

DIGITAL RESEARCH

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

DYNAMIC DEBUGGING TOOL (DDT)

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DEMMOV

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SER. # DDT MOVE PROGRAM

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1)
2)
3) 000E = 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) 0005 = BDOS EQU 0005H
10) 0009 = 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 C33D01 JMP START
15) 0106 434F505952 DB 'COPYRIGHT (C) 1976, DIGITAL RESEARCH'
16) 0130 4444542056SIGHON, DB 'DDT VERS '
17) 0139 312E DB VERSION/10+'0','.'
18) 013B 3424 DB VERSION MOD 10 + '0','s'
19) 013D 310002 START, LXI SP,STACK
20) 0140 C5 PUSH B
21) 0141 C5 PUSH B
22) 0142 113001 LXI D,SIGHON
23) 0145 0209 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

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RELOC, MOV H,M ;BC=0?
ORA C
JZ ENDR1
;
; NOT END OF THE RELOCATION, MAY BE INTO NEXT BYTE OF BIT M
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 REL0 ;FOR ANOTHER BYTE TO RELOCATE
;
ENDREL, ;END OF RELOCATION
POP D ;CLEAR STACKED ADDRESS
MVI L,0
LXI D,BIAS
DAD D
PCHL ;GO TO RELOCATED PROGRAM
END

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```

121> 0102 C32E06
122>
123>
124> 0105 CD4101
125> 0109 CA2E06
126> 010B 110000
127> 010E 010000
128> 0191 210F07
129> 0194 09
130> 0195 7E
131> 0196 FE20
132> 0199 CA8001
133> 019B CD7801
134> 019E 68
135> 019F 62
136> 01A0 29
137> 01A1 29
138> 01A2 29
139> 01A3 29
140> 01A4 5F
141> 01A5 1600
142> 01A7 19
143> 01A8 EB
144> 01A9 03
145> 01AA 79
146> 01AB FE04
147> 01AD C29101
148>
149>
150> 01B0 42
151> 01B1 4B
152> 01B2 7B
153> 01B3 05
154> 01B4 04
155> 01B5 C9
156>
157>
158> 01B6 CD8501
159> 01B9 C22E06
160> 01BC C9
161>
162>
163> 01BD 210600
164> 01C0 3E00
165> 01C2 56
166> 01C3 23
167> 01C4 3E01
168> 01C6 9E
169> 01C7 D0
170> 01C8 210001
171> 01CB 220600
172> 01CE C9
173>
174>
175>
176>
177>
178>
179> 01CF 17
180> 01D0 17

```

```

JMP ERR
;
GADDR. JGET ADDRESS VALUE TO B (HIGH ORDER) AND C (LOW) WITH COPY OF
CALL SCAN
JZ ERR
LXI D,0
LXI B,0 JOPCODE INDEX
GAB. LXI H,OPCODE
DAD B
MOV A,M JNEXT CHARACTER
CPI
JZ GAI
CALL HEX JCONVERT ACCUMULATOR
MOV L,E
MOV H,D JCOPY D,E TO H,L
DAD H J*2
DAD H J*4
DAD H J*8
DAD H J*16
MOV E,A
MVI D,0
DAD D J+CHAR
XCHG JBACK TO D,E
INX B JNEXT POSITION
MOV A,C
CPI 4
JNZ GAB JFOR ANOTHER
;
GAI. J,D,E CONTAINS RESULT
MOV B,D
MOV C,E
MOV A,E JCOPY OF LOW BYTE TO ACCUMULATOR
DCR B
INR B JSETS ZERO FLAG IF B IS ZERO
RET
;
GBYTE. JGET BYTE VALUE TO ACCUMULATOR AND C, CHECK FOR HIGH ORDER,ZE
CALL GADDR
JNZ ERR
RET
;
INIT. JINITIALIZE THE JUMPS AROUND DISASSEMBLER
LXI H,JLOC1+1 JADDRESS FIELD OF JUMP AT 5H
MVI A,MODLOC AND 0FFH JLOW ORDER ADDRESS OF THIS MO
SUB M JALREADY ADDRESSING THIS MODULE
INX H JOR A MODULE BELOW THIS POINT?
MVI A,MODLOC SHR 8 JIF SO, SKIP THIS OPERATION
SBB M
RNC JNO CARRY IF (5H) <= MODLOC
LXI H,MODLOC JCHANGE ADDRESS
SHLD JLOC1+1 JFIELD OF JUMP AT 5H
RET
;
*****
***** ASSEMBLER MODULE STARTS HERE *****
;
ADJ. JMOVE REGISTER INDICATOR TO MIDDLE FIELD OF CODE
RAL
RAL

```

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```

01D1 17
01D2 E638
01D4 C9
01D5 17
01D6 17
01D7 17
01D8 17
01D9 E630
01DB C9
01DC EB
01DD 210F07
01DE EB
01E1 7B
01E2 BE
01E3 C2E001
01E6 23
01E7 7A
01E8 BE
01E9 C8
01EA 2B
01EB 2B
01EC 2B
01ED 0D
01EE C2E101
01F1 0D
01F2 C9
01F3 0604
01F5 D5
01F6 110F07
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. JMOVE TO LEFT BY 4 AND MASK
RAL
RAL
RAL
RAL
ANI 110000B
RET
;
SEAR2. JSAME AS SEAR, EXCEPT 2 CHARACTER MATCH
H,L ADDRESS TABLE TO MATCH ON
XCHG
LHLD OPCODE J2ND BYTE IN D, 1ST BYTE IN E
XCHG JH,L ADDRESS TABLE
MOV A,E JGET 1ST BYTE
CMP M JMATCH?
JNZ SEAR1 JTO ADDRESS NEXT ELT
INX H JNEXT TO MATCH
MOV A,D J2ND CHAR
CMP M
RZ JMATCH AT CURRENT ENTRY
DCX H
DCX H
DCX H JADDRESSES NEXT ELEMENT
DCR C
JNZ SEAR0 JFOR ANOTHER COMPARE
;
NO MATCH IN TABLE, RETURN WITH NON-ZERO VALUE
DCR C
RET
;
SEAR. JSEARCH 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 B,E
ADDRESSING PROPER BYTE, NON-ZERO IF NOT FOUND.
MVI B,4 J4 CHARACTER MATCH
;
PUSH D JSAVE THE CURRENT BYTE VALUE LOCATION
LXI D,OPCODE JADDRESS CHARACTERS TYPED
LDAX D JPOINT TO FIRST BYTE TO MATCH
CMP M JSAME CHARACTER AS TABLE?
JNZ SE2 JNO, SKIP TO NXT TABLE ENTRY
INX H JYES, LOOK AT NEXT CHARACTER
INX D JMOVE TO NEXT CHARACTER TYPED
DCR B JDECREMENT CHARACTER COUNT
JNZ SE1 JMORE 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> 0200 C20602      JNZ     SE2
242>
243>
244> 0200 11F0FF      H.L AT END OF FOUR BYTE AREA. MOVE BACK 8
245> 020E 19          LXI     D,-8
246>
247> 020F D1          DAD     D      ;H.L READY FOR NXT. MATCH
248> 0210 13          POP     D      ;RESTORE BYTE POINTER
249> 0211 0D          INX     D      ;MOVE TO NEXT IN CASE MATCH OK
250> 0212 C2F301      DCR     C      ;MORE OPCODES TO MATCH?
251>
252>
253> 0215 0D          JNZ     SEAR   ;LOOK FOR MORE
254> 0216 C9          RET
255>
256>
257>
258> 0217 C5          NO MATCH FOUND IN TABLE. SET NON-ZERO VALUE AND RETURN
259> 0218 CD4101      DCR     C
260> 0219 CA2E06      RET
261> 021F 0E00
262> 0220 217907      GETREG. ;SCAN FOR SIMPLE REGISTER REFERENCE
263> 0223 CD0C01      PUSH   B
264> 0226 C22E06      CALL  SCAN
265> 0229 0D          JZ     ERR
266> 022A 79          MVI   C,8      ;8 REGISTERS
267> 022B C1          LXI   H,SREG   ;SIMPLE REGISTERS
268> 022C C9          CALL  SEAR2   ;LOOK FOR 2 CHAR MATCH
269>
270>
271> 022D C5          JNZ   ERR
272> 022E CD4101      DCR   C
273> 0231 CA2E06      MOV  A,C
274> 0234 0E05      POP  B
275> 0236 218007      LXI  H,DREG
276> 0239 CD3F01      CALL SEAR
277> 023C C22E06      JNZ  ERR
278> 023F 0D          DCR  C
279> 0240 79          MOV  A,C
280> 0241 C1          POP  B
281> 0242 C9          RET
282>
283>
284> 0243 CD2D02      GETDR. ;GET DOUBLE REGISTER (BDHSP)
285> 0246 FE04      CALL  GETD
286> 0248 CA2E06      CPI   4        ;PSW?
287> 024B C9          JZ    ERR
288>
289>
290>
291> 024C CD2D02      GETPR. ;GET PUSH/POP REGISTER (BDH OR PSW)
292> 024F FE03      CALL  GETD
293> 0251 CA2E06      CPI   3
294> 0254 FE04      JZ    ERR
295> 0256 C8          CPI   4
296> 0257 3D          PHZ
297> 0258 C9          DCR  A        ;PSW MUST BE ADJUSTED
298>
299>
300> 0259 218F07      CONA. ;GET CONDITION CODE
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 CD0C01
320> 0278 C22E06
321> 027B 0D
322> 027C 79
323> 027D CDF0F1
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 218C01
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>

```

```

MOP.
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  MOP

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 SCANB
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> 0292 C38C02
363>
364>
365> 0293 0E9A
366> 0297 21E706
367> 029A CDF301
368> 029D C2C902
369>
370>
371> 02C0 CD8C02
372> 02C3 CD8601
373> 02C6 C38D02
374>
375>
376> 02C9 0E86
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 218307
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 0E00
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 0E00
420> 0310 C3F502

```

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

CHK1. CHECK GROUP-1 VALUES
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

CHK2. CHECK GROUP-2 OPCODES, REQUIRE DOUBLE BYTE OPERAND
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,01000000 ;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,0
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,10000000 ;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 C22803
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 214807

```

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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 110B
CALL SETM
CALL GBYTE
JMP SETM
;
CHK7. ;CHECK FOR GROUP-7
MVI C,6
LXI H,ETAB7
CALL SEAR
JNZ CHK8
;
; LXI,STAX,INR,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 110B1111B
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 C28003      JNZ  CHK9
483>
484>
485> 0378 CDB601      RST. GET OPERAND
486> 037B FE00         CALL GBYTE
487> 037D D22E06      CPI B
488> 0380 C0CF01      JMC ERR
489> 0383 F6C7        CALL ADJ
490> 0385 C38D02      ORI 11000111B
491>                   JMP  SETM
492>
493> 0388 0E02        ; POP/PUSH?
494> 038A 215707      MVI C,2
495> 038D CDF301      LXI H, PPOP+4
496> 0390 C2A003      CALL SEAR
497>                   JNZ  CHK10
498>
499>                   ; C=2 IF PUSH, 1 IF POP
500> 0393 0D          DCR C
501> 0394 C29C03      JNZ  PP0
502>
503>                   ; POP, SET BIT PATTERN
504> 0397 0EC1        MVI C,11000001B
505> 0399 C39E03      JMP  PPI
506>
507>                   ; PUSH
508> 039C 0EC5        MVI C,11000101B
509> 039E C04C02      CALL GETPR ;DOUBLE PUSH/POP REGISTER TO PROPER FIELD
510> 03A1 CDD501      CALL ADJ4 ;MOVE TO FIELD
511> 03A4 B1          ORA C
512> 03A5 C38D02      JMP  SETM
513>
514>                   ; J/C/R?
515> 03A8 3A0F07      LDA OPCODE
516> 03AB FE4A        CPI 'J'
517> 03AD C2B003      JNZ  CHK11
518> 03B0 CD0102      CALL GCONA
519>                   ; CONDITION CODE TO FIELD IN ACCUM, ADDRESS TO B,C
520> 03B3 F602        ORI 0100
521> 03B5 C3C203      JMP  FADDR ;FILL ADDRESS
522>
523>                   ; CHK11.
524> 03B8 FE43        CPI 'C'
525> 03BA C2CD03      JNZ  CHK12
526> 03BD CD0102      CALL GCONA
527> 03C0 F604        ORI 1000
528>
529>                   ; FADDR.
530> 03C2 CD0D02      CALL SETM
531> 03C5 79          MOV A,C
532> 03C6 CD0D02      CALL SETM
533> 03C9 78          MOV A,B
534> 03CA C38D02      JMP  SETM
535>
536>                   ; CHK12.
537> 03CD FE52        CPI 'R'
538> 03CF C22E06      JNZ  ERR
539> 03D2 CD5902      CALL GCON
540> 03D5 F6C0        ORI 11000000B
541> 03D7 C38D02      JMP  SETM
542>
543> *****
544> ***** END OF ASSEMBLER MODULE, START DISASSFMAIFR *****

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541>
542>
543> 03DA 2A0E01      RDBYTE, LHLD MPC
544> 03DD D5          PUSH D ;SAVE DE
545> 03DE EB          XCHG ;MAX PC TO D,E
546> 03DF 2A0C01      LHLD 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          LHLD 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          RGRNT, INR A
567> 03F6 E607        ANI 07
568> 03F8 FE06        CPI 06
569> 03FA DAFF03      JC RGP1
570> 03FD C603        ADI 03
571> 03FF FE05        CPI 05
572> 0401 DA0604      JC RGP2
573> 0404 C602        ADI 02
574> 0406 C641        RCP2, ADI 41H
575> 0408 4F          MOV C,A
576> 0409 C31501      JMP  C0
577>
578> 040C 47          DECODE, MOV B,A
579> 040D E6F0        ANI 0FH
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 C0
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  C0
598>
599> 042A 0604        PRINT, MVI B,4
600> 042C 4E          P1, MOV C,M
601> 042D CD1501      CALL C0

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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 E630     ANI      30H
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,M
619> 044B CD1501  CALL    CO
620> 044E 23      INX      H
621> 044F 4E      MOV      C,M
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> 0452 C2F503  JNZ      RCPRNT
631> 0455 0E53     MVI      C,53H
632> 0457 CD1501  CALL    CO
633> 046A 0E50     MVI      C,50H
634> 046C C31501  JMP      CO
635>
636>
637> 046F CD3C01  PRPC,  JPRINT 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, JENTER HERE FROM DEBUGGER - SET UP JMPS
650> 0489 39      LXI     H,0
651> 048A 221301  DAD     SP
652> 048D CD8D01  SHLD   DLDSR JSP SAVED FOR LATER RETURN
653> 0490 00      CALL   INIT
654>
655> 0490 3A1001  CHECK FOR PAGE MODE DISPLAY
656> 0493 07      LDA     PAGM JGET PAGE MODE (NUMBER OF LINES TO PRINT)
657> 0494 CA8004  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  SHLD   MPC
662>
663> 049D 3C      255 IMPLIES TRACE MODE
664> 049E C2AB04  INR     A
665>
666> 04A1 3C      JNZ   DISASM JNOT TRACE MODE IF BR
667> 04A2 321001  TRACE MODE, SET TO 1 AND IGNORE ADDRESS FIELD
668> 04A5 2A0C01  INR     A JI IN ACC
669> 04A8 C3C404  STA    PAGM
670>
671>
672>
673>
674> 04AB 0E08     LHL    PC JRECOVER PC
675> 04AD D0612     JMP    DIS1
676> 04B0 E601
677> 04B2 C25906
678>
679>
680> 04B5 211001  CHECK FOR BREAK AT CONSOLE
681> 04B8 7E      MVI    C,CHKIO
682> 04B9 B7      CALL   BDOS
683> 04BA CAC104  ANI    1
684>
685>
686> 04BD 35      JNZ   GOBACK
687> 04BE CA5906
688>
689> 04C1 CD6F04  DIS0,  CALL   PRPC JLINE NUMBER
690> 04C4 CDDA03  CALL   RDBYTE
691> 04C7 57      MOV    D,A
692> 04C8 215E06  LXI    H,TABLE
693> 04CB 011100  LXI    B,11H
694> 04CE BE      CMP    M
695> 04CF CA2006  JZ     TG1
696> 04D2 23      INX    H
697> 04D3 0D      DCR    C
698> 04D4 C2CE04  JNZ    D1
699> 04D7 0E0A     MVI    C,0AH
700> 04D9 BE      CMP    M
701> 04DA CA0C06  JZ     TG2
702> 04DD 23      INX    H
703> 04DE 0D      DCR    C
704> 04DF C2D904  JNZ    D2
705> 04E2 0E06     MVI    C,6
706> 04E4 BE      CMP    M
707> 04E5 CAF005  JZ     TG3
708> 04E8 23      INX    H
709> 04E9 0D      DCR    C
710> 04EA C2E404  JNZ    D3
711> 04ED E6C0     ANI    BC0H
712> 04EF FE40     CPI    40H
713> 04F1 CAD605  JZ     MG0
714> 04F4 FE00     CPI    00H
715> 04F6 CAC705  JZ     MG1
716> 04F9 7A      MOV    A,D
717> 04FA E6C7     ANI    BC7H
718> 04FC D604     SUI    04
719> 04FE CAB005  JZ     MG2
720> 0501 3D      DCR    A

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```

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,PAGM
MOV A,M
ORA A JZERO?
JZ DIS0 JMP 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 BC0H
CPI 40H
JZ MG0
CPI 00H
JZ MG1
MOV A,D
ANI BC7H
SUI 04
JZ MG2
DCR A

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721>	0502	CAB205	JZ	MC3
722>	0505	3D	DCR	A
723>	0506	CA9E05	JZ	MC4
724>	0509	7A	MOV	A, D
725>	050A	E6C0	ANI	0C0H
726>	050C	CA7205	JZ	MC5
727>	050F	7A	MOV	A, D
728>	0510	E6C7	ANI	0C7H
729>	0512	D6C0	SUI	0C0H
730>	0514	CA6705	JZ	MC6
731>	0517	D602	SUI	02
732>	0519	CA5C05	JZ	MC7
733>	051C	D602	SUI	02
734>	051E	CA5105	JZ	MC8
735>	0521	D603	SUI	03
736>	0523	CA4205	JZ	MC9
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	C3A804	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	C3A804	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	C3A804	JMP	DISASM
766>	0572	213307	LXI	H, PLXI
767>	0575	7A	MOV	A, D
768>	0576	E60F	ANI	BFH
769>	0578	3D	DCR	A
770>	0579	CA9005	JZ	MC51
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	CD5804	CALL	RPPRNT
780>	058D	C3A804	JMP	DISASM

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781>	0590	CD2A04	MC51.	CALL	PRINT
782>	0593	CD5804		CALL	RPPRNT
783>	0596	0E2C		MVI	C, 2CH
784>	0598	CD1501		CALL	CO
785>	059B	C3FB05		JMP	D7
786>	059E	212F07	MC4.	LXI	H, PHVI
787>	05A1	CD2A04		CALL	PRINT
788>	05A4	CD3A04		CALL	XTRACT
789>	05A7	CD5803		CALL	RGRNT
790>	05AA	0E2C		MVI	C, 2CH
791>	05AC	CD1501		CALL	CO
792>	05AF	C31706		JMP	D8
793>	05B2	212B07	MC3.	LXI	H, PDCR
794>	05B5	C3B805		JMP	D5
795>	05B8	212707	MC2.	LXI	H, PINR
796>	05BB	CD2A04	D5.	CALL	PRINT
797>	05BE	CD3A04		CALL	XTRACT
798>	05C1	CD5803	D6.	CALL	RGRNT
799>	05C4	C3A804		JMP	DISASM
800>	05C7	7A	MC1.	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	MC0.	LXI	H, PHOV
809>	05D9	CD2A04		CALL	PRINT
810>	05DC	CD3A04		CALL	XTRACT
811>	05DF	CD5803		CALL	RGRNT
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	CD5803		CALL	RGRNT
817>	05ED	C3A804		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	CDDA03	D7.	CALL	RDBYTE
826>	05FE	57		MOV	D, A
827>	05FF	CDDA03		CALL	RDBYTE
828>	0602	CD0C04		CALL	DECODE
829>	0605	7A		MOV	A, D
830>	0606	CD0C04		CALL	DECODE
831>	0609	C3A804		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	21BF06		LXI	H, TAB2-4
837>	0613	09		DAD	B
838>	0614	CD2A04		CALL	PRINT
839>	0617	CDDA03	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, '7'
853> 0633 C01501      CALL   CO
854>                   ;
855> 0636 2A1301      LHL   DLDSP
856> 0639 F9          SPHL
857> 063A 2A1101      LHL   TPC ;RESTORE PC
858> 063D 220C01      SHLD  PC
859>                   ;
860>                   ;
861> 0640 210000      ASMEH, ;ENTER HERE FROM DEBUGGER
862> 0643 39          LXI    H, 0
863> 0644 221301      DAD    SP
864> 0647 C0B001      SHLD  DLDSP
865> 0649 C0B001      CALL   INIT
866>                   ;
867> 064A C06F04      ASM0,  CALL   PRPC ;PRINT PC VALUE
868> 064D 221101      SHLD  TPC ;SAVE PC VALUE
869> 0650 C00500      CALL   GETBUFF ;FILL INPUT BUFFER
870> 0653 C09602      CALL   GETOP ;GET OPERATION
871> 0656 C34A06      JMP    ASM0
872>                   ;
873> 0659 2A1301      GOBACK, LHL   DLDSP
874> 065C F9          SPHL
875> 065D C9          RET
876>                   ;
877> 065E 0070F17    TABLE, DB    000H, 007H, 00FH, 017H
878> 0662 1F272F37    DB    01FH, 027H, 02FH, 037H
879> 0668 3F76C9E3    DB    03FH, 076H, 0C9H, 0E3H
880> 066A E9E8F3F9    DB    0E9H, 0E8H, 0F3H, 0F9H
881> 066E F8C6CED3    DB    0FBH, 0C6H, 0CEH, 0D3H
882> 0672 D6D8DEE6    DB    0D6H, 0D8H, 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 504340C58    DB    'PCHL', 'KTHL', '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    'CNP '
922>
923> 0727 494E5220      PINR, DB    'INR '
924> 072B 44435220      PDCR, DB    'DCR '
925> 072F 4D564920      PMVI, DB    'MVI '
926> 0733 4C56492053PLXI, 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          CREG, 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          OPCODE, 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 = BDDOSE 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>
31> 0001 = CIF EQU 1
32> 0002 = COF EQU 2
33> 0003 = RIF EQU 3
34> 0004 = POF EQU 4
35> 0005 = LOF EQU 5
36>
37> 0007 = IDS EQU 7
38> 000A = GETF EQU 10 ;FILL BUFFER FROM CONSOLE
39> 000B = CHKIO EQU 11 ;CHECK IO STATUS
40> 000C = LIFT EQU 12 ;LIFT HEAD ON DISK
41> 000F = OPF EQU 15 ;DISK FILE OPEN
42> 0014 = RDF EQU 20 ;READ DISK FILE
43> 001A = DMAF EQU 26 ;SET DMA ADDRESS
44>
45> 0050 = DBP EQU 50H ;DISK BUFFER POINTER
46> 0090 = DBF EQU 00H ;DISK BUFFER ADDRESS
47> 005C = DFCB EQU 5CH ;DISK FILE CONTROL BLOCK
48> 0000 = FDN EQU 0 ;DISK NAME
49> 0001 = FFH 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 = FLW EQU 33 ;FCB LENGTH
55>
56> 001A = DEOF EQU 1AH ;CONTROL-Z (EOF)
57> 003D = CR EQU 0DH
58> 003A = LF EQU 0AH
59>
60> 0007 = RSTNUM EQU 7 ;RESTART NUMBER

```

DEM

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SER. # DEBUGGER

```

61> 0030 =
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 C3A00D
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 BREAKPOINT VERSION
;-----
PCH PCL
HLH HLL
SPH SPL
RA FLG
B C
D E
;-----
FLG FIELD: NZ010E1C (MINUS, ZERO, IDC, EVEN, CARRY)

0005 = AVAL EQU 5 ;A REGISTER COUNT IN HEADER
0006 = BVAL EQU 6
0007 = DVAL EQU 7
0008 = HVAL EQU 8
0009 = SVAL EQU 9
000A = 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 DDT
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 PADDX ;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 BDOSC+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 NLOAD ;MAX LOAD LOCATION

;-----
SETUP RESTART TEMPLATE
SHLD PLOC
LXI H, SPBASE

```

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121> 0342 319411
122> 0345 E5
123> 0346 210200
124> 0349 E5
125> 0344 28
126> 0346 28
127> 034C 229411
128> 034F E5
129> 0350 E5
130> 0351 222411
131> 0354 222511
132>
133> 0357 JEC3
134> 0359 223000
135> 035C 210300
136> 035F 223900
137>
138>
139> 0362 3A5D00
140> 0365 FE20
141> 0367 CA7100
142>
143>
144> 036A 210000
145> 036D E5
146> 036E C34100
147>
148>
149>
150>
151> START.
152> 0371 310C11
153> 0374 CD0D0D
154> 0377 3E2D
155> 0379 CD0F0D
156>
157>
158> 037C CD5EAD
159>
160> 037F CD050D
161> 0382 FE0D
162> 0384 CA7100
163> 0387 D641
164> 0389 DA530D
165> 038C FE1A
166> 038E D2530D
167>
168> 0391 5F
169> 0392 1600
170> 0394 219E00
171> 0397 19
172> 0398 19
173> 0399 5E
174> 039A 23
175> 039B 56
176> 039C EB
177> 039D E9
178>
179> 039E E500
180>

LXI SP,STACK-4
PUSH H ;INITIAL SP
LXI H,100 ;INITIAL PSU
PUSH H
DCX H
DCX H ;CLEARED
SHLD HLOC ;H,L CLEARED
PUSH H ;B,C CLEARED
PUSH H ;D,E CLEARED
SHLD TRACER ;CLEAR TRACE FLAG
SHLD USERBRK ;CLEAR USER BREAK DURING TRACE/UNTRACE

MVI A,0C3H ;JMP RESTART)
STA RSTLOC
LXI H,BREAKA ;BREAK POINT SUBROUTINE
SHLD RSTLOC+1 ;RESTART LOCATION ADDRESS FIELD

CHECK FOR FILE NAME PASSED TO DEMON, AND LOAD IF PRESENT
LDA FCB+FFN ;BLANK IF NO NAME PASSED
CPI '
JZ START

PUSH A ZERO, AND READ
LXI H,0
PUSH H
JMP RINIT

MAIN COMMAND LOOP

START.
LXI SP,STACK-12 ;INITIALIZE SP IN CASE OF ERROR
CALL CRLF ;INITIAL CRLF
MVI A,'-'
CALL PCHAR ;OUTPUT PROMPT

GET INPUT BUFFER
CALL GETBUFF ;FILL COMMAND BUFFER

CALL GHC ;GET CHARACTER
CPI CR
JZ START
SUI 'A' ;LEGAL CHARACTER?
JC ERROR ;COMMAND ERROR
CPI 'Z'-'A'+1
JNC ERROR
CHARACTER IN REGISTER A IS COMMAND, MUST BE IN THE RANGE A-Z
MOV E,A ;INDEX TO E
MVI D,0 ;DOUBLE PRECISION INDEX
LXI H,JMPTAB;BASE OF TABLE
DAD D
DAD D ;INDEXED
MOV E,M ;LD BYTE
INX H
MOV D,M ;HD BYTE
XCHG ;TD H,L
PCHL ;GONE...

JMPTAB, ;JUMP TABLE TO SUBROUTINES
DW ASSM ;A ENTER ASSEMBLER LANGUAGE

181> 03A0 530D
182> 03A2 3009
183> 03A4 6009
184> 03A6 530D
185> 03A8 F609
186> 03AA 080A
187> 03AC 740A
188> 03AE 9E0A
189> 03B0 530D
190> 03B2 530D
191> 03B4 0109
192> 03B6 F40A
193> 03B8 5701
194> 03BA 530D
195> 03BC 530D
196> 03BE 530D
197> 03C0 300B
198> 03C2 0E0C
199> 03C4 570C
200> 03C6 530C
201> 03C8 530D
202> 03CA 530D
203> 03CC 8F0C
204> 03CE 530D
205> 03D0 530D
206>
207>
208>
209> 03D2 E5
210> 03D3 D5
211> 03D4 C5
212> 03D5 AF
213> 03D6 325B00
214> 03D9 0E0F
215> 03DB 115C00
216> 03DE CD1E00
217> 03E1 C1
218> 03E2 D1
219> 03E3 E1
220> 03E4 C9
221>
222>
223>
224> 03E5 210901
225> 03E8 CD150B
226> 03EB D2530D
227>
228> 03EE CD300E
229> 03F1 3D
230> 03F2 C2530D
231> 03F5 CD0E0E
232> 03F8 220C01
233> 03FB CD0901
234> 03FE C37100
235>
236>
237>
238>
239>
240> 0301 CD270B

DW CERROR ;B
DW CALLPR ;C CALL PROGRAM
DW DISPLAY ;D DISPLAY RAM MEMORY
DW CERROR ;E
DW FILL ;F FILL MEMORY
DW GOTO ;G GO TO MEMORY ADDRESS
DW HEXARI ;H HEXADECEMAL SUM AND DIFFERENCE
DW IMFCB ;I FILL INPUT FILE CONTROL BLOCK
DW CERROR ;J
DW CERROR ;K
DW LASSM ;L LIST ASSEMBLY LANGUAGE
DW MOVE ;M MOVE MEMORY
DW CERROR ;N
DW CERROR ;O
DW CERROR ;P
DW CERROR ;Q
DW REWD ;R READ HEXADECEMAL FILE
DW SETMEM ;S SET MEMORY COMMAND
DW TRACE ;T
DW UNTRACE ;U
DW CERROR ;V
DW CERROR ;W
DW EXAMINE ;X EXAMINE AND MODIFY REGISTERS
DW CERROR ;Y
DW CERROR ;Z

; FILE OPEN ROUTINE. THIS SUBROUTINE OPENS THE DISK INPUT
OPN.
PUSH H
PUSH D
PUSH B
XRA A
STA DDP ;CLEAR BUFFER POINTER
MVI C,OPF
LXI D,BFCB
CALL TRAPAD ;TD BDS
POP B
POP D
POP H
RET

; ASSEMBLER LANGUAGE INPUT
ASSM.
CHECK FOR ASSM PRESENT
LXI H,ASSEM ;BASE OF ASSEMBLER
CALL COMLOAD ;COMPARE AGAINST MLOAD
JNC CERROR ;NOT THERE

CALL SCANEXP ;SCAN THE EXPRESSIONS WHICH FOLLOW
DCR A ;ONE EXPRESSION EXPECTED
JNZ CERROR
CALL GETVAL ;GET EXPRESSION TO H,L
SHLD DISPC
CALL ASSEM
JMP START

; ASSEMBLER LANGUAGE OUTPUT LISTING
LASSM.
L<CR> LISTS FROM CURRENT DISASSM PC FOR SEVERAL LINES
L<NUMBER><CR> LISTS FROM <NUMBER> FOR SEVERAL LINES
L<NUMBER>,<NUMBER> LISTS BETWEEN LOCATIONS
CALL CHKDIS ;DISASSM 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 CD8E0E      CALL     GETVAL ;ENX1 TO H,L
246> 0910 220C01      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 CD8E0E      ;
252> 091A 220E01      ANOTHER EXPRESSION FOLLOWS
253> 091D 3D          CALL     GETVAL
254> 091E C2530D      SHLD    DISPM ;SETS MAX VALUE
255> 0921 AF          DCR     A
256> 0922 C32709      JNZ     CERROR ;ERROR IF MORE EXPN'S
257>
258> 0925 3E0C        XRA     A ;CLEAR PAGE MODE
259> 0927 321001      JMP     SPAG0
260> 092A CD0601      MVI     A,PSIZE ;SCREEN SIZE FOR LIST
261> 092D C37108      STA     DISPC
262>
263>
264>
265>
266>
267>
268>
269>
270>
271>
272>
273>
274>
275>
276>
277>
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294>
295>
296>
297>
298>
299>
300>

```

```

301> 095E E3          XTHL
302> 095F E9          PCHL
303>
304>
305> 0960 CD300E      ;
306> 0963 CA7F09      ;
307> 0966 CD0E0E      ;
308> 0969 DA6F09      ;
309> 096C 223A11      ;
310>
311> 096F E67F        ;
312> 0971 3D          ;
313> 0972 CA7F09      ;
314> 0975 CD0E0E      ;
315> 0978 3D          ;
316> 0979 C2530D      ;
317> 097C C38A09      ;
318>
319>
320> 097F 2A3A11      ;
321> 0982 7D          ;
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 CD060D      ;
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
;
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: ;B OR 1 EXPN, DISPLAY HALF SCREEN
LHLD    DISLOC
MOV     A,L
ANI     0FH ;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 ;JUMF 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
INX     H
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> DROP THRU AT END OF CHARACTERS
362> 09CF 2A3A11 LHL D DISLOC
363> 09D2 CD0E0D CALL DISCOM ;END OF DISPLAY?
364> 09D5 DA7108 JC START
365>
366>
367> 09D8 C38D09 NO. CONTINUE WITH NEXT LINE
368> JMP DISP3
369>
370>
371>
372> FILL MEMORY AREA WITH FIXED DATA ELEMENT
373>
374> SCAN3. ;SCAN THREE EXPN'S FOR FILL AND MOVE
375> CALL SCANEXP
376> CPI 3
377> JNZ CERROR
378> CALL GETVAL
379> PUSH H
380> CALL GETVAL
381> PUSH H
382> CALL GETVAL
383> POP D
384> POP B ;BC, DE, HL
385> RET
386>
387> BCDE. ;COMPARE BC > DE (CARRY GEN'D IF TRUE)
388> MOV A, E
389> SUB C
390> MOV A, D
391> SBB B
392> RET
393>
394> FILL.
395> CALL SCAN3 ;EXPRESSIONS SCANNED BC, DE, HL
396> MOV A, H ;MUST BE ZERO
397> ORA A
398> JNZ CERROR
399> CALL BCDE ;END OF FILL?
400> JC START
401> MOV A, L ;DATA
402> STAX B ;TO MEMORY
403> INX B ;NEXT TO FILL
404> JMP FILL0
405>
406>
407> GO COMMAND WITH OPTIONAL BREAKPOINTS
408>
409> GOTO.
410> CALL CRLF ;READY FOR GO.
411> CALL SCANEXP ;0, 1, OR 2 EXPS
412> CALL GETVAL
413> PUSH H ;START ADDRESS
414> CALL GETVAL
415> PUSH H ;BKPT1
416> CALL GETVAL
417> MOV B, H ;BKPT2
418> MOV C, L
419> POP D ;BKPT1
420> POP H ;GOTO ADDRESS
421>
422> COPR.
423> DI

```

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421> 0A20 CA3B0A
422> 0A23 DA290A
423>
424> 0A26 229611
425>
426> 0A29 E67F
427> 0A2B 3D
428> 0A2C CA3B0A
429> 0A2F CD4C0A
430> 0A32 3D
431> 0A33 CA3B0A
432>
433> 0A36 59
434> 0A37 58
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 CA670A
458>
459> 0A57 23
460> 0A58 7E
461> 0A59 23
462> 0A5A 46
463> 0A5B 23
464>
465> 0A5C 8B
466> 0A5D C2670A
467> 0A60 78
468> 0A61 8A
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
LHL PLOC ;PC IN HL
PUSH H ;INTO USER'S STACK
LHL 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
CMP D ;HIGH =?
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      STAX  D      ;TO CODE
482> 0A71 C1      POP   B
483> 0A72 F1      POP   PSW
484> 0A73 C9      RET
485>
486>
487>
488>
489>
490>
491> 0A74 CD300E   CALL  SCANEXP
492> 0A77 FE02     CPI   2
493> 0A79 C2530D   JNZ  CERROR
494> 0A7C CD0E0E   CALL  GETVAL ;FIRST VALUE TO H,L
495> 0A7F E5       PUSH H
496> 0A80 CD0E0E   CALL  GETVAL ;SECOND VALUE TO H,L
497> 0A83 D1       POP   D      ;FIRST VALUE TO D,E
498> 0A84 E5       PUSH H      ;SAVE A COPY OF SECOND VAALUE
499> 0A85 CDBD0D   CALL  CRLF   ;NEW LINE
500> 0A88 19       DAD   D      ;SUM IN H,L
501> 0A8C CD6D0D   CALL  PADDR
502> 0A8F E1       POP   H
503> 0A90 AF       XRA   A      ;RESTORE SECOND VALUE
504> 0A91 95       SUB   L      ;CLEAR ACCUM FOR SUBTRACTION
505> 0A92 5F       MOV   L,A    ;BACK TO L
506> 0A93 3E00     MVI  A,0    ;CLEAR IT AGAIN
507> 0A95 9C       SBB  H
508> 0A96 67       MOV   H,A
509> 0A97 19       DAD   D      ;DIFFERENCE IN HL
510> 0A98 CD6D0D   CALL  PADDR
511> 0A9B C37100   JMP   START
512>
513> ; SET INPUT FILE CONTROL BLOCK (AT 5CH) TO SIMULATE CONSOLE COMMAND
514> INFCB,
515>
516> 0A9E AF       ; FILL FCB AT 5CH
517> 0A9F 327C00   XRA   A
518> 0AA2 325C00   STA  FCB+FCR ;CLEAR CURRENT RECORD
519> 0AA5 CD850D   STA  FCB     ;CLEAR DISK NUMBER
520> 0AA8 0E09     CALL  GNC    ;CHARACTER IN A
521> 0AAA 215D00   MVI  C,9    ;FILE NAME LENGTH+1
522>                LXI  H,FCB+FFH ;START OF NAME
523>
524> FLP, ; FILL NAME
525> 0AAD 77       MOV   M,A
526> 0AAE 23       INX  H
527> 0AAF 0D       DCR  C
528> 0AB0 CA530D   JZ   CERROR ;FILE NAME TOO LONG.
529>
530> 0AB3 CD850D   CALL  GNC    ;READ NEXT CHAR
531> 0AB6 FE2E     CPI   ' '
532> 0AB8 CAC00A   JZ   FLB    ;FOUND .. BLANK OUT
533>                NOT  .. MAY BE CR
534> 0AB9 FE0D     CPI   CR
535> 0ABD C2AD0A   JNZ  FLP    ;FOR ANOTHER STORE
536>
537>                NAME FILLED, EXTEND WITH BLANKS
538> 0AC0 0D       DCR  C
539> 0AC1 CACA0A   JZ   TFT
540> 0AC4 3620     MVI  M,' '
541> 0AC6 23       INX  H

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```

541> 0AC7 C3C00A   JMP   FLB
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 CDB009   ;
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 EB

```

```

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, ;
;
; MOVE0, 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)
;
; CON, ;CON 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  'M'
RET
;
; CONLOAD, ;COMPARE HL > MLOAD
XCHG ;H,L TO D,E

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```
601> 0016 2A6411 LHLD MLOAD ;MLOAD TO H,L
602> 0019 7D MOV A,L ;MLOAD LSB
603> 001A 93 SUB E
604> 001B 7C MOV A,H
605> 001C 9A SBB D ;MLOAD-OLDHL GENS CARRY IF HL>MLOAD
606> 001D EB XCHG
607> 001E C9 RET
608>
609>
610> 001F CD1500 ;CKMLOAD. ;CHECK FOR HL > MLOAD AND SET MLOAD IF SO
611> 0022 00 CALL COMLOAD ;CARRY IF HL>MLOAD
612> 0023 226411 RNC
613> 0026 C9 SHLD MLOAD ;CHANGE IT
614> RET
615>
616> 0027 E5 ;CHKDIS. ;CHECK FOR DISASM PRESENT
617> 0020 210601 PUSH H
618> 0022 CD1500 LXI H,DISEH ;ENTRY POINT
619> 002E E1 CALL COMLOAD
620> 002F C9 POP H
621> RET
622>
623> 0030 CD300E ;READ. CALL SCANEXP
624> 0033 210000 LXI H,0
625> 0036 CA4000 JZ READH
626> 0039 3D DCR A ;ONE EXPRESSION?
627> 003A C2530D JNZ CERROR
628> 003D CD600E CALL GETVAL ;EXPRESSION TO H,L
629> 0040 E5 PUSH H ;SAVE IT FOR BELOW
630> 0041 CDD200 CALL OPN ;OPEN INPUT FILE
631> 0044 FEFF CPI 255
632> 0046 CA530D JZ CERROR
633> CONTINUE IF FILE OPEN WENT OK
634> DISK FILE OPEHED AND INITIALIZED
635>
636>
637> 0049 CD0400 ;CHECK FOR 'COM' FILE AND LOAD DIRECT TIL EOF
638> 004C C27500 CALL COM ;LOOK FOR 'COM'
639> JNZ HREAD
640>
641> 004F E1 ;COM FILE, LOAD WITH OFFSET GIVEN BY PUSHED REGISTER H
642> 0050 110001 POP H
643> 0053 19 LXI D,100H ;BASE OF TRANSPARENT AREA
644> DAD D
645> REG H HOLDS LOAD ADDRESS
646> 0054 E5 ;LOAD COM FILE
647> 0055 115C00 PUSH H ;SAVE DMA ADDRESS
648> 0058 0E14 LXI D,DFCB
649> 005A CD1E00 MVI C,RDF ;READ SECTOR
650> 005D E1 CALL TRAPAD
651> 005E B7 POP H
652> 005F C2DA00 GRA A ;SET FLAGS TO CHECK RETURN CODE
653> JNZ RLIFT
654> 0062 110000 ;MOVE FROM 00H TO LOAD ADDRESS IN H,L
655> 0065 0E00 LXI D,DFB
656> 0067 1A MVI C,00H ;BUFFER SIZE
657> 0068 13 LDAH D ;LOAD NEXT BYTE
658> 0069 77 INX D
659> 006A 23 MOV M,A ;STORE NEXT BYTE
660> 006B 0D INX H
DCR C
```

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```
661> 006C C26700 JNZ LCOM1
662> LOADED, CHECK ADDRESS AGAINST MLOAD
663> 006F CD1F00 CALL CKMLOAD
664> 0072 C35400 JMP LCOM0
665>
666>
667>
668> 0075 CD1C0D ;OTHERWISE ASSUME HEX FILE IS BEING LOADED
669> 0078 FE1A CALL DISKR ;NEXT CHAR TO ACCUM
670> 007A CA530D CPI DEOF ;PAST END OF TAPE?
671> 007D DE3A JZ CERROR ;FOR ANOTHER COMMAND
672> 007F C27500 SBI ' '
673> JNZ HREAD ;LOOKING FOR START OF RECORD
674>
675> 0082 57 ;START FOUND, CLEAR CHECKSUM
676> 0083 E1 MOV D,A
677> 0084 E5 POP H
678> 0085 CDBA00 PUSH H
679> 0088 5F CALL RBYTE
680> 0089 CDBA00 MOV E,A ;SAVE LENGTH
681> 008C F5 CALL RBYTE ;HIGH ORDER ADDR
682> 008D CDBA00 PUSH PSW
683> 0090 C1 CALL RBYTE ;LOW ORDER ADDR
684> 0091 4F POP B
685> 0092 09 MOV C,A
686> 0093 7B DAD B ;BIASED ADDR IN H
687> 0094 B7 MOV A,E ;CHECK FOR LAST RECORD
688> 0095 C2A000 ORA A
689> JNZ RDTYPE
690> 0098 60 ;END OF TAPE, SET LOAD ADDRESS
691> 0099 69 MOV H,B
692> 009A 229611 MOV L,C
693> 009D C3DA00 SHLD PLOC ;SET PC VALUE
694> JMP RLIFT ;FOR ANOTHER COMMAND
695>
696> 00A0 CDBA00 ;RDTYPE. CALL RBYTE ;RECORD TYPE = 0
697>
698>
699> 00A3 CDBA00 ;LOAD RECORD
700> 00A6 77 CALL RBYTE
701> 00A7 23 MOV M,A
702> 00A8 1D INX H
703> 00A9 C2A300 DCR E
704> JNZ RED1 ;FOR ANOTHER BYTE
705> 00AC CDBA00 ;OTHERWISE AT END OF RECORD - CHECKSUM
706> 00AF F5 CALL RBYTE
707> 00B0 CD1F00 PUSH PSW ;FOR CHECKSUM CHECK
708> 00B3 F1 CALL CKMLOAD ;CHECK AGAINST MLOAD
709> 00B4 C2530D POP PSW
710> 00B7 C37500 JNZ CERROR ;CHECKSUM ERROR
711> JMP HREAD ;FOR ANOTHER RECORD
712>
713> 00BA C5 ;RBYTE. ;READ ONE BYTE FROM BUFF AT WBP TO REC-A
714> 00BB E5 COMPUTE CHECKSUM IN REC-D
715> 00BC D5 PUSH B
716> 00BD CD1C0D PUSH H
717> 00C0 CDB10E PUSH D
718> CALL DISKR ;GET ONE MORE CHARACTER
719> 00C0 CDB10E CALL HEXCON ;CONVERT TO HEX (OR ERROR)
720>
```

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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 CDB10E CALL HEXCON
730>
731> OTHERWISE SECOND NIBBLE OK, SO MERGE
732> 08D0 C1 POP B ;PREVIOUS NIBBLE TO REG-B
733> 08D1 80 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 ;ACCUMULATING
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
742> 08D9 C9 RET ;BACK TO INITIAL STATE WITH ACCUM SET
743>
744> RLIFT: ;LIFT HEAD ON DISK BEFORE RETURNING
745> 08DA 0E0C MVI C,LIFT
746> 08DC CD1E08 CALL TRAPAD
747> ;'NEXT' 'PC'
748> 08DF 21030C LXI H,MSG ;LOAD MESSAGE
749> RLIO: MOV A,M
750> 08E3 B7 ORA A ;LAST CHAR
751> 08E4 CAEE0B JZ RLII
752> 08E7 CD6F0D CALL PCHAR
753> 08EA 23 INX H ;NEXT CHAR
754> RLII: JMP RLIO
755> 08EE CDBD0D CALL CALF
756> 08F1 2A6411 LHL MLOAD
757> 08F4 CDD60D CALL PADDR
758> 08F7 CD6D0D CALL BLANK
759> 08FA 2A9611 LHL PLOC
760> 08FD CDD60D CALL PADDR
761> 0900 C37108 JMP START
762> 0903 0D0A4E4558LMSG. DB CR,LF,'NEXT PC',0
763>
764> SET MEMORY COMMAND
765>
766> SETHEM: ;ONE EXPRESSION EXPECTED
767> 090E CD380E CALL SCANEXP ;SETS FLAGS
768> 0911 3D DCR A ;ONE EXPRESSION ONLY
769> 0912 C2530D JNZ CERROR
770> 0915 CD0E0E CALL GETVAL ;START ADDRESS IS IN H,L
771> 0918 CDBD0D CALL CRLF ;NEW LINE
772> 091B E5 PUSH H ;SAVE CURRENT ADDRESS
773> 091C CDD60D CALL PADDR ;PRINTED
774> 091F CD6D0D CALL BLANK ;SEPARATOR
775> 0922 E1 POP H ;GET DATA
776> 0923 7E MOV A,M
777> 0924 E5 PUSH H ;SAVE ADDRESS TO FILL
778> 0925 CDAD0D CALL PBYTE ;PRINT BYTE
779> 0928 CD6D0D CALL BLANK ;ANOTHER SEPARATOR
780> 092B CD5E0D CALL GETBUFF ;FILL INPUT BUFFER
781> 092E 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 CERROR ;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 CERROR ;DATA IS IN L
795> 0C4C 7D MOV A,L
796> 0C4D E1 POP H ;RESTORE DATA VALUE
797> 0C4E 77 MOV M,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 JEFF MVI A,OFFH ;SET TRACE MODE FLAG
808>
809> 0C59 322911 STA TMODE
810> 0C5C CD300E CALL SCANEXP
811> 0C5F 210000 LXI H,0
812> 0C62 222511 SHLD USERBRK ;CLEAR USERBRK
813> 0C65 CAB60C JZ TRAC0
814>
815> EXPRESSIONS WERE GIVEN, FORMS ARE
816> TX TRACE FOR X STEPS ACC = 1
817> TX, BRK TRACE FOR X STEPS, CALL 'BRK' AT EACH STOP ACC=2
818> T, BRK CALL 'BRK' ACC = 1, CY = 1
819>
820> 0C68 DA760C JC SETTR0
821> 0C6B CDBE0E CALL GETVAL ;TO H,L
822> 0C6E F5 PUSH PSW
823> 0C6F 7D MOV A,L ;CHECK FOR ZERO
824> 0C70 B4 ORA H
825> 0C71 CA530D JZ CERROR
826> 0C74 F1 POP PSW ;RECALL NUMBER OF PARAMETERS
827> 0C75 2B DCR H ;TRACE VALUE - 1
828> 0C76 E5 ;H,L CONTAINS TRACE COUNT, SAVE IT FOR LATER
829>
830> LOOK FOR BREAK ADDRESS
831> 0C77 3D DCR A ;IF ONLY ONE SPECIFIED, THEN SKIP USERBRK
832> 0C78 CA950C JZ SETTR1
833> 0C7B 3D DCR A ;MUST BE TWO VALUES
834> 0C7C C2530D JNZ CERROR ;MORE THAN TWO SPECIFIED
835> 0C7F CD0E0E CALL GETVAL ;VALUE TO H,L
836> 0C82 222511 SHLD USERBRK
837> SETTR1: ;RECALL TRACE COUNT
838> 0C85 E1 POP H
839> 0C86 222A11 SHLD TRACR
840> 0C89 CDEC0E CALL DSTATE ;STARTING STATE IS DISPLAYED
841> 0C8C C31F0A JMP GOPR ;SETS BREAKPOINTS AND STARTS EXECUTION

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041>
042>
043>
044> 0C0F CD050D
045> 0C92 FE0D
046> 0C94 C29D0C
047> 0C97 CDEC0E
048> 0C9A C37108
049>
050>
051> 0C9D 010B00
052>
053> 0CA0 215B0F
054> 0CA3 BE
055> 0CA4 CAB00C
056> 0CA7 23
057> 0CA8 04
058> 0CA9 0D
059> 0CAA C2A30C
060>
061> 0CAD C3530D
062>
063>
064> 0CB0 CD050D
065> 0CB3 FE0D
066> 0CB5 C2530D
067>
068>
069> 0CB8 C5
070> 0CB9 CDBD0D
071> 0CBC CDC20E
072> 0CCF CD6D0D
073> 0CC2 CD5E0D
074> 0CC5 CD300E
075> 0CC8 B7
076> 0CC9 CA7108
077> 0CCC 3D
078> 0CCD C2530D
079> 0CD0 CD0E0E
080> 0CD3 C1
081>
082> 0CD4 78
083> 0CD5 FE05
084> 0CD7 D2010D
085>
086> 0CDA 7C
087> 0CDB B7
088> 0CDC C2530D
089> 0CDF 7D
090> 0CE0 FE02
091> 0CE2 D2530D
092>
093> 0CE5 CD8B0E
094>
095> 0CE8 67
096> 0CE9 41
097> 0CEA 3EFE
098> 0CEC CDFB0C
099> 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

; REGISTER CHANGE OPERATION
EXAM0,
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

; MATCH IN RVECT, B HAS REGISTER NUMBER
EXAM2,
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 ;NDNE?
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

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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

; LEFT ROTATE FOR FLAG SETTING
LROTATE,
PATTERN IS IN REGISTER A, COUNT IN REGISTER B
DCR B
RZ ;ROTATE COMPLETE
RLC ;END-AROUND ROTATE
JMP LROTATE

; MAY BE ACCUMULATOR CHANGE
EXAM4,
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

; MUST BE DOUBLE REGISTER PAIR
EXAM5,
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

; DISK READ
DISKR,
;DISK READ
PUSH H
PUSH D
PUSH B

; READ DISK INPUT
RDI,
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

; NEXT BUFFER IN
NDI,
MVI C,RDF

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961> 003E 115C00 LXI D,DFCB
962> 0041 CD1E00 CALL TRAPAD
963> 0044 B7 GRA A
964> 0045 C24E0D JNZ DEF
965>
966>
967> 0048 325800 ; BUFFER READ OK
968> 004B C3270D STA DBP ;STORE 00H
969> JMP RDC
970>
971> 004E 37 DEF ;SET CARRY AND RETURN (END FILE)
972> STC
973> RRET, POP B
974> POP D
975> POP H
976> 0052 C9 RET
977>
978>
979> 0053 C0B10D ; ERROR: ;ERROR IN COMMAND
980> 0056 3E3F CALL CRLF
981> 0058 CD6F0D MVI A,'?'
982> 005B C3710D CALL PCHAR
983> JMP START
984>
985> ; SUBROUTINES
986> GETBUFF, ;FILL COMMAND BUFFER AND SET POINTERS
987> MVI C,GETF ;GET BUFFER FUNCTION
988> LXI D,COMLEN;START OF COMMAND BUFFER
989> CALL TRAPAD ;FILL BUFFER
990> LXI H,COMBUF;NEXT TO GET
991> SHLD NEXTCOM
992> RET
993>
994> BLANK, MVI A,' '
995>
996> PCHAR, ;PRINT CHARACTER TO CONSOLE
997> PUSH H
998> PUSH D
999> PUSH B
000> MOV E,A
001> MVI C,COF
002> CALL TRAPAD
003> POP B
004> POP D
005> POP H
006> 0076 C9 RET
007>
008>
009> TRANS,
010> ; TRANSLATE TO UPPER CASE
011> CPI 7FH ;RUBOUT?
012> RZ
013> CPI ('A' OR 01000000) ;UPPER CASE A
014> RC
015> ANI 1011111B ;CLEAR UPPER CASE BIT
016> RET
017>
018>
019> GNC,
020> ; GET NEXT BUFFER CHARACTER FROM CONSOLE
021> PUSH H ;SAVE FOR REUSE LOCALLY
022> LXI H,CURLN

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021> 0089 7E MOV A,M
022> 008A E7 ORA A ;ZERO?
023> 008B 3E0D MVI A,CR
024> 008D CA9C0D JZ GNCRET ;RETURN WITH CR IF EXHAUSTED
025> 0090 35 DCR H ;CURLN=CURLN-1
026> 0091 2A4011 LHLD NEXTCOM
027> 0094 7E MOV A,M ;GET NEXT CHARACTER
028> 0095 23 INX H ;NEXTCOM=NEXTCOM+1
029> 0096 224011 SHLD NEXTCOM ;UPDATED
030> 0099 CD7C0D CALL TRANS
031> 009C E1 GNCRET, POP H ;RESTORE ENVIRONMENT
032> 009D C9 RET
033>
034>
035> 009E FE0A ;PRINT NIBBLE IN LO ACCUM
036> 00A0 D2A80D CPI 10
037> 00A3 C630 JNC PHIBH ;JUMP IF A-
038> 00A5 C36F0D ADI '0'
039> 00A8 C637 JMP PCHAR ;RET THRU PCHAR
040> 00AA C36F0D PHIBH, ADI 'A'-10
041> JMP PCHAR
042>
043> 00AD F5 ;BYTE, PUSH PSW ;SAVE A COPY FOR LO NIBBLE
044> 00AE 1F RAR
045> 00AF 1F RAR
046> 00B0 1F RAR
047> 00B1 1F RAR
048> 00B2 E60F ANI 0FH ;MASK HO NIBBLE TO LO NIBBLE
049> 00B4 CD9E0D CALL PHIB
050> 00B7 F1 POP PSW ;RECALL BYTE
051> 00B8 E60F ANI 0FH
052> 00BA C39E0D JMP PHIB
053>
054> 00BD 3E0D ;CRLF, ;CARRIAGE RETURN LINE FEED
055> 00BF CD6F0D MVI A,CR
056> 00C2 3E0A CALL PCHAR
057> 00C4 C36F0D MVI A,LF
058> JMP PCHAR
059>
060>
061> 00C7 C5 ;BREAK, ;CHECK FOR BREAK KEY
062> 00C8 D5 PUSH B
063> 00C9 E5 PUSH D
064> 00CA 0C0B PUSH H
065> 00CC CD1E00 MVI C,CHKIO
066> 00CF E601 CALL TRAPAD
067> 00D1 E1 ANI 1B
068> 00D2 D1 POP H
069> 00D3 C1 POP D
070> 00D4 C9 POP B
071> RET
072>
073>
074> PADDX, ;SAME AS PADDR, EXCEPT PRINT VALUE IN D,E
075> XCHG
076>
077> PADDR, ;PRINT THE ADDRESS VALUE IN H,L
078> MOV A,H
079> CALL PBYTE
080> MOV A,L
081> JMP PBYTE
082>
083>
084> PGRAPH, ;PRINT GRAPHIC CHARACTER IN REG-A OR '.' IF NOT

```

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```

061> 00DE FE7F      CPI      7FH
062> 00E0 D2E80D    JNC      PPERIOD
063> 00E3 FE20      CPI      ' '
064> 00E5 D26F0D    JNC      PCHAR
065>
066> 00E8 3E2E      MVI      A, ' '
067> 00EA C36F0D    JMP      PCHAR
068>
069>
090> 00ED EB         XCHG
091> 00EE 2A3C11    LHLD    DISMAX
092> 00F1 7D        MOV     A, L
093> 00F2 93        SUB     E
094> 00F3 6F        MOV     L, A ;REPLACE FOR ZERO TESTS LATER
095> 00F4 7C        MOV     A, H
096> 00F5 9A        SBB    D
097> 00F6 EB        XCHG
098> 00F7 C9        RET
099>
100>
101> 00F8 FE0D      CPI      CR
102> 00FA C8        RZ
103> 00FB FE2C      CPI      ' '
104> 00FD C8        RZ
105> 00FE FE20      CPI      ' '
106> 0000 C9        RET
107>
108>
109> 0001 D630      SUI     '0'
110> 0003 FE0A      CPI     10
111> 0005 D8        RC      ;MUST BE 0-9
112> 0006 C8F9      ADI     ('0'-'A'+10) AND 0FFH
113> 0008 FE10      CPI     15
114> 000A D8        RC      ;MUST BE 0-15
115> 000B C3530D    JMP     CERROR ;BAD HEX DIGIT
116>
117>
118> 000E EB        XCHG
119> 000F 5E        MOV     E, M
120> 0010 23        INX     H
121> 0011 56        MOV     D, M
122> 0012 23        INX     H
123> 0013 EB        XCHG
124> 0014 C9        RET
125>
126>
127> 0015 EB        XCHG
128> 0016 210000    LXI     H, 0
129>
130> 0019 CD010E    CALL    HEXCON
131> 001C 29        DAD     H ;*2
132> 001D 29        DAD     H ;*4
133> 001E 29        DAD     H ;*8
134> 001F 29        DAD     H ;*16
135> 0020 05        ORA     L ;HL=HL*HEX
136> 0021 6F        MOV     L, A
137> 0022 CD850D    CALL    GNC
138> 0025 CDF00D    CALL    DELIM ;DELIMITER?
139> 0028 C2190E    JNZ     GETEXP0
140> 002B EB        XCHG

```

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```

141> 0E2C C9        RET
142>
143>
144> 0E2D 73        MOV     M, E
145> 0E2E 23        INX     H
146> 0E2F 72        MOV     M, D
147> 0E30 23        INX     H
148> 0E31 E5        PUSH    H
149> 0E32 213311    LXI     H, EXPLIST
150> 0E35 34        INR     M ;COUNT NUMBER OF EXPN'S
151> 0E36 E1        POP     H
152> 0E37 C9        RET
153>
154>
155>
156>
157> 0E38 CD850D    CALL    GNC
158>
159> 0E3B 213311    LXI     H, EXPLIST
160> 0E3E 3600      MVI     M, 0 ;ZERO EXPRESSIONS
161> 0E40 23        INX     H ;READY TO FILL EXPRESSION LIST
162> 0E41 FE0D      CPI     CR ;END OF LINE
163> 0E43 CA7D0E    JZ      SCANRET
164>
165>
166> 0E46 FE2C      CPI     ' '
167> 0E48 C2560E    JNZ     SCAN0
168>
169> 0E4B 3E00      MARK    AS COMMA
170> 0E4D 323311    MVI     A, 00H
171> 0E50 110000    STA     EXPLIST
172> 0E53 C3530E    LXI     D, 0
173>
174>
175> 0E56 CD150E    JMP     SCAN0
176>
177> 0E59 CD2D0E    CALL    GETEXP ;EXPRESSION TO D,E
178> 0E5C FE0D      CALL    SCSTORE ;STORE THE EXPRESSION AND INCREMENT H,L
179> 0E5E CA7D0E    CPI     CR
180> 0E61 CD850D    JZ      SCANRET
181> 0E64 CD150E    CALL    GNC
182> 0E67 CD150E    CALL    GETEXP
183>
184> 0E6A FE0D      CALL    SCSTORE
185> 0E6F CD850D    CALL    GNC
186> 0E72 CD150E    CALL    GETEXP
187> 0E75 CD2D0E    CALL    SCSTORE
188> 0E78 FE0D      CPI     CR
189> 0E7A C2530D    JNZ     CERROR
190>
191>
192> 0E7D 113311    LXI     D, EXPLIST ;LOOK AT COUNT
193> 0E80 1A        LDAX    D ;LOAD COUNT TO ACC
194> 0E81 FE01      CPI     01H ;, WITHOUT 0?
195> 0E83 CA530D    JZ      CERROR
196> 0E86 13        INX     D ;READY TO EXTRACT EXPN'S
197> 0E87 07        ORA     A ;ZERO FLAG MAY BE SET
198> 0E88 07        RLC
199> 0E89 0F        RRC ;SET CARRY IF NO BIT SET (.B)
200> 0E8A C9        RET ;WITH FLAGS SET

```

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```

201>
202>
203>
204>
205>
206>
207> 0E38 E5
208> 0E3C 216E0F
209> 0E3F 58
210> 0E39 1600
211> 0E32 19
212> 0E33 4E
213> 0E34 219011
214> 0E37 7E
215> 0E38 EB
216> 0E39 E1
217> 0E3A C9
218>
219>
220> 0E98 CD800E
221> 0E9E 0D
222> 0E3F CAAG0E
223> 0EA2 1F
224> 0EA3 C39E0E
225> 0E96 E601
226> 0EA8 C9
227>
228>
229> 0EA9 0606
230> 0EAB 21660F
231> 0EAE 5F
232> 0EAF 1600
233> 0EB1 19
234> 0EB2 5E
235> 0E93 16FF
236> 0E95 219011
237> 0EB0 19
238> 0EB9 C9
239>
240>
241> 0EBA CDA90E
242> 0EBD 5E
243> 0EBE 23
244> 0EBF 56
245> 0EC0 EB
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 TEMPL
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,RINK ;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 PNIB
RET

DELT0, ;NOT FLAG, DISPLAY = AND DATA

```

```

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 CDB601
0F2B C3570F

```

```

0F2E 28
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,RVECT ;REGISTER VECTOR
MVI B,0 ;REGISTER COUNT
CALL CALF

```

```

; DSTAB,
PUSH B
PUSH H
CALL DELT ;ELEMENT DISPLAYED
POP H ;RVECT 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 DSTAB
; YES, BLANK AND GO AGAIN
CALL BLANK
JMP DSTAB

```

```

; READY TO SEND DECODED INSTRUCTION

```

```

; DSTA1,
CALL BLANK
CALL HRRK ;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 DISASSM PC
LXI H,DISPG,PAGE NODE = 0FFH TO TRACE
MVI M,0FFH
CALL DISEN
JMP DSTRET

```

```

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

```

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```

21> 0F39 23      INX      H      ;READY FOR NEXT BYTE
22> 0F3A CDE0D0  CALL    DISCOM  ;ZERO SET IF ONE BYTE TO PRINT, CARRY IF NO MO
23> 0F3D DA578F  JC      DSTRET
24> 0F40 F5      PUSH   PSW     ;SAVE RESULT OF ZERO TEST
25> 0F41 CD650D  CALL    BLANK   ;SEPARATOR
26> 0F44 F1      POP     PSW     ;RECALL ZERO
27> 0F45 B3      ORA    E      ;ZERO TEST
28> 0F46 CA530F  JZ      DSTA2
29>
30> 0F49 5E      ;
31> 0F4A 23      MOV    A,M
32> 0F4B 56      INX    H
33> 0F4C EB      MOV    D,M
34> 0F4D CDD60D  XCHG
35> 0F50 C3570F  CALL   PADDR   ;PRINT ADDRESS
36>
37>
38> 0F53 7E      ;DSTA2, ;PRINT BYTE VALUE
39> 0F54 CDAD0D  MOV    A,M
40>
41>
42> 0F57 C1      ;DSTRET, POP    B      ;AUX BREAKPOINT
43> 0F58 D1      PDP    D      ;RESTORE BREAKPOINT
44> 0F59 F1      POP    PSW    ;RESTORE COUNT
45> 0F5A C9      RET
46>
47> 0F5B 435A4D4549RVECT, DB 'CZHEIAGDHSP'
48> 0F66 F6      RINX, DB (<BLOC-STACK) AND 0FFH ;LOCATION OF BC
49> 0F67 F4      DB (<DLOC-STACK) AND 0FFH ;LOCATION OF DE
50> 0F68 FC      DB (<HLOC-STACK) AND 0FFH ;LOCATION OF HL
51> 0F69 FA      DB (<SLOC-STACK) AND 0FFH ;LOCATION OF SP
52> 0F6A FE      DB (<PLOC-STACK) AND 0FFH ;LOCATION OF PC
53>
54> 0F6B 0107000305FLGTAB, FLGTAB ELEMENTS DETERMINE SHIFT COUNT TO SET/EXTRACT FLAGS
55> DB 1,7,8,3,5 ;CY, ZER, SIGN, PAR, IDCY
56>
57> 0F70 218000  ;CLRTRACE, LXI    H,0 ;CLEAR THE TRACE FLAG
58> 0F73 222A11  SHLD   TRACER
59> 0F76 C9      RET
60>
61>
62> 0F77 F3      ;BREAKP, DI ;ARRIVE HERE WHEN PROGRAMMED BREAK OCCURS
63> 0F78 229411  SHLD   HLOC    ;HL SAVED
64> 0F7B E1      POP    H      ;RECALL RETURN ADDRESS
65> 0F7C 28      DCX    H      ;DECREMENT FOR RESTART
66> 0F7D 229611  SHLD   PLOC
67>
68> 0F80 F5      ;DAD SP BELOW DESTROYS CY, SO SAVE AND RECALL
69> 0F81 210200  PUSH   PSW    ;INTO USER'S STACK
70> 0F84 39      LXI    H,2    ;BIAS SP BY 2 BECAUSE OF PUSH
71> 0F85 F1      DAD    SP     ;SP IN HL
72> 0F86 319411  POP    PSW    ;RESTORE CY AND FLAGS
73> 0F89 E5      LXI    SP,STACK-4;LOCAL STACK
74> 0F8A F5      PUSH   H      ;SP SAVED
75> 0F8B C5      PUSH   B
76> 0F8C D5      PUSH   D
77>
78> 0F8D 2A9611  ;MACHINE STATE SAVED, CLEAR BREAK POINTS
79> 0F90 7E      LHLD   PLOC   ;CHECK FOR RST INSTRUCTION
80> 0F91 FEFF   MOV    A,M    ;OPCODE TO A
CPI    RSTIN

```

TEST
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```

381> 0F93 F5
382>
383>
384> 0F94 E5
385>
386>
387> 0F95 212C11
388> 0F98 7E
389> 0F99 3600
390> 0F9B B7
391> 0F9C CAAC0F
392> 0F9F 3D
393> 0FA0 47
394> 0FA1 23
395> 0FA2 5E
396> 0FA3 23
397> 0FA4 75
398> 0FA5 23
399> 0FA6 7E
400> 0FA7 12
401> 0FA8 78
402> 0FA9 C39B0F
403>
404>
405> 0FAC E1
406> 0FAD F1
407> 0FAE CACD0F
408>
409>
410> 0FB1 23
411> 0FB2 229611
412> 0FB5 EB
413> 0FB6 010612
414> 0FB9 CDF109
415> 0FBC DACD0F
416>
417>
418> 0FBF CD700F
419> 0FC2 2A2711
420> 0FC5 EB
421> 0FCF 3E02
422> 0FC0 B7
423> 0FC9 37
424> 0FCA C31F0A
425>
426>
427> 0FCD FB
428> 0FCE 2A2A11
429> 0FD1 7C
430> 0FD2 B5
431> 0FD3 CAF30F
432>
433>
434> 0FD6 2B
435> 0FD7 222A11
436> 0FDA CDC70D
437> 0FDD C2F30F
438> 0FE0 3A2911
439> 0FE3 B7
440> 0FE4 C2ED0F

```

```

;SAVE CONDITION CODES FOR LATER TEST
PUSH   PSW
;SAVE PLOC FOR LATER INCREMENT OR DECREMENT
PUSH   H
;
;CLEAR BREAKPOINTS WHICH ARE PENDING
LXI    H,BREAKS
MOV    A,M
MVI    M,0 ;SET TO ZERO BREAKS
CLER0: ORA    A ;ANY MORE?
JZ     CLER1
DCR    A
MOV    B,A ;SAVE COUNT
INX    H ;ADDRESS OF BREAK
MOV    E,M ;LOW ADDR
INX    H
MOV    D,M ;HIGH ADDR
STAX   D ;INSTRUCTION
MOV    A,B ;BACK TO PROGRAM
JMP    CLER0
;
CLER1: ;CLEARED, CONTINUE TRACING, OR STOP EXECUTION
POP    H ;RESTORE PLOC
POP    PSW ;RESTORE CONDITION FLAGS
JZ     BREAK0 ;BRANCH IF PROGRAMMED INTERRUPT
;
;MUST BE FRONT PANEL INTERRUPT, CHECK IF IN BDOS
INX    H ;DON'T DECREMENT ON PANEL INTERRUPT
SHLD   PLOC ;RESTORE TO NEXT LOGICAL INSTRUCTION
XCHG ;TO D,E FOR COMPARE
LXI    B,BDOS ;BASE OF BDOS
CALL   BCDE ;CY IF BDOS ^PLOC
JC     BREAK0 ;BRANCH IF PLOC <= BDOS
;
;IN THE BDOS, DON'T BREAK UNTIL THE RETURN OCCURS
CALL   CLRTRACE ;CLEAR TRACE FLAGS
LHLD   RETLOC ;TRAPPED RETLOC ON ENTRY TO DOS
XCHG ;TO D,E READY FOR BREAKPOINT
MVI    A,02H ;LOOKS LIKE G,BBBB
ORA    A ;SETS FLAGS
STC ;SUBSEQUENT TEST FOR CY
JMP    GOPR ;START PROGRAM EXECUTION, WITH BREAKPOINT
;
BREAK0: ;NORMAL BREAKPOINT
EI
LHLD   TRACER
MOV    A,M
ORA    L
JZ     STOPEX
;
;TRACE IS ON
DCX    H
SHLD   TRACER
CALL   BREAK ;BREAK KEY DEPRESSED?
JNZ    STOPEX
LDA    TMODE ;TRACE MODE T IF 0FFH
ORA    A
JNZ    BREAK1

```

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441>      ) NOT TRACING, BUT MONITORING, SO SET BREAKPOINTS
442> 0FE7 CD3010 ) CALL HBRK
443> 0FEA C31F8A ) JMP Gopr
444>
445> BREAK1: ) TRACING AND MONITORING
446> 0FED CDEC0E ) CALL DSTATE )STATE DISPLAYED, CHECK FOR BREAKPOINTS
447> 0FF0 C31F8A ) JMP Gopr )STARTS EXECUTION
448>
449> STOPEX: )
450> 0FF3 210000 ) LXI H,0
451> 0FF6 222511 ) SHLD USERBRK )CLEAR USER BREAK ADDRESS
452> 0FF9 CD700F ) CALL CLRTRACE )TRACE FLAGS GO TO ZERO
453> 0FFC 3E2A ) MVI A,'*'
454> 0FFE CD6F0D ) CALL PCHAR
455> 1001 2A9611 ) LHL PLOC
456>
457> 1004 CD270B ) )
458> 1007 D20D10 ) CALL CHKDIS
459> 100A 220C01 ) JNC STOP0
460> 100D CD060D ) SHLD DISPC
461> 1010 2A9411 ) CALL PADDR
462> 1013 223A11 ) LHL HLOC
463> 1016 C37100 ) SHLD DISLOC
464> ) JMP START
465>
466> CAT: )DETERMINE OPCODE CATEGORY - CODE IN REGISTER B
467> 1019 110D00 ) D,E CONTAIN DOUBLE PRECISION CATEGORY NUMBER ON RETURN
468> 101C 210A11 ) LXI D,OPMAX )D=0,E=OPMAX
469> 101F 7E ) LXI H,OPLIST
470> 1020 AB ) MOV A,M )MASK TO A
471> 1021 23 ) ANA B )MASK OPCODE FROM B
472> 1022 BE ) INX H )READY FOR COMPARE
473> 1023 23 ) CMP M )SAME AFTER MASK?
474> 1024 CA2C10 ) INX H )READY FOR NEXT COMPARE
475> 1027 14 ) JZ CAT1 )EXIT IF COMPARED OK
476> 1028 1D ) INR D )UP COUNT IF NOT MATCHED
477> 1029 C21F10 ) DCR E )FINISHED?
478> 102C 5A ) JNZ CAT0
479> 102D 1600 ) MOV E,D )E IS CATEGORY NUMBER
480> 102F C9 ) MVI D,0 )DOUBLE PRECISION
481> ) RET
482>
483> NBRK: )FIND NEXT BREAK POINT ADDRESS
484> ) UPON RETURN, REGISTER A IS SETUP AS IF USER TYPED G,B1,B2 DR
485> ) G,B1 DEPENDING UPON OPERATOR CATEGORY. B,C CONTAINS SECOND BP
486> ) D,E CONTAINS PRIMARY BP. HL ADDRESS NEXT OPCODE BYTE
487> 1030 2A9611 ) LHL PLOC
488> 1033 46 ) MOV B,M )GET OPERATOR
489> 1034 23 ) INX H )HL ADDRESS BYTE FOLLOWING OPCODE
490> 1035 E5 ) PUSH H )SAVE IT FOR LATER
491> 1036 CD1910 ) CALL CAT )DETERMINE OPERATOR CATEGORY
492> 1039 212411 ) LXI H,CATNO )SAVE CATEGORY NUMBER
493> 103C 73 ) MOV M,E
494> 103D 214710 ) LXI H,CATTAB;CATEGORY TABLE BASE
495> 1040 19 ) DAD D )INXED
496> 1041 19 ) DAD D )INXED*2
497> 1042 5E ) MOV E,M )LOW BYTE TO E
498> 1043 23 ) INX H
499> 1044 56 ) MOV D,M )HIGH BYTE TO D
500> 1045 EB ) XCHG
501> 1046 E9 ) PCHL )JUMP INTO TABLE

```

```

502> 1047 6310 ) CATTAB: DW JMPOP )JUMP OPERATOR
503> 1048 8910 ) DW CCOP )JUMP CONDITIONAL
504> 104B 6310 ) DW JMPOP )CALL OPERATOR (TREATED AS JMP)
505> 104D 8910 ) DW CCOP )CALL CONDITIONAL
506> 104F 6910 ) DW RETOP )RETURN FROM SUBROUTINE
507> 1051 9810 ) DW RSTOP )RESTART
508> 1053 AD10 ) DW PCOP )PCHL
509> 1055 CF10 ) DW IMOP )SINGLE PRECISION IMMEDIATE (2 BYTE)
510> 1057 CF10 ) DW IMOP )ADI ... CPI
511> 1059 CC10 ) DW DIMOP )DOUBLE PRECISION IMMEDIATE (3 BYTES)
512> 105B CC10 ) DW DIMOP )LHL ... STA
513> 105D C210 ) DW RCOP )RETURN CONDITIONAL
514> 105F CF10 ) DW IMOP )IN/OUT
515> ) NEXT DW MUST BE THE LAST IN THE SEQUENCE
516> 1061 BD10 ) DW SIMOP )SIMPLE OPERATOR (1 BYTE)
517>
518> 1063 CD7710 ) JMPOP: )GET OPERAND FIELD, CHECK FOR BDOS
519> 1066 C2D210 ) CALL GETOPA )GET OPERAND ADDRESS TO D,E AND COMPARE WITH
520> ) JNZ ENDP )TREAT AS SIMPLE OPERATOR IF NOT BDOS
521> ) OTHERWISE, TREAT AS A RETURN INSTRUCTION
522> 1069 CD8210 ) RETOP: CALL GETSP )ADDRESS AT STACKTOP TO D,E
523> 106C C3D210 ) JMP ENDP )TREAT AS SIMPLE OPERATOR
524> )
525> )
526> 106F 3E06 ) CBDOS: )COMPARE D,E WITH BDOS ADDRESS, RETURN ZERO IF EQUAL
527> 1071 BB ) MVI A,BDOS AND OFFH
528> 1072 C0 ) CMP E
529> 1073 3E12 ) RNZ
530> 1075 BA ) MVI A,BDOS SHR 8
531> 1076 C9 ) CMP D
532> ) RET
533> )
534> 1077 C1 ) GETOPA: )GET OPERAND ADDRESS AND COMPARE WITH BDOS
535> 1078 E1 ) POP B )GET RETURN ADDRESS
536> 1079 5E ) POP H )GET OPERAND ADDRESS
537> 107A 23 ) MOV E,M
538> 107B 56 ) INX H
539> 107C 23 ) MOV D,M
540> 107D E5 ) INX H
541> 107E C5 ) PUSH H )UPDATED PC INTO STACK
542> 107F C36F10 ) PUSH B )RETURN ADDRESS TO STACK
543> ) JMP CBDS )RETURN THROUGH CBDOS WITH ZERO FLAG SET
544> )
545> 1082 2A9211 ) GETSP: )GET RETURN ADDRESS FROM USER'S STACK TO D,E
546> 1085 5E ) LHL SLOC
547> 1086 23 ) MOV E,M
548> 1087 56 ) INX H
549> 1088 C9 ) MOV D,M
550> ) RET
551> )
552> 1089 CD7710 ) CCOP: )CALL CONDITIONAL OPERATOR
553> 108C CA9610 ) CALL GETOPA )GET OPERAND ADDRESS TO D,E / COMPARE WITH
554> ) JZ CCOPI
555> ) NOT THE BDOS, BREAK AT OPERAND ADDRESS AND NEXT ADDRESS
556> 108F C1 ) POP B )NEXT ADDRESS TO B,C
557> 1090 C5 ) PUSH B )BACK TO STACK
558> 1091 3E02 ) MVI A,2 )TWO BREAKPOINTS
559> 1093 C3D410 ) JMP RETCAT )RETURN FROM NBRK
560> )
561> )
562> 1096 D1 ) CCOPI: )BREAK ADDRESS AT NEXT LOCATION ONLY, WAIT FOR RETURN FROM
563> ) 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> 109B 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>              JNZ     RST0
569>
570>              SOFT RST, NO BREAK POINT SINCE IT WILL OCCUR IMMEDIATELY
571> 10A1 AF       XRA     A
572> 10A2 C3D610   JMP     RETCAT1 ;ZERO ACCUMULATOR
573> 10A5 E638     RST0.  ANI     111000B ;GET RESTART NUMBER
574> 10A7 5F       MOV     E,A
575> 10A8 1600     MVI     D,0     ;DOUBLE PRECISION BREAKPOINT TO D,E
576> 10AA C3D210   JMP     ENDOP
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>              JNZ     ENDOP
583> 10B7 C36910   PCHL   TO BDOS, USE RETURN ADDRESS
584>              JMP     RETOP
585> 10BA C3D210   JMP     ENDOP
586>
587> 10BD D1       SIMOP. ;SIMPLE OPERATOR, USE STACKED PC
588> 10BE D5       POP     D
589> 10BF C3D210  PUSH   D
590>              JMP     ENDOP
591>
592> 10C2 CB8210   RCOND. ;RETURN CONDITIONAL
593> 10C5 C1       CALL   GETSP   ;GET RETURN ADDRESS FROM STACK
594> 10C6 C5       POP     B      ;B,C ALTERNATE LOCATION
595> 10C7 3E02     PUSH   B      ;REPLACE IT
596> 10C9 C3D410   MVI     A,2
597>              JMP     RETCAT ;TO SET FLAGS AND RETURN
598>
599> 10CC D1       DIMOP. ;DOUBLE PRECISION IMMEDIATE OPERATOR
600> 10CD 13       POP     D
601> 10CE D5       INX     D      ;INCREMENTED ONCE, DROP THRU FOR ANOTHER
602> 10CF D5       PUSH   D      ;COPY BACK
603>
604> 10D0 13       IMOP.  ;SINGLE PRECISION IMMEDIATE
605> 10D1 D5       POP     D
606> 10D2 13       INX     D
607> 10D3 D5       PUSH   D
608>
609> 10D2 3E01     ENDOP. ;END OPERATOR SCAN
610> 10D4 3C       MVI     A,1    ;SINGLE BREAKPOINT
611> 10D5 37       RETCAT. ;RETURN FROM HBRK
612> 10D6 37       INR     A      ;COUNT UP FOR G,...
613> 10D7 37       STC
614>
615> 10D6 F5       RETCAT1.
616> 10D7 2A2511   PUSH   PSU     ;SAVE REGISTER STATE IN CASE USERBRK
617> 10DA 7C       LHL    USERBRK
618> 10DB 85       MOV     A,H
619> 10DC CA0711  ORA     L
620>              JZ     RETCAT2 ;NO USERBRK IF ZERO

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10DF D5      PUSH  D      ;SAVE BREAK POINT
10E0 C5      PUSH  B      ;SAVE AUX BREAK POINT
10E1 E5      PUSH  H      ;SAVE USERBRK ADDRESS FOR PCHL BELOW
10E2 212411  ;
10E3 4E      USER BREAK OCCURS HERE, CALL USER ROUTINE AND CHECK RETURN
10E4 4E      LXI     H,CATNO
10E5 4E      MOV     C,M   ;OPCODE CATEGORY IS IN C
10E6 2A9611  LHL    PLOC
10E7 E8      XCHG   ;LOCATION OF INSTRUCTION IN D,E
10E8 21EF10  LXI     H,RETUSER
10E9 E3      XTHL   ;RETURN ADDRESS TO STACK, USERBRK TO H,L
10EA E9      PCHL
10EB E9
10EC E9
10ED E9
10EE E9
10EF B7      RETUSER. ;RETURN FROM USER BREAK, CHECK REGISTER A
10F0 C1      ORA     A
10F1 D1      POP     B     ;RESTORE BREAKPOINTS
10F2 CA0711  POP     D
10F3 F5      JZ     RETCAT2
10F4 F3      ;
10F5 F3      ;
10F6 3E23    ;
10F7 F3      ;
10F8 CD6F0D  ;
10F9 F1      ;
10FA CDAD0D  ;
10FB 3E20    ;
10FC CD6F0D  ;
10FD CD6F0D  ;
10FE CD6F0D  ;
10FF CD6F0D  ;
1100 CD6F0D  ;
1101 CD6F0D  ;
1102 CD6F0D  ;
1103 CD6F0D  ;
1104 CD6F0D  ;
1105 CD6F0D  ;
1106 CD6F0D  ;
1107 F1      ;
1108 E1      ;
1109 C9      ;
110A FFC3    ;
110B FFC3    ;
110C C7C2    ;
110D FFC3    ;
110E FFC3    ;
110F C7C4    ;
1110 C7C4    ;
1111 FFC9    ;
1112 FFC9    ;
1113 C7C7    ;
1114 C7C7    ;
1115 FFE9    ;
1116 FFE9    ;
1117 C706    ;
1118 C706    ;
1119 C706    ;
111A C706    ;
111B CF01    ;
111C CF01    ;
111D E722    ;
111E E722    ;
111F C700    ;
1120 C700    ;
1121 F7D3    ;
1122 F7D3    ;
1123 F7D3    ;
1124 F7D3    ;
1125 F7D3    ;
1126 F7D3    ;
1127 F7D3    ;
1128 F7D3    ;
1129 F7D3    ;
112A F7D3    ;
112B F7D3    ;
112C F7D3    ;
112D F7D3    ;
112E F7D3    ;
112F F7D3    ;
1130 F7D3    ;
1131 F7D3    ;
1132 F7D3    ;
1133 F7D3    ;
1134 F7D3    ;
1135 F7D3    ;
1136 F7D3    ;
1137 F7D3    ;
1138 F7D3    ;
1139 F7D3    ;
113A F7D3    ;
113B F7D3    ;
113C F7D3    ;
113D F7D3    ;
113E F7D3    ;
113F F7D3    ;
1140 F7D3    ;
1141 F7D3    ;
1142 20      ;

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OPCODE CATEGORY TABLES
OPLIST, DB 1111#1111B, 1100#0011B ;0 JMP
DB 1100#0111B, 1100#0010B ;1 JCOND
DB 1111#1111B, 1100#1101B ;2 CALL
DB 1100#0111B, 1100#0100B ;3 CCOND
DB 1111#1111B, 1100#1001B ;4 RET
DB 1100#0111B, 1100#0111B ;5 RST 0..7
DB 1111#1111B, 1110#1001B ;6 PCHL
DB 1100#0111B, 0000#0110B ;7 MVI
DB 1100#0111B, 1100#0110B ;8 ADI...CPI
DB 1100#1111B, 0000#0001B ;9 LXI
DB 1110#0111B, 0010#0010B ;10 LHL SHLD LDA S
DB 1100#0111B, 1100#0000B ;11 RCOND
DB 1111#0111B, 1101#0011B ;12 IN OUT
OPMAX EQU (<$-OPLIST)/2
;
;
;
CATNO, DS 1 ;CATEGORY NUMBER SAVED IN HBRK
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, DS 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>
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 =     BLOC   EQU     STACK-12 ;D,E
693>
694> 1198 00     ;
695> 1199      NOP
                END
                ;FOR RELOCATION BOUNDARY

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