

IDENTIFICATION

PRODUCT CODE: MAINDEC-8E-D8GC-D
PRODUCT NAME: RANDOM DCA TEST
DATE CREATED: JUNE 11, 1971
MAINTAINER: DIAGNOSTIC GROUP
AUTHOR: BRUCE HANSEN

COPYRIGHT © 1971
DIGITAL EQUIPMENT CORPORATION

1. ABSTRACT

THIS PROGRAM TESTS THE DCA INSTRUCTION OF THE PDP-8/E. THE DCA INSTRUCTION ADDRESS, OPERAND ADDRESS, AND OPERANDS ARE TAKEN FROM A RANDOM NUMBER GENERATOR.

2. REQUIREMENTS

2.1 EQUIPMENT

PDP-8/E EQUIPPED WITH TELETYPE.

2.2 STORAGE

THE DIAGNOSTIC PROGRAM IS STORED IN LOCATIONS 0000 THROUGH 0407. THE PROGRAM USES 0410 THROUGH 7600 FOR A TEST AREA. THE BINARY LOADER MUST BE STORED IN THE LAST MEMORY PAGE.

2.3 PRELIMINARY PROGRAMS

MAINDEC-8E-D0A(N), AND MAINDEC-8E-D0B(N)

3. LOADING PROCEDURE

3.1 METHOD

THE STANDARD BINARY LOADER IS USED.

4. STARTING PROCEDURE

4.1 CONTROL SWITCH SETTINGS

SR0 (0) HALT AFTER ERROR PRINTOUT.
SR1 (1) BYPASS ERROR PRINTOUT
SR2 HOLD "FROM" CONSTANT (1). SELECT RANDOM "FROM" (0).
SR3 HOLD "OPERAND ADDRESS" CONSTANT (1). SELECT RANDOM "OPERAND ADDRESS" (0).
SR4 HOLD "OPERAND" CONSTANT (1). SELECT RANDOM "OPERAND" (0).

4.2 STARTING ADDRESS

0200

4.3 OPERATOR ACTION

-
1. SET SR TO 0200.
 2. PRESS LOAD ADDRESS
 3. SET SR TO 0000
 4. PRESS CLEAR THEN CONTINUE

5. OPERATING PROCEDURE

SAME AS SECTION 4.

6. ERRORS

6.1 ERROR PRINTOUTS

F XXXX A YYYY O NNNN

L RRRR C MMMM

E

FROM,	F XXXX WHERE XXXX = ADDRESS OF THE DCA INSTRUCTION
ADDRESS,	A YYYY WHERE YYYY = ADDRESS WHERE DCA WILL DEPOSIT OPERAND
OPERAND	O NNNN WHERE NNNN = THE OPERAND TO BE DEPOSITED.
LOCATION,	L RRRR WHERE RRRR = A NONZERO LOCATION SOMEWHERE IN THE TEST FIELD.
CONTENTS,	C MMMM WHERE MMMM = CONTENTS OF LOCATION RRRR.
END,	E THIS LETTER IS TYPED TO INFORM THAT THE ENTIRE TEST AREA HAS BEEN SEARCHED FOR NONZERO OPERANDS.

EXAMPLES

A. THE FOLLOWING IS A TYPICAL ERROR PRINTOUT:

```
F 4572 A 0205 O 2525
L 0205 C 2527
E
```

LINE 1 IS SIMPLY A STATEMENT OF THE PROBLEM. IT SAYS THAT A DCA INSTRUCTION LOCATED AT 4572 TRIED TO DEPOSIT THE OPERAND 2525 INTO LOCATION 0205.

LINE 2 SAYS THAT INSTEAD OF FINDING A 2525 IN LOCATION 0205, THE PROGRAM FOUND A 2527. BIT 10 WAS "PICKED UP." THE E SIGNIFIES THAT A SEARCH OF THE TEST AREA SHOWED ONLY THE ABOVE PRINTED LOCATIONS DIFFERING FROM WHAT THEY SHOULD BE.

B. THE FOLLOWING IS A TYPICAL ERROR PRINTOUT:

```
F 4572 A 0205 O 2525
L 0215 C 2525
E
```

LINE 1 IS A STATEMENT OF THE PROBLEM AS IN THE PREVIOUS EXAMPLE. LINE 2 SAYS THAT LOCATION 0215 CONTAINS 2525, AND THE E ON LINE 3 SAYS THAT NO OTHER LOCATIONS WERE DISTURBED. IT IS APPARENT THEN THAT THE DCA INSTRUCTION DEPOSITED ITS OPERAND NOT INTO LOCATION 0205, BUT INTO LOCATION 0215. BIT 8 WAS "PICKED UP".

ERROR RECOVERY

TO ENTER A SCOPE MODE LOOP, SET SR0 TO A 0. WHEN A HALT OCCURS FOLLOWING AN ERROR, SET SWITCHES 1, 2, 3, AND 4 AND PUSH CONTINUE. A SCOPE MODE LOOP IS ENTERED USING THE CONDITIONS DESCRIBED BY THE LAST ERROR PRINTOUT.

IF IT IS DESIRED TO ENTER A SCOPE MODE LOOP USING A SPECIFIC SET OF CONDITIONS, STOP THE PROGRAM AND MAKE THE FOLLOWING ENTRIES:

- A. ENTER DESIRED FROM ADDRESS INTO MEMORY LOCATION 0167.
- B. ENTER DESIRED OPERAND ADDRESS INTO MEMORY LOCATION 0166.
- C. ENTER DESIRED OPERAND INTO MEMORY LOCATION 0170.

RESTART THE PROGRAM USING A CONTROL SWITCH SETTING OF 3600.

7. RESTRICTIONS (NONE)

8. MISCELLANEOUS

8.1 EXECUTION TIME

3904 RANDOM TESTS/PASS

7 PASSES/BELL

27,328 RANDOM TESTS/PASS

9. PROGRAM DESCRIPTION

MEMORY LOCATIONS 0410 THROUGH 7600 ARE DESIGNATED AS TEST LOCATIONS, AND ZEROS ARE DEPOSITED INTO EACH AT THE BEGINNING OF THE PROGRAM. THE PROGRAM NOW SELECTS A LOCATION FOR THE DCA INSTRUCTION. THIS SELECTED LOCATION MAY BE SPECIFIED OR RANDOM, DEPENDING UPON THE SWITCH REGISTER SETTING. THE OPERAND AND OPERAND ADDRESS ARE SELECTED IN A SIMILAR MANNER. THE PROGRAM NOW JUMPS TO THE TEST DCA, PERFORMS THE INSTRUCTION, THEN JUMPS BACK TO A CHECKING ROUTINE. THE CHECKING ROUTINE VERIFIES THAT THE OPERAND WAS DEPOSITED CORRECTLY. IF AN ERROR IS DETECTED, THE ERROR ROUTINE SEARCHES THE TEST AREA AND PRINTS THE CONTENTS OF ANY NONZERO LOCATION EXCEPT FOR THE TEST DCA INSTRUCTION. UPON COMPLETION OF THIS SCAN THROUGH THE TEST AREA, AN E IS PRINTED AND A NEW TEST IS BEGUN.

THE TELETYPE BELL RINGS AFTER 7 PASSES OF 3904 TEST/PASS.

```

/RANDOM DCA TEST
/SR0(0)=WALT ON ERROR
/SR1(1)=NO PRINTOUTS
/SR2(1)=CONSTANT FROM
/SR3(1)=CONSTANT OPERAND ADDRESS
/SR4(1)=CONSTANT OPERAND
*0

```

```

0000 0000
0001 5001      JMP 1
0002 0002      2
0003 0003      3
0004 0000      0
0005 0000      0
0006 7771      CNT2, 7771
0007 0400      PSUB, SUB
0010 0000      WORK, 0
0011 0000      CNT, 0
0012 0300      M7500, -7500
0013 0207      BEL, 207
0014 0003      THREE, 3

```

```

/CLEAR MEMORY
*20

```

```

0020 1175      START, TAD LIMLO
0021 3010      DCA WORK
0022 3410      DCA I WORK
0023 1010      TAD WORK
0024 7041      CIA
0025 1174      TAD LIMHI
0026 7640      SEA CLA
0027 5022      JMP START+2

```

```

/CHECK FOR CONSTANT FROM
CK1, LAS
      RTL
      SPA
      JMP CK2

```

```

0030 7604
0031 7006
0032 7510
0033 5052

```

```

/GET FROM ADDRESS
JMS GENRAN
DCA FROM

```

```

0034 4154
0035 3167

0036 1167      TAD FROM
0037 7510      SPA
0040 5046      JMP .+6
0041 7041      CIA
0042 1175      TAD LIMLO
0043 7710      SPA CLA
0044 5052      JMP CK2
0045 5034      JMP CK1+4
0046 7041      CIA
0047 1174      TAD LIMHI
0050 7710      SPA CLA
0051 5034      JMP CK1+4

```

```
0052 7604 /CHECK FOR CONSTANT OPERAND ADDRESS
0053 7006 CK2, LAS
0054 7004 RTL
0055 7510 RAL
0056 5075 SPA
JMP CK3
```

```
0057 4154 /GET OPERAND ADDRESS
0060 3166 JMS GENRAN
DCA OPAD
```

```
0061 1166 TAD OPAD
0062 7510 SPA
0063 5071 JMP .+6
0064 7041 CIA
0065 1175 TAD LIMLO
0066 7710 SPA CLA
0067 5075 JMP CK3
0070 5057 JMP CK2+5
0071 7041 CIA
0072 1174 TAD LIMHI
0073 7710 SPA CLA
0074 5057 JMP CK2+5
```

```
0075 7604 /CHECK FOR CONSTANT OPERAND
0076 7006 CK3, LAS
0077 7006 RTL
0100 7710 RTL
0101 5104 SPA CLA
JMP CK4
```

```
0102 4154 /GET OPERAND
0103 3170 JMS GENRAN
DCA OPER
```

```
0104 1167 /CHECK FOR FROM+1=OPERAND ADDRESS
0105 7041 /CHECK FOR FROM=OPERAND ADDRESS
0106 1166 CK4, TAD FROM
0107 7450 CIA
0110 5030 TAD OPAD
0111 7041 SNA
0112 7040 JMP CK1
0113 7650 CIA
0114 5030 CMA
SNA CLA
JMP CK1
```

```
0115 1171 /PLACE THE INSTRUCTIONS
0116 3567 TAD DCA1
0117 1167 DCA I FROM
0120 7001 TAD FROM
0121 3173 IAC
0122 1172 DCA FROMP1
TAD JMP1
```

0123 3573
 0124 1170
 0125 7000
 0126 5567
 0127 7402

DCA I FROMP1
 TAD OPER
 NOP
 JMP I FROM
 HLT

/GO OUT TO TEST
 /JMP FAILURE

0130 1566
 0131 7041
 0132 1170
 0133 7640
 0134 4577
 0135 3566
 0136 3567
 0137 3573

/RETURN FROM TEST
 BACK, TAD I OPAD
 CIA
 TAD OPER
 SZA CLA
 JMS I AERR
 DCA I OPAD
 DCA I FROM
 DCA I FROMP1

0140 1011
 0141 7001
 0142 3011
 0143 1011
 0144 1012
 0145 7640
 0146 5030
 0147 3011
 0150 2006
 0151 5030
 0152 4407
 0153 5030

/RING BELL AFTER 7 PASSES OF 3904 TEST PER PASS

TAD CNT
 IAC
 DCA CNT
 TAD CNT
 TAD M7500
 SZA CLA
 JMP CK1
 DCA CNT
 ISZ CNT2
 JMP CK1
 JMS I PSUB
 JMP CK1

0154 0000
 0155 7200
 0156 1165
 0157 7104
 0160 7430
 0161 1014
 0162 3165
 0163 1165
 0164 5554
 0165 2525

/RANDOM NUMBER GENERATOR
 GENRAN, 0

CLA
 TAD RANUM
 RAL CLL
 SZL
 TAD THREE
 DCA RANUM
 TAD RANUM
 JMP I GENRAN
 RANUM, 2525

/CONSTANTS AND VARIABLES

0166 3000
 0167 3001
 0170 2525
 0171 3566
 0172 5130
 0173 3002
 0174 7600
 0175 0410
 0176 0000
 0177 0201

OPAD, 3000
 FROM, 3001
 OPER, 2525
 DCA1, DCA I OPAD
 JMP1, JMP BACK
 FROMP1, 3002
 LIMH1, 7600
 LIMLO, 410
 WORK1, 0
 AERR, ERR

```

0200      *200
0200  5020      /DCA ERROR, CHECK ALL MEMORY
0201  0000      JMP START
ERR,      0
0202  7604      LAS
0203  7004      RAL
0204  7710      SPA CLA
0205  5601      JMP I ERR
0206  4265      JMS PHD
0207  1175      TAD LIMLO
0210  3010      DCA WORK
0211  1410      TAD I WORK
0212  7640      SZA CLA
0213  4233      JMS ER1
0214  1010      TAD WORK
0215  7041      CIA
0216  1174      TAD LIMHI
0217  7640      SZA CLA
0220  5211      JMP , -7
0221  1374      TAD E
0222  4351      JMS PRINT
0223  1375      TAD CR
0224  4351      JMS PRINT
0225  1376      TAD LF
0226  4351      JMS PRINT
0227  7604      LAS
0230  7700      SMA CLA
0231  7402      HLT      /HALT ON ERROR
0232  5601      JMP I ERR

0233  0000      /MEMORY LOCATION WRONG (MAYBE)
0234  1010      ER1, 0
0235  7041      TAD WORK
0236  1167      CIA
0237  7650      TAD FROM
0240  5633      SNA CLA
0241  1010      JMP I ER1      /FORGET IT. THIS IS LOC FROM
0242  7041      TAD WORK
0243  1173      CIA
0244  7650      TAD FROMP1
0245  5633      SNA CLA
0246  1372      JMP I ER1      /FORGET IT. THIS IS LOC FROM+1
0247  4351      TAD L
0250  1010      JMS PRINT
0251  4310      TAD WORK
0252  1010      JMS TYPAC
0253  3176      TAD WORK
0254  1373      DCA WORK1
0255  4351      TAD C
0256  1576      JMS PRINT
0257  4310      TAD I WORK1
          JMS TYPAC

```

0260	1375	TAD CR
0261	4351	JMS PRINT
0262	1376	TAD LF
0263	4351	JMS PRINT
0264	5633	JMP I ER1

/PRINT FIRST LINE OF ERROR

0265	0000	PHD,	0
0266	7200		CLA
0267	1367		TAD F
0270	4351		JMS PRINT
0271	1167		TAD FROM
0272	4310		JMS TYPAC
0273	1371		TAD A
0274	4351		JMS PRINT
0275	1166		TAD OPAD
0276	4310		JMS TYPAC
0277	1377		TAD O
0300	4351		JMS PRINT
0301	1170		TAD OPER
0302	4310		JMS TYPAC
0303	1375		TAD CR
0304	4351		JMS PRINT
0305	1376		TAD LF
0306	4351		JMS PRINT
0307	5665		JMP I PHD

/TYPE AC CONTENTS IN OCTAL

0310	5310	TYPAC,	JMP ,
0311	3366		DCA SAVE+3
0312	1366		TAD SAVE+3
0313	7012		RTR
0314	7010		RAR
0315	3365		DCA SAVE+2
0316	1365		TAD SAVE+2
0317	7012		RTR
0320	7010		RAR
0321	3364		DCA SAVE+1
0322	1364		TAD SAVE+1
0323	7012		RTR
0324	7010		RAR
0325	3363		DCA SAVE
0326	1370		TAD SPACE
0327	4351		JMS PRINT
0330	1357		TAD FOUR
0331	3360		DCA CTR

0332	1363	LUP,	TAD SAVE
0333	0361		AND MSK7
0334	1362		TAD TW6

0335	4351	JMS PRINT
0336	1364	TAD SAVE+1
0337	3363	DCA SAVE
0340	1365	TAD SAVE+2
0341	3364	DCA SAVE+1
0342	1366	TAD SAVE+3
0343	3365	DCA SAVE+2
0344	2360	ISE CTR
0345	0332	JMP LUP
0346	1370	TAD SPACE
0347	4351	JMS PRINT
0350	5710	JMP I TYPAC
0351	0000	PRINT, 0
0352	6046	TLB
0353	6041	TSF
0354	5353	JMP .-1
0355	7200	CLA
0356	5751	JMP I PRINT

/CONSTANTS

0357	7774	FOUR, -4
0360	0000	CTR, 0
0361	0007	MSK7, 7
0362	0260	TW6, 0260
0363	0000	SAVE, 0
0364	0000	0
0365	0000	0
0366	0000	0
0367	0306	F, 306
0370	0240	SPACE, 240
0371	0301	A, 301
0372	0314	L, 314
0373	0303	C, 303
0374	0305	E, 305
0375	0215	CR, 215
0376	0212	LF, 212
0377	0317	O, 317

0400	0400	*400
0400	0000	SUB, 0
0401	1207	TAD PASS
0402	3006	DCA CNT2
0403	1013	TAD BEL
0404	6046	TLB
0405	7200	CLA
0406	0600	JMP I SUB
0407	7771	PASS, 7771
		S