PERMANENT MEMORANDUM

DATE October 4, 1961

SUBJECT Instruction Test Programs

TO Technicians, PDP-1 Distribution List

ABSTRACT A series of small diagnostic routines for checking memory reference and augmented instructions. Each routine is written using the program format for PDP-1 maintenance programs (see memo - 1127).

FROM Steve Lambert

APPROVED BY Benjamin M. Gurley

INTRODUCTION

The following routines are written in sequential order starting with a basic set of instructions, that are assumed working, and branching out into different areas of the machine using these instructions to analyze other instructions.

OPERATING INSTRUCTIONS

To start each test, ss #1 must be off. With ss #2 on, each routine will iterate about itself provided ss #1 is off. SS #2 off, the following routine (in read-in-mode format) on tape, will be read in . All Frap symbols used, are defined in memo - 1127.

```
,TEST 1

,clear memory

,9/15/61
,G. B. & S. L.
org 7762
be0                 szs 10
ph0                 hlt
                    dzm * t1
                    idx t1
                    sas p0
                    jmp be0
fi0                 rpb
                    dio p0
                    spi *
                    rpb
p0                  7762
                    jmp fi0
t1                  0
end .


,TEST 2
,skip spa sma szs 1 2 3 hlt cma cla test don't skip uses jmp
,partially tests sza
,9/15/61
,G. B. & S. L.
be1                 szs 10
ph0                 hlt
                    cla
                    sza
er0                 hlt          ,0 no good
                    sza *
                    jmp p0
p1                  cma
                    sza
```

```
                    650000      ,end sza check
er1                 hlt

                    cma
                    sza
er2                 hlt
                    spa
er3                 hlt
                    cma
                    spa

                    650000
er4                 hlt
                    sma
er5                 hlt
                    cma
                    sma
                    650000
er6                 hlt
fil                 szs 20
                    jmp bel
                    rpb
                    dio ¢ & 3
                    spi *
                    rpb
                    0
                    jmp fil
p0                  szs 30
phl                 hlt
                    jmp pl

end .



,TEST 3
,test for all lac dac idx and addl sas also uses jmp hlt
,9/17/61
,G. B. & S. L.

be2                 szs 10
                    hlt

                    lac tl
                    dac p2
                    cla
                    dac t3
                    dac t4
                    jmp p2
pl                  idx t4
                    lac t3
                    add tb3 & l
                    dac t3
                    sas t4
ehl                 hlt
                    sza *
                    jmp p3
p2                  sas
```

```
                    jmp p1
                    idx p2
                    jmp p1
t3                  0
t4                  0
tb3                 0
                    1
                    3
                    7
                    17

                    37
                    77
                    177
                    377
                    777
                    1777
                    3777
                    7777
                    17777

                    37777
                    77777
                    177777
                    377777
                    777777
t1                  sas tb3
t2                  sas tb3 & 2
p3                  lac p2
                    sas t2
                    hlt
fi2                 szs 20
                    jmp be2
                    rpb
                    dio ¢ & 3
                    spi *
                    rpb
                    0
                    jmp fi2
end .


,TEST 4
,add sub lio dio sas sza lac jmp isp test szo dac hlt idx dap spi
,9/14/61
,G. B. & S. L.
be3                 szs 10
                    hlt
                    law tb5
                    dap p5
                    dzm t1
                    dzm t2
                    dzm t3
                    dzm t4
```

```
                dzm t5
                dzm t6
p2              lac t7
                dac p6 & 1

                lac t10
                dac p6 & 2
p3              lac t1
                add t11
                szo *
                jmp ¢ & 3
                sas t13
                hlt
                dac t1
                lac t11
                add t2
                szo *
                jmp ¢ & 3
                sas t13
                hlt
                dac t2
                lac t3
                sub t12
                szo *
                jmp ¢ & 3
                sas t13
                hlt
                dac t3
                lio t3
                dio t4
                idx t5
                sas t4
t7              hlt
                sas t3
                hlt
                sas t2
               hlt
                sas t1
               hlt
                isp t6
p6             0
                0
p5              sas
                jmp p3
                sza *
                jmp p13
                sas t14
                jmp p7
                lac t10
                dac p6 & 1
                lac t7
               dac p6 & 2
                jmp p11
p7              spi *
```

```
                jmp p10
p7              spi *
                jmp p11
                sas t12
                jmp p3
                idx p5
                jmp p2
p11             idx p5
                jmp p3

fi3             szs 20
                jmp be3
                rpb
                dio ¢ & 3
                spi *
                rpb
                0
                jmp fi3
t1              0

t2              0
t3              0

t4              0

t5              0
t6              0
t10             jmp p6 & 3
t11             1
t12             777776
t13             400000
t14             377777
tb5             1
                2
                3
                4
                7
                10

                17
                20
                37

                40
                77
                100

                177

                200

                377
                400
                777
```

```
                1000
                1777
                2000
                3777
                4000

                7777
                10000
                17777
                20000
                37777
                40000
                77777

                100000
                177777
                200000
                377777
                400000
                777776
                000000
end .


,TEST 5
,ior xor & and test
,9/14/61
,G. B. & S. L.
be4             szs 10
                hlt
                law tb1
                dac t1
                law tb2
                dac t2
p0              lac * t1
                ior * t1
                sas * t1
                hlt
                lac * t1
                ior * t2
                cma
                sza
                hlt
                lac * t2
                ior * t1
                cma
                sza
                hlt

                lac * t2
                ior * t2
                sas * t2
```

```
hlt         hlt
            lac * t1

            and * t1
            sas * t1

            hlt

            lac * t1
            and * t2
            sza

            hlt
            lac * t2
            and * t1

            sza
            hlt
            lac * t2

            and * t2

            sas * t2

            hlt
            lac * t1
            xor * t1
            sza

            hlt
            lac * t1
            xor * t2

            cma
            sza
            hlt

            lac * t2
            xor * t1
            cma
            sza
            hlt
            lac * t2
            xor * t2
            sza

            hlt
            idx t1

            idx t2
            sas t3

            jmp p0
fi4         szs 20
            jmp be4

            rpb
            dio ¢ & 3
            spi *

            rpb
            0
            jmp fi4

t1          0
```

```
t2              0

t3              tb2 & 23
tb1             0
                1
                2
                4

                10
                20
                40
                100
                200

                400
                1000

                2000
                4000
                10000
                20000
                40000
                100000
                200000
                400000
tb2             777777
                777776
                777775
                777773
                777767

                777757

                777737
                777677
                777577

                777377

                776777
                775777


                773777
                767777

                757777
                737777

                677777

                577777

                377777
end .
```

```
,TEST 6
,jmp jsp jda test
,9/20/61
,G. B. & S. L.

                org 7721
be5             szs 10

                hlt
                dzm t1
                law 1
                dap t2
                lac t2
                dac * t1
                idx t2
                idx t2
                idx t1
                lac t4
                dac * t1
                idx t1

                lac t2
                dac * t1
                idx t2
                idx t2
                idx t1
                lac t3
                dac * t1
                idx t1
                sas t5

                jmp be5 & 5
                jmp p2t & 1
p1              0 p2
                dap p2

                sas t1
                hlt
                idx t1
                idx t1
                sas t5
p2              jmp
                law 2
                dac t1

fi5             szs 20
                jmp be5
```

```
                rpb

                dio ¢ & 3
                spi
                rpb

                0
                jmp fi5
t1
t2              jmp
t3              jsp p1 & 1
t4              170000 p1
t5              be5 - 1
end .



,TEST 7
,cal test
,9/25/61
,G. B. & S. L.
org 100         0

                dap p0

                sas t1

                hlt
                sad t2
                jmp p4
                idx t1
                sas t3

p0              jmp

fi6             szs 20

                jmp be6
                rpb
                dio ¢ & 3
                spi *

                rpb
                0

                jmp fi6
p4              add t4
                dac t1

                idx t1
                jmp p0
be6             szs 10

                hlt
                dzm t1

p5              idx t1
                sad t2

                jmp p1
                sad t3

                jmp p3
```

```
p2              ior t6
                dac * t1
                jmp p5
p1              add t4
                dac t1
                jmp p2
p3              dzm t1
                idx t1
                idx t1
                lac t5
                dac 77
                jmp 1
t3              7777
t6              160000
t1              0
t2              77
t4              60
t5              jmp 157
end .


,TEST 8
,simple ac & io shift rotate test
,9/21/61
,G. B. & S. L.

be7             szs 10
ph1             hlt
                lac t1
                dac t2
                lio t2
                ril s9
                ral s9
                dio t3
                sas t3
eh1             hlt
                rir s9
                rar s9
                sas t2
eh2             hlt
                dio t3
                sas t3
eh3             hlt
                sal s9
```

```
                sil s9
                dio t3
                sas t3
eh4             hlt
                lac t2
                lio t2
                sar s9
                sir s9
                dio t3
                sas t3
eh5             hlt
                idx t1
                sza
                jmp be7
fi7             szs 20
                jmp be7
                rpb
                dio ¢ & 3
                spi *
                rpb
                0
                jmp fi7
t1              0
t2              0
t3              0
end .


,TEST 9
, super rotate test
, 9/20/61
,G. B.
be10            szs 10
                hlt
p17             law 1
                dac p05    , base initialize
p13             law  tb2[illegible]e
                dap p11
                dap p12    ,setup
p16             cla cma cli             ,test that it does move
                rcr s9
                rcl s1
                rcr s1
                ral s2
                rar s1
                rir s9
                ril s1
                dio p06
                sas p06
```

```
                hlt
                rir         ,test for zero rotate
                rcr
                ril
                ril
                rcr
                rar
                rcl
                ral
                ral
                dio p06
                sas p06
                hlt
p11             lac
p12             lio
                jda p00
                rar
                sas * p11
                hlt
                dio p06
                sas p06
                hlt         ,finish rar
                lac * p11
                lio * p12
                jda p00
                ral
                sas * p11
                hlt
                dio p06
                sas p06
                hlt         ,finish ral
                lac * p11
                lio * p12
                jda p00
                rir
                sas * p11
                hlt
                dio p06
                sas p06
                hlt         ,rir done
                lac * p11
                lio * p12
                jda p00
                ril
                sas * p11
                hlt
                dio p06
                sas p06
```

```
                hlt         ,ril done

                lac * p11
                lio * p12
                jda p00
                rcr
                sas * p11
                hlt
                dio p06
                sas p06
                hlt         , rcr done
                lac * p11
                lio * p12
                jda p00
                rcl
                sas * p11
                hlt
                dio p06
                sas p06
                hlt         ,rcl done
                idx p12
                idx p11
                sas p14
                jmp p16
                idx p05
                sas p15
                jmp p13
fil0            szs 20
                jmp be10
                rpb
                dio ¢ & 3
                spi *
                rpb
                0
                jmp fil0
p10             jmp p01
p06             0           ,temp for residue
p05             0           ;base
p02             0           ;temp for command
p00             0           ,ac
                dap p01     ,return
                lac * p01
                dac p02
                idx p01     ,return
                law p03
                dap p08     ,to put commands away
                law 44      ;36
                dac p06
p07             lac p06
                sub p05
                spa
                jmp p09
```

```
                dac p06
                law p04
                add p05
                dap ¢ & 1
                lac
                add p02
p08             dac
                idx p08
                jmp p07
p09             law p04
                add p06
                dap ¢ & 1
                lac
                add p02
                dac * p08
                idx p08
                lac p10
                dac * p08
                lac p00
p03             0
org p03         & 46
p01             jmp
p04             0
                s1
                s2
                s3
                s4
                s5
                s6
                s7
                s8
                s9
p15             12
p14             lac tb2 & 5
tb2             0
                - 0
                525252
                252525
end .


,TEST 10
,shift test law dap isp ior rar idx
,9/22/61
,S. L.
bell            szs 10
                hlt
                law p5
```

```
                dap p4
                law tb1
                dap p1

                law tb3

                dap p5
                law tb4
                dap p6
                law * 3
                dac t1
                law tb2
                dap p2 & 2

p1              law
                dap p7
                idx p1

                isp t1
                jmp p2
                sad t2
                jmp  fill[illegible]
                sad t12
                jmp p14
                law p7 - 4
                dap p4
                law t10
                dap p11

                dap p12
p2              law * 7
                dac t3
                lac

                dac p10
                dac t4
                idx p10

                idx p2 & 2

                isp t3
p4              jmp
                jmp p1 - 2

p14             law t11
                jmp p2 - 2
p5              law

                dap p11

                idx p5
p6              law
                dap p12
                idx p6
                law 1
                dac t5
```

```
                law * 11
                dac t6
p7              lac
                lio * p7
p10
p11             sas
e_hl            hlt
                dio t7
                lac t7
p12             sas
eh2             hlt
                lac t5
                ral s1
                dac t5
                ior t4
                dac p10
                isp t6
                jmp p7
                jmp p2 & 2
fill            szs 20
                jmp bell
                rpb
                dio ¢ & 3
                spi *
                rpb
                0
                jmp fill
t1              0
t3              0
t4              0
t5              0
t6              0
t7              0
tb1             252525
                525252
t10             000000
t11             777777
tb2             sal
                sar
                sil
                sir
                scl
                scr
tb3             125252
                125252
                252525
```

```
252525
                252525
                125252
                125252

                652525

                652525

                525252

                525252

                652525
                652525
t2              2
t12             1
tb4             252525
                252525
                125252
                125252
                525252
                525252
                525252
                525252
                652525
                652525
                252525

                252525

end .
```