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IDENTIFICATION

PRODUCT CODE: MAINDEC-8E-D0GB-D

PRODUCT NAME: RANDOM DCA TEST

DATE CREATED: DECEMBER 10, 1970

MAINTAINER: DIAGNOSTIC GROUP

AUTHOR: BRUCE HANSEN

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-8/E-D0AA, AND MAINDEC-8E-D0BA

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.

6.2 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".

6.3 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
          0000      *0
0000      0000              0
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
          0020      *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              SZA 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
```

```
                        /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            DCA I FROMP
0124  1170            TAD OPER
0125  7000            NOP
0126  5567            JMP I FROM              /GO OUT TO TEST
0127  7402            HLT                     /JMP FAILURE

                      /RETURN FROM TEST
0130  1566      BACK,  TAD I OPAD
0131  7041            CIA
0132  1170            TAD OPER
0133  7640            SZA CLA
0134  4577            JMS I AERR
0135  3566            DCA I OPAD
0136  3567            DCA I FROM
0137  3573            DCA I FROMP1

                      /RING BELL AFTER 7 PASSES OF 3904 TEST PER PASS
0140  1011            TAD CNT
0141  7001            IAC
0142  3011            DCA CNT
0143  1011            TAD CNT
0144  1012            TAD M7500
0145  7640            SZA CLA
0146  5030            JMP CK1
0147  3011            DCA CNT
0150  2006            ISZ CNT2
0151  5030            JMP CK1
0152  4407            JMS I PSUB
0153  5030            JMP CK1

                      /RANDOM NUMBER GENERATOR
0154  0000      GENRAN, 0
0155  7200            CLA
0156  1165            TAD RANUM
0157  7104            RAL CLL
0160  7430            SZL
0161  1014            TAD THREE
0162  3165            DCA RANUM
0163  1165            TAD RANUM
0164  5554            JMP I GENRAN
0165  2525      RANUM,  2525


                      /CONSTANTS AND VARIABLES

0166  3000      OPAD,   3000
0167  3001      FROM,   3001
0170  2525      OPER,   2525
0171  3566      DCA1,   DCA I OPAD
0172  5130      JMP1,   JMP BACK
0173  3002      FROMP1, 3002
0174  7600      LIMHI,  7600
0175  0410      LIMLO,  410
0176  0000      WORK1,  0
0177  0201      AERR,   ERR
```

```
        0200    *200
                /DCA ERROR, CHECK ALL MEMORY
0200    5020            JMP START
0201    0000    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

                /MEMORY LOCATION WRONG (MAYBE)
0233    0000    ER1,    0
0234    1010            TAD WORK
0235    7041            CIA
0236    1167            TAD FROM
0237    7650            SNA CLA
0240    5633            JMP I ER1               /FORGET IT. THIS IS LOC FROM
0241    1010            TAD WORK
0242    7041            CIA
0243    1173            TAD FROMP1
0244    7650            SNA CLA
0245    5633            JMP I ER1               /FORGET IT. THIS IS LOC FROM+1
0246    1372            TAD L
0247    4351            JMS PRINT
0250    1010            TAD WORK
0251    4310            JMS TYPAC
0252    1010            TAD WORK
0253    3176            DCA WORK1
0254    1373            TAD C
0255    4351            JMS PRINT
0256    1576            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          ISZ CTR
0345  5332          JMP LUP
0346  1370          TAD SPACE
0347  4351          JMS PRINT
0350  5710          JMP I TYPAC
0351  0000  PRINT,  0
0352  6046          TLS
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          TLS
0405  7200          CLA
0406  5600          JMP I SUB
0407  7771  PASS,   7771
      $
```

```
0000  11111111  11111000  11111111  11111111  11111111  11111111  11111111  11111111
0100  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111

0200  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111
0300  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111

0400  11111111  00000000  00000000  00000000  00000000  00000000  00000000  00000000
0500  00000000  00000000  00000000  00000000  00000000  00000000  00000000  00000000

0600
0700


1000
1100

1200
1300

1400
1500

1600
1700


2000
2100

2200
2300

2400
2500

2600
2700


3000
3100

3200
3300

3400
3500

3600
3700
```

```
4000
4100

4200
4300

4400
4500

4600
4700


5000
5100

5200
5300

5400
5500

5600
5700


6000
6100

6200
6300

6400
6500

6600
6700


7000
7100

7200
7300

7400
7500

7600
7700
```

```
        )    @371
        R    @177
        BACK    @130
        BEL     @013
        C       @373
        CK1     @030
        CK2     @052
        CK3     @075
        CK4     @104
        CNT     @011
        CNT2    @006
        CR      @375
        CTR     @360
        DCA1    @171
        E       @374
        ER1     @233
        ERR     @201
        F       @367
        FOUR    @357
        FROM    @167
        FROMP1  @173
        GENRAN  @154
        JMP1    @172
        L       @372
        LF      @376
        LIMHI   @174
        LIMLO   @175
        LUP     @332
        M7500   @012
        MSK7    @361
        O       @377
        OPAD    @166
        OPER    @170
        PASS    @407
        PHD     @265
        PRINT   @351
        PSUB    @007
        RANUM   @165
        SAVE    @363
        SPACE   @370
        START   @020
        SUB     @400
        THREE   @014
        TW6     @362
        TYPAC   @310
        WORK    @010
        WORK1   @176


ERRORS DETECTED: 0

LINKS GENERATED: 0

RUN-TIME:  3 SECONDS
```