

# CPT 122 - Introduction to Computer Hardware

## Module 1 Unit 1: Definitions and Computer Basics



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# Understanding Computer Hardware Basics

## What is a Computer

- A computer is an electronic device that processes data under the control of stored instructions
- Capable of accepting input, processing it, producing output, and storing information

## Characteristics of Computers

- High Speed
- Accuracy
- Storage Capability
- Versatility
- Automation

## Basic Components of a Computer System

- Central Processing Unit (CPU)
- Memory (RAM, ROM)
- Storage Devices (HDD, SSD)
- Motherboard
- Power Supply Unit (PSU)

## Types of Computer Systems

- Personal Computers (Desktops, Laptops)
- Workstations
- Servers
- Mainframes
- Supercomputers
- Embedded Systems

# Evolution of Computers: Abacus to Modern PCs

## Abacus

- An ancient tool used for arithmetic calculations
- Consisting of beads that can be moved along rods to represent numbers

## Mechanical Calculators

- Early mechanical devices for performing arithmetic operations
- Examples include the Pascaline and the Difference Engine

## First Generation Computers (1940s–1950s)

- Used vacuum tubes
- Large, expensive, and, consumed a lot of power

## Second Generation Computers (1950s–1960s)

- Transistors replaced vacuum tubes
- Made computers smaller, faster, and more reliable

## Third Generation Computers (1960s–1970s)

- Integrated circuits combine multiple transistors into a single chip
- Reduced size and cost

## Fourth Generation Computers (1970s–Present)

- Microprocessors, which integrate the CPU onto a single chip, revolutionized computing
- Examples; Intel 4004, IBM PC, and Apple Macintosh

## Fourth Generation Computers (Present & Beyond)

- Focus on artificial intelligence, machine learning, and advanced computing technologies like quantum computing
- Examples; modern AI systems, deep learning frameworks, and quantum computers





# Key Milestones in Computer Development

## Zuse Z3

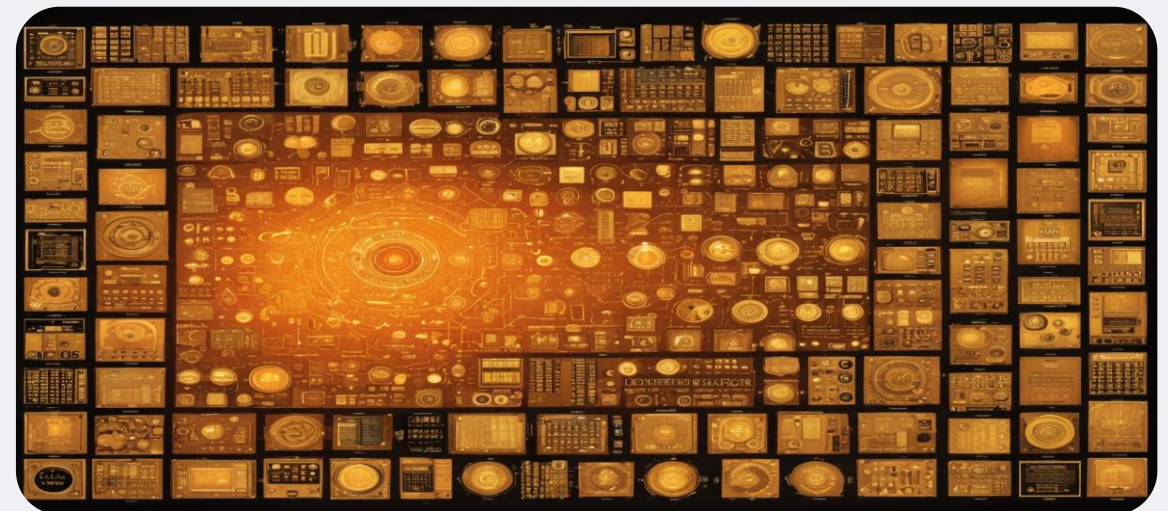
- The first programmable computer.
- Developed by Konrad Zuse in 1941.

## IBM PC

- Introduction of the personal computer in 1981.
- Made computers accessible to individuals and small businesses.

## Internet and World Wide Web

- Creation of the Internet in the late 1960s.
- Development of the World Wide Web in the early 1990s.
- Transformed global information sharing and access.



# Overview of Computer Systems

## Personal Computers (PCs)

- Desktops and laptops designed for individual use
- Offers power and mobility

## Workstations

- High-performance systems for technical or scientific applications
- Require advanced processing capabilities

## Servers

- Networked computers providing data, resources, and services
- Essential for data centers and businesses

## Mainframes

- Large-scale systems known for reliability and scalability
- Used for bulk data processing tasks

## Supercomputers

- Extremely fast machines for complex scientific calculations and research
- Utilize thousands of processors in parallel



# Components of Computer Systems

## CPU (Central Processing Unit)

- The brain of the computer
- Responsible for executing instructions
- Performs computations

## Memory (RAM)

- Volatile memory
- Used for temporary storage
- Stores data and instructions during processing

## Storage Devices

- Include HDD (Hard Disk Drive)
- Include SSD (Solid-State Drive)
- Store data electronically

## Motherboard

- Main circuit board
- Houses essential components like the CPU and memory
- Provides connectivity for peripherals

## Power Supply Unit (PSU)

- Converts electrical power
- Powers the computer's internal components
- Ensures efficient functioning





# Importance of Computers in Various Sectors

## Education

- Computers and the Internet have revolutionized learning
- Providing access to vast information and resources through online platforms and virtual classrooms

## Healthcare

- Computers play a crucial role in medical imaging
- Electronic health records
- Telemedicine
- Research for new treatments and drugs

## Business

- From e-commerce platforms to financial management systems
- Computers enable businesses to operate efficiently
- Reach global markets

## Entertainment

- Computers drive digital content creation
- Streaming services
- Interactive gaming experiences
- Enhancing entertainment options for users



# Operations of a Computer System

## Processing Operations

- **CPU (Central Processing Unit):** Directs operations, fetches, decodes, and executes instructions.
- **ALU (Arithmetic Logic Unit):** Performs arithmetic and logical operations.
- **Registers:** Fast storage locations for temporary data holding.
- **Cache Memory:** Volatile memory providing high-speed data access to the CPU.

## Storage Operations and Data Retention

- **Primary Memory (RAM):** Temporary storage for data being processed.
- **Secondary Memory:** HDD (Hard Disk Drives), SSD (Solid- State Drives), Optical Drives, Cloud Storage.
- **Data Retention:** Volatile (temporary) and non-volatile (permanent) memory.

## Output Operations and Data Presentation

- **Monitors:** Display visual output from the computer.
- **Printers:** Produce physical copies of documents and images.
- **Speakers:** Output audio signals for sound.
- **Projectors:** Project visual output onto screens or surfaces.

## Key Takeaways

- Processing Operations involve the CPU, ALU, registers, and cache memory.
- Output Operations present processed data through monitors, printers, speakers, and projectors.
- Storage Operations save data in primary memory (RAM) and secondary memory (HDD, SSD, optical drives, cloud storage).



# Processing Operations in Computer Systems

## The Central Processing Unit (CPU)

- **Control Unit:** Directs processor operations by fetching, decoding, and executing instructions.
- **Arithmetic Logic Unit (ALU):** Performs arithmetic and logical operations.
- **Registers:** Fast storage locations within the CPU for temporary data holding.
- **Cache Memory:** Volatile memory providing high-speed data access to the CPU.

## Importance of Processing Operations

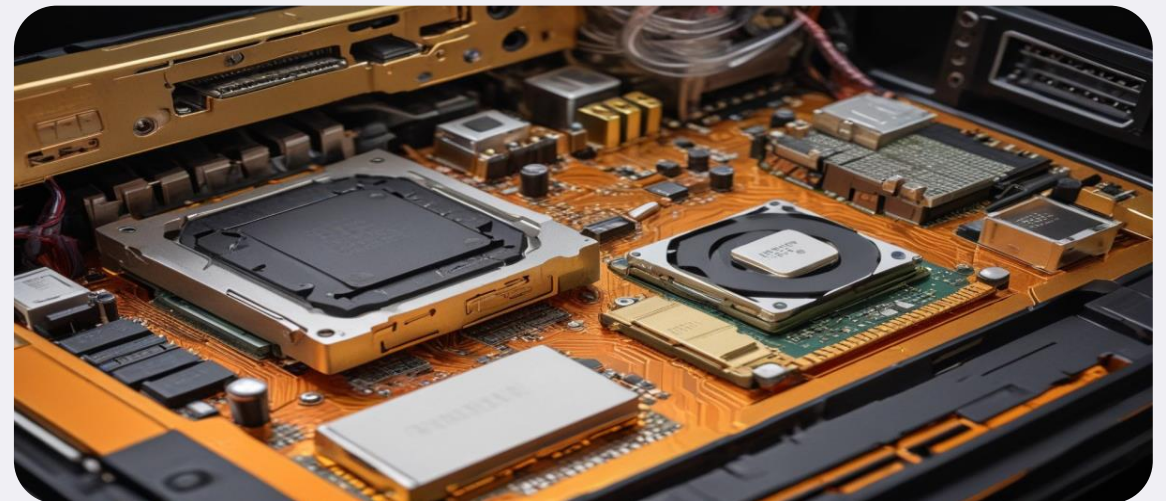
Core functions of the CPU in manipulating data based on program instructions.

Essential for executing tasks, processing information, and running applications efficiently.

Key component in the overall performance and speed of a computer system.

## Process Cycle

- **Fetch:** Retrieve instructions from the computer's memory.
- **Decode:** Interpret the meaning of the instruction.
- **Execute:** Perform operations like calculations or data manipulation.
- **Store:** Save the operation results back in memory for future use.



# **Output Operations and Data Presentation**

## **Monitors**

- Display devices that visually present processed data from the computer
- Available in various types like LCD, LED, and OLED
- Different resolution levels

## **Printers**

- Devices that produce physical copies of documents, images, and outputs
- Include inkjet, laser, and 3D printers

## **Speakers**

- Output devices that generate audio signals
- Convert digital audio data into sound waves for music, notifications, and other audio

## **Projectors**

- Devices used to project visual output onto screens or surfaces
- Commonly used for presentations and entertainment purposes



# Storage Operations and Data Retention

## Primary Memory (RAM)

- Volatile memory used for temporary storage of data during processing.
- Loses its contents when the computer is powered off.

## Data Retention

- **Volatile Memory:** Temporary storage that loses data when power is off (e.g., RAM).
- **Non-volatile Memory:** Permanent storage that retains data even when power is off (e.g., HDD, SSD).

## Secondary Memory

- **Hard Disk Drives (HDD):** Utilize spinning magnetic disks for data read and write operations.
- **Solid-State Drives (SSD):** Store data electronically using flash memory, offering faster access speeds and reliability compared to HDDs.
- **Optical Drives:** Employ lasers to read and write data on optical discs like CDs, DVDs, and Blu-ray discs.
- **Cloud Storage:** Remote storage services accessed via the internet, providing scalable storage solutions and easy data access from any location with an internet connection.

## Importance of Storing Data

- Saving data in primary and secondary memory ensures information can be retrieved and used in the future.
- Data retention in non-volatile memory guarantees data persistence even during power loss or system shutdown.



