General Register Organization

Session No.: 14
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. #13

Input - Output Instructions

Pre-Session Quiz

- Attempt the Pre-Session-14 quiz on LMS.

Opening: Engaging Questions

- *"Why do we need registers if we already have main memory?"*

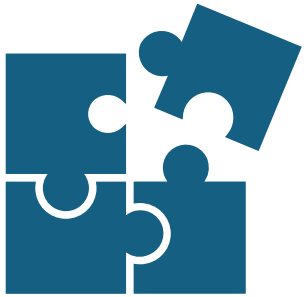
→ This sparks discussion on speed differences and efficiency.

- *"What happens if the CPU had to fetch every piece of data directly from RAM instead of registers?"*

→ Leads to the importance of registers for faster execution.

- "

How did it affect the way you approached the problem?



What challenges and benefits did you experience?

GALGOTIAS UNIVERSITY

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

Learning Outcome 1: Understand the concept and purpose of general registers in CPU organization.

Learning Outcome 2: Differentiate between general-purpose registers, special-purpose registers, and their roles.

Session Outline

General Register Organization

Activity 1

Activity 2

Disussion

Conclusion

GALGOTIAS UNIVERSITY

General Register Organization

Computer Organization and Architecture

GALGOTIAS UNIVERSITY

Learning Objectives

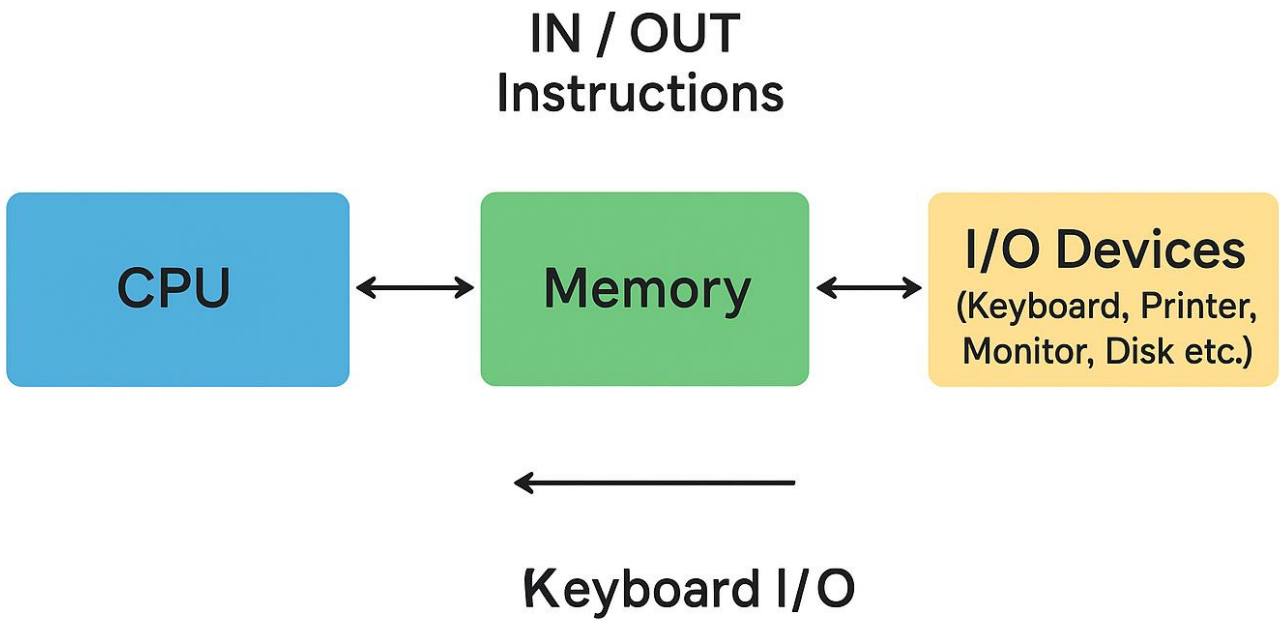
- Understand the purpose of general registers in CPU organization.
- Differentiate between general-purpose and special-purpose registers.

Introduction

What are Registers?

- Small, high-speed storage locations inside the CPU.
- Hold instructions, data, and addresses temporarily.
- Faster than main memory access.

Introduction to I/O



Types of Registers

- **General-purpose registers (R0, R1, ...).**
- **Special-purpose registers:**
  - Accumulator (AC)
  - Program Counter (PC)
  - Memory Address Register (MAR)
  - Memory Data Register (MDR)
  - Instruction Register (IR)

Register Transfer Language (RTL)

- Describes operations in terms of data transfer between registers.
- Example: R1 ← R2 + R3
- Shows contents of R2 and R3 are added and stored in R1.

GALGOTIAS UNIVERSITY

Instruction Execution with Registers

- **1. Instruction Fetch:** PC, MAR, MDR, IR
- **2. Instruction Decode:** IR, Control Unit
- **3. Operand Fetch:** General-purpose registers
- **4. Execution:** ALU uses registers
- **5. Result Storage:** Accumulator or GPRs

- **Formative:**
- Observe participation in RTL practice.
- Ability to identify registers in execution.
- **Summative:**
- Name and categorize CPU registers.
- Write RTL for simple operations.
- Explain how registers improve execution speed.

GALGOTIAS UNIVERSITY

Follow-up / Extended Activities

•Research how Intel/ARM processors organize registers.

•Mini-project: Pseudo-code showing register usage in multiplication.

•Explore register organization in instruction pipeline design.

Activity-1 :

Think–Pair–Share: Why Registers?

•**Think:** Ask students *“Why do we need registers if we already have main memory?”*

•**Pair:** Students discuss with a partner how registers differ from memory in terms of speed and usage.

•**Share:** Pairs present answers → teacher summarizes into advantages of GRO.

Activity-2 :

Control Word Design (Group Activity)

- Divide class into groups.
- Each group is given a task (e.g., MOV R2 → R1, SUB R4, R5).
- Students design a **control word** specifying:
  - Source register(s).
  - Operation (ALU function).
  - Destination register.
- Groups present → compare answers.

Reflection Time:

Reflection Question:

- *"How does using registers instead of memory improve CPU performance?"*
- *"Which register (PC, IR, MAR, MDR, Flags) do you think is the most critical for CPU operation, and why?"*
- *"If the CPU had only one register, how would program execution be affected?"*

Conclusion

- Registers are the **fastest storage elements** in a computer system.
- They **bridge the speed gap** between CPU and memory.
- General-purpose and special-purpose registers **work together** to execute instructions efficiently.
- Effective register organization **reduces memory access** and enhances system performance

Ensure attainment of LOs in alignment to the learning activities:

Learning Outcome 1: Know the concept and purpose of general registers in CPU organization.

Learning Outcome 2: Learn about between general-purpose registers, special-purpose registers, and their roles.

Discussion on the post session activities

- Attend post session quiz of Session-14 on LMS.

Information about the next lesson

Stack Organization

Queries