



DATA GENERAL
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PROGRAM

Double Precision Subtraction

TAPES

ASCII Source: 090-000018

ABSTRACT

This routine performs a subtraction of two double precision,
two's complement numbers.

1. REQUIREMENTS

1.1 Memory

1K or larger alterable memory

1.2 Equipment

NOVA central processor

1.3 External Subroutines

None

1.4 Other

None

2. OPERATING PROCEDURE

2.1 Calling Sequence

JSR .DSUB
address of higher order word of subtrahend
return

2.2 Input Format

The minuend is passed in AC0, AC1 (high order, low order). The subtrahend must be in two consecutive memory words, higher order followed by lower order. The word following the JSR .DSUB should contain the address of the higher order word of the subtrahend.

2.3 Output Format

The double precision difference is returned in AC0, AC1 (high order, low order).

2.4 Error Returns

None

2.5 State of Active Registers upon Exit

AC \emptyset , AC1, AC3, and Carry are destroyed by .DSUB.
AC2 remains unchanged.

2.6 Cautions to User

No check is made for overflow. Incorrect results will be obtained if differences exceed $2^{31}-1$ in magnitude.

3. DISCUSSION

3.1 Algorithms

The double subtract algorithm is based on the fact that the low order word of a two's complement, double precision number may be considered an unsigned binary number. The low order words are subtracted. If no "borrow" occurred from the high order, the high order words are also subtracted. Otherwise, 1 is subtracted from the results of the high order subtraction to compensate for the "borrow". (Note that the latter can be accomplished with one instruction, ADC.)

3.2 Limitations and Accuracy

The routine is exact provided the magnitude of the result does not exceed $2^{31}-1$.

3.3 Size and Timing

The routine is 15 (octal) words in length.

Execution time is 54.9 μ seconds.

3.4 References

See section 2.2 of "How to Use the NOVA" for a further discussion of double precision arithmetic.

3.5 Flow Diagrams

None

4. EXAMPLES AND APPLICATIONS

An ASCII source tape of .DSUB is provided with the NOVA software. This tape should be edited into user software that requires double precision subtraction.

5. PROGRAM LISTING

A listing of .DSUB follows. No origin has been given, enabling the user to edit the source anywhere within his routines.

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; DOUBLE SUBTRACTION
; COMPUTES THE DIFFERENCE OF TWO DOUBLE PRECISION TWO'S
;   COMPLEMENT INTEGERS

; INPUT:          D1 IN AC0, AC1 (HIGH AND LOW)
;                ADDRESS OF D2 IN WORD AFTER JSR
; OUTPUT:         D1-D2 IN AC0, AC1 (HIGH AND LOW)

; CALLING SEQUENCE:
;   JSR    .DSUB
;   ADDRESS OF SECOND OPERAND
;   RETURN

; CAUTION:       NO CHECK IS MADE FOR OVERFLOW

; UNCHANGED:    AC2
; DESTROYED:    AC0, AC1, AC3, CARRY

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00000 054014 .DSUB: STA 3,.BE03      ; SAVE RETURN
00001 050013          STA 2,.BE02    ; *SAVE AC2
00002 035400          LDA 3,0,3      ; ADDRESS OF D2
00003 031400          LDA 2,0,3      ; HIGH ORDER OF D2
00004 035401          LDA 3,1,3      ; LOW ORDER OF D2
00005 166423          SUBZ 3,1,SNC   ; LOW ORDER SUBTRACT
00006 142001          ADC 2,0,SKP    ; BORROW
00007 142400          SUB 2,0        ; NO BORROW
00010 030013          LDA 2,.BE02    ; *RESTORE AC2
00011 010014          ISZ .BE03      ; BUMP RETURN
00012 002014          JMP 0,.BE03    ; AND RETURN

00013 000000 .BE02: 0                ; *SAVE AC2
00014 000000 .BE03: 0                ; SAVE RETURN

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