           POPR                    ;GET FIRST ARGUMENT OFF STACK
                                        28200           JMP     FADD            ;ADD THE TWO NUMBERS USING SINGLE PRECISION
                                        28220
                                        28240
                                        28260           ;INTEGER MULTIPLICATION         (HL):=(DE)*(HL)
                                        28280           ;ALTERS A,B,C,D,E,H,L
                                        28300   IMULT:  PUSH    H               ;SAVE SECOND ARGUMENT IN CASE OF OVERFLOW
                                        28320           PUSH    D               ;SAVE FIRST ARGUMENT
                                        28340           CALL    IMULDV          ;FIX UP THE SIGNS
                                        28360           PUSH    B               ;SAVE THE SIGN OF THE RESULT
                                        28380           MOV     B,H             ;COPY SECOND ARGUMENT INTO (BC)
                                        28400           MOV     C,L
                                        28420           LXI     H,$CODE         ;ZERO (HL), THAT IS WHERE THE PRODUCT GOES
                                        28440           MVI     A,20            ;SET UP A COUNT
                                        28460   IMULT1: DAD     H               ;ROTATE PRODUCT LEFT ONE
                                        28480           JC      IMULTS          ;CHECK FOR OVERLFOW
```

```
28500          XCHG                    ;ROTATE FIRST ARGUMENT LEFT ONE TO SEE IF
28520          DAD     H               ; WE ADD IN (BC) OR NOT
28540          XCHG
28560          JNC     IMULT2          ;DON'T ADD IN ANYTHING
28580          DAD     B               ;ADD IN (BC)
28600          JC      IMULT5          ;CHECK FOR OVERLFOW
28620  IMULT2: DCR     A               ;ARE WE DONE?
28640          JNZ     IMULT1          ;NO, DO IT AGAIN
28660          POP     B               ;WE ARE DONE, GET SIGN OF RESULT
28680          POP     D               ;GET ORIGINAL FIRST ARGUMENT
28700  IMLDIV: MOV     A,H             ;ENTRY FROM IDIV, IS RESULT .GE. 32768?
28720          ORA     A
28740          JM      IMULT3          ;IT IS, CHECK FOR SPECIAL CASE OF -32768
28760          POP     D               ;RESULT IS OK, GET SECOND ARGUMENT OFF STACK
28780          MOV     A,B             ;GET THE SIGN OF RESULT IN A
28800          JMP     INEGA           ;NEGATE THE RESULT IF NECESSARY
28820  IMULT3: XRI     200             ;IS RESULT 32768?
28840          ORA     L               ;NOTE: IF WE GET HERE FROM IDIV, THE RESULT
28860          JZ      IMULT4          ; MUST BE 32768, IT CANNOT BE GREATER
28880          XCHG                    ;IT IS .GT. 32768, WE HAVE OVERFLOW
28900          XWD     1000,001        ;"LXI   B" OVER NEXT 2 BYTES
28920  IMULT5: POP     B               ;GET SIGN OF RESULT OFF STACK
28940          POP     H               ;GET THE ORIGINAL FIRST ARGUMENT
28960          CALL    CONSIM          ;FLOAT IT
28980          POP     H               ;GET THE ORIGINAL SECOND ARGUMENT
29000          CALL    PUSHF           ;SAVE FLOATED FIRST ARUMENT
29020          CALL    CONSIM          ;FLOAT SECOND ARGUMENT
29040  FMULT1: POPR                    ;GET FIRST ARGUMENT OFF STACK, ENTRY FROM POLYX

29060          JMP     FMULT           ;MULTIPLY THE ARGUMENTS USING SINGLE PRECISION
29080  IMULT4: MOV     A,B             ;IS RESULT +32768 OR -32768?
29100          ORA     A               ;GET ITS SIGN
29120          POP     B               ;DISCARD ORIGINAL SECOND ARGUMENT
29140          RM                      ;THE RESULT SHOULD BE NEGATIVE, IT IS OK
29160          PUSH    D               ;IT IS POSITIVE, SAVE REMAINDER FOR MOD
29180          CALL    CONSIM          ;FLOAT -32768
29200          POP     D               ;GET MOD'S REMAINDER BACK
29220          JMP     NEG             ;NEGATE -32768 TO GET 32768, WE ARE DONE
29240
29260
29280          ;INTEGER DIVISION       (HL):=(DE)/(HL)
29300          ;REMAINDER IS IN (DE), QUOTIENT IN (HL)
29320          ;ALTERS A,B,C,D,E,H,L
29340  IDIV:   MOV     A,H             ;CHECK FOR DIVISION BY ZERO
29360          ORA     L
29380          JZ      DV0ERR          ;WE HAVE DIVISION BY ZERO!!
29400          CALL    IMULDV          ;FIX UP THE SIGNS
29420          PUSH    B               ;SAVE THE SIGN OF THE RESULT
29440          XCHG                    ;GET DENOMINATOR IN (HL)
29460          CALL    INEGHL          ;NEGATE IT
29480          MOV     B,H             ;SAVE NEGATED DENOMINATOR IN (BC)
29500          MOV     C,L
29520          LXI     H,$CODE         ;ZERO WHERE WE DO THE SUBTRACTION
```



```
29540          MVI     A,21            ;SET UP A COUNT
29560          PUSH    PSW             ;SAVE IT
29580          ORA     A               ;CLEAR CARRY
29600          JMP     IDIV3           ;GO DIVIDE
29620  IDIV1:  PUSH    PSW             ;SAVE COUNT
29640          PUSH    H               ;SAVE (HL) I.E. CURRENT NUMERATOR
29660          DAD     B               ;SUBTRACT DENOMINATOR
29680          JNC     IDIV2           ;WE SUBTRACTED TOO MUCH, GET OLD (HL) BACK
29700          POP     PSW             ;THE SUBTRACTION WAS GOOD, DISCARD OLD (HL)
29720          STC                     ;NEXT BIT IN QUOTIENT IS A ONE
29740          XWD     1000,076        ;"MVI   A" OVER NEXT BYTE
29760  IDIV2:  POP     H               ;IGNORE THE SUBTRACTION, WE COULDN'T DO IT
29780  IDIV3:  MOV     A,E             ;SHIFT IN THE NEXT QUOTIENT BIT
29800          RAL
29820          MOV     E,A
29840          MOV     A,D             ;SHIFT THE HO
29860          RAL
29880          MOV     D,A
29900          MOV     A,L             ;SHIFT IN THE NEXT BIT OF THE NUMERATOR
29920          RAL
29940          MOV     L,A
29960          MOV     A,H             ;DO THE HO
29980          RAL
30000          MOV     H,A             ;SAVE THE HO
30020          POP     PSW             ;GET COUNT BACK
30040          DCR     A               ;ARE WE DONE?
30060          JNZ     IDIV1           ;NO, DIVIDE AGAIN
30080          XCHG                    ;GET QUOTIENT IN (HL), REMAINDER IN (DE)
30100          POP     B               ;GET SIGN OF RESULT
30120          PUSH    D               ;SAVE REMAINDER SO STACK WILL BE ALRIGHT
30140          JMP     IMLDIV          ;CHECK FOR SPECIAL CASE OF 32768
30160
30180
30200          ;GET READY TO MULTIPLY OR DIVIDE
30220          ;ALTERS A,B,C,D,E,H,L
30240  IMULDV: MOV     A,H             ;GET SIGN OF RESULT
30260          XRA     D
30280          MOV     B,A             ;SAVE IT IN B
30300          CALL    INEGH           ;NEGATE SECOND ARGUMENT IF NECESARY
30320          XCHG                    ;PUT (DE) IN (HL), FALL IN AND NEGATE FIRST
30340                                  ; ARGUMENT IF NECESSARY
30360
30380
30400          ;NEGATE H,L
30420          ;ALTERS A,C,H,L
30440  INEGH:  MOV     A,H             ;GET SIGN OF (HL)
30460  INEGA:  ORA     A               ;SET CONDITION CODES
30480          RP                      ;WE DON'T HAVE TO NEGATE, IT IS POSITIVE
30500  INEGHL: XRA     A               ;CLEAR A
30520          MOV     C,A             ;STORE A ZERO (WE USE THIS METHOD FOR ISUB)
30540          SUB     L               ;NEGATE LO
30560          MOV     L,A             ;SAVE IT
30580          MOV     A,C             ;GET A ZERO BACK
```

```
1899                    30600           SBB     H               ;NEGATE MO
1900                    30620           MOV     H,A             ;SAVE IT
1901                    30640           RET                     ;ALL DONE
1902                    30660
1903                    30680
1904                    30700           ;INTEGER ABSOLUTE VALUE
1905                    30720           ;ALTERS A,B,C,D,E,H,L
1906                    30740   IABS:   LDA     FACLO+1         ;GET SIGN OF INTEGER IN FAC
1907                    30760           ORA     A               ;CHECK ITS SIGN
1908                    30780           RP                      ;IT IS POSITIVE, LEAVE IT ALONE
1909                    30800                                   ;FALL INTO INEG AND NEGATE IT
1910                    30820
1911                    30840
1912                    30860           ;INTEGER NEGATION
1913                    30880           ;ALTERS A,B,C,D,E,H,L
1914                    30900   INEG:   LHLD    FACLO           ;GET THE INTEGER
1915                    30920           CALL    INEGHL          ;NEGATE IT
1916                    30940           SHLD    FACLO           ;STORE IT BACK IN THE FAC
1917                    30960           XRI     200             ;CHECK FOR SPECIAL CASE OF 32768
1918                    30980           ORA     L
1919                    31000           RNZ                     ;IT DID NOT OCCUR, EVERYTHING IS FINE
1920                    31020           XCHG                    ;WE HAVE IT, FLOAT 32768
1921                    31040           MVI     A,4             ;CHANGE VALTYP TO "SINGLE PRECISION"
1922                    31060           STA     VALTYP
1923                    31080   INEGAD: MVI     B,230           ;ENTRY FROM IADD, SET EXPONENT
1924                    31100           JMP     FLOATR          ;GO FLOAT THE NUMBER
1925                    31120
1926                    31140
1927                    31160           ;MOD OPERATOR
1928                    31180           ;(ML):=(DE)-(DE)/(ML)*(ML),  (DE)=QUOTIENT
1929                    31200           ;ALTERS A,B,C,D,E,H,L
1930                    31220   MOD:    PUSH    D               ;SAVE (DE) FOR ITS SIGN
1931                    31240           CALL    IDIV            ;DIVIDE AND GET THE REMAINDER
1932                    31260           XCHG                    ;PUT REMAINDER IN (DE)
1933                    31280           MVI     A,2             ;SET VALTYP TO "INTEGER" IN CASE RESULT OF
1934                    31300           STA     VALTYP          ; THE DIVISION WAS 32768
1935                    31320           POP     PSW             ;GET THE SIGN OF (DE) BACK
1936                    31340           JMP     INEGA>          ;NEGATE THE REMAINDER IF NECESSARY
1937                    31360   PAGE
```



```
1938                    31380   SUBTTL  DOUBLE PRECISION ARITHMETIC ROUTINES
1939                    31400   IFE     LENGTH-2,<
1940                    31420   COMMENT %
1941                    31440           DOUBLE PRECISION ARITHMETIC CONVENTIONS
1942                    31460
1943                    31480   DOUBLE PRECISION NUMBERS ARE 8 BYTE QUANTITIES
1944                    31500   THE LAST 4 BYTES IN MEMORY ARE IN THE SAME FORMAT AS SINGLE PRECISION NUMBERS
1945                    31520   THE FIRST 4 BYTES ARE 32 MORE LOW ORDER BITS OF PRECISION
1946                    31540   THE LOWEST ORDER BYTE COMES FIRST IN MEMORY
1947                    31560
1948                    31580   CALLING CONVENTIONS:
1949                    31600   FOR ONE ARGUMENT FUNCTIONS:
1950                    31620           THE ARGUMENT IS IN THE FAC, THE RESULT IS LEFT IN THE FAC
1951                    31640   FOR TWO ARGUMENT OPERATIONS:
1952                    31660           THE FIRST ARGUMENT IS IN ARG-7,6,5,4,3,2,1,0  (NOTE: ARGLO=ARG-7)
1953                    31680           THE SECOND ARGUMENT IS IN THE FAC
1954                    31700           THE RESULT IS LEFT IN THE FAC
1955                    31720   VALTYP(DOUBLE PRECISION)=10 OCTAL
1956                    31740   %
1957                    31760
1958                    31780
1959                    31800           ;DOUBLE PRECISION SUBTRACTION   FAC:=ARG-FAC
1960                    31820           ;ALTERS ALL REGISTERS
1961                    31840   DSUB:   CALL    NEG             ;NEGATE THE SECOND ARGUMENT
1962                    31860                                   ;FALL INTO DADD
1963                    31880
1964                    31900
1965                    31920           ;DOUBLE PRECISION ADDITION      FAC:=ARG+FAC
1966                    31940           ;ALTERS ALL REGISTERS
1967                    31960   DADD:   LXI     H,ARG           ;GET  POINTER TO EXPONENT OF FIRST ARGUMENT
1968                    31980           MOV     A,M             ;CHECK IF IT IS ZERO
1969                    32000           ORA     A
1970                    32020           RZ                      ;IT IS, RESULT IS ALREADY IN FAC
1971                    32040           MOV     B,A             ;SAVE EXPONENT FOR UNPACKING
1972                    32060           DCX     H               ;POINT TO MO AND SIGN
1973                    32080           MOV     C,M             ;GET MO AND SIGN FOR UNPACKING
1974                    32100           LXI     D,FAC           ;GET POINTER TO EXPONENT OF SECOND ARGUMENT
1975                    32120           LDAX    D               ;GET EXPONENT
1976                    32140           ORA     A               ;SEE IF IT IS ZERO
1977                    32160           JZ      VMOVFA          ;IT IS, MOVE ARG TO FAC AND WE ARE DONE
1978                    32180           SUB     B               ;SUBTRACT EXPONENTS TO GET SHIFT COUNT
1979                    32200           JNC     DADD2           ;PUT THE SMALLER NUMBER IN FAC
1980                    32220           CMA                     ;NEGATE SHIFT COUNT
1981                    32240           INR     A
1982                    32260           PUSH    PSW             ;SAVE SHIFT COUNT
1983                    32280           PUSH    B               ;SAVE MO TO UNPACK LATER
1984                    32300           MVI     C,10            ;SWITCH FAC AND ARG, SET UP A COUNT
1985                    32320           INX     H               ;POINT TO ARG
1986                    32340   DADD1:  LDAX    D               ;GET A BYTE OF THE FAC
1987                    32360           MOV     B,M             ;GET A BYTE OF ARG
1988                    32380           MOV     M,A             ;PUT THE FAC BYTE IN ARG
1989                    32400           MOV     A,B             ;PUT THE ARG BYTE IN A
1990                    32420           STAX    D               ;PUT THE ARG BYTE IN FAC
```

```
32440            DCX     D              ;POINT TO THE NEXT LO BYTE OF FAC
32460            DCX     H              ;POINT TO THE NEXT LO BYTE OF ARG
32480            DCR     C              ;ARE WE DONE?
32500            JNZ     DADD1          ;NO, DO THE NEXT LO BYTE
32520            POP     B              ;GET THE HO BACK
32540            POP     PSW            ;GET THE SHIFT COUNT BACK
32560   DADD2:   CPI     71             ;ARE WE WITHIN 56 BITS?
32580            RNC                    ;NO, ALL DONE
32600            PUSH    PSW            ;SAVE SHIFT COUNT
32620            CALL    UNPACK         ;UNPACK THE NUMBERS
32640            MOV     B,A            ;SAVE SUBTRACTION FLAG
32660            MOV     A,C            ;SAVE THE UNPACKED HO
32680            STA     ARG+1
32700            POP     PSW            ;GET SHIFT COUNT
32720            CALL    DSHFTR         ;SHIFT FAC RIGHT THE RIGHT NUMBER OF TIMES
32740            ORA     B              ;GET SUBTRACTION FLAG, HERE A=0
32760            JP      DADD3          ;SUBTRACT NUMBERS IF THEIR SIGNS ARE DIFFERENT
32780            CALL    DADDAA         ;SIGNS ARE THE SAME, ADD THE NUMBERS
32800            JNC     DROUND         ;ROUND THE RESULT IF NO CARRY
32820            INR     M              ;WE HAVE OVERFLOW, ADD ONE TO THE EXPONENT
32840            JZ      OVERR          ;CHECK FOR OVERFLOW
32860            MVI     D,1            ;SHIFT NUMBER RIGHT ONE, SHIFT IN CARRY
32880            CALL    DSHFRA
32900            JMP     DROUND         ;ROUND THE RESULT
32920   DADD3:   XRD     1000,076       ;"MVI  A", SUBTRACT THE NUMBERS
32940            SBB     M              ;GET THE SUBTRACT INSTRUCTION IN A
32960            CALL    DADDA          ;SUBTRACT THE NUMBERS
32980            INX     M              ;POINT TO THE UNPACKED SIGN
33000            MOV     A,M            ;COMPLEMENT IT, SINCE THE FAC WAS SMALLER
33020            CMA
33040            MOV     M,A
33060            CC      DNEGR          ;NEGATE THE RESULT IF IT WAS NEATIVE
33080                                   ;FALL INTO DNORML
33100
33120
33140            ;NORMALIZE FAC
33160            ;ALTERS A,B,C,D,H,L
33180   DNORML:  XRA     A              ;CLEAR SHIFT COUNT
33200   DNORM1:  MOV     B,A            ;SAVE SHIFT COUNT
33220            LDA     FAC+1          ;GET HO
33240            ORA     A              ;SEE IF WE CAN SHIFT 8 LEFT
33260            JNZ     DNORM5         ;WE CAN'T, SEE IF NUMBER IS NORMALIZED
33280            LXI     H,DFACLO+1     ;WE CAN, GET POINTER TO LO
33300            MVI     C,10           ;SET UP A COUNT
33320   DNORM2:  MOV     D,M            ;GET A BYTE OF FAC
33340            MOV     M,A            ;PUT IN BYTE FROM LAST LOCATION, THE FIRST
33360                                   ; TIME THROUGH A IS ZERO
33380            MOV     A,D            ;PUT THE CURRENT BYTE IN A FOR NEXT TIME
33400            INX     H              ;INCREMENT POINTER TO NEXT HIGHER ORDER
33420            DCR     C              ;ARE WE DONE?
33440            JNZ     DNORM2         ;NO, DO THE NEXT BYTE
33460            MOV     A,B            ;SUBTRACT 8 FROM SHIFT COUNT
33480            SUI     10
```



```
33500            CPI     300            ;HAVE WE SHIFTED ALL BYTES TO ZERO?
33520            JNZ     DNORM1         ;NO, TRY TO SHIFT 8 MORE
33540            JMP     ZERO           ;YES, THE NUMBER IS ZERO
33560   DNORM3:  DCR     B              ;DECREMENT SHIFT COUNT
33580            LXI     H,DFACLO+1     ;GET POINTER TO LO
33600            CALL    DSHFLC         ;SHIFT THE FAC LEFT
33620            ORA     A              ;SEE IF NUMBER IS NORMALIZED
33640   DNORM5:  JP      DNORM3         ;SHIFT FAC LEFT ONE IF IT IS NOT NORMALIZED
33660            MOV     A,B            ;GET THE SHIFT COUNT
33680            ORA     A              ;SEE IF NO SHIFTING WAS DONE
33700            JZ      DROUND         ;NONE WAS, PROCEED TO ROUND THE NUMBER
33720            LXI     H,FAC          ;GET POINTER TO EXPONENT
33740            ADD     M              ;UPDATE IT
33760            MOV     M,A            ;SAVE UPDATED EXPONENT
33780            JNC     ZERO           ;UNDERFLOW, THE RESULT IS ZERO
33800            RZ                     ;RESULT IS ALREADY ZERO, WE ARE DONE
33820                                   ;FALL INTO DROUND AND ROUND THE RESULT
33840
33860
33880            ;ROUND FAC
33900            ;ALTERS A,B,H,L
33920   DROUND:  LDA     DFACLO+1       ;GET EXTRA BYTE TO SEE IF WE HAVE TO ROUND
33940   DROUNB:  ORA     A              ;ENTRY FROM DDIV
33960            CM      DROUNA         ;ROUND UP IF NECESSARY
33980            LXI     H,FAC+1        ;GET POINTER TO UNPACKED SIGN
34000            MOV     A,M            ;GET SIGN
34020            ANI     200            ;ISOLATE SIGN BIT
34040            DCX     H              ;POINT TO HO
34060            DCX     H
34080            XRA     M              ;PACK SIGN AND HO
34100            MOV     M,A            ;PUT PACKED SIGN AND HO IN FAC
34120            RET                    ;WE ARE DONE
34140
34160
34180            ;SUBROUTINE FOR ROUND: ADD ONE TO FAC
34200   DROUNA:  LXI     H,DFACLO       ;GET POINTER TO LO, ENTRY FROM DINT
34220            MVI     B,7            ;SET UP A COUNT
34240   DROUNA1: INR     M              ;INCREMENT A BYTE
34260            RNZ                    ;RETURN IF THERE WAS NO CARRY
34280            INX     H              ;INCREMENT POINTER TO NEXT HIGHER ORDER
34300            DCR     B              ;HAVE WE INCREMENTED ALL BYTES
34320            JNZ     DROUNA1        ;NO, TRY THE NEXT ONE
34340            INR     M              ;YES, INCREMENT THE EXPONENT
34360            JZ      OVERR          ;CHECK FOR OVERFLOW
34380            DCX     H              ;THE NUMBER OVERFLOWED ITS EXPONENT
34400            MVI     M,200          ;PUT 200 IN HO
34420            RET                    ;ALL DONE
34440
34460
34480            ;ADD OR SUBTRACT 2 DBL QUANTITIES
34500            ;ALTERS A,C,D,E,H,L
34520   DADDD:   LXI     H,FBUFFR+^D17  ;ENTRY FROM DDIV
34540            LXI     D,ARGLO        ;ADD OR SUBTRACT FBUFFR+17 AND ARG
```

```
34560            JMP     DADDS           ;DO THE OPERATION
34580
34600   DADDAA: XWD     1000,076        ;"MVI   A", ENTRY FROM DADD, DMULT
34620            ADC     M               ;SETUP ADD INSTRUCTION FOR LOOP
34640   DADDA:  LXI     H,ARGLO         ;GET POINTER TO ARG, ENTRY FROM DADD
34660   DADDFO: LXI     D,DFACLO        ;GET POINTER TO FAC, ENTRY FROM FOUT
34680   DADDS:  MVI     C,7             ;SET UP A COUNT
34700            STA     DADDOP          ;STORE THE ADD OR SUBTRACT INSTRUCTION
34720            XRA     A               ;CLEAR CARRY
34740   DADDL:  LDAX    D               ;GET A BYTE FROM RESULT NUMBER
34760   DADDOP: NOP                     ;THIS IS EITHER "ADC     M" OR "SBB       M"
34780            STAX    D               ;SAVE THE CHANGED BYTE
34800            INX     D               ;INCREMENT POINTERS TO NEXT HIGHER ORDER BYTE
34820            INX     H
34840            DCR     C               ;ARE WE DONE?
34860            JNZ     DADDL           ;NO, DO THE NEXT HIGHER ORDER BYTE
34880            RET                     ;ALL DONE
34900
34920
34940            ;NEGATE SIGNED NUMBER IN FAC
34960            ;THIS IS USED BY DADD, DINT
34980            ;ALTERS A,B,C,H,L
35000   DNEGR:  MOV     A,M             ;COMPLEMENT SIGN OF FAC
35020            CMA                     ;USE THE UNPACKED SIGN BYTE
35040            MOV     M,A             ;SAVE THE NEW SIGN
35060            LXI     H,DFACLO-1      ;GET POINTER TO LO
35080            MVI     B,10            ;SET UP A COUNT
35100            XRA     A               ;CLEAR CARRY AND GET A ZERO
35120            MOV     C,A             ;SAVE ZERO IN C
35140   DNEGR1: MOV     A,C             ;GET A ZERO
35160            SBB     M               ;NEGATE THE BYTE OF FAC
35180            MOV     M,A             ;UPDATE FAC
35200            INX     H               ;INCREMENT POINTER TO NEXT HIGHER ORDER BYTE
35220            DCR     B               ;ARE WE DONE?
35240            JNZ     DNEGR1          ;NO, NEGATE THE NEXT BYTE
35260            RET                     ;ALL DONE
35280
35300
35320            ;SHIFT DBL FAC RIGHT ONE
35340            ;A = SHIFT COUNT
35360            ;ALTERS A,C,D,E,H,L
35380   DSHFTR: LXI     H,DFACLO-1      ;GET POINTER TO LO
35400            MVI     M,0             ;PUT ZERO IN EXTRA LO ORDER BYTE
35420   DSHFR1: SUI     10              ;SEE IF WE CAN SHIFT 8 RIGHT
35440            JC      DSHFR3          ;WE CAN'T, CHECK IF WE ARE DONE
35460   DSHFRM: LXI     H,FAC-1         ;ENTRY FROM DMULT, GET POINTER TO HO
35480            MVI     E,0             ;SHIFT A ZERO INTO THE HO
35500            MVI     D,10            ;SET UP A COUNT
35520   DSHFR2: MOV     C,M             ;SAVE A BYTE OF FAC
35540            MOV     M,E             ;PUT THE LAST BYTE IN ITS PLACE
35560            MOV     E,C             ;SET UP E FOR NEXT TIME THROUGH THE LOOP
35580            DCX     H               ;POINT TO NEXT LOWER ORDER BYTE
35600            DCR     D               ;ARE WE DONE?
```



```
35620            JNZ     DSHFR2          ;NO, DO THE NEXT BYTE
35640            JMP     DSHFR1          ;YES, SEE IF WE CAN SHIFT OVER 8 MORE
35660   DSHFR3: ADI     11              ;CORRECT SHIFT COUNT
35680            MOV     D,A             ;SAVE SHIFT COUNT IN D
35700   DSHFR4: XRA     A               ;CLEAR CARRY
35720            DCR     D               ;ARE WE DONE?
35740            RZ                      ;YES
35760   DSHFRA: LXI     H,FAC-1         ;NO, GET POINTER TO LO, ENTRY FROM DADD, DMULT
35780            MVI     E,10            ;SET UP A COUNT, ROTATE FAC ONE LEFT
35800   DSHFR5: MOV     A,M             ;GET A BYTE OF THE FAC
35820            RAR                     ;ROTATE IT LEFT
35840            MOV     M,A             ;PUT THE UPDATED BYTE BACK
35860            DCX     H               ;DECREMENT POINTER TO NEXT LOWER ORDER BYTE
35880            DCR     E               ;ARE WE DONE?
35900            JNZ     DSHFR5          ;NO, ROTATE THE NEXT LOWER ORDER BYTE
35920            JMP     DSHFR4          ;YES, SEE IF WE ARE DONE SHIFTING
35940
35960
35980            ;ROTATE FAC LEFT ONE
36000            ;ALTERS A,C,H,L
36020   DSHFLC: MVI     C,10            ;SET UP A COUNT
36040   DSHFTL: MOV     A,M             ;GET A BYTE OF FAC
36060            RAL                     ;ROTATE IT LEFT ONE
36080            MOV     M,A             ;UPDATE BYTE IN FAC
36100            INX     H               ;INCREMENT POINTER TO NEXT HIGHER ORDER BYTE
36120            DCR     C               ;ARE WE DONE?
36140            JNZ     DSHFTL          ;NO, ROTATE THE NEXT BYTE
36160            RET                     ;ALL DONE
36180
36200
36220            ;DOUBLE PRECISION MULTIPLICATION        FAC:=ARG*FAC
36240            ;ALTERS ALL REGISTERS
36260   DMULT:  FSIGN                   ;CHECK IF WE ARE MULTIPLYING BY ZERO
36280            RZ                      ;YES, ALL DONE, THE FAC IS ZERO
36300            CALL    MULDVA          ;ADD EXPONENTS AND TAKE CARE OF SIGNS
36320            CALL    DMULDV          ;ZERO FAC AND PUT FAC IN FBUFFR
36340            MOV     M,C             ;PUT UNPACKED HO IN ARG
36360            LXI     D,ARGLO         ;GET POINTER TO LO OF ARG
36380            MVI     B,7             ;SET UP A COUNT
36400   DMULT2: LDAX    D               ;GET THE BYTE OF ARG TO MULTIPLY BY
36420            INX     D               ;INCREMENT POINTER TO NEXT HIGHER BYTE
36440            ORA     A               ;CHECK IF WE ARE MULTIPLYING BY ZERO
36460            PUSH    D               ;SAVE POINTER TO ARG
36480            JZ      DMULT5          ;WE ARE
36500            MVI     C,10            ;SET UP A COUNT
36520   DMULT3: PUSH    B               ;SAVE COUNTERS
36540            RAR                     ;ROTATE MULTIPLIER RIGHT
36560            MOV     B,A             ;SAVE IT
36580            CC      DADDAA          ;ADD IN OLD FAC IF BIT OF MULTIPIER WAS ONE
36600            MVI     D,1             ;ROTATE PRODUCT RIGHT ONE
36620            CALL    DSHFRA
36640            MOV     A,B             ;GET MULTIPLIER IN A
36660            POP     B               ;GET COUNTERS BACK
```

```
36680           DCR     C               ;ARE WE DONE WITH THIS BYTE OF ARG?
36700           JNZ     DMULT3          ;NO, MULTIPLY BY THE NEXT BIT OF THE MULTIPLIER

36720   DMULT4: POP     D               ;YES, GET POINTER INTO ARG BACK
36740           DCR     B               ;ARE WE DONE?
36760           JNZ     DMULT2          ;NO, MULTIPLY BY NEXT HIGHER ORDER BY OF ARG
36780           JMP     NORMAL          ;ALL DONE, NORMALIZE AND ROUND RESULT
36800   DMULT5: CALL    DSHFRM          ;SHIFT PRODUCT RIGHT ONE BYTE, WE ARE
36820           JMP     DMULT4          ; MULTIPLYIING BY ZERO
36840
36860
36880           ;CONSTANT FOR DIV10, DDIV10
36900   DTEN:   000     ; 1000
36920           000
36940           000
36960           000
36980   FTEN:   000     ; 10,0
37000           000
37020           040
37040           204
37060
37080           ;DOUBLE PRECISION DIVIDE FAC BY 10
37100           ;ALTERS ALL REGISTERS
37120   DDIV10: CALL    VMOVAF          ;SAVE THE FAC IN ARG
37140           LXI     H,DTEN          ;GET POINTER TO A DOUBLE PRECISION 10
37160           CALL    VMOVFM          ;MOVE TEN INTO THE FAC
37180                                   ;FALL INTO DDIV AND DIVIDE BY TEN
37200
37220
37240           ;DOUBLE PRECISION DIVISION      FAC:=ARG/FAC
37260           ;ALTERS ALL REGISTERS
37280   DDIV:   FSIGN                   ;CHECK FOR DIVISION BY ZERO
37300           JZ      DV0ERR          ;DON'T LET HIM DO IT
37320           CALL    MULDVS          ;SUBTRACT EXPONENTS AND CHECK SIGNS
37340           INR     M               ;ADD TWO TO EXPONENT TO CORRECT SCALING
37360           INR     M
37380           CALL    DMULDV          ;ZERO FAC AND PUT FAC IN FBUFFR
37400           LXI     H,ARG           ;GET POINTER TO THE EXTRA HO BYTE WE WILL USE
37420           MOV     M,C             ;ZERO IT
37440           MVI     B,0             ;ZERO FLAG TO SEE WHEN WE START DIVIDING
37460   DDIV1:  XWD     1000,076        ;"MVI   A", SUBTRACT FBUFFR FROM ARG
37480           SBB     M               ;GET SUBTRACT INSTRUCTION
37500           CALL    DADDD           ;DO THE SUBTRACTION
37520           LDAX    D               ;SUBTRACT FROM EXTRA HO BYTE
37540           SBB     C               ;HERE C=0
37560           CMC                     ;CARRY=1 IF SUBTRACTION WAS GOOD
37580           JC      DDIV2           ;WAS IT OK?
37600           XWD     1000,076        ;"MVI   A"  NO, ADD FBUFFR BACK IN
37620           ADC     M               ;GET ADD INSTRUCTION
37640           CALL    DADDD           ;DO THE ADDITION
37660           XRA     A               ;CLEAR CARRY
37680           XWD     1000,332        ;"JC" OVER NEXT TWO BYTES
37700   DDIV2:  STAX    D               ;STORE THE NEW HIGHEST ORDER BYTE
```



```
37720           INR     B               ;INCREMENT FLAG TO SHOW WE COULD DIVIDE
37740           LDA     FAC-1           ;CHECK IF WE ARE DONE DIVIDING
37760           INR     A               ;SET SIGN FLAG WITHOUT AFFECTING CARRY
37780           DCR     A
37800           RAR                     ;PUT CARRY IN MSB FOR DROUND
37820           JM      DROUNB          ;WE ARE DONE, WE HAVE 57 BITS OF ACCURACY
37840           RAL                     ;GET OLD CARRY BACK WHERE IT BELONGS
37860           LXI     H,QFACLO        ;GET POINTER TO LO OF FAC
37880           MVI     C,7             ;SET UP A COUNT, SHIFT FAC LEFT ONE
37900           CALL    DSHFTL          ;SHIFT IN THE NEXT BIT IN THE QUOTIENT
37920           LXI     H,ARGLO         ;GET POINTER TO LO IN ARG
37940           CALL    DSHFLC          ;SHIFT DIVIDEND ONE LEFT
37960           MOV     A,B             ;IS THIS THE FIRST TIME AND WAS THE
37980           ORA     A               ; SUBTRACTION NOT GOOD? (B WILL GET
38000           JNZ     DDIV1           ; CHANGED ON THE FIRST OR SECOND SUBTRACTION)
38020           LXI     H,FAC           ;YES, SUBTRACT ONE FROM EXPONENT TO CORRECT
38040           DCR     M               ; SCALING
38060           JNZ     DDIV1           ;CONTINUE DIVIDING IF NO OVERFLOW
38080           JMP     OVERR           ;WE HAVE OVERFLOW!!
38100
38120
38140           ;TRANSFER FAC TO FBUFFR FOR DMULT AND DDIV
38160           ;ALTERS A,B,C,D,E,H,L
38180   DMULDV: MOV     A,C             ;PUT UNPACKED HO BACK IN ARG
38200           STA     ARG-1
38220           DCX     H               ;POINT TO HO OF FAC
38240           LXI     D,FBUFFR+*023   ;POINT TO END OF FBUFFR
38260           MVI     B,7             ;SET UP A COUNT
38280           MVI     C,0             ;GET A ZERO TO FILL FAC WITH
38300   DMLDV1: MOV     A,M             ;GET A BYTE FROM FAC
38320           STAX    D               ;PUT IT IN FBUFFR
38340           MOV     M,C             ;PUT A ZERO IN FAC
38360           DCX     D               ;POINT TO NEXT BYTE IN FBUFFR
38380           DCX     H               ;POINT TO NEXT LOWER ORDER BYTE IN FAC
38400           DCR     B               ;ARE WE DONE?
38420           JNZ     DMLDV1          ;NO, TRANSFER THE NEXT BYTE
38440           RET                     ;ALL DONE
38460
38480
38500           ;DOUBLE PRECISION MULTIPLY THE FAC BY 10
38520           ;ALTERS ALL REGISTERS
38540   DMUL10: CALL    VMOVAF          ;SAVE THE FAC IN ARG
38560                                   ;VMOVAF EXITS WITH (DE)=FAC+1
38580           XCHG                    ;GET THE POINTER INTO THE FAC IN (HL)
38600           DCX     H               ;POINT TO THE EXPONENT
38620           MOV     A,M             ;GET THE EXPONENT
38640           ADI     2               ;MULTIPLY FAC BY 4 BY ADDING 2 TO THE EXPONENT
38660           JC      OVERR           ;CHECK FOR OVERFLOW
38680           MOV     M,A             ;SAVE THE NEW EXPONENT
38700           PUSH    H               ;SAVE POINTER TO FAC
38720           CALL    DADD            ;ADD IN THE ORIGINAL FAC TO GET 5 TIMES  FAC
38740           POP     H               ;GET THE POINTER TO FAC BACK
38760           INR     M               ;ADD ONE TO EXPONENT TO GET 10 TIMES FAC
```

```
                                        38780          RNZ                     ;ALL DONE IF OVERFLOW DID NOT OCCUR
                                        38800          JMP     OVERR>          ;IT DID, GIVE THE APPROPRIATE MESSAGE
                                        38820   PAGE
```



```
                                        38840   SUBTTL  FLOATING POINT INPUT ROUTINE
                                        38860           ;ALTERS ALL REGISTERS
                                        38880           ;THE NUMBER IS LEFT IN FAC
                                        38900           ;AT ENTRY, (HL) POINTS TO THE FIRST CHARACTER IN A TEXT BUFFER.
                                        38920           ;THE FIRST CHARACTER IS ALSO IN A.  WE PACK THE DIGITS INTO THE FAC
                                        38940           ;AS AN INTEGER AND KEEP TRACK OF WHERE THE DECIMAL POINT IS.
                                        38960           ;C IS 377 IF WE HAVE NOT SEEN A DECIMAL POINT, 0 IF WE HAVE.
                                        38980           ;B IS THE NUMBER OF DIGITS AFTER THE DECIMAL POINT.
                                        39000           ;AT THE END, B AND THE EXPONENT (IN E) ARE USED TO DETERMINE HOW MANY
                                        39020           ;TIMES WE MULTIPLY OR DIVIDE BY TEN TO GET THE CORRECT NUMBER.
                        001531'         39040   FIN:
                                        39060   IFN     STRING,<
                                        39080           ;IF WE ARE CALLED BY VAL, THE SIGNS MAY NOT BE CRUNCHED
                        001531' 001000  000376  39100           CPI     "-"             ;SEE IF NUMBER IS NEGATIVE
                        001532' 000000  000055
                        001533' 001000  000365  39120           PUSH    PSW             ;SAVE SIGN
                        001534' 001000  000312  39140           JZ      FIN1            ;IGNORE MINUS SIGN
                        001535' 000000  001545'
                        001536' 000000  001526'
                        001537' 001000  000376  39160           CPI     "+"             ;IGNORE A LEADING SIGN
                        001540' 000000  000053
                        001541' 001000  000312  39180           JZ      FIN1>
                        001542' 000000  001545'
                        001543' 000000  001535'
                        001544' 001000  000053  39200           DCX     H               ;SET CHARACTER POINTER BACK ONE
                        001545'                 39220   FIN1:
                                                39240   IFN     LENGTH-2,<
                        001545' 001000  000315  39260           CALL    ZERO            ;CLEAR FAC
                        001546' 000000  000173'
                        001547' 000000  001542'
                        001550' 001000  000107  39280           MOV     B,A             ;CLEAR FLAGS: B=DECIMAL PLACE COUNT
                        001551' 001000  000127  39300           MOV     D,A             ;D=SIGN OF EXPONENT
                        001552' 001000  000137  39320           MOV     E,A             ;E=EXPONENT
                        001553' 001000  000057  39340           CMA
                        001554' 001000  000117  39360           MOV     C,A             ;C="." FLAG
                                                39380           ;HERE TO GET THE NEXT DIGIT OF THE NUMBER, A DECIMAL POINT OR AN "E"
                        001555' 001000  000327  39400   FINC:   CHRGET                 ;GET A CHARACTER
                        001556' 001000  000332  39420           JC      FINDIG          ;DO WE HAVE A DIGIT?
                        001557' 000000  001702'
                        001560' 000000  001546'
                        001561' 001000  000376  39440           CPI     "."             ;TEST FOR DECIMAL POINT
                        001562' 000000  000056
                        001563' 001000  000312  39460           JZ      FINDP
                        001564' 000000  001635'
                        001565' 000000  001557'
                        001566' 001000  000376  39480           CPI     "E"             ;CHECK FOR BEGINNING OF EXPONENT
                        001567' 000000  000105
                        001570' 001000  000302  39500           JNZ     FINE            ;"NONE OF THE ABOVE" SO END OF NUMBER
                        001571' 000000  001641'
                        001572' 000000  001564'
                                                39520           ;HERE TO CHECK FOR THE SIGN OF THE EXPONENT
                        001573' 001000  000327  39540           CHRGET                  ;CHECK FOR ITS SIGN
                                                39560   IFN     STRING,<
```

```
001574' 001000  000345          39580          PUSH    H                ;SAVE TEXT POINTER
001575' 001000  000041          39600          LXI     H,FINEC          ;PUT FINEC ON STACK SO WE CAN JUMP
001576' 000000  001621'
001577' 000000  001571'
001600' 001000  000343          39620          XTHL>                    ; TO IT IN LESS BYTES
001601' 001000  000025          39640          DCR     D                ;SET SIGN OF EXPONENT FLAG
001602' 001000  000376          39660          CPI     MINUTK           ;NEGATIVE EXPONENT?
001603' 000000  000000*
                                                39680  IFE     STRING,<
                                                39700          JZ      FINEC>
                                                39720  IFN     STRING,<
001604' 001000  000310          39740          RZ
001605' 001000  000376          39760          CPI     "-"
001606' 000000  000055
001607' 001000  000310          39780          RZ>
001610' 001000  000024          39800          INR     D                ;NO, RESET FLAG
                                                39820  IFN     STRING,<
001611' 001000  000376          39840          CPI     "+"
001612' 000000  000053
001613' 001000  000310          39860          RZ>
001614' 001000  000376          39880          CPI     PLUSTK           ;IGNORE "+"
001615' 000000  000000*
                                                39900  IFE     STRING,<
                                                39920          JZ      FINEC>
                                                39940  IFN     STRING,<
001616' 001000  000310          39960          RZ
001617' 001000  000361          39980          POP     PSW>             ;GET FINEC OFF STACK
001620' 001000  000053          40000          DCX     H                ;CHECK IF LAST CHARACTER WAS A DIGIT
                                                40020                   ;HERE TO GET THE NEXT DIGIT OF THE EXPONENT
001621' 001000  000327          40040  FINEC:  CHRGET                   ;GET NEXT CHARACTER
001622' 001000  000332          40060          JC      FINEDG           ;IS IT A DIGIT?
001623' 000000  001742'
001624' 000000  001576'
001625' 001000  000024          40080          INR     D                ;NO, EXPONENT ALL IN
001626' 001000  000302          40100          JNZ     FINE             ;SET ITS SIGN
001627' 000000  001641'
001630' 000000  001623'
001631' 001000  000257          40120          XRA     A
001632' 001000  000223          40140          SUB     E
001633' 001000  000137          40160          MOV     E,A
001634' 001000  000014          40180          INR     C                ;MAKE SURE C IS NOT 377
                                                40200                   ;HERE TO CHECK IF WE HAVE SEEN 2 DECIMAL POINTS AND SET THE DECIMAL
                                                40220                   ; POINT FLAG
001635' 001000  000014          40240  FINDP:  INR     C                ;DECIMAL POINTS!! -- SET FLAG
001636' 001000  000312          40260          JZ      FINC             ;CONTINUE SCANNING CHARACTERS
001637' 000000  001555'
001640' 000000  001627'
                                                40280                   ;WE DON'T WANT TWO SO END OF NUMBER
                                                40300                   ;HERE TO MULTIPLY OR DIVIDE BY 10 THE CORRECT NUMBER OF TIMES,
                                                40320                   ;WE HAVE ALREADY READ IN ALL THE DIGITS,
001641' 001000  000345          40340  FINE:   PUSH    H                ;SAVE POINTER FOR LATER
001642' 001000  000173          40360          MOV     A,E              ;EXPONENT=EXPONENT-# OF DECIMAL PLACES
001643' 001000  000220          40380          SUB     B
```



```
001644' 001000  000364          40400  FINE2:  CP      FINMUL           ;MULTIPLY BY TEN IF EXPONENT IS POSITIVE
001645' 000000  001672'
001646' 000000  001637'
001647' 001000  000362          40420          JP      FINE3            ;DIVIDE BY TEN IF EXPONENT IS NEGATIVE
001650' 000000  001660'
001651' 000000  001645'
001652' 001000  000365          40440          PUSH    PSW              ;SAVE EXPONENT
001653' 001000  000315          40460          CALL    DIV10            ;DIVIDE NUMBER BY TEN
001654' 000000  000637'
001655' 000000  001650'
001656' 001000  000361          40480          POP     PSW              ;GET EXPONENT
001657' 001000  000074          40500          INR     A                ;INCREMENT IT
001660' 001000  000302          40520  FINE3:  JNZ     FINE2            ;DO AGAIN IF WE ARE NOT DONE
001661' 000000  001644'
001662' 000000  001654'
                                                40540  IFE     STRING,<
                                                40560          POP     H>               ;GET CHARACTER POINTER
                                                40580  IFN     STRING,<
001663' 001000  000321          40600          POP     D                ;GET CHARACTER POINTER
001664' 001000  000361          40620          POP     PSW              ;GET SIGN
001665' 001000  000314          40640          CZ      NEG              ;NEGATE IF NECESSARY
001666' 000000  001175'
001667' 000000  001661'
001670' 001000  000353          40660          XCHG>                    ;GET CHARACTER POINTER IN (HL)
001671' 001000  000311          40680          RET>                     ;ALL DONE
                                                40700  IFE     LENGTH=2,<
                                                40720          XCHG                     ;SAVE THE TEXT POINTER IN (DE)
                                                40740          LXI     B,377+$CODE      ;CLEAR FLAGS:  B=DECIMAL PLACE COUNT
                                                40760                                   ;C="." FLAG
                                                40780          MOV     H,C              ;ZERO (HL)
                                                40800          MOV     L,C
                                                40820          CALL    CONISS           ;ZERO FAC, SET VALTYP TO "INTEGER"
                                                40840          XCHG                     ;GET THE TEXT POINTER BACK IN (HL)
                                                40860                   ;HERE TO CHECK FOR A DIGIT, A DECIMAL POINT, "E" OR "D"
                                                40880  FINC:   CHRGET                   ;GET THE NEXT CHARACTER OF THE NUMBER
                                                40900          JC      FINDIG           ;WE HAVE A DIGIT
                                                40920          CPI     "."              ;CHECK FOR A DECIMAL POINT
                                                40940          JZ      FINDP            ;WE HAVE ONE, I GUESS
                                                40960          CPI     "E"              ;CHECK FOR A SINGLE PRECISION EXPONENT
                                                40980          JZ      FINEX            ;WE HAVE A SINGLE PRECISION NUMBER
                                                41000          CPI     "D"              ;CHECK FOR A DOUBLE PRECISION EXPONENT
                                                41020          JNZ     FINE             ;WE DON'T HAVE ONE, THE NUMBER IS FINISHED
                                                41040          ORA     A                ;DOUBLE PRECISION NUMBER -- TURN OFF ZERO FLAG
                                                41060  FINEX:  CALL    FINFRC           ;FORCE THE FAC TO BE SNG OR DBL
                                                41080          PUSH    H                ;SAVE THE TEXT POINTER
                                                41100          LXI     H,FINEC          ;GET ADDRESS TO JUMP TO, THIS IS TO SAVE BYTES
                                                41120          XTHL                     ;PUT IT ON STACK AND GET TEXT POINTER
                                                41140                   ;HERE TO CHECK FOR THE SIGN OF THE EXPONENT
                                                41160          CHRGET                   ;GET THE FIRST CHARACTER OF THE EXPONENT
                                                41180          DCR     D                ;SET SIGN OF EXPONENT TO MINUS
                                                41200          CPI     MINUTK           ;CHECK IF THE EXPONENT IS NEGATIVE
                                                41220          RZ                       ;IT IS
                                                41240          CPI     "-"              ;THIS IS IN CASE WE ARE CALLED BY VAL
```

```
                                 RZ
                                 INR     D               ;EXPONENT IS STILL POSITIVE, RESET FLAG
                                 CPI     PLUSTK          ;IGNORE A LEADING PLUS SIGN
                                 RZ
                                 CPI     "+"
                                 RZ
                                 DCX     H               ;THE FIRST CHARACTER WAS NOT A SIGN, GO BACK
                                                         ; AND CHECK FOR A DIGIT
                                 POP     PSW             ;POP FINEC OFF THE STACK, WE NO LONGER NEED IT
                                 ;HERE TO GET THE NEXT DIGIT OF THE EXPONENT
                        FINEC:   CHRGET                  ;GET THE NEXT CHARATER
                                 JC      FINEDG          ;PACK THE NEXT DIGIT INTO THE EXPONENT
                                 INR     D               ;IT WAS NOT A DIGIT, PUT THE CORRECT SIGN ON
                                 JNZ     FINE            ; THE EXPONENT, IT IS POSITIVE
                                 XRA     A               ;THE EXPONENT IS NEGATIVE
                                 SUB     E               ;NEGATE IT
                                 MOV     E,A             ;SAVE IT AGAIN
                                 ;HERE TO FINISH UP THE NUMBER
                        FINE:    LDA     VALTYP          ;FINISH UP -- WHAT KIND OF A NUMBER IS IT?
                                 CPI     2
                                 JNZ     FINEF           ;IT IS A FLOATING POINT ONE
                                 ;HERE TO FINISH UP AN INTEGER
                                 POP     PSW             ;IT IS AN INTEGER, GET ITS SIGN
                                 XCHG                    ;SAVE THE TEXT POINTER IN (DE)
                                 CZ      INEG            ;NEGATE IT IF NECESSARY
                                 XCHG                    ;GET THE TEXT POINTER BACK IN (HL)
                                 RET                     ;ALL DONE
                                 ;HERE TO FINISH UP A FLOATING POINT NUMBER
                        FINEF:   PUSH    H               ;SAVE THE TEXT POINTER
                                 MOV     A,E             ;FIND OUT HOW MANY TIMES WE HAVE TO MULTIPLY
                                 SUB     B               ; OR DIVIDE BY TEN
                                 ;HERE TO MULTIPLY OR DIVIDE BY TEN THE CORRECT NUMBER OF TIMES
                        FINEF2:  CP      FINMUL          ;MULTIPLY IF WE HAVE TO
                                 CM      FINDIV          ;DIVIDE IF WE HAVE TO
                                 JNZ     FINEF2          ;MULTIPLY OR DIVIDE AGAIN IF WE ARE NOT DONE
                                 ;HERE TO PUT THE CORRECT SIGN ON THE NUMBER
                                 POP     D               ;GET THE TEXT POINTER
                                 POP     PSW             ;GET THE SIGN
                                 CZ      NEG             ;NEGATE IF NECESSARY
                                 XCHG                    ;GET THE TEXT POINTER IN (HL)
                                 LDA     VALTYP          ;WE WANT -32768 TO BE AN INT, BUT UNTIL NOW
                                 CPI     4               ; IT WOULD BE A SNG
                                 RNZ                     ;IT IS NOT SNG, SO IT IS NOT -32768
                                 PUSH    H               ;WE HAVE A SNG, SAVE TEXT POINTER
                                 LXI     H,POPHRT        ;GET ADDRESS THAT POP'S H OFF STACK BECAUSE
                                 PUSH    H               ; CONIS2 DOES FUNNY THINGS WITH THE STACK
                                 CALL    CONIS2          ;CHECK IF WE HAVE -32768
                                 RET                     ;WE DON'T, POPHRT IS STILL ON THE STACK SO
                                                         ; WE CAN JUST RETURN

                                 ;HERE TO CHECK IF WE HAVE SEEN 2 DECIMAL POINTS AND SET THE DECIMAL
                                 ; POINT FLAG
                        FINDP:   INR     C               ;SET THE FLAG
```



```
                                 JNZ     FINEF           ;WE HAD 2 DECIMAL POINTS, NOW WE ARE DONE
                                 CALL    FINFRC          ;THIS IS THE FIRST ONE, CONVERT FAC TO SNG
                                 JMP     FINC            ;CONTINUE LOOKING FOR DIGITS

                                 ;FORCE THE FAC TO BE SNG OR DBL
                                 ;IF THE ZERO FLAG IS ON, THEN FORCE THE FAC TO BE SNG
                                 ;IF THE ZERO FLAG IS OFF, FORCE THE FAC TO BE DBL
                        FINFRC:  PUSH    H               ;SAVE TEXT POINTER
                                 PUSH    D               ;SAVE EXPONENT INFORMATION
                                 PUSH    B               ;SAVE DECIMAL POINT INFORMATION
                                 PUSH    PSW             ;SAVE WHAT WE WANT THE FAC TO BE
                                 CZ      FRCSNG          ;CONVERT TO SNG IF WE HAVE TO
                                 POP     PSW             ;GET TYPE FLAG BACK
                                 CNZ     FRCDBL          ;CONVERT TO DBL IF WE HAVE TO
                                 POP     B               ;GET DECIMAL POINT INFORMATION BACK
                                 POP     D               ;GET EXPONENT INFORMATION BACK
                                 POP     H               ;GET TEXT POINTER BACK
                                 RET>                    ;ALL DONE

                                 ;THIS SUBROUTINE MULIPLIES BY TEN ONCE,
                                 ;IT IS A SUBROUTINE BECAUSE IT SAVES BYTES WHEN WE CHECK IF A IS ZERO
                        FINMUL:  RZ                      ;RETURN IF EXPONENT IS ZERO, ENTRY FROM FOUT
                        FINMLT:  PUSH    PSW             ;SAVE EXPONENT, ENTRY FROM FOUT
                        IFN      LENGTH=2,<
                                 CALL    MUL10>          ;MULTIPLY BY TEN
001672' 001000  000310
001673' 001000  000365
001674' 001000  000315
001675' 000000  001106'
001676' 000000  001666'

                        IFE      LENGTH=2,<
                                 LDA     VALTYP          ;SEE WHAT KIND OF NUMBER WE HAVE
                                 CPI     4
                                 PUSH    PSW             ;SAVE THE TYPE
                                 CZ      MUL10           ;WE HAVE A SNG, MULTIPLY BY 10.0
                                 POP     PSW             ;GET THE TYPE BACK
                                 CNZ     DMUL10>         ;WE HAVE A DBL, MULTIPLY BY 1000
                                 POP     PSW             ;GET EXPONENT
                        DCRART:  DCR     A               ;DECREASE IT
                                 RET                     ;ALL DONE
001677' 001000  000361
001700' 001000  000075
001701' 001000  000311

                        IFE      LENGTH=2,<
                        FINDIV:  PUSH    PSW             ;WE HAVE TO DIVIDE -- SAVE COUNT
                                 LDA     VALTYP          ;SEE WHAT KIND OF NUMBER WE HAVE
                                 CPI     4
                                 PUSH    PSW             ;SAVE THE TYPE
                                 CZ      DIV10           ;WE HAVE A SNG NUMBER
                                 POP     PSW             ;GET THE TYPE BACK
                                 CNZ     DDIV10          ;WE HAVE A DBL NUMBER
                                 POP     PSW             ;GET COUNT BACK
                                 INR     A               ;UPDATE IT
                                 RET>

                                 ;HERE TO PACK THE NEXT DIGIT OF THE NUMBER INTO THE FAC
                                 ;WE MULTIPLY THE FAC BY TEN AND ADD IN THE NEXT DIGIT
001702'                 FINDIG:
```

This subroutine multiplies by TEN once.
IT is used by FIN, FOUT

```
                                        43340   IFN     LENGTH=2,<
2578  001702' 001000  000325            43360           PUSH    D               ;DIGITS: SAVE EXPONENT INFORMATION
2579  001703' 001000  000127            43380           MOV     D,A             ;PROTECT DIGIT FROM BELOW
2580  001704' 001000  000170            43400           MOV     A,B             ;INCREMENT DECIMAL PLACE COUNT
2581  001705' 001000  000211            43420           ADC     C               ; IF PAST THE DECIMAL POINT
2582  001706' 001000  000127            43440           MOV     B,A
2583  001707' 001000  000325            43460           PUSH    B               ;SAVE NECESSARY DATA
2584  001710' 001000  000345            43480           PUSH    H
2585  001711' 001000  000325            43500           PUSH    D               ;SAVE DIGIT
2586  001712' 001000  000315            43520           CALL    MUL10           ;MULTIPLY OLD NUMBER BY 10
2587  001713' 000000  001106'
2588  001714' 000000  001675'
2589  001715' 001000  000361            43540           POP     PSW             ;GET NEXT DIGIT
2590  001716' 001000  000326            43560           SUI     "0"             ;SUBTRACT OFF ASCII CODE
2591  001717' 000000  000060
2592                                    43580   IFE     EXTFNC,<
2593                                    43600           CALL    PUSHF           ;PUT NUMBER ON STACK
2594                                    43620           CALL    FLOAT           ;CONVERT TO FLOATING POINT NUMBER
2595                                    43640           POPR
2596                                    43660           CALL    FADD>           ;ADD IN NEXT DIGIT
2597                                    43680   IFN     EXTFNC,<
2598  001720' 001000  000315            43700           CALL    FINLOG>
2599  001721' 000000  001731'
2600  001722' 000000  001713'
2601  001723' 001000  000341            43720           POP     H               ;RECALL DATA
2602  001724' 001000  000301            43740           POP     B
2603  001725' 001000  000321            43760           POP     D
2604  001726' 001000  000303            43780           JMP     FINC>           ;GET NEXT CHARACTER
2605  001727' 000000  001555'
2606  001730' 000000  001721'
2607                                    43800   IFE     LENGTH=2,<
2608                                    43820           PUSH    D               ;SAVE EXPONENT INFORMATION
2609                                    43840           MOV     A,B             ;INCREMENT DECIMAL PLACE COUNT IF WE ARE
2610                                    43860           ADC     C               ; PAST THE DECIMAL POINT
2611                                    43880           MOV     B,A
2612                                    43900           PUSH    B               ;SAVE DECIMAL POINT INFORMATION
2613                                    43920           PUSH    H               ;SAVE TEXT POINTER
2614                                    43940           MOV     A,M             ;GET THE DIGIT
2615                                    43960           SUI     "0"             ;CONVERT IT TO ASCII
2616                                    43980           PUSH    PSW             ;SAVE THE DIGIT
2617                                    44000           LDA     VALTYP          ;SEE WHAT KIND OF A NUMBER WE HAVE
2618                                    44020           CPI     4
2619                                    44040           JNC     FINDGV          ;WE DO NOT HAVE AN INTEGER
2620                                    44060           ;HERE TO PACK THE NEXT DIGIT OF AN INTEGER
2621                                    44080           LHLD    FACLO           ;WE HAVE AN INTEGER, GET IT IN (HL)
2622                                    44100           LXI     D,^D3277+$CODE  ;SEE IF WE WILL OVERFLOW
2623                                    44120           COMPAR                  ;COMPAR RETURNS WITH CARRY ON IF
2624                                    44140           JNC     FINDG2          ; (HL) .LT. (DE), SO THE NUMBER IS TOO BIG
2625                                    44160           MOV     D,H             ;COPY (HL) INTO (DE)
2626                                    44180           MOV     E,L
2627                                    44200           DAD     H               ;MULTIPLY (HL) BY 2
2628                                    44220           DAD     H               ;MULTIPLY (HL) BY 2, (HL) NOW IS 4*(DE)
2629                                    44240           DAD     D               ;ADD IN OLD (HL) TO GET 5*(DE)
```



```
2630                                    44260           DAD     H               ;MULTIPLY BY 2 TO GET TEN TIMES THE OLD (HL)
2631                                    44280           POP     PSW             ;GET THE DIGIT
2632                                    44300           MOV     C,A             ;SAVE IT SO WE CAN USE DAD, B IS ALREADY ZERO
2633                                    44320           DAD     B               ;ADD IN THE NEXT DIGIT
2634                                    44340           MOV     A,H             ;CHECK FOR OVERFLOW
2635                                    44360           ORA     A               ;OVERFLOW OCCURED IF THE MSB IS ON
2636                                    44380           JM      FINDG1          ;WE HAVE OVERFLOW!!
2637                                    44400           SHLD    FACLO           ;EVERYTHING IS FINE, STORE THE NEW NUMBER
2638                                    44420   FINDGE: POP     H               ;ALL DONE, GET TEXT POINTER BACK
2639                                    44440           POP     B               ;GET DECIMAL POINT INFORMATION BACK
2640                                    44460           POP     D               ;GET EXPONENT INFORMATION BACK
2641                                    44480           JMP     FINC            ;GET THE NEXT CHARACTER
2642                                    44500           ;HERE TO HANDLE 32768, 32769
2643                                    44520   FINDG1: MOV     A,C             ;GET THE DIGIT
2644                                    44540           PUSH    PSW             ;PUT IT BACK ON THE STACK
2645                                    44560           ;HERE TO CONVERT THE INTEGER DIGITS TO SINGLE PRECISION DIGITS
2646                                    44580   FINDG2: CALL    CONSI           ;CONVERT THE INTEGER TO SINGLE PRECISION
2647                                    44600           XRA     A               ;DO NOT TAKE THE FOLLOWING JUMP
2648                                    44620           ;HERE TO DECIDE IF WE HAVE A SINGLE OR DOUBLE PRECISION NUMBER
2649                                    44640   FINDGV: JNZ     FINDGD          ;FALL THROUGH IF VALTYP WAS 4 I,E, SNG PREC
2650                                    44660           MOVRI   224,164,044,000 ;GET 1000000, DO WE HAVE 7 DIGITS ALREADY?
2651                                    44680           CALL    FCOMP           ;IF SO, FAC .GE, 1000000
2652                                    44700           JP      FINDG3          ;WE DO, CONVERT TO DOUBLE PRECISION
2653                                    44720           POP     PSW             ;GET THE NEXT DIGIT
2654                                    44740           CALL    FINLOG          ;PACK IT INTO THE FAC
2655                                    44760           JMP     FINDGE          ;GET FLAGS OFF STACK AND WE ARE DONE
2656                                    44780           ;HERE TO CONVERT A 7 DIGIT SINGLE PRECISION NUMBER TO DOUBLE PRECISION
2657                                    44800   FINDG3: CALL    CONDS           ;CONVERT SINGLE TO DOUBLE PRECISION
2658                                    44820           ;HERE TO PACK IN THE NEXT DIGIT OF A DOUBLE PRECISION NUMBER
2659                                    44840   FINDGD: CALL    DMUL10          ;MULTIPLY THE FAC BY 10
2660                                    44860           CALL    VMOVAF          ;SAVE THE FAC IN ARG
2661                                    44880           POP     PSW             ;GET THE NEXT DIGIT
2662                                    44900           CALL    FLOAT           ;CONVERT THE DIGIT TO SINGLE PRECISION
2663                                    44920           CALL    CONDS           ;NOW, CONVERT THE DIGIT TO DOUBLE PRECISION
2664                                    44940           CALL    DADD            ;ADD IN THE DIGIT
2665                                    44960           JMP     FINDGE>         ;GET THE FLAGS OFF THE STACK AND WE ARE DONE
2666
2667                                    45000   IFN     EXTFNC,<
2668                                    45020           ;SUBROUTINE FOR FIN, LOG
2669  001731' 001000  000315            45040   FINLOG: CALL    PUSHF           ;SAVE FAC ON STACK
2670  001732' 000000  001205'
2671  001733' 000000  001727'
2672  001734' 001000  000315            45060           CALL    FLOAT           ;CONVERT A TO A FLOATING POINT NUMBER
2673  001735' 000000  001150'
2674  001736' 000000  001732'
2675                                    45080   IFN     LENGTH=2,<
2676  001737' 001000  000303            45100           JMP     FADDT>          ;ADD IT IN
2677  001740' 000000  000023'
2678  001741' 000000  001735'
2679                                    45120   IFE     LENGTH=2,<
2680                                    45140           POPR                    ;GET PREVIOUS NUMBER OFF STACK
2681                                    45160           JMP     FADD>>          ;ADD IT IN
2682
```

```
                                        45200          ;HERE WE PACK IN THE NEXT DIGIT OF THE EXPONENT
                                        45220          ;WE MUTIPLY THE OLD EXPONENT BY TEN AND ADD IN THE NEXT DIGIT
                                        45240          ;NOTE: EXPONENT OVERFLOW IS NOT CHECKED FOR
001742' 001000  000173                  45260  FINEDG: MOV    A,E            ;EXPONENT DIGIT -- MULTIPLY EXPONENT BY 10
001743' 001000  000007                  45280          RLC                   ;FIRST BY 4
001744' 001000  000007                  45300          RLC
001745' 001000  000203                  45320          ADD    E              ;ADD 1 TO MAKE 5
001746' 001000  000007                  45340          RLC                   ;NOW DOUBLE TO GET 10
001747' 001000  000226                  45360          ADD    M              ;ADD IT IN
001750' 001000  000326                  45380          SUI    "0"            ;SUBTRACT OFF ASCII CODE
001751' 000000  000060
001752' 001000  000137                  45400          MOV    E,A            ;STORE EXPONENT
001753' 001000  000303                  45420          JMP    FINEC          ;CONTINUE
001754' 000000  001621'
001755' 000000  001740'
                                        45440  PAGE
```



```
                                        45460  SUBTTL  FLOATING POINT OUTPUT ROUTINE
                                        45480          ;ENTRY TO LINPRT
001756' 001000  000345                  45500  INPRT:  PUSH   H              ;SAVE LINE NUMBER
001757' 001000  000041                  45520          LXI    H,INTXT##      ;PRINT MESSAGE
001760' 000000  000000*
001761' 000000  001754'
001762' 001000  000315                  45540          CALL   STROUT
001763' 000000  000000*
001764' 000000  001760'
001765' 001000  000341                  45560          POP    H              ;FALL INTO LINPRT

                                        45620          ;PRINT THE 2 BYTE NUMBER IN H,L
                                        45640          ;ALTERS ALL REGISTERS
001766'                                 45660  LINPRT:
                                        45680  IFN     LENGTH=2,<
001766' 001000  000353                  45700          XCHG                  ;SET UP REGISTERS FOR FLOATR
001767' 001000  000257                  45720          XRA    A
001770' 001000  000006                  45740          MVI    B,230
001771' 000000  000230
001772' 001000  000315                  45760          CALL   FLOATR#        ;CONVERT TO FLOATING POINT
001773' 000000  001155'
001774' 000000  001763'
                                        ~~45780  IFE     LENGTH=2,<~~
                                        45800          CALL   CONISS         ;PUT THE LINE NUMBER IN THE FAC AS AN INTEGER
                                        45820          XRA    A              ;SET FORMAT TO FREE FORMAT
                                        45840          CALL   FOUINI#        ;SET UP THE SIGN
001775' 001000  000041                  45860          LXI    H,STROUI##     ;PUT PRINT STRING ADDRESS ON STACK SO WE WILL
001776' 000000  000000*
001777' 000000  001773'
002000' 001000  000345                  45880          PUSH   H              ; RETURN TO IT AND DO AN "INX   H"
                                        45900                                ;THIS GETS RID OF THE SPACE FOR THE SIGN AT
                                        45920                                ; THE BEGINNING OF A LINE NUMBER
                                        45940                                ;FALL INTO FOUT
                                        45960  IFE     LENGTH=2,<
                                        ~~45980  PUSH   B~~                  ~~;PUT DUMMY FIELD LENGTHS ON STACK~~  CALL FOUT2
                                        46000          JMP    ~~FOUT1~~      ;PRINT THE NUMBER
                                                                STROUI##

                                        46060          ;FLOATING OUTPUT OF FAC
                                        46080          ;ALTERS ALL REGISTERS
                                        46100          ;THE ORIGINAL CONTENTS OF THE FAC IS LOST
                                        46120  IFN     LENGTH=2,<
002001' 001000  000041                  46140  FOUT:   LXI    H,FBUFFR       ;GET BEGINING OF CHARACTER BUFFER
002002' 000000  000000*
002003' 000000  001776'
002004' 001000  000345                  46160          PUSH   H              ;SAVE IT FOR WHEN WE RETURN
                                        46180          ;PUT THE SIGN OF THE NUMBER IN THE BUFFER AND MAKE IT POSITIVE
002005' 001000  000357                  46200          FSIGN                 ;GET SIGN OF NUMBER
002006' 001000  000066                  46220          MVI    M," "          ;PRINT SPACE IF POSITIVE
002007' 000000  000040
002010' 001000  000362                  46240          JP     FOUT1
002011' 000000  002015'
```

```
002012' 000000  002002'
002013' 001000  000066          46260          MVI     M,"-"          ;PRINT A MINUS SIGN IF NEGATIVE
002014' 000000  000055
002015' 001000  000043          46280  FOUT1:  INX     H              ;INCREMENT POINTER TO NEXT CHRACTER POSITION
002016' 001000  000066          46300          MVI     M,"0"          ;PUT A ZERO IN BUFFER IN CASE NUMBER=0
002017' 000000  000060
002020' 001000  000512          46320          JZ      FOUT19         ;DO IT IF THE NUMBER IS ZERO
002021' 000000  002266'
002022' 000000  002411'
002023' 001000  000345          46340          PUSH    H              ;SAVE BUFFER POINTER
002024' 001000  000374          46360          CM      NEG            ;NEGATE NUMBER IF NEGATIVE
002025' 000000  001175'
002026' 000000  002021'

                                46400  ;HERE WE GET THE FAC IN THE RANGE 100000 ,LE, FAC ,LE, 999999 AND ROUND IT TO
                                46420  ;AN INTEGER,  WE KEEP A COUNT OF HOW MANY TIMES WE MULTIPLY OR DIVIDE BY TEN
                                46440  ;SO WE KNOW WHAT THE EXPONENT WILL BE,  THE FAC IS THEN CONVERTED TO AN
                                46460  ;INTEGER IN C,D,E,  WE USE A TABLE OF POWERS OF TEN TO CALCULATE EACH DIGIT,
                                46480  ;THIS ALGORITHM IS USED FOR SPEED,
002027' 001000  000257          46500          XRA     A              ;PUT TEN'S EXPONENT COUNT ON STACK
002030' 001000  000365          46520          PUSH    PSW
002031' 001000  000315          46540          CALL    FOUTCB         ;SEE IF NUMBER IS TOO BIG OR TOO SMALL
002032' 000000  002274'
002033' 000000  002225'
002034' 001000  000001          46560  FOUT3:  MOVRI   221,103,117,370 ;IS NUMBER ,LE, 99999,94997  IT IS TOO SMALL
002035' 000000  000103
002036' 000000  000021
002037' 001000  000021
002040' 000000  000370
002041' 000000  000117
002042' 001000  000315          46580          CALL    FCOMP          ;FCOMP RETURNS 377, 0 OR 1 IN A, SO THE
002043' 000000  001317'
002044' 000000  002032'
                                46600                                 ; PARITY WILL BE ODD IFF 1 IS RETURNED
002045' 001000  000342          46620          JPO     FOUT5          ;NO, NUMBER IS IN RANGE
002046' 000000  002071'
002047' 000000  002043'
002050' 001000  000361          46640          POP     PSW
002051' 001000  000315          46660          CALL    FINMLT         ;YES, MULTIPLY IT BY TEN TO GET
002052' 000000  001673'
002053' 000000  002046'
002054' 001000  000365          46680          PUSH    PSW            ; IT IN RANGE
002055' 001000  000303          46700          JMP     FOUT3          ;SEE IF NUMBER IS NOW IN RANGE
002056' 000000  002034'
002057' 000000  002052'
002060' 001000  000315          46720  FOUT9:  CALL    DIV10          ;NO, DIVIDE NUMBER BY TEN, IT IS TOO BIG
002061' 000000  000637'
002062' 000000  002056'
002063' 001000  000361          46740          POP     PSW            ;ADD ONE TO EXPONENT
002064' 001000  000074          46760          INR     A
002065' 001000  000365          46780          PUSH    PSW
002066' 001000  000315          46800          CALL    FOUTCB         ;IS NUMBER ,LE, 999999,4997
002067' 000000  002274'
```



```
002070' 000000  002061'
                                46820                                 ;YES, NUMBER IS IN PRINTING RANGE, I.E,
                                46840                                 ; ALL DIGITS TO BE PRINTED ARE THE INTEGER PART
002071' 001000  000315          46860  FOUT5:  CALL    FADDH          ;ROUND NUMBER TO NEAREST INTEGER
002072' 000000  000000'
002073' 000000  002067'
002074' 001000  000074          46880          INR     A              ;MAKE A NON-ZERO, SINCE NUMBER IS POSITIVE
                                46900                                 ; AND NON-ZERO, ROUND WILL EXIT WITH THE HO
                                46920                                 ; IN A, SO THE MSB WILL ALWAYS BE ZERO AND
                                46940                                 ; ADDING ONE WILL NEVER CAUSE A TO BE ZERO
002075' 001000  000315          46960          CALL    GINT           ;GET INTEGER PART IN C,D,E
002076' 000000  001372'
002077' 000000  002072'
002100' 001000  000315          46980          CALL    MOVFR          ;SAVE NUMBER IN FAC
002101' 000000  001225'
002102' 000000  002076'
                                47000          ;DECIDE IF THE NUMBER SHOULD BE PRINTED IN FIXED OR FLOATING NOTATION
002103' 001000  000001          47020          LXI     B,2*400+6+$CODE ;SET DECIMAL POINT COUNT FOR E NOTATION
002104' 000000  001006*
002105' 000000  002101'
                                47040                                 ;C = DIGIT COUNT
002106' 001000  000361          47060          POP     PSW            ;GET EXPONENT
                                47080          ADD     C              ;IS NUMBER SHOULD BE PRINTED IN E NOTATION?
002107' 001000  000201                                                SHOULD ?
002110' 001000  000372          47100          JM      FOUT6          ;YES, IT IS ,LT, ,1
002111' 000000  002124'
002112' 000000  002104'
002113' 001000  000376          47120          CPI     7
002114' 000000  000007
002115' 001000  000322          47140          JNC     FOUT6          ;YES,  IT IS ,GT, 999999
002116' 000000  002124'
002117' 000000  002111'
002120' 001000  000074          47160          INR     A
002121' 001000  000107          47180          MOV     B,A            ;B = DECIMAL POINT COUNT
002122' 001000  000076          47200          MVI     A,1            ;SET FIXED POINT FLAG, THE EXPONENT IS ZERO
002123' 000000  000001
                                47220                                 ; IF WE ARE USING FIXED POINT NOTATION
002124' 001000  000075          47240  FOUT6:  DCR     A              ;E NOTATION; ADD S TO ORIGINAL EXPONENT
002125' 001000  000341          47260          POP     H              ;GET BUFFER POINTER FROM STACK
002126' 001000  000365          47280          PUSH    PSW            ;SAVE EXPONENT FOR LATER
                                47300          ;CALCULATE THE DIGITS OF THE NUMBER
002127' 001000  000021          47320          LXI     D,FOUTBL       ;STORE LOC OF LARGEST POWER OF TEN
002130' 000000  002316'
002131' 000000  002116'
002132' 001000  000005          47340  FOUT8:  DCR     B              ;SEE IF IT IS TIME TO PRINT A DECIMAL POINT
002133' 001000  000066          47360          MVI     M,"."          ;PUT A DECIMAL POINT IN THE BUFFER
002134' 000000  000056
002135' 001000  000314          47380          CZ      INXHRT         ;INCREMENT THE BUFFER POINTER IF IT IS TIME
002136' 000000  001252'
002137' 000000  002130'
002140' 001000  000305          47400          PUSH    B              ;SAVE FLAGS
002141' 001000  000345          47420          PUSH    H              ;SAVE CHARACTER POINTER
```

```
 2858  002142' 001000  000325          47440          PUSH    D                ;SAVE POWER OF TEN POINTER
 2859  002143' 001000  000315          47460          CALL    MOVRF            ;GET NUMBER IN C,D,E
 2860  002144' 000000  001240'
 2861  002145' 000000  002136'
 2862  002146' 001000  000341          47480          POP     H                ;GET POWER OF TEN POINTER
 2863  002147' 001000  000006          47500          MVI     B,"0"-1          ;B = NEXT DIGIT TO BE PRINTED
 2864  002150' 000000  000057
 2865  002151' 001000  000004          47520  FOUT10: INR     B                ;ADD ONE TO DIGIT
 2866  002152' 001000  000173          47540          MOV     A,E              ;SUBTRACT LO
 2867  002153' 001000  000226          47560          SUB     M
 2868  002154' 001000  000137          47580          MOV     E,A
 2869  002155' 001000  000043          47600          INX     H                ;POINT TO NEXT BYTE OF POWER OF TEN
 2870  002156' 001000  000172          47620          MOV     A,D              ;SUBTRACT MO
 2871  002157' 001000  000236          47640          SBB     M
 2872  002160' 001000  000127          47660          MOV     D,A
 2873  002161' 001000  000043          47680          INX     H
 2874  002162' 001000  000171          47700          MOV     A,C              ;SUBTRACT MO
 2875  002163' 001000  000236          47720          SBB     M
 2876  002164' 001000  000117          47740          MOV     C,A
 2877  002165' 001000  000053          47760          DCX     H                ;POINT TO BEGINNING OF POWER OF TEN
 2878  002166' 001000  000053          47780          DCX     H
 2879  002167' 001000  000322          47800          JNC     FOUT10           ;SUBTRACT AGAIN IF RESULT WAS POSITIVE
 2880  002170' 000000  002151'
 2881  002171' 000000  002144'
 2882  002172' 001000  000315          47820          CALL    FADDA            ;IT WASN'T, ADD POWER OF TEN BACK IN
 2883  002173' 000000  000274'
 2884  002174' 000000  002170'
 2885  002175' 001000  000043          47840          INX     H                ;INCREMENT POINTER TO NEXT POWER OF TEN
 2886  002176' 001000  000315          47860          CALL    MOVFR            ;SAVE C,D,E IN FAC
 2887  002177' 000000  001225'
 2888  002200' 000000  002173'
 2889  002201' 001000  000353          47880          XCHG                     ;GET POWER OF TEN POINTER IN (DE)
 2890  002202' 001000  000341          47900          POP     H                ;GET BUFFER POINTER
 2891  002203' 001000  000160          47920          MOV     M,B              ;PUT CHARACTER IN BUFFER
 2892  002204' 001000  000043          47940          INX     H                ;INCREMENT BUFFER POINTER
 2893  002205' 001000  000301          47960          POP     B                ;GET COUNTERS OFF STACK
 2894  002206' 001000  000015          47980          DCR     C                ;WAS THAT THE LAST DIGIT?
 2895  002207' 001000  000302          48000          JNZ     FOUT8            ;DO MORE IF NOT
 2896  002210' 000000  002132'
 2897  002211' 000000  002177'
 2898  002212' 001000  000005          48020          DCR     B                ;SEE IF DECIMAL POINT GOES AFTER LAST DIGIT
 2899  002213' 001000  000312          48040          JZ      FOUT12           ;IT DOES, WE HAVE NO ZEROS TO SUPPRESS
 2900  002214' 000000  002232'
 2901  002215' 000000  002210'
 2902                                   48060          ;SUPPRESS THE TRAILING ZEROS
 2903  002216' 001000  000053          48080  FOUT11: DCX     H                ;GO BACK TO LAST CHARACTER
 2904  002217' 001000  000176          48100          MOV     A,M              ;GET IT
 2905  002220' 001000  000376          48120          CPI     "0"              ;IGNORE TRAILING ZEROS
 2906  002221' 000000  000060
 2907  002222' 001000  000312          48140          JZ      FOUT11
 2908  002223' 000000  002216'
 2909  002224' 000000  002214'
 2910                                   48160          ;SUPPRESS DECIMAL POINT IF WE HAVE AN INTEGER
```



```
 2911  002225' 001000  000376          48180          CPI     "."              ;IGNORE DECIMAL POINT BEFORE TRAILING ZEROS
 2912  002226' 000000  000056
 2913  002227' 001000  000304          48200          CNZ     INXHRT           ;IF NO DP, MOVE POINTER TO NEXT POSITION
 2914  002230' 000000  001252'
 2915  002231' 000000  002223'
 2916  002232' 001000  000361          48220  FOUT12: POP     PSW              ;GET DECIMAL EXPONENT
 2917  002233' 001000  000312          48240          JZ      FOUT17           ;RETURN IF NUMBER WAS IN FIXED POINT FORMAT
 2918  002234' 000000  002271'
 2919  002235' 000000  002230'
 2920                                   48260          ;FLOATING POINT NOTATION -- PUT AN "E" IN THE BUFFER
 2921  002236' 001000  000066          48280          MVI     M,"E"            ;PUT AN "E" IN THE BUFFER
 2922  002237' 000000  000105
 2923  002240' 001000  000043          48300          INX     H                ;PUT SIGN OF EXPONENT IN BUFFER
 2924                                   48320          ;PUT IN THE SIGN OF THE EXPONENT
 2925  002241' 001000  000066          48340          MVI     M,"+"            ;A PLUS IF POSITIVE
 2926  002242' 000000  000053
 2927  002243' 001000  000362          48360          JP      FOUT14
 2928  002244' 000000  002252'
 2929  002245' 000000  002234'
 2930  002246' 001000  000066          48380          MVI     M,"-"            ;A MINUS IF NEGATIVE
 2931  002247' 000000  000055
 2932  002250' 001000  000057          48400          CMA                      ;NEGATE EXPONENT
 2933  002251' 001000  000074          48420          INR     A
 2934                                   48440          ;CALCULATE THE TWO DIGIT EXPONENT
 2935  002252' 001000  000006          48460  FOUT14: MVI     B,"0"-1          ;INITIALIZE TEN'S DIGIT COUNT
 2936  002253' 000000  000057
 2937  002254' 001000  000004          48480  FOUT15: INR     B                ;INCREMENT DIGIT
 2938  002255' 001000  000326          48500          SUI     12               ;SUBTRACT TEN
 2939  002256' 000000  000012
 2940  002257' 001000  000322          48520          JNC     FOUT15           ;DO IT AGAIN IF RESULT WAS POSITIVE
 2941  002260' 000000  002254'
 2942  002261' 000000  002244'
 2943  002262' 001000  000306          48540          ADI     "0"+12           ;ADD BACK IN TEN AND CONVERT TO ASCII
 2944  002263' 000000  000072
 2945                                   48560          ;PUT THE EXPONENT IN THE BUFFER
 2946  002264' 001000  000043          48580          INX     H
 2947  002265' 001000  000160          48600          MOV     M,B              ;PUT TEN'S DIGIT OF EXPONENT IN BUFFER
 2948  002266' 001000  000043          48620  FOUT19: INX     H                ;WHEN WE JUMP TO HERE, A IS ZERO
 2949  002267' 001000  000167          48640          MOV     M,A              ;PUT ONE'S DIGIT IN BUFFER
 2950  002270' 001000  000043          48660          INX     H                ;INCREMENT POINTER
 2951  002271' 001000  000161          48680  FOUT17: MOV     M,C              ;PUT ZERO AT END OF BUFFER
 2952  002272' 001000  000341          48700          POP     H                ;EXIT WITH (HL) POINTING TO STRING
 2953  002273' 001000  000311          48720          RET                      ;ALL DONE
 2954
 2955                                   48760          ;SEE IF FAC ,LE, 999999,499
 2956  002274' 001000  000001          48780  FOUTCB: MOVRI   224,164,043,367 ;COMPARE NUMBER WITH CONSTANT
 2957  002275' 000000  000164
 2958  002276' 000000  000224
 2959  002277' 001000  000021
 2960  002300' 000000  000367
 2961  002301' 000000  000043
 2962  002302' 001000  000315          48800          CALL    FCOMP
 2963  002303' 000000  001317'
```

```
002334' 000000  002260'
002335' 001000  000341          48820           POP     H               ;GET RETURN ADDRESS OFF STACK
002336' 001000  000342          48840           JPO     FOUT9           ;NUMBER TOO BIG, DIVIDE BY TEN
002337' 000000  002260'
002310' 000000  002303'
002311' 001000  000351          48860           PCHL                    ;NUMBER OK, RETURN

                                48900           ;CONSTANTS FOR FOUT
002312' 000000  000000          48920   FHALF:  000     ; 1/2
002313' 000000  000000          48940           000     ;THIS CONSTANT IS ALSO USED BY SQR, SIN, COS
002314' 000000  000000          48960           000
002315' 000000  000200          48980           200
                                49000           ;POWER OF TEN TABLE
002316' 000000  000240          49020   FOUTBL: 240     ; 100000
002317' 000000  000206          49040           206
002320' 000000  000001          49060           001
002321' 000000  000020          49080           020     ; 10000
002322' 000000  000047          49100           047
002323' 000000  000000          49120           000
002324' 000000  000350          49140           350     ; 1000
002325' 000000  000003          49160           003
002326' 000000  000000          49180           000
002327' 000000  000144          49200           144     ; 100
002330' 000000  000000          49220           000
002331' 000000  000000          49240           000
002332' 000000  000012          49260           012     ; 10
002333' 000000  000000          49280           000
002334' 000000  000000          49300           000
002335' 000000  000001          49320           001     ; 1
002336' 000000  000000          49340           000
002337' 000000  000000          49360           000>
                                49380   IFE     LENGTH=2,<
                                49400           ;OUTPUT THE VALUE IN THE FAC ACCORDING TO THE FORMAT SPECIFICATIONS
                                49420           ; IN A,B,C
                                49440           ;ALL REGISTERS ARE ALTERED
                                49460           ;THE ORIGINAL CONTENTS OF THE FAC IS LOST
                                49480
                                49500           ;THE FORMAT IS SPECIFIED IN A, B AND C AS FOLLOWS:
                                49520           ;THE BITS OF A MEAN THE FOLLOWING:
                                49540   ;BIT 7  0 MEANS FREE FORMAT OUTPUT, I.E, THE OTHER BITS OF A MUST BE ZERO,
                                49560   ;       TRAILING ZEROS ARE SUPPRESSED, A NUMBER IS PRINTED IN FIXED OR FLOATING

                                49580   ;       POINT NOTATION ACCORDING TO ITS MAGNITUDE, THE NUMBER IS LEFT
                                49600   ;       JUSTIFIED IN ITS FIELD, B AND C ARE IGNORED,
                                49620   ;       1 MEANS FIXED FORMAT OUTPUT, I.E, THE OTHER BITS OF A ARE CHECKED FOR
                                49640   ;       FORMATTING INFORMATION, THE NUMBER IS RIGHT JUSTIFIED IN ITS FIELD,
                                49660   ;       TRAILING ZEROS ARE NOT SUPPRESSED,  THIS IS USED FOR PRINT USING,
                                49680   ;BIT 6  1 MEANS GROUP THE DIGITS IN THE INTEGER PART OF THE NUMBER INTO GROUPS
                                49700   ;       OF THREE AND SEPARATE THE GROUPS BY COMMAS
                                49720   ;       0 MEANS DONT PRINT THE NUMBER WITH COMMAS
                                49740   ;BIT 5  1 MEANS FILL THE LEADING SPACES IN THE FIELD WITH ASTERISKS ("*")
                                49760   ;BIT 4  1 MEANS OUTPUT THE NUMBER WITH A FLOATING DOLLAR SIGN ("$")
                                49780   ;BIT 3  1 MEANS PRINT THE SIGN OF A POSITIVE NUMBER AS A PLUS SIGN ("+")
```



```
                                49800   ;       INSTEAD OF A SPACE
                                49820   ;BIT 2  1 MEANS PRINT THE SIGN OF THE NUMBER AFTER THE NUMBER
                                49840   ;BIT 1  UNUSED
                                49860   ;BIT 0  1 MEANS PRINT THE NUMBER IN FLOATING POINT NOTATION I.E, "E NOTATION"
                                49880   ;       IF THIS BIT IS ON, THE COMMA SPECIFICATION (BIT 6) IS IGNORED,
                                49900   ;       0 MEANS PRINT THE NUMBER IN FIXED POINT NOTATION,  NUMBER .GE, 1E16
                                49920   ;       CANNOT BE PRINTED IN FIXED POINT NOTATION,
                                49940
                                49960           ;B AND C TELL HOW BIG THE FIELD IS:
                                49980   ;B  =   THE NUMBER OF PLACES IN THE FIELD TO THE LEFT OF THE DECIMAL POINT
                                50000   ;       (B DOES NOT INCLUDE THE DECIMAL POINT)
                                50020   ;C  =   THE NUMBER OF PLACES IN THE FIELD TO THE RIGHT OF THE DECIMAL POINT
                                50040   ;       (C INCLUDES THE DECIMAL POINT)
                                50060   ;       B AND C DONOT INCLUDE THE 4 POSITIONS FOR THE EXPONENT IF BIT 0 IS ON
                                50080           ;FOUT ASSUMES B+C .LE, 24 (DECIMAL)
                                50100
                                50120           ;ENTRY TO PRINT THE FAC IN FREE FORMAT
                                50140   FOUT:    XRA     A               ;SET FORMAT FLAGS TO FREE FORMATED OUTPUT
                                50160           ;ENTRY TO PRINT THE FAC USING THE FORMAT SPECIFICATIONS IN A, B AND C
                                50180   PUFOUT: CALL    FOUINI          ;SAVE THE FORMAT SPECIFICATION IN A AND PUT
                                50200                                   ;A SPACE FOR POSITIVE NUMBERS IN THE BUFFER
                                50220           PUSH    B               ;SAVE THE FIELD LENGTH SPECIFICATIONS
                                50240           ANI     10              ;CHECK IF POSITIVE NUMBERS GET A PLUS SIGN
                                50260           JZ      FOUT1           ;THEY DONT
                                50280           MVI     M,"+"           ;THEY DO, PUT IN A PLUS SIGN
                                50300   FOUT1:  LDA     VALTYP          ;SEE WHAT KIND OF A VALUE WE HAVE
                                50320           MOV     B,A             ;SAVE IT
                                50340           XCHG                    ;SAVE BUFFER POINTER
                                50360           CALL    VSIGN           ;GET THE SIGN OF THE FAC
                                50380           XCHG                    ;PUT THE BUFFER POINTER BACK IN (HL)
                                50400           MOV     A,B             ;GET THE VALTYP BACK
                                50420           JP      FOUT2           ;IF WE HAVE A NEGATIVE NUMBER, NEGATE IT
                                50440           MVI     M,"-"           ; AND PUT A MINUS SIGN IN THE BUFFER
                                50460           PUSH    H               ;SAVE THE BUFFER POINTER
                                50480           CALL    VNEG            ;NEGATE THE NUMBER
                                50500           POP     H               ;GET THE BUFFER POINTER BACK
                                50520   FOUT2:  INX     H               ;POINT TO WHERE THE NEXT CHARACTER GOES
                                50540           LDA     TEMP3           ;GET THE FORMAT SPECIFICATION
                                50560           MOV     D,A             ;SAVE IT FOR LATER
                                50580           RAL                     ;PUT THE FREE FORMAT OR NOT BIT IN THE CARRY
                                50600           LDA     VALTYP          ;GET THE VALTYP, VNEG COULD HAVE CHANGED THIS
                                50620                                   ; SINCE -32768 IS INT AND 32768 IS SNG,
                                50640                                   ; SO B IS NOT ACCURATE
                                50660           JC      FOUTFX          ;THE MAN WANTS FIXED FORMATED OUTPUT
                                50680           ;HERE TO PRINT NUMBERS IN FREE FORMAT
                                50700           POP     B               ;WE CAN IGNORE THE OLD B AND C
                                50720           MVI     M,"0"           ;PUT A ZERO IN THE BUFFER IN CASE THE NUMBER
                                50740           JZ      FOUTZR          ; IS ZERO,  IT IS, FINISH IT UP
                                50760           CPI     4               ;DECIDE WHAT KIND OF A VALUE WE HAVE
                                50780           JNC     FOUFRY          ;WE HAVE A SNG OR DBL
                                50800           ;HERE TO PRINT AN INTEGER IN FREE FORMAT
                                50820           LXI     B,$CODE         ;SET THE DECIMAL POINT COUNT AND COMMA COUNT
                                50840                                   ; TO ZERO
```

```
                                50860           CALL    FOUTCI          ;CONVERT THE INTEGER TO DECIMAL
                                50880                                   ;FALL INTO FOUTZS AND ZERO SUPPRESS THE THING
                                50900
                                50920           ;ZERO SUPPRESS THE DIGITS IN FBUFFR
                                50940           ;ASTERISK FILL AND ZERO SUPPRESS IF NECESSARY
                                50960           ;SET UP B AND CONDITION CODES IF WE HAVE A TRAILING SIGN
                                50980   FOUTZS: LXI     H,FBUFFR+1      ;GET POINTER TO THE SIGN
                                51000           MOV     B,M             ;SAVE THE SIGN IN B
                                51020           MVI     C," "           ;DEFAULT FILL CHARACTER TO A SPACE
                                51040           LDA     TEMP3           ;GET FORMAT SPECS TO SEE IF WE HAVE TO
                                51060           MOV     E,A             ; ASTERISK FILL,  SAVE IT
                                51080           ANI     40
                                51100           JZ      FOTZS1          ;WE DON'T
                                51120           MOV     A,B             ;WE DO, SEE IF THE SIGN WAS A SPACE
                                51140           CMP     C               ;ZERO FLAG IS SET IF IT WAS
                                51160           MVI     C,"*"           ;SET FILL CHARACTER TO AN ASTERISK
                                51180           JNZ     FOTZS1          ;SET THE SIGN TO AN ASTERISK IF IT WAS A SPACE
                                51200           MOV     B,C             ;B HAS THE SIGN, C THE FILL CHARACTER
                                51220   FOTZS1: MOV     M,C             ;FILL IN THE ZERO OR THE SIGN
                                51240           CHRGET                  ;GET THE NEXT CHARACTER IN THE BUFFER
                                51260                                   ;SINCE THERE ARE NO SPACES, "CHRGET" IS
                                51280                                   ; EQUIVALENT TO "INX    H"/"MOV A,M"
                                51300           CPI     "0"             ;DO WE HAVE A ZERO?
                                51320           JZ      FOTZS1          ;YES, SUPPRESS IT
                                51340           CPI     54              ;54#","  DO WE HAVE A COMMA?
                                51360           JZ      FOTZS1          ;YES, SUPPRESS IT
                                51380           CPI     "."             ;ARE WE AT THE DECIMAL POINT?
                                51400           JNZ     FOTZS2          ;NO, I GUESS NOT
                                51420           DCX     H               ;YES, BACK UP AND PUT A ZERO BEFORE IT
                                51440           MVI     M,"0"
                                51460   FOTZS2: MOV     A,E             ;GET THE FORMAT SPECS TO CHECK FOR A FLOATING
                                51480           ANI     20              ; DOLLAR SIGN
                                51500           JZ      FOTZS3          ;WE DON'T HAVE ONE
                                51520           DCX     H               ;WE HAVE ONE, BACK UP AND PUT IN THE DOLLAR
                                51540           MVI     M,"$"           ; SIGN
                                51560   FOTZS3: MOV     A,E             ;DO WE HAVE A TRAILING SIGN?
                                51580           ANI     4
                                51600           RNZ                     ;YES, RETURN; NOTE THE NON-ZERO FLAG IS SET
                                51620   FOFXIS: DCX     H               ;NO, BACK UP ONE AND PUT THE SIGN BACK IN
                                51640                                   ;PEOPLE JUMP HERE WHO WANT A "DCX       H" AND
                                51660                                   ; DON'T CARE ABOUT M
                                51680           MOV     M,B             ;PUT IN THE SIGN
                                51700           RET                     ;ALL DONE
                                51720
                                51740           ;HERE TO INITIALLY SET UP THE FORMAT SPECS AND PUT IN A SPACE FOR THE
                                51760           ;SIGN OF A POSITIVE NUMBER
                                51780   FOUINI: STA     TEMP3           ;SAVE THE FORMAT SPECIFICATION
                                51800           LXI     H,FBUFFR+1      ;GET A POINTER INTO FBUFFR
                                51820           MVI     M," "           ;PUT IN A SPACE
                                51840           RET                     ;ALL DONE
                                51860
                                51880           ;HERE TO PRINT A SNG OR DBL IN FREE FORMAT
                                51900   FOUFRV: PUSH    H               ;SAVE THE BUFFER POINTER
```



```
                                51920           JZ      FOUFRS          ;WE HAVE A SNG
                                51940           ;HERE TO SET UP THE FLAG TO PRINT A DBL IN FREE FORMAT
                                51960           MVI     D,20            ;WE HAVE A DBL, SET THE DIGIT COUNT
                                51980           XWD     1000,001        ;"LXI   B" OVER THE NEXT TWO BYTES
                                52000           ;HERE TO SET UP THE FLAG TO PRINT A SNG IN FREE FORMAT
                                52020   FOUFRS: MVI     D,6             ;SET THE DIGIT COUNT
                                52040           CALL    FOUTNV          ;NORMALIZE THE FAC SO ALL SIGNIFICANT DIGITS
                                52060                                   ; ARE IN THE INTEGER PART
                                52080           LXI     B,2*400+$CODE   ;B = DECIMAL POINT COUNT
                                52100                                   ;C = COMMA COUNT
                                52120                                   ;SET COMMA COUNT TO ZERO AND DECIMAL POINT
                                52140                                   ; COUNT FOR E NOTATION
                                52160           ADD     D               ;SEE IF NUMBER SHOULD BE PRINTED IN E NOTATION
                                52180           JM      FOFRS1          ;IT SHOULD, IT IS .LT. .1
                                52200           INR     D               ;CHECK IF IT IS TOO BG
                                52220           CMP     D
                                52240           JNC     FOFRS1          ;IT IS TOO BIG, IT IS .GT. 10**D-1
                                52260           INR     A               ;IT IS OK FOR FIXED POINT NOTATION
                                52280           MOV     B,A             ;SET DECIMAL POINT COUNT
                                52300           MVI     A,1             ;SET FIXED POINT FLAG, THE EXPONENT IS ZERO
                                52320                                   ; IF WE ARE USING FIXED POINT NOTATION
                                52340   FOFRS1: DCR     A               ;E NOTATION: ADD D-1 TO ORIGINAL EXPONENT
                                52360           POP     H               ;GET THE BUFFER POINTER BACK
                                52380           PUSH    PSW             ;SAVE THE EXPONENT FOR LATER
                                52400           CALL    FOUTCV          ;CONVERT THE NUMBER TO DECIMAL DIGITS
                                52420           ;HERE TO SUPPRESS THE TRAILING ZEROS
                                52440   FOFRS2: DCX     H               ;MOVE BACK TO THE LAST CHARACTER
                                52460           MOV     A,M             ;GET IT AND SEE IF IT WAS ZERO
                                52480           CPI     "0"
                                52500           JZ      FOFRS2          ;IT WAS, CONTINUE SUPPRESSING
                                52520           CPI     "."             ;HAVE WE SUPPRESSED ALL THE FRACTIONAL DIGITS?
                                52540           CNZ     INXHRT          ;YES, IGNORE THE DECIMAL POINT ALSO
                                52560           POP     PSW             ;GET THE EXPONENT BACK
                                52580           JZ      FOUTON          ;WE ARE DONE IF WE ARE IN FIXED POINT NOTATION
                                52600                                   ;FALL IN AND PUT THE EXPONENT IN THE BUFFER
                                52620
                                52640           ;HERE TO PUT THE EXPONENT AND "E" OR "D" IN THE BUFFER
                                52660           ;THE EXPONENT IS IN A
                                52680   FOFLDN: MOV     B,A             ;SAVE THE EXPONENT
                                52700           LDA     VALTYP          ;GET THE VALTYP TO DEIDE IF WE PRINT AN "E"
                                52720           CPI     4               ; OR A "D"
                                52740           MOV     A,B             ;GET THE EXPONENT BACK
                                52760           JZ      FOUCEE          ;WE HAVE TO PRINT AN "E"
                                52780           MVI     M,"D"           ;GET THE "D"
                                52800           XWD     1000,001        ;"LXI   B" OVER THE NEXT TWO BYTES
                                52820   FOUCEE: MVI     M,"E"           ;GET AN "E"
                                52840           INX     H               ;PUT SIGN OF EXPONENT IN BUFFER
                                52860           ;PUT IN THE SIGN OF THE EXPONENT
                                52880           MVI     M,"+"           ;A PLUS IF POSITIVE
                                52900           JP      FOUCE1
                                52920           MVI     M,"-"           ;A MINUS IF NEGATIVE
                                52940           CMA                     ;NEGATE EXPONENT
                                52960           INR     A
```

```
                        ;CALCULATE THE TWO DIGIT EXPONENT
        FOUCE1: MVI     B,"0"-1         ;INITIALIZE TEN'S DIGIT COUNT
        FOUCE2: INR     B               ;INCREMENT DIGIT
                SUI     12              ;SUBTRACT TEN
                JNC     FOUCE2          ;DO IT AGAIN IF RESULT WAS POSITIVE
                ADI     "0"+12          ;ADD BACK IN TEN AND CONVERT TO ASCII
                ;PUT THE EXPONENT IN THE BUFFER
                INX     H
                MOV     M,B             ;PUT TEN'S DIGIT OF EXPONENT IN BUFFER
                INX     H               ;WHEN WE JUMP TO HERE, A IS ZERO
                MOV     M,A             ;PUT ONE'S DIGIT IN BUFFER
        FOUTZR: INX     H               ;INCREMENT POINTER, HERE TO FINISH UP PRINTING
                                        ; A FREE FORMAT ZERO
        FOUTON: MVI     M,0             ;PUT A ZERO AT THE END OF THE NUMBER
                XCHG                    ;SAVE THE POINTER TO THE END OF THE NUMBER
                                        ; IN (DE) FOR FFXFLY
                LXI     H,FBUFFR+1      ;GET A POINTER TO THE BEGINNING
                RET                     ;ALL DONE

                ;HERE TO PUT A POSSIBLE COMMA COUNT IN C, AND ZERO C IF WE ARE NOT
                ;USING THE COMMA SPECIFICATION
        FOUTCC: MOV     C,A             ;SAVE A POSSIBLE COMMA COUNT
        FOUICC: LDA     TEMP3           ;GET THE FORMAT SPECS
                ANI     100             ;LOOK AT THE COMMA BIT
                RNZ                     ;WE ARE USING COMMAS, JUST RETURN
                MOV     C,A             ;WE AREN'T, ZERO THE COMMA COUNT
                RET                     ;ALL DONE

                ;HERE TO PRINT A NUMBER IN FIXED FORMAT
        FOUTFX: CPI     4               ;CHECK WHAT KIND OF VALUE WE HAVE
                MOV     A,D             ;GET THE FORMAT SPECS
                JNC     FOUFXV          ;WE HAVE A SNG OR A DBL
                ;HERE TO PRINT AN INTEGER IN FIXED FORMAT
                RAR                     ;CHECK IF WE HAVE TO PRINT IT IN FLOATING
                JC      FFXIFL          ; POINT NOTATION
                ;HERE TO PRINT AN INTEGER IN FIXED FORMAT=FIXED POINT NOTATION
                LXI     B,6*400+3*$CODE ;SET DECIMAL POINT COUNT TO 6 AND
                                        ; COMMA COUNT TO 3
                CALL    FOICC           ;CHECK IF WE DON'T HAVE TO USE THE COMMAS
                POP     D               ;GET THE FIELD LENGTHS
                MOV     A,D             ;SEE IF WE HAVE TO PRINT EXTRA SPACES BECAUSE
                SUI     5               ; THE FIELD IS TOO BIG
                CP      FOTZER          ;WE DO, PUT IN ZEROS, THEY WILL LATER BE
                                        ; CONVERTED TO SPACES OR ASTERISKS BY FOUTZS
                PUSH    D               ;SAVE THE FIELD LENGTHS AGAIN
                CALL    FOUTCI          ;CONVERT THE NUMBER TO DECIMAL DIGITS
                POP     D               ;GET THE FIELD LENGTHS BACK
                ORA     E               ;DO WE NEED A DECIMAL POINT?  HERE A=0
                CZ      FOFXIS          ;WE DON'T, BACKSPACE OVER IT,  AT FOFXIS,
                                        ; WE DON'T CARE ABOUT B, WE ONLY WANT THE
                                        ; "DCX  H",  LATER ON WE WILL DO A "MVI M,0"
                                        ; AND COVER UP WHAT WAS IN B,
                CNZ     FOTZER          ;FOFXIS PRESERVES THE CONDITION CODES
```



```
                                        ;IF WE DO HAVE DECIMAL PLACES, FILL THEM UP
                                        ; WITH ZEROS
                                        ;FALL IN AND FINISH UP THE NUMBER

                ;HERE TO FINISH UP A FIXED FORMAT NUMBER
        FOUTTS: PUSH    H               ;SAVE BUFFER POINTER
                CALL    FOUTZS          ;ZERO SUPPRESS THE NUMBER
                POP     H               ;GET THE BUFFER POINTER BACK
                JZ      FFXIX1          ;CHECK IF WE HAVE A TRAILING SIGN
                MOV     M,B             ;WE DO, PUT THE SIGN IN THE BUFFER
                INX     H               ;INCREMENT THE BUFFER POINTER
        FFXIX1: MVI     M,0             ;PUT A ZERO AT THE END OF THE NUMBER

                ;HERE TO CHECK IF A FIXED FORMAT=FIXED POINT NUMBER OVERFLOWED ITS
                ;FIELD LENGTH
                ;D = THE B IN THE FORMAT SPECIFICATION
                ;THIS ASSUMES THE LOCATION OF THE DECIMAL POINT IS IN TEMP2
                LXI     H,FBUFFR        ;GET A POINTER TO THE BEGINNING
        FOUBE1: INX     H               ;INCREMENT POINTER TO THE NEXT CHARACTER
        FOUBE5: LDA     TEMP2           ;GET THE LOCATION OF THE DECIMAL POINT
                SUB     L               ;FIGURE OUT HOW MUCH SPACE WE ARE TAKING
                SUB     D               ;IS THIS THE RIGHT AMOUNT OF SPACE TO TAKE?
                RZ                      ;YES, WE ARE DONE, RETURN FROM FOUT
                MOV     A,M             ;NO, WE MUST HAVE TOO MUCH SINCE WE STARTED
                                        ; CHECKING FROM THE BEGINNING OF THE BUFFER
                                        ; AND THE FIELD MUST BE SMALL ENOUGH TO FIT IN
                                        ; THE BUFFER,  GET THE NEXT CHARACTER IN
                                        ; THE BUFFER
                CPI     " "             ;IF IT IS A SPACE OR AN ASTERISK, WE CAN
                JZ      FOUBE1          ; IGNORE IT AND MAKE THE FIELD SHORTER WITH
                CPI     "*"             ; NO ILL EFFECTS
                JZ      FOUBE1
                DCX     H               ;MOVE THE POINTER BACK ONE TO READ THE
                                        ; CHARACTER WITH CHMGET
                PUSH    H               ;SAVE THE POINTER

                ;HERE WE SEE IF WE CAN IGNORE THE LEADING ZERO BEFORE A DECIMAL POINT,
                ;THIS OCCURS IF WE SEE THE FOLLOWING: (IN ORDER)
                ;       A SIGN (EITHER "-" OR "+")              [OPTIONAL]
                ;       A DOLLAR SIGN                           [OPTIONAL]
                ;       A ZERO                                  [MANDATORY]
                ;       A DECIMAL POINT                         [MANDATORY]
                ;       ANOTHER DIGIT                           [MANDATORY]
                ;IF YOU SEE A LEADING ZERO, IT MUST BE THE ONE BEFORE A DECIMAL POINT
                ;OR ELSE FOUTZS WOULD HAVE SUPPRESSED IT, SO WE CAN JUST "INX  H"
                ;OVER THE CHARACTER FOLLOWING THE ZERO, AND NOT CHECK FOR THE
                ;DECIMAL POINT EXPLICITLY,
        FOUBE2: PUSH    PSW             ;PUT THE LAST CHARACTER ON THE STACK,  THE
                                        ; ZERO FLAG IS SET,  THE FIRST TIME THE ZERO
                                        ; ZERO FLAG IS NOT SET,
                LXI     B,FOUBE2        ;GET THE ADDRESS WE GO TO IF WE SEE A CHARACTER

                PUSH    B               ; WE ARE LOOKING FOR
```

```
55080          CHRGET                  ;GET THE NEXT CHARACTER
55100          CPI     "-"             ;SAVE IT AND GET THE NEXT CHARACTER IF IT IS
55120          RZ                      ; A MINUS SIGN, A PLUS SIGN OR A DOLLAR SIGN
55140          CPI     "+"
55160          RZ
55180          CPI     "$"
55200          RZ
55220          POP     B               ;IT ISN'T, GET THE ADDRESS OFF THE STACK
55240          CPI     "0"             ;IS IT A ZERO?
55260          JNZ     FOUBE4          ;NO, WE CAN NOT GET RID OF ANOTHER CHARACTER
55280          INX     H               ;SKIP OVER THE DECIMAL POINT
55300          CHRGET                  ;GET THE NEXT CHARACTER
55320          JNC     FOUBE4          ;IT IS NOT A DIGIT, WE CAN'T SHORTEN THE FIELD
55340          DCX     H               ;WE CAN!!!  POINT TO THE DECIMAL POINT
55360          XWD     1000,001        ;"LXI   B" OVER THE NEXT 2 BYTES
55380  FOUBE3: DCX     H               ;POINT BACK ONE CHARACTER
55400          MOV     M,A             ;PUT THE CHARACTER BACK
55420
55440          ;IF WE CAN GET RID OF THE ZERO, WE PUT THE CHARACTERS ON THE STACK
55460          ;BACK INTO THE BUFFER ONE POSITION IN FRONT OF WHERE THEY ORIGINALLY
55480          ;WERE,  NOTE THAT THE MAXIMUM NUMBER OF STACK LEVELS THIS USES IS
55500          ;THREE -- ONE FOR THE LAST ENTRY FLAG, ONE FOR A POSSIBLE SIGN,
55520          ;AND ONE FOR A POSSIBLE DOLLAR SIGN,  WE DON'T HAVE TO WORRY ABOUT
55540          ;THE FIRST CHARACTER BEING IN THE BUFFER TWICE BECAUSE THE POINTER
55560          ;WHEN FOUT EXITS WILL BE POINTING TO THE SECOND OCCURANCE.
55580          POP     PSW             ;GET THE CHARACTER OFF THE STACK
55600          JZ      FOUBE3          ;PUT IT BACK IN THE BUFFER IF IT IS NOT THE
55620                                  ; LAST ONE
55640          POP     B               ;GET THE BUFFER POINTER OFF THE STACK
55660          JMP     FOUBE3          ;SEE IF THE FIELD IS NOW SMALL ENOUGH
55680          ;HERE IF THE NUMBER IS TOO BIG FOR THE FIELD
55700  FOUBE4: POP     PSW             ;GET THE CHARACTERS OFF THE STACK
55720          JZ      FOUBE4          ;LEAVE THE NUMBER IN THE BUFFER ALONE
55740          POP     H               ;GET THE POINTER TO THE BEGINNING OF THE
55760                                  ; NUMBER MINUS 1
55780          MVI     M,"%"           ;PUT IN A PERCENT SIGN TO INDICATE THE NUMBER
55800                                  ; WAS TOO LARGE FOR THE FIELD
55820          RET                     ;ALL DONE -- RETURN FROM FOUT
55840
55860          ;HERE TO PRINT A SNG OR DBL IN FIXED FORMAT
55880  FOUFXV: PUSH    H               ;SAVE THE BUFFER POINTER
55900          RAR                     ;GET FIXED OR FLOATING NOTATION FLAG IN CARRY
55920          JC      FFXFLV          ;PRINT THE NUMBER IN E-NOTATION
55940          JZ      FFXSFX          ;WE HAVE A SNG
55960          ;HERE TO PRINT A DBL IN FIXED FORMAT--FIXED POINT NOTATION
55980          LXI     D,FFXOXM        ;GET POINTER TO 1D16
56000          CALL    DCOMPO          ;WE CAN'T PRINT A NUMBER ,GE, 10^16 IN FIXED
56020                                  ; POINT NOTATION
56040          LXI     D,16*400+$CODE  ;SET D = NUMBER OF DIGITS TO PRINT FOR A DBL
56060                                  ;C = 0 FOR DBL (THIS IS FOR COMMAS)
56080          JM      FFXSDC          ;IF THE FAC WAS SMALL ENOUGH, GO PRINT IT
56100          ;HERE TO PRINT IN FREE FORMAT WITH A PERCENT SIGN A NUMBER ,GE, 10^16
56120  FFXSDO: XRA     A               ;SET THE FORMAT SPECS TO FREE FORMAT
```



```
56140          STA     TEMP3
56160          POP     H               ;GET THE BUFFER POINTER
56180          DCX     H               ;SET IT UP TO JUMP BACK INTO FOUT
56200                                  ;NOW (HL)=FBUFFR+1
56220          CALL    FOUT1           ;PRINT THE NUMBER IN FREE FORMAT, THE SIGN
56240                                  ; IS ALREADY IN THE BUFFER
56260          DCX     H               ;POINT IN FRONT OF THE NUMBER
56280          MVI     M,"%"           ;PUT IN THE PERCENT SIGN
56300          RET                     ;ALL DONE--RETURN FROM FOUT
56320          ;HERE TO PRINT A SNG IN FIXED FORMAT--FIXED POINT NOTATION
56340  FFXSFX: MOVRI   226,016,033,312 ;GET 1E16, CHECK IF THE NUMBER IS TOO BIG
56360          CALL    FCOMP
56380          JP      FFXSDO          ;IT IS, PRINT IT IN FREE FORMAT WITH A % SIGN
56400          LXI     D,6*400+2+$CODE ;SET UP FLAGS FOR SNG --
56420                                  ;D = NUMBER OF DIGITS TO PRINT IN A SNG
56440                                  ;C = 2 (THIS IS FOR THE COMMAS)
56460          ;HERE TO ACTUALLY PRINT A SNG OR DBL IN E NOTATION
56480  FFXSDC: FSIGN                   ;SEE IF WE HAVE ZERO
56500          CNZ     FOUTNV          ;IF NOT, NORMALIZE THE NUMBER SO ALL DIGITS TO
56520                                  ; BE PRINTED ARE IN THE INTEGER PART
56540          POP     H               ;GET THE BUFFER POINTER
56560          POP     B               ;GET THE FIELD LENGTH SPECS
56580          JM      FFXXVS          ;DO DIFFERENT STUFF IF [redacted] EXPONENT IS NEGATIVE

56600          ;HERE TO PRINT A NUMBER WITH NO FRACTIONAL DIGITS
56620          PUSH    B               ;SAVE THE FIELD LENGTH SPECS AGAIN
56640          MOV     C,A             ;SAVE THE EXPONENT
56660          MOV     A,B             ;WE HAVE TO PRINT LEADING ZEROS IF THE FIELD
56680          SUB     D               ; HAS MORE CHARACTERS THAN THERE ARE DIGITS IN
56700          SUB     C               ; THE NUMBER
56720          CP      FOTZER          ;FOUTZS WILL LATER SUPPRESS THEM
56740          MOV     A,C             ;SET UP THE COMMA COUNT
56760          ADD     E
56780          MOV     E,C             ;WE NO LONGER NEED THE NUMBER WE SETUP IN E
56800  FFXXV1: SUI     3               ;REDUCE A MOD 3
56820          JNC     FFXXV1
56840          ADI     3               ;ADD 3 BACK AND ADD IN 2 MORE FOR SCALING
56860          CALL    FOUTCC          ;CHECK IF WE HAVE TO USE COMMAS AT ALL
56880          MOV     A,E             ;SETUP THE DECIMAL POINT COUNT
56900          ADD     D
56920          INR     A
56940          MOV     B,A             ;IT GOES IN B
56960          PUSH    D               ;SAVE SNG OR DBL AND EXPONENT INFORMATION
56980          CALL    FOUTCV          ;CONVERT THE NUMBER TO DECIMAL DIGITS
57000          POP     D               ;GET THE SNG OR DBL AND EXPONENT INFO BACK
57020          ORA     E               ;PUT IN DIGITS AFTER THE NUMBER IF IT
57040                                  ; IS BIG ENOUGH, HERE A=0
57060          CNZ     FOTZRC          ;THERE CAN BE COMMAS IN THESE ZEROS
57080          POP     D               ;GET THE FIELD LENGTH SPECS
57100          ORA     E               ;HERE A=0
57120          CNZ     FOUTDP          ;PRINT A DECIMAL POINT IF NECESSARY
57140          DCR     A               ;SEE IF WE SHOULD PRINT SOME ZEROS TO FILL IN
57160          CP      FOTZER          ; THE DECIMAL PLACES
```

```
                        57160          JMP     FOUTTS          ;GO CHECK THE SIZE, ZERO SUPPRESS, ETC, AND
                        57200                                  ; FINISH THE NUMBER
                        57220          ;HERE TO PRINT A SNG OR DBL THAT HAS FRACTIONAL DIGITS
                        57240  FFXXV5: MOV     E,A             ;SAVE THE EXPONENT, WE DON'T NEED WHAT IS IN E
                        57260          MOV     A,C             ;DIVIDE BY TEN THE RIGHT NUMBER OF TIMES SO
                        57280          ORA     A               ; THE RESULT WILL BE ROUNDED CORRECTLY AND
                        57300          CNZ     OCRART          ; HAVE THE CORRECT NUMBER OF SIGNIFICANT
                        57320          ADD     E               ; DIGITS
                        57340          PUSH    PSW             ;SAVE THIS NUMBER FOR LATER
                        57360  FFXXV2: CM      FINDIV          ;THIS IS THE DIVIDE LOOP
                        57380          JM      FFXXV2
                        57400          MOV     A,E             ;WE HAVE TWO CASES DEPENDING ON WHETHER THE
                        57420          ADD     D               ; THE NUMBER IS ,LT, ,1 OR NOT
                        57440          MOV     A,B
                        57460          JM      FFXXV3
                        57480          ;HERE TO PRINT NUMBERS ,GE, ,1
                        57500          SUB     D               ;PRINT SOME LEADING ZEROS IF THE FIELD IS
                        57520          SUB     E               ; BIGGER THAN THE NUMBER OF DIGITS WE WILL
                        57540          CP      FOTZER          ; PRINT
                        57560          POP     PSW             ;WE DON'T NEED THE NUMBER WE SAVED BEFORE
                        57580          MOV     B,E             ;GET ALL THE PERTINENT INFO IN B,C
                        57600          PUSH    B               ;SAVE THE EXPONENT AND "C" IN FIELD SPEC
                        57620          MOV     A,E             ;SET UP THE DECIMAL POINT COUNT
                        57640          ADD     D
                        57660          INR     A
                        57680          MOV     B,A
                        57700          MOV     A,D             ;SET UP THE COMMA COUNT
                        57720          ANI     2               ;THESE 2 INSTRUCTIONS MAP 6 TO 4
                        57740          ADI     2               ; AND 16 TO 2
                        57760          ADD     E
                        57780          CALL    FOUTCC          ;CHECK IF WE HAVE TO DO THE COMMA THING
                        57800          JMP     FFXXV6          ;CONVERT THE DIGITS AND DO THE TRIMMING UP
                        57820          ;HERE TO PRINT A NUMBER ,LT, ,1
                        57840  FFXXV3: CALL    FOTZER          ;PUT ALL ZEROS BEFORE THE DECIMAL POINT
                        57860          MOV     A,C             ;SAVE C
                        57880          CALL    FOUTDP          ;PUT IN A DECIMAL POINT
                        57900          MOV     C,A             ;RESTORE C
                        57920          POP     PSW             ;GET THE NUMBER WE SAVED
                        57940          JM      FFXXV4          ;DECIDE HOW MANY ZEROS TO PRINT BETWEEN THE
                        57960          XRA     A               ; DECIMAL POINT AND THE FIRST DIGIT WE WILL
                        57980          SUB     E               ; PRINT,  HERE THE FIELD IS BIG ENOUGH TO
                        58000          SUB     D               ; HOLD ALL THE DIGITS
                        58020          JMP     FFXXV5          ;GO PRINT THEM
                        58040  FFXXV4: MOV     A,C             ;HERE WE HAD TO DIVIDE BY TEN SO THE FIELD
                        58060          SUB     D               ; IS SMALLER THAN ALL SIGNIFICANT DIGITS IN
                        58080          DCR     A               ; THE NUMBER
                        58100  FFXXV5: CALL    FOTZER          ;PRINT THE ZEROS
                        58120          MOV     B,E             ;SAVE THE EXPONENT IN B
                        58140          PUSH    B               ;SAVE EXPONENT AND THE "C" IN THE FIELD SPEC
                        58160          MOV     B,A             ;ZERO THE DECIMAL PLACE COUNT
                        58180          MOV     C,A             ;ZERO THE COMMA COUNT
                        58200  FFXXV6: CALL    FOUTCV          ;CONVERT THE NUMBER TO DECIMAL DIGITS
                        58220          POP     D               ;GET THE EXPONENT AND FIELD SPEC BACK
```



```
                        58240          ORA     E               ;CHECK IF WE HAVE TO PRINT ANY ZEROS AFTER
                        58260                                  ; THE LAST DIGIT
                        58280          JZ      FFXXV7          ;CHECK IF THERE WERE ANY DECIMAL PLACES AT ALL
                        58300          ADD     D               ;PRINT SOME MORE TRAILING ZEROS
                        58320          DCR     A
                        58340          CP      FOTZER
                        58360          JMP     FOUTTS          ;FINISH UP THE NUMBER
                        58380          ;THERE WERE NO DECIMAL PLACES, IGNORE ALL DIGITS AFTER THE DECIMAL
                        58400          ;POINT
                        58420  FFXXV7: LHLD    TEMP2           ;THE END OF THE NUMBER IS WHERE THE DP IS
                        58440          JMP     FOUTTS          ;FINISH UP THE NUMBER
                        58460
                        58480          ;HERE TO PRINT AN INTEGER IN FIXED FORMAT--FLOATING POING NOTATION
                        58500  FFXIFL: PUSH    H               ;SAVE THE BUFFER POINTER
                        58520          PUSH    D               ;SAVE THE FORMAT SPECS
                        58540          CALL    CONSI           ;CONVERT THE INTEGER TO A SNG
                        58560          POP     D               ;GET THE FORMAT SPECS BACK
                        58580          POP     H               ;GET THE BUFFER POINTER BACK
                        58600          XRA     A               ;SET FLAGS TO PRINT THE NUMBER AS A SNG
                        58620                                  ;FALL INTO FFXFLV
                        58640
                        58660          ;HERE TO PRINT A SNG OR DBL IN FIXED FORMAT=FLOTATING POINT NOTATION
                        58680  FFXFLV: JZ      FFXSFL          ;IF WE HAVE A SNG, SET THE RIGHT FLAGS
                        58700          MVI     E,20            ;WE HAVE A DBL, GET HOW MANY DIGITS WE HAVE
                        58720          XWD     1000,001        ;"LXI   B" OVER THE NEXT TWO BYTES
                        58740  FFXSFL: MVI     E,6             ;WE HAVE A DBL, GET HOW MANY DIGITS WE PRINT
                        58760          FSIGN                   ;SEE IF WE HAVE ZERO
                        58780          CNZ     FOUTNV          ;IF NOT, NORMALIZE THE NUMBER SO ALL DIGITS TO
                        58800                                  ; BE PRINTED ARE IN THE INTEGER PART
                        58820          POP     H               ;GET THE BUFFER POINTER BACK
                        58840          POP     B               ;GET THE FIELD LENGTH SPECS
                        58860          PUSH    PSW             ;SAVE THE EXPONENT
                        58880          MOV     A,C             ;CALCULATE HOW MANY SIGNIFICANT DIGITS WE MUST
                        58900          ORA     A               ; PRINT
                        58920          PUSH    PSW             ;SAVE THE "C" FIELD SPEC FOR LATER
                        58940          CNZ     OCRART
                        58960          ADD     B
                        58980          MOV     C,A
                        59000          MOV     A,D             ;GET THE FIELD SPEC
                        59020          ANI     4               ;SEE IF THE SIGN IS A TRAILING SIGN
                        59040          CPI     1               ;SET CARRY IF A IS ZERO
                        59060          SBB     A               ;SET D=0 IF WE HAVE A TRAILING SIGN,
                        59080          MOV     D,A             ; D=377 IF WE DO NOT
                        59100          ADD     C
                        59120          MOV     C,A             ;SET C=NUMBER OF SIGNIFICANT DIGITS TO PRINT
                        59140          SUB     E               ;IF WE HAVE LESS THAN E, THEN WE MUST GET RID
                        59160  FFXLV1: CM      FINDIV          ; OF SOME BY DIVIDING BY TEN AND ROUNDING
                        59180          JM      FFXLV1
                        59200          PUSH    B               ;SAVE THE "B" FIELD SPEC AND # OF SIG DIGITS
                        59220          MOV     A,B             ;SET THE DECIMAL PLACE COUNT
                        59240          INR     A
                        59260          SUB     D               ;TAKE INTO ACCOUNT IF THE SIGN IS TRAILING
                        59280          MOV     B,A
```

```
                59300           MVI     C,0             ;SET COMMA COUNT TO ZERO, THE COMMA SPEC IS
                59320           PUSH    D               ; IGNORED,  SAVE TRAILING SIGN INFO
                59340           CALL    FOUTCV          ;CONVERT THE NUMBER TO DECIMAL DIGITS
                59360           POP     D               ;GET THE TRAILING SIGN INFO BACK
                59380           POP     B               ;GET # OF SIG DIGITS AND "B" FIELD SPEC BACK
                59400           MOV     A,C             ;PRINT TRAILING ZEROS IF THE FIELD LENGTH IS
                59420           SUB     E               ; LONGER THAN THE NUMBER OF DIGITS WE CAN PRINT

                59440           CP      FOTZRC          ;THE DECIMAL POINT COULD COME OUT IN HERE
                59460           POP     PSW             ;GET THE "C" FIELD SPEC BACK
                59480           CZ      FOFXIS          ;IF C=0, THE LAST THING WAS A DECIMAL POINT,
                59500                                   ; SO IGNORE IT.  ALL WE CARE ABOUT IS THE
                59520                                   ; "DCX  H" AND NOT THE "MOV     M,B" AT FOFXIS
                59540           POP     PSW             ;GET THE EXPONENT BACK
                59560           ADD     E               ;SCALE IT CORRECTLY
                59580           SUB     B
                59600           SUB     D
                59620           PUSH    B               ;SAVE THE "B" FIELD SPEC
                59640           CALL    FOFLDN          ;PUT THE EXPONENT IN THE BUFFER
                59660           XCHG                    ;GET THE POINTER TO THE END IN (HL)
                59680                                   ; IN CASE WE HAVE A TRAILING SIGN
                59700           POP     D               ;GET THE "B" FIELD SPEC IN D, PUT ON A POSSIBLE

                59720           JMP     FOUTTS          ; TRAILING SIGN AND WE ARE DONE
                                                         POSSIBLE
                59740
                59760           ;NORMALIZE THE NUMBER IN THE FAC SO ALL THE DIGITS ARE IN THE INTEGER
                59760           ;PART,  RETURN THE BASE 10 EXPONENT IN A
                59800           ;D,E ARE LEFT UNALTERED
                59820   FOUTNV: PUSH    D               ;SAVE (DE)
                59840           LDA     VALTYP          ;GET WHAT KIND OF VALUE WE HAVE
                59860           CPI     4
                59880           JNZ     FOUTND          ;WE HAVE A DBL
                59900           ;NORMALIZE A SNG
                59920           XRA     A               ;ZERO THE EXPONENT
                59940           PUSH    PSW             ;SAVE IT
                59960           CALL    FOUNSC          ;IS THE FAC TOO BIG OR TOO SMALL?
                59980   FOUNS1: MOVRI   221,183,117,370 ;GET 99999,9499 TO SEE IF THE FAC IS BIG
                60000           CALL    FCOMP           ; ENOUGH YET
                60020           JPO     FOUNS3          ;IT IS, WE ARE DONE
                60040           POP     PSW             ;IT ISN'T, MULTIPLY BY TEN
                60060           CALL    FINMLT
                60080           PUSH    PSW             ;SAVE THE EXPONENT AGAIN
                60100           JMP     FOUNS1          ;NOW SEE IF IT IS BIG ENOUGH
                60120   FOUNS2: POP     PSW             ;THE FAC IS TOO BIG, GET THE EXPONENT
                60140           CALL    FINDIV          ;DIVIDE IT BY TEN
                60160           PUSH    PSW             ;SAVE THE EXPONENT AGAIN
                60180           CALL    FOUNSC          ;SEE IF THE FAC IS SMALL ENOUGH
                60200   FOUNS3: POP     PSW             ;WE ARE DONE, GET THE EXPONENT BACK
                60220           POP     D               ;GET (DE) BACK
                60240           RET                     ;ALL DONE
                60260           ;HERE TO SEE IF THE FAC IS SMALL ENOUGH YET
                60280   FOUNSC: MOVRI   224,164,043,367 ;GET 999999,499 TO SEE IF THE FAC IS TOO BIG
                60300           CALL    FCOMP
```



```
                60320           POP     H               ;GET THE RETURN ADRESS OFF THE STACK
                60340           JPO     FOUNS2          ;IT IS TOO BIG, MAKE IT SMALLER
                60360           PCHL                    ;IT IS SMALL ENOUGH, RETURN
                60380           ;HERE TO NORMALIZE A DBL NUMBER
                60400   >
                60420   PAGE
```

```
                                        60440   SUBTTL  EXPONENTIATION AND THE SQUARE ROOT FUNCTION
                                        60460   IFE     EXTFNC,<
                                        60480           ;SQUARE ROOT FUNCTION  ---  X=SQR(A)
                                        60500           ;WE FIRST SCALE THE ARGUMENT TO BETWEEN .5 AND 2 BY LOOKING AT THE
                                        60520           ;EXPONENT AND USING SQR(M*2^(2*N))=2^N*SQR(M),  THEN NEWTON'S METHOD
                                        60540           ;IS USED TO COMPUTE SQR(M),  THE EXPONENT IS SAVED TO SCALE THE
                                        60560           ;RESULT AT THE END.
                                        60580           ;NEWTON'S METHOD FOR SQUARE ROOT:
                                        60600           ;  X(0)=A
                                        60620           ;  X(N+1)=(X(N)+A/X(N))/2
                                        60640   SQR:    FSIGN                   ;CHECK FOR ERROR CONDITION
                                        60660           JM      FCERR           ;CAN'T TAKE SQR OF NEGATIVE NUMBER
                                        60680           RZ                      ;  0=SQR(0)
                                        60700           LXI     H,FAC           ;SCALE ARGUMENT TO BETWEEN .5 AND 2
                                        60720           MOV     A,M             ;GET EXPONENT
                                        60740           RAR                     ;GET EXPONENT OF SCALE FACTOR
                                        60760                                   ;USE  SQR(M*2^(2*N))=2^N*SQR(M)
                                        60780           PUSH    PSW             ;SAVE IT
                                        60800           PUSH    H               ;SAVE POINTER TO EXPONENT
                                        60820           MVI     A,100           ;SET EXPONENT OF SCALED DOWN NUMBER
                                        60840           RAL
                                        60860           MOV     M,A             ;REPLACE IT
                                        60880           LXI     H,FBUFFR        ;SAVE A
                                        60900           CALL    MOVMF
                                        60920           MVI     A,4             ;SET ITERATION COUNT
                                        60940   SQR1:   PUSH    PSW             ;SAVE COUNT
                                        60960           CALL    PUSHF           ;SAVE X(N)
                                        60980           LXI     H,FBUFFR        ;COMPUTE A/X(N)
                                        61000           CALL    MOVRM           ;GET A IN THE REGISTERS
                                        61020           CALL    FDIV
                                        61040           POPH
                                        61060           CALL    FADD            ;ADD IN X(N)
                                        61080           LXI     H,FHALF         ;DIVIDE BY 2
                                        61100           CALL    FMULTS
                                        61120           POP     PSW             ;GET COUNT
                                        61140           DCR     A               ;ARE WE DONE?
                                        61160           JNZ     SQR1            ;NO, DO MORE ITERATIONS
                                        61180           POP     H               ;YES, SET EXPONENT OF ANSWER
                                        61200           POP     PSW             ;GET SCALE FACTOR
                                        61220           ADI     300             ;CONVERT TO AN EXPONENT
                                        61240           ADD     M               ;ADD EXPONENT IN
                                        61260           MOV     M,A             ;REPLACE EXPONENT
                                        61280           RET>                    ;ALL DONE


                                        61340   IFN     EXTFNC,<
                                        61360           ;SUBROUTINE FOR FPWR, ATN
002340' 001000  000041                  61380   PSHNEG: LXI     H,NEG           ;GET THE ADDRESS OF NEG
002341' 000000  001175'
002342' 000000  002307'
002343' 001000  000343                  61400           XTHL                    ;SWITCH RET ADDR AND ADDR OF NEG
002344' 001000  000351                  61420           PCHL                    ;RETURN, THE ADDRESS OF NEG IS ON THE STACK
```



```
                                        61480           ;SQUARE ROOT FUNCTION
                                        61500           ;WE USE SQR(X)=X^.5
002345' 001000  000315                  61520   SQR:    CALL    PUSHF           ;SAVE ARG
002346' 000000  001205'
002347' 000000  002341'
002350' 001000  000041                  61540           LXI     H,FHALF         ;GET 1/2
002351' 000000  002312'
002352' 000000  002346'
002353' 001000  000315                  61560           CALL    MOVFM           ;  SQR(X)=X^.5
002354' 000000  001222'
002355' 000000  002351'
002356' 001000  000301                  61580   FPWRT:  POPR                    ;GET ARG IN REGISTERS, ENTRY TO FPWR IF
002357' 001000  000321                                                          ; ARGUMENT IS ON STACK,  FALL INTO FPWR
                                        61600
                                        61660           ;EXPONENTIATION     ---     X^Y
                                        61680           ;N,B,  0^0=1
                                        61700           ;FIRST WE CHECK IF Y=0, IF SO, THE RESULT IS 1.
                                        61720           ;NEXT, WE CHECK IF X=0, IF SO, THE RESULT IS 0.
                                        61740           ;THEN WE CHECK IF X IS POSITIVE, IF NOT, WE CHECK THAT Y IS A
                                        61760           ;NEGATIVE INTEGER, AND WHETHER IT IS EVEN OR ODD.  IF Y IS A NEGATIVE
                                        61780           ;INTEGER, WE NEGATE X,  IF NOT, LOG WILL GIVE AN FC ERROR WHEN WE CALL
                                        61800           ;IT,  IF X IS NEGATIVE AND Y IS ODD, WE PUSH THE ADDRESS OF NEG ON THE
                                        61820           ;STACK SO WE WILL RETURN TO IT AND GET A NEGATIVE RESULT,  TO COMPUTE
                                        61840           ;THE RESULT WE USE X^Y=EXP(Y*LOG(X))
002360' 001000  000357                  61860   FPWR:   FSIGN                   ;SEE IF Y IS ZERO
002361' 001000  000312                  61880           JZ      EXP             ;IT IS, RESULT IS ONE
002362' 000000  002456'
002363' 000000  002354'
002364' 001000  000170                  61900           MOV     A,B             ;SEE IF X IS ZERO
002365' 001000  000267                  61920           ORA     A
002366' 001000  000312                  61940           JZ      ZERO0           ;IT IS, RESULT IS ZERO
002367' 000000  000174'
002370' 000000  002362'
002371' 001000  000325                  61960           PUSHR                   ;SAVE X ON STACK
002372' 001000  000305
002373' 001000  000171                  61980           MOV     A,C             ;CHECK THE SIGN OF X
002374' 001000  000366                  62000           ORI     177             ;TURN THE ZERO FLAG OFF
002375' 000000  000177
002376' 001000  000315                  62020           CALL    MOVRF           ;GET Y IN THE REGISTERS
002377' 000000  001240'
002400' 000000  002367'
002401' 001000  000362                  62040           JP      FPWR1           ;NO PROBLEMS IF X IS POSITIVE
002402' 000000  002422'
002403' 000000  002377'
002404' 001000  000325                  62060           PUSHR                   ;SAVE Y
002405' 001000  000305
002406' 001000  000315                  62080           CALL    INT             ;SEE IF Y IS AN INTEGER
002407' 000000  001445'
002410' 000000  002402'
002411' 001000  000301                  62100           POPR                    ;GET Y BACK
```

```
3659  002412' 001000  000321
3660  002413' 001000  000365          62120          PUSH   PSW          ;SAVE LO OF INT FOR EVEN AND ODD INFORMATION
3661  002414' 001000  000315          62140          CALL   FCOMP        ;SEE IF WE HAVE AN INTEGER
3662  002415' 000000  001317'
3663  002416' 000000  002407'
3664  002417' 001000  000341          62160          POP    H            ;GET EVEN-ODD INFORMATION
3665  002420' 001000  000174          62180          MOV    A,H          ;PUT EVEN-ODD FLAG IN CARRY
3666  002421' 001000  000037          62200          RAR
3667  002422' 001000  000341          62220  FPWR1:  POP    H            ;GET X BACK IN FAC
3668  002423' 001000  000042          62240          SHLD   FAC-1        ;STORE HO'S
3669  002424' 777777  777777*
3670  002425' 000000  002415'
3671  002426' 001000  000341          62260          POP    H            ;GET LO'S OFF STACK
3672  002427' 001000  000004          62280          SHLD   FACLO        ;STORE THEM IN FAC
3673  002430' 000000  001454*
3674  002431' 000000  002424'
3675  002432' 001000  000334          62300          CC     PSHNEG       ;NEGATE NUMBER AT END IF Y WAS ODD
3676  002433' 000000  002340'
3677  002434' 000000  002430'
3678  002435' 001000  000314          62320          CZ     NEG          ;NEGATE THE NEGATIVE NUMBER
3679  002436' 000000  001175'
3680  002437' 000000  002433'
3681  002440' 001000  000325          62340  FPWR2:  PUSHR               ;SAVE Y AGAIN
3682  002441' 001000  000305
3683  002442' 001000  000315          62360          CALL   LOG          ;COMPUTE  EXP(Y*LOG(X))
3684  002443' 000000  000421'
3685  002444' 000000  002436'
3686  002445' 001000  000301          62380          POPR                ;IF X WAS NEGATIVE AND Y NOT AN INTEGER THEN
3687  002446' 001000  000321
3688  002447' 001000  000315          62400          CALL   FMULT>       ; LOG WILL BLOW HIM OUT OF THE WATER
3689  002450' 000000  002517'
3690  002451' 000000  002443'
3691                                  62420  ;       JMP    EXP
3692                                  62440  PAGE
```



```
3693                                  62460  SUBTTL  EXPONENTIAL FUNCTON
3694                                  62480  IFN     EXTFNC,<
3695                                  62500          ;WE FIRST SAVE THE ORIGINAL ARGUMENT AND MULTIPLY THE FAC BY LOG2(E)
3696                                  62520          ;THE RESULT IS USED TO DETERMINE IF WE WILL GET OVERFLOW SINCE
3697                                  62540          ;EXP(X)=2^(X*LOG2(E)) WHERE LOG2(E)=LOG(E) BASE 2, THEN WE SAVE THE
3698                                  62560          ;INTEGER PART OF THIS TO SCALE THE ANSWER AT THE END, SINCE
3699                                  62580          ;2^Y=2^INT(Y)*2^(Y-INT(Y)) AND 2^INT(Y) IS EASY TO COMPUTE,  SO WE
3700                                  62600          ;NOW COMPUTE 2^(X*LOG2(E)-INT(X*LOG2(E))) BY
3701                                  62620          ;P(LN(2)*(INT(X*LOG2(E))+1)-X) WHERE P IS AN APPROXIMATION
3702                                  62640          ;POLYNOMIAL,  THE RESULT IS THEN SCALED BY THE POWER OF 2 WE
3703                                  62660          ;PREVIOUSLY SAVED.
3704  002452' 001000  000315          62680  EXP:    CALL   PUSHF        ;SAVE ARGUMENT
3705  002453' 000000  001205'
3706  002454' 000000  002450'
3707  002455' 001000  000001          62700          MOVRI  201,070,252,073 ;GET LOG(E) BASE 2,   CACULATE:
3708  002456' 000000  000070
3709  002457' 000000  000201
3710  002460' 001000  000021
3711  002461' 000000  000073
3712  002462' 000000  000252
3713  002463' 001000  000315          62720          CALL   FMULT        ;   INT(ARG/LN(2)) = INT(ARG*LOG2(E))
3714  002464' 000000  002517'
3715  002465' 000000  002453'
3716  002466' 001000  000072          62740          LDA    FAC          ;CARRY=0 IF FAC IS TOO BIG
3717  002467' 000000  001446*
3718  002470' 000000  002464'
3719  002471' 001000  000376          62760          CPI    210          ; I.E, IF ABS(FAC) .GE. 128
3720  002472' 000000  000210
3721  002473' 001000  000322          62780          JNC    MLOVEX       ;IT IS TOO BIG
3722  002474' 000000  001073'
3723  002475' 000000  002467'
3724  002476' 001000  000315          62800          CALL   INT          ;IS ARGUMENT TOO BIG?
3725  002477' 000000  001445'
3726  002500' 000000  002474'
3727  002501' 001000  000306          62820          ADI    200          ;CHECK FOR OVERFLOW
3728  002502' 000000  000200
3729  002503' 001000  000306          62840          ADI    2
3730  002504' 000000  000002
3731  002505' 001000  000332          62860          JC     MLOVEX       ;WE HAVE OVERFLOW!!
3732  002506' 000000  001073'
3733  002507' 000000  002477'
3734  002510' 001000  000365          62880          PUSH   PSW          ;SAVE SCALE FACTOR
3735  002511' 001000  000041          62900          LXI    H,FONE       ;ADD ONE TO THE NUMBER
3736  002512' 000000  000400'
3737  002513' 000000  002506'
3738  002514' 001000  000315          62920          CALL   FADDS
3739  002515' 000000  000003'
3740  002516' 000000  002512'
3741  002517' 001000  000315          62940          CALL   MULLN2       ;MULTIPLY BY LN(2)
3742  002520' 000000  002506'
3743  002521' 000000  002515'
3744  002522' 001000  000361          62960          POP    PSW          ;GET SCALE FACTOR OFF STACK
3745  002523' 001000  000301          62980          POPR                ;GET ARGUMENT
```

```
002524' 001000  000321
002525' 001000  000365          63000           PUSH    PSW             ;PUT SCALE FACTOR BACK ON STACK
002526' 001000  000315          63020           CALL    FSUB            ;SUBTRACT ORIGINAL ARG
002527' 000000  000017'
002530' 000000  002520'
002531' 001000  000315          63040           CALL    NEG
002532' 000000  001175'
002533' 000000  002527'
002534' 001000  000041          63060           LXI     H,EXPCON        ;EVALUATE THE APPROXIMATION POLYNOMIAL
002535' 000000  002552'
002536' 000000  002532'
002537' 001000  000315          63080           CALL    POLY
002540' 000000  002632'
002541' 000000  002535'
002542' 001000  000021          63100           LXI     D,$CODE         ;MULTIPLY BY 2 ** (B-1) INSTEAD OF JUST
002543' 000000  001477*
002544' 000000  002540'
002545' 001000  000301          63120           POP     B               ; ADDING IT TO THE EXPONENT SO FMULT
002546' 001000  000112          63140           MOV     C,D             ; WILL CHECK FOR EXPONENT OVERFLOW
002547' 001000  000303          63160           JMP     FMULT
002550' 000000  002517'
002551' 000000  002543'

                                63200           ;CONSTANTS FOR EXP
002552' 000000  000010          63220   EXPCON: 10      ;DEGREE
002553' 000000  000100          63240           100     ; -.0001413161
002554' 000000  000056          63260           056
002555' 000000  000224          63280           224
002556' 000000  000164          63300           164
002557' 000000  000160          63320           160     ; .001329882
002560' 000000  000117          63340           117
002561' 000000  000056          63360           056
002562' 000000  000167          63380           167
002563' 000000  000156          63400           156     ; -.00830136
002564' 000000  000002          63420           002
002565' 000000  000210          63440           210
002566' 000000  000172          63460           172
002567' 000000  000346          63480           346     ; .04165735
002570' 000000  000240          63500           240
002571' 000000  000052          63520           052
002572' 000000  000174          63540           174
002573' 000000  000120          63560           120     ; -.1666653
002574' 000000  000252          63580           252
002575' 000000  000252          63600           252
002576' 000000  000176          63620           176
002577' 000000  000377          63640           377     ; .4999999
002600' 000000  000377          63660           377
002601' 000000  000177          63680           177
002602' 000000  000177          63700           177
002603' 000000  000000          63720           000     ; =1.0
002604' 000000  000000          63740           000
002605' 000000  000200          63760           200
002606' 000000  000201          63780           201
```



```
002607' 000000  000000          63800           000     ; 1.0
002610' 000000  000000          63820           000
002611' 000000  000000          63840           000
002612' 000000  000201          63860           201>
                                63880   PAGE
```

```
                                        SUBTTL  POLYNOMIAL EVALUATOR AND THE RANDOM NUMBER GENERATOR
                                        IFN     EXTFNC,<
                                                ;EVALUATE P(X"2)*X
                                                ;POINTER TO DEGREE+1 IS IN (HL)
                                                ;THE CONSTANTS FOLLOW THE DEGREE
                                                ;CONSTANTS SHOULD BE STORED IN REVERSE ORDER, FAC HAS X
                                                ;WE COMPUTE:
                                                ; C0*X+C1*X"3+C2*X"5+C3*X"7+...+C(N)*X"(2*N+1)
002615' 001000  000315                  POLYX:  CALL    PUSHF           ;SAVE X
002614' 000000  001205'
002615' 000000  002550'
002616' 001000  000021                          LXI     D,FMULTT        ;PUT ADDRESS OF FMULTT ON STACK SO WHEN WE
002617' 000000  000515'
002620' 000000  002614'
002621' 001000  000325                          PUSH    D               ; RETURN WE WILL MULTIPLY BY X
002622' 001000  000345                          PUSH    H               ;SAVE CONSTANT POINTER
002623' 001000  000315                          CALL    MOVRF           ;SQUARE X
002624' 000000  001240'
002625' 000000  002617'
002626' 001000  000315                          CALL    FMULT
002627' 000000  000517'
002630' 000000  002624'
002631' 001000  000341                          POP     H               ;GET CONSTANT POINTER
                                                                        ;FALL INTO POLY


                                                ;POLYNOMIAL EVALUATOR
                                                ;POINTER TO DEGREE+1 IS IN (HL), IT IS UPDATED
                                                ;THE CONSTANTS FOLLOW THE DEGREE
                                                ;CONSTANTS SHOULD BE STORED IN REVERSE ORDER, FAC HAS X
                                                ;WE COMPUTE:
                                                ; C0+C1*X+C2*X"2+C3*X"3+...+C(N-1)*X"(N-1)+C(N)*X"N
002632' 001000  000315                  POLY:   CALL    PUSHF           ;SAVE X
002633' 000000  001205'
002634' 000000  002627'
002635' 001000  000176                          MOV     A,M             ;GET DEGREE
002636' 001000  000043                          INX     H               ;INCREMENT POINTER TO FIRST CONSTANT
002637' 001000  000315                          CALL    MOVFM           ;MOVE FIRST CONSTANT TO FAC
002640' 000000  001222'
002641' 000000  002633'
002642' 001000  000006                          XWD     1000,006        ;"MVI   B" OVER NEXT BYTE
002643' 001000  000361                  POLY1:  POP     PSW             ;GET DEGREE
002644' 001000  000301                          POPR                    ;GET X
002645' 001000  000321
002646' 001000  000075                          DCR     A               ;ARE WE DONE?
002647' 001000  000310                          RZ                      ;YES, RETURN
002650' 001000  000325                          PUSHR                   ;NO, SAVE X
002651' 001000  000305
002652' 001000  000365                          PUSH    PSW             ;SAVE DEGREE
002653' 001000  000345                          PUSH    H               ;SAVE CONSTANT POINTER
002654' 001000  000315                          CALL    FMULT           ;EVALUATE THE POLY, MULTIPLY BY X
002655' 000000  000517'
002656' 000000  002640'
```



```
002657' 001000  000341                          POP     H               ;GET LOCATION OF CONSTANTS
002660' 001000  000315                          CALL    MOVRM           ;GET CONSTANT
002661' 000000  001243'
002662' 000000  002655'


                                                PUSH    H               ;STORE LOCATION OF CONSTANTS SO FADD AND FMULT
002663' 001000  000345
002664' 001000  000315                          CALL    FADD            ; WILL NOT SCREW THEM UP, ADD IN CONSTANT
002665' 000000  000025'
002666' 000000  002661'
002667' 001000  000341                          POP     H               ;MOVE CONSTANT POINTER TO NEXT CONSTANT
002670' 001000  000303                          JMP     POLY1>          ;SEE IF DONE
002671' 000000  002643'
002672' 000000  002665'


                                                ;PSUEDO-RANDOM NUMBER GENERATOR
                                                ;IF ARG=0, THE LAST RANDOM NUMBER GENERATED IS RETURNED
                                                ;IF ARG .LT. 0, A NEW SEQUENCE OF RANDOM NUMBERS IS STARTED
                                                ; USING THE ARGUMENT
                                                ;TO FORM THE NEXT RANDOM NUMBER IN THE SEQUENCE, WE MULTIPLY THE
                                                ;PREVIOUS RANDOM NUMBER BY A RANDOM CONSTANT, AND ADD IN ANOTHER
                                                ;RANDOM CONSTANT,  THEN THE HO AND LO BYTES ARE SWITCHED, THE
                                                ;EXPONENT IS PUT WHERE IT WILL BE SHIFTED IN BY NORMAL, AND THE
                                                ;EXPONENT IN THE FAC SET TO 200 SO THE RESULT WILL BE LESS THAN 1.
                                                ;THIS IS THEN NORMALIZED AND SAVED FOR THE NEXT TIME.
                                                ;THE HO AND LO BYTES WERE SWITCHED SO WE HAVE A RANDOM CHANCE OF
                                                ;GETTING A NUMBER LESS THAN OR GREATER THAN .5
002673'                                 RND:
                                        IFN     LENGTH=2,<
002673' 001000  000357                          FSIGN>                  ;GET SIGN OF ARG
                                        IFE     LENGTH=2,<
                                                CALL    VSIGN           ;GET THE SIGN OF THE ARG
                                                PUSH    PSW             ;SAVE THE SIGN
                                                CM      FRCSNG          ;IF IT IS NEGATIVE, FORCE IT TO BE A SNG
                                                MVI     A,4             ; SINCE WE WILL USE IT
                                                STA     VALTYP          ;MAKE SURE THE RESULT IS "SINGLE PRECISION"
                                                POP     PSW>            ;GET THE SIGN BACK
002674' 001000  000372                          JM      RND1            ;START NEW SEQUENCE IF NEGATIVE
002675' 000000  002725'
002676' 000000  002671'
002677' 001000  000041                          LXI     H,RNDX          ;GET LAST NUMBER GENERATED
002700' 000000  002752'
002701' 000000  002675'
002702' 001000  000315                          CALL    MOVFM
002703' 000000  001222'
002704' 000000  002700'
002705' 001000  000310                          RZ                      ;RETURN LAST NUMBER GENERATED IF ZERO
                                        IFE     EXTFNC,<
                                                CALL    FMULTS>         ;MULTIPLY BY CONSTANT A
                                        IFN     EXTFNC,<
002706' 001000  000315                          CALL    MOVRM
002707' 000000  001243'
002710' 000000  002703'
```

```
3910  002711' 001000  000315          65400            CALL    FMULT>
3911  002712' 000000  000517'
3912  002713' 000000  002707'
3913  002714' 001000  000001          65420            MOVRI   150,050,261,106 ;ADD IN CONSTANT OF ORDER 2"(-24)
3914  002715' 000000  000050
3915  002716' 000000  000150
3916  002717' 001000  000021
3917  002720' 000000  000106
3918  002721' 000000  000261
3919  002722' 001000  000315          65440            CALL    FADD
3920  002723' 000000  000025'
3921  002724' 000000  002712'
3922  002725' 001000  000315          65460   RND1:    CALL    MOVRF            ;SWITCH HO AND LO BYTES,
3923  002726' 000000  001240'
3924  002727' 000000  002723'
3925  002730' 001000  000173          65480            MOV     A,E              ;GET LO
3926  002731' 001000  000131          65500            MOV     E,C              ;PUT HO IN LO BYTE
3927  002732' 001000  000117          65520            MOV     C,A              ;PUT LO IN HO BYTE
3928  002733' 001000  000066          65540            MVI     M,200            ;MAKE RESULT POSITIVE
3929  002734' 000000  000200
3930  002735' 001000  000053          65560            DCX     H                ;GET POINTER TO EXPONENT
3931  002736' 001000  000106          65580            MOV     B,M              ;PUT EXPONENT IN OVERFLOW POSITION
3932  002737' 001000  000066          65600            MVI     M,200            ;SET EXP SO RESULT WILL BE BETWEEN 0 AND 1
3933  002740' 000000  000200
3934  002741' 001000  000315          65620            CALL    NORMAL           ;NORMALIZE THE RESULT
3935  002742' 000000  000146'
3936  002743' 000000  002726'
3937  002744' 001000  000041          65640            LXI     H,RNDX           ;SAVE RANDOM NUMBER GENERATED FOR NEXT
3938  002745' 000000  002752'
3939  002746' 000000  002742'
3940  002747' 001000  000303          65660            JMP     MOVMF            ; TIME
3941  002750' 000000  001254'
3942  002751' 000000  002745'
3943
3944                                  65700            ;CONSTANTS AND STORAGE FOR RND
3945  002752' 000000  000122          65720   RNDX:    122      ;LAST RANDOM NUMBER GENERATED, BETWEEN 0 AND 1
3946  002753' 000000  000307          65740            307
3947  002754' 000000  000117          65760            117
3948  002755' 000000  000200          65780            200
3949  002756' 000000  000172          65800            172      ;RANDOM NUMBER OF ORDER 2"24
3950  002757' 000000  000104          65820            104
3951  002760' 000000  000065          65840            065
3952  002761' 000000  000230          65860            230
3953                                  65880   PAGE
```



```
3954                                  65900   SUBTTL   SINE, COSINE AND TANGENT FUNCTIONS
3955                                  65920   IFN      EXTFNC,<
3956                                  65940            ;COSINE FUNCTION
3957                                  65960            ;IDEA:  USE COS(X)=SIN(X+PI/2)
3958  002762' 001000  000041          65980   COS:     LXI     H,PI2            ;ADD PI/2 TO FAC
3959  002763' 000000  003070'
3960  002764' 000000  002750'
3961  002765' 001000  000315          66000            CALL    FADDS>
3962  002766' 000000  000003'
3963  002767' 000000  002763'
3964                                  66020                                     ;FALL INTO SIN
3965
3966
3967                                  66080            ;SINE FUNCTION
3968                                  66100            ;IDEA: USE IDENTITIES TO GET FAC IN QUADRANTS I OR IV
3969                                  66120            ;THE FAC IS DIVIDED BY 2*PI AND THE INTEGER PART IS IGNORED BECAUSE
3970                                  66140            ;SIN(X+2*PI)=SIN(X),  THEN THE ARGUMENT CAN BE COMPARED WITH PI/2 BY
3971                                  66160            ;COMPARING THE RESULT OF THE DIVISION WITH PI/2/(2*PI)=1/4.
3972                                  66180            ;IDENTITIES ARE THEN USED TO GET THE RESULT IN QUADRANTS I OR IV.
3973                                  66200            ;AN APPROXIMATION POLYNOMIAL IS THEN USED TO COMPUTE SIN(X).
3974  002770' 001000  000315          66220   SIN:     CALL    PUSHF            ;DIVIDE FAC BY 2*PI
3975  002771' 000000  001205'
3976  002772' 000000  002766'
3977  002773' 001000  000001          66240            MOVRI   203,111,017,333 ;AFTER DIVIDING BY 2*PI, RESULT IS
3978  002774' 000000  000111
3979  002775' 000000  000203
3980  002776' 001000  000021
3981  002777' 000000  000333
3982  003000' 000000  000017
3983  003001' 001000  000315          66260            CALL    MOVFR            ; BETWEEN 0 AND 1
3984  003002' 000000  001225'
3985  003003' 000000  002771'
3986  003004' 001000  000301          66280            POPR
3987  003005' 001000  000321
3988  003006' 001000  000315          66300            CALL    FDIV
3989  003007' 000000  000655'
3990  003010' 000000  003002'
3991  003011' 001000  000315          66320            CALL    PUSHF            ;DISREGARD INTEGER PART SINCE SIN
3992  003012' 000000  001205'
3993  003013' 000000  003007'
3994  003014' 001000  000315          66340            CALL    INT              ; IS PERIODIC WITH PERIOD 2*PI
3995  003015' 000000  001445'
3996  003016' 000000  003012'
3997  003017' 001000  000301          66360            POPR
3998  003020' 001000  000321
3999  003021' 001000  000315          66380            CALL    FSUB
4000  003022' 000000  000017'
4001  003023' 000000  003015'
4002                                  66400   IFE      EXTFNC,<
4003                                  66420            LXI     B,177*400+$CODE ;GET 1/4
4004                                  66440            MOV     D,C
4005                                  66460            MOV     E,C
4006                                  66480            CALL    FSUB>
```

```
                                        SINE, COSINE AND TANGENT FUNCTIONS

                                        IFN     EXTFNC,<
003024' 001000  000041                  LXI     H,FR4           ;SEE WHAT QUADRANT WE ARE IN
003025' 000000  003074'
003026' 000000  003022'
003027' 001000  000315                  CALL    FSUBS>
003030' 000000  000011'
003031' 000000  003025'
003032' 001000  000357                  FSIGN
003033' 001000  000067                  STC                     ;SET QUADRANT I FLAG
003034' 001000  000362                  JP      SIN1            ;FIRST QUADRANT, GET BACK ORIGINAL X
003035' 000000  003044'
003036' 000000  003030'
003037' 001000  000315                  CALL    FADDH           ;ADD 1/2
003040' 000000  000000'
003041' 000000  003039'
003042' 001000  000357                  FSIGN
003043' 001000  000267                  ORA     A               ;CLEAR CARRY
003044' 001000  000365          SIN1:   PUSH    PSW             ;SAVE QUADRANT FLAG
003045' 001000  000364                  CP      NEG             ;NEGATE IF IN QUADRANTS I, II OR III
003046' 000000  001175'
003047' 000000  003040'

                                        IFE     EXTFNC,<
                                                LXI     B,177*400+$CODE ;GET 1/4
                                                MOV     D,C
                                                MOV     E,C
                                                CALL    FADD>
                                        IFN     EXTFNC,<
003050' 001000  000041                          LXI     H,FR4           ;ADD 1/4,  IN QUADRANTS II, III
003051' 000000  003074'
003052' 000000  003046'

                                                                        ; USE THE IDENTITY: SIN(PI-X)=SIN(X)
                                                                        ;IN QUADRANT IV, USE THE IDENTITY:
003053' 001000  000315                          CALL    FADDS>          ;   SIN(X-2*PI)=SIN(X)
003054' 000000  000003'
003055' 000000  003051'

003056' 001000  000361                          POP     PSW             ;GET QUADRANT FLAG
003057' 001000  000324                          CNC     NEG             ;NEGATE IF IN QUADRANTS II, III OR IV
003060' 000000  001175'
003061' 000000  003054'

                                                IFE     EXTFNC,<        ;EVALUATE APPROXIMATION POLYNOMIAL
                                                        CALL    PUSHF   ;SAVE X
                                                        CALL    MOVRF   ;SQUARE X
                                                        CALL    FMULT
                                                        CALL    PUSHF   ;SAVE X**2
                                                        LXI     H,SINCON
                                                        CALL    MOVFM   ;MOVE FIRST CONSTANT INTO FAC
                                                        POPR            ;GET X**2
                                                        MVI     A,4     ;GET DEGREE
                                                POLY1:  PUSH    PSW     ;SAVE DEGREE
                                                        PUSHR           ;SAVE X**2
                                                        PUSH    H       ;SAVE CONSTANT POINTER
                                                        CALL    FMULT   ;EVALUATE THE POLY, MULTIPLY BY X**2
                                                        POP     H       ;GET POINTER TO CONSTANTS
```



```
                                                        CALL    MOVRM   ;GET CONSTANT
                                                        PUSH    H       ;SAVE POINTER
                                                        CALL    FADD    ;ADD IN CONSTANT
                                                        POP     H       ;MOVE POINTER TO NEXT CONSTANT
                                                        POPR            ;GET X**2
                                                        POP     PSW     ;GET DEGREE
                                                        DCR     A       ;SEE IF DONE
                                                        JNZ     POLY1   ;NO, DO NEXT TERM
                                                        JMP     FMULT1> ;MULTIPLY BY X AND WE ARE DONE
                                                IFN     EXTFNC,<
003062' 001000  000041                          LXI     H,SINCON        ;CALCULATE THE SIN BY EVALUATING
003063' 000000  003100'
003064' 000000  003060'
003065' 001000  000303                          JMP     POLYX>          ;  THE APPROXIMATION POLYNOMIAL
003066' 000000  002613'
003067' 000000  003063'

                                                ;CONSTANTS FOR SIN, COS
                                        IFN     EXTFNC,<
003070' 000000  000333          PI2:    333     ; PI/2
003071' 000000  000017                  017
003072' 000000  000111                  111
003073' 000000  000201                  201
003074' 000000  000000          FR4:    000     ; 1/4
003075' 000000  000000                  000
003076' 000000  000000                  000
003077' 000000  000177                  177>
003100'                         SINCON:
                                        IFN     EXTFNC,<
003100' 000000  000005                  5>      ;DEGREE
003101' 000000  000272                  272     ; 39,701067
003102' 000000  000327                  327
003103' 000000  000036                  036
003104' 000000  000206                  206
003105' 000000  000144                  144     ; -76,57498
003106' 000000  000046                  046
003107' 000000  000231                  231
003110' 000000  000207                  207
003111' 000000  000130                  130     ; 81,60223
003112' 000000  000064                  064
003113' 000000  000043                  043
003114' 000000  000207                  207
003115' 000000  000340                  340     ; -41,34168
003116' 000000  000135                  135
003117' 000000  000245                  245
003120' 000000  000206                  206
003121' 000000  000332                  332     ; 6,283185
003122' 000000  000017                  017
003123' 000000  000111                  111
003124' 000000  000203                  203


                                        IFN     EXTFNC,<
                                        ;TANGENT FUNCTION
```

```
                                        68220          ;TAN(X)=SIN(X)/COS(X)
4114  003125' 001000  000315            68240  TAN:    CALL    PUSHF          ;SAVE ARG
4115  003126' 000000  001205'
4116  003127' 000000  003066'
4117  003130' 001000  000315            68260          CALL    SIN            ;   TAN(X)=SIN(X)/COS(X)
4118  003131' 000000  002770'
4119  003132' 000000  003126'
4120  003133' 001000  000301            68280          POP     B              ;GET X OFF STACK
4121  003134' 001000  000341            68300          POP     H              ;PUSHF SMASHES (DE)
4122  003135' 001000  000315            68320          CALL    PUSHF
4123  003136' 000000  001205'
4124  003137' 000000  003131'
4125  003140' 001000  000353            68340          XCHG                   ;GET LO'S WHERE THEY BELONG
4126  003141' 001000  000315            68360          CALL    MOVFR
4127  003142' 000000  001225'
4128  003143' 000000  003136'
4129  003144' 001000  000315            68380          CALL    COS
4130  003145' 000000  002762'
4131  003146' 000000  003142'
4132  003147' 001000  000303            68400          JMP     FDIVT>
4133  003150' 000000  000653'
4134  003151' 000000  003145'
4135                                    68420  PAGE
```



```
4136                                    68440  SUBTTL  ARCTANGENT FUNCTION
4137                                    68460  IFN     EXTFNC,<
4138                                    68480          ;IDEA: USE IDENTITIES TO GET ARG BETWEEN 0 AND 1 AND THEN USE AN
4139                                    68500          ;APPROXIMATION POLYNOMIAL TO COMPUTE ARCTAN(X)
4140  003152' 001000  000357            68520  ATN:    FSIGN                  ;SEE IF ARG IS NEGATIVE
4141  003153' 001000  000374            68540          CM      PSHNEG         ;IF ARG IS NEGATIVE, USE:
4142  003154' 000000  002340'
4143  003155' 000000  003150'
4144  003156' 001000  000374            68560          CM      NEG            ;   ARCTAN(X)=-ARCTAN(-X)
4145  003157' 000000  001175'
4146  003160' 000000  003154'
4147  003161' 001000  000072            68580          LDA     FAC            ;SEE IF FAC .GT. 1
4148  003162' 000000  002467*
4149  003163' 000000  003157'
4150  003164' 001000  000376            68600          CPI     201
4151  003165' 000000  000201
4152  003166' 001000  000332            68620          JC      ATN2
4153  003167' 000000  003205'
4154  003170' 000000  003162'
4155  003171' 001000  000021            68640          LXI     B,201*400+$CODE ;GET THE CONSTANT 1
4156  003172' 000000  100400*
4157  003173' 000000  003167'
4158  003174' 001000  000121            68660          MOV     D,C
4159  003175' 001000  000131            68680          MOV     E,C            ;COMPUTE RECIPROCAL TO USE THE IDENTITY:
4160  003176' 001000  000315            68700          CALL    FDIV           ;  ARCTAN(X)=PI/2-ARCTAN(1/X)
4161  003177' 000000  000655'
4162  003200' 000000  003172'
4163  003201' 001000  000041            68720          LXI     H,FSUBS        ;PUT FSUBS ON THE STACK SO WE WILL RETURN
4164  003202' 000000  000011'
4165  003203' 000000  003177'
4166  003204' 001000  000345            68740          PUSH    H              ; TO IT AND SUBTRACT THE REULT FROM PI/2
4167  003205' 001000  000041            68760  ATN2:   LXI     H,ATNCON       ;EVALUATE APPROXIMATION POLYNOMIAL
4168  003206' 000000  003217'
4169  003207' 000000  003202'
4170  003210' 001000  000315            68780          CALL    POLYX
4171  003211' 000000  002613'
4172  003212' 000000  003206'
4173  003213' 001000  000041            68800          LXI     H,PI2          ;GET POINTER TO PI/2 IN CASE WE HAVE TO
4174  003214' 000000  003070'
4175  003215' 000000  003211'
4176  003216' 001000  000311            68820          RET                    ; SUBTRACT THE RESULT FROM PI/2
4177
4178                                    68860          ;CONSTANTS FOR ATN
4179  003217' 000000  000011            68880  ATNCON: 11      ;DEGREE
4180  003220' 000000  000112            68900          112     ; .002866226
4181  003221' 000000  000327            68920          327
4182  003222' 000000  000073            68940          073
4183  003223' 000000  000170            68960          170
4184  003224' 000000  000002            68980          002     ; -.01616574
4185  003225' 000000  000156            69000          156
4186  003226' 000000  000204            69020          204
4187  003227' 000000  000173            69040          173
4188  003230' 000000  000376            69060          376     ; .04290961
```

```
4189  003231' 000000  000301          69080          301
4190  003232' 000000  000057          69100          057
4191  003233' 000000  000174          69120          174
4192  003234' 000000  000164          69140          164     ; =.07528964
4193  003235' 000000  000061          69160          061
4194  003236' 000000  000232          69180          232
4195  003237' 000000  000175          69200          175
4196  003240' 000000  000204          69220          204     ; .1065626
4197  003241' 000000  000075          69240          075
4198  003242' 000000  000132          69260          132
4199  003243' 000000  000175          69280          175
4200  003244' 000000  000310          69300          310     ; =.142089
4201  003245' 000000  000177          69320          177
4202  003246' 000000  000221          69340          221
4203  003247' 000000  000176          69360          176
4204  003250' 000000  000344          69380          344     ; .1999355
4205  003251' 000000  000273          69400          273
4206  003252' 000000  000114          69420          114
4207  003253' 000000  000176          69440          176
4208  003254' 000000  000154          69460          154     ; =.3333315
4209  003255' 000000  000252          69480          252
4210  003256' 000000  000252          69500          252
4211  003257' 000000  000177          69520          177
4212  003260' 000000  000000          69540          000     ; 1.0
4213  003261' 000000  000000          69560          000
4214  003262' 000000  000000          69580          000
4215  003263' 000000  000201          69600          201>
4216                                  69620    PAGE
```



```
4217                                  69640    SUBTTL  SYSTEM INITIALIZATION CODE
4218                                  69660    RADIX   10              ;IN ALL NON-MATH PACKAGE CODE
4219                                  69680    ;THIS IS THE SYSTEM INITIALIZATION CODE
4220                                  69700    ;IT SHOULD BE LOADED AT THE END OF THE BASIC
4221                                  69720    ;INTERPRETER
4222
4223                                  69760    INTERNAL        INIT
4224
4225                                  69800    EXTERNAL        CRDO,LINGET,QINLIN,READY,SCRTCH,STROUT,REASON,BUF
4226                                  69820    EXTERNAL        SNERR,OMERR,ILLFUN
4227
4228                145040            69860    FUNIO==<"0256*"0312>+"040+$CODE
4229  003264'                         69880    INITSA: BLOCK   10
4230  003276' 001000  000041          69900    INITAT: LXI     H,AUTTXT
4231  003277' 000000  004035'
4232  003300' 000000  003214'
4233  003301' 001000  000315          69920            CALL    STROUT
4234  003302' 000000  001763*
4235  003303' 000000  003277'
4236  003304'                         69940    INIT:
4237                                  69960    IFN     REALIO,<
4238  003304' 001000  000333          69980            IN      1               ;IGNORE GARBAGE CHARACTER IN INTERFACE
4239  003305' 000000  000001
4240  003306' 001000  000333          70000            IN      "0255           ;SEE WHAT KIND OF I/O HE IS
4241  003307' 000000  000377
4242  003310' 001000  000346          70020            ANI     "0100           ;IS HE FUNNY TTY?
4243  003311' 000000  000100
4244  003312' 001000  000312          70040            JZ      NOTSIO
4245  003313' 000000  003343'
4246  003314' 000000  003302'
4247  003315' 001000  000041          70060            LXI     H,FUNIO
4248  003316' 000000  145040*
4249  003317' 000000  003313'
4250  003320' 001000  000042          70080            SHLD    CNLCA2##+2
4251  003321' 000000  000002*
4252  003322' 000000  003316'
4253  003323' 001000  000046          70100            MVI     M,"0310
4254  003324' 000000  000310
4255  003325' 001000  000042          70120            SHLD    CNLCA3##+2
4256  003326' 000000  000002*
4257  003327' 000000  003321'
4258                                  70140    IFN     LENGTH,<
4259  003330' 001000  000046          70160            MVI     M,"0304         ;SUBSTITUE "CNZ"
4260  003331' 000000  000304
4261  003332' 001000  000042          70180            SHLD    CNLCA4##+2>
4262  003333' 000000  000002*
4263  003334' 000000  003326'
4264                                  70200    FUNIO==$CODE+<"0256*"0312>+2
4265  003335' 001000  000041          70220            LXI     H,FUNIO
4266  003336' 000000  145002*
4267  003337' 000000  003335'
4268  003340' 001000  000042          70240            SHLD    CNLCA1##+2
4269  003341' 000000  000002*
```

```
003342' 000000  003336'
003343' 001000  000333          70260  NOTSIO: IN      ^0255
003344' 000000  000377
003345' 001000  000346          70280          ANI     ^040
003346' 000000  000040
003347' 001000  000312          70300          JZ      NOTPIO
003350' 000000  003400'
003351' 000000  003341'
                145002          70320  FUNIO==$CODE+<^0256*^0312>+2
003352' 001000  000041          70340          LXI     H,FUNIO
003353' 000000  145002*
003354' 000000  003350'
003355' 001000  000042          70360          SHLD    CNLCA2+2
003356' 000000  000002*
003357' 000000  003353'
003360' 001000  000046          70380          MVI     H,^0310
003361' 000000  000310
003362' 001000  000042          70400          SHLD    CNLCA3+2
003363' 000000  000002*
003364' 000000  003356'
                                70420  IFN     LENGTH,<
003365' 001000  000046          70440          MVI     H,^0304
003366' 000000  000304
003367' 001000  000042          70460          SHLD    CNLCA4+2>
003370' 000000  000002*
003371' 000000  003363'
                145001          70480  FUNIO==$CODE+<^0256*^0312>+1
003372' 001000  000041          70500          LXI     H,FUNIO
003373' 000000  145001*
003374' 000000  003370'
003375' 001000  000042          70520          SHLD    CNLCA1+2
003376' 000000  000002*
003377' 000000  003373'
003400'                         70540  NOTPIO:>
003400' 001000  000041          70560          LXI     H,$CODE+^065535
003401' 000000  177777*
003402' 000000  003376'
003403' 001000  000042          70580          SHLD    CURLIN##        ;IN CASE OF ERROR MESSAGE
003404' 000000  000000*
003405' 000000  003401'
003406' 001000  000041          70600          LXI     H,TSTACK        ;SET UP TEMP STACK
003407' 000000  003315'
003410' 000000  003404'
003411' 001000  000371          70620          SPHL
003412' 001000  000042          70640          SHLD    STKTOP##
003413' 000000  000000*
003414' 000000  003407'
                                70660  IFN     CONTRW,<
003415' 001000  000257          70680          XRA     A
003416' 001000  000062          70700          STA     CNTWFL##>
003417' 000000  000000*
003420' 000000  003413'
003421' 001000  000315          70720          CALL    CRDO            ;TYPE A CR
```



```
003422' 000000  000000*
003423' 000000  003417'
                                70740  IFN     STRING,<
003424' 001000  000041          70760          LXI     H,TEMPST##
003425' 000000  000000*
003426' 000000  003422'
003427' 001000  000042          70780          SHLD    TEMPPT##>
003430' 000000  000000*
003431' 000000  003425'
                                70800  IFN     REALIO,<
003432' 001000  000041          70820          LXI     H,MEMORY        ;ASK HOW MUCH MEMORY AVAILABLE
003433' 000000  004243'
003434' 000000  003430'
003435' 001000  000315          70840          CALL    STROUT          ;CALL THE STRING PRINTER
003436' 000000  003302*
003437' 000000  003433'
003440' 001000  000315          70860          CALL    QINLIN          ;GET A LINE OF INPUT
003441' 000000  000000*
003442' 000000  003436'
003443' 001000  000327          70880          CHRGET                  ;GET A CHAR
003444' 001000  000376          70900          CPI     "A"
003445' 000000  000101
003446' 001000  000312          70920          JZ      INITAT
003447' 000000  003276'
003450' 000000  003441'
003451' 001000  000267          70940          ORA     A
003452' 001000  000302          70960          JNZ     USEDE9          ;NON ZERO, DONT USE DEFAULT
003453' 000000  003501'
003454' 000000  003447'
003455' 001000  000041          70980          LXI     H,LASTWR
003456' 000000  004257'
003457' 000000  003453'
003460' 001000  000043          71000  LOOPMM: INX     H
003461' 001000  000076          71020          MVI     A,311
003462' 000000  000467
003463' 001000  000167          71040          MOV     M,A
003464' 001000  000276          71060          CMP     M
003465' 001000  000302          71080          JNZ     USEDEF
003466' 000000  003515'
003467' 000000  003460'
003470' 001000  000075          71100          DCR     A
003471' 001000  000167          71120          MOV     M,A
003472' 001000  000276          71140          CMP     M
003473' 001000  000312          71160          JZ      LOOPMM
003474' 000000  003460'
003475' 000000  003466'
003476' 001000  000303          71180          JMP     USEDEF
003477' 000000  003515'
003500' 000000  003474'
003501' 001000  000041          71200  USEDE9: LXI     H,BUF
003502' 000000  000000*
003503' 000000  003477'
003504' 001000  000315          71220          CALL    LINGET          ;GET DECIMAL AMOUNT OF MEMORY IN [D,E]
```

```
4376  003505' 000000  000000*
4377  003506' 000000  003502'
4378  003507' 001000  000267          71240          ORA     A
4379  003510' 001000  000302          71260          JNZ     SNERR          ;MAKE SURE HE HAS A TERMINATOR
4380  003511' 000000  000000*
4381  003512' 000000  003505'
4382  003513' 001000  000053          71280          XCHG
4383  003514' 001000  000053          71300          DCX     H
4384  003515' 001000  000053          71320  USEDEF: DCX     H>
4385                                  71340  IFE     REALIO,<
4386                                  71360          LXI     H,SCODE+16190>
4387  003516' 001000  000345          71380          PUSH    H              ;ALSO SAVE FOR LATER
4388  003517' 001000  000041          71400  TTYW:   LXI     H,TTYWID
4389  003520' 000000  004127'
4390  003521' 000000  003511'
4391  003522' 001000  000315          71420          CALL    STROUT
4392  003523' 000000  003436*
4393  003524' 000000  003520'
4394  003525' 001000  000315          71440          CALL    GINLIN
4395  003526' 000000  003441*
4396  003527' 000000  003523'
4397  003530' 001000  000327          71460          CHRGET
4398  003531' 001000  000267          71480          ORA     A
4399  003532' 001000  000312          71500          JZ      DFLENT
4400  003533' 000000  003604'
4401  003534' 000000  003526'
4402  003535' 001000  000041          71520          LXI     H,BUF
4403  003536' 000000  003502*
4404  003537' 000000  003533'
4405  003540' 001000  000315          71540          CALL    LINGET
4406  003541' 000000  003505*
4407  003542' 000000  003536'
4408  003543' 001000  000172          71560          MOV     A,D
4409  003544' 001000  000267          71580          ORA     A
4410  003545' 001000  000302          71600          JNZ     TTYW
4411  003546' 000000  003517'
4412  003547' 000000  003541'
4413  003550' 001000  000173          71620          MOV     A,E
4414  003551' 001000  000376          71640          CPI     16
4415  003552' 000000  000020
4416  003553' 001000  000332          71660          JC      TTYW
4417  003554' 000000  003517'
4418  003555' 000000  003546'
4419  003556' 001000  000062          71680          STA     LINPT1##       ;DECLARE LINPT1 EXTERNAL
4420  003557' 000000  000000*
4421  003560' 000000  003554'
4422                                  71700  IFN     LENGTH,<
4423  003561' 001000  000062          71720          STA     LINPT2##>
4424  003562' 000000  000000*
4425  003563' 000000  003557'
4426                                  71740  IFN     STRING,<
4427  003564' 001000  000062          71760          STA     LINPT3##>
4428  003565' 000000  000000*
```



```
4429  003566' 000000  003562'
4430  003567' 001000  000326          71780  MORCPS: SUI     14
4431  003570' 000000  000016
4432  003571' 001000  000322          71800          JNC     MORCPS
4433  003572' 000000  003567'
4434  003573' 000000  003565'
4435  003574' 001000  000306          71820          ADI     28
4436  003575' 000000  000034
4437  003576' 001000  000057          71840          CMA
4438  003577' 001000  000074          71860          INR     A
4439  003600' 001000  000203          71880          ADD     E
4440  003601' 001000  000062          71900          STA     LINPT4##
4441  003602' 000000  000000*
4442  003603' 000000  003572'
4443  003604'                         71920  DFLENT:
4444                                  71940  IFN     STRING,<               ;SET UP DEFAULT STRING SPACE
4445  003604' 001000  000021          71960          LXI     D,SCODE+^D65536-^D50+1
4446  003605' 000000  177717*
4447  003606' 000000  003602'
4448  003607' 001000  000341          71980          POP     H
4449  003610' 001000  000042          72000          SHLD    MEMSIZ##       ;SAVE IN REAL MEMORY SIZE
4450  003611' 000000  000000*
4451  003612' 000000  003605'
4452  003613' 001000  000042          72020          SHLD    FRETOP##       ;STRINGS START FROM HERE DOWN
4453  003614' 000000  000000*
4454  003615' 000000  003611'
4455  003616' 001000  000031          72040          DAD     D              ;CALC STRBOT BY SUBTRACTING 200 FROM STKTOP
4456  003617' 001000  000322          72060          JNC     OMERR          ;MUST BE POSITIVE
4457  003620' 000000  000000*
4458  003621' 000000  003614'
4459  003622' 001000  000053          72080          DCX     H              ;ONE LOWER IS STKTOP
4460  003623' 001000  000345          72100          PUSH    H>             ;SAVE IT ON STACK
4461                                  72120  IFE     EXTFNC,<
4462                                  72140
4463                                  72160  ; FUNCTION DELETION ROUTINE FOR 4K MACHINE
4464                                  72180  ; TO ADD A NEW FUNCTION JUST UPDATE TBLDO
4465                                  72200
4466                                  72220  ASKAGN: LXI     H,TBLDO        ;START OF FUNCTION TABLE
4467                                  72240  LOPASK: PUSHM                   ;PUT ON CANDIDATE FOR START OF FREE MEMORY
4468                                  72260          LXI     D,TBDASK       ;DONE ASKING?
4469                                  72280          COMPAR
4470                                  72300          JZ      FINFUN         ;YES, GET FIRST FREE MEM LOC
4471                                  72320                                 ;INTO [D,E] AND QUIT
4472                                  72340          PUSHM                  ;PUT ON MESSAGE LOCATION
4473                                  72360          XTHL                   ;[H,L]=MESSAGE POINTER
4474                                  72380                                 ;POINTER INTO TBLDO GOES ON THE STACK
4475                                  72400          CALL    STROUT         ;PRINT THE MESSAGE
4476                                  72420          CALL    GINLIN         ;SEE WHAT HE HAS TO SAY
4477                                  72440          CHRGET                 ;SEE WHAT THE FIRST CHARACTER OF INPUT WAS
4478                                  72460          POP     H              ;POP OFF POINTER INTO TBLDO
4479                                  72480          CPI     "Y"
4480                                  72500  FINFUN: POP     D              ;POP OFF CANDIDATE FOR START OF
4481                                  72520                                 ;FREE MEMORY
```

```
                                        72540          JZ      HAVFNS          ;HE WANTS IT SO WE ARE DONE
                                        72560          CPI     "N"             ;IF A BAD ANSWER
                                        72580          JNZ     ASKAGN          ;MAKE HIM START OVER
                                        72600          PUSHM                   ;PUSH ON FUNCTION CALL
                                        72620                                  ;LOCATION THAT WE FIX UP
                                        72640          XTHL                    ;[H,L]=FIXUP PLACE
                                        72660                                  ;POINTER INTO TBLDO GOES ON THE STACK
                                        72680          LXI     D,ILLFUN        ;THIS IS WHAT WE STORE
                                        72700          MOV     M,E
                                        72720          INX     H
                                        72740          MOV     M,D
                                        72760          POP     H               ;GET TBLDO POINTER
                                        72780          JMP     LOPASK>         ;GO ASK AGAIN FOR ANOTHER FUNCTION
                                        72800  IFN     EXTFNC,<
003624' 001000  000041                  72820  ASKAGN: LXI     H,FNS           ;ASK IF WANTS SIN, COS, ATN.
003625' 000000  004010'
003626' 000000  003620'
003627' 001000  000315                  72840          CALL    STROUT          ;THE STRING
003630' 000000  003523*
003631' 000000  003625'
003632' 001000  000315                  72860          CALL    QINLIN
003633' 000000  003526*
003634' 000000  003630'
003635' 001000  000327                  72880          CHRGET
003636' 001000  000376                  72900          CPI     "Y"
003637' 000000  000131
003640' 001000  000021                  72920          LXI     D,INITSA        ;ASSUME NOT DELETE ANY FNS
003641' 000000  003264'
003642' 000000  003633'
003643' 001000  000312                  72940          JZ      HAVFNS          ;YUP.
003644' 000000  003712'
003645' 000000  003641'
003646' 001000  000376                  72960          CPI     "A"
003647' 000000  000101
003650' 001000  000312                  72980          JZ      OKCHAR
003651' 000000  003660'
003652' 000000  003644'
003653' 001000  000376                  73000          CPI     "N"
003654' 000000  000116
003655' 001000  000302                  73020          JNZ     ASKAGN
003656' 000000  003624'
003657' 000000  003651'
003660' 001000  000041                  73040  OKCHAR: LXI     H,ILLFUN        ;MAKE SURE BOMBS IF TRIES TO CALL THEM
003661' 000000  000000*
003662' 000000  003656'
003663' 001000  000021                  73060          LXI     D,ATN
003664' 000000  003152'
003665' 000000  003661'
003666' 001000  000042                  73080          SHLD    ATNFIX##
003667' 000000  000000*
003670' 000000  003664'
003671' 001000  000376                  73100          CPI     "A"             ;DELETE ATN BUT NOT SIN, COS?
003672' 000000  000101
```



```
003673' 001000  000312                  73120          JZ      HAVFNS          ;TEST
003674' 000000  003712'
003675' 000000  003667'
003676' 001000  000042                  73140          SHLD    COSFIX##
003677' 000000  000000*
003700' 000000  003674'
003701' 001000  000042                  73160          SHLD    TANFIX##
003702' 000000  000000*
003703' 000000  003677'
003704' 001000  000042                  73180          SHLD    SINFIX##
003705' 000000  000000*
003706' 000000  003702'
003707' 001000  000021                  73200          LXI     D,COS>
003710' 000000  002762'
003711' 000000  003705'
003712'                                 73220  HAVFNS:                         ;TEXT ALWAYS PRECEDED BY ZERO
003712' 001000  000353                  73240          XCHG                    ;PUT BOTTOM OF MEMORY IN [H,L]
003713' 001000  000066                  73260          MVI     M,0             ;STORE IT
003714' 000000  000000
003715' 001000  000043                  73280          INX     H               ;INCREMENT POINTER
003716' 001000  000042                  73300          SHLD    TXTTAB##        ;SAVE BOTTOM OF MEMORY
003717' 000000  000000*
003720' 000000  003710'
003721' 001000  000343                  73320          XTHL
003722' 001000  000021                  73340          LXI     D,TSTACK
003723' 000000  004315'
003724' 000000  003717'
003725' 001000  000347                  73360          COMPAR
003726' 001000  000332                  73380          JC      OMERR
003727' 000000  003620*
003730' 000000  003723'
003731' 001000  000321                  73400          POP     D
003732' 001000  000371                  73420          SPHL
003733' 001000  000042                  73440          SHLD    STKTOP
003734' 000000  003413*
003735' 000000  003727'
003736' 001000  000353                  73460          XCHG
003737' 001000  000315                  73480          CALL    REASON
003740' 000000  000000*
003741' 000000  003734'
003742' 001000  000173                  73500          MOV     A,E             ;SUBRACT VARTAB FROM STKTOP
003743' 001000  000225                  73520          SUB     L               ;LOW PART
003744' 001000  000157                  73540          MOV     L,A             ;
003745' 001000  000172                  73560          MOV     A,D             ;HIGH PART
003746' 001000  000234                  73580          SBB     H               ;
003747' 001000  000147                  73600          MOV     M,A             ;LEAVE IN [B,C]
003750' 001000  000001                  73620          LXI     B,SCODE+65520
003751' 000000  177760*
003752' 000000  003740'
003753' 001000  000011                  73640          DAD     B
003754' 001000  000315                  73660          CALL    CROO            ;TYPE CRLF
003755' 000000  003422*
003756' 000000  003751'
```

```
4588  003757' 001000  000315          73680          CALL    LINPRT          ;PRINT # OF BYTES FREE
4589  003760' 000000  001766'
4590  003761' 000000  003755'
4591  003762' 001000  000041          73700          LXI     H,WORDS         ;TYPE THE HEADING
4592  003763' 000000  004146'
4593  003764' 000000  003760'
4594  003765' 001000  000315          73720          CALL    STROUT          ;"ALTAIR BASIC VERSION-----"
4595  003766' 000000  003630*
4596  003767' 000000  003763'
4597  003770' 001000  000041          73740          LXI     H,STROUT
4598  003771' 000000  003766*
4599  003772' 000000  003766'
4600  003773' 001000  000042          73760          SHLD    REPINI##+1
4601  003774' 000000  000001*
4602  003775' 000000  003771'
4603  003776' 001000  000315          73780          CALL    SCRTCH          ;NOW SET UP EVERYTHING ELSE
4604  003777' 000000  000000*
4605  004000' 000000  003774'
4606                                  73800  IFN     LPTSW,<
4607                                  73820         MVI     A,4
4608                                  73840         OUT     2               ;CLEAR THE LPT
4609                                  73860         XRA     A
4610                                  73880         STA     PRTFLG##
4611                                  73900         STA     LPTPOS##>
4612  004001' 001000  000041          73920  IFE    CONSSW,<LXI     H,READY>
4613  004002' 000000  000000*
4614  004003' 000000  003777'
4615                                  73940  IFN     CONSSW,<
4616                                  73960         LXI     H,CONSDO##>
4617  004004' 001000  000042          73980         SHLD    SCODE+2
4618  004005' 000000  000002*
4619  004006' 000000  004002'
4620  004007' 001000  000351          74000         PCHL
4621
4622                                  74040  IFE     EXTFNC,<
4623                                  74060  TBLDO:  ADR(INITSA)
4624                                  74080         ADR(FNS)
4625                                  74100         ADR(SINFIX)
4626                                  74120         ADR(SIN)
4627                                  74140         ADR(FNS2)
4628                                  74160         ADR(RNDFIX)
4629                                  74180         ADR(RND)
4630                                  74200         ADR(FNS3)
4631                                  74220         ADR(SQRFIX)
4632                                  74240         ADR(SQR)
4633                                  74260  TBDASK:                         ;END OF ASK TABLE
4634                                  74280  FNS:    DC"WANT SIN"
4635                                  74300         0
4636                                  74320  FNS2:   DC"WANT RND"
4637                                  74340         0
4638                                  74360  FNS3:   DC"WANT SQR"
4639                                  74380         0>
4640                                  74400  IFN     EXTFNC,<
```

JMP INIT — OPTIONAL READY


```
4641  004010' 000000  000127          74420  FNS:    DC"WANT SIN-COS-TAN-ATN"
4642  004011' 000000  000101
4643  004012' 000000  000116
4644  004013' 000000  000124
4645  004014' 000000  000040
4646  004015' 000000  000123
4647  004016' 000000  000111
4648  004017' 000000  000116
4649  004020' 000000  000055
4650  004021' 000000  000103
4651  004022' 000000  000117
4652  004023' 000000  000123
4653  004024' 000000  000055
4654  004025' 000000  000124
4655  004026' 000000  000101
4656  004027' 000000  000116
4657  004030' 000000  000055
4658  004031' 000000  000101
4659  004032' 000000  000124
4660  004033' 000000  000116
4661  004035' 000000  000316
4662  004034' 000000  000000          74440          0>
4663  004035' 000000  000015          74460  AUTTXT: ACRLF
4664  004036' 000000  000012
4665  004037' 000000  000014          74480          "D10
4666  004040' 000000  000127          74500          DC"WRITTEN BY BILL GATES & PAUL ALLEN & MONTE DAVIDOFF,"
4667  004041' 000000  000122
4668  004042' 000000  000111
4669  004043' 000000  000124
4670  004044' 000000  000124
4671  004045' 000000  000105
4672  004046' 000000  000116
4673  004047' 000000  000040
4674  004050' 000000  000102
4675  004051' 000000  000131
4676  004052' 000000  000040
4677  004053' 000000  000102
4678  004054' 000000  000111
4679  004055' 000000  000114
4680  004056' 000000  000114
4681  004057' 000000  000040
4682  004060' 000000  000107
4683  004061' 000000  000101
4684  004062' 000000  000124
4685  004063' 000000  000105
4686  004064' 000000  000123
4687  004065' 000000  000040
4688  004066' 000000  000046
4689  004067' 000000  000040
4690  004070' 000000  000122
4691  004071' 000000  000101
4692  004072' 000000  000125
4693  004073' 000000  000114
```

```
004074' 000000  000040
004075' 000000  000101
004076' 000000  000114
004077' 000000  000114
004100' 000000  000105
004101' 000000  000116
004102' 000000  000040
004103' 000000  000046
004104' 000000  000040
004105' 000000  000115
004106' 000000  000117
004107' 000000  000116
004110' 000000  000124
004111' 000000  000105
004112' 000000  000040
004113' 000000  000104
004114' 000000  000101
004115' 000000  000126
004116' 000000  000111
004117' 000000  000104
004120' 000000  000117
004121' 000000  000106
004122' 000000  000106
004123' 000000  000056
004123' 000000  000256
004124' 000000  000015          74520           ACRLF
004125' 000000  000012
004126' 000000  000000          74540           0
                                
004127' 000000  000124          74560   TTYWID: DC"TERMINAL WIDTH"
004130' 000000  000105
004131' 000000  000122
004132' 000000  000115
004133' 000000  000111
004134' 000000  000116
004135' 000000  000101
004136' 000000  000114
004137' 000000  000040
004140' 000000  000127
004141' 000000  000111
004142' 000000  000104
004143' 000000  000124
004144' 000000  000110
004144' 000000  000310
004145' 000000  000000          74600           0
004146' 000000  000040          74620   WORDS:  DC" BYTES FREE"
004147' 000000  000102
004150' 000000  000131
004151' 000000  000124
004152' 000000  000105
004153' 000000  000123
004154' 000000  000040
004155' 000000  000106
```



```
004156' 000000  000122
004157' 000000  000105
004160' 000000  000105
004160' 000000  000305
004161' 000000  000015          74640           ACRLF
004162' 000000  000012
004163' 000000  000015          74660           ACRLF
004164' 000000  000012
004165' 000000  000101          74680           DC"ALTAIR BASIC VERSION 3.0"
004166' 000000  000114
004167' 000000  000124
004170' 000000  000101
004171' 000000  000111
004172' 000000  000122
004173' 000000  000040
004174' 000000  000102
004175' 000000  000101
004176' 000000  000123
004177' 000000  000111
004200' 000000  000105
004201' 000000  000040
004202' 000000  000126
004203' 000000  000105
004204' 000000  000122
004205' 000000  000123
004206' 000000  000111
004207' 000000  000117
004210' 000000  000116
004211' 000000  000040
004212' 000000  000063
004213' 000000  000056
004214' 000000  000060
004214' 000000  000260
004215' 000000  000015          74700           ACRLF
004216' 000000  000012
                                74720   IFE     LENGTH,<DC"[FOUR-K VERSION]">
004217' 000000  000133          74740   IFE     LENGTH-1,<DC"[EIGHT-K VERSION]">
004220' 000000  000105
004221' 000000  000111
004222' 000000  000107
004223' 000000  000110
004224' 000000  000124
004225' 000000  000055
004226' 000000  000113
004227' 000000  000040
004230' 000000  000126
004231' 000000  000105
004232' 000000  000122
004233' 000000  000123
004234' 000000  000111
004235' 000000  000117
004236' 000000  000116
004237' 000000  000135
```

```
 4800  004237' 000000  000335
 4801                                  74760   IFE     LENGTH=2,<DC"[BIG VERSION]">
 4802  004240' 000000  000015          74780           ACRLF
 4803  004241' 000000  000012
 4804  004242' 000000  000000          74800           0
 4805
 4806  004243' 000000  000115          74840   MEMORY: DC"MEMORY SIZE"
 4807  004244' 000000  000105
 4808  004245' 000000  000115
 4809  004246' 000000  000117
 4810  004247' 000000  000122
 4811  004250' 000000  000131
 4812  004251' 000000  000040
 4813  004252' 000000  000123
 4814  004253' 000000  000111
 4815  004254' 000000  000132
 4816  004255' 000000  000105
 4817  004255' 000000  000305
 4818  004256' 000000  000000          74860           0
 4819  004257'                         74880   LASTWR::                        ;LAST WORD OF SYSTEM CODE+1
 4820  004257'                         74900           BLOCK   "030            ;SPACE FOR TEMP STACK
 4821  004315'                         74920   TSTACK::
 4822                                  74940   IFE     LENGTH,<
 4823                                  74960           BLOCK   "013000>
 4824                                  74980   IFN     LENGTH,<
 4825  004315'                         75000           BLOCK   "010000>
 4826                  004005'         75020           .C2==:.P
 4827                                  75040   END
```

NO ERRORS DETECTED

PROGRAM BREAK IS 027735

9K CORE USED


```
A          000007          DMULT      001476' INT   FMULT3     000632'
ABS        001173' INT     DMULT1     001506'       FMULT4     000571'
AFFF       000105          DMULT2     001524'       FMULT5     000607'
ASKAGN     003624'         DSKFUN     000000  SPD   FMULTA     000605'
ATN        003152' INT     DV0ERR     000657' EXT   FMULTB     000600'
ATN2       003205'         E          000003        FMULTT     000515' INT
ATNCON     003217'         ERROR      000272' EXT   FNS        004010'
ATNFIX     003667' EXT     ERROV      000270' EXT   FONE       000400' INT
AUTTXT     004035'         EXP        002452' INT   FOUT       002001' INT
B          000000          EXPCON     002552'       FOUT1      002015'
BSERR      001522' EXT     EXTFNC     000001  SPD   FOUT10     002151'
BUF        003536' EXT     FAC        003162' EXT   FOUT11     002216'
C          000001          FACLO      002430' EXT   FOUT12     002232'
CASSW      000001  SPD     FADD       000025' INT   FOUT14     002252'
CNLCA1     000000  EXT     FADD1      000057'       FOUT15     002254'
CNLCA2     000000  EXT     FADD3      000125'       FOUT17     002271'
CNLCA3     000000  EXT     FADDA      000274'       FOUT19     002266'
CNLCA4     000000  EXT     FADDH      000000'       FOUT3      002034'
CNTHFL     003417' EXT     FADDS      000003' INT   FOUT5      002071'
CONSSW     000000  SPD     FADDT      000023' INT   FOUT6      002124'
CONTRW     000001  SPD     FADFLT     000143'       FOUT8      002132'
COS        002762' INT     FBUFFR     002002' EXT   FOUT9      002060'
COSFIX     003677' EXT     FCERR      000423' EXT   FOUT8L     002316'
CRDO       003755' EXT     FCOMP      001317' INT   FOUTCB     002274'
CURLIN     003404' EXT     FCOMPE     001347'       FPWR       002360' INT
D          000002          FCOMPD     001344'       FPWR1      002422'
DCRART     001700'         FCOMPS     001141'       FPWR2      002440'
DFLENT     003604'         FDIV       000655' INT   FPWRT      002356' INT
DIV10      000637'         FDIV1      000720'       FR4        003074'
                           FDIV2      000755'       FRETOP     003614' EXT
                           FDIVA      000733'       FSUB       000017' INT
                           FDIVB      000727'       FSUB3      000011'
                           FDIVC      000723'       FSUBT      000015' INT
                           FDIVG      000736'       FUNIO      145001  SPD
                           FDIVT      000653' INT   H          000004
                           FHALF      002312'       HAVFNS     003712'
                           FIN        001531' INT   ICOMPS     001142'
                           FIN1       001545'       ILLFUN     003661' EXT
                           FINC       001555'       INIT       003304' INT
                           FINDIG     001702'       INITAT     003276'
                           FINDP      001635'       INITSA     003264'
                           FINE       001641'       INPRT      001756' INT
                           FINE2      001644'       INRART     001145' INT
                           FINE3      001660'       INT        001445' INT
                           FINEC      001621'       INTXT      001760' EXT
                           FINEDG     001742'       INXHRT     001252' INT
                           FINLOG     001731'
                           FINMLT     001673'
                           FINMUL     001672'
                           FLOAT      001156' INT
                           FLOATR     001155' INT
                           FMULT      000517' INT
                           FMULT2     000557'
```

L	000085		OKCHAR	003660'		SHIFTR	000334'		
LASTWR	004257'	INT	OMERR	003727'	EXT	SHRADD	000362'		
LENGTH	000001	SPD	OVERR	000267'	INT	SIGN	001322'	EXT	
LINGET	003541'	EXT	PI2	003070'		SIGNC	001135'	INT	
LINPRT	001766'	INT	PLUSTK	001615'	EXT	SIGNS	001143'	INT	
LINPT1	003557'	EXT	POLY	002632'		SIN	002770'	INT	
LINPT2	003562'	EXT	POLY1	002643'		SIN1	003044'		
LINPT3	003565'	EXT	POLYX	002613'		SINCON	003100'		
LINPT4	003602'	EXT	PUPHRT	000630'		SINFIX	003705'	EXT	
LOG	000421'	INT	PUPPRT	001474'		SNERR	003511'	EXT	
LOGCN2	000404'		PSHNEG	002340'		SQR	002345'	INT	
LOOPMM	003460'		PSW	000006	SPD	STKTOP	003734'	EXT	
LPTSW	000000	SPD	PUSHF	001205'	INT	STRING	000001	SPD	
M	000006	SPD	QINLIN	003633'	EXT	STROUI	001176'	EXT	
MEMORY	004245'		QINT	001372'	INT	STROUT	003771'	EXT	
MEMSIZ	003611'	EXT	QINTA	001436'		TAN	003125'	INT	
MINUTK	001603'	EXT	READY	004002'	EXT	TANFIX	003702'	EXT	
MLOVEX	001073'		REALIO	000001	SPD	TEMPPT	003430'	EXT	
MORCPS	003567'		REASON	003740'	EXT	TEMPST	003425'	EXT	
MOVE	001257'	INT	REPIN1	000000	EXT	TSTACK	004315'	INT	
MOVE1	001261'		RND	002673'	INT	TTYW	003517'		
MOVFM	001222'	INT	RND1	002725'		TTYWID	004127'		
MOVFR	001225'	INT	RNDX	002752'		TXTTAB	003717'	EXT	
MOVMF	001254'	INT	ROUND	000233'		UNPACK	001272'		
MOVRF	001240'	INT	ROUNDA	000255'		USEDE9	003501'		
MOVRM	001243'	INT	ROUNDB	000234'		USEDEF	003515'		
MUL10	001106'		SCRTCH	003777'	EXT	WORDS	004146'		
MULDIM	000001	SPD	SGN	001147'	INT	ZERO	000173'	INT	
MULDIV	001035'		SHFTR1	000336'		ZERO0	000174'		
MULDV1	001076'		SHFTR2	000353'		SCODE	002543'	EXT	
MULDV2	001077'		SHFTR3	000356'		.C2	004005'	SIN	
MULLN2	000506'					.P	004005'	SPD	
NEG	001175'	INT							
NEGR	000310'								
NORM1	000151'								
NORM2	000200'								
NORM3	000210'								
NORMAL	000146'								
NOTPIO	003400'								

A	212	213	218	231	251	299	301	302	304	306	308	310	312	344
	345	346	347	355	356	372	381	383	384	385	386	390	393	401
	412	416	423	427	472	474	476	478	480	482	492	494	495	496
	498	499	501	502	504	505	507	537	538	544	546	547	549	550
	552	553	555	613	684	709	712	739	740	761	762	764	765	767
	768	770	772	784	827	832	837	866	867	868	869	875	876	879
	882	883	886	887	904	905	906	915	917	918	920	921	923	925
	927	935	966	967	971	977	980	986	993	1000	1029	1030	1037	1068
	1070	1096	1126	1129	1247	1265	1269	1274	1275	1279	1333	1334	1343	1349
	1359	1363	1367	1371	1530	1531	1532	1533	1534	1555	1559	1565	1580	1582
	1605	1614	1622	1624	1695	1698	1714	2342	2343	2344	2346	2402	2404	2416
	2429	2559	2579	2580	2582	2686	2694	2716	2771	2801	2812	2838	2839	2840
	2843	2866	2868	2870	2872	2874	2876	2924	2933	2949	3637	3638	3644	3665
	3839	3848	3925	3927	4023	4318	4348	4356	4358	4363	4364	4378	4398	4408
	4409	4413	4438	4575	4577	4578	4580							
ABS	89	1111#												
AFFF	4642#	4643#	4644#	4645#	4646#	4647#	4648#	4649#	4650#	4651#	4652#	4653#	4654#	4655#
	4656#	4657#	4658#	4659#	4660#	4661#	4661	4667#	4668#	4669#	4670#	4671#	4672#	4673#
	4674#	4675#	4676#	4677#	4678#	4679#	4680#	4681#	4682#	4683#	4684#	4685#	4686#	4687#
	4688#	4689#	4690#	4691#	4692#	4693#	4694#	4695#	4696#	4697#	4698#	4699#	4700#	4701#
	4702#	4703#	4704#	4705#	4706#	4707#	4708#	4709#	4710#	4711#	4712#	4713#	4714#	4715#
	4716#	4717#	4718#	4718	4724#	4725#	4726#	4727#	4728#	4729#	4730#	4731#	4732#	4733#
	4734#	4735#	4736#	4737#	4737	4740#	4741#	4742#	4743#	4744#	4745#	4746#	4747#	4748#
	4749#	4750#	4750	4756#	4757#	4758#	4759#	4760#	4761#	4762#	4763#	4764#	4765#	4766#
	4767#	4768#	4769#	4770#	4771#	4772#	4773#	4774#	4775#	4776#	4777#	4778#	4779#	4779
	4784#	4785#	4786#	4787#	4788#	4789#	4790#	4791#	4792#	4793#	4794#	4795#	4796#	4797#
	4798#	4799#	4800#	4800	4807#	4808#	4809#	4810#	4811#	4812#	4813#	4814#	4815#	4816#
	4817#	4817												
ASKAGN	4496#	4522												
ATN	92	4140#	4528											
ATN2	4153	4167#												
ATNCON	4168	4179#												
ATNFIX	4531#	4531												
AUTTXT	4231	4663#												
B	198	210	212	226	240	300	301	342	345	356	379	390	392	412
	420	497	498	516	527	553	555	620	622	624	628	630	674	692
	695	696	768	770	781	806	864	874	883	886	902	925	927	986
	976	977	979	980	1029	1037	1083	1097	1098	1199	1225	1241	1250	1333
	1359	1530	1561	1570	1695	1710	2342	2417	2580	2582	2583	2602	2717	2823
	2839	2850	2856	2863	2865	2891	2893	2898	2935	2937	2947	3618	3637	3643
	3654	3658	3682	3686	3745	3763	3846	3851	3931	3986	3997	4120	4155	4581
	4584													
BSERR	1702#	1702	1712											
BUF	4225#	4373	4405											
C	311	312	346	352	384	386	426	427	454	456	481	482	506	507
	529	530	544	546	684	740	761	783	784	864	867	904	921	923
	935	1096	1200	1223	1275	1279	1343	1349	1355	1363	1531	1585	1624	1696
	2346	2405	2408	2581	2828	2874	2876	2894	2951	3644	3764	3926	3927	4158
	4159													
CASSW	6#													
CNLCA1	4269#	4269	4301											
CNLCA2	4251#	4251	4283											
CNLCA3	4258#	4256	4288											

CNLCA4	4262#	4262	4294											
CNTWFL	4320#	4320												
CONSSW	9#	4612	4615											
CONTRW	11#	4317												
COS	92	3958#	4130	4548										
COSFIX	4539#	4539												
CROO	4223#	4323	4586											
CURLIN	4308#	4308												
D	199	211	241	307	308	352	353	381	383	452	477	478	503	504
	528	529	547	549	623	629	675	695	739	746	747	750	751	772
	782	783	807	868	918	920	936	1085	1221	1232	1246	1248	1367	1532
	1579	1580	2343	2370	2380	2398	2436	2578	2579	2585	2603	2847	2858	2870
	2872	3619	3642	3653	3659	3681	3687	3746	3760	3764	3815	3818	3847	3850
	3987	3998	4156	4408	4445	4455	4508	4527	4547	4559	4566	4578		
DCRART	2559#													
DFLENT	4400	4443#												
DIV10	790#	2426	2798											
DMULT	94	1692#												
DMULT1	1700#	1716												
DMULT2	1700	1714#												
DSKFUN	8#													
DV0ERR	106#	815												
E	303	304	343	391	450	463	473	474	500	501	527	528	550	552
	696	721	771	781	782	869	915	917	937	1219	1371	1533	1581	1622
	2344	2403	2404	2416	2686	2689	2694	2866	2868	3925	3926	4159	4413	4439
	4575													
ERROR	100#	466												
ERROV	106#	464												
EXP	92	3635	3704#											
EXPCON	3755	3770#												
EXTFNC	30#	91	191	580	670	996	1608	1613	1621	1626	1628	2592	2597	2667
	3554	3596	3694	3805	3904	3906	3955	4002	4007	4028	4033	4046	4069	4077
	4087	4111	4137	4461	4495	4622	4640							
FAC	106#	216	374	398	414	490	611	943	973	1042	1063	1094	1124	1175
	1202	1263	1346	1603	3669	3717	4148							
FACLO	106#	270	707	1170	1197	1211	1233	1610	3673					
FADD	88	186	212#	626	653	1039	3864	3920						
FADD1	228	242#												
FADD3	273	299#												
FADDA	276	472#	2883											
FADDM	179#	2810	4020											
FADDS	88	182#	3739	3962	4040									
FADDT	98	210#	2677											
FADFLT	315#	1105	1630											
FBUFFR	106#	2743												
FCERR	106#	606												
FCOMP	89	1333#	2783	2963	3662									
FCOMP2	1352#	1358#												
FCOMPO	1354#													
FCOMPS	1066#	1339												
FDIV	88	632	813#	3989	4161									
FDIV1	873#	939	948											
FDIV2	893	902#												

FDIVA	829	884#						
FDIVB	834	880#						
FDIVC	839	876#						
FDIVG	871	887#	896	929	933			
FDIVT	98	806#	4133					
FHALF	180	2972#	3613					
FIN	88	2322#						
FIN1	2329	2334	2337#					
FINC	2348#	2410	2605					
FINDIG	2350	2576#						
FINDP	2355	2408#						
FINE	2360	2400	2415#					
FINE2	2418#	2431						
FINE3	2422	2430#						
FINEC	2367	2394#	2696					
FINEDG	2396	2686#						
FINLOG	657	2599	2669#					
FINMLT	2540#	2791						
FINMUL	2419	2545#						
FLOAT	88	1083#	2673					
FLOATR	88	1093#	2720					
FMULT	88	676#	3689	3714	3766	3824	3855	3911
FMULT2	702	709#						
FMULT3	714	781#						
FMULT4	735#	774						
FMULT5	742	760#						
FMULTA	686	752#						
FMULTB	690	747#						
FMULTT	96	674#	3816					
FNS	4497	4641#						
FONE	92	586#	635	3736				
FOUT	88	2742#						
FOUT1	2751	2755#						
FOUT10	2865#	2880						
FOUT11	2903#	2908						
FOUT12	2900	2916#						
FOUT14	2928	2935#						
FOUT15	2937#	2941						
FOUT17	2918	2951#						
FOUT19	2759	2948#						
FOUT3	2776#	2795						
FOUT5	2787	2809#						
FOUT6	2831	2836	2843#					
FOUT8	2850#	2896						
FOUT9	2797#	2967						
FOUTBL	2848	2977#						
FOUTCB	2774	2804	2956#					
FPWR	92	3633#						
FPWR1	3651	3667#						
FPWR2	3681#							
FPWRT	100	3618#						
FR4	4009	4035	4082#					
FRETOP	4453#	4453						

FSUB	88	200#	3749	4000										
FSUBS	192#	638	4012	4164										
FSUBT	98	198#												
FUNIO	4226#	4248	4264#	4266	4278#	4280	4296#	4298						
H	179	251	268	269	282	305	309	343	353	354	380	391	397	413
	422	475	479	489	610	634	640	697	700	701	704	705	706	710
	716	762	764	778	826	831	836	873	879	882	903	924	941	942
	946	972	994	999	1001	1041	1093	1100	1123	1173	1178	1199	1210	1220
	1222	1224	1226	1249	1262	1272	1273	1336	1341	1345	1358	1362	1366	1370
	1374	1375	1547	1555	1565	1576	1602	1692	1700	1705	2336	2365	2366	2392
	2415	2584	2601	2701	2702	2708	2726	2729	2742	2745	2755	2761	2844	2857
	2862	2869	2873	2877	2878	2885	2890	2892	2903	2923	2946	2948	2950	2952
	2965	3600	3612	3664	3665	3667	3671	3735	3754	3819	3826	3840	3853	3857
	3861	3866	3897	3930	3937	3958	4008	4034	4070	4121	4163	4166	4167	4173
	4230	4247	4253	4259	4265	4279	4285	4291	4297	4304	4310	4326	4333	4352
	4355	4372	4383	4384	4387	4388	4402	4448	4459	4460	4496	4524	4554	4579
	4580	4591	4597	4612										
HAVFNS	4512	4536	4550#											
ICOMPS	1067#													
ILLFUN	4226#	4525												
INIT	4223	4236#												
INITAT	4230#	4346												
INITSA	4229#	4509												
INPRT	90	2701#												
INRART	90	1070#												
INT	89	1602#	3656	3725	3995									
INTXT	2703#	2703												
INXHRT	90	1226#	2854	2914										
L	290	342	354	355	392	496	499	502	505	537	539	678	765	767
	817	875	878	971	1200	4576	4577							
LASTWR	4353	4819#												
LENGTH	46	19	29	34	79	93	97	99	101	108	195	197	208	243
	287	289	327	341	433	518	520	541	543	561	672	711	717	719
	736	738	744	754	759	776	780	793	803	912	914	957	1002	1015
	1076	1112	1133	1243	1285	1379	1434	1584	1586	1595	1636	1688	1721	1939
	2338	2443	2547	2551	2562	2577	2607	2675	2679	2714	2722	2733	2741	2995
	3885	3887	4258	4290	4422	4782	4783	4801	4822	4824				
LINGET	4225#	4376	4406											
LINPRT	90	2713#	4589											
LINPT1	4426#	4420												
LINPT2	4424#	4424												
LINPT3	4428#	4428												
LINPT4	4441#	4441												
LOG	92	604#	3684											
LOGCN2	590#	641												
LOOPMM	4355#	4367												
LPTSW	7#	4606												
M	283	302	306	310	400	401	420	423	458	472	476	480	492	494
	613	622	709	822	823	827	832	837	945	975	986	993	1044	1097
	1101	1126	1129	1219	1221	1223	1225	1247	1265	1269	1271	1274	1281	1348
	1360	1364	1368	1372	1554	1605	1614	1618	2691	2748	2753	2756	2851	2867
	2871	2875	2891	2904	2921	2925	2930	2947	2949	2951	3839	3928	3931	3932
	4358	4359	4364	4365	4552									

MEMORY	4334	4806#												
MEMSIZ	4450#	4450												
MINUTK	106#	2372												
MLOVEX	997#	3722	3732											
MORCPS	4430#	4433												
MOVE	88	1241#												
MOVE1	1246#	1252												
MOVFM	90	1187#	3616	3842	3901									
MOVFR	90	220	238	429	801	1195#	2820	2887	3984	4127				
MOVMF	90	1232#	3941											
MOVRF	90	1027	1210#	1549	2860	3648	3821	3923						
MOVRM	90	183	193	1188	1219#	3859	3908							
MUL10	1026#	2549	2587											
MULDIM	31#	93	1688											
MULDIV	681	820	966#											
MULDV1	982	1000#												
MULDV2	969	1001#												
MULLN2	659#	3742												
NEG	90	201	1123#	2439	2763	3601	3679	3752	4026	4044	4145			
NEGK	316	489#	1573											
NORM1	349#	362												
NORM2	379#	388												
NORM3	349	387#												
NORMAL	326#	698	3935											
NOTPIO	4276	4303#												
NOTSIO	4245	4271#												
OKCHAR	4517	4524#												
OMERR	4226#	4457	4564											
OVERR	89	285	463#	951	1020	1035	1047							
PI2	3959	4078#	4174											
PLUSTK	106#	2386												
POLY	3758	3836#												
POLY1	3845#	3868												
POLYX	644	3812#	4074	4171										
POPHRT	778#	988												
POPPRT	1632#													
PSHNEG	3600#	3676	4142											
PSW	247	252	621	655	898	899	1266	1270	1276	1280	1623	1632	2327	2391
	2424	2428	2437	2546	2558	2589	2772	2789	2793	2800	2802	2827	2845	2916
	3660	3734	3744	3747	3845	3852	4024	4042						
PUSHF	89	234	791	1168#	2670	3610	3705	3813	3837	3975	3992	4115	4123	
QINLIN	4225#	4340	4395	4503										
QINT	89	1530#	1616	2817										
QINTA	1557	1579#												
READY	4223#	4613												
REALIO	5#	12	4237	4332	4385									
REASON	4223#	4573												
REPINI	4601#	4601												
RND	89	3884#												
RND1	3895	3922#												
RNOX	3898	3938	3945#											
ROUND	279	296	395	412#										
ROUNDA	418	450#	1568											

ROUNDB	413#	989												
SCRTCH	4225#	4604												
SGN	89	1077#												
SHFTR1	521#	533												
SHFTR2	524	535#												
SHFTR3	538#	557												
SHIFTR	254	516#	1563											
SHRADD	293	545#												
SIGN	106#	1336												
SIGNC	89	1062#												
SIGNS	96	1068#												
SIN	89	3974#	4118											
SIN1	4017	4024#												
SINCON	4071	4086#												
SINFIX	4545#	4545												
SNERR	4220#	4380												
SQR	89	3609#												
STKTOP	4315#	4315	4569											
STRING	32#	95	2323	2364	2373	2375	2381	2387	2389	2433	2435	4325	4426	4444
	4664	4720	4752	4754	4781	4803								
STROUI	2727#	2727												
STROUT	2706	4225#	4234	4337	4392	4500	4595	4598						
TAN	92	4114#												
TANFIX	4542#	4542												
TEMPFT	4330#	4330												
TEMPST	4327#	4327												
TSTACK	4311	4560	4821#											
TTYW	4388#	4411	4417											
TTYWID	4389	4723#												
TXTTAB	4556#	4556												
UNPACK	249	991	1262#	1552										
USEDE9	4350	4372#												
USEDEF	4361	4370	4384#											
WORDS	4592	4739#												
ZERO	88	372#	403	1017	2340									
ZERO0	373#	3640												
$CODE	107#	693	748	1086	1693	2824	3761	4156	4228	4264	4278	4296	4305	4446
	4582	4618												
.C2	4826#													
.P	86#	181	182#	184	185#	187	188#	194	195#	202	203#	217	218#	221
	222#	229	230#	235	236#	239	240#	250	251#	255	256#	271	272#	274
	275#	277	278#	280	281#	286	287#	294	295#	297	298#	317	318#	350
	351#	363	364#	375	376#	389	390#	396	397#	399	400#	404	405#	415
	416#	419	420#	430	431#	467	468#	491	492#	525	526#	534	535#	558
	559#	607	608#	612	613#	627	628#	633	634#	636	637#	639	640#	642
	643#	645	646#	654	655#	658	659#	682	683#	687	688#	691	692#	694
	695#	699	700#	703	704#	708	709#	715	716#	743	744#	749	750#	775
	776#	792	793#	802	803#	816	817#	821	822#	830	831#	835	836#	840
	841#	872	873#	894	895#	897	898#	910	911#	930	931#	934	935#	940
	941#	944	945#	949	950#	952	953#	970	971#	974	975#	983	984#	989
	990#	992	993#	1018	1019#	1021	1022#	1028	1029#	1036	1037#	1040	1041#	1043
	1044#	1048	1049#	1064	1065#	1087	1088#	1095	1096#	1106	1107#	1125	1126#	1171
	1172#	1176	1177#	1189	1190#	1198	1199#	1203	1204#	1212	1213#	1234	1235#	1253

1254#	1264	1265#	1337	1338#	1340	1341#	1347	1348#	1353	1354#	1550	1551#	1553
1554#	1558	1559#	1564	1565#	1569	1570#	1574	1575#	1604	1605#	1611	1612#	1617
1618#	1631	1632#	1694	1695#	1703	1704#	1709	1710#	1713	1714#	1717	1718#	2330
2331#	2335	2336#	2341	2342#	2351	2352#	2356	2357#	2361	2362#	2368	2369#	2397
2398#	2401	2402#	2411	2412#	2420	2421#	2423	2424#	2427	2428#	2432	2433#	2440
2441#	2550	2551#	2586	2589#	2600	2601#	2606	2607#	2671	2672#	2674	2675#	2678
2679#	2697	2698#	2704	2705#	2707	2708#	2721	2722#	2728	2729#	2744	2745#	2752
2753#	2760	2761#	2764	2765#	2775	2776#	2784	2785#	2788	2789#	2792	2793#	2796
2797#	2799	2800#	2805	2806#	2811	2812#	2818	2819#	2821	2822#	2825	2826#	2832
2833#	2837	2838#	2849	2850#	2855	2856#	2861	2862#	2881	2882#	2884	2885#	2888
2889#	2897	2898#	2901	2902#	2909	2910#	2915	2916#	2919	2920#	2929	2930#	2942
2943#	2964	2965#	2968	2969#	3602	3603#	3611	3612#	3614	3615#	3617	3618#	3636
3637#	3641	3642#	3649	3650#	3652	3653#	3657	3658#	3663	3664#	3670	3671#	3674
3675#	3677	3678#	3680	3681#	3685	3686#	3690	3691#	3706	3707#	3715	3716#	3718
3719#	3723	3724#	3726	3727#	3733	3734#	3737	3738#	3740	3741#	3743	3744#	3750
3751#	3753	3754#	3756	3757#	3759	3760#	3762	3763#	3767	3768#	3814	3815#	3817
3818#	3822	3823#	3825	3826#	3838	3839#	3843	3844#	3856	3857#	3860	3861#	3865
3866#	3869	3870#	3896	3897#	3899	3900#	3902	3903#	3909	3910#	3912	3913#	3921
3922#	3924	3925#	3936	3937#	3939	3940#	3942	3943#	3960	3961#	3963	3964#	3976
3977#	3985	3986#	3990	3991#	3993	3994#	3996	3997#	4001	4002#	4010	4011#	4013
4014#	4018	4019#	4021	4022#	4027	4028#	4036	4037#	4041	4042#	4045	4046#	4072
4073#	4075	4076#	4116	4117#	4119	4120#	4124	4125#	4128	4129#	4131	4132#	4134
4135#	4143	4144#	4146	4147#	4149	4150#	4154	4155#	4157	4158#	4162	4163#	4165
4166#	4169	4170#	4172	4173#	4175	4176#	4232	4233#	4235	4236#	4246	4247#	4249
4250#	4252	4253#	4257	4258#	4263	4264#	4267	4268#	4270	4271#	4277	4278#	4281
4282#	4284	4285#	4289	4290#	4295	4296#	4299	4300#	4302	4303#	4306	4307#	4309
4310#	4312	4313#	4316	4317#	4321	4322#	4324	4325#	4328	4329#	4331	4332#	4335
4336#	4338	4339#	4341	4342#	4347	4348#	4351	4352#	4354	4355#	4362	4363#	4368
4369#	4371	4372#	4374	4375#	4377	4378#	4381	4382#	4390	4391#	4393	4394#	4396
4397#	4401	4402#	4404	4405#	4407	4408#	4412	4413#	4418	4419#	4421	4422#	4425
4426#	4429	4430#	4434	4435#	4442	4443#	4447	4448#	4451	4452#	4454	4455#	4458
4459#	4498	4499#	4501	4502#	4504	4505#	4510	4511#	4513	4514#	4518	4519#	4523
4524#	4526	4527#	4529	4530#	4532	4533#	4537	4538#	4540	4541#	4543	4544#	4546
4547#	4549	4550#	4557	4558#	4561	4562#	4565	4566#	4570	4571#	4574	4575#	4583
4584#	4587	4588#	4590	4591#	4593	4594#	4596	4597#	4599	4600#	4602	4603#	4605
4606#	4614	4615#	4619	4620#	4626								

ACI	752														
ACRLF	46#	4663	4719	4751	4753	4780	4802								
ADC	385	477	481	2581											
ADD	400	473	976	2689	2691	2828	4439								
ADI	535	984	1032	2943	3727	3729	4435								
ANA	1581														
ANI	424	4242	4273												
CALL	182	192	200	233	237	248	253	275	292	625	631	637	643	652	
	656	680	798	800	819	990	1026	1038	1187	1351	1548	1551	1562	1615	
	1629	2339	2425	2548	2586	2598	2669	2672	2705	2719	2773	2782	2790	2797	
	2803	2809	2816	2819	2859	2882	2886	2962	3609	3615	3647	3655	3661	3683	
	3688	3704	3713	3724	3738	3741	3748	3751	3757	3812	3820	3823	3836	3841	
	3854	3858	3863	3900	3907	3910	3919	3922	3934	3961	3974	3983	3988	3991	
	3994	3999	4011	4019	4039	4114	4117	4122	4126	4129	4160	4170	4233	4322	
	4336	4339	4375	4391	4394	4405	4499	4502	4572	4585	4588	4594	4603		
CC	315	1567	1572	3675											
CHRGET	41#	2348	2363	2394	4342	4397	4505								
CM	417	1556	2762	4141	4144										
CMA	230	493	998	1066	2345	2932	4437								
CMC	891														
CMP	1360	1364	1368	4359	4365										
CNC	4043														
CNZ	2913														
COMPAR	43#	4562													
CP	2418	4025													
CPI	244	359	1606	2325	2331	2352	2357	2371	2377	2382	2385	2833	2905	2911	
	3719	4150	4343	4414	4506	4514	4519	4533							
CZ	2438	2853	3678												
DAD	380	750	924	1700	1705	1710	4455	4584							
DC	4641	4666	4723	4739	4755	4783	4806								
DCR	379	539	771	906	945	1250	1585	1714	2370	2559	2843	2850	2894	2898	
	3848	4363													
DCX	826	851	836	994	1362	1366	1370	1579	2336	2392	2877	2878	2903	3930	
	4383	4384	4459												
FSIGN	44#	604	676	813	997	1077	1115	1342	2747	3633	3886	4014	4022	4140	
IN	4238	4240	4271												
INR	231	283	450	452	454	456	630	822	823	905	1044	1070	1582	2380	
	2396	2405	2408	2429	2801	2812	2838	2865	2933	2937	4438				
INX	282	305	309	422	475	479	710	1100	1220	1222	1224	1226	1248	1249	
	1272	1273	1358	2755	2869	2873	2885	2892	2923	2946	2948	2950	3840	4355	
	4554														
JC	523	1034	1701	1711	2349	2395	3731	4152	4416	4563					
JM	908	2830	3894												
JMP	185	295	428	465	532	556	950	1019	1046	1104	2604	2676	2695	2794	
	3765	3867	3940	4073	4132	4369									
JNC	227	278	402	741	892	1707	2835	2879	2940	3721	4432	4456			
JNZ	348	361	773	938	947	1251	1715	2359	2399	2430	2895	4349	4360	4379	
	4418	4521													
JP	272	387	981	1016	2421	2750	2927	3650	4016						
JPE	605														
JPO	2786	2966													
JZ	219	284	394	713	814	968	987	1335	2328	2333	2354	2409	2758	2899	
	2907	2917	3634	3639	4244	4275	4345	4366	4399	4511	4516	4535			

LDA	215	928	1062	1609	3716	4147									
LDAX	1246														
LHLD	1169	1174													
LXI	179	269	397	413	489	610	634	640	692	697	701	706	747	942	
	972	1041	1085	1093	1123	1210	1232	1262	1338	1345	1602	1692	2366	2702	
	2726	2742	2823	2847	3600	3612	3735	3754	3760	3815	3897	3937	3958	4008	
	4034	4070	4155	4163	4167	4173	4230	4247	4265	4279	4297	4304	4310	4326	
	4333	4352	4372	4388	4402	4445	4496	4508	4524	4527	4547	4559	4581	4591	
	4597	4612													
MOV	212	251	301	302	304	306	308	310	312	342	343	345	346	352	
	353	354	355	356	381	383	384	386	390	391	392	401	412	420	
	423	427	472	474	476	478	480	482	492	494	496	498	499	501	
	502	504	505	507	527	528	529	537	544	546	547	549	550	552	
	553	555	613	622	684	695	696	709	739	740	761	762	764	765	
	767	768	770	772	781	782	783	784	827	832	837	864	867	868	
	869	875	878	879	882	883	886	904	915	917	918	920	921	923	
	925	927	935	966	971	977	980	986	993	1029	1037	1096	1097	1126	
	1129	1199	1200	1219	1221	1223	1225	1247	1265	1269	1274	1275	1279	1333	
	1343	1349	1359	1363	1367	1371	1530	1531	1532	1533	1555	1565	1580	1605	
	1614	1622	1624	1695	2342	2343	2344	2346	2404	2416	2579	2580	2582	2686	
	2694	2839	2866	2868	2870	2872	2874	2876	2891	2904	2947	2949	2951	3637	
	3644	3665	3764	3839	3925	3926	3927	3931	4158	4159	4356	4364	4408	4413	
	4575	4577	4578	4580											
MOVRI	57#	614	646	659	794	2776	2956	3707	3913	3977					
MVI	290	456	463	516	530	678	721	817	887	1083	1098	1101	1241	1559	
	1570	1618	1698	2717	2748	2753	2756	2840	2851	2863	2921	2925	2930	2935	
	3928	3932	4253	4259	4285	4291	4356	4552							
ORA	213	218	268	347	393	416	712	936	937	967	1000	1030	1334	1534	
	1696	3638	4023	4348	4378	4398	4409								
ORI	1267	1277	3645												
OUTCHR	42#														
PCHL	2969	3604	4620												
POP	198	199	210	211	240	241	252	628	629	655	674	675	751	778	
	806	807	898	899	902	903	946	999	1001	1270	1280	1374	1375	1576	
	1632	2391	2428	2436	2437	2558	2589	2601	2602	2603	2708	2789	2800	2827	
	2844	2862	2890	2893	2916	2952	2965	3618	3619	3658	3659	3664	3667	3671	
	3686	3687	3744	3745	3746	3763	3826	3845	3846	3847	3857	3866	3986	3987	
	3997	3998	4042	4120	4121	4448	4566								
POPR	54#	198	210	240	628	674	806	3618	3658	3686	3745	3846	3986	3997	
PUSH	247	621	623	624	700	704	705	716	746	873	874	941	1173	1178	
	1266	1276	1341	1547	1623	2327	2365	2415	2424	2546	2578	2583	2584	2585	
	2701	2729	2745	2761	2772	2793	2802	2845	2856	2857	2858	3642	3643	3653	
	3654	3660	3681	3682	3734	3747	3818	3819	3850	3851	3852	3853	3861	4024	
	4166	4387	4460												
PUSHFM	46#														
PUSHM	45#														
PUSHR	51#	623	3642	3653	3681	3850									
RAL	382	911	916	919	922	926	931	1067	1103	1566	1625				
RAR	545	548	551	554	735	760	763	766	769	907	978	1354	3666		
RET	376	483	508	779	785	995	1071	1130	1180	1205	1227	1254	1282	1356	
	1376	1577	1590	1633	1718	2442	2560	2953	4176						
RLC	2687	2688	2690												
RM	1350														

RNC	246	1612													
RNZ	451	453	455	459	1045	1069	1361	1365	1369	1373	1583				
RP	1116														
RST	604	676	813	997	1077	1115	1342	2348	2363	2394	2747	3633	3886	4014	
	4022	4140	4342	4397	4505	4562									
RZ	214	405	540	677	1031	1344	1535	1697	2376	2379	2384	2390	2545	3849	
	3903														
SBB	303	307	311	500	503	506	1068	2871	2875	4579					
SBI	880	884	889												
SHLD	689	1196	1201	3668	3672	4250	4255	4261	4268	4282	4287	4293	4300	4307	
	4314	4329	4449	4452	4530	4538	4541	4544	4555	4568	4600	4617			
SPHL	4313	4567													
STA	373	685	828	833	838	870	895	932	4319	4419	4423	4427	4440		
STC	900	4015													
SUB	226	300	497	620	1372	1561	2403	2417	2867	4576					
SUI	357	521	676	2590	2692	2938	4430								
SYNCHK	398														
XCHG	232	236	688	720	777	865	1168	1179	1195	1204	1704	1706	2441	2715	
	2889	4125	4382	4551	4571										
XRA	299	344	372	426	495	538	866	975	979	1271	1281	1348	1355	1554	
	2402	2716	2771	4318											
XRI	1127														
XTHL	1172	1177	2369	3603	4558										

SPOOLER RUNTIME 14 SECONDS, 44 KCS, 402 DISK READS, 3 DISK WRITES, 118 PAGES

END USER MITS [6000,6000] JOB F4 SEQ. 205 DATE 27-AUG-75 07:36:23 MONITOR ALBUQUERQUE SCHOOLS 507A **END**

END USER MITS [6000,6000] JOB F4 SEQ. 205 DATE 27-AUG-75 07:36:23 MONITOR ALBUQUERQUE SCHOOLS 507A **END**