UNIVERSITY OF ILLINOIS

DIGITAL COMPUTER

LIBRARY ROUTINE RA2 - 315

TITLE: Square Root Auxiliary for Routine A7, Floating Decimal Arithmetic Routine (DOI or SADOI)

TYPE: Closed

NUMBER OF WORDS: 30

PRESET PARAMETERS: S3, Location of Floating Accumulator
S4, Location of first word of Routine A7

TEMPORARY STORAGE: 0, 1, 2, all of Floating Accumulator

DURATION: Approximately 25 msec

DESCRIPTION: This routine computes the square root of the number in the floating accumulator to full double precision, using Newton's method, as described in Routine R1 - 116. The contents of the Floating Accumulator are standardized by this routine on entry, so the programmer need not use an interpretive N2F instruction for this purpose before entry. The routine is entered with a 8J x F order, where x is the location of the first word of this routine, and control is returned to A7 so that the next interpretive instruction obeyed will be the one following the 8J order, with the computed square root in the floating accumulator.

NOTE 1: If the floating accumulator is negative, this routine will stop on a division hangup.

NOTE 2: If A7 is operating in the fixed-point mode, an additional right shift of the floating accumulator of 256 - N(2S3) places is required for an arithmetically correct result.

DATE January 5, 1961
PROGRAMMED BY John Ehrman
APPROVED BY J. M. Snyder

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LOCATION	ORDER	NOTES PAGE 1 RA 2
	00K(RA2)	
0	L5 3L	
	42 25L	Set shift address
1	L5 S3	
	40 3S3	
2	50 1S3	
	F5 2L	Standardize Floating Accumulator
3	26 284S4	
	10 1F	
4	40 S3	
	L5 2S3	
5	L0 5S3	
	L4 387S4	Correct exponent for standardization
6	10 1F	
	40 2S3	and set bias for new exponent
7	S5 F	
	00 1F	Test for odd exponent
8	36 11L	
	F5 2S3	jump if was even
9	40 2S3	
	L5 S3	Correct exponent and Floating Accumulator
10	10 1F	
	40 S3	
11	S5 F	
	40 1S3	
12	51 S3	
	10 1F	Compute single-length square root
13	SJ F	
	40 2F	$y_0 = (1/2 + 1/2x)$
14	L5 S3	
	50 1S3	
15	66 2F	
	S5 24L	

LOCATION	ORDER	NOTES PAGE 2 RA 2
16	L0 2F	
	32 18L	$y_{k+1} = y_k + 1/2(\frac{\text{Floating Accumulator}}{y_k} + y_k)$
17	10 1F	
	L4 2F	
18	22 13L	
	FS 2F	Test $\lvert y_k \rvert \geq 1/2$? jump if not.
19	36 23L	
	F5 25L	set shift to scale down
20	42 25L	
	L5 2F	
21	40 3S3	
	50 386S4	double precision division to form $\frac{\text{F. A.}}{y_n}$
22	L5 15L	
	26 244S4	
23	L5 2F	
	80 1F	Scale up divisor
24	26 21L	
	L5 S3	
25	50 1S3	
	10 1F	properly scale $\frac{\text{Floating Accumulator}}{y_n}$
26	00 1F	
	40 S3	
27	S5 F	
	40 1S3	
28	L5 2F	
	50 386S4	
29	10 1F	
	26 116S4	re-enter A7 to form $1/2\ (\frac{\text{F. A.}}{y_n} + y_n)$