

UNIVERSITY OF ILLINOIS
DIGITAL COMPUTER LABORATORY

NEW COMPUTER LIBRARY ROUTINE J3-DPR1-24V

TITLE: Decimal Print Routine
TYPE: closed, multiple entry, relocatable, mnemonic
LENGTH: 73 words
TEMPORARY STORAGE: 6 words at fixed memory locations 0-5
DURATION: determined by punch speed
FAST REGISTERS CHANGED: none
SUBROUTINES USED: none
ENTRIES: Let the first word of program be at location N.

1) Entry JSB 15,0, N+0

prints p numbers from core memory beginning at initial location I, in the following format

$$\frac{\pm \overline{xx} \dots x}{10} \pm \frac{\overline{xx}}{2} \square \square \square \text{number} \square \square \square \text{number} \square \square \square \text{number}$$
 (4 numbers on a line, separated by 3 spaces).

The parameters I, p have to be written in the word following the word containing the JSB instruction:

I
P
0
0

In order to have r numbers printed on one line (instead of 4) and S spaces separating them (instead of 3), overwrite the instructions in words 10R and 11R in the following way:

10R	CJU 6,2, 11R CSM 6,2, r	$r \geq 1$ $S \geq 0$
11R	SFN 8,3, S+1 CSM 8,2, S	

Notice: Accumulator is changed.

2) Entry JSB 15,0, N+2

prints one number out of the accumulator, preceded by a CRLF, in the format

$$\frac{+.xx---x}{10} \pm \frac{xx}{2}$$

No parameters

Notice: After printing, the number is no longer in the accumulator.

3) Entry JSB 15,0, N+4

prints one number out of the accumulator in a very adaptable manner, determined by 7 parameters, which have to be written in the 2 words following the word containing the JSB instruction:

Parameters	Range
S	$-1 \leq S$
n	$1 \leq n (\leq 13 \text{ for format 1 only})$
k	$0 \leq k \leq n$
0	0,1
Format	any character
pos. sign	} only relevant for format 0
suppress	
replace	

Format 0 (fraction)

$$\underbrace{\boxed{} \dots \boxed{}}_S + \frac{\overbrace{xx---x.x---x}^n}{k}$$

automatic n increment (see page 3)

Format 1 (floating point)

$$\underbrace{\boxed{} \dots \boxed{}}_S + \frac{\overbrace{xx---x.x---x}^n}{k} \cdot 10 \pm \frac{xx}{2}$$

S = number of spaces preceding the sign.

S = -1 means CRLF, S = 0 means no space

n = number of decimal digits computed; if initial zeros are printed, it is equal to the number of digits printed

k = number of digits after point, k = 0 means no point

positive sign: a negative number is always preceded by a "-".

A positive number can be preceded by any character. Of special interest are:

character	decimal	octal
+	10	00012
space	56	00070
delay	48	00060

suppress: 0 = initial zeros are suppressed

1 = initial zeros are printed

replace: suppressed initial zeros are replaced by

nothing } if this parameter = $\begin{cases} 0 \\ 1 \end{cases}$
spaces }

if initial zeros are printed, this parameter is irrelevant.

Further explanations for format 0 (fraction)

a) Automatic n-increment

If the number to be converted is $\geq 10^{n-k}$, it cannot be correctly represented by n-k decimal digits before the point. Hence n is increased until number $< 10^{n-k}$.

Notice: There is no n-increment for Format 1 (floating point).

b) If the user asks for k decimal digits after the point, the number a_0 is multiplied by 10^k . If $10^k a_0 \geq 4^{6k} 10^{38}$, this leads to OV and a nonsense result. This limitation of the size of k is no real restriction, however, since the additional digits after the point would not be significant anyway.

c) The method used to convert a number a_0 from binary to decimal assumes that a_0 is an integer. In general a_0 is not an integer, but as long as $|a_0| < 2^{4k}$, it is rounded and the integer part $[a_0 + 1/2]$ is converted exactly. If $|a_0| \geq 2^{4k}$, this is no longer possible, and the unrounded number a_0 is submitted to the algorithm.

REMARK: This print routine clears OV.

ACCURACY: This subroutine is not planned for maximum accuracy; frequent multiplications by 10 may generate a considerable round-off error. Integers up to 13 digits are exact. For format 0 (fraction) more than 13 digits are not significant.

DATE: October 30, 1962

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APPROVED BY: