Department: Information Technology

Computer Organization

Multiprocessor

Presented By:

Neelkumar J Patel

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Introduction

- **Multiprocessor system is an interconnection of two or more CPUs with memory and input-output equipment**

- The components that forms multiprocessor are CPUs IOPs connected to input –output devices , and memory unit that may be partitioned into a number of separate modules.

- Multiprocessor are classified as multiple instruction stream, multiple data stream (MIMD) system.

Why Choose a Multiprocessor?

- A single CPU can only go so fast, use more than one CPU to improve performance

- Multiple users

- Multiple applications

- Multi-tasking within an application

- Responsiveness and/or throughput

- Share hardware between CPUs

What you the difference between Multiprocessor and Multicomputer?

Multiprocessor

- A multiprocessor system is simply a computer that has more than one CPU on its motherboard.
- Multiprocessing is the use of two or more central processing units (CPUs) within a single computer system.

Multicomputer

- A computer made up of several computers. The term generally refers to an architecture in which each processor has its own memory rather than multiple processors with a shared memory

How multiprocessor are classified?

- Multiprocessor are classified by the way their memory is organized, mainly it is classified into two types

    1. Tightly coupled multiprocessor
    2. Loosely coupled multiprocessor

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Tightly coupled Multiprocessor

- A **multiprocessor** is a tightly coupled computer system having two or more processing units (**Multiple Processors**) each sharing main memory and peripherals, in order to simultaneously process programs

- Tightly coupled Multiprocessor is also know as shared memory system

Loosely-coupled multiprocessor

- Loosely-coupled multiprocessor systems (often referred to as clusters) are based on multiple standalone single or dual processor commodity computers interconnected via a high speed communication system.

- Loosely-coupled multiprocessor is also known as distributed memory.

- Example

    A Linux beowulf cluster

Difference b/w Tightly coupled and Loosely coupled multiprocessor

Tightly coupled

- Tightly-coupled systems physically smaller than loosely-coupled system.
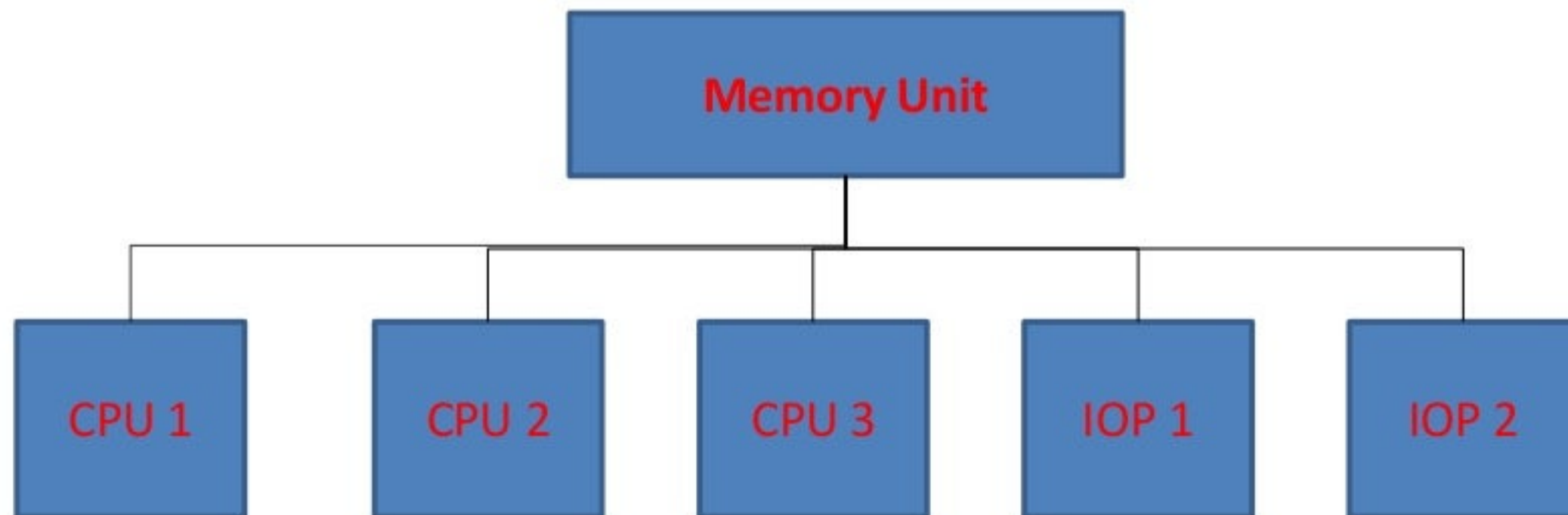
- More expensive .

Loosely coupled

- It is just opposite of tightly coupled system.

- Less expensive.

Interconnection Structures

- The physical forms for establishing an interconnection network .

  1. Time shared common bus.

  2. Multiport memory.

  3. Crossbar switch

  4. Multistage switching network.
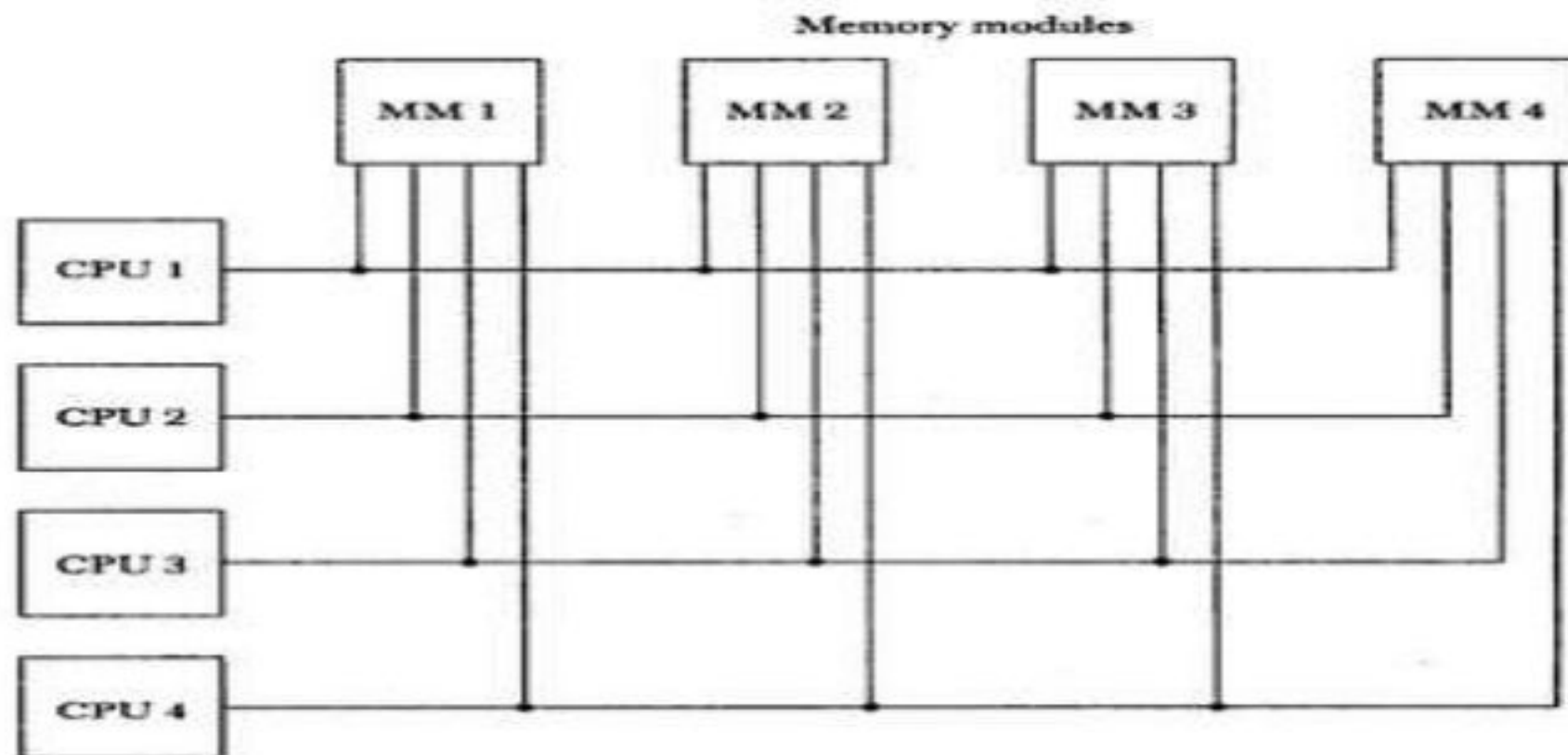
  5. Hypercube system.

1. Time –shared common bus.

- A system common bus multiprocessor system consists of a number of processors connected through path to a memory unit.
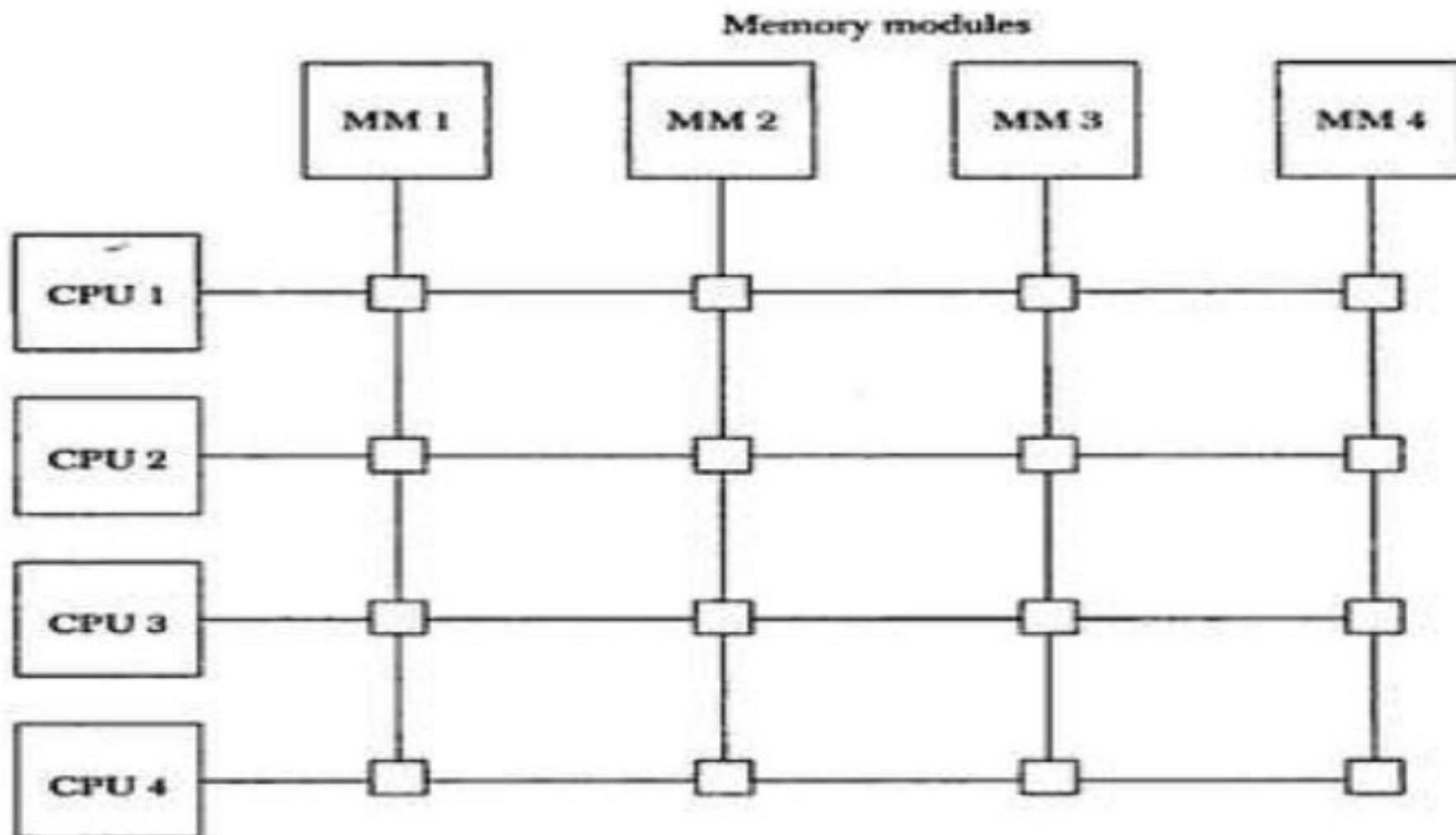
```
        ┌─────────────────┐
        │   Memory Unit   │
        └────────┬────────┘
   ┌────────┬────┴───┬────────┬────────┐
┌──┴──┐ ┌──┴──┐ ┌──┴──┐ ┌──┴──┐ ┌──┴──┐
│CPU 1│ │CPU 2│ │CPU 3│ │IOP 1│ │IOP 2│
└─────┘ └─────┘ └─────┘ └─────┘ └─────┘
```

2. Multiport Memory

- A multiport memory system employs separate buses between each memory module and each CPU.
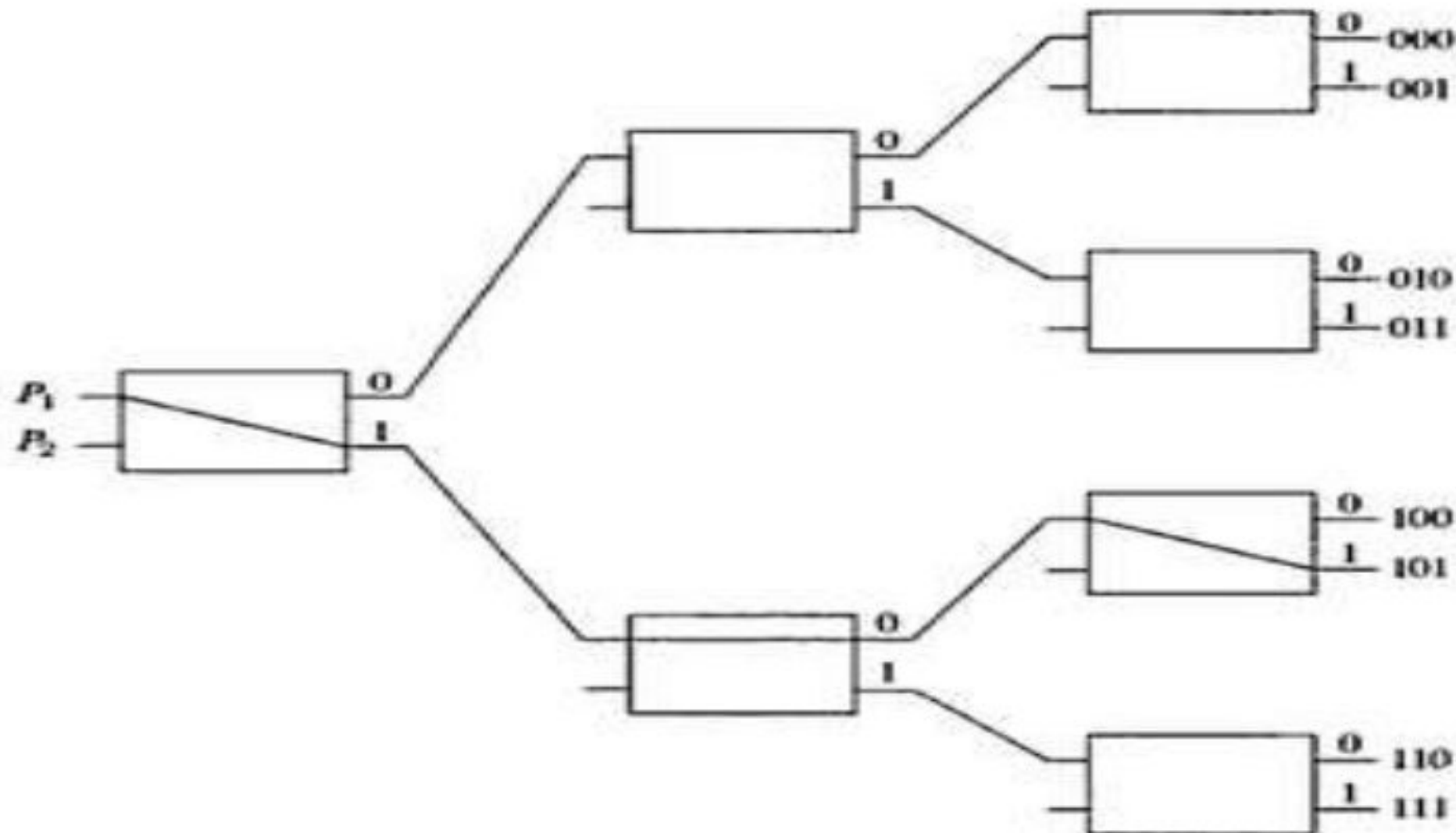

Memory modules

3. Cross bar switch

The crossbar switch organization consists of a number of crosspoints that are placed at intersections between processor buses and memory module paths.


Memory modules

4. Multistage switching Network

- The basic component of a multistage network is a two- input , two- output interchange

5. Hypercube Interconnection

- The hypercube or binary n-cube multiprocessor structure is loosely coupled system composed of $N=2^n$ processor interconnected in an n-dimensional binary cube.

- Hyper cube structures for n = 1,2,3.

One – cube   Two – cube   Three cube
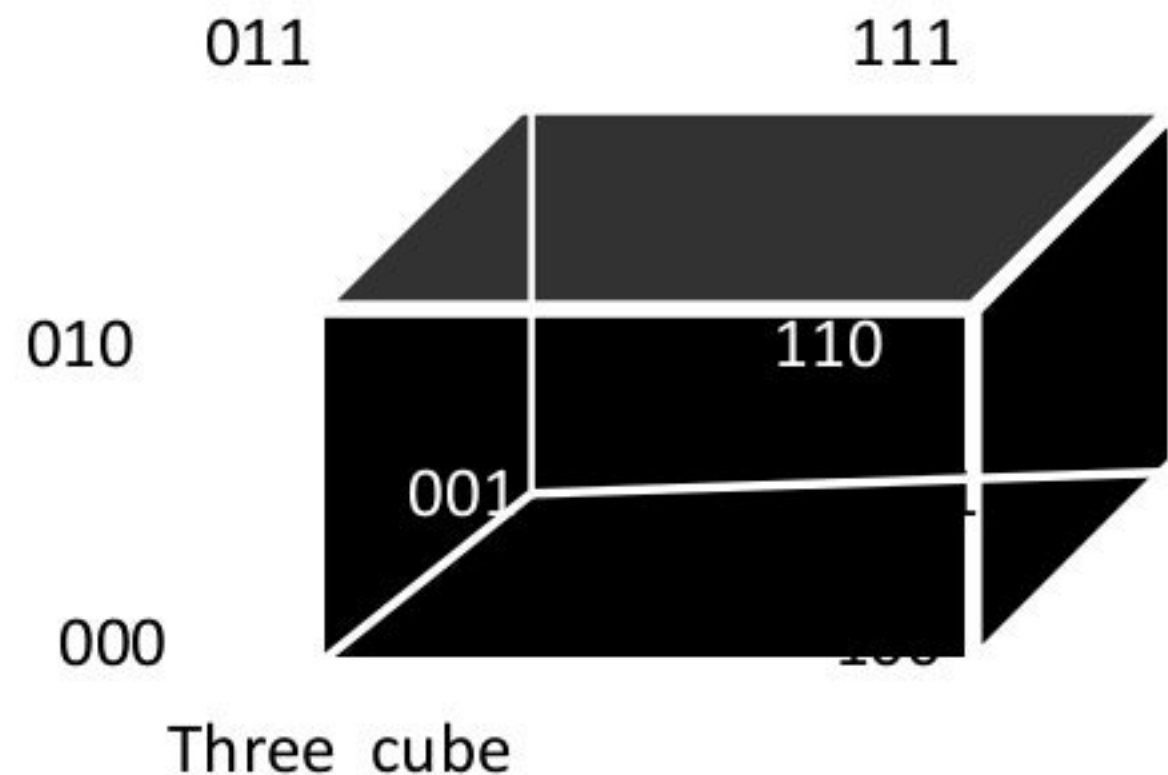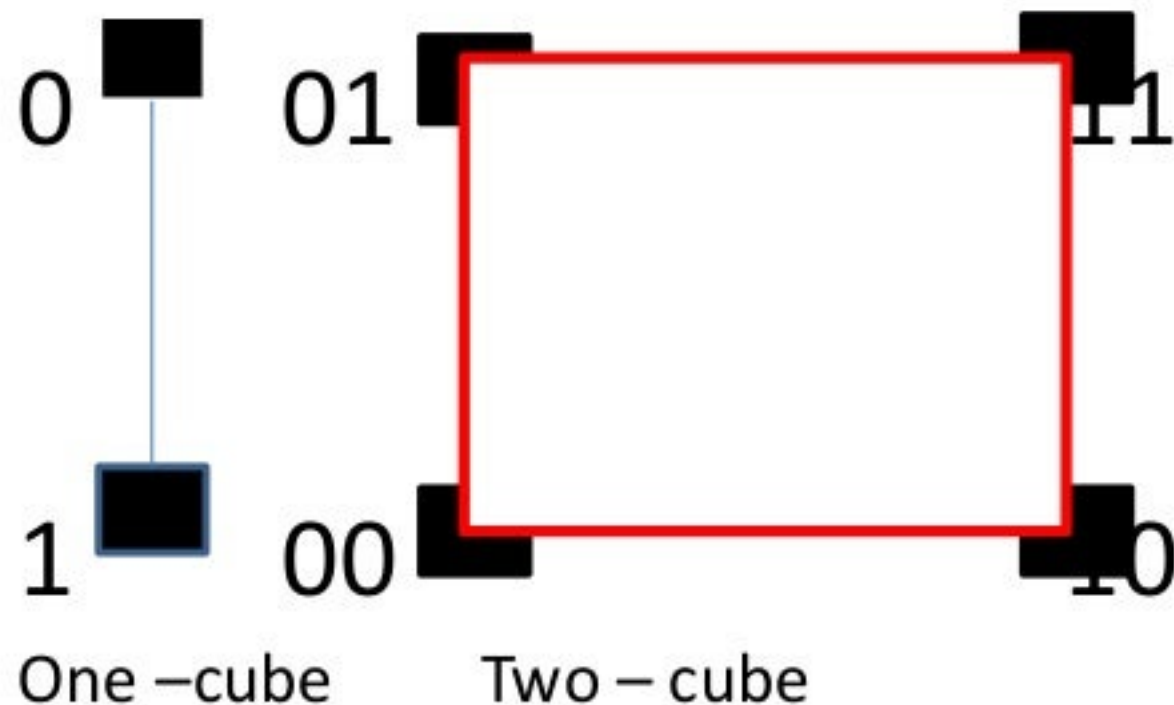
References

- M.Morris Mano Computer System Architecture , Third Edition , Pearson Education.

- Aakriti Sharma, Advance Computer Architecture in simple steps.

Thank you….