1. IDENTIFICATION

1.1 Digital-8-24-U-Sym

1.2 Unsigned Decimal Print, Double Precision

1.3 January 19, 1966

2. ABSTRACT

This subroutine permits the typeout of a double-precision integer stored in the usual convention for double-precision numbers, (see Digital-8-13-F-Sym). The one exception is that all 24 bits are interpreted as magnitude bits (i.e. the bit "0" of the high-order word is not a sign bit). The typeout is in the form of a seven-digit, positive, decimal integer.

3. REQUIREMENTS

3.1 Storage

This subroutine requires (73) locations.

3.2 Subprograms and/or Subroutines (none)

3.3 Equipment

Basic PDP-8 with ASR-33

4. USAGE

4.1 Loading

The symbolic tape provided is assembled with either PAL III or MACRO-8. It may be assembled with the user program or separately with the proper origin setting. Neither origin setting nor "$" terminating character exists on the tape, but the tape does have a PAUSE on the end.

4.2 Calling Sequence

This subroutine is called by an effective JMS UDPRNT. The location immediately following the calling JMS contains the address of the high-order portion of the double-precision integer stored in the usual double-precision format.

5. RESTRICTIONS (none)

6. DESCRIPTION

6.1 Discussion

This is basic double-precision subroutine used to obtain decimal output corresponding to double-precision, binary words. First, the binary equivalent of 10,000,000 is subtracted from the original number until under-flow occurs. A count is kept of the number of subtractions necessary to accomplish this, thus yielding the most significant decimal digit. Then this digit is added to 2608 and printed on the ASR-33 through the AC. This process is repeated using the proper power of ten to give the seven remaining digits.

6.2 Examples and/or Applications (none)

6.3 Scaling

The numbers are interpreted and typed out as integers.

7. METHOD (See Digital-8-22-U-Sym)

8. FORMAT

8.1 Input Data (Not Applicable)

8.2 Core Data

The double-precision integers are stored in the usual double-precision format, (see Digital-8-13-F-Sym), with the exception that bit "0" of the high-order word is interpreted as part of the number not a sign bit.

8.3 Output Data

Output is in the form of eight consecutive decimal digits. No sign is printed. Spacing, tabulation, carriage return, etc., are not provided for in this subroutine. See Digital-8-19-U-Sym which contains short subroutines for those purposes.

9. EXECUTION TIME

9.1 Minimum (Not Applicable)

9.2 Maximum (Not Applicable)

9.3 Average

This subroutine is output limited at 10 cps by the ASR-33

10. PROGRAM

10.1 Core Map (none)

10.2 Dimension List(s) (none)

10.3 Macro, Parameter, and Variable Lists (none)

10.4 Program Listing

```
                /CHECK OUTB PROGRAM FOR UNSIGNED , DOUBLE-PRECISION PRINT
                *200
                RETURN=JMS TYCR
                PRINT=JMS UDPRNT
                SPACE=JMS TYSP
                DEFINE DBLADD A B
                <CLA CLL; TAD A+1; TAD B+1; DCA A+1; RAL; TAD A ;TAD B; DCA A
                DEFINE DSHFT C D
                <CLA CLL; TAD C; RAL; DCA C ;TAD D; RAL; DCA D>
                DEFINE DMOVE E F
                <CLA; TAD E; DCA F; TAD E+1; DCA F+1>
0200  4777    INITL,      RETURN
0201  7300                CLA CLL
0202  3305                DCA TEMP
0203  3306                DCA TEMP+1
0204  1374                TAD (-5)
0205  3313                DCA COUNT1
0206  1373                TAD (-2)
```

2. ABSTRACT

This subroutine permits the typeout of a double-precision integer stored in the usual convention for double-precision numbers, (see Digital-8-13-F-Sym). The one exception is that all 24 bits are interpreted as magnitude bits (i.e. the bit "0" of the high-order word is not a sign bit). The typeout is in the form of a seven-digit, positive, decimal integer.

3. REQUIREMENTS

3.1 Storage

This subroutine requires (73) locations.

3.2 Subprograms and/or Subroutines (none)

3.3 Equipment

Basic PDP-8 with ASR-33

4. USAGE

4.1 Loading

The symbolic tape provided is assembled with either PAL III or MACRO-8. It may be assembled with the user program or separately with the proper origin setting. Neither origin setting nor "$" terminating character exists on the tape, but the tape does have a PAUSE on the end.

4.2 Calling Sequence

This subroutine is called by an effective JMS UDPRNT. The location immediately following the calling JMS contains the address of the high-order portion of the double-precision integer stored in the usual double-precision format.

5. RESTRICTIONS (none)

6. DESCRIPTION

6.1 Discussion

This is basic double-precision subroutine used to obtain decimal output corresponding to double-precision, binary words. First, the binary equivalent of 10,000,000 is subtracted from the original number until under-flow occurs. A count is kept of the number of subtractions necessary to accomplish this, thus yielding the most significant decimal digit. Then this digit is added to 2608 and printed on the ASR-33 through the AC. This process is repeated using the proper power of ten to give the seven remaining digits.

6.2 Examples and/or Applications (none)

6.3 Scaling

The numbers are interpreted and typed out as integers.

7. METHOD (See Digital-8-22-U-Sym)

8. FORMAT

8.1 Input Data (Not Applicable)

8.2 Core Data

The double-precision integers are stored in the usual double-precision format, (see Digital-8-13-F-Sym), with the exception that bit "0" of the high-order word is interpreted as part of the number not a sign bit.

8.3 Output Data

Output is in the form of eight consecutive decimal digits. No sign is printed. Spacing, tabulation, carriage return, etc., are not provided for in this subroutine. See Digital-8-19-U-Sym which contains short subroutines for those purposes.

9. EXECUTION TIME

9.1 Minimum (Not Applicable)

9.2 Maximum (Not Applicable)

9.3 Average

This subroutine is output limited at 10 cps by the ASR-33

10. PROGRAM

10.1 Core Map (none)

10.2 Dimension List(s) (none)

10.3 Macro, Parameter, and Variable Lists (none)

10.4 Program Listing

```
                /CHECK OUTB PROGRAM FOR UNSIGNED , DOUBLE-PRECISION PRINT
                *200
                RETURN=JMS TYCR
                PRINT=JMS UDPRNT
                SPACE=JMS TYSP
                DEFINE DBLADD A B
                <CLA CLL; TAD A+1; TAD B+1; DCA A+1; RAL; TAD A ;TAD B; DCA A
                DEFINE DSHFT C D
                <CLA CLL; TAD C; RAL; DCA C ;TAD D; RAL; DCA D>
                DEFINE DMOVE E F
                <CLA; TAD E; DCA F; TAD E+1; DCA F+1>
0200  4777    INITL,      RETURN
0201  7300                CLA CLL
0202  3305                DCA TEMP
0203  3306                DCA TEMP+1
0204  1374                TAD (-5)
0205  3313                DCA COUNT1
0206  1373                TAD (-2)
```

```
0207  3314              DCA COUNT2
0210  4777              RETURN
0211  4776  TOP,        PRINT;
0212  0307   DNUMB
0213  4775              SPACE
0214  7300              DBLADD DNUMB,VARCON
0215  1310
0216  1312
0217  3310
0220  7004
0221  1307
0222  1311
0223  3307
0224  2313              ISZ COUNT1
0225  5211              JMP TOP
0226  4777  FIVE,       RETURN
0227  1374              TAD (-5)
0230  3313              DCA COUNT1
0231  2314              ISZ COUNT2
0232  5211              JMP TOP
0233  1373              TAD (-2)
0234  3314              DCA COUNT2
0235  7200              DMOVE VARCON, TEMP
0236  1311
0237  3305
0240  1312
0241  3306
0242  7300              DSHFT VARCON+1,VARCON
0243  1312
0244  7004
0245  3312
0246  1311
0247  7004
0250  3311
0251  7300              DSHFT VARCON+1,VARCON
0252  1312
0253  7004
0254  3312
0255  1311
0256  7004
0257  3311
0260  7300              DBLADD VARCON,TEMP
0261  1312
0262  1306
0263  3312
0264  7004
0265  1311
0266  1305
0267  3311
0270  7300              DSHFT VARCON+1,VARCON
0271  1312
0272  7004
0273  3312
0274  1311
0275  7004
0276  3311
0277  7200              DMOVE VARCON,DNUMB
0300  1311
```

```
0301  3307
0302  1312
0303  3310
0304  5211              JMP TOP
0305  0000  TEMP, DUBL 0
0306  0000
0307  0000  DNUMB, DUBL 0
0310  0000
0311  0000  VARCON, DUBL 1
0312  0001
0313  0000  COUNT1,   0
0314  0000  COUNT2,   0
0373  7776  PAGE
0374  7773
0375  0627
0376  0400
0377  0617
            PAUSE

            /UNSIGNED DECIMAL PRINT, DOUBLE PRECISION
            /CALLING SEQUENCE:   JMS UDPRNT /SUBROUTINE CALLED
            /                    HI ADDR    /ADDRESS OF HIGH ORDER WORD
            /                    RETURN     /RETURN WITH AC AND L CLEAR

0200  0000  UDPRNT,   0
0201  7300            CLA CLL
0202  1600            TAD I UDPRNT       /PICK UP ADDRESS OF HIGH-ORDER WORD
0203  3267            DCA UDGET
0204  1667            TAD I UDGET        /PICK UP BOTH WORDS FOR USE IN SUBROUTIN
0205  3261            DCA UDHIGH
0206  2267            ISZ UDGET
0207  1667            TAD I UDGET
0210  3262            DCA UDLOW
0211  1255            TAD UDLOOP         /INITIALIZE DIGIT COUNTER FOR "8"
0212  3260            DCA UDCNT
0213  1256            TAD UDADDR         /INITIALIZE TO TABLE OF POWERS OF TEN
0214  3270            DCA UDPTR
0215  2200            ISZ UDPRNT         /INDEX LINKAGE FOR CORRECT RETURN
0216  1670  UDARND,   TAD I UDPTR        /PICK UP CURRENT POWER OF TEN FOR
0217  2270            ISZ UDPTR          /USE IN SUBTRACTION
0220  3263            DCA UDHSUB
0221  1670            TAD I UDPTR
0222  2270            ISZ UDPTR
0223  3264            DCA UDLSUB
0224  7100  UDDO,     CLL                /DOUBLE PRECISION SUBTRACTION
0225  1264            TAD UDLSUB
0226  1262            TAD UDLOW
0227  3266            DCA UDTEML
0230  7004            RAL
0231  1263            TAD UDHSUB
0232  1261            TAD UDHIGH
0233  7420            SNL                /DID IT UNDERFLOW?
0234  5242            JMP UDOUT          /NO, COUNT IS DONE
0235  2265            ISZ UDBOX          /YES, COUNT NOT DONE YET. INDEX DIGIT
0236  3261            DCA UDHIGH         /DEPOSIT REMAINING PORTIONS OF WORD
0237  1266            TAD UDTEML
0240  3262            DCA UDLOW
```

```
0241  5224            JMP UDDO            /GO BACK AND SUBTRACT AGAIN
0242  7200  UDOUT,     CLA
0243  1265            TAD UDBOX           /PICK UP RESULTING DIGIT
0244  1257            TAD UDTWO           /ADD "260" TO IT
0245  6046            TLS                 /TYPE IT OUT
0246  6041            TSF
0247  5246            JMP .-1
0250  7300            CLA CLL
0251  3265            DCA UDBOX           /INITIALIZE DIGIT TO "0"
0252  2260            ISZ UDCNT           /HAVE WE TYPED "8" DIGITS
0253  5216            JMP UDARND          /NO, DETERMINE NEXT DIGIT
0254  5600            JMP I UDPRNT        /YES, SUBROUTINE DONE. RETURN
0255  7770  UDLOOP,    -10                 /COUNT OF "8" DIGITS
0256  0271  UDADDR,    UDCON1              /INITIAL ADDRESS OF POWERS OF TEN
0257  0260  UDTWO,     260                 /ICODE  FOR DIGITS
0260  0000  UDCNT,     0                   /STORAGE LOCATIONS
0261  0000  UDHIGH,    0
0262  0000  UDLOW,     0
0263  0000  UDHSUB,    0
0264  0000  UDLSUB,    0
0265  0000  UDBOX,     0
0266  0000  UDTEML,    0
0267  0000  UDGET,     0
0270  0000  UDPTR,     0
0271  3166  UDCON1,    3166                /POWERS OF TEN
0272  4600              4600               /-10,000,000
0273  7413              7413               /-1,000,000
0274  6700              6700
0275  7747              7747               /-100,000
0276  4540              4540
0277  7775              7775               /-10,000
0300  4360              4360
0301  7777              7777               /-1,000
0302  6030              6030
0303  7777              7777               /-100
0304  7634              7634
0305  7777              7777               /-10
0306  7766              7766
0307  7777              7777               /-1
0310  7777              7777
            PAUSE
```

```
UDADDR  0256
UDARND  0216
UDBOX   0265
UDCNT   0260
UDCON1  0271
UDDO    0224
UDGET   0267
UDHIGH  0261
UDHSUB  0263
UDLOOP  0255
UDLOW   0262
UDLSUB  0264
UDOUT   0242
UDPRNT  0200
UDPTR   0270
UDTEML  0266
UDTWO   0257


00000000 00000001 00000002 00000003 00000004
00000005 00000006 00000007 00000008 00000009
00000010 00000020 00000030 00000040 00000050
00000060 00000070 00000080 00000090 00000100
00000100 00000200 00000300 00000400 00000500
00000600 00000700 00000800 00000900 00001000
00001000 00002000 00003000 00004000 00005000
00006000 00007000 00008000 00009000 00010000
00010000 00020000 00030000 00040000 00050000
00060000 00070000 00080000 00090000 00100000
00100000 00200000 00300000 00400000 00500000
00600000 00700000 00800000 00900000 01000000
01000000 02000000 03000000 04000000 05000000
06000000 07000000 08000000 09000000 10000000
10000000 03222784 13222784 06445568 1
```

11 DIAGRAMS

11.1 Flow Charts