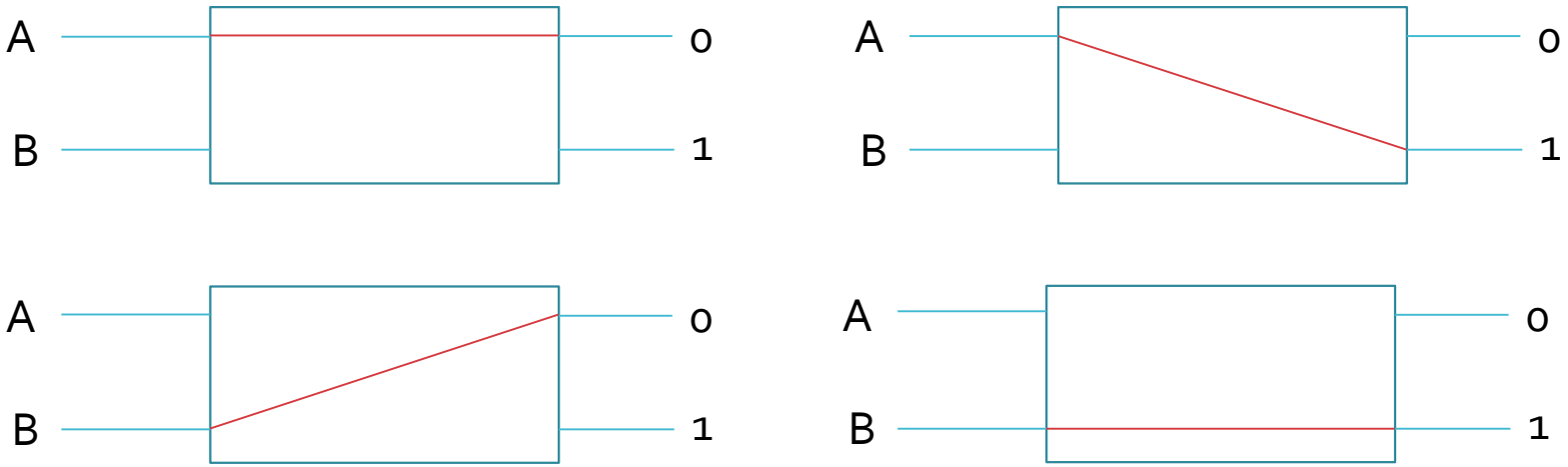
Multistage Switching Networks

Multistage Switching Network

- **Multistage interconnection networks** (MINs) are a class of high speed computer **networks** usually composed of processing **elements** (PEs) on one end of the **network** and memory **elements** (MEs) on the other end, connected by **switching elements** (SEs).

Crossbar /Interchange Switch

- The basic component of a multistage switching network is a two input, two output interchange/crossbar switch.



- **Main problem** is that if both A and B request the same output terminal, only one of them connected, other will be blocked and resubmitted.

Crossbar /Interchange Switch

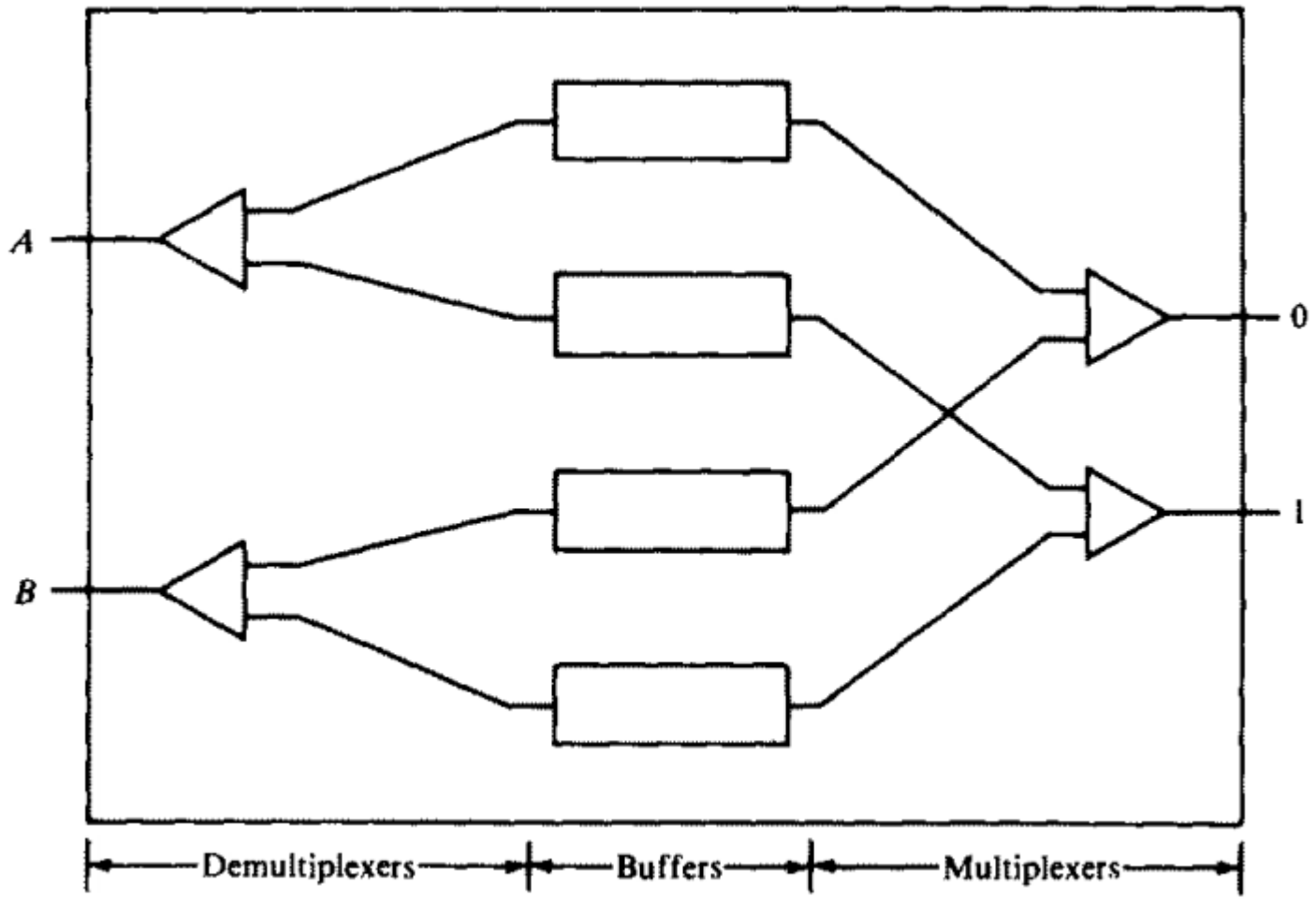


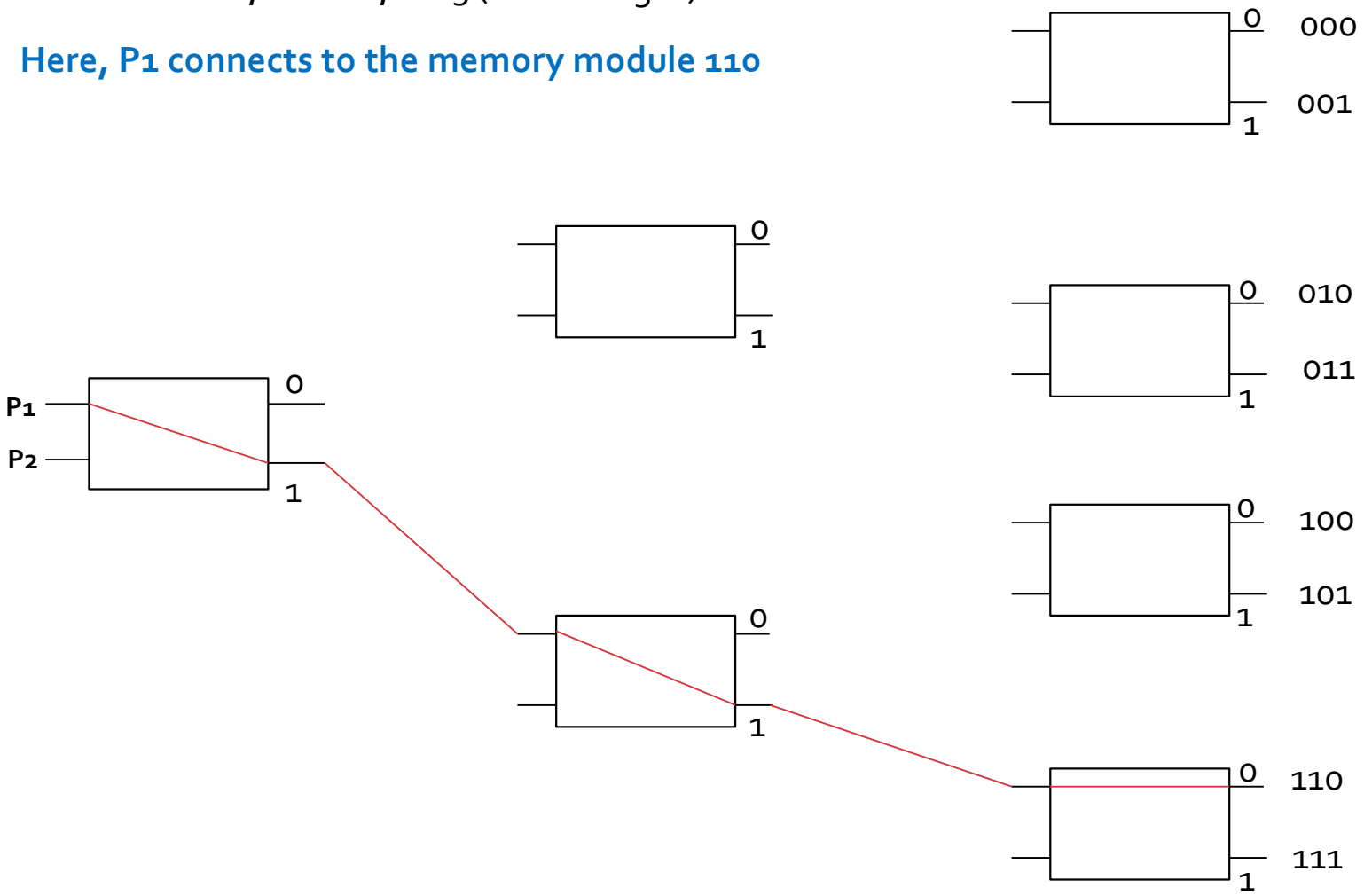
Figure: 2 x 2 Crossbar Switch with buffer

Binary Switch Network

- Build a binary switch network or 1 x 8 demultiplexer where processor P1 and P2 are connected through switches to the memory modules marked in binary 000 to 111.

- **Solution:** Here, 8 = 2^n, n = 3 (no. of stages)

Here, P1 connects to the memory module 110



Delta Network

- A ***delta network*** is defined as an *a* ^ *n* x *b* ^ *n* switching network with *n* stages consisting of *a* x *b* crossbar modules. The interconnection or link patterns between stages is such that there exists a unique path of constant length from any source to any destination.

Where, a → no. of inputs of each module and shuffle

b → no. of outputs of each module and base number of final stage output module

n → no. of stages

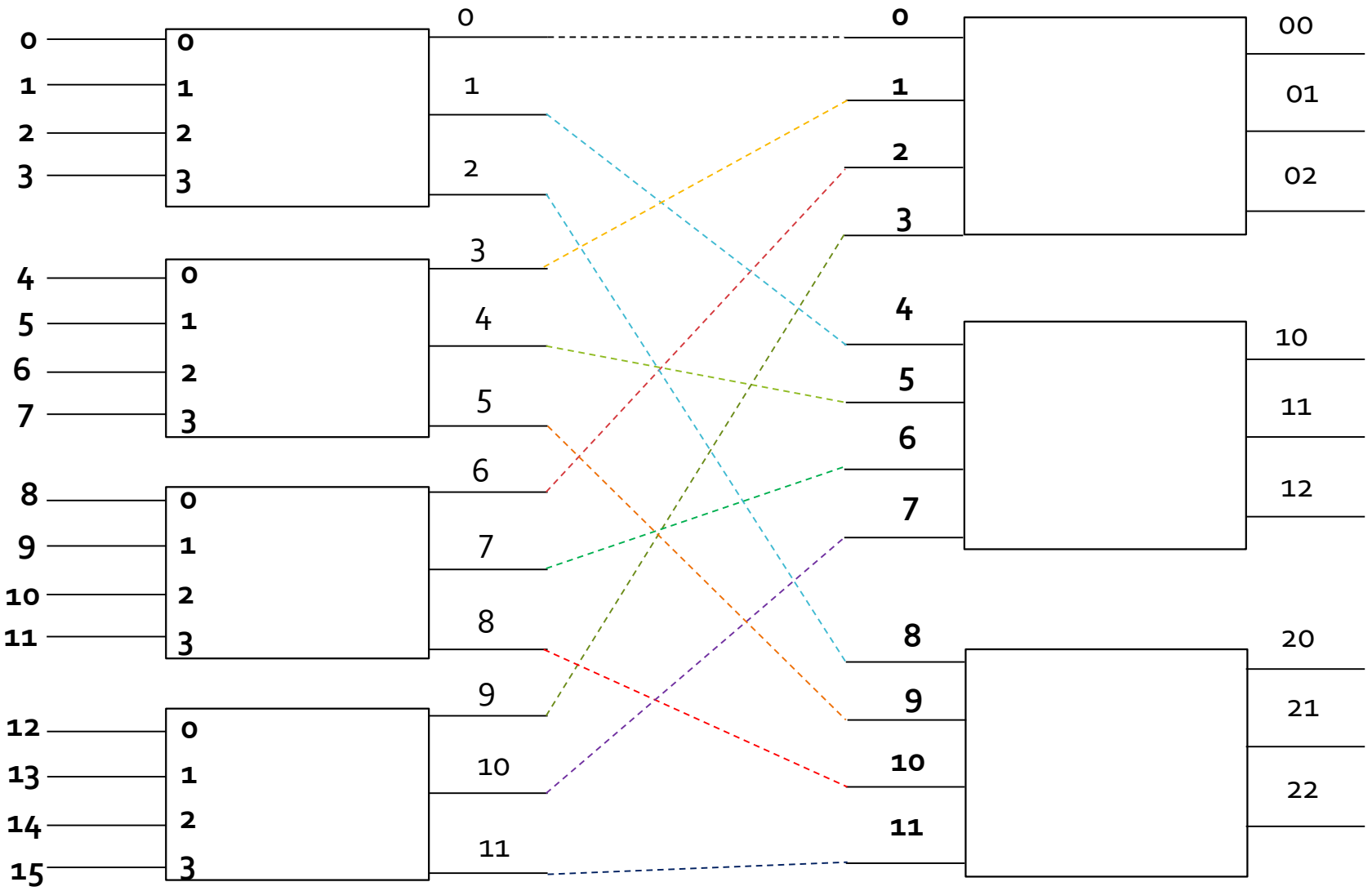
x → stage number

a ^ n-x * b ^ x-1 → no. of modules in each stage

$$S_{qc}(i) = \begin{cases} q_i \ mod\ (qc-1), 0 \le i < (qc-1) \\ i, i = (qc-1) \end{cases}$$

Delta Network

- Design a 4^2 x 3^2 delta network.



Delta Network

i	q_i	$S_{qc}(i)$
0	0	0
1	4	4
2	8	8
3	12	1
4	16	5
5	20	9
6	24	2
7	28	6
8	32	10
9	36	3
10	40	7
11	44	11

Omega Switching Network

- Omega network has self routing property and used in parallel computing architectures.
- It works for each possible input.
- The interconnection between stages are defined by the logical rotate left of the bits used in the port id's.
- 000→000→000→000
- 001→010→100→001
- 011→110→101→011
- 111→111→111→111
- If bit '1' then cell out to the lower port
- If bit 'o' then cell out to the upper port

8x8 Omega Switching Network