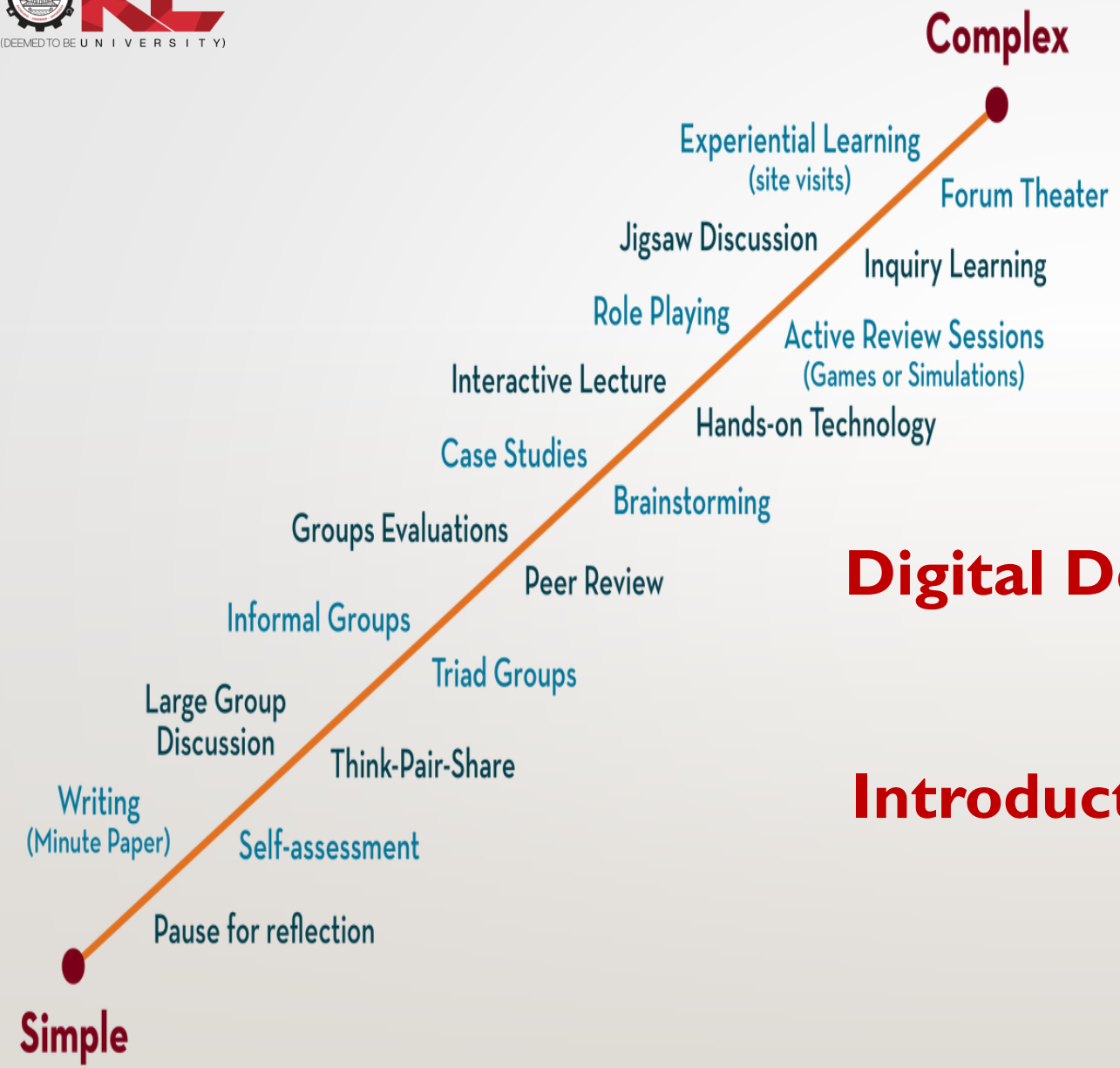


Department of BES-II

Digital Design and Computer Architecture

23EC1202

Topic:

Introduction, Features of Micro Computer

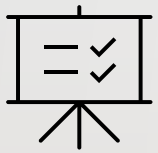
Session No: 22

(DEEMED TO BE UNIVERSITY)

AIM OF THE SESSION

To familiarize students with the basic concept of Microcomputer, Internal Architecture and organization of Micro Computer.

INSTRUCTIONAL OBJECTIVES



This Session is designed to:

1. Demonstrate organization of Microcomputer
2. Describe the working of Microprocessor
3. List out the basic components in Microprocessor and Microcomputer
4. Describe the working of Microcomputer and Microprocessor

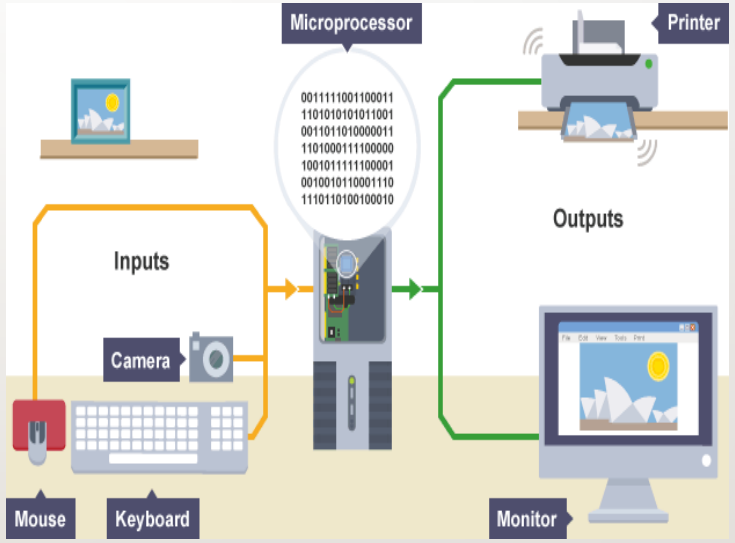
LEARNING OUTCOMES

At the end of this session, you should be able to:

1. Define Microprocessor, Microcomputer, Memory architecture.
2. Summarize about the working of Microcomputer.

Micro Computer

- Definitions : **computer** is general purpose electronic device that processes data, performs calculations, and executes tasks based on instructions.
- It consists of hardware (physical components) and software (programs) and is used for storing, retrieving, and processing information.
- microprocessor as CPU along with memory, I/O devices, etc.
- A **microcomputer** is a small, personal computer with a microprocessor as its central processing unit (CPU), designed for individual use.
- Examples include desktops, laptops, and tablets.

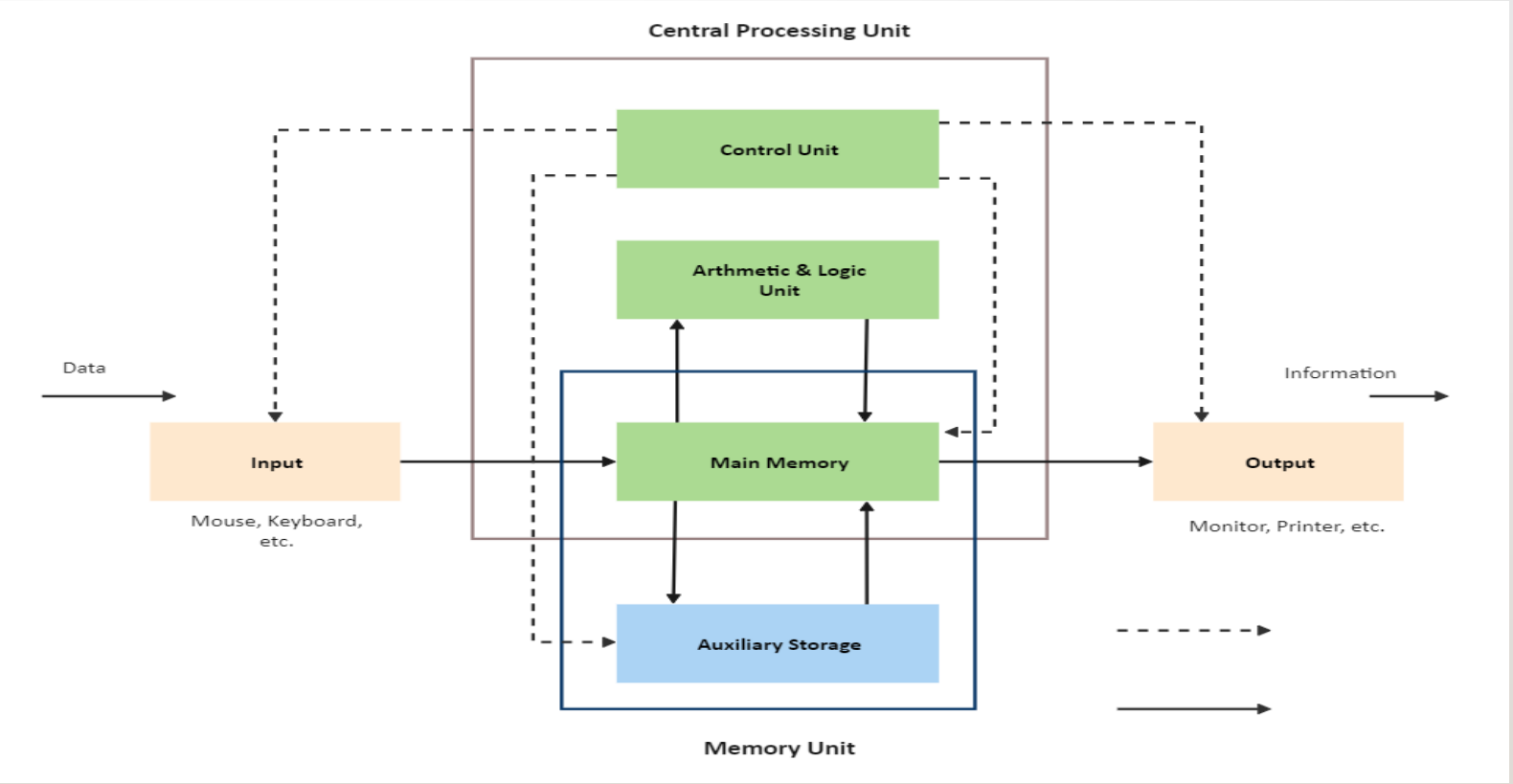


Block diagram of Microcomputer

- Central Processing Unit (CPU)
- Memory
- Input / Output Ports
- Operating System (OS)

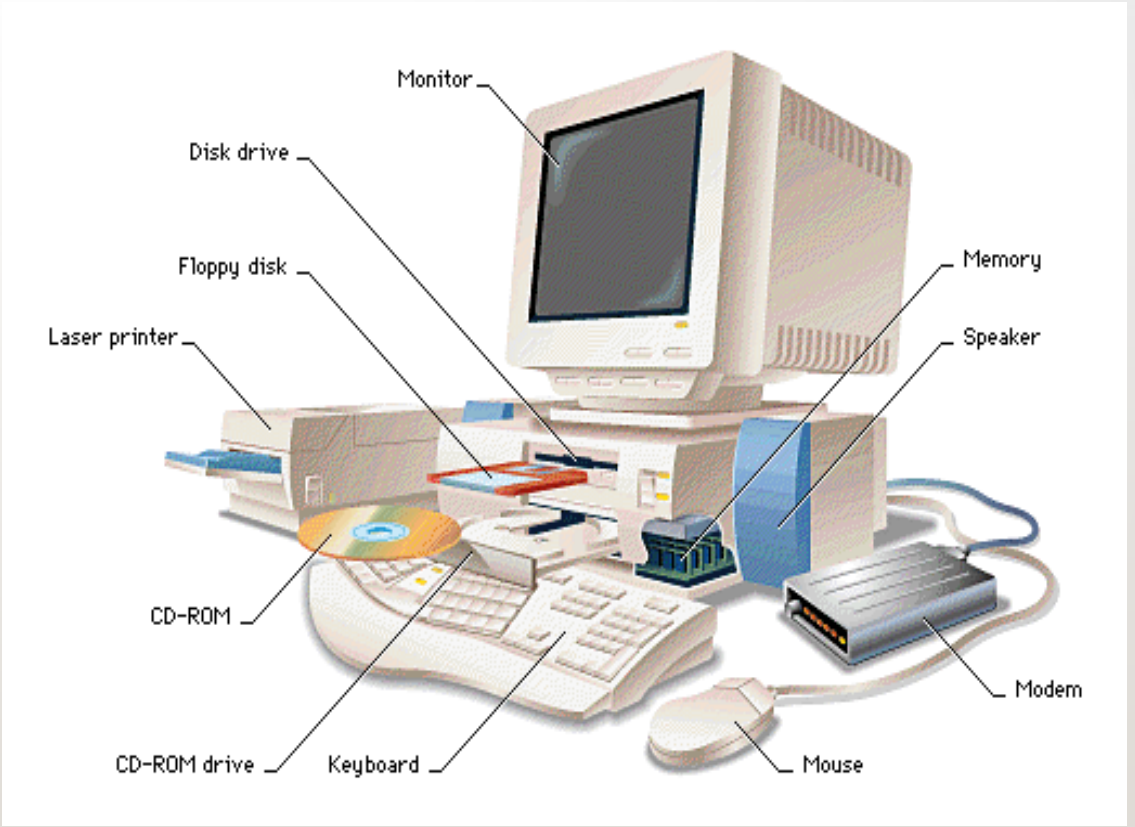
Features are :

- Multimedia
- Expandability and Upgradeability



Microcomputer – I/O Devices

- The input/output or I/O Section allows the computer to take in data from the outside world or send data to the outside world.
- Peripherals such as keyboards, video display terminals, printers are connected to I/O Port.

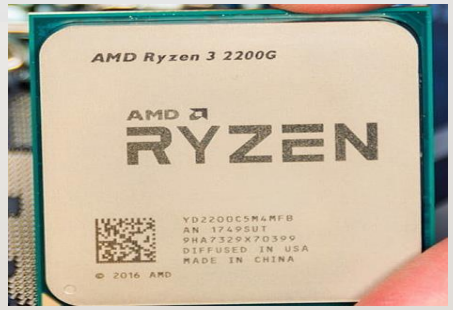


Microcomputer - CPU

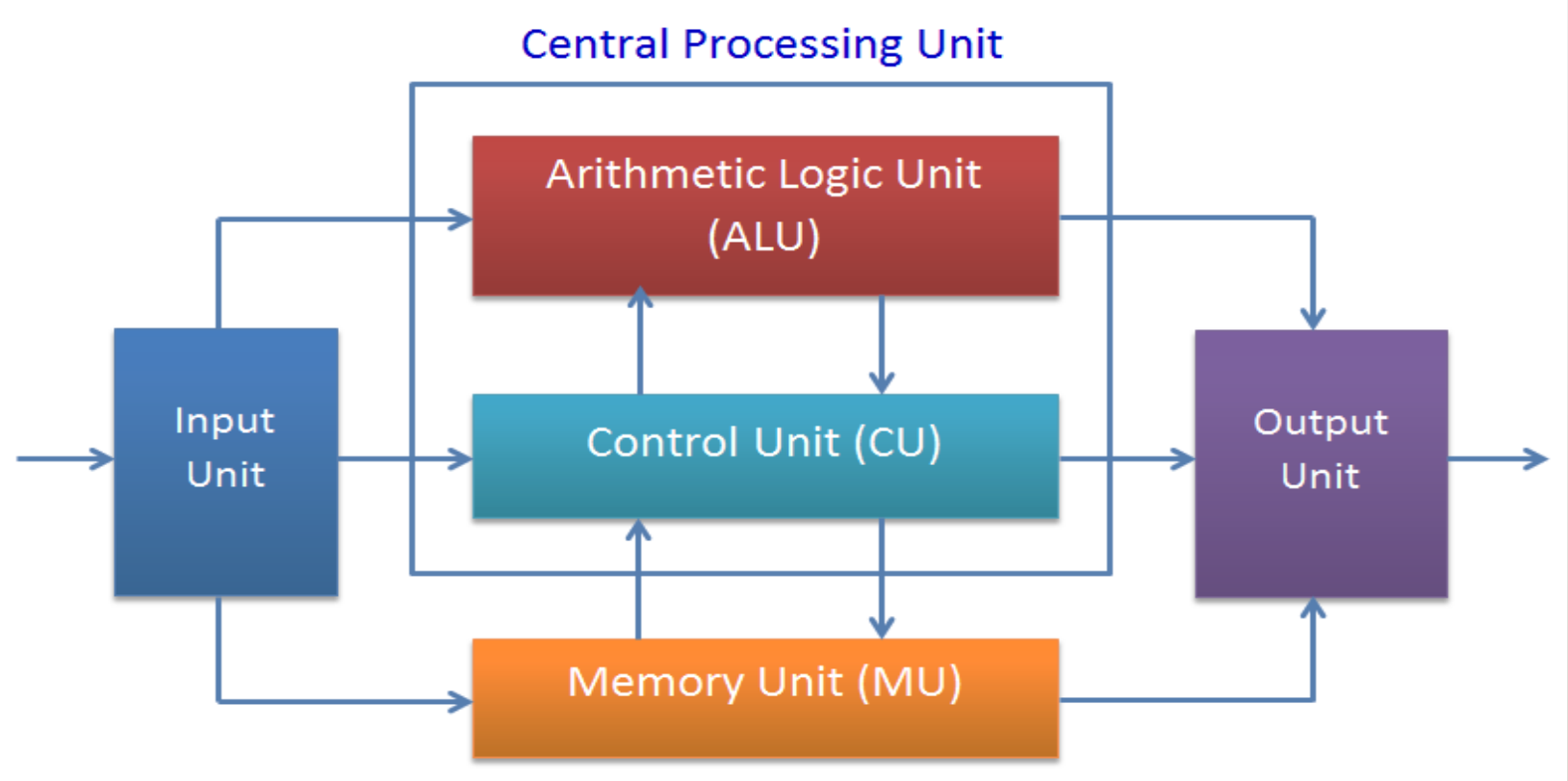
Central Processing Unit (CPU)

A **microprocessor** is a compact, integrated circuit (IC) that serves as the central processing unit (CPU) of a computer, performing arithmetic, logic, control, and input/output operations.

- CPU, which is a **microprocessor**, is considered as the brain of the computer.
- CPU performs all types of data processing operations, controls the working of all parts of the computer.
- It stores data, intermediate results, and instructions (program).
- It fetches binary coded instructions from memory, decodes the instructions into a series of simple actions and carries out these actions in a sequence of steps.



Components of CPU



Microprocessor

- **What is a Microprocessor ?**

Microprocessor can be used in applications where task is not predefined and is assigned by the user.

Ex: Intel i3, i5, i7, core 2 duo etc.

Applications: Computers, Mobiles, Videogames, Communication, Automobiles etc.

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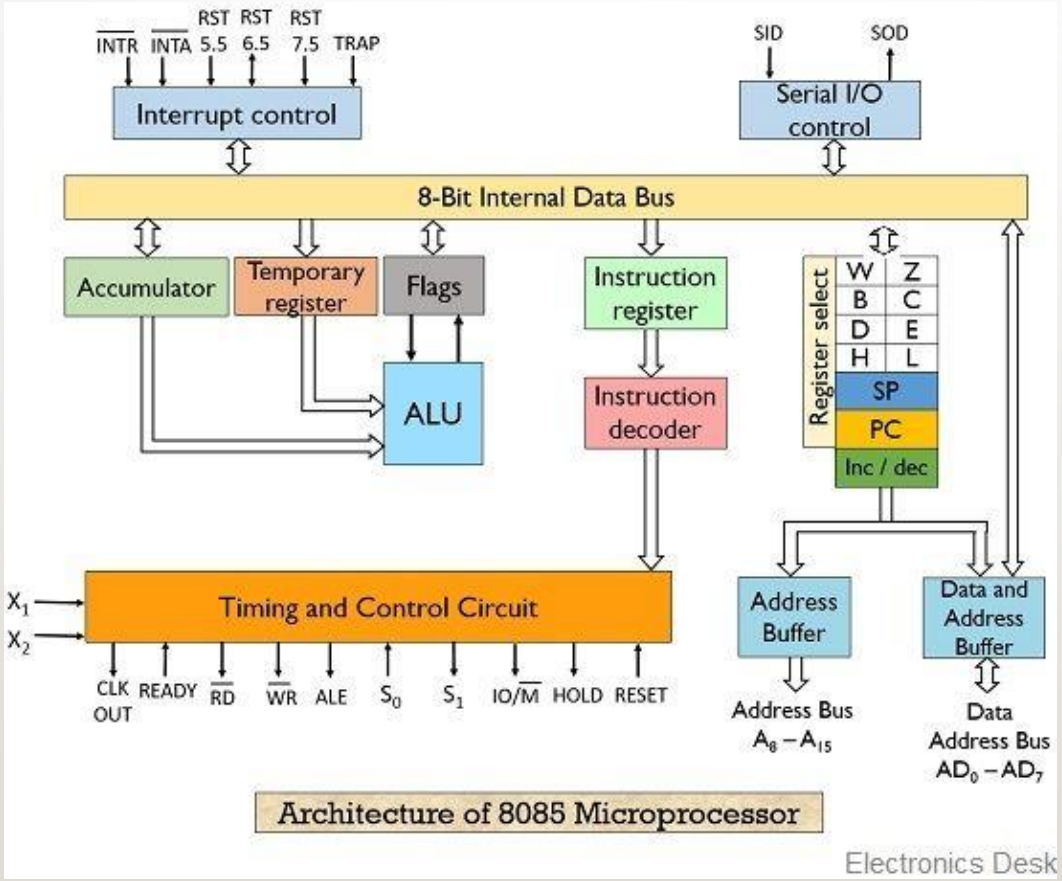
Generations of Microprocessor

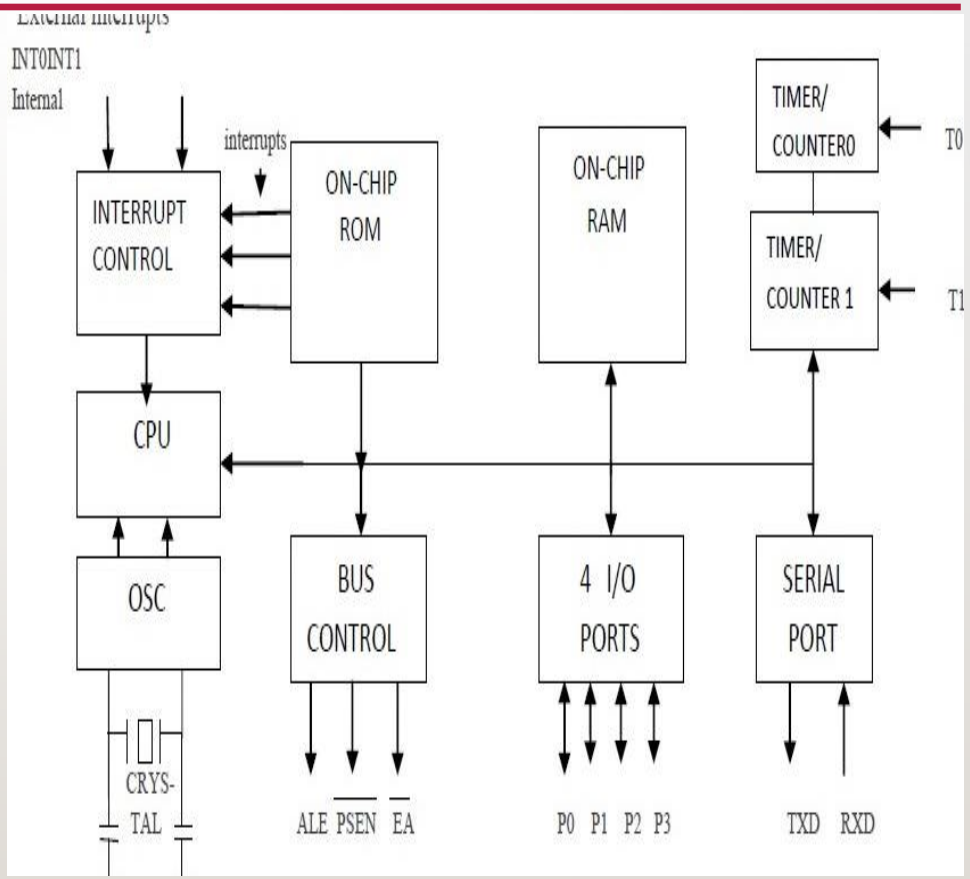
Name of the Processor	Year of Invention	No. of transistors	Instructions per second
INTEL 4004/4040 (4 bit)	1971 by Ted Hoff and Stanley Mazor	2300	60,000
8008 (8 bit)/8080 (8 bit)	1972/1974	3500/6000	50,000, 10 times faster than 8008
8085 (8 bit)	1976 (16-bit address bus)	6500	769230
8086 (16 bit)	1978 (multiply and divide instruction, 16-bit data bus and 20-bit address bus)	29000	2.5 Million
8088 (16 bit)	1979 (cheaper version of 8086 and 8-bit external bus)	29000	2.5 Million
80186/80188/80286 (16 bit)	1982	134000	4 Million
PENTIUM (32 bit)	1993	3.1 Million	100 million

Architecture of 8085 Micro Processor



Microcontroller

- **Microcontroller :** Designed for specific task,
- once program is written it can't be altered.
- Microprocessor with RAM, ROM and IO Ports available on a single chip.
- **A microcontroller** is a small computer on a single integrated circuit that is designed to control specific tasks within electronic systems. It combines the functions of a central processing unit (CPU), memory, and input/output interfaces, all on a single chip. **Ex:** Arduino, ARM, AT Mega328, 8051 etc. **Applications:** Microwave oven, washing machines.



Microprocessor Vs Microcontroller

Microprocessor	Microcontroller
The microprocessor is designed to be general-purpose.	A microcontroller is a specialized form of a microprocessor.
It is a processor in which memory and I/O output component is connected externally, looks large in size.	It is a controlling device in which memory and I/O output component is present internally, looks small in size.
It is a dependent unit.	It is self-sufficient.
It is used in personal computers.	It is used in Embedded systems.
It's system cost is high.	It's system cost is low.
Microprocessor has less number of registers. Therefore most of the operations are memory based.	Microcontroller has more number of registers. Therefore a program is easier to write.

Arithmetic Logic Unit (ALU)

Performs Arithmetic Operations: The Arithmetic Logic Unit (ALU) in a CPU is responsible for executing all the arithmetic operations, such as addition, subtraction, multiplication, and division, essential for processing data and executing instructions.

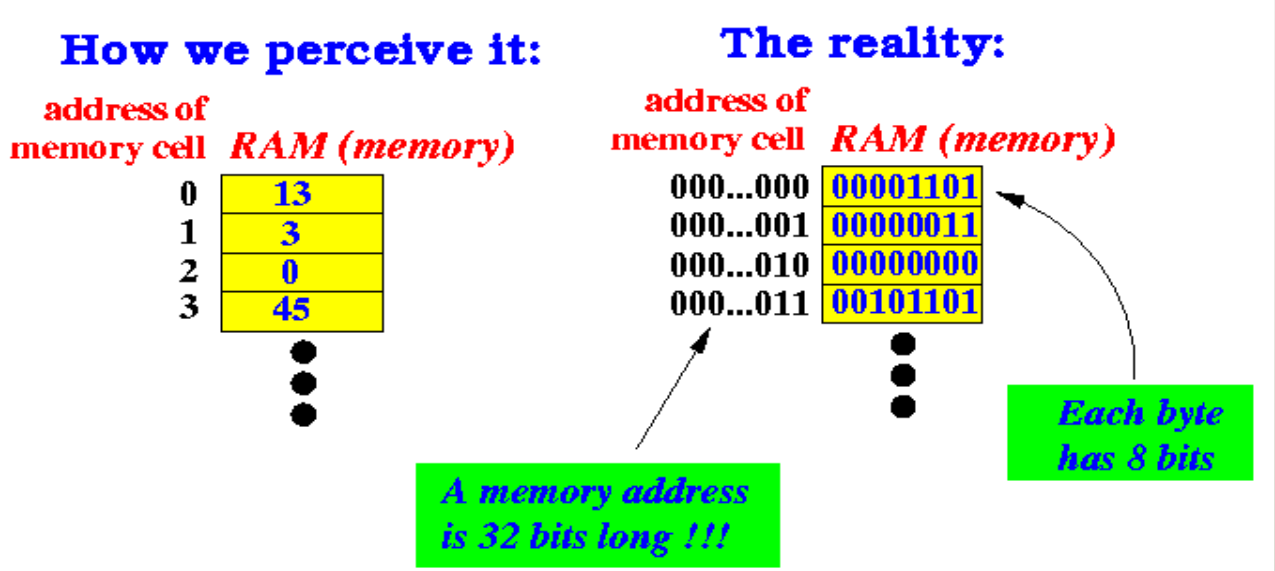
Handles Logical Operations: Beyond arithmetic, the ALU performs logical operations including AND, OR, NOT, and XOR, which are crucial for decision-making processes, comparisons, and conditional executions in programming and computer operations.

Memory @ CPU

- **Registers:** These are tiny, very fast memory locations that hold a minimal amount of data currently being used by the CPU. Think of them as the CPU's notepad for immediate calculations.
- **Cache:** This is a small but faster memory compared to main RAM. It stores frequently accessed data and instructions from main memory, allowing the CPU to retrieve them quicker.
- **Control Unit Interaction:** The control unit relies on registers to store operands (data) and instructions during processing.
- **Limited Capacity:** Compared to main memory, CPU memory (registers and cache) is much smaller in size. This prioritizes speed over massive storage.

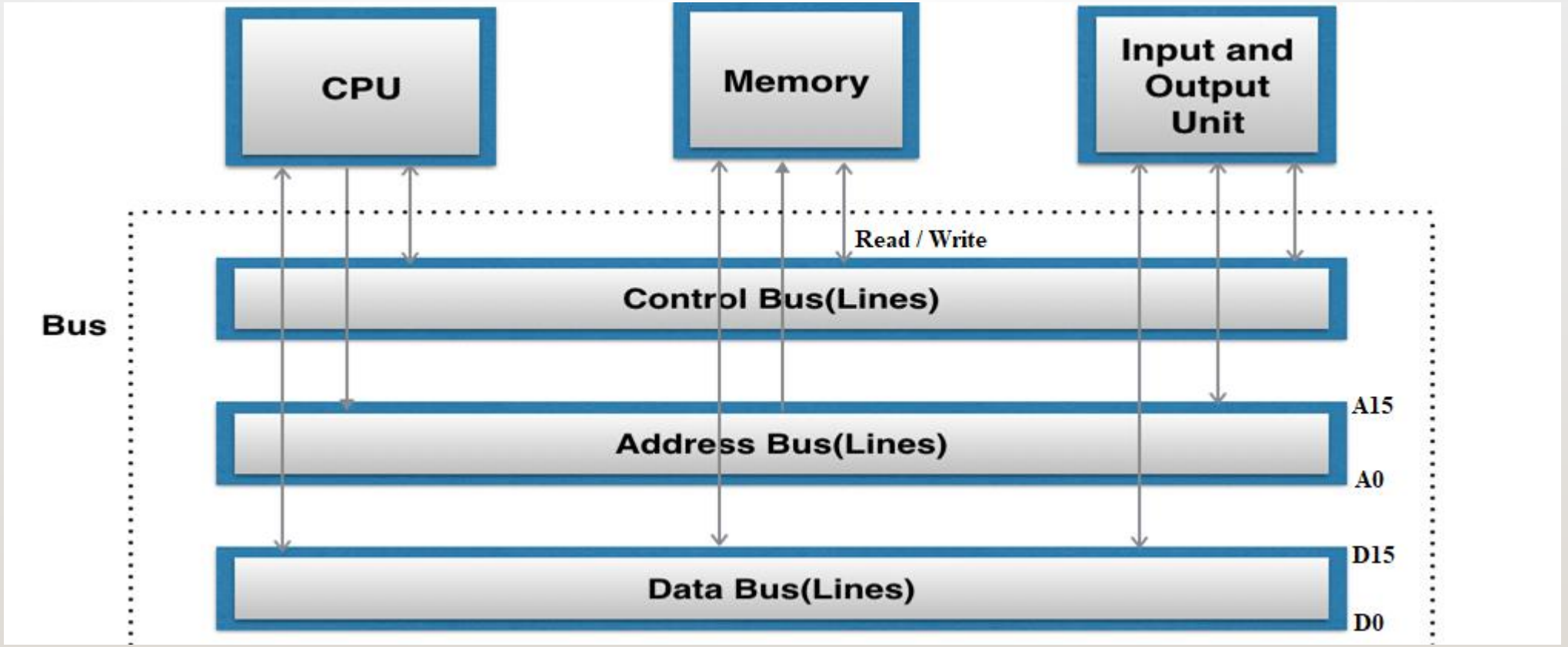
How data is stored in memory?

- Memory is usually measured by the number of bytes it can hold. It is measured in Kilo, Mega ,Giga and Tera.
- A Kilo in computer language is $2^{10} = 1024$.



S.No	Unit & Description
1	Kilobyte (KB) 1 KB = 1024 Bytes
2	Megabyte (MB) 1 MB = 1024 KB
3	Gigabyte (GB) 1 GB = 1024 MB
4	Terabyte (TB) 1 TB = 1024 GB
5	Petabyte (PB) 1 PB = 1024 TB

Microcomputer - Buses



Microcomputer - Buses

- **Address bus** - carries memory addresses from the processor to other components such as primary storage and input/output devices.
- **Data bus** - carries the data between the processor and other components.
- **Control bus** - carries control signals from the processor to other components.

SELF-ASSESSMENT QUESTIONS

1. Which of the following is the main component of the microcomputer?

a) ROM
b) Microprocessor
c) Motherboard
d) Bus system.

2. Which one are the functional units of a microprocessor?

a) to control computer traffic
b) to store information
c) to perform arithmetic operation
d) none of the above.

TERMINAL QUESTIONS

Short answer questions:

1. Explore the significance of a microprocessor in modern computing devices.

Long answer questions:

1. Illustrate the architecture of a CPU and its constituent blocks, elaborating on their functions.
2. Analyze the role and significance of I/O devices in computer systems with examples.
3. Make use of various buses in microcomputer architecture to investigate on data transfer, detailing their types, functions.

REFERENCES FOR FURTHER LEARNING OF THE SESSION

Reference Books:

1. Computer Organization by Carl Hamacher, Zvonko Vranesic and Saftwat Zaky.
2. Computer System Architecture by M. Morris Mano
3. Computer Organization and Architecture by William Stallings

Sites and Web links:

1. https://www.geeksforgeeks.org/computer-organization-and-architecture-tutorials/
2. https://www.javatpoint.com/microprocessor-introduction

THANK YOU

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Team – Digital Design & Computer Architecture