

COMPUTER FUNDAMENTALS

Practical Guide

Introduction to Computer Science

Introduction to Computer and Its Organization

What is a Computer?

A computer is an electronic device that accepts data as input, processes it according to a set of instructions (program), stores the data, and produces output in a desired format. It can perform arithmetic and logical operations at high speed and with great accuracy.

[Computer System Block Diagram]

Computer Organization

Computer organization refers to the operational units and their interconnections that realize the architectural specifications. The main components include:

- Input Unit: Accepts data and instructions from the user
- Central Processing Unit (CPU): Processes data and controls operations
- Memory Unit: Stores data and instructions temporarily or permanently
- Output Unit: Presents processed data to the user
- Control Unit: Manages and coordinates all computer operations

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Computer Characteristics

Speed

Computers can process millions of instructions per second (MIPS). Modern computers operate at speeds measured in gigahertz (GHz).

Accuracy

Computers perform calculations with 100% accuracy. Errors occur only due to incorrect input or faulty programming.

Diligence

Unlike humans, computers can work continuously without fatigue, maintaining the same level of accuracy and speed.

Versatility

Computers can perform various tasks simultaneously, from simple calculations to complex scientific simulations.

Storage Capacity

Computers can store vast amounts of data in a very small physical space, measured in gigabytes (GB) or terabytes (TB).

Automation

Once programmed, computers can automatically execute tasks without human intervention.

Classification and Generations of Computers

Classification of Computers

Computers can be classified based on size, purpose, and data handling capabilities:

- Supercomputers: Most powerful, used for complex scientific calculations
- Mainframe Computers: Large systems for bulk data processing
- Mini Computers: Mid-sized, multi-user systems
- Workstations: High-performance single-user computers
- Microcomputers (PCs): Personal computers for individual use
- Embedded Computers: Specialized computers in devices

[Computer Classification Hierarchy]

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Generations of Computers

First Generation (1940-1956): Vacuum Tubes

- Used vacuum tubes for circuitry and magnetic drums for memory
- Very large in size, consumed lots of electricity
- Generated excessive heat and frequent failures
- Examples: ENIAC, UNIVAC, EDVAC

Second Generation (1956-1963): Transistors

- Transistors replaced vacuum tubes
- Smaller, faster, cheaper, and more energy-efficient
- Used assembly language and high-level languages
- Examples: IBM 1401, CDC 1604

Third Generation (1964-1971): Integrated Circuits

- Used Integrated Circuits (ICs) with multiple transistors
- Significantly smaller and more reliable
- Introduction of keyboards and monitors
- Examples: IBM 360 series, PDP-8

Fourth Generation (1971-Present): Microprocessors

- Microprocessors with thousands of ICs on a single chip
- Development of personal computers (PCs)
- GUI, mouse, and networking capabilities
- Examples: Intel 4004, IBM PC, Apple Macintosh

Fifth Generation (Present-Future): AI

- Based on Artificial Intelligence and parallel processing
- Voice recognition, natural language processing
- Quantum computing and neural networks
- Examples: AI systems, quantum computers

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Input and Output Devices of Computer

Input Devices

Input devices are hardware components used to provide data and control signals to a computer system:

- **Keyboard:**

Primary text input device with alphanumeric keys, function keys, and special keys

- **Mouse:**

Pointing device used to interact with graphical user interfaces through clicking and dragging

- **Scanner:**

Converts physical documents and images into digital format

- **Microphone:**

Captures audio input for voice commands, recording, and communication

- **Webcam:**

Captures video input for video conferencing and recording

- **Touchscreen:**

Combined input/output device allowing direct interaction with display

- **Joystick/Gamepad:**

Gaming input devices for controlling movement and actions

[Common Input Devices]

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Output Devices

Output Devices

Output devices are hardware components that receive data from a computer and present it to the user:

- **Monitor/Display:**

Visual output device showing text, images, and video. Types include LCD, LED, OLED

- **Printer:**

Produces hard copy output on paper. Types: Inkjet, Laser, Dot Matrix, 3D printers

- **Speakers:**

Audio output devices for playing sounds, music, and voice

- **Headphones:**

Personal audio output devices worn on or in the ears

- **Projector:**

Displays computer output on large screens or walls for presentations

- **Plotter:**

Specialized printer for producing large-scale graphics and engineering drawings

[Common Output Devices]

Key Differences

Input devices send data TO the computer, while output devices receive data FROM the computer. Some devices like touchscreens and network cards can function as both input and output devices.