

- 1. IDENTIFICATION
- 1.1 Digital-8-25-U-Sym
- 1.2 Signed Decimal Print, Double Precision
- 1.3 January 19, 1966

2. ABSTRACT

This subroutine permits the typeout of the contents of two consecutive computer words as one signed, double-precision, two's complement number. If bit 0 of the high order word is a "1," the remaining 23 bits represent a negative integer in two's complement form; if bit 0 equals "0," the remaining bits represent a positive integer. If the number is negative, a minus sign is printed; if positive, space.

3. REQUIREMENTS

3.1 Storage

This subroutine requires 86 core locations.

3.2 Subprograms and/or Subroutine (None)

3.3 Equipment

Basic PDP-8 with ASR-33

4. USAGE

4.1 Loading

The symbolic tape provided is in PAL III or MACRO-8 language. It may be assembled with the user's program or separately with the proper origin setting. Neither origin setting nor "\$" terminating character exists on the symbolic tape provided, but a PAUSE pseudo-instruction is the last line on tape.

4.2 Calling Sequence

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

5. RESTRICTIONS (None)

6. DESCRIPTION

6.1 Discussion

This is a basic subroutine to obtain signed, decimal output corresponding to a double-precision binary word stored in two consecutive locations in memory. First, the binary number is sensed to determine if it is positive or negative. If positive, a space is printed. If negative, a minus sign is printed, and the number complemented to form the absolute value. Then the same algorithm is followed as in the unsigned double-precision printout (Digital-8-24-U-Sym).

6.2 Examples and/or Applications (None)

6.3 Scaling

The numbers are interpreted and typed out as integers.

7. METHOD (See Digital-8-24-U)

8. FORMAT

8.1 Input Data (Not Applicable)

8.2 Core Data

The double precision integers are stored in the usual signed, double-precision format, (see Digital-8-13-F-Sym).

8.3 Output Data

Output is in the form of seven consecutive decimal digits preceded by either a space or a minus sign. Spacing, tabulation, carriage return, etc., are not provided in this subroutine. See Digital-8-19-U-Sym which contains subroutines for these purposes. If the user wishes to print a "+" sign instead of a space he may change the contents of location SDPLUS from "-15" to "-2".

9. EXECUTION TIME

9.1 Minimum

9.2 Maximum

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-OUT PROGRAM FOR SIGNED, DOUBLE-PRECISION PRINT(POSITIVE NUMBERS)
*200
RETURN=JMS TYCR
PRINT=JMS SDPRNT
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>

INITL,    RETURN
          CLA CLL
          DCA TEMP
```

```
      DCA TEMP+1
      TAD (-5)
      DCA COUNT1
      TAD (-2)
      DCA COUNT2
      RETURN
TOP,   PRINT; DNUMB
      SPACE
      DBLADD DNUMB,VARCON
      ISZ COUNT1
      JMP TOP
FIVE,  RETURN
      TAD (-5)
      DCA COUNT1
      ISZ COUNT2
      JMP TOP
      TAD (-2)
      DCA COUNT2
      DMOVE VARCON, TEMP
      DSHFT VARCON+1,VARCON
      DSHFT VARCON+1,VARCON
      DBLADD VARCON,TEMP
      DSHFT VARCON+1,VARCON
      DMOVE VARCON, DNUMB
      JMP TOP
TEMP,  DUBL 0
DNUMB, DUBL 0
VARCON, DUBL 1
COUNT1, 0
COUNT2, 0
PAGE
PAUSE
```

/CHECK-OUT PROGRAM FOR SIGNED ,DOUBLE-PRECISION PRINT (NEGATIVE NUMBERS)

*200

RETURN=JMS TYCR

PRINT=JMS SDPRNT

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>

DEFINE DBLSUB G H TE

<CLA CLL; TAD H; CMA; DCA TE; TAD H+1; CIA CLL; SZL; ISZ TE; NOP
CLL; TAD G+1; DCA G+1; RAL; TAD G; TAD TE; DCA G>

Control Program (modified*)

```
INITL,      RETURN
            CLA CLL
            DCA TEMP
            DCA TEMP+1
            TAD (-5)
            DCA COUNT1
            TAD (-2)
            DCA COUNT2
            RETURN
TOP,         PRINT; DNUMB
            SPACE
            DBLSUB DNUMB, VARCON, TEM
ARCON
            ISZ COUNT1
            JMP TOP
FIVE,       RETURN
            TAD (-5)
            DCA COUNT1
            ISZ COUNT2
            JMP TOP
            TAD (-2)
            DCA COUNT2
            DMOVE VARCON, TEMP
            DSHFT VARCON+1,VARCON
            DSHFT VARCON+1,VARCON
            DBLADD VARCON,TEMP
            DSHFT VARCON+1,VARCON
            DMOVE VARCON, DNUMB
            JMP TOP
TEMP, DUBL 0
DNUMB, DUBL 0
VARCON, DUBL -1
COUNT1, 0
COUNT2, 0
TEM, 0
PAGE
PAUSE

/SIGNED DECIMAL PRINT, DOUBLE PRECISION
/CALLING SEQUENCE:  JMS SDPRNT /SUBROUTINE CALLED
/                   HIADDR    /ADDRESS OF HIGH ORDER WORD
/                   RETURN    /RETURN WITH AC AND L CLEAR
SDPRNT, 0
            CLA CLL
            TAD I SDPRNT          /PICK UP ADDRESS OF HIGH-ORDER WORD
            DCA SDGET
            TAD I SDGET          /PICK UP HIGH-ORDER WORD
            SMA CLA              /IS IT NEGATIVE?
            TAD SDPLUS          /NO, GENERATE CODE FOR SPACE
            TAD SDMNS           /YES, GENERATE CODE FOR "MINUS"
            JMS SDTYPE          /TYPE IT OUT
            TAD I SDGET          /PICK UP HIGH-ORDER WORD AGAIN
            SPA                 /IS IT POSITIVE?
```

*Modifications made on this Macro in check-out.

Signed Double Precision Print-out Positive Numbers

0000000	0000001	0000002	0000003	0000004
0000005	0000006	0000007	0000008	0000009
0000010	0000020	0000030	0000040	0000050
0000060	0000070	0000080	0000090	0000100
0000100	0000200	0000300	0000400	0000500
0000600	0000700	0000800	0000900	0001000
0001000	0002000	0003000	0004000	0005000
0006000	0007000	0008000	0009000	0010000
0010000	0020000	0030000	0040000	0050000
0060000	0070000	0080000	0090000	0100000
0100000	0200000	0300000	0400000	0500000
0600000	0700000	0800000	0900000	1000000
1000000	2000000	3000000	4000000	5000000
6000000	7000000	8000000	-7777216	-6777216
-6777				

Double Precision Print-out Negative Numbers

0000000	-0000001	-0000002	-0000003	-0000004
-0000005	-0000006	-0000007	-0000008	-0000009
-0000010	-0000020	-0000030	-0000040	-0000050
-0000060	-0000070	-0000080	-0000090	-0000100
-0000100	-0000200	-0000300	-0000400	-0000500
-0000600	-0000700	-0000800	-0000900	-0001000
-0001000	-0002000	-0003000	-0004000	-0005000
-0006000	-0007000	-0008000	-0009000	-0010000
-0010000	-0020000	-0030000	-0040000	-0050000
-0060000	-0070000	-0080000	-0090000	-0100000
-0100000	-0200000	-0300000	-0400000	-0500000
-0600000	-0700000	-0800000	-0900000	-1000000
-1000000	-2000000	-3000000	-4000000	-5000000
-6000000	-7000000	-8000000	7777216	6777216
6777216	-3222784	355		

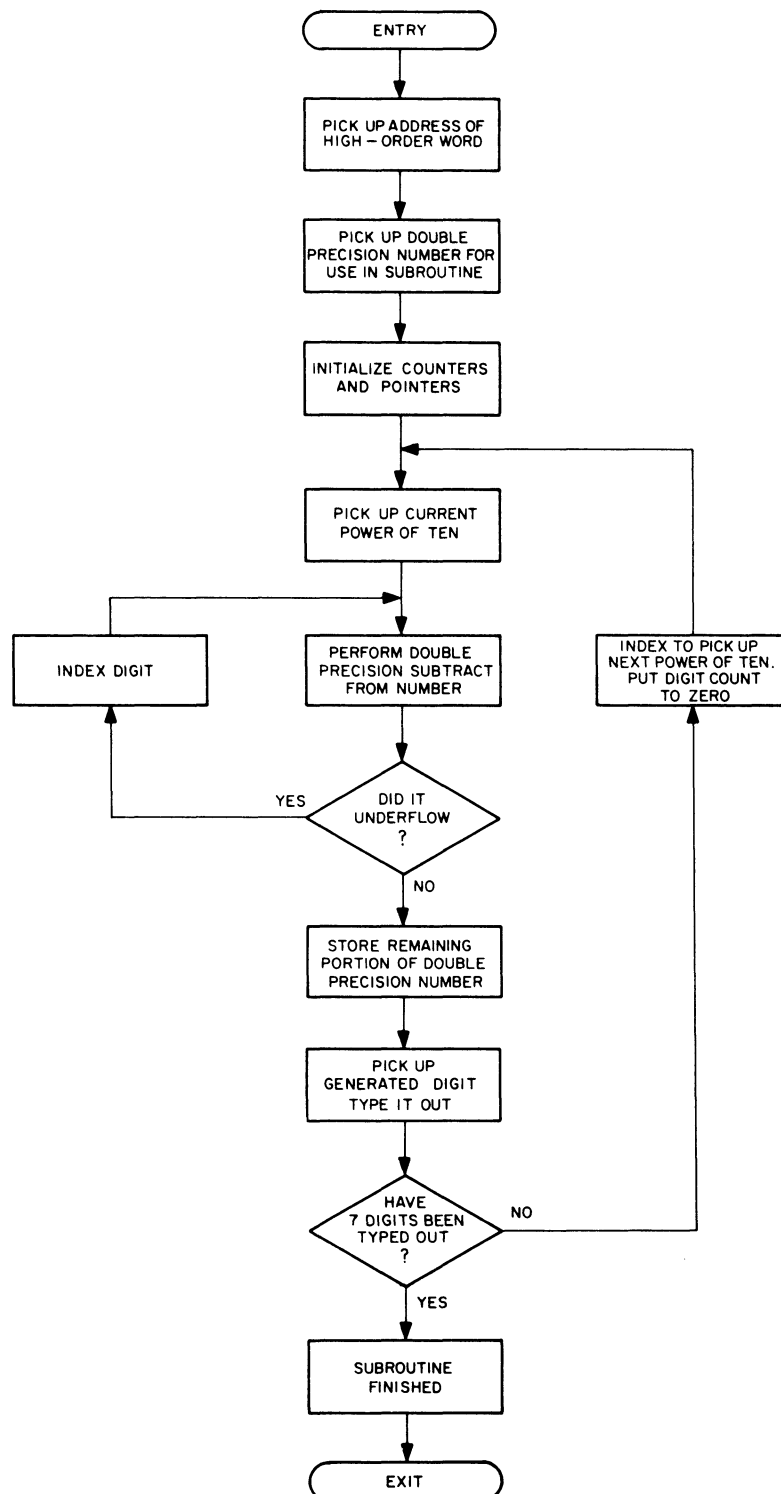
	CMA CML	/NO, COMPLEMENT IT. SET LINK
	DCA SDHIGH	/STORE POSITIVE WORD FOR USE IN SUBROUTINE
	ISZ SDGET	
	TAD I SDGET	/PICK UP LOW-ORDER WORD
	SZL	/IS LINK SET?
	CMA CLL IAC	/YES, FORM TWO'S COMPLEMENT
	SZL	/DID AC OVERFLOW FROM "IAC"?
	ISZ SDHIGH	/YES, CORRECT HIGH-ORDER WORD
	DCA SDLOW	/STORE POSITIVE LOW-ORDER WORD
	TAD SDLOOP	/INITIALIZE DIGIT COUNTER TO "7"
	DCA SDCNT	
	TAD SDADDR	/INITIALIZE POINTER TO TABLE OF POWERS
	DCA SDPTR	
	ISZ SDPRNT	/INDEX LINKAGE FOR CORRECT RETURN
SDARND,	TAD I SDPTR	/PICK UP POWER OF TEN FOR USE IN SUBTRACT
	ISZ SDPTR	
	DCA SDHSUB	
	TAD I SDPTR	
	ISZ SDPTR	
	DCA SDLSUB	
SDDO,	CLL	/DOUBLE PRECISION SUBTRACTION
	TAD SDLSUB	
	TAD SDLOW	
	DCA SDTEML	
	RAL	
	TAD SDHSUB	
	TAD SDHIGH	
	SPA	/DID IT UNDERFLOW?
	JMP SDOUT	/NO, COUNT IS DONE
	ISZ SDBOX	/YES, COUNT NOT DONE. INDEX DIGIT
	DCA SDHIGH	/DEPOSIT REMAINING HIGH-ORDER PORTION
	TAD SDTEML	/RESTORE REMAINING LOW-ORDER PORTION
	DCA SDLOW	
	JMP SDDO	/GO BACK AND SUBTRACT AGAIN
SDOUT,	CLA	
	TAD SDBOX	/PICK UP RESULTING DIGIT
	JMS SDTYPE	/TYPE IT OUT
	DCA SDBOX	/INITIALIZE DIGIT TO "0"
	ISZ SDCNT	/HAVE WE TYPED "7" DIGITS
	JMP SDARND	/NO, DETERMINE NEXT DIGIT
	JMP I SDPRNT	/YES, SUBROUTINE DONE. RETURN
SDTYPE,	0	/TYPEOUT ROUTINE
	TAD SDTWO	
	TLS	
	TSF	
	JMP .-1	
	CLA CLL	
	JMP I SDTYPE	
SDLOOP,	-7	/COUNT OF SEVEN DIGITS
SDADDR,	SDCONL	/INITIAL ADDRESS OF POWERS OF TEN
SDTWO,	260	/BASIC CODE FOR DIGITS
SDPLUS,	-15	/"SPACE". TO TYPE "+", REPLACE BY "-2"
SDMNS,	-3	/"MINUS"
SDCNT,	0	/STORAGE LOCATIONS
SDHIGH,	0	
SDLOW,	0	
SDHSUB,	0	

SDLSUB,	0	
SDBOX,	0	
SDTEML,	0	
SDGET,	0	
SDPTR,	0	
SDCONL,	7413	/TABLE OF POWERS OF TEN
	6700	/-1,000,000
	7747	/-100,000
	4540	
	7775	/-10,000
	4360	
	7777	/-1,000
	6030	
	7777	/-100
	7634	
	7777	/-10
	7766	
	7777	/-1
	7777	

PAUSE

11. DIAGRAMS

11.1 Flow Chart



12. REFERENCES

12.1 Other Library Programs

Digital-8-13-F-Sym

Digital-8-19-U-Sym

Digital-8-24-U-Sym

