

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

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1. ABSTRACT  
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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  
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2.1 EQUIPMENT  
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PDP-8/E EQUIPPED WITH TELETYPE.

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

3. LOADING PROCEDURE  
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3.1 METHOD  
-----

THE STANDARD BINARY LOADER IS USED.

4. STARTING PROCEDURE  
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4.1 CONTROL SWITCH SETTINGS  
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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.

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

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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)  
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8. MISCELLANEOUS  
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8.1 EXECUTION TIME  
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3904 RANDOM TESTS/PASS  
7 PASSES/BELL  
27,328 RANDOM TESTS/PASS

9. PROGRAM DESCRIPTION  
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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
0000 0000
0001 0001      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 0020
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      SPA CLA
0027 0022      JMP START+2

```

```

/CHECK FOR CONSTANT FROM

```

```

0030 7604      CK1, LAS
0031 7006      RTL
0032 7510      SPA
0033 0052      JMP CK2

```

```

/GET FROM ADDRESS

```

```

0034 4154      JMS GENRAN
0035 3167      DCA FROM

0036 1167      TAD FROM
0037 7510      SPA
0040 0046      JMP ,+6
0041 7041      CIA
0042 1175      TAD LIMLO
0043 7710      SPA CLA
0044 0052      JMP CK2
0045 0034      JMP CK1+4
0046 7041      CIA
0047 1174      TAD LIMHI
0050 7710      SPA CLA
0051 0034      JMP CK1+4

```

```

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

/GET OPERAND ADDRESS
0057 4154      JMS GENRAN
0060 3166      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

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

/GET OPERAND
0102 4154      JMS GENRAN
0103 3170      DCA OPER

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

/PLACE THE INSTRUCTIONS
0115 1171      TAD DCA1
0116 3567      DCA I FROM
0117 1167      TAD FROM
0120 7001      IAC
0121 3173      DCA FROMP1
0122 1172      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      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      SEA CLA
0214      1010      JMS ER1
0215      7041      TAD WORK
0216      1174      CIA
0217      7640      TAD LIMHI
0220      9211      SEA 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
                       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	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	*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