

II DIGITAL RESEARCH

Post Office Box 579, Pacific Grove, California 93950, (408) 373-3403

DYNAMIC DEBUGGING TOOL (DDT)

CP/M VERSION _____

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SER. # _____

DEMMOV

CP/M VERSION _____
 (CONTROL DISKETTE)
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SER. # DDT MOVE PROGRAM

```

1>
2>
3> 080E = VERSION EQU 14
4> ; DDT RELOCATOR PROGRAM, INCLUDED WITH THE MODULE TO PERFORM
5> ; THE MOVE FROM 200H TO THE DESTINATION ADDRESS
6> 0703 = BIAS EQU 703H ;DISTANCE UP TO DEMON
7> 0100 ORG 100H
8> 0200 = STACK EQU 200H
9> 0805 = BDOS EQU 0805H
10> 0809 = PRNT EQU 9 ;BDOS PRINT FUNCTION
11> 0200 = MODULE EQU 200H ;MODULE ADDRESS
12>
13> 0100 010000 LXI B,0 ;ADDRESS FIELD FILLED-IN WHEN MODULE BUILT
14> 0103 C3D01 JMP START
15> 0106 434F505952 DB 'COPYRIGHT (C) 1976, DIGITAL RESEARCH'
16> 0130 4444542056SIGNON, DB 'DDT VERS '
17> 0139 312E DB VERSION/10+'0','.'
18> 0139 3424 DB VERSION MOD 10 + '0','.'
19> 013D 310002 START, LXI SP,STACK
20> 0140 C5 PUSH B
21> 0141 C5 PUSH B
22> 0142 113001 LXI D,SIGNON
23> 0145 0E09 MVI C,PRNT
24> 0147 CD0500 CALL BDOS
25> 014A C1 POP B ;RECOVER LENGTH OF MOVE
26> 014B 210700 LXI H,BDOS+2;ADDRESS FIELD OF JUMP TO BDOS (TOP MEMORY)
27> 014E 7E MOV A,M ;A HAS HIGH ORDER ADDRESS OF MEMORY TOP
28> 014F 3D DCR A ;PAGE DIRECTLY BELOW BDOS
29> 0150 90 SUB B ;A HAS HIGH ORDER ADDRESS OF RELOC AREA
30> 0151 57 MOV D,A
31> 0152 1E00 MVI E,0 ;D,E ADDRESSES BASE OF RELOC AREA
32> 0154 D5 PUSH D ;SAVE FOR RELOCATION BELOW
33>
34> 0155 210002 LXI H,MODULE;READY FOR THE MOVE
35> 0159 78 MOVE, MOV A,B ;BC=0?
36> 0159 81 ORA C
37> 015A CA6501 JZ RELOC
38> 015D 08 DCX B ;COUNT MODULE SIZE DOWN TO ZERO
39> 015E 7E MOV A,M ;GET NEXT ABSOLUTE LOCATION
40> 015F 12 STAX D ;PLACE IT INTO THE RELOC AREA
41> 0160 13 INX D
42> 0161 23 INX H
43> 0162 C35801 JMP MOVE
44>
45> RELOC, ;STORAGE MOVED, READY FOR RELOCATION
46> ; HL ADDRESSES BEGINNING OF THE BIT MAP FOR RELOCATION
47> 0165 D1 POP D ;RECALL BASE OF RELOCATION AREA
48> 0166 C1 POP B ;RECALL MODULE LENGTH
49> 0167 E5 PUSH H ;SAVE BIT MAP BASE IN STACK
50> 0168 62 MOV H,D ;RELOCATION BIAS IS IN D
51>

```

```

52> 0169 78
53> 016A B1
54> 016B CA8701
55>
56>
57> 016E 08
58> 016F 78
59> 0170 E607
60> 0172 C27A01
61>
62> 0175 E3
63> 0176 7E
64> 0177 23
65> 0178 E3
66> 0179 6F
67> 017A 7D
68> 017B 17
69> 017C 6F
70> 017D D20301
71>
72>
73> 0180 1A
74> 0181 84
75> 0182 12
76> 0183 13
77> 0184 C36901
78>
79>
80> 0187 D1
81> 0188 2E00
82> 018A 110307
83> 018D 19
84> 018E E9
85> 018F

```

```

RELOC, MOV A,B ;BC=0?
ORA C
JZ ENDREL

; NOT END OF THE RELOCATION, MAY BE INTO NEXT BYTE OF BIT MAP
DCX B ;COUNT LENGTH DOWN
MOV A,E
ANI 111B ;0 CAUSES FETCH OF NEXT BYTE
JNZ REL1
; FETCH BIT MAP FROM STACKED ADDRESS
XTHL
MOV A,M ;NEXT 8 BITS OF MAP
INX H
XTHL ;BASE ADDRESS GOES BACK TO STACK
MOV L,A ;L HOLDS THE MAP AS WE PROCESS 8 LOCATION
REL1, MOV A,L
RAL ;CY SET TO 1 IF RELOCATION NECESSARY
MOV L,A ;BACK TO L FOR NEXT TIME AROUND
JNC REL2 ;SKIP RELOCATION IF CY=0

; CURRENT ADDRESS REQUIRES RELOCATION
LDAX D
ADD H ;APPLY BIAS IN H
STAX D
REL2, INX D ;TO NEXT ADDRESS
JMP RELOC ;FOR ANOTHER BYTE TO RELOCATE

; END OF RELOCATION
ENDREL, POP D ;CLEAR STACKED ADDRESS
MVI L,0
LXI D,BIAS
DAD D ;GO TO RELOCATED PROGRAM
PCHL
END

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```

2>
3> 0100      ORG      100H
4> 1206 =    EQU      $+1106H
5>           BDOS
6>           ; CP/M DEBUGGER DISASSEMBLER/ASSEMBLER MODULE
7>           ; RELOCATABLE VERSION
8>           ;
9>           ; COPYRIGHT (C) 1976
10>          ; DIGITAL RESEARCH
11>          ; BOX 579 PACIFIC GROVE
12>          ; CALIFORNIA 93950
13>          ;
14> 0000 =    FALSE   EQU      0
15> FFFF =    TRUE    EQU      NOT FALSE
16>
17> 0000 =    DEMON   EQU      $+700H
18>
19> 0005 =    JLOC1   EQU      5H
20>
21> 0009 =    GETBUFF EQU      DEMON+9H
22> 000C =    GNC     EQU      DEMON+0CH
23>
24> 000C =    CI      EQU      GNC          ;SYNONYM FOR GNC
25> 0002 =    CONO    EQU      2           ;CONSOLE OUTPUT FUNCTION
26> 000B =    CHKIO   EQU      11         ;CHECK FOR CHARACTER INPUT DURING LIST
27>
28> 000D =    CR      EQU      0DH
29> 000A =    LF      EQU      0AH
30> 0009 =    TAB     EQU      09H
31>
32> MODLOC.   ;MODULE LOCATION
33> 0100 C30008 JMP      DEMON    ;BRANCH AROUND DISASSEMBLER IF USED
34> 0103 C36D01 JMP      INIT     ;INITIALIZE JUMPS
35> 0106 C38604 JMP      DISENT
36> 0109 C34006 JMP      ASHEN    ;ENTRY POINT FOR ASSEMBLER
37> 010C      DS      2           ;CURRENT FAKED PC DURING DISASSEMBLY
38> 010E      DS      2           ;MAX VALUE FOR PC (STOP ADDRESS)
39> 0110      DS      1           ;PAGE MODE IF NON ZERO
40> 0111      DS      2           ;TEMPORARY PC FOR ASSEMBLER RESTORE ON ERROR
41> 0113      DS      2           ;ENTRY SP VALUE
42>
43>
44>
45> CO.       ;PRINT CHARACTER IN REGISTER C
46> 0115 F5   PUSH     PSW
47> 0116 C5   PUSH     B
48> 0117 D5   PUSH     D
49> 0118 E5   PUSH     H
50> 0119 59   MOV      E,C        ;CHARACTER MOVES TO E
51> 011A 0E02 MVI      C,CONO    ;OUTPUT FUNCTION
52> 011C CD0612 CALL     BDOS
53> 011F E1   POP      H
54> 0120 D1   POP      D
55> 0121 C1   POP      B
56> 0122 F1   POP      PSW
57> 0123 C9   RET
58>
59>
60> DELIM.    ;CHECK FOR DELIMITER

```

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SER. # DISASSEMBLER/ASSEMBLER

```

61> 0124 FE20
62> 0126 C8
63> 0127 FE09
64> 0129 C8
65> 012A FE2C
66> 012C C8
67> 012D FE0D
68> 012F C8
69> 0130 FE7F
70> 0132 CA4006
71> 0135 C9
72>
73>
74> 0136 0E0D
75> 0138 CD1501
76> 013B 0E0A
77> 013D CD1501
78> 0140 C9
79>
80>
81>
82> 0141 CD0C00
83>
84> 0144 FE0D
85> 0146 CA2E06
86> 0149 CD2401
87> 014C CA4101
88>
89>
90> 014F 0E04
91> 0151 218F07
92> 0154 3620
93> 0156 23
94> 0157 0D
95> 0158 C25401
96>
97>
98> 015B 0E05
99> 015D 218F07
100> 0160 77
101> 0161 CD0C00
102> 0164 CD2401
103> 0167 CA7201
104> 016A 23
105> 016B 0D
106> 016C CA2E06
107> 016F C36001
108>
109>
110> 0172 3A8F07
111> 0175 FE20
112> 0177 C9
113>
114>
115> 0178 D630
116> 017A FE0A
117> 017C D8
118> 017D C6F9
119> 017F FE10
120> 0181 D8

```

```

CPI      ' '
RZ
CPI      TAB
RZ
CPI      ' '
RZ
CPI      CR
RZ
CPI      7FH
JZ      ASHEN  ;RESTART CURRENT LINE
RET

;
; CRLF.  ;RETURN AND LINE FEED
;
; MVI      C,CR
; CALL     CO
; MVI      C,LF.
; CALL     CO
; RET

;
; SCAN.  ;FILL OPCODE WITH CHARACTER
;
; SC1.   CALL     CI
; SCAN0. ;ENTER HERE IF CHARACTER SCANNED
; CPI      CR
; JZ      ERR
; CALL     DELIM
; JZ      SC1

;
; CLEAR BUFFER
;
; MVI      C,4
; LXI      H,OPCODE
; SC0.   MVI      H,' '
; INX      H
; DCR      C
; JNZ     SC0

;
; GARBAGE REMOVED AT BEGINNING OF SCAN
;
; MVI      C,5
; LXI      H,OPCODE
; SC2.   MOV      M,A          ;STORE CHARACTER
; CALL     CI
; CALL     DELIM
; JZ      SC3
; INX      H
; DCR      C
; JZ      ERR          ;TOO LONG
; JMP      SC2

;
; SC3.   ;END OF CURRENT SCAN, COMPARE FOR EMPTY
; LDA      OPCODE
; CPI      ' '
; RET

;
; HEX.   ;CONVERT ACCUMULATOR TO HEXADECIMAL
;
; SUI      '0'
; CPI      10
; RC
; RC      ;'0' - '9'
; ADI      ('0'-'A'+10) AND 0FFH
; CPI      16
; RC

```

CURRENT LINE _____

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```

121> 0102 C32E06 JMP ERR
122>
123>
124> 0105 CD4101 GADDR. GET ADDRESS VALUE TO B (HIGH ORDER) AND C (LOW) WITH COPY OF
125> 0109 CA2E06 CALL SCAN
126> 0108 110000 JZ ERR
127> 010E 010000 LXI D,0
128> 0191 218F07 LXI B,0 ;OPCODE INDEX
129> 0194 09 LXI H,OPCODE
130> 0195 7E DAD B
131> 0196 FE20 MOV A,M ;NEXT CHARACTER
132> 0199 CA8001 CPI
133> 0198 CD7801 JZ GAI
134> 019E 68 CALL HEX ;CONVERT ACCUMULATOR
135> 019F 62 MOV L,E
136> 01A0 29 MOV H,D ;COPY D,E TO H,L
137> 01A1 29 DAD H ;*2
138> 01A2 29 DAD H ;*4
139> 01A3 29 DAD H ;*8
140> 01A4 5F DAD H ;*16
141> 01A5 1600 MOV E,A
142> 01A7 19 MVI D,0
143> 01A8 EB XCHG ;BACK TO D,E
144> 01A9 03 INX B ;NEXT POSITION
145> 01AA 79 MOV A,C
146> 01AB FE04 CPI 4
147> 01AD C29101 JNZ GAO ;FOR ANOTHER
148>
149>
150> 01B0 42 GAI. D,E CONTAINS RESULT
151> 01B1 48 MOV B,D
152> 01B2 78 MOV C,E
153> 01B3 05 MOV A,E ;COPY OF LOW BYTE TO ACCUMULATOR
154> 01B4 04 DCR B
155> 01B5 C9 INR B ;SETS ZERO FLAG IF B IS ZERO
156> RET
157>
158> 01B6 CD8501 GBYTE. GET BYTE VALUE TO ACCUMULATOR AND C, CHECK FOR HIGH ORDER, ZE
159> 01B9 C22E06 CALL GADDR
160> 01BC C9 JNZ ERR
161> RET
162>
163> 01BD 210600 INIT. INITIALIZE THE JUMPS AROUND DISASSEMBLER
164> 01C0 3E00 LXI H,JLOC1+1 ;ADDRESS FIELD OF JUMP AT 5H
165> 01C2 56 MVI A,MODLOC AND 0FFH ;LOW ORDER ADDRESS OF THIS MO
166> 01C3 23 SUB H ;ALREADY ADDRESSING THIS MODULE
167> 01C4 3E01 INX H ;OR A MODULE BELOW THIS POINT?
168> 01C6 9E MVI A,MODLOC SHR 8 ;IF SO, SKIP THIS OPERATION
169> 01C7 D8 SBB H
170> 01C8 210001 RNC ;NO CARRY IF (5H) <= MODLOC
171> 01CB 220600 LXI H,MODLOC ;CHANGE ADDRESS
172> 01CE C9 SHLD JLOC1+1 ;FIELD OF JUMP AT 5H
173> RET
174>
175>
176>
177>
178>
179> 01CF 17 ADJ. MOVE REGISTER INDICATOR TO MIDDLE FIELD OF CODE
180> 01D0 17 RAL
RAL

```

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```

01D1 17
01D2 E638
01D4 C9
01D5 17
01D6 17
01D7 17
01D8 17
01D9 E630
01DB C9

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```

01DC EB
01DD 210F07
01DE EB
01E1 7B
01E2 BE
01E3 C2E801
01E6 23
01E7 7A
01E8 BE
01E9 C8
01EA 28
01EB 28
01EC 28
01ED 0D
01EE C2E101

```

```

01F1 0D
01F2 C9

```

```

01F3 0604

```

```

01F5 D5
01F6 118F07
01F9 1A
01FA BE
01FB C20602
01FE 23
01FF 13
0200 05
0201 C2F901

```

```

0204 D1
0205 C9

```

```

0206 23
0207 05

```

```

RAL
ANI 111000B
RET

```

```

ADJ4. MOVE TO LEFT BY 4 AND MASK

```

```

RAL
RAL
RAL
RAL
ANI 110000B
RET

```

```

SEAR2. SAME AS SEAR, EXCEPT 2 CHARACTER MATCH

```

```

H,L ADDRESS TABLE TO MATCH ON
XCHG
LHLD OPCODE ;2ND BYTE IN D, 1ST BYTE IN E
XCHG ;H,L ADDRESS TABLE
SEA0. MOV A,E ;GET 1ST BYTE
CMP M ;MATCH?
JNZ SEAI ;TO ADDRESS NEXT ELT
INX H ;NEXT TO MATCH
MOV A,D ;2ND CHAR
CMP M
RZ ;MATCH AT CURRENT ENTRY
DCX H
DCX H
DCX H ;ADDRESSES NEXT ELEMENT
DCR C
JNZ SEA0 ;FOR ANOTHER COMPARE

```

```

NO MATCH IN TABLE, RETURN WITH NON-ZERO VALUE
DCR C
RET

```

```

SEAR. SEARCH FOR MATCH IN OPCODE TABLE, LENGTH OF TABLE IN REG-
D,E CONTAINS ADDRESS OF BINARY EQUIVALENT OF OPCODE
H,L ADDRESS FOUR CHARACTER OPCODE TO MATCH
OPCODE CONTAINS FOUR BYTE OPCODE TYPED AT CONSOLE
RETURNS WITH ZERO VALUE IF OPCODE FOUND, WITH D,E
ADDRESSING PROPER BYTE, NON-ZERO IF NOT FOUND.
MVI B,4 ;4 CHARACTER MATCH

```

```

PUSH D ;SAVE THE CURRENT BYTE VALUE LOCATION
LXI D,OPCODE ;ADDRESS CHARACTERS TYPED
LDAX D ;POINT TO FIRST BYTE TO MATCH
SE1. CMP M ;SAME CHARACTER AS TABLE?
JNZ SE2 ;NO, SKIP TO NXT TABLE ENTRY
INX H ;YES, LOOK AT NEXT CHARACTER
INX D ;MOVE TO NEXT CHARACTER TYPED
DCR B ;DECREMENT CHARACTER COUNT
JNZ SE1 ;MORE TO MATCH?

```

```

COMPLETE MATCH, RETURN WITH D,E ADDRESSING BYTE VALUE
POP D
RET

```

```

MISMATCH, FINISH COUNT
SE2. INX H
DCR B

```

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241> 0208 C20602
 242>
 243>
 244> 0208 11F0FF
 245> 020E 19
 246>
 247> 020F D1
 248> 0210 13
 249> 0211 00
 250> 0212 C2F301
 251>
 252>
 253> 0215 00
 254> 0216 C9
 255>
 256>
 257>
 258> 0217 C5
 259> 0218 CD4101
 260> 0218 CA2E06
 261> 021E 0E00
 262> 0220 217907
 263> 0223 CDDC01
 264> 0226 C22E06
 265> 0229 00
 266> 022A 79
 267> 022B C1
 268> 022C C9
 269>
 270>
 271> 022D C5
 272> 022E CD4101
 273> 0231 CA2E06
 274> 0234 0E05
 275> 0236 218807
 276> 0239 CDF301
 277> 023C C22E06
 278> 023F 00
 279> 0240 79
 280> 0241 C1
 281> 0242 C9
 282>
 283>
 284> 0243 CD2D02
 285> 0246 FE04
 286> 0248 CA2E06
 287> 024B C9
 288>
 289>
 290> 024C CD2D02
 291> 024F FE03
 292> 0251 CA2E06
 293> 0254 FE04
 294> 0256 C0
 295> 0257 3D
 296> 0258 C9
 297>
 298>
 299>
 300> 0259 218F07

JNZ SE2
 H.L AT END OF FOUR BYTE AREA. MOVE BACK 8
 LXI D, -8
 DAD D ;H.L READY FOR NXT. MATCH
 POP D ;RESTORE BYTE POINTER
 INX D ;MOVE TO NEXT IN CASE MATCH OK
 DCR C ;MORE OPCODES TO MATCH?
 JNZ SEAR ;LOOK FOR MORE
 NO MATCH FOUND IN TABLE. SET NON-ZERO VALUE AND RETURN
 DCR C
 RET
 GETREG: ;SCAN FOR SIMPLE REGISTER REFERENCE
 PUSH B
 CALL SCAN
 JZ ERR
 MVI C, 0 ;8 REGISTERS
 LXI H, SREG ;SIMPLE REGISTERS
 CALL SEAR2 ;LOOK FOR 2 CHAR MATCH
 JNZ ERR
 DCR C
 MOV A, C
 POP B
 RET
 GETD: ;GET DOUBLE PRECISION REGISTER
 PUSH B
 CALL SCAN
 JZ ERR
 MVI C, 5
 LXI H, DREG
 CALL SEAR
 JNZ ERR
 DCR C
 MOV A, C
 POP B
 RET
 GETDR: ;GET DOUBLE REGISTER (BDHSP)
 CALL GETD
 CPI 4 ;PSW?
 JZ ERR
 RET
 GETPR: ;GET PUSH/POP REGISTER (BDH OR PSW)
 CALL GETD
 CPI 3
 JZ ERR
 CPI 4
 RNZ
 DCR A ;PSW MUST BE ADJUSTED
 RET
 GCON: ;GET CONDITION CODE
 BUFFER IS SCANNED. MOVE LEFT BEFORE COMPARE
 LXI H, OPCODE

301> 025C 119007
 302> 025F 0E02
 303> 0261 1A
 304> 0262 77
 305> 0263 23
 306> 0264 13
 307> 0265 0D
 308> 0266 C26102
 309>
 310>
 311> 0269 1A
 312> 026A FE20
 313> 026C C22E06
 314> 026F 77
 315>
 316>
 317> 0270 216907
 318> 0273 0E08
 319> 0275 CDDC01
 320> 0278 C22E06
 321> 027B 0D
 322> 027C 79
 323> 027D CDFC01
 324> 0280 C9
 325>
 326>
 327> 0281 CD5902
 328> 0284 F5
 329> 0285 CD8501
 330> 0288 F1
 331>
 332> 0289 F6C0
 333> 028B C9
 334>
 335>
 336> 028C 1A
 337>
 338>
 339> 028D 2A8C01
 340> 0290 77
 341> 0291 23
 342> 0292 220C01
 343> 0295 C9
 344>
 345>
 346>
 347>
 348> 0296 CD8C08
 349> 0299 FE0D
 350> 029B CA5906
 351> 029E CD4401
 352> 02A1 CA2E06
 353>
 354>
 355> 02A4 0E11
 356> 02A6 218F06
 357> 02A9 115E06
 358> 02AC CDF301
 359> 02AF C28502
 360>

NOP: LXI D, OPCODE+1
 MVI C, 2 ;MOVE TWO CHARACTERS
 LDAX D ;LOAD CHARACTER TO MOVE
 MOV M, A ;MOVE LEFT
 INX H ;NEXT DESTINATION
 INX D ;NEXT SOURCE
 DCR C
 JNZ NOP
 MUST BE BLANK AT END
 LDAX D
 CPI ' '
 JNZ ERR
 MOV M, A
 NOW READY TO DO THE COMPARE
 LXI H, CREG
 MVI C, 8
 CALL SEAR2
 JNZ ERR
 DCR C
 MOV A, C
 CALL ADJ ;MOVE TO BITS 3,4,5 OF BYTE (LSB = 0)
 RET
 GCONA: ;GET CONDITION CODE TO REGISTER A. DOUBLE ADDRESS TO B.C
 CALL GCON ;CONDITION CODE TO A
 PUSH PSW
 CALL GADDR ;VALUE TO B.C
 POP PSW
 INCLUDE HIGH ORDER 11'S FOR J AND C OPCODES
 ORI 11000000
 RET
 SETMD: ;SET MEMORY AT LOCATION PC TO VALUE ADDRESSED BY B
 LDAX D ;VALUE TO ACCUM
 SETH: ;SET MEMORY AT LOCATION PC TO VALUE IN ACCUM. INC PC
 LHLD PC
 MOV M, A ;STORE AT PC
 INX H ;PC=PC+1
 SHLD PC
 RET
 GETOP: ;PROCESS NEXT OPCODE
 CALL CI
 CPI CR
 JZ GOBACK ;RETURN IF SIMPLE INPUT
 CALL SCAN0
 JZ ERR
 CHK0: ;CHECK FOR OPCODES WITH NO OPERANDS
 MVI C, 17 ;LENGTH OF GROUP-0
 LXI H, ETAB1 ;END OF GROUP-0
 LXI D, TABLE ;FIRST BYTE VALUE
 CALL SEAR ;LOOK FOR MATCH
 JNZ CHK1 ;NO MATCH. CHECK FOR GROUP-1

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```

361>
362> 02B2 C38C02
363>
364>
365> 02B3 0E0A
366> 02B7 21E706
367> 02BA CDF301
368> 02BD C2C902
369>
370>
371> 02C0 CD8C02
372> 02C3 CD8601
373> 02C6 C38D02
374>
375>
376> 02C9 0E06
377> 02CB 21FF06
378> 02CE CDF301
379> 02D1 C2E102
380>
381>
382> 02D4 CD8C02
383>
384> 02D7 CD8501
385> 02DA CD8D02
386> 02DD 78
387> 02DE C38D02
388>
389>
390> 02E1 0E01
391> 02E3 210307
392> 02E6 CDF301
393> 02E9 C2FD02
394>
395>
396> 02EC CD1702
397> 02EF CDCF01
398> 02F2 47
399> 02F3 0E40
400>
401>
402> 02F5 CD1702
403> 02F8 B1
404> 02F9 B0
405> 02FA C38D02
406>
407>
408> 02FD 0E08
409> 02FF 212307
410> 0302 CDF301
411> 0305 C21303
412>
413>
414> 0308 0D
415> 0309 79
416> 030A CDCF01
417> 030D 47
418>
419> 030E 0E08
420> 0310 C3F502

```

```

MATCHED OPCODE, D,E ADDRESS BYTE VALUE
JMP SETMD ;SET MEMORY AT PC AND INC PC

CHECK GROUP-1 VALUES
CHK1. MVI C,10 ;LENGTH OF GROUP-1
      LXI H,ETAB2
      CALL SEAR ;D,E REMAIN SET
      JNZ CHK2 ;NO MATCH, CHECK NEXT GROUP

MATCH FOUND, SET BYTE AND GET BYTE OPERAND
CALL SETMD
CALL GBYTE ;GETS BYTE VALUE TO ACCUMULATOR
JMP SETM ;PUTS BYTE VALUE TO MEMORY AT PC

CHECK GROUP-2 OPCODES, REQUIRE DOUBLE BYTE OPERAND
CHK2. MVI C,6
      LXI H,ETAB3
      CALL SEAR
      JNZ CHK3 ;NO MATCH

FOUND MATCH, GET OPCODE BIT PATTERN AND STORE
CALL SETMD
;ENTER HERE FOR DOUBLE BYTE OPERANDS
CALL GADDR ;VALUE IN B,A
CALL SETM
MOV A,B
JMP SETM

CHK3. ;CHECK FOR MOV INSTRUCTION
      MVI C,1
      LXI H,PMOV
      CALL SEAR
      JNZ CHK4

MOV INSTRUCTION GET DESTINATION OPERAND
CALL GETREG ;VALUE TO ACCUMULATOR
CALL ADJ
MOV B,A ;SAVE IN B
MVI C,01000000B ;BIT PATTERN FOR MOV

OP1. ;GET NEXT OPERAND FOR MOV, FIRST OPERAND FOR ACCUM/REG OPERAT
      CALL GETREG
      ORA C ;SETS HIGH ORDER TWO BITS
      ORA B ;SETS DESTINATION/OPERATOR
      JMP SETM

CHK4. ;CHECK FOR GROUP-5 (ACCUM/REG OPERATOR)
      MVI C,8
      LXI H,ETAB5
      CALL SEAR
      JNZ CHK5

ACCUM/REG INSTRUCTION, C COUNTS OPERATORS AS SEARCH PROCEEDS
DCR C
MOV A,C
CALL ADJ
MOV B,A
OPERATOR NUMBER (SHIFTED) SAVED FOR LATER MASK
MVI C,10000000B ;ACCUM/REG OPERATOR INDICATOR
JMP OP1 ;GETS OPERAND AND SAVES BYTE IN MEMORY

```

```

421>
422>
423> 0313 0E02
424> 0315 212B07
425> 0318 CDF301
426> 031B C22B03
427>
428>
429> 031E 0C
430> 031F 0C
431> 0320 0C
432> 0321 CD1702
433> 0324 CDCF01
434> 0327 B1
435> 0328 C38D02
436>
437>
438> 032B 0E01
439> 032D 212F07
440> 0330 CDF301
441> 0333 C24703
442>
443>
444> 0336 CD1702
445> 0339 CDCF01
446> 033C F606
447> 033E CD8D02
448> 0341 CD8601
449> 0344 C38D02
450>
451>
452> 0347 0E06
453> 0349 214707
454> 034C CDF301
455> 034F C26D03
456>
457>
458> 0352 79
459> 0353 FE04
460> 0355 DA5A03
461>
462>
463> 0358 C605
464>
465> 035A 47
466> 035B CD4302
467> 035E CDD501
468> 0361 B0
469> 0362 CD8D02
470>
471> 0365 E6CF
472> 0367 FE01
473> 0369 C0
474> 036A C3D702
475>
476>
477>
478>
479> 036D 0E01
480> 036F 214B07

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```

CHK5. ;MAY BE INR/DCR
      MVI C,2
      LXI H,PCDR
      CALL SEAR
      JNZ CHK6

C=2 IF DCR, =1 IF INR
INR C ;+1
INR C ;+2
INR C ;+3
CALL GETREG ;VALUE TO ACCUM
CALL ADJ
ORA C ;FILL PROPER INSTRUCTION INDICATOR
JMP SETM

CHK6. ;MAY BE A MVI INSTRUCTION
      MVI C,1
      LXI H,PMVI
      CALL SEAR
      JNZ CHK7

MVI INSTRUCTION, GET REGISTER
CALL GETREG ;VALUE GOES TO ACCUMULATOR
CALL ADJ
ORI 1108
CALL SETM
CALL GBYTE
JMP SETM

CHK7. ;CHECK FOR GROUP-7
      MVI C,6
      LXI H,ETAB7
      CALL SEAR
      JNZ CHK8

LXI,STAX,INX,DAD,LDA, OR DCX
MOV A,C ;A=1...6
CPI 4
JC IN0

MUST BE DAD,LDA, OR DCX
ADI 5 ;CHANGES ACCUM TO 9,10, OR 11
;ACCUMULATOR CONTAINS CODE, SAVE IT
MOV B,A
CALL GETDR ;DOUBLE REGISTER VALUE TO ACCUM
CALL ADJ4 ;ADJUST VALUE TO MIDDLE FIELD
ORA B ;FILLS REMAINING BITS
CALL SETM
MAY BE LXI
ANI 11001111B
CPI 1
RHZ ;NOT LXI
JMP OP2 ;PICK UP OPERAND

CHK8. ;RST?
      MVI C,1
      LXI H,RST

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481> 0372 CDF301      CALL    SEAR
482> 0375 C28803      JNZ     CHK9
483>
484>
485> 0378 CDB601      RST, GET OPERAND
486> 037B FE08          CALL    GBYTE
487> 037D D22E06      CPI      8
488> 0380 C0CF01      JNC      ERR
489> 0383 F6C7          CALL    ADJ
490> 0385 C38D02      ORI      11000111B
491>                      JMP     SETM
492>
493> 0388 0E02          CHK9,  POP/PUSH?
494> 038A 215707          MVI     C, 2
495> 038D CDF301          LXI     H, PPOP+4
496> 0390 C2A803          CALL    SEAR
497>                      JNZ     CHK10
498>
499> 0393 0D            C=2 IF PUSH, 1 IF POP
500> 0394 C29C03          DCR     C
501>                      JNZ     PP0
502>
503> 0397 0EC1          POP, SET BIT PATTERN
504> 0399 C39E03          MVI     C, 110000001B
505>                      JMP     PPI
506>
507> 039C 0EC5          PP0,  PUSH
508> 039E C04C02          MVI     C, 11000101B
509> 03A1 C0D501          PP1,  CALL    GETPR  ;DOUBLE PUSH/POP REGISTER TO PROPER FIELD
510> 03A4 B1            CALL    ADJ4  ;MOVE TO FIELD
511> 03A5 C38D02          ORA     C
512>                      JMP     SETM
513>
514> 03A8 3A8F07          CHK10,  J/C/R?
515> 03AB FE4A          LDA     OPCODE
516> 03AD C2B803          CPI     'J'
517> 03B0 C08102          JNZ     CHK11
518>                      CALL    GCONA
519>                      CONDITION CODE TO FIELD IN ACCUM, ADDRESS TO B,C
520> 03B3 F602          ORI     010B
521> 03B5 C3C203          JMP     FADDR  ;FILL ADDRESS
522>
523> 03B8 FE43          CHK11,  CPI     'C'
524> 03BA C2CD03          JNZ     CHK12
525> 03BD C08102          CALL    GCONA
526> 03C0 F604          ORI     100B
527>
528> 03C2 C08D02          FADDR,  CALL    SETM
529> 03C5 79            MOV     A, C
530> 03C6 C08D02          CALL    SETM
531> 03C9 78            MOV     A, B
532> 03CA C38D02          JMP     SETM
533>
534> 03CD FE52          CHK12,  CPI     'R'
535> 03CF C22E06          JNZ     ERR
536> 03D2 C05902          CALL    GCON
537> 03D5 F6C0          ORI     11000000B
538> 03D7 C38D02          JMP     SETM
539>
540> *****
540> ***** END OF ASSEMBLER MODULE, START DISASSEMBLER *****

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541>
542>
543> 03DA 2A0E01      RDBYTE, LHL D MPC
544> 03DD D5          PUSH D ;SAVE DE
545> 03DE EB          XCHG ;MAX PC TO D.E
546> 03DF 2A0C01      LHL D PC ;CURRENT PC
547>
548> 03E2 78          SUBTRACT PC FROM MPC, STOP IF CARRY GENERATED
549> 03E3 95          MOV A, E
550> 03E4 7A          SUB L
551> 03E5 9C          MOV A, D
552> 03E6 D2EE03      SBB H
553>                      JNC RD0
554>
555> 03E9 2A1301      PC EXCEEDS MPC, RETURN
556> 03EC F9          LHL OLDSP
557> 03ED C9          SPHL ;RESTORE ORIGINAL STACK POINTER
558>                      RET
559>
560> 03EE D1          RD0, POP D ;RESTORE D.E
561> 03EF 7E          MOV A, M
562> 03F0 23          INX H
563> 03F1 220C01      SHLD PC
564> 03F4 C9          RET
565>
566> 03F5 3C          RGPRT, INR A
567> 03F6 E607          ANI 07
568> 03F8 FE06          CPI 06
569> 03FA DAFF03          JC RGP1
570> 03FF FE05          ADI 03
571> 0401 DA0604          RGP1, CPI 05
572> 0404 C602          JC RGP2
573> 0406 C641          ADI 02
574> 0408 4F          RGP2, ADI 41H
575> 0409 C31501      MOV C, A
576>                      JMP CO
577>
578> 040C 47          DECODE, MOV B, A
579> 040D E6F0          ANI 0F0H
580> 040F 0F          RRC
581> 0410 0F          RRC
582> 0411 0F          RRC
583> 0412 0F          RRC
584> 0413 C690          ADI 90H
585> 0415 27          DAA
586> 0416 CE40          ACI 40H
587> 0418 27          DAA
588> 0419 4F          MOV C, A
589> 041A CD1501      CALL CO
590> 041D 78          MOV A, B
591> 041E E60F          ANI 0FH
592> 0420 C690          ADI 90H
593> 0422 27          DAA
594> 0423 CE40          ACI 40H
595> 0425 27          DAA
596> 0426 4F          MOV C, A
597> 0427 C31501      JMP CO
598>
599> 042A 0604          PRINT, MVI B, 4
600> 042C 4E          P1, MOV C, M
600> 042D CD1501      CALL CO

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601> 0430 23      INX      H
602> 0431 05      DCR      B
603> 0432 C22C04   JNZ      P1
604> 0435 0E20     MVI      C,20H
605> 0437 C31501   JMP      CO
606> 043A 7A      XTRACT. MOV    A,D
607> 043B E638     ANI      38H
608> 043D 0F      RRC
609> 043E 0F      RRC
610> 043F 0F      RRC
611> 0440 C9      RET
612>
613> 0441 CD3A04   CCPRNT. CALL   XTRACT
614> 0444 07      ADD      A
615> 0445 4F      MOV      C,A
616> 0446 215807   LXI      H,CCODE
617> 0449 09      DAD      B
618> 044A 4E      MOV      C,H
619> 044B CD1501   CALL   CO
620> 044E 23      INX      H
621> 044F 4E      MOV      C,H
622> 0450 CD1501   CALL   CO
623> 0453 0E20     MVI      C,20H
624> 0455 CD1501   CALL   CO
625> 0458 C31501   JMP      CO
626>
627> 045B CD3A04   RPPRNT. CALL   XTRACT
628> 045E E606     ANI      06
629> 0450 FE06     CPI      06
630> 0462 C2F503   JNZ      RCPRNT
631> 0465 0E53     MVI      C,53H
632> 0467 CD1501   CALL   CO
633> 046A 0E50     MVI      C,50H
634> 046C C31501   JMP      CO
635>
636>
637> 046F CD3C01   PRPC.  PRINT CRLF FOLLOWED BY PC VALUE
638> 0472 2A0C01   CALL   CRLF
639> 0475 7C      LHL      PC
640> 0476 CD0C04   MOV      A,H
641> 0479 7D      CALL   DECODE
642> 047A CD0C04   MOV      A,L
643> 047D 0E20     CALL   DECODE
644> 047F CD1501   MVI      C, ' '
645> 0482 CD1501   CALL   CO
646> 0485 C9      RET
647>
648>
649> 0486 210000   DISENT. ENTER HERE FROM DEBUGGER - SET UP JMPS
650> 0489 39      LXI      H,0
651> 048A 221301   DAD      SP
652> 048D CDBD01   SHLD   OLDSP  JSP SAVED FOR LATER RETURN
653>
654>
655> 0490 3A1001   CALL   INIT
656> 0493 07      LDA      PACM  JGET PAGE MODE (NUMBER OF LINES TO PRINT)
657> 0494 CAAB04   ORA      A      JSET FLAGS
658>
659>
660> 0497 21FFFF   JZ      DISASM JNOT PAGE MODE
        SET MPC TO 0FFFFH
        LXI      H,0FFFFH

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661> 049A 220E01
662>
663> 049D 3C
664> 049E C2AB04
665>
666> 04A1 3C
667> 04A2 321001
668> 04A5 2A0C01
669> 04A8 C3C404
670>
671>
672>
673>
674> 04AB 0E0B
675> 04AD D0612
676> 04B0 E601
677> 04B2 C25906
678>
679>
680> 04B5 211001
681> 04B8 7E
682> 04B9 B7
683> 04BA CAC104
684>
685>
686> 04BD 35
687> 04BE CA5906
688>
689> 04C1 CD6F04
690> 04C4 CDDA03
691> 04C7 57
692> 04C8 215E06
693> 04CB 011100
694> 04CE BE
695> 04CF CA2006
696> 04D2 23
697> 04D3 0D
698> 04D4 C2CE04
699> 04D7 0E0A
700> 04D9 BE
701> 04DA CA0C06
702> 04DD 23
703> 04DE 0D
704> 04DF C2D904
705> 04E2 0E06
706> 04E4 BE
707> 04E5 CAF005
708> 04E8 23
709> 04E9 0D
710> 04EA C2E404
711> 04ED E6C0
712> 04EF FE40
713> 04F1 CAD605
714> 04F4 FE00
715> 04F6 CAC705
716> 04F9 7A
717> 04FA E6C7
718> 04FC D604
719> 04FE CAB005
720> 0501 3D

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        SHLD   MPC
        255 IMPLIES TRACE MODE
        INR      A
        JNZ     DISASM JNOT TRACE MODE IF 8R
        TRACE MODE, SET TO 1 AND IGNORE ADDRESS FIELD
        INR      A      J1 IN ACC
        STA      PACM
        LHL      PC      JRECOVER PC
        JMP      DIS1
        DISASM.
        CHECK FOR BREAK AT CONSOLE
        MVI      C,CHKIO
        CALL     BDOS
        ANI      1
        JNZ      GOBACK
        CHECK TO SEE IF ENOUGH LINES PRINTED IN PAGE MODE
        LXI      H,PACM
        MOV      A,M
        ORA      A      JZERO?
        JZ       DIS0  JUMP IF NOT PAGE MODE
        PAGE MODE. DECREMENT AND CHECK FOR ZERO
        DCR      M
        JZ       GOBACK
        DIS0.   CALL   PRPC  JLINE NUMBER
        DIS1.   CALL   RDBYTE
        MOV      D,A
        LXI      H, TABLE
        LXI      B, 11H
        D1.     CMP      M
        JZ       TG1
        INX      H
        DCR      C
        JNZ      D1
        MVI      C, 0AH
        D2.     CMP      M
        JZ       TG2
        INX      H
        DCR      C
        JNZ      D2
        MVI      C, 6
        D3.     CMP      M
        JZ       TG3
        INX      H
        DCR      C
        JNZ      D3
        ANI      0C0H
        CPI      40H
        JZ       MG0
        CPI      80H
        JZ       MG1
        MOV      A,D
        ANI      0C7H
        SUI      04
        JZ       MG2
        DCR      A

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721>	0502	CAB205	JZ	MG3
722>	0505	3D	DCR	A
723>	0506	CA9E05	JZ	MG4
724>	0509	7A	MOV	A, D
725>	050A	E6C0	ANI	0C0H
726>	052C	CA7205	JZ	MG5
727>	050F	7A	MOV	A, D
728>	0510	E6C7	ANI	0C7H
729>	0512	D6C0	SUI	0C0H
730>	0514	CA6705	JZ	MG6
731>	0517	D602	SUI	02
732>	0519	CA5C05	JZ	MG7
733>	051C	D602	SUI	02
734>	051E	CA5105	JZ	MG8
735>	0521	D603	SUI	03
736>	0523	CA4205	JZ	MG9
737>	0526	7A	MOV	A, D
738>	0527	E607	ANI	07
739>	0529	4F	MOV	C, A
740>	052A	215207	LXI	H, PPOP-1
741>	052D	09	DAD	B
742>	052E	CD2A04	CALL	PRINT
743>	0531	CD3A04	CALL	XTRACT
744>	0534	FE06	CPI	06
745>	0536	C2C105	JNZ	D6
746>	0539	214F07	LXI	H, PPSW
747>	053C	CD2A04	CALL	PRINT
748>	053F	C3AB04	JMP	DISASM
749>	0542	214B07	LXI	H, PRST
750>	0545	CD2A04	CALL	PRINT
751>	0548	CD3A04	CALL	XTRACT
752>	054B	CD0C04	CALL	DECODE
753>	054E	C3AB04	JMP	DISASM
754>	0551	0E43	MVI	C, 43H
755>	0553	CD1501	CALL	CO
756>	0556	CD4104	CALL	CCPRNT
757>	0559	C3FB05	JMP	D7
758>	055C	0E4A	MVI	C, 4AH
759>	055E	CD1501	CALL	CO
760>	0561	CD4104	CALL	CCPRNT
761>	0564	C3FB05	JMP	D7
762>	0567	0E52	MVI	C, 52H
763>	0569	CD1501	CALL	CO
764>	056C	CD4104	CALL	CCPRNT
765>	056F	C3AB04	JMP	DISASM
766>	0572	213307	LXI	H, PLXI
767>	0575	7A	MOV	A, D
768>	0576	E60F	ANI	0FH
769>	0578	3D	DCR	A
770>	0579	CA9005	JZ	MG51
771>	057C	FE04	CPI	04
772>	057E	DA8305	JC	D4
773>	0581	D605	SUI	05
774>	0583	07	ADD	A
775>	0584	07	ADD	A
776>	0585	4F	MOV	C, A
777>	0586	09	DAD	B
778>	0587	CD2A04	CALL	PRINT
779>	058A	CD5004	CALL	RPPRNT
780>	058D	C3AB04	JMP	DISASM

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781>	0590	CD2A04	MG51.	CALL	PRINT
782>	0593	CD5004		CALL	RPPRNT
783>	0596	0E2C		MVI	C, 2CH
784>	0598	CD1501		CALL	CO
785>	0598	C3FB05		JMP	D7
786>	059E	212F07	MG4.	LXI	H, PMVI
787>	05A1	CD2A04		CALL	PRINT
788>	05A4	CD3A04		CALL	XTRACT
789>	05A7	CD5003		CALL	RPPRNT
790>	05AA	0E2C		MVI	C, 2CH
791>	05AC	CD1501		CALL	CO
792>	05AF	C31706		JMP	D8
793>	05B2	212B07	MG3.	LXI	H, PDCR
794>	05B5	C3BB05		JMP	D5
795>	05B8	212707	MG2.	LXI	H, PINR
796>	05BB	CD2A04	D5.	CALL	PRINT
797>	05BE	CD3A04		CALL	XTRACT
798>	05C1	CD5003	D6.	CALL	RPPRNT
799>	05C4	C3AB04		JMP	DISASM
800>	05C7	7A	MG1.	MOV	A, D
801>	05C8	E638		ANI	3BH
802>	05CA	0F		RRC	
803>	05CB	4F		MOV	C, A
804>	05CC	210707		LXI	H, PADD
805>	05CF	09		DAD	B
806>	05D0	CD2A04		CALL	PRINT
807>	05D3	C3E705		JMP	D9
808>	05D6	210307	MG0.	LXI	H, PMOV
809>	05D9	CD2A04		CALL	PRINT
810>	05DC	CD3A04		CALL	XTRACT
811>	05DF	CD5003		CALL	RPPRNT
812>	05E2	0E2C		MVI	C, 2CH
813>	05E4	CD1501		CALL	CO
814>	05E7	7A	D9.	MOV	A, D
815>	05E8	E607		ANI	07
816>	05EA	CD5003		CALL	RPPRNT
817>	05ED	C3AB04		JMP	DISASM
818>	05F0	79	TC3.	MOV	A, C
819>	05F1	07		ADD	A
820>	05F2	07		ADD	A
821>	05F3	4F		MOV	C, A
822>	05F4	21E706		LXI	H, TAB3-4
823>	05F7	09		DAD	B
824>	05F8	CD2A04		CALL	PRINT
825>	05FB	CD0A03	D7.	CALL	RDBYTE
826>	05FE	57		MOV	D, A
827>	05FF	CD0A03		CALL	RDBYTE
828>	0602	CD0C04		CALL	DECODE
829>	0605	7A		MOV	A, D
830>	0606	CD0C04		CALL	DECODE
831>	0609	C3AB04		JMP	DISASM
832>	060C	79	TC2.	MOV	A, C
833>	060D	07		ADD	A
834>	060E	07		ADD	A
835>	060F	4F		MOV	C, A
836>	0610	218F06		LXI	H, TAB2-4
837>	0613	09		DAD	B
838>	0614	CD2A04		CALL	PRINT
839>	0617	CD0A03	D8.	CALL	RDBYTE
840>	061A	CD0C04		CALL	DECODE

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841> 061D C3A804      JMP    DISASM
842> 0620 79          TC1,  MOV    A, C
843> 0621 87          ADD     A
844> 0622 87          ADD     A
845> 0623 4F          MOV     C, A
846> 0624 217B06       LXI     H, TAB1-4
847> 0627 09          DAD     B
848> 0628 C02A04       CALL   PRINT
849> 062B C3A804       JMP     DISASM
850>                      ENTER HERE FOR ERROR REPORTING
851> 062E C03601       CALL   CRLF
852> 0631 0E3F         MVI     C, '?'
853> 0633 C01501       CALL   CO
854>
855> 0636 2A1301       LHLD    OLDSP
856> 0639 F9          SPHL
857> 063A 2A1101       LHLD    TPC      ; RESTORE PC
858> 063D 220C01       SHLD    PC
859>
860>
861>                      ASMEH, ENTER HERE FROM DEBUGGER
862> 0640 210000       LXI     H, 0
863> 0643 39          DAD     SP
864> 0644 221301       SHLD    OLDSP
865> 0647 C0BD01       CALL   INIT
866>
867> 064A C06F04       ASM0,  CALL   PRPC    ; PRINT PC VALUE
868> 064D 221101       SHLD    TPC      ; SAVE PC VALUE
869> 0650 C0B500       CALL   GETBUFF ; FILL INPUT BUFFER
870> 0653 C09602       CALL   GETOP   ; GET OPERATION
871> 0656 C34A06       JMP     ASM0
872>
873> 0659 2A1301       GOBACK, LHLD    OLDSP
874> 065C F9          SPHL
875> 065D C9          RET
876>
877> 065E 00070F17     TABLE, DB     000H, 007H, 00FH, 017H
878> 0662 1F272F37     DB     01FH, 027H, 02FH, 037H
879> 0666 3F76C9E3     DB     03FH, 076H, 0C9H, 0E3H
880> 066A E9E0F3F9     DB     0E9H, 0E0H, 0F3H, 0F9H
881> 066E F8C6CED3     DB     0FBH, 0C6H, 0CEH, 0D3H
882> 0672 D6D8DEE6     DB     0D6H, 0DBH, 0DEH, 0E6H
883> 0676 EEF6FE22     DB     0EEH, 0F6H, 0FEH, 022H
884> 067A 2A323AC3     DB     02AH, 032H, 03AH, 0C3H
885> 067E CD          DB     0CDH
886> 067F 4549202053TAB1, DB     'EI ', 'SPHL', 'DI ', 'XCHG'
887>
888>
889>
890> 068F 5043404C58     DB     'PCHL', 'XTHL', 'RET ', 'HLT '
891>
892>
893> 069F 434D432053     DB     'CMC ', 'STC ', 'CMA ', 'DAA '
894>
895>
896> 06AF 5241522052     DB     'RAR ', 'RAL ', 'RRC ', 'RLC '
897>
898>
899> 06BF 4E4F5020 ETAB1, DB     'NOP '
900> 06C3 435049204FTAB2, DB     'CPI ', 'ORI ', 'XRI ', 'ANI '

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901>
902>
903> 06D3 5342492049     DB     'SBI ', 'IN ', 'SUI ', 'OUT '
904>
905>
906> 06E3 41434920     DB     'ACI '
907> 06E7 41444920 ETAB2, DB     'ADI '
908>
909> 06EB 43414C4C4ATAB3, DB     'CALL', 'JMP ', 'LDA ', 'STA '
910>
911>
912> 06FB 4C484C44     DB     'LHLD'
913> 06FF 53404C44 ETAB3, DB     'SHLD'
914>
915>
916> 0703 4D4F5620 PMOV, DB     'MOV '
917> 0707 4144442041PADD, DB     'ADD ', 'ADC ', 'SUB ', 'SBB '
918>
919>
920> 0717 414E412058     DB     'ANA ', 'XRA ', 'ORA '
921> 0723 434D5020 ETAB5, DB     'CMP '
922>
923> 0727 494E5220 PINR, DB     'INR '
924> 072B 44435220 PDCR, DB     'DCR '
925> 072F 4D564920 PMVI, DB     'MVI '
926> 0733 4C50492053PLXI, DB     'LXI ', 'STAX', 'INX ', 'DAD '
927>
928>
929> 0743 4C444158     DB     'LDAX'
930> 0747 44435020 ETAB7, DB     'DCX '
931>
932>
933> 074B 52535420 PRST, DB     'RST '
934> 074F 50535720 PPSW, DB     'PSW '
935> 0753 504F502050PPOP, DB     'POP ', 'PUSH'
936>
937> 075B 4E5A5A204ECCODE, DB     'NZ', 'Z ', 'NC', 'C '
938>
939> 0763 504F504550     DB     'PO', 'PE', 'P '
940> 0769 4D20          DB     'M '
941>
942>
943> 076B 4220432044     DB     'B ', 'C ', 'D ', 'E '
944> 0773 40204C204D     DB     'H ', 'L ', 'M '
945> 0779 4120          SREG, DB     'A '
946>
947> 077B 4220202044     DB     'B ', 'D ', 'H ', 'SP '
948> 078B 50535720 DREG, DB     'PSW '
949>
950> 078F          OP CODE, DS     4
951> 0793          END

```

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```

1>
2>
3> 0100
4>
5>
6>
7>
8>
9>
10>
11>
12> 0000 = FALSE EQU 0
13> FFFF = TRUE EQU NOT FALSE
14> 0103 = DISIN EQU $+3
15> 0000 = DEMON EQU $+700H
16> 1206 = BDOS EQU $+1106H
17> 0005 = BDOSE EQU 5H ; ENTRY POINT TO DOS FROM USER PROGRAMS
18> 0100 = PCBASE EQU 100H ; DEFAULT PC
19> 0100 = SPBASE EQU 100H ; DEFAULT SP
20> 0106 = DISEN EQU DISIN+3 ; DISASSEMBLER ENTRY POINT
21> 0109 = ASSEM EQU DISEN+3 ; ASSEMBLER ENTRY POINT
22> 010C = DISPC EQU ASSEM+3 ; DISASSEMBLER PC VALUE
23> 010E = DISPM EQU DISPC+2 ; DISASSEMBLER PC MAX VALUE
24> 0110 = DISPC EQU DISPM+2 ; DISASSEMBLER PAGE MODE IF NON ZERO
25> 000C = PSIZE EQU 12 ; NUMBER OF ASSEMBLY LINES TO LIST WITH
26> 0020 = CSIZE EQU 32 ; COMMAND BUFFER SIZE
27> 0032 = SSIZE EQU 50 ; LOCAL STACK SIZE
28>
29>
30> 0001 = CIF EQU 1 ; BASIC DISK OPERATING SYSTEM CONSTANTS
31> 0002 = COF EQU 2
32> 0003 = RIF EQU 3
33> 0004 = POF EQU 4
34> 0005 = LDF EQU 5
35>
36> 0007 = IDS EQU 7
37> 000A = GETF EQU 10 ; FILL BUFFER FROM CONSOLE
38> 000B = CHKIO EQU 11 ; CHECK IO STATUS
39> 000C = LIFT EQU 12 ; LIFT HEAD ON DISK
40> 000F = OPF EQU 15 ; DISK FILE OPEN
41> 0014 = RDF EQU 20 ; READ DISK FILE
42> 001A = DMAF EQU 26 ; SET DMA ADDRESS
43>
44> 005E = DBP EQU 50H ; DISK BUFFER POINTER
45> 0090 = DBF EQU 80H ; DISK BUFFER ADDRESS
46> 005C = DFCB EQU 5CH ; DISK FILE CONTROL BLOCK
47> 005C = FCB EQU DFCB
48> 0000 = FDN EQU 0 ; DISK NAME
49> 0001 = FFN EQU 1 ; FILE NAME
50> 0009 = FFT EQU 9 ; FILE TYPE
51> 000C = FRL EQU 12 ; REEL NUMBER
52> 000F = FRC EQU 15 ; RECORD COUNT
53> 0020 = FCR EQU 32 ; CURRENT RECORD
54> 0021 = FLN EQU 33 ; FCB LENGTH
55>
56> 001A = DEOF EQU 1AH ; CONTROL-Z (EOF)
57> 003D = CR EQU 0DH
58> 000A = LF EQU 0AH
59>
60> 0007 = RSTNUM EQU 7 ; RESTART NUMBER

```

DEM
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SER. # DEBUGGER

```

61> 0038 =
62> 00FF =
63>
64>
65>
66>
67>
68>
69>
70>
71>
72>
73>
74>
75> 0005 =
76> 0006 =
77> 0007 =
78> 0008 =
79> 0009 =
80> 000A =
81>
82>
83> 0000
84>
85> 0000 C31E08
86> 0003 C32608
87>
88> 0006 C3770F
89>
90> 0009 C35E0D
91> 000C C3850D
92> 000F C36F0D
93> 0012 C3AD0D
94> 0015 C3D50D
95> 0018 C3300E
96> 001B C30E0E
97>
98>
99>
100>
101> 001E E3
102> 001F 222711
103> 0022 E3
104> 0023 C30612
105>
106>
107>
108> 0026 210008
109> 0029 220608
110> 002C AF
111> 002D 322C11
112>
113> 0030 210001
114> 0033 220C01
115> 0036 223A11
116> 0039 226411
117>
118>
119> 003C 229611
120> 003F 210001

```

```

RSTLOC EQU RSTNUM+8 ; RESTART LOCATION
RSTIN EQU 0C7H OR (RSTNUM SHL 3) ; RESTART INSTRUCTION

;-----
; TEMPLATE FOR PROGRAMMED BREAKPOINTS
;-----
PCH , PCL
HLH , HLL
SPH , SPL
RA , FLG
B , C
D , E
;-----
FLG FIELD: MZ010E1C (MINUS, ZERO, IDC, EVEN, CARRY)

AVAL EQU 5 ; A REGISTER COUNT IN HEADER
BVAL EQU 6
DVAL EQU 7
HVAL EQU 8
SVAL EQU 9
PVAL EQU 10

ORG DEMON ; START OF DEBUGGER
DEMON ENTRY POINTS
JMP TRAPAD ; TRAP ADDRESS FOR RETURN IN CASE INTERRUPT
JMP BEGIN

BREAKA,
JMP BREAKP
USEFUL ENTRY POINTS FOR PROGRAMS RUNNING WITH BDT
JMP GETBUFF ; GET ANOTHER BUFFER FULL
JMP GNC ; GET NEXT CHARACTER
JMP PCHAR ; PRINT A CHARACTER FROM A
JMP PBYTE ; PRINT BYTE IN REGISTER A
JMP PADDR ; PRINT ADDRESS IN REGISTERS D,E
JMP SCANEXP ; SCAN 0,1,2, OR 3 EXPRESSIONS
JMP GETVAL ; GET VALUE TO H,L

;
; TRAPAD, ; GET THE RETURN ADDRESS FOR THIS JUMP TO BDOS IN CASE OF
; A SOFT INTERRUPT DURING BDOS PROCESSING.
XTHL ; PC TO HL
SHLD RETLOC ; MAY NOT NEED IT
XTHL
JMP BDOS

;
; BEGIN,
;
LXI H, DEMON
SHLD BDOSE+1 ; CHANGE ENTRY POINT ADDRESS FOR DOS
XRA A ; ZERO ACC
STA BREAKS ; CLEARS BREAK POINT COUNT

;
;
LXI H, PCBASE
SHLD DISPC ; INITIAL VALUE FOR DISASSEMBLER
SHLD DISLOC ; INITIAL VALUE FOR DISPLAY
SHLD MLOAD ; MAX LOAD LOCATION

;
; SETUP RESTART TEMPLATE
SHLD PLOC
LXI H, SPBASE

```

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```

121> 0842 319411 LXI SP,STACK-4
122> 0845 E5 PUSH H ;INITIAL SP
123> 0846 210200 LXI H,100 ;INITIAL PSU
124> 0849 E5 PUSH H
125> 084A 28 DCX H
126> 084B 28 DCX H ;CLEARED
127> 084C 229411 SHLD HLOC ;H,L CLEARED
128> 084F E5 PUSH H ;B,C CLEARED
129> 0850 E5 PUSH H ;D,E CLEARED
130> 0851 222A11 SHLD TRACER ;CLEAR TRACE FLAG
131> 0854 222511 SHLD USERBRK ;CLEAR USER BREAK DURING TRACE/UNTRACE
132>
133> 0857 JEC3 MVI A,0C3H ;JMP RESTART)
134> 0859 323000 STA RSTLOC
135> 085C 210600 LXI H,BREAKA ;BREAK POINT SUBROUTINE
136> 085F 223900 SHLD RSTLOC+1 ;RESTART LOCATION ADDRESS FIELD
137>
138> CHECK FOR FILE NAME PASSED TO DEMON, AND LOAD IF PRESENT
139> 0862 3A5D00 LDA FCB+FFN ;BLANK IF NO NAME PASSED
140> 0865 FE20 CPI ' '
141> 0867 CA7108 JZ START
142>
143> PUSH A ZERO, AND READ
144> 086A 210000 LXI H,0
145> 086D E5 PUSH H
146> 086E C34100 JMP RINIT
147>
148>
149>
150>
151> START,
152> 0871 318C11 LXI SP,STACK-12 ;INITIALIZE SP IN CASE OF ERROR
153> 0874 C0ED0D CALL CRLF ;INITIAL CRLF
154> 0877 3E2D MVI A,'-'
155> 0879 C0EF0D CALL PCHAR ;OUTPUT PROMPT
156>
157> GET INPUT BUFFER
158> 087C C05E0D CALL GETBUFF ;FILL COMMAND BUFFER
159>
160> CALL GNC ;GET CHARACTER
161> 0882 FE0D CPI CR
162> 0884 CA7108 JZ START
163> 0887 D641 SUI 'A' ;LEGAL CHARACTER?
164> 0889 DA530D JC ERROR ;COMMAND ERROR
165> 088C FE1A CPI 'Z'-'A'+1
166> 088E D2530D JNC ERROR
167> CHARACTER IN REGISTER A IS COMMAND, MUST BE IN THE RANGE A-Z
168> 0891 5F MOV E,A ;INDEX TO E
169> 0892 1600 MVI D,0 ;DOUBLE PRECISION INDEX
170> 0894 219E08 LXI H,JMPTAB;BASE OF TABLE
171> 0897 19 DAD D
172> 0898 19 DAD D ;INDEXED
173> 0899 5E MOV E,M ;LD BYTE
174> 089A 23 INX H
175> 089B 56 MOV D,M ;HD BYTE
176> 089C EB XCHG ;TO H,L
177> 089D E9 PCHL ;GONE...
178>
179> JMPTAB, ;JUMP TABLE TO SUBROUTINES
180> 089E E508 DW ASSM ;A ENTER ASSEMBLER LANGUAGE

```

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181> 08A0 530D DW CERROR ;B
182> 08A2 3009 DW CALLPR ;C CALL PROGRAM
183> 08A4 6009 DW DISPLAY ;D DISPLAY RAM MEMORY
184> 08A6 530D DW CERROR ;E
185> 08A8 F609 DW FILL ;F FILL MEMORY
186> 08AA 0A0A DW GOTO ;G GO TO MEMORY ADDRESS
187> 08AC 740A DW HEXARI ;H HEXADECEMAL SUM AND DIFFERENCE
188> 08AE 9E0A DW INFCB ;I FILL INPUT FILE CONTROL BLOCK
189> 08B0 530D DW CERROR ;J
190> 08B2 530D DW CERROR ;K
191> 08B4 0109 DW LASSM ;L LIST ASSEMBLY LANGUAGE
192> 08B6 F40A DW MOVE ;M MOVE MEMORY
193> 08B8 570D DW CEPORR ;N
194> 08BA 530D DW CERROR ;O
195> 08BC 530D DW CERROR ;P
196> 08BE 530D DW CERROR ;Q
197> 08C0 3008 DW REWD ;R READ HEXADECEMAL FILE
198> 08C2 0E0C DW SETHEM ;S SET MEMORY COMMAND
199> 08C4 570C DW TRACE ;T
200> 08C6 530C DW UNTRACE ;U
201> 08C8 530D DW CERROR ;V
202> 08CA 530D DW CERROR ;W
203> 08CC 8F0C DW EXAMINE ;X EXAMINE AND MODIFY REGISTERS
204> 08CE 530D DW CERROR ;Y
205> 08D0 530D DW CERROR ;Z
206>
207>
208>
209> 08D2 E5 OPN, ;FILE OPEN ROUTINE. THIS SUBROUTINE OPENS THE DISK INPUT
210> 08D3 D5 PUSH H
211> 08D4 C5 PUSH D
212> 08D5 AF PUSH B
213> 08D6 325B00 XRA A
214> 08D9 0E0F STA DRP ;CLEAR BUFFER POINTER
215> 08DB 115C00 MVI C,0FF
216> 08DE C01E00 LXI D,DFCB
217> 08E1 C1 CALL TRAPAD ;TO BDS
218> 08E2 D1 POP B
219> 08E3 E1 POP D
220> 08E4 C9 POP H
221> RET
222>
223> ASSM, ;ASSEMBLER LANGUAGE INPUT
224> 08E5 210901 CHECK FOR ASSM PRESENT
225> 08E8 C0150B LXI H,ASSEM ;BASE OF ASSEMBLER
226> 08EB D2530D CALL CONLOAD ;COMPARE AGAINST HLOAD
227> JNC ERROR ;NOT THERE
228>
229> CALL SCANEXP ;SCAN THE EXPRESSIONS WHICH FOLLOW
230> 08EE CD300E DCR A ;ONE EXPRESSION EXPECTED
231> 08F1 3D JNZ CERROR
232> 08F2 C2530D CALL GETVAL ;GET EXPRESSION TO H,L
233> 08F5 C06E0E SHLD DISPC
234> 08F8 220C01 CALL ASSEM
235> 08FE C37100 JMP START
236>
237> LASSM, ;ASSEMBLER LANGUAGE OUTPUT LISTING
238> L<CR> LISTS FROM CURRENT DISASM PC FOR SEVERAL LINES
239> L<NUMBER><CR> LISTS FROM <NUMBER> FOR SEVERAL LINES
240> 0901 CD270B L<NUMBER>,<NUMBER> LISTS BETWEEN LOCATIONS
CALL CHKDIS ;DISASM PRESENT?

```

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241> 0904 D2530D      JNC      CERROR
242>
243> 0907 CD390E      CALL     SCANEXP ;SCAN EXPRESSIONS WHICH FOLLOW
244> 090A CA2509      JZ       SPACE ;BRANCH IF NOT EXPRESSIONS
245> 090D CD0E0E      CALL     GETVAL ;EXP1 TO H.L
246> 0910 D20C01      SHLD     DISPC ;SETS BASE PC FOR LIST
247> 0913 3D          DCR      A ;ONLY EXPRESSION?
248> 0914 CA2509      JZ       SPACE ;SETS SINGLE PAGE MODE
249>
250>
251> 0917 CD0E0E      ; ANOTHER EXPRESSION FOLLOWS
252> 091A D20E01      CALL     GETVAL
253> 091D 3D          SHLD     DISPM ;SETS MAX VALUE
254> 091E C2530D      DCR      A
255> 0921 AF          JNZ      CERROR ;ERROR IF MORE EXPN'S
256> 0922 C32709      XRA      A ;CLEAR PAGE MODE
257>
258> 0925 3E0C          JMP      SPAG0
259> 0927 321001      MVI      A,PSIZE ;SCREEN SIZE FOR LIST
260> 092A CD0E01      STA      DISPC
261> 092D C37108      CALL     DISEN ;CALL DISASSEMBLER
262>
263>
264>
265>
266>
267>
268>
269>
270>
271> 0930 CD300E      CALL     CALLPR.
272> 0933 DA530D      CALL     SCANEXP
273> 0935 CA530D      JC       CERROR ;CANNOT BE ,XXX
274> 0939 CD0E0E      JZ       CERROR ;CANNOT BE C ALONE
275> 093C E5          CALL     GETVAL ;ADDRESS TO CALL IN H.L
276>
277>
278> 093D 010000      PUCH     H ;READY FOR CALL
279> 0940 3D          ; GET REMAINING PARAMETERS
280> 0941 C24909      REG-A CONTAINS 1,2,OR 3 CORRESPONDING TO NUMBER OF VALUES
281>
282> 0944 C5          LXI      B,0
283> 0945 C5          DCR      A
284> 0946 C35909      JNZ      CALL0
285>
286> 0949 CD0E0E      ; NO PARAMETERS, STACK TWO ZEROS
287> 094C E5          PUSH     B
288> 094D 3D          PUSH     B
289> 094E C25509      JMP      CALL2
290>
291> 0951 C5          ; AT LEAST ONE PARAMETER
292> 0952 C35909      CALL     CALL0
293>
294> 0955 CD0E0E      CALL     GETVAL
295> 0958 E5          PUSH     H
296>
297> 0959 D1          ; ONLY ONE PARAMETER, STACK A ZERO
298> 095A C1          PUSH     B
299>
300> 095B 217108      JMP      CALL2
301>
302>
303>
304>
305>
306>
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308>
309>
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360>

```

```

301> 095E E3          XTHL
302> 095F E9          PCHL
303>
304>
305> 0960 CD300E      ; DISPLAY:
306> 0963 CA7F09      CALL     SCANEXP ;GET 0,1,OR 2 EXPNS
307> 0966 CD0E0E      JZ       DISP1 ;ASSUME CURRENT DISLOC
308> 0969 DA6F09      CALL     GETVAL ;GET VALUE TO H.L
309> 096C 223A11      JC       DISF0 ;CARRY SET IF ,B FORM
310>
311> 096F E67F      SHLD     DISLOC ;OTHERWISE DISPC ALREADY SET
312> 0971 3D          ; GET NEXT VALUE
313> 0972 CA7F09      ANI      7FH ;IN CASE ,B
314> 0975 CD0E0E      DCR      A
315> 0978 3D          JZ       DISP1 ;SET HALF PAGE MODE
316> 0979 C2530D      CALL     GETVAL
317> 097C C38A09      DCR      A ;A,B,C NOT ALLOWED
318>
319>
320> 097F 2A3A11      JNZ      CERROR
321> 0982 7D          JMP      DISP2
322> 0983 E6F0
323> 0985 6F
324> 0986 11BF00
325> 0989 19
326> 098A 223C11
327>
328> 098D CDBD0D
329> 0990 CDC70D
330> 0993 C27108
331> 0996 2A3A11
332> 0999 223E11
333> 099C CD600D
334> 099F CD600D
335> 09A2 7E
336> 09A3 CDAD0D
337> 09A6 23
338> 09A7 CDE00D
339> 09AA DAB509
340> 09AD 7D
341> 09AE E60F
342> 09B0 C29F09
343>
344>
345> 09B3 223A11
346> 09B6 2A3E11
347> 09B9 EB
348> 09BA CD6D0D
349>
350> 09BD 1A
351> 09BE CDDE0D
352> 09C1 13
353> 09C2 2A3A11
354> 09C5 7D
355> 09C6 93
356> 09C7 C2BD09
357> 09CA 7C
358> 09CB 92
359> 09CC C2BD09
360>

```

```

;CALL ADDRESS IN H.L RETURN IN STACK
;CALL USER

; DISPLAY:
CALL     SCANEXP ;GET 0,1,OR 2 EXPNS
JZ       DISP1 ;ASSUME CURRENT DISLOC
CALL     GETVAL ;GET VALUE TO H.L
JC       DISF0 ;CARRY SET IF ,B FORM
SHLD     DISLOC ;OTHERWISE DISPC ALREADY SET

DISP0:   ;GET NEXT VALUE
ANI      7FH ;IN CASE ,B
DCR      A
JZ       DISP1 ;SET HALF PAGE MODE
CALL     GETVAL
DCR      A ;A,B,C NOT ALLOWED
JNZ      CERROR
JMP      DISP2

; DISP1: ;0 OR 1 EXPN, DISPLAY HALF SCREEN
LHLD     DISLOC
MOV      A,L
ANI      0F0H ;NORMALIZE TO LINE START
MOV      L,A
LXI      D,PSIZE*16-1
DAD      D

DISP2:   SHLD     DISMAX
; DISPLAY MEMORY FROM DISLOC TO DISMAX

DISP3:   CALL     CRLF
CALL     BREAK ;BREAK KEY?
JNZ      START ;STOP CURRENT EXPANSION
LHLD     DISLOC
SHLD     TDISP
CALL     PADDR ;PRINT LINE ADDRESS

DISP4:   CALL     BLANK
MOV      A,H ;GET NEXT DATA BYTE
CALL     PBYTE ;PRINT BYTE
INX      H
CALL     DISCOM ;COMPARE H,L WITH DISMAX
JC       DISCH ;CARRY SET IF H,L > DISMAX
MOV      A,L ;CHECK FOR LINE OVERFLOW
ANI      0FH
JNZ      DISP4 ;JUMP FOR ANOTHER BYTE

; DISCH: ;DISPLAY AREA IN CHARACTER FORM
SHLD     DISLOC ;UPDATE FOR NEXT WRITE
LHLD     TDISP
XCHG
CALL     BLANK

; DISCH0: LDAX     D ;GET BYTE
CALL     PGRAPH ;PRINT IF GRAPHIC CHARACTER
INX      D
LHLD     DISLOC ;COMPARE FOR END OF LINE
MOV      A,L
SUB      E
JNZ      DISCH0
MOV      A,H
SUB      D
JNZ      DISCH0

```

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```

361>
362> 09CF 2A3A11
363> 09D2 CD0D0D
364> 69D5 DA7108
365>
366>
367> 09D8 C38D09
368>
369>
370>
371>
372>
373> 09DB CD380E
374> 09DE FE03
375> 09E0 C2530D
376> 09E3 CD0E0E
377> 09E6 E5
378> 09E7 CD0E0E
379> 09EA E5
380> 09EB CD0E0E
381> 09EE D1
382> 09EF C1
383> 09F0 C9
384>
385>
386> 09F1 7B
387> 09F2 91
388> 09F3 7A
389> 09F4 98
390> 09F5 C9
391>
392>
393> 09F6 CDD809
394> 09F9 7C
395> 09FA B7
396> 09FB C2530D
397> 09FE CDF109
398> 0A01 DA7108
399> 0A04 7D
400> 0A05 02
401> 0A06 03
402> 0A07 C3FE09
403>
404>
405>
406>
407> 0A0A CDD80D
408> 0A0D CD380E
409> 0A10 CD0E0E
410> 0A13 E5
411> 0A14 CD0E0E
412> 0A17 E5
413> 0A18 CD0E0E
414> 0A1B 44
415> 0A1C 4D
416> 0A1D D1
417> 0A1E E1
418>
419>
420> 0A1F F3

```

```

DROP THRU AT END OF CHARACTERS
LHLD DISLOC
CALL DISCOM ;END OF DISPLAY?
JC START

NO, CONTINUE WITH NEXT LINE
JMP DISP3

FILL MEMORY AREA WITH FIXED DATA ELEMENT

SCAN3: ;SCAN THREE EXPN'S FOR FILL AND MOVE
CALL SCANEXP
CPI 3
JNZ CERROR
CALL GETVAL
PUSH H
CALL GETVAL
PUSH H
CALL GETVAL
POP D
POP B ;BC, DE, HL
RET

BCDE: ;COMPARE BC > DE (CARRY GEN'D IF TRUE)
MOV A, E
SUB C
MOV A, D
SBB B
RET

FILL:
CALL SCAN3 ;EXPRESSIONS SCANNED BC, DE, HL
MOV A, H ;MUST BE ZERO
ORA A
JNZ CERROR
CALL BCDE ;END OF FILL?
JC START
MOV A, L ;DATA
STAX B ;TO MEMORY
INX B ;NEXT TO FILL
JMP FILL0

GO COMMAND WITH OPTIONAL BREAKPOINTS

GOTO:
CALL CRLF ;READY FOR GO.
CALL SCANEXP ;0, 1, OR 2 EXPS
CALL GETVAL
PUSH H ;START ADDRESS
CALL GETVAL
PUSH H ;BKPT1
CALL GETVAL
MOV B, H ;BKPT2
MOV C, L
POP D ;BKPT1
POP H ;GOTO ADDRESS

COPR:
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421> 0A20 CA380A
422> 0A23 DA290A
423>
424> 0A26 229611
425>
426> 0A29 E67F
427> 0A2B 3D
428> 0A2C CA380A
429> 0A2F CD4C0A
430> 0A32 3D
431> 0A33 CA380A
432>
433> 0A36 59
434> 0A37 50
435> 0A38 CD4C0A
436>
437>
438> 0A3B 318C11
439> 0A3E D1
440> 0A3F C1
441> 0A40 F1
442> 0A41 E1
443> 0A42 F9
444> 0A43 2A9611
445> 0A46 E5
446> 0A47 2A9411
447> 0A4A FB
448> 0A4B C9
449>
450>
451> 0A4C F5
452> 0A4D C5
453> 0A4E 212C11
454> 0A51 7E
455> 0A52 34
456> 0A53 B7
457> 0A54 CA67BA
458>
459> 0A57 23
460> 0A58 7E
461> 0A59 23
462> 0A5A 46
463> 0A5B 23
464>
465> 0A5C BB
466> 0A5D C2670A
467> 0A60 78
468> 0A61 BA
469> 0A62 C2670A
470>
471> 0A65 7E
472> 0A66 12
473> 0A67 23
474> 0A68 73
475> 0A69 23
476> 0A6A 72
477> 0A6B 23
478> 0A6C 1A
479> 0A6D 77
480> 0A6E 3EFF

```

```

JZ GOP1 ;NO BREAK POINTS
JC GOP0
SET PC
SHLD PLOC ;INTO MACHINE STATE
;SET BREAKS
ANI 7FH ;CLEAR, BIT
DCR A ;IF 1 THEN SKIP (2,3 IF BREAKPOINTS)
JZ GOP1
CALL SETBK ;BREAK POINT FROM D.E
DCR A
JZ GOP1
SECOND BREAK POINT
MOV E, C ;TO D.E
MOV D, B ;SECOND BREAK POINT SET
CALL SETBK

;RESTORE MACHINE STATE AND START IT
LXI SP, STACK-12
POP D
POP B
POP PSW
POP H ;SP IN HL
SPHL
LHLD PLOC ;PC IN HL
PUSH H ;INTO USER'S STACK
LHLD HLOC ;HL RESTORED
EI
RET

SETBK: ;SET BREAK POINT AT LOCATION D.E
PUSH PSW
PUSH B
LXI H, BREAKS ;NUMBER OF BREAKS SET SO FAR
MOV A, H
INR H ;COUNT BREAKS UP
ORA A ;ONE SET ALREADY?
JZ SETBK0
ALREADY SET, MOVE PAST ADDR. DATA FIELDS
INX H
MOV A, H ;CHECK = ADDRESSES
INX H
MOV B, H ;CHECK NO ADDRESS
INX H
DON'T SET TWO BREAKPOINTS IF EQUAL
CMP E ;LOW =?
JNZ SETBK0
MOV A, B ;HIGH =?
CMP D
JNZ SETBK0
EQUAL ADDRESSES, REPLACE REAL DATA
MOV A, H ;GET DATA BYTE
STAX D ;PUT BACK INTO CODE
SETBK0: INX H ;ADDRESS FIELD
MOV M, E ;LSB
INX H
MOV M, D ;MSB
INX H ;DATA FIELD
LDAX D ;GET BYTE FROM PROGRAM
MOV M, A ;TO BREAKS VECTOR
MVI A, RSTIN ;RESTART INSTRUCTION

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481> 0A70 12
482> 0A71 C1
483> 0A72 F1
484> 0A73 C9

STAX D ;TO CODE
POP B
POP PSW
RET

HEXADECIMAL ARITHMETIC

HEXARI.

485>
486>
487>
488>
489>
490> 0A74 CD380E
491> 0A77 FE02
492> 0A79 C2530D
493> 0A7C CD0E0E
494> 0A7F E5
495> 0A80 CD0E0E
496> 0A83 D1
497> 0A84 E5
498> 0A85 CDD0D
499> 0A88 19
500> 0A89 CDD60D
501> 0A8C CD6D0D
502> 0A8F E1
503> 0A90 AF
504> 0A91 95
505> 0A92 6F
506> 0A93 3E00
507> 0A95 9C
508> 0A96 67
509> 0A97 19
510> 0A98 CDD60D
511> 0A9B C37100
512>

CALL SCANEXP
CPI 2
JNZ CERROR
CALL GETVAL ;FIRST VALUE TO H,L
PUSH H
CALL GETVAL ;SECOND VALUE TO H,L
POP D
PUSH H ;SAVE A COPY OF SECOND VALUE
CALL CRLF ;NEW LINE
DAD D ;SUM IN H,L
CALL PADDD
CALL BLANK
POP H ;RESTORE SECOND VALUE
XRA A ;CLEAR ACCUM FOR SUBTRACTION
SUB L
MOV L,A ;BACK TO L
MVI A,0 ;CLEAR IT AGAIN
SBB H
MOV H,A
DAD D ;DIFFERENCE IN HL
CALL PADDD
JMP START

; SET INPUT FILE CONTROL BLOCK (AT 5CH) TO SIMULATE CONSOLE COMMAND
INFCB.

FILL FCB AT 5CH
XRA A
STA FCB+FCR ;CLEAR CURRENT RECORD
STA FCB ;CLEAR DISK NUMBER
CALL GNC ;CHARACTER IN A
MVI C,9 ;FILE NAME LENGTH+1
LXI H,FCB+FFH ;START OF NAME

FLP.

;FILL NAME
MOV M,A
INX H
DCR C
JZ CERROR ;FILE NAME TOO LONG.

CALL GNC ;READ NEXT CHAR
CPI ' ' ;FOUND .. BLANK OUT
JZ FLB
NOT .. MAY BE CR
CPI CR
JNZ FLP ;FOR ANOTHER STORE

NAME FILLED, EXTEND WITH BLANKS

FLB.

DCR C
JZ TFT
MVI M, ' '
INX H

536>
537> 0AC0 0D
538> 0AC1 CACA0A
539> 0AC4 3620
540> 0AC6 23

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541> 0AC7 C3C00A

542>
543>
544> 0ACA 0E04
545> 0ACC FE2E
546> 0ACE C2E50A
547>
548>

549> 0AD1 216500

550>
551> 0AD4 CD850D
552> 0AD7 FE0D
553> 0AD9 CAE50A
554> 0ADC 77
555> 0ADD 23
556> 0ADE 0D
557> 0ADF CA530D
558> 0AE2 C3D40A
559>

560>

561> 0AE5 0D
562> 0AE6 CAEF0A
563> 0AE9 3620
564> 0AEB 23
565> 0AEC C3E50A
566>

567>

568> 0AEF 3600
569> 0AF1 C37100
570>

571>

572>

573> 0AF4 CDD809

574>

575> 0AF7 CDF109

576> 0AFA DA7100

577> 0AFD 0A

578> 0AFE 03

579> 0AFF 77

580> 0B00 23

581> 0B01 C3F70A

582>

583>

584>

585>

586> 0B04 216500

587> 0B07 7E

588> 0B08 FE43

589> 0B0A C0

590> 0B0B 23

591> 0B0C 7E

592> 0B0D FE4F

593> 0B0F C0

594> 0B10 23

595> 0B11 7E

596> 0B12 FE4D

597> 0B14 C9

598>

599>

600> 0B15 0B

JMP FLB

BLANKS FILLED, SCAN FILE TYPE IF ' ' FOUND
TFT, MVI C,4
CPI ' ' ;ENDED WITH . OR CR
JNZ FLB1 ;FILL REMAINDER WITH BLANKS

SCAN FILE TYPE
LXI H,FCB+FFT

FLP1, CALL GNC
CPI CR
JZ FLB1
MOV M,A
INX H
DCR C
JZ CERROR ;TOO LONG
JMP FLP1

FILL WITH BLANKS

FLB1, DCR C
JZ FLZ
MVI M, ' '
INX H
JMP FLB1

ZERO THE EXTENT

FLZ, MVI M,0
JMP START

MOVE MEMORY

MOVE.

CALL SCAN3 ;BC,DE,HL
;HAS B,C PASSED D,E?
CALL BCDE
JC START ;END OF MOVE
LDAX B ;CHAR TO ACCUM
INX B ;NEXT TO GET
MOV M,A ;MOVE IT TO MEMORY
INX H
JMP MOVE0 ;FOR ANOTHER

READ FILES (HEX OR COM)

COM, ;COM FILE IF ZERO AT END

LXI H,FCB+FFT
MOV A,M
CPI 'C'
RNZ
INX H
MOV A,M
CPI 'O'
RNZ
INX H
MOV A,M
CPI 'N'
RET

CONLOAD, ;COMPARE HL > MLOAD
XCHG ;H,L TO D,E

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721> SHIFT LEFT AND MASK
722> 08C3 07 RLC
723> 08C4 07 RLC
724> 08C5 07 RLC
725> 08C6 07 RLC
726> 08C7 E6F0 ANI 0F0H
727> 08C9 F5 PUSH PSW ;SAVE FOR A FEW STEPS
728> 08CA CD1C0D CALL DISKR
729> 08CD CD010E CALL HEXCON
730>
731> OTHERWISE SECOND NIBBLE OK, SO MERGE
732> 08D0 C1 POP B ;PREVIOUS NIBBLE TO REG-B
733> 08D1 B8 ORA B
734> 08D2 47 MOV B,A ;VALUE IS NOW IN B TEMPORARILY
735> 08D3 D1 POP D ;CHECKSUM
736> 08D4 82 ADD D ;ACCUMLATING
737> 08D5 57 MOV D,A ;BACK TO CS
738> ZERO FLAG REMAINS SET
739> 08D6 78 MOV A,B ;BRING BYTE BACK TO ACCUMULATOR
740> 08D7 E1 POP H
741> 08D8 C1 POP B ;BACK TO INITIAL STATE WITH ACCUM SET
742> 08D9 C9 RET
743> RLIFT, ;LIFT HEAD ON DISK BEFORE RETURNING
744> 08DA 0E0C MVI C,LIFT
745> 08DC CD1E08 CALL TRAPAD
746> ;'NEXT' 'PC'
747> 08DF 21030C LXI H,LMSG ;LOAD MESSAGE
748> 08E2 7E MOV A,M
749> 08E3 B7 ORA A ;LAST CHAR
750> 08E4 CAEE0B JZ RL11
751> 08E7 CD6F0D CALL PCHAR
752> 08EA 23 INX H ;NEXT CHAR
753> 08EB C3E20B JMP RL10
754> 08EE CDBD0D CALL CRLF
755> 08F1 2A6411 LHLD MLOAD
756> 08F4 CDD60D CALL PADDR
757> 08F7 CD6D0D CALL BLANK
758> 08FA 2A9611 LHLD PLOC
759> 08FD CDD60D CALL PADDR
760> 0C00 C37108 JMP START
761> 0C03 0D0A4E4558LMSG, DB CR,LF,'NEXT PC',0
762>
763> SET MEMORY COMMAND
764>
765> SETHEM, ;ONE EXPRESSION EXPECTED
766> 0C0E CD380E CALL SCANEXP ;SETS FLAGS
767> 0C11 3D DCR A ;ONE EXPRESSION ONLY
768> 0C12 C2530D JNZ ERROR
769> 0C15 CD0E0E CALL GETVAL ;START ADDRESS IS IN H,L
770> 0C18 CDBD0D CALL CRLF ;NEW LINE
771> 0C1B E5 PUSH H ;SAVE CURRENT ADDRESS
772> 0C1C CDD60D CALL PADDR ;PRINTED
773> 0C1F CD6D0D CALL BLANK ;SEPARATOR
774> 0C22 E1 POP H ;GET DATA
775> 0C23 7E MOV A,M
776> 0C24 E5 PUSH H ;SAVE ADDRESS TO FILL
777> 0C25 CDAD0D CALL PBYTE ;PRINT BYTE
778> 0C28 CD6D0D CALL BLANK ;ANOTHER SEPARATOR
779> 0C2B CD5E0D CALL GETBUFF ;FILL INPUT BUFFER
780> 0C2E CD850D CALL GNC ;MAY BE EMPTY (NO CHANGE)

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781> 0C31 E1 POP H ;RESTORE ADDRESS TO FILL
782> 0C32 FE0D CPI CR
783> 0C34 CA4F0C JZ SETM1
784> 0C37 FE2E CPI ' '
785> 0C39 CA7108 JZ START
786> DATA IS BEING CHANGED
787> 0C3C E5 PUSH H ;SAVE ADDR TO FILL
788> 0C3D CD3B0E CALL SCANEX ;FIRST CHARACTER ALREADY SCANNED
789> 0C40 3D DCR A ;ONE ITEM?
790> 0C41 C2530D JNZ ERROR ;MORE THAN ONE
791> 0C44 CD0E0E CALL GETVAL ;VALUE TO H,L
792> 0C47 7C MOV A,H
793> 0C48 B7 ORA A ;NO ZERO?
794> 0C49 C2530D JNZ ERROR ;DATA IS IN L
795> 0C4C 7D MOV A,L
796> 0C4D E1 POP H ;RESTORE DATA VALUE
797> 0C4E 77 MOV H,A
798> 0C4F 23 INX H ;NEXT ADDRESS READY
799> 0C50 C3180C JMP SETM0
800>
801> UNTRACE MODE
802> UNTRACE, XRA A ;CLEAR TRACE MODE FLAG
803> 0C53 AF JMP ETRACE
804> 0C54 C3590C
805>
806> START TRACE
807> 0C57 3EFF MVI A,OFFH ;SET TRACE MODE FLAG
808> ETRACE,
809> 0C59 322911 STA TMODE
810> 0C5C CD3B0E CALL SCANEXP
811> 0C5F 210000 LXI H,0
812> 0C62 222511 SHLD USERBRK ;CLEAR USERBRK
813> 0C65 CA860C JZ TRAC0
814> EXPRESSIONS WERE GIVEN, FORMS ARE
815> TX TRACE FOR X STEPS ACC = 1
816> TX,BRK TRACE FOR X STEPS, CALL 'BRK' AT EACH STOP ACC=2
817> T,BRK CALL "BRK" ACC = 1, CY = 1
818>
819> 0C68 DA760C JC SETTR0
820> 0C6B CD0E0E CALL GETVAL ;TO H,L
821> 0C6E F5 PUSH PSW
822> 0C6F 7D MOV A,L ;CHECK FOR ZERO
823> 0C70 B4 ORA H
824> 0C71 CA530D JZ ERROR
825> 0C74 F1 POP PSW ;RECALL NUMBER OF PARAMETERS
826> 0C75 2B DCR H ;TRACE VALUE - 1
827> SETTR0, ;H,L CONTAINS TRACE COUNT, SAVE IT FOR LATER
828> 0C76 E5 PUSH H
829> LOOK FOR BREAK ADDRESS
830> 0C77 3D DCR A ;IF ONLY ONE SPECIFIED, THEN SKIP USERBRK
831> 0C78 CA950C JZ SETTR1
832> 0C7B 3D DCR A ;MUST BE TWO VALUES
833> 0C7C C2530D JNZ ERROR ;MORE THAN TWO SPECIFIED
834> 0C7F CD0E0E CALL GETVAL ;VALUE TO H,L
835> 0C82 222511 SHLD USERBRK
836> SETTR1, ;RECALL TRACE COUNT
837> 0C85 E1 POP H
838> 0C86 222A11 SHLD TRACR
839> 0C89 CDEC0E CALL DSTATE ;STARTING STATE IS DISPLAYED
840> 0C8C C31F0A JMP Gopr ;SETS BREAKPOINTS AND STARTS EXECUTION

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841>
842>
843>
844> 0C8F CD850D
845> 0C92 FE0D
846> 0C94 C29D0C
847> 0C97 CDEC0E
848> 0C9A C37108
849>
850>
851> 0C9D 010800
852>
853> 0CA0 215B0F
854> 0CA3 BE
855> 0CA4 CAB00C
856> 0CA7 23
857> 0CA8 04
858> 0CA9 0D
859> 0CAA C2A30C
860>
861> 0CAD C3530D
862>
863>
864> 0CB0 CD850D
865> 0CB3 FE0D
866> 0CB5 C2530D
867>
868>
869> 0CB8 C5
870> 0CB9 CDBD0D
871> 0CBC CDC20E
872> 0CCF CD6D0D
873> 0CC2 CD5E0D
874> 0CC5 CD300E
875> 0CC8 B7
876> 0CC9 CA7108
877> 0CCC 3D
878> 0CCD C2530D
879> 0CD0 CD0E0E
880> 0CD3 C1
881>
882> 0CD4 78
883> 0CD5 FE05
884> 0CD7 D2010D
885>
886> 0CDA 7C
887> 0CDB B7
888> 0CDC C2530D
889> 0CDF 7D
890> 0CE0 FE02
891> 0CE2 D2530D
892>
893> 0CE5 CD8B0E
894>
895> 0CE8 67
896> 0CE9 41
897> 0CEA 3EFE
898> 0CEC CDFB0C
899> 0CEF A4
900> 0CF0 41

```

EXAMINE AND MODIFY CPU REGISTERS.
 EXAMINE.
 CALL GNC ;CR?
 CPI CR
 JNZ EXAM0
 CALL DSTATE ;DISPLAY CPU STATE
 JMP START
 EXAM0. ;REGISTER CHANGE OPERATION
 LXI B,PVAL+1 ;B=0,C=PVAL (MAX REGISTER NUMBER)
 LOOK FOR REGISTER MATCH IN RVECT
 LXI H,RVECT
 EXAM1. CMP M ;MATCH IN RVECT?
 JZ EXAM2
 INX H ;NEXT RVECT
 INR B ;INCREMENT COUNT
 DCR C ;END OF RVECT?
 JNZ EXAM1
 NO MATCH
 JMP CERROR
 EXAM2. ;MATCH IN RVECT, B HAS REGISTER NUMBER
 CALL GNC
 CPI CR ;ONLY CHARACTER?
 JNZ CERROR
 WRITE CONTENTS, AND GET ANOTHER BUFFER
 PUSH B ;SAVE COUNT
 CALL CRLF ;NEW LINE FOR ELEMENT
 CALL DELT ;ELEMENT WRITTEN
 CALL BLANK
 CALL GETBUFF ;FILL COMMAND BUFFER
 CALL SCANEXP ;GET INPUT EXPRESSION
 ORA A ;NONE?
 JZ START
 DCR A ;MUST BE ONLY ONE
 JNZ CERROR
 CALL GETVAL ;VALUE IS IN H,L
 POP B ;RECALL REGISTER NUMBER
 CHECK CASES FOR FLAGS, REG-A, OR DOUBLE REGISTER
 MOV A,B
 CPI AYAL
 JNC EXAM4
 SETTING FLAGS, MUST BE ZERO OR ONE
 MOV A,H
 ORA A
 JNZ CERROR
 MOV A,L
 CPI 2
 JNC CERROR
 0 OR 1 IN H,L REGISTERS - GET CURRENT FLAGS AND MASK POSITION
 CALL FLGSHF
 SHIFT COUNT IN C, D,E ADDRESS FLAG POSITION
 MOV H,A ;FLAGS TO H
 MOV B,C ;SHIFT COUNT TO B
 MVI A,0FEH ;11111110 IN ACCUM TO ROTATE
 CALL LROTATE ;ROTATE REG-A LEFT
 ANA H ;MASK ALL BUT ALTERED BIT
 MOV B,C ;RESTORE SHIFT COUNT TO B

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901> 0CF1 67
902> 0CF2 7D
903> 0CF3 CDFB0C
904> 0CF6 B4
905> 0CF7 12
906> 0CF8 C37108
907>
908>
909>
910> 0CFB 05
911> 0CFC C8
912> 0CFD 07
913> 0CFE C3FB0C
914>
915>
916> 0D01 C2110D
917>
918> 0D04 7C
919> 0D05 B7
920> 0D06 C2530D
921> 0D09 7D
922> 0D0A 219111
923> 0D0D 77
924> 0D0E C37108
925>
926>
927> 0D11 E5
928> 0D12 CDA90E
929> 0D15 D1
930> 0D16 73
931> 0D17 23
932> 0D18 72
933> 0D19 C37108
934>
935>
936> 0D1C E5
937> 0D1D D5
938> 0D1E C5
939>
940>
941> 0D1F 3A5B08
942> 0D22 F67F
943> 0D24 CA3C0D
944>
945>
946>
947> 0D27 1608
948> 0D29 5F
949> 0D2A 218008
950> 0D2D 19
951> 0D2E 7E
952> 0D2F FE1A
953> 0D31 CA4E0D
954> 0D34 215B08
955> 0D37 34
956> 0D38 B7
957> 0D39 C34F0D
958>
959>
960> 0D3C 0E14

```

MOV H,A ;SAVE MASKED FLAGS
 MOV A,L ;0/1 TO LSB OF ACCUM
 CALL LROTATE ;ROTATED TO CHANGED POSITION
 ORA H ;RESTORE ALL OTHER FLAGS
 STAX D ;BACK TO MACHINE STATE
 JMP START ;FOR ANOTHER COMMAND
 LROTATE. ;LEFT ROTATE FOR FLAG SETTING
 IS IN REGISTER A, COUNT IN REGISTER B
 DCR B
 RZ ;ROTATE COMPLETE
 RLC ;END-AROUND ROTATE
 JMP LROTATE
 EXAM4. ;MAY BE ACCUMULATOR CHANGE
 JNZ EXAM5
 MUST BE BYTE VALUE
 MOV A,H
 ORA A
 JNZ CERROR
 MOV A,L ;GET BYTE TO STORE
 LXI H,ALOC ;A REG LOCATION IN MACHINE STATE
 MOV M,A ;STORE IT AWAY
 JMP START
 EXAM5. ;MUST BE DOUBLE REGISTER PAIR
 PUSH H ;SAVE VALUE
 CALL GETDBA ;DOUBLE ADDRESS TO HL
 POP D ;VALUE TO D,E
 MOV M,E
 INX H
 MOV M,D ;ALTERED MACHINE STATE
 JMP START
 DISKR. ;DISK READ
 PUSH H
 PUSH D
 PUSH B
 RDI. ;READ DISK INPUT
 LDA DBP
 ANI 7FH
 JZ NDI ;GET NEXT DISK INPUT RECORD
 READ CHARACTER
 RDC. MVI D,0
 MOV E,A
 LXI H,DBF
 DAD D
 MOV A,M
 CPI DEOF
 JZ DEF ;END OF FILE
 LXI H,DBP
 INR H
 ORA A
 JMP RRET
 NDI. ;NEXT BUFFER IN
 MVI C,RDF

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961> 003E 115C00
962> 0041 CD1E00
963> 0044 B7
964> 0045 C24E0D
965>
966>
967> 0048 325B00
968> 004B C3270D
969>
970>
971> 004E 37
972>
973> 004F C1
974> 0050 D1
975> 0051 E1
976> 0052 C9
977>
978>
979> 0053 CDBD0D
980> 0056 3E3F
981> 0058 CD6F0D
982> 005B C37100
983>
984>
985>
986> 005E 0E0A
987> 0060 114211
988> 0063 CD1E00
989> 0066 214411
990> 0069 224011
991> 006C C9
992>
993>
994> 006D 3E20
995>
996>
997> 006F E5
998> 0070 D5
999> 0071 C5
000> 0072 5F
001> 0073 0E02
002> 0075 CD1E00
003> 0078 C1
004> 0079 D1
005> 007A E1
006> 007B C9
007>
008>
009>
010> 007C FE7F
011> 007E C8
012> 007F FE61
013> 0081 D8
014> 0082 E65F
015> 0084 C9
016>
017>
018>
019> 0085 E5
020> 0086 214311

```

```

LXI D,DFCB
CALL TRAPAD
ORA A
JNZ DEF
;
; BUFFER READ OK
STA DBP ;STORE 00H
JMP RDC
;
DEF: ;SET CARRY AND RETURN (END FILE)
STC
RRET:
POP B
POP D
POP H
RET
;
; ERROR: ERROR IN COMMAND
CALL CRLF
MVI A,'?'
CALL PCHAR
JMP START
;
; SUBROUTINES
GETBUFF: ;FILL COMMAND BUFFER AND SET POINTERS
MVI C,GETF ;GET BUFFER FUNCTION
LXI D,COMLEN;START OF COMMAND BUFFER
CALL TRAPAD ;FILL BUFFER
LXI H,COMBUF;NEXT TO GET
SHLD NEXTCOM
RET
;
BLANK:
MVI A,' '
;
PCHAR: ;PRINT CHARACTER TO CONSOLE
PUSH H
PUSH D
PUSH B
MOV E,A
MVI C,COF
CALL TRAPAD
POP B
POP D
POP H
RET
;
TRANS:
;
; TRANSLATE TO UPPER CASE
CPI 7FH ;RUBOUT?
RZ
CPI ('A' OR 0100000B) ;UPPER CASE A
RC
ANI 1011111B ;CLEAR UPPER CASE BIT
RET
;
GHC:
;
; GET NEXT BUFFER CHARACTER FROM CONSOLE
PUSH H ;SAVE FOR REUSE LOCALLY
LXI H,CURLN

```

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```

021> 0089 7E
022> 008A E7
023> 008B 3E0D
024> 008D CA9C0D
025> 0090 35
026> 0091 2A4011
027> 0094 7E
028> 0095 23
029> 0096 224011
030> 0099 CD7C0D
031> 009C E1
032> 009D C9
033>
034>
035> 009E FE0A
036> 00A0 D2A80D
037> 00A3 C630
038> 00A5 C36F0D
039> 00A8 C637
040> 00AA C36F0D
041>
042> 00AD F5
043> 00AE 1F
044> 00AF 1F
045> 00B0 1F
046> 00B1 1F
047> 00B2 E60F
048> 00B4 CD9E0D
049> 00B7 F1
050> 00B8 E60F
051> 00BA C39E0D
052>
053>
054> 00BD 3E0D
055> 00BF CD6F0D
056> 00C2 3E0A
057> 00C4 C36F0D
058>
059>
060> 00C7 C5
061> 00C8 D5
062> 00C9 E5
063> 00CA 0E0B
064> 00CC CD1E00
065> 00CF E601
066> 00D1 E1
067> 00D2 D1
068> 00D3 C1
069> 00D4 C9
070>
071>
072> 00D5 EB
073>
074>
075> 00D6 7C
076> 00D7 CDAD0D
077> 00DA 7D
078> 00DB C3AD0D
079>
080>

```

```

MOV A,M
ORA A ;ZERO?
MVI A,CR
JZ GNCRET ;RETURN WITH CR IF EXHAUSTED
DCR H ;CURLN=CURLN-1
LHLD NEXTCOM
MOV A,M ;GET NEXT CHARACTER
INX H ;NEXTCOM=NEXTCOM+1
SHLD NEXTCOM ;UPDATED
CALL TRANS
GNCRET: POP H ;RESTORE ENVIRONMENT
RET
;
PHIB: ;PRINT NIBBLE IN LO ACCUM
CPI 10
JNC PHIBH ;JUMP IF A-10
ADI '0'
PHIBH: ADI 'A'-10
JMP PCHAR
;
PBYTE: PUSH PSW ;SAVE A COPY FOR LO NIBBLE
RAR
RAR
RAR
RAR
ANI 0FH ;MASK HD NIBBLE TO LO NIBBLE
CALL PHIB
POP PSW ;RECALL BYTE
ANI 0FH
JMP PHIB
;
CRLF: ;CARRIAGE RETURN LINE FEED
MVI A,CR
CALL PCHAR
MVI A,LF
JMP PCHAR
;
BREAK: ;CHECK FOR BREAK KEY
PUSH B
PUSH D
PUSH H
MVI C,CHKIO
CALL TRAPAD
ANI 1B
POP H
POP D
POP B
RET
;
PADDX: ;SAME AS PADDR, EXCEPT PRINT VALUE IN D,E
XCHG
;
PADDR: ;PRINT THE ADDRESS VALUE IN H,L
MOV A,H
CALL PBYTE
MOV A,L
JMP PBYTE
;
PGRAPH: ;PRINT GRAPHIC CHARACTER IN REG-A OR '.' IF NOT

```

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```

001> 00DE FE7F
002> 00E0 D2E80D
003> 00E3 FE20
004> 00E5 D26F0D
005>
006> 00E8 3E2E
007> 00EA C36F0D
008>
009>
010> 00ED EB
011> 00EE 2A3C11
012> 00F1 7D
013> 00F2 93
014> 00F3 6F
015> 00F4 7C
016> 00F5 9A
017> 00F6 EB
018> 00F7 C9
019>
020> 00F8 FE0D
021> 00FA C8
022> 00FB FE2C
023> 00FD C8
024> 00FE FE20
025> 0000 C9
026>
027> 0001 D630
028> 0003 FE0A
029> 0005 D8
030> 0006 C8F9
031> 0008 FE10
032> 000A D8
033> 000B C3530D
034>
035> 000E EB
036> 000F 5E
037> 0010 23
038> 0011 56
039> 0012 23
040> 0013 EB
041> 0014 C9
042>
043> 0015 EB
044> 0016 210000
045>
046> 0019 CD010E
047> 001C 29
048> 001D 29
049> 001E 29
050> 001F 29
051> 0020 85
052> 0021 6F
053> 0022 CD850D
054> 0025 CDF00D
055> 0028 C2190E
056> 002B EB

```

```

CPI 7FH
JNC PPERIOD
CPI ' '
JNC PCHAR
PPERIOD: MVI A, ' '
JMP PCHAR
DISCOM: ;COMPARE H,L AGAINST DISMAX. CARRY SET IF HL > DISMAX AND
XCHG
LHLD DISMAX
MOV A,L
SUB E
MOV L,A ;REPLACE FOR ZERO TESTS LATER
MOV A,H
SUB D
XCHG
RET
DELIM: ;CHECK FOR DELIMITER CHARACTER
CPI CR
RZ
CPI ' '
RZ
CPI ' '
RZ
CPI ' '
RZ
RET
HEXCON: ;CONVERT ACCUMULATOR TO PURE BINARY FROM EXTERNAL HEX
SUI '0'
CPI 10
RC ;MUST BE 0-9
ADI ('0'-'A'+10) AND 0FFH
CPI 16
RC ;MUST BE 0-15
JMP ERROR ;BAD HEX DIGIT
GETVAL: ;GET NEXT EXPRESSION VALUE TO H,L (POINTER IN D,E ASSUMED)
XCHG
MOV E,H
INX H
MOV D,M
INX H
XCHG
RET
GETEXP: ;GET HEX VALUE TO D,E
XCHG
LXI H,0
GETEXP8: CALL HEXCON
DAD H ;*2
DAD H ;*4
DAD H ;*8
DAD H ;*16
ORA L ;HL=HL*HEX
MOV L,A
CALL GNC
CALL DELIM ;DELIMITER?
JNZ GETEXP8
XCHG

```

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```

141> 0E2C C9
142>
143>
144> 0E2D 73
145> 0E2E 23
146> 0E2F 72
147> 0E30 23
148> 0E31 E5
149> 0E32 213311
150> 0E35 34
151> 0E36 E1
152> 0E37 C9
153>
154>
155>
156>
157> 0E38 CD850D
158>
159> 0F30 213311
160> 0E3E 3600
161> 0E40 23
162> 0E41 FE0D
163> 0E43 CA7D0E
164>
165>
166> 0E46 FE2C
167> 0E48 C2560E
168>
169> 0E4B 3E80
170> 0E4D 323311
171> 0E50 110000
172> 0E53 C3530E
173>
174>
175> 0E56 CD150E
176> 0E59 CD2D0E
177> 0E5C FE0D
178> 0E5E CA7D0E
179> 0E61 CD850D
180> 0E64 CD150E
181> 0E67 CD2D0E
182>
183> 0E6A FE0D
184> 0E6C CA7D0E
185> 0E6F CD850D
186> 0E72 CD150E
187> 0E75 CD2D0E
188> 0E78 FE0D
189> 0E7A C2530D
190>
191> 0E7D 113311
192> 0E80 1A
193> 0E81 FE81
194> 0E83 CA530D
195> 0E86 13
196> 0E87 B7
197> 0E88 07
198> 0E89 0F
199> 0E8A C9
200>

```

```

RET
SCSTORE: ;STORE D,E TO H,L AND INCREMENT ADDRESS
MOV M,E
INX H
MOV M,D
INX H
PUSH H
LXI H,EXPLIST
INR M ;COUNT NUMBER OF EXPN'S
POP H
RET
SCANEXP: ;SCAN EXPRESSIONS - CARRY SET IF ,B
ZERO SET IF NO EXPRESSIONS, A SET TO NUMBER OF EXPRESSIONS
M1 ORDER BIT SET IF ,B ALSO
CALL GNC
SCANEX: ;ENTER HERE IF CHARACTER ALREADY SCANNED
LXI H,EXPLIST
MVI M,0 ;ZERO EXPRESSIONS
INX H ;READY TO FILL EXPRESSION LIST
CPI CR ;END OF LINE
JZ SCANRET
;
; NOT CR, MUST BE DIGIT OR COMMA
CPI ' '
JNZ SCANE0
MARK AS COMMA
MVI A,80H
STA EXPLIST
LXI D,0
JMP SCANE1
;
SCANE0: ;NOT CR OR COMMA
CALL GETEXP ;EXPRESSION TO D,E
SCANEX: CALL SCSTORE ;STORE THE EXPRESSION AND INCREMENT H,L
CPI CR
JZ SCANRET
CALL GNC
CALL GETEXP
CALL SCSTORE
; SECOND DIGIT SCANNED
CPI CR
JZ SCANRET
CALL GNC
CALL GETEXP
CALL SCSTORE
CPI CR
JNZ ERROR
SCANRET: LXI D,EXPLIST ;LOOK AT COUNT
LDAX D ;LOAD COUNT TO ACC
CPI 81H ;, WITHOUT B?
JZ ERROR
INX D ;READY TO EXTRACT EXPN'S
ORA A ;ZERO FLAG MAY BE SET
RLC
RRC ;SET CARRY IF NO BIT SET (.B)
RET ;WITH FLAGS SET

```

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```

201>
202>
203>
204>
205>
206>
207> 0E0B E5
208> 0E3C 21600F
209> 0E3F 58
210> 0E90 1600
211> 0E92 19
212> 0E93 4E
213> 0E34 219011
214> 0E97 7E
215> 0E98 E8
216> 0E99 E1
217> 0E9A C9
218>
219>
220> 0E9B CD800E
221> 0E9E 0D
222> 0E9F CAA60E
223> 0EA2 1F
224> 0EA3 C39E0E
225> 0EA6 E601
226> 0EA8 C9
227>
228>
229> 0EA9 D606
230> 0EAB 21660F
231> 0EAE 5F
232> 0EAF 1600
233> 0EB1 19
234> 0EB2 5E
235> 0EB3 16FF
236> 0EB5 219011
237> 0EB8 19
238> 0EB9 C9
239>
240>
241> 0EBA CDA90E
242> 0EBD 5E
243> 0EBE 23
244> 0EBF 56
245> 0EC0 E8
246> 0EC1 C9
247>
248>
249> 0EC2 7E
250> 0EC3 CD6F0D
251> 0EC6 78
252> 0EC7 FE05
253> 0EC9 D2D30E
254>
255>
256> 0ECC CD960E
257> 0ECF CD9E0D
258> 0ED2 C9
259>
260>

```

SUBROUTINES FOR CPU STATE DISPLAY

FLGSHF. ;SHIFT COMPUTATION FOR FLAG GIVEN BY REG-B
REG A CONTAINS FLAG UPON EXIT (UNSHIFTED)
REG C CONTAINS NUMBER OF SHIFTS REQUIRED+1
REGS D,E CONTAIN ADDRESS OF FLAGS IN TEMPLATE

PUSH H
LXI H,FLGTAB ;SHIFT TABLE
MOV E,B
MVI D,0
DAD D
MOV C,M ;SHIFT COUNT TO C
LXI H,FLOC ;ADDRESS OF FLAGS
MOV A,M ;TO REG A
XCHG ;SAVE ADDRESS
POP H
RET

GETFLG. ;GET FLAG GIVEN BY REG-B TO REG-A AND MASK
CALL FLGSHF ;BITS TO SHIFT IN REG-A
GETFL0. DCR C
JZ GETFL1
RAR
JMP GETFL0
GETFL1. ANI 1B
RET

GETDBA. ;GET DOUBLE BYTE ADDRESS CORRESPONDING TO REG-A TO HL
SUI BVAL ;NORMALIZE TO 0,1,...
LXI H,RINX ;INDEX TO STACKED VALUES
MOV E,A ;INDEX TO E
MVI D,0 ;DOUBLE PRECISION
DAD D ;INDEXED INTO VECTOR
MOV E,M ;OFFSET TO E
MVI D,0FFH ;-1
LXI H,STACK
DAD D ;HL HAS BASE ADDRESS
RET

GETDBL. ;GET DOUBLE BYTE CORRESPONDING TO REG-A TO HL
CALL GETDBA ;ADDRESS OF ELT IN HL
MOV E,M ;LSB
INX H
MOV D,M ;MSB
XCHG ;BACK TO HL
RET

DELT. ;DISPLAY CPU ELEMENT GIVEN BY COUNT IN REG-B, ADDRESS IN H,L
MOV A,M ;GET CHARACTER
CALL PCHAR ;PRINT IT
MOV A,B ;GET COUNT
CPI AVAL ;PAST A?
JNC DELT0 ;JMP IF NOT FLAG

DISPLAY FLAG
CALL GETFLG ;FLAG TO REG-A
CALL PMIB
RET

DELT0. ;NOT FLAG, DISPLAY - AND DATA

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0ED3 F5
0ED4 3E3D
0ED6 CD6F0D
0ED9 F1
0EDA C2E50E

0EDD 219111
0EE0 7E
0EE1 CDAD0D
0EE4 C9

0EE5 CDBA0E
0EE8 CDD60D
0EEB C9

0EEC 215B0F
0EEF 0600
0EF1 CDBD0D
0EF4 C5
0EF5 E5
0EF6 CDC20E
0EF9 E1
0EFA C1
0EFB 04
0EFC 23
0EFD 78
0EFE FE0B
0F00 D20E0F
0F03 FE05
0F05 DAF40E

0F08 CD6D0D
0F0B C3F40E

0F0E CD6D0D
0F11 CD3010
0F14 F5
0F15 D5
0F16 C5
0F17 CD270B
0F1A D22E0F

0F1D 2A9611
0F20 220C01
0F23 211001
0F26 36FF
0F28 CD0601
0F2B C3570F

0F2E 2B
0F2F 223C11
0F32 2A9611
0F35 7E
0F36 CDAD0D

PUSH PSW
MVI A,'='
CALL PCHAR
POP PSW
JNZ DELT1 ;JUMP IF NOT REG-A

REGISTER A, DISPLAY BYTE VALUE
LXI H,ALOC
MOV A,M
CALL PBYTE
RET

DELT1. ;DOUBLE BYTE DISPLAY
CALL GETDBL ;TO H,L
CALL PADDR ;PRINTED
RET

DSTATE. ;DISPLAY CPU STATE
LXI H,RVCT ;REGISTER VECTOR
MVI B,0 ;REGISTER COUNT
CALL CALF
DSTA0. PUSH B
PUSH H
CALL DELT ;ELEMENT DISPLAYED
POP H ;RVCT ADDRESS RESTORED
POP B ;COUNT RESTORED
INR B ;NEXT COUNT
INX H ;NEXT REGISTER
MOV A,B ;LAST COUNT?
CPI PVAL+1
JNC DSTA1 ;JMP IF PAST END
CPI AVAL ;BLANK AFTER?
JC DSTA0
YES, BLANK AND GO AGAIN
CALL BLANK
JMP DSTA0

READY TO SEND DECODED INSTRUCTION

DSTA1. CALL BLANK
CALL HERRK ;COMPUTE BREAKPOINTS IN CASE OF TRACE
PUSH PSW ;SAVE EXPRESSION COUNT - B,C AND D,E HAVE
PUSH D ;SAVE BP ADDRESS
PUSH B ;SAVE AUX BREAKPOINT
CALL CHKDIS ;CHECK TO SEE IF DISASSEMBLER IS HERE
JNC DCHEX ;DISPLAY HEX IF NOT
DISASSEMBLE CODE
LHLD PLOC ;GET CURRENT PC
SHLD DISPC ;SET DISASM PC
LXI H,DISPG ;PAGE MODE = 0FFH TO TRACE
MVI H,0FFH
CALL DISEN
JMP DSTRET

DCHEX. ;DISPLAY HEX
DCX H ;POINT TO LAST TO WRITE
SHLD DISMAK ;SAVE FOR COMPARE BELOW
LHLD PLOC ;START ADDRESS OF TRACE
MOV A,M ;GET OPCODE
CALL PBYTE

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```

441>
442> 0FE7 CD3010
443> 0FEA C31F0A
444>
445>
446> 0FED CDEC0E
447> 0FF0 C31F0A
448>
449>
450> 0FF3 210000
451> 0FF6 222511
452> 0FF9 CD700F
453> 0FFC 3E2A
454> 0FFE CD6F0D
455> 1001 2A9611
456>
457> 1004 CD270B
458> 1007 D20D10
459> 100A 220C01
460> 100D CD060D
461> 1010 2A9411
462> 1013 223A11
463> 1016 C37108
464>
465>
466>
467> 1019 110D00
468> 101C 210A11
469> 101F 7E
470> 1020 A8
471> 1021 23
472> 1022 BE
473> 1023 23
474> 1024 CA2C10
475> 1027 14
476> 1028 1D
477> 1029 C21F10
478> 102C 5A
479> 102D 1600
480> 102F C9
481>
482>
483>
484>
485>
486> 1030 2A9611
487> 1033 46
488> 1034 23
489> 1035 E5
490> 1036 CD1910
491> 1039 212411
492> 103C 73
493> 103D 214710
494> 1040 19
495> 1041 19
496> 1042 5E
497> 1043 23
498> 1044 56
499> 1045 EB
500> 1046 E9

      NOT TRACING, BUT MONITORING, SO SET BREAKPOINTS
      CALL NBRK
      JMP GOPR

BREAK1:  ;TRACING AND MONITORING
      CALL DSTATE ;STATE DISPLAYED, CHECK FOR BREAKPOINTS
      JMP GOPR ;STARTS EXECUTION

STOPEX:
      LXI H,0
      SHLD USERBRK ;CLEAR USER BREAK ADDRESS
      CALL CLRTRAC ;TRACE FLAGS GO TO ZERO
      MVI A,0
      CALL PCHAR
      LHL PLOC
      ;CHECK TO ENSURE DISASSEMBLER IS PRESENT
      CALL CHKDIS
      JNC STOP0
      SHLD DISPC
      CALL PADDR
      LHL HLOC
      SHLD DISLOC
      JMP START

CAT: ;DETERMINE OPCODE CATEGORY - CODE IN REGISTER B
      ;D,E CONTAIN DOUBLE PRECISION CATEGORY NUMBER ON RETURN
      LXI D,OPMAX ;D=0,E=OPMAX
      LXI H,OPLIST
CAT0:
      MOV A,M ;MASK TO A
      ANA B ;MASK OPCODE FROM B
      INX H ;READY FOR COMPARE
      CMP M ;SAME AFTER MASK?
      INX H ;READY FOR NEXT COMPARE
      JZ CAT1 ;EXIT IF COMPARED OK
      INR D ;UP COUNT IF NOT MATCHED
      DCR E ;FINISHED?
      JNZ CAT0
CAT1:
      MOV E,D ;E IS CATEGORY NUMBER
      MVI D,0 ;DOUBLE PRECISION
      RET

NBRK: ;FIND NEXT BREAK POINT ADDRESS
      ;UPON RETURN, REGISTER A IS SETUP AS IF USER TYPED G,B1,B2 OR
      ;G,B1 DEPENDING UPON OPERATOR CATEGORY. B,C CONTAINS SECOND BP
      ;D,E CONTAINS PRIMARY BP. HL ADDRESS NEXT OPCODE BYTE
      LHL PLOC
      MOV B,M ;GET OPERATOR
      INX H ;HL ADDRESS BYTE FOLLOWING OPCODE
      PUSH H ;SAVE IT FOR LATER
      CALL CAT ;DETERMINE OPERATOR CATEGORY
      LXI H,CATNO ;SAVE CATEGORY NUMBER
      MOV M,E
      LXI H,CATTAB;CATEGORY TABLE BASE
      DAD D ;INXED
      DAD D ;INXED*2
      MOV E,M ;LOW BYTE TO E
      INX H
      MOV D,M ;HIGH BYTE TO D
      XCHG
      PCHL ;JUMP INTO TABLE

```

```

501> 1047 6310
502> 1049 8910
503> 104B 6310
504> 104D 8910
505> 104F 6910
506> 1051 9810
507> 1053 AD10
508> 1055 CF10
509> 1057 CF10
510> 1059 CC10
511> 105B CC10
512> 105D C210
513> 105F CF10
514>
515> 1061 BD10
516>
517>
518> 1063 CD7710
519> 1066 C2D210
520>
521> 1069 CD8210
522> 106C C3D210
523>
524>
525> 106F 3E06
526> 1071 B8
527> 1072 C0
528> 1073 3E12
529> 1075 BA
530> 1076 C9
531>
532>
533> 1077 C1
534> 1078 E1
535> 1079 5E
536> 107A 23
537> 107B 56
538> 107C 23
539> 107D E5
540> 107E C5
541> 107F C36F10
542>
543> 1082 2A9211
544> 1085 5E
545> 1086 23
546> 1087 56
547> 1088 C9
548>
549>
550>
551> 1089 CD7710
552> 108C CA9610
553>
554> 108F C1
555> 1090 C5
556> 1091 3E02
557> 1093 C3D410
558>
559>
560> 1096 D1

CATTAB: DW JNPOP ;JUMP OPERATOR
        DW CCOP ;JUMP CONDITIONAL
        DW JNPOP ;CALL OPERATOR (TREATED AS JNP)
        DW CCOP ;CALL CONDITIONAL
        DW RETOP ;RETURN FROM SUBROUTINE
        DW RSTOP ;RESTART
        DW PCOP ;PCHL
        DW IMOP ;SINGLE PRECISION IMMEDIATE (2 BYTE)
        DW IMOP ;ADI ... CPI
        DW DIMOP ;DOUBLE PRECISION IMMEDIATE (3 BYTES)
        DW DIMOP ;LHL ... STA
        DW RCOND ;RETURN CONDITIONAL
        DW IMOP ;IN/OUT
        ;NEXT DW MUST BE THE LAST IN THE SEQUENCE
        DW SINOP ;SIMPLE OPERATOR (1 BYTE)

JNPOP: ;GET OPERAND FIELD, CHECK FOR BDOS
      CALL GETOPA ;GET OPERAND ADDRESS TO D,E AND COMPARE WITH
      JNZ ENDP ;TREAT AS SIMPLE OPERATOR IF NOT BDOS
      ;OTHERWISE, TREAT AS A RETURN INSTRUCTION
      RETOP: CALL GETSP ;ADDRESS AT STACKTOP TO D,E
            JMP ENDP ;TREAT AS SIMPLE OPERATOR

CBDOS: ;COMPARE D,E WITH BDOS ADDRESS, RETURN ZERO IF EQUAL
      MVI A,BDOS AND 0FFH
      CMP E
      RNZ
      MVI A,BDOS SHR 8
      CMP D
      RET

GETOPA: ;GET OPERAND ADDRESS AND COMPARE WITH BDOS
      POP B ;GET RETURN ADDRESS
      POP H ;GET OPERAND ADDRESS
      MOV E,M
      INX H
      MOV D,M
      INX H
      PUSH H ;UPDATED PC INTO STACK
      PUSH B ;RETURN ADDRESS TO STACK
      JMP CBDOS ;RETURN THROUGH CBDOS WITH ZERO FLAG SET

GETSP: ;GET RETURN ADDRESS FROM USER'S STACK TO D,E
      LHL SLOC
      MOV E,M
      INX H
      MOV D,M
      RET

CCOP: ;CALL CONDITIONAL OPERATOR
      CALL GETOPA ;GET OPERAND ADDRESS TO D,E / COMPARE WITH
      JZ CCOP1
      ;NOT THE BDOS, BREAK AT OPERAND ADDRESS AND NEXT ADDRESS
      POP B ;NEXT ADDRESS TO B,C
      PUSH B ;BACK TO STACK
      MVI A,2 ;TWO BREAKPOINTS
      JMP RETCAT ;RETURN FROM NBRK

CCOP1: ;BREAK ADDRESS AT NEXT LOCATION ONLY. WAIT FOR RETURN FROM
      POP D

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561> 1097 D5      PUSH    D      ;BACK TO STACK
562> 1098 C3D210  JMP      ENDOP    ;ONE BREAKPOINT ADDRESS
563>
564>
565> 1098 78      RSTOP.  ;RESTART INSTRUCTION - CHECK FOR RST 7
566> 109C FEFF      MOV      A,B
567> 109E C2A510   CPI      RSTIN  ;RESTART INSTRUCTION USED FOR SOFT INT
568>
569>
570> 10A1 AF      ; SOFT RST, NO BREAK POINT SINCE IT WILL OCCUR IMMEDIATELY
571> 10A2 C3D610   XRA      A
572> 10A5 E638     JMP      RETCAT1 ;ZERO ACCUMULATOR
573> 10A7 5F      RST0.   ANI      111000B ;GET RESTART NUMBER
574> 10A8 1600     MOV      E,A
575> 10AA C3D210   MVI      D,0      ;DOUBLE PRECISION BREAKPOINT TO D,E
576>
577>
578> 10AD 2A9411   PCOP.   ;PCHL
579> 10B0 EB      LHL      HLOC
580> 10B1 CD6F10   XCHG     ;HL VALUE TO D,E FOR BREAKPOINT
581> 10B4 C2D210   CALL     CBDS    ;BDOS VALUE?
582>
583> 10B7 C36910   JNZ      ENDOP
584>
585> 10B8 C3D210   PCHL    TO BDOS, USE RETURN ADDRESS
586>
587>
588> 10BD D1      JMP      ENDOP
589>
590> 10BE D5      ;SINOP.  ;SIMPLE OPERATOR, USE STACKED PC
591> 10BF C3D210  POP      D
592>
593>
594> 10C2 CD8210  PUSH    D
595> 10C5 C1      JMP      ENDOP
596> 10C6 C5
597> 10C7 3E02
598> 10C9 C3D410  ;RCOND.  ;RETURN CONDITIONAL
599>
600> 10CC D1      CALL     GETSP   ;GET RETURN ADDRESS FROM STACK
601> 10CD 13      POP      B      ;B,C ALTERNATE LOCATION
602> 10CE D5      PUSH    B      ;REPLACE IT
603>
604>
605> 10CF D1      MVI      A,2
606> 10D0 13      JMP      RETCAT ;TO SET FLAGS AND RETURN
607> 10D1 D5
608>
609>
610> 10D2 3E01   DIMOP.  ;DOUBLE PRECISION IMMEDIATE OPERATOR
611>
612> 10D4 3C      POP      D
613> 10D5 37      INX      D      ;INCREMENTED ONCE, DROP THRU FOR ANOTHER
614>
615>
616> 10D6 F5      PUSH    D      ;COPY BACK
617>
618> 10D7 2A2511  INOP.   ;SINGLE PRECISION IMMEDIATE
619> 10DA 7C      POP      D
620> 10DB 85      INX      D
621> 10DC CA0711  PUSH    D

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10DF D5      PUSH    D      ;SAVE BREAK POINT
10E0 C5      PUSH    B      ;SAVE AUX BREAK POINT
10E1 E3      PUSH    H      ;SAVE USERBRK ADDRESS FOR PCHL BELOW
10E2 212411   ; USER BREAK OCCURS HERE, CALL USER ROUTINE AND CHECK RETURN
10E3 4E      LXI      H,CATNO
10E6 2A9611   MOV      C,M      ;OPCODE CATEGORY IS IN C
10E9 EB      LHL      PLOC
10EA 21EF10   XCHG     ;LOCATION OF INSTRUCTION IN D,E
10ED E3      LXI      H,RETUSER
10EE E9      XTHL     ;RETURN ADDRESS TO STACK, USERBRK TO H,L
10EF B7
10F0 C1
10F1 D1
10F2 CA0711   RETUSER. ;RETURN FROM USER BREAK, CHECK REGISTER A
10F5 F5
10F6 3E23
10F8 CD6F0D   ORA      A
10FB F1      POP      B      ;RESTORE BREAKPOINTS
10FC CDAD0D   POP      D
10FF 3E20     JZ      RETCAT2
1101 CD6F0D   ABORT    THE OPERATION WITH A CONDITION
1104 C3F30F   PUSH    PSW
1107 F1      MVI      A,'B'
1108 E1      CALL     PCHAR
1109 C9      POP      PSW
1110 F1      CALL     PBYTE
1111 C9      MVI      A,' '
1112 C9      CALL     PCHAR
1113 C9      CALL     STOPEX ;STOP EXECUTION
1114 C9
1115 C9
1116 C9
1117 C9
1118 C9
1119 C9
1120 C9
1121 C9
1122 C9
1123 C9
1124 C9
1125 C9
1126 C9
1127 C9
1128 C9
1129 C9
1130 C9
1131 C9
1132 C9
1133 C9
1134 C9
1135 C9
1136 C9
1137 C9
1138 C9
1139 C9
1140 C9
1141 C9
1142 20

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OPCODE CATEGORY TABLES
OPLIST. DB 11111111B, 11000011B ;0 JMP
DB 11000111B, 11000010B ;1 JCOND
DB 11111111B, 11000110B ;2 CALL
DB 11000111B, 11000100B ;3 CCOND
DB 11111111B, 11000101B ;4 RET
DB 11000111B, 11000111B ;5 RST 0..7
DB 11111111B, 11000101B ;6 PCHL
DB 11000111B, 00000110B ;7 MVI
DB 11000111B, 11000110B ;8 ADI...CPI
DB 11001111B, 00000001B ;9 LXI
DB 11100111B, 00100110B ;10 LHL SHLD LDA S
DB 11000111B, 11000000B ;11 RCOND
DB 11110111B, 11010011B ;12 IN OUT
OPMAX EQU ($-OPLIST)/2
CATNO. DS 1 ;CATEGORY NUMBER SAVED IN MBRK
USERBRK. DS 2 ;USER BREAK ADDRESS IF NON-ZERO
RETLOC. DS 2 ;RETURN ADDRESS TO USER FROM BDOS
TMODE. DS 1 ;TRACE MODE
TRACER. DS 2 ;TRACE COUNT
BREAKS. DS 7 ;BREAKS/BKPT1/DAT1/BKPT2/DAT2
EXPLIST. DS 7 ;COUNT+(EXP1)(EXP2)(EXP3)
DISLOC. DS 2 ;DISPLAY LOCATION
DISMAX. DS 2 ;MAX VALUE FOR CURRENT DISPLAY
TDISP. DS 2 ;TEMP 16 BIT LOCATION
NEXTCOM. DS 2 ;NEXT LOCATION FROM COMMAND BUFFER
COMLEN. DB CSIZE ;MAX COMMAND LENGTH

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681>	1143	CURLN:	DS	1	;	CURRENT COMMAND LENGTH
682>	1144	COMBUF:	DS	Csize	;	COMMAND BUFFER
683>	1164	MLOAD:	DS	2	;	MAX LOAD ADDRESS
684>	1166		DS	SSize	;	STACK AREA
685>		STACK:				
686>	1196 =	PLOC	EQU	STACK-2	;	PC IN TEMPLATE
687>	1194 =	HLOC	EQU	STACK-4	;	HL
688>	1192 =	SLOC	EQU	STACK-6	;	SP
689>	1191 =	ALOC	EQU	STACK-7	;	A
690>	1190 =	FLOC	EQU	STACK-8	;	FLAGS
691>	118E =	BLOC	EQU	STACK-10	;	BC
692>	118C =	DLOC	EQU	STACK-12	;	D, E
693>						
694>	1198 00		NOP			
695>	1199		END			

;FOR RELOCATION BOUNDARY

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