Chapter 20

20.1 An algorithm has 0.4 fraction of sequential operation. How much speed-up can be expected?

Solution: Let n be the number of processors. Let it be 5. Sequential operation is 0.4. Therefore,

$$Speedup = \frac{1}{0.4 + \frac{(1-0.4)}{5}} = \frac{1}{0.52} \approx 1.9$$

This implies that the execution using 5 processors would result in an execution that is 1.9 times faster than sequential machine.

20.2 Let Σ be a set of integers. Let $x = \{3, 14, 18, 48\}$. What is the output prefix computation Σ if ⊕ is addition? Repeat the process when ⊕ is multiplication.

***Solution*:**

If ⊕ is addition, then

Answer = { 3, 3+14, 3+14+18, 3+14+18+48 }

= { 3, 17, 35, 83 }

If ⊕ is multiplication, then

Answer = { 3, 3×14, 3×14×18, 3×14×18×48 }

= { 3, 52, 756, 36288 }

20.3 Find the minimum element of the following array using wire or circuit model. Show the steps for solving the data.

A = { 1, 23, 45, 89, 100, 140, 390, 400 }

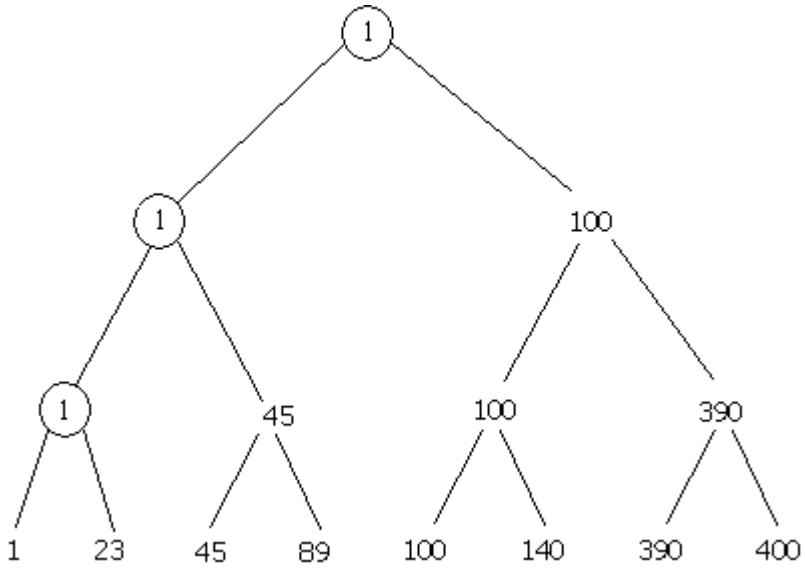
Solution:

Split this into

{1, 23, 45, 89 } { 100, 140, 390, 400 }

Split { 1, 23, 45, 89 } to { 1, 23 } { 45, 89 }

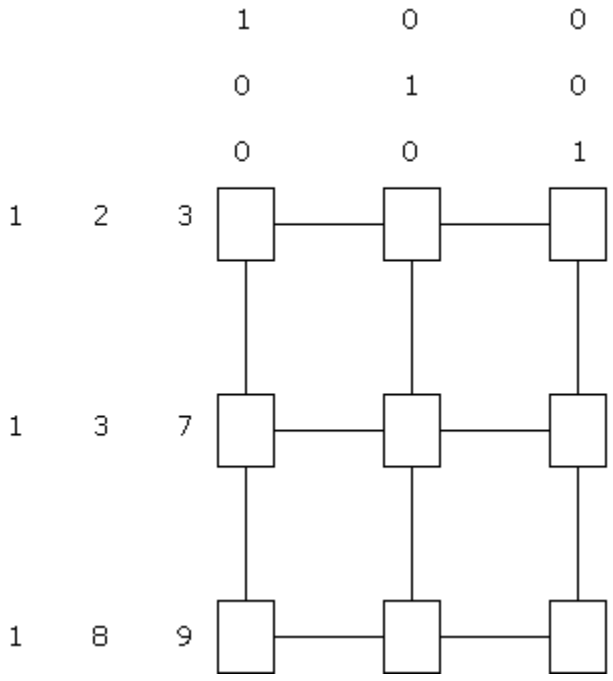
Split {100, 140, 390, 400 } to { 100, 140 } { 390, 400}

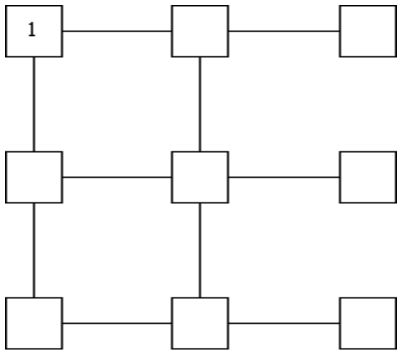


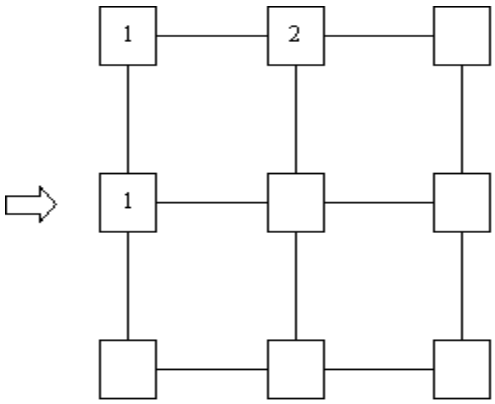
∴ Minimum is 1.

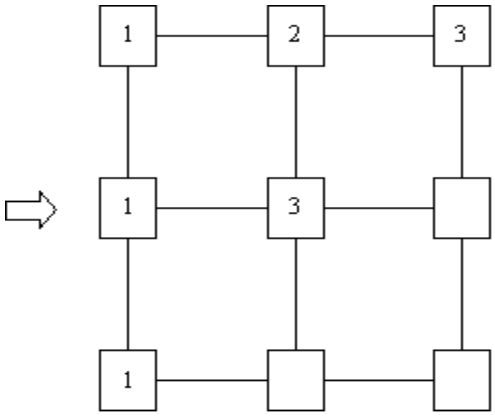
20.4 Use mesh networks and apply parallel matrix multiplication for the following two matrices. Show the intermediate steps.

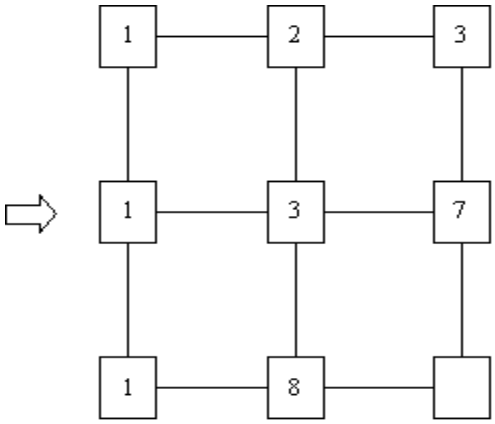
a) $A = \begin{pmatrix} 1 & 2 & 3 \\ 1 & 3 & 7 \\ 1 & 8 & 9 \end{pmatrix}$ *and* $\begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}$

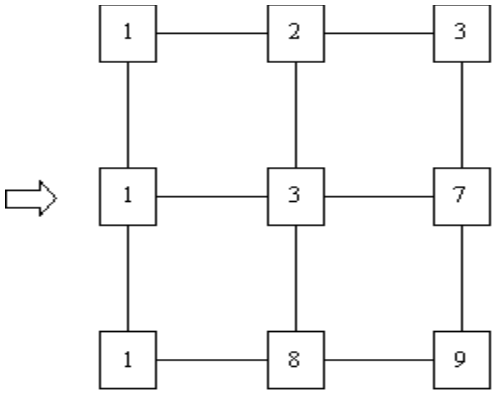












b) $A = \begin{pmatrix} 1 & 7 \\ 9 & 12 \end{pmatrix}$ $B = \begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}$