

IDENTIFICATION

PRODUCT CODE: MAINDEC-8E-D0GC-D
PRODUCT NAME: RANDOM DCA TEST
DATE CREATED: JUNE 11, 1971
MAINTAINER: DIAGNOSTIC GROUP
AUTHOR: BRUCE HANSEN

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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 SOME-
WHERE 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 ZEROES 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)=HALT 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

0030	7604	CK1, LAS
0031	7006	RTL
0032	7510	SPA
0033	5052	JMP CK2

/GET FROM ADDRESS

0034	4154	JMS GENRAN
0035	3167	DCA FROM
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
SEA 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
SEA 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
LIMHI, 7600
LIMLO, 410
WORK1, 0
AERR, ERR

```

      0200      *200
      0200 5020 /DCA ERROR, CHECK ALL MEMORY
      0201 0000      JMP START
      0202 7604      ERR, 0
      0203 7004      LAS
      0204 7710      RAL
      0205 5601      SPA CLA
      0206 4265      JMP I ERR
      0207 1175      JMS PHD
      0210 3010      TAD LIMLO
      0211 1410      DCA WORK
      0212 7640      TAD I WORK
      0213 4233      SZA CLA
      0214 1010      JMS ER1
      0215 7041      TAD WORK
      0216 1174      CIA
      0217 7640      TAD LIMHI
      0220 5211      SZA CLA
      0221 1374      JMP , -7
      0222 4351      TAD E
      0223 1375      JMS PRINT
      0224 4351      TAD CR
      0225 1376      JMS PRINT
      0226 4351      TAD LF
      0227 7604      JMS PRINT
      0230 7700      LAS
      0231 7402      SMA CLA
      0232 5601      HLT          /HALT ON ERROR
      0233 0000      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
      0257 4310      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	5332	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	5600	JMP I SUB
0407	7771	PASS, 7771
		S