CS & IT ENGINEERING

COMPUTER ORGANIZATION AND ARCHITECTURE

Basics of COA

Lecture No.- 01

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Topics to be Covered

Topic — Prerequisites

Topic — Why COA

Topic — Data In Computers

Topic — Components of Computer

Topic — Binary Numbers

- Basic components of computer: CPU, memory (RAM, ROM, HDD), I/O

- Number system: Binary, Decimal, Hexadecimal etc.

- Digital logic basics: Mux, Decoder etc.

Powers of 2:

Unit	Time	Bit or Byte
K (Kilo)	10^3	2^{10}
M (Mega)	10^6	2^{20}
G (Giga)	10^9	2^{30}
T (Tera)	10^{12}	2^{40}

millisec. $\Rightarrow 10^{-3}$ sec (ms)

microsec $\Rightarrow 10^{-6}$ sec (μs)

nanosec $\Rightarrow 10^{-9}$ sec (ns)

$$2^0 = 1$$

$$2^1 = 2$$

$$2^2 = 4$$

$$2^3 = 8$$

$$2^4 = 16$$

$$2^5 = 32$$

$$2^6 = 64$$

$$2^7 = 128$$

$$2^8 = 256$$

$$2^9 = 512$$

$$2^{10} = 1024 = 1 kilo$$

$$2^{11} = 2048$$

$$2^{12} = 4096$$

$$2^{13} = 8192$$

- To understand: How a computer works

- To understand other courses: OS, Compiler, Programming etc.

- Help in real world development: DBMS, Hardware Design, IoT problems etc.

- **Number System**

  Binary, Hexadecimal, Decimal

  Conversion from one system to another

  Signed numbers: Sign-Magnitude, 1's Complement, 2's Complement

- **Decoder**

- **Multiplexer**

Computer Architecture:

- Conceptual design and fundamental operational structure.

Computer Organization: *Implementation of Computer architecture*

- Deals with physical devices and their interconnections

- With a perspective of improving the performance.

Computer Architecture	Computer Organization
• CPU Design	• I/O Organization
• Instructions	• Memory Organization
• Addressing modes	• Performance
• Data format	

CPU

Cache

RAM

Interrupt

DMA (Direct Memory Access)

I/O devices
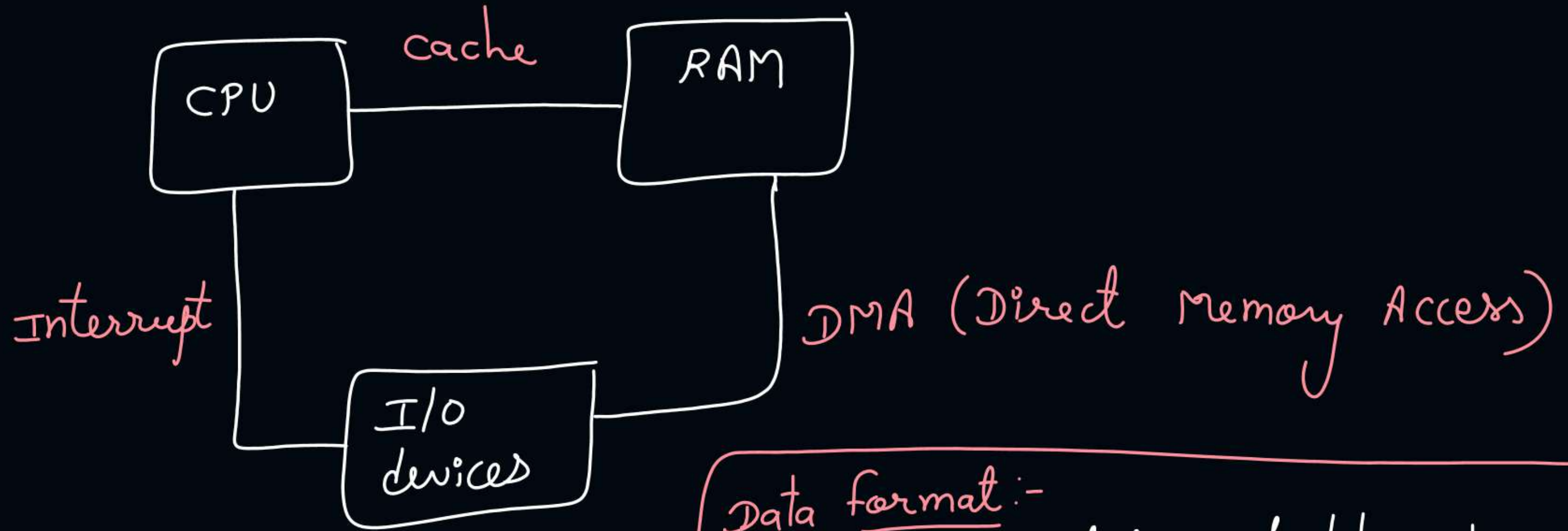
Data format :-
Type of representation of data in binary.

Syllabus :-

→ Basics

→ Instruction
  └→ Addressing modes

→ CPU design
  ├→ CPU
  ├→ Data path
  └→ Control unit

→ Floating point Representation

→ IO organization

→ mem. organ
  └→ Cache ──────→ Disk

→ Pipelining

Data (Binary)

Number

character

Fixed point

floating point

$\rightarrow$ ASCII

$\rightarrow$ EBCDIC

unsigned

signed

$\rightarrow$ sign-Magnitude

$\rightarrow 1^s$ Complement

$\rightarrow 2^s$ — || ——— $\}$ Prerequisite

$\longrightarrow$ Binary

$\longrightarrow$ Decimal to binary

$\longrightarrow$ Binary to decimal

$\longrightarrow$ Binary to hexadecimal

$\longrightarrow$ Decimal to ─ ┃┃ ─────

$\longrightarrow$ Hexadecimal to Binary

$\longrightarrow$ ── ┃┃ ───── to decimal

- CPU $\Rightarrow$
  - Control Unit
  - ALU (Arithmetic Logic Unit)

- Memory: $\longrightarrow$ Primary/main memory $\longrightarrow$ RAM
  $\longrightarrow$ ROM

- I/O Devices:

working of computer system :-

RAM (main memory)

CPU

OS
Program 1
2
3
4

Instructions
+
Data
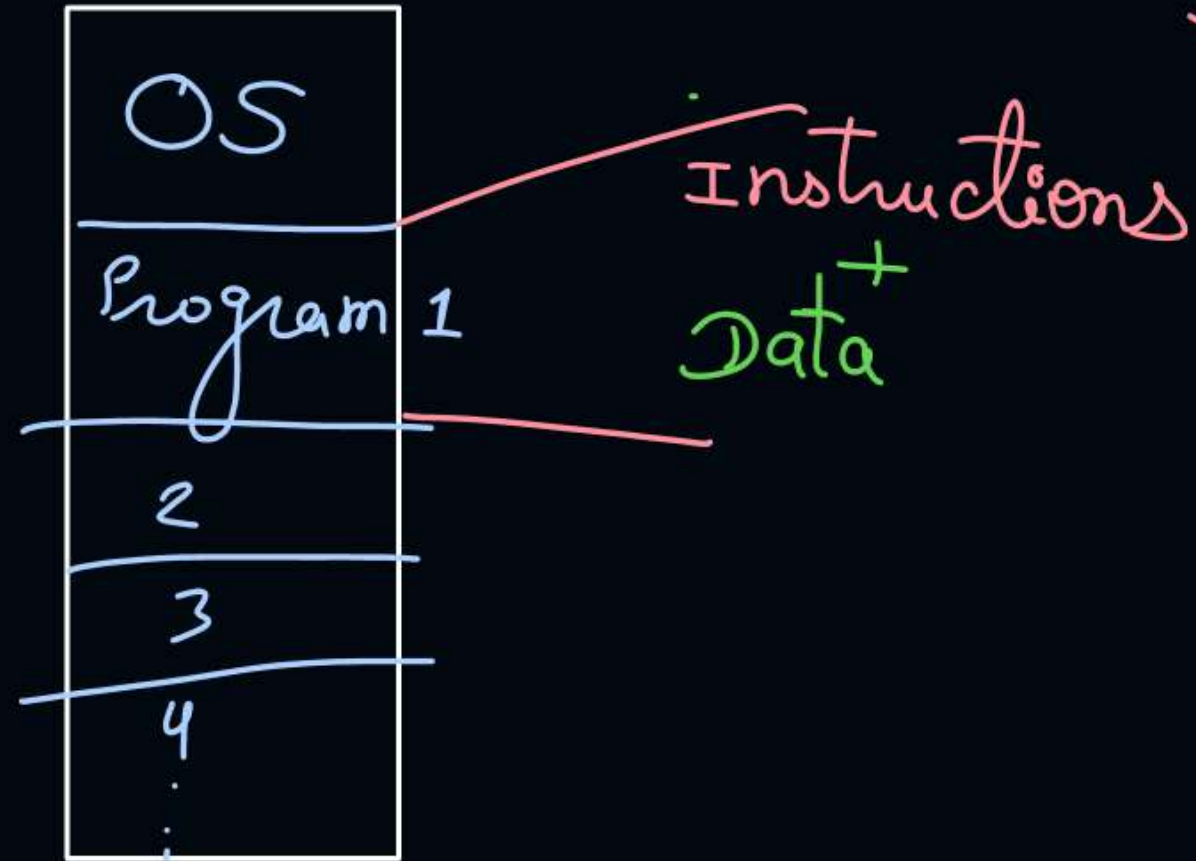
- System Buses

- CPU Registers

System Buses: Collection of Communication lines

4 lines
can transmit
4 bits parallely.

single line

can transmit
one bit at a
time.

CPU ← System bus → Mem. & I/O
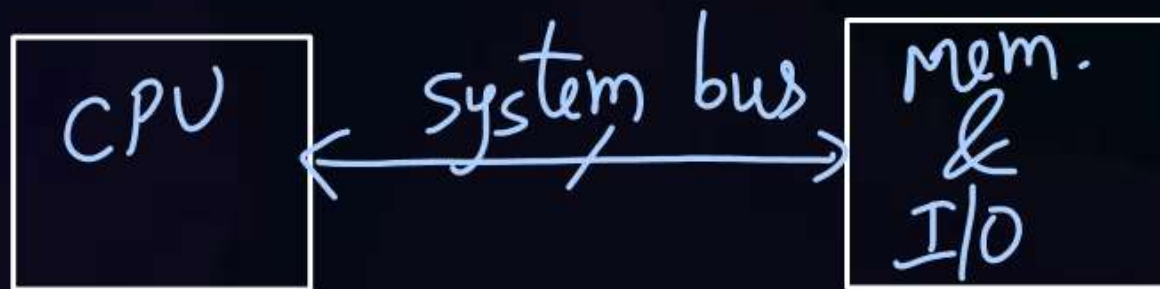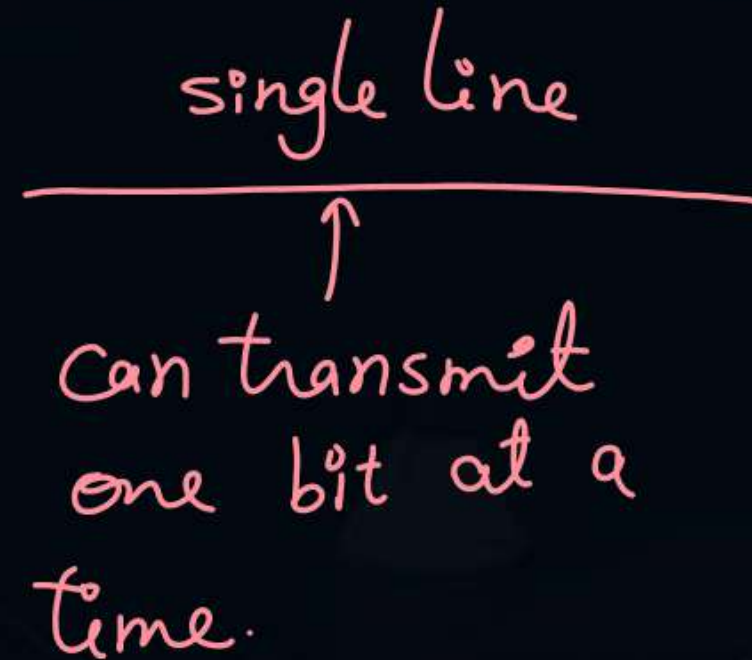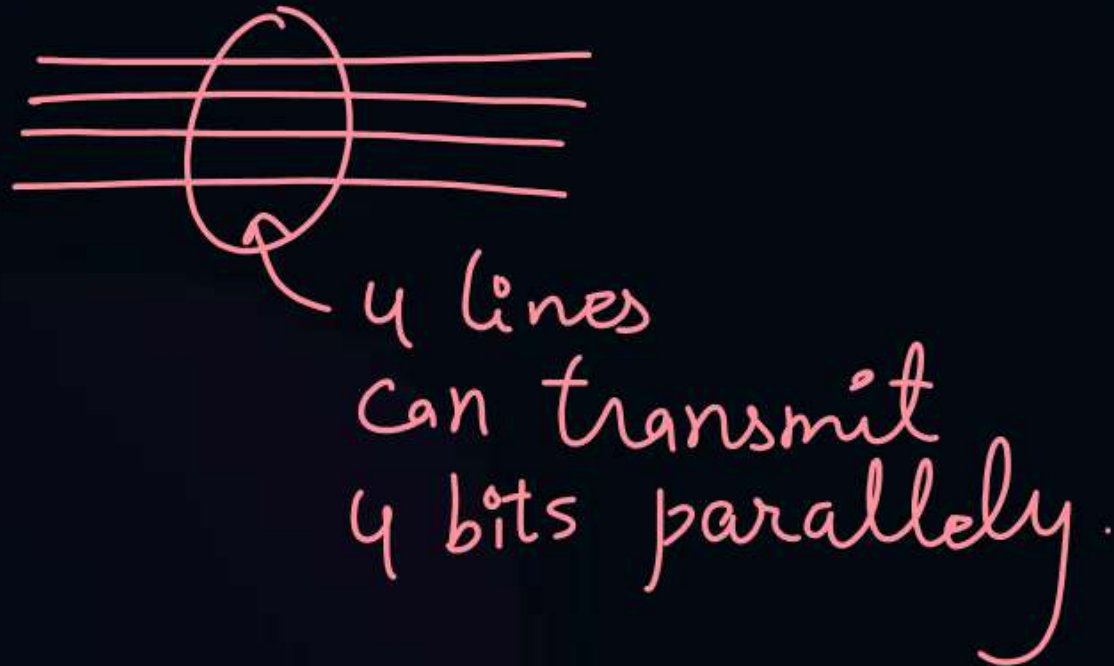
System Buses:

- Address Bus

- Data Bus

- Control Bus

CPU

Address bus

Data bus

Control bus

memory & I/O devices
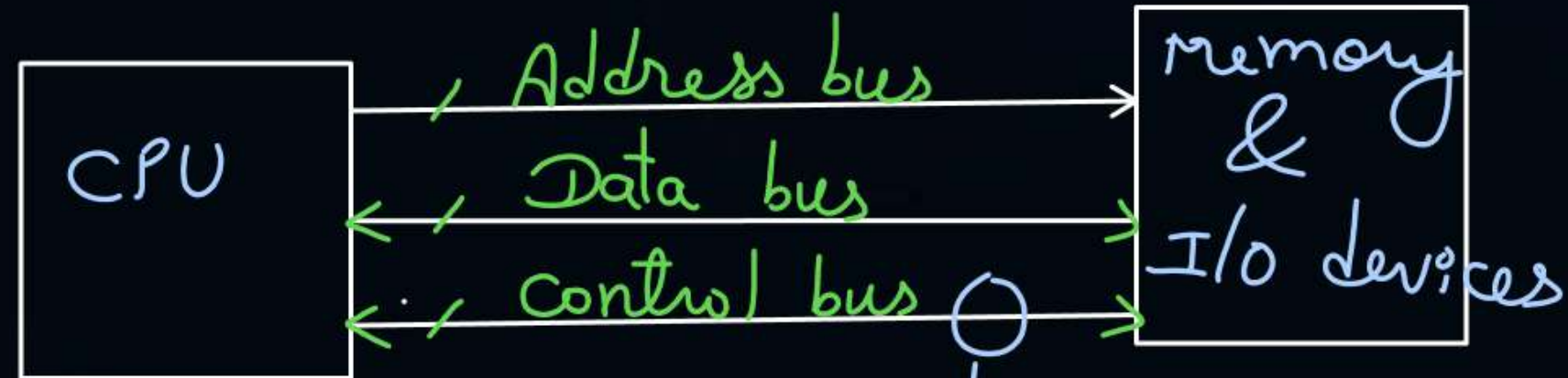
every individual line in control bus is unidirectional

Some Control Signal :-

from CPU to memory $\Rightarrow$ Read
write

from CPU to I/O $\Rightarrow$ Read
write

I/O to CPU $\Rightarrow$ Interrupt

from mem. to CPU
$\Downarrow$
wait
Ready

2 mins Summary

Topic   Architecure vs Organization

Topic   Numbers & Data in Computers

Topic   Components of Computer

Topic   System Buses

Topic   Types of Buses

Happy Learning

THANK - YOU