

UNIVERSITY OF ILLINOIS
DIGITAL COMPUTER LABORATORY

NEW COMPUTER LIBRARY ROUTINE E1-DIVF-32

TITLE: divided differences

TYPE: closed, relocatable, mnemonic

LENGTH: 14 words

TEMPORARY STORAGE: 3 words of fixed memory locations 0, 1, 2
a block of (k+1) consecutive locations beginning at S_0

SUBROUTINES USED: none

DURATION: dependent on the duration of the auxiliary routine for evaluating the function $f(x)$. The auxiliary is entered (k+1) times

FAST REGISTERS CHANGED: none

PARAMETERS: link in M15
4 parameters which have to be written in the word following the one with the JSB instruction:

f	address of auxiliary for $f(x)$
X_0	address of first abscissa
S_0	{ address of first location of temporary storage block k-th divided difference
k	

USE: The user must provide:

1) k+1 abscissas $X_0, X_1, X_2, \dots, X_k$
in locations X_0, X_0+1, \dots, X_0+k

- 2) An auxiliary routine for evaluating a function $f(x)$, beginning at location f .
- 3) A block of $k+1$ consecutive words beginning at location S_0 .

The subroutines computes a divided difference table and stores:

k-th	divided difference	$f[x_0, \dots, x_k]$	in location S_0
(k-1)st	divided difference	$f[x_1, \dots, x_k]$	in location S_0+1
(k-2)nd	divided difference	$f[x_2, \dots, x_k]$	in location S_0+2
	⋮		
1st	divided difference	$f[x_{k-1}, x_k]$	in location S_0+k-1
	the value of the function	$f(x_k)$	in location S_0+k

The k -th divided difference $f[x_0, x_1, \dots, x_k]$ is also left in the accumulator.

DATE: December 21, 1962

PROGRAMMED BY: J. Nievergelt

0	SFR2,0 SFR6,2,1
1	ATN15,1 LFR6,0 SFR7,2,2
2	ATN9,0 CAM13,0 ATN10,0 CAM14,0 ATN11,0
3	CSM12,2,1
4	CAD13,1 ATN8,0 JSB15,0,0,0,0
5	STR14,1 CJUL2,2,3R
6	ATN1,0 CSM15,0 CAM13,0 ATN15,0 ATN11,0
7	CAM14,2,1
8	ATN9,0 CSB13,0 ATN9,0 ADD14,1 STR2,3 ATN10,0
9	CSB13,1 ATN10,0 ADD13,0 DIV2,3
10	SBM13,3,1
11	STR10,0 SFN14,0 ATN11,0 CAM12,0 JPM12,2,7R
12	CJUL5,1,6R LFR6,2,1
13	LFR7,2,2 LFR2,0 JLH15,0

read parameters into F6

(M14) ← S₀

(M12) ← - (k + 1)

fill up S₀, S₁, ..., S_k
with f(x₀), f(x₁), ..., f(x_k)

(M15) ← -k

(M14) (M11) + (M15) + 1