# Input–Output Instructions

**Session No.: 13**
**Course Name: Computer Organization & Architecture**
**Course Code: R1UC305T**
**Instructor Name: Mr. Sandeep Bhatia**
**Duration: 50 mins**
**Date of Conduction of Class:**

# Review of the key concepts of session no. #12
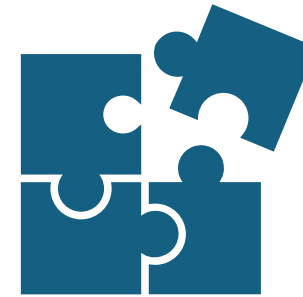
Register reference instructions

# Pre-Session Quiz

- Attempt the Pre-Session-13 quiz on LMS.

# Opening: Engaging Questions

- *"When you press a key on the keyboard, how does that character appear on the screen?"*
- *"If the CPU is the brain of the computer, what part acts as its eyes, ears, and hands?"*
- *"Why do you think the CPU needs special instructions to talk to devices like printers, keyboards, or hard drives?"*

What challenges and benefits did you experience?

How did it affect the way you approached the problem?

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

Learning Outcome 1: Understand the role of Input–Output operations in computer systems.

Learning Outcome 2: Explain common I/O instructions (IN, OUT, etc.) and their use.

# Session Outline

Input–Output Instructions

Activity 1

Activity 2

Disussion

Conclusion

# Input–Output Instructions

Computer Organization and Architecture

# Learning Objectives

- - Understand the role of Input–Output operations in computer systems.

- - Explain common I/O instructions (IN, OUT, etc.).

# Introduction to I/O

- - CPU communicates with external devices through I/O operations.

- - Devices include: Keyboard, Mouse, Monitor, Printer, Disk.

- - Special I/O instructions or memory mapping are used for communication.

# Methods of I/O Communication

- - Memory-Mapped I/O:
-    * Devices assigned memory addresses.
-    * Regular load/store instructions used.

- - Isolated (Port-Mapped) I/O:
-    * Separate address space for I/O.
-    * Special instructions like IN and OUT are used.

# Common I/O Instructions

- - IN: Transfers data from I/O port → CPU register.
- - OUT: Transfers data from CPU register → I/O port.
- - INS / OUTS: Block data transfer between I/O and memory.
- - TEST / STATUS instructions: Check device readiness.

# I/O Control Techniques

- - Programmed I/O (Polling): CPU repeatedly checks device status.

- - Interrupt-Driven I/O: Device signals CPU when ready.

- - Direct Memory Access (DMA): Data transferred directly between device and memory without CPU intervention.

# Example: Reading from Keyboard

- 1. CPU executes IN instruction with keyboard port address.
- 2. Control unit activates keyboard controller.
- 3. Keyboard sends ASCII value onto data bus.
- 4. CPU stores it in accumulator/register.

# Summary & Reflection

- - I/O instructions enable CPU–device communication.

- - Two methods: Memory-Mapped I/O and Isolated I/O.

- - Key instructions: IN, OUT, INS, OUTS.

- - Control techniques: Programmed I/O, Interrupts, DMA.

# Activity-1 : Woo flash

# Activity-2 : Woo flash



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# **Reflection Time:**

Reflection Question:

• Why is DMA faster than programmed I/O or interrupts?

# Conclusion

- Input–Output (I/O) instructions are essential for enabling communication between the **CPU and external devices**.

- Two major approaches: **Memory-Mapped I/O** and **Isolated (Port-Mapped) I/O**.

- Core instructions like **IN, OUT, INS, and OUTS** allow data transfer between CPU registers and I/O devices.

- Different control techniques (**Programmed I/O, Interrupt-driven I/O, DMA**) balance efficiency and CPU workload.

- Efficient I/O operations ensure that a computer system can interact effectively with its environment.

**Key takeaway:**
*A computer is only as useful as its ability to communicate with the outside world — and I/O instructions are the bridge that makes this possible.*

# Ensure attainment of LOs in alignment to the learning activities:

Learning Outcome 1: Know the role of Input–Output operations in computer systems.

Learning Outcome 2: Learned about common I/O instructions (IN, OUT, etc.) and their use.

# Discussion on the post session activities

- Attend post session quiz of Session-13 on LMS.

# Information about the next lesson

General Register Organization

**Queries**