

UNIVERSITY OF ILLINOIS
DIGITAL COMPUTER

AUXILIARY
LIBRARY ROUTINE V 13 - 314

TITLE: Error Function (DOI or SADOI)
TYPE: Closed, standard entry
NUMBER OF WORDS: 22
TEMPORARY STORAGE: 0, 1, 2
ACCURACY: Maximum error $\pm 10 \times 2^{-39}$ (see below)
DURATION: 10 milliseconds
DESCRIPTION: This routine computes the function

$$\operatorname{erf}(x) = \frac{2}{\sqrt{\pi}} \int_0^x e^{-t^2} dt$$

for $|x| < 1$ by use of a polynomial expansion. The routine is to be entered with the argument in the accumulator and the link address in the right address position in Q. When the link is obeyed, the computed function will be in the accumulator and quotient registers.

NOTE 1: An incorrect result is given when $x = -1$.

NOTE 2: The rounding of the coefficients in the power series is done in such a way that the error in the computed values will be found to be considerably smaller than the maximum given above. The errors for a large range of experimental values were found to be less than 5×10^{-12} .

DATE	December 12, 1960
PROGRAMMED BY	<i>Jim Elmer</i>
APPROVED BY	<i>J. Snyder</i>

LOCATION	ORDER	NOTES	PAGE 1	V 13
	00K(V13)			
0	40 F			
	K5 13L			
1	42 10L			
	50 F	Plant link		
2	7J F			
	40 1F	x^2 at 1		
3	L5 L			
	42 5L	Plant coefficient address		
4	23 5L			
	50 2F	Enter loop		
5	7J 1F			
	L4 F	Form $\sum_{n=0}^8 C_n x^{2n}$		
6	40 2F			
	F5 5L			
7	42 5L			
	L0 11L	End test		
8	32 4L			
	50 2F			
9	75 F			
	66 12L	Form $x(\sum C_n x^{2n}) \div \sqrt{\pi/2}$		
10	S5 F			
	22 F	Exit via link		
11	LJ 1F			
	L4 22L	End constant		
12	40 F			
	00 38 6226 925 453J	$\sqrt{\pi/2}$		
13	00 F			
	00 93 8982J	$C_8 = .000000938982$		
14	NO F			
	00 4999 8767 1076J	$C_7 = -.000012328924$		
15	00 F			
	00 1059 6568 2J	$C_6 = .000105965682$		
16	NO F			
	00 4992 4292 5533J	$C_5 = -.000757074467$		

LOCATION	ORDER	NOTES	PAGE 2	V 13
17	00 F 00 4629 4589 26J	$C_4 = .004629458926$		
18	NO F 00 4761 9050 8999J	$C_3 = -.023809491002$		
19	00 F 00 9999 9996 832J	$C_2 = .099999996832$		
20	NO F 00 1666 6666 6785J	$C_1 = -.333333333215$		
21	80 F 00 F	$C_0 = 1$		