

8-NEIGHBOR SUM

Statement of Problem

A rectangular mesh is given with I rows and J columns. For each interior point of the mesh its 8 immediate neighbors are to be summed, and the result is stored at this point.

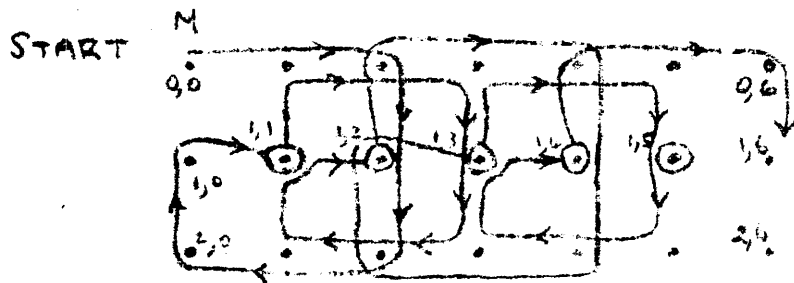
Let $x_{i,j}$ be the current value at (i,j) .
and $x'_{i,j}$ the new value to be stored at (i,j)

Then $x'_{i,j} = x_{i-1,j-1} + x_{i-1,j} + x_{i-1,j+1} + x_{i,j-1} + x_{i,j} + x_{i,j+1} + x_{i+1,j-1} + x_{i+1,j} + x_{i+1,j+1}$

Note: (i) The boundary points in the i^{th} row are $x_{i,0}$ and $x_{i,J-1}$. The interior points are $x_{i,j}$ (where $j = 1, 2, 3, \dots, J-2$).

(ii) The mesh is assumed to be stored row-wise, so that $L(x_{i,j}) = M + J \cdot i + j$ and $L(x_{i+1,0}) = 1 + L(x_{i,J-1})$, where M is the base address of the mesh: i.e., $M = L(x_{0,0})$

Method of Scanning the Mesh



Starting at The base address M, proceed clockwise around the point (1,1) until all 8 neighbors have been picked up. Store the sum in (1,1) and proceed in like manner to (1,2).

8 NEIGHBOR SUM (cont'd)

TABLE OF INCREMENTS

LOCATION	Δ	STEP
B+8	+1	0,0 to 0,1
B+7	+1	0,1 to 0,2
B+6	+J	0,2 to 1,2
B+5	+J	1,2 to 2,2
B+4	-1	2,2 to 2,1
B+3	-1	2,1 to 2,0
B+2	-J	2,0 to 1,0
B+1	+1	1,0 to 1,1
B	-J	1,1 to 0,1

USE OF INDEX REGISTERS

LOCATION	CONTENTS
2	Relative address of current mesh point
3	Relative address of current increment
4	Row limit = $J_i + (J-2)$

Note: M. base address of mesh
 B = base address of table

PROGRAM

LOCATION	OPERATION	TC	ADDRESS	REMARKS
	Load Index 2	0	0	$C(2) = 0$
	Load Index 3	0	L(8)	$C(3) = 8$
	FB - Load	0	0	$C(ACC) = 0$
	FB - Add	2	M	Contribute to Neighbor Sum
	Add Index 2	3	B	Advance mesh address by Δ
	CE ↓ B on NZ 3	0	μ	$C(3) = C(3) - 1$
	FB - Store	2	M	Store the Neighbor Sum
	Add Index 2	3	B	Advance mesh address by Δ
	Load Index 3	0	L(8)	Reset to beginning of table
	Comp Index 2	0	4	} End of row?
NO	B on Index Low	0	λ	
YES	Add Index 4 μ	0	J	Advance row limit by J
	Add Index 2 μ	0	2	Advance mesh address by 2
	Comp Index 2 μ	0	IJ	} End of mesh?
NO	B on Index Low	0	λ	
YES	END			