UNIVERSITY OF ILLINOIS
DIGITAL COMPUTER

ILLINOIS CODE 68 - R4

TITLE	Cube Root (DOI or SADOI)
TYPE	Closed
NUMBER OF WORDS	15
TEMPORARY STORAGE	0,1 2
ACCURACY	$\pm 2^{-39}$
DURATION	Less than 31 milliseconds for $\|A\| \geq 2^{-2}$ 31-160 milliseconds for $2^{-39} \leq \|A\| < 2^{-2}$ 266 milliseconds for A = 0
READ AROUND	Within and adjacent to subroutine 17 Adjacent to temporary storage 42.5
DESCRIPTION	Computes the cube root of a 39-digit real argument A. When the routine is entered A must be in the accumulator. The cube root of A is found by Newton's iteration method, where $x_0 = 1 - 2^{-39}$ $x_{n+1} = x_n + (1/3)(A/x_n^2 - x_n)$ Convergence of the process is assumed when $(1/3)(A/x_n^2 - x_n) \geq 0$. Upon completion of the routine the accumulator contains the signed cube root of A.

ENTRY

	any
p	50 p
p + 1	26 (R4)

11/4/60

DATE December 29, 1952
CODED BY D.J. Wheeler
CHECKED BY R.F. King
APPROVED BY J.P.Nash

LOCATION	ORDER	NOTES		PAGE 1 R4
	00K(R4)			
0	40 F		N(0) = Argument A	
	S5 1F			
1	L4 L		Set link address	
	42 11L			
2	L7 13L		Set starting iterate	
	40 2F	From 9'	$x_0 = 1 - 2^{-39}$	
3	50 2F			
	75 2F		$N(1) = x_n^2$	
4	40 1F			
	L7 F			
5	50 13L			
	66 1F		$N(1) = (A/x_n^2 - x_n)$	
6	S5 F			
	L0 2F			
7	40 1F			
	50 1F			
8	75 14L		Test $1/3\ (A/x_n^2 - x_n)$	
	36 10L			
9	L4 2F		$NR_1 = x_{n+1} = x_n + 1/3\ (A/x_n^2 - x_n)$	
	22 2L			
10	L5 F	From 8'	Test sign of A	
	36 12L			
11	L3 2F			
	22 ( )F	By 1'	Exit with $NR_1 = \pm \sqrt[3]{\lvert A \rvert}$	
12	L7 2F	From 10'		
	22 11L			
13	80 F			
	00 1F		$-1 + 2^{-39}$	
14	00F 00 3333			
	3333 3333 J		1/3	