



BCA



Semester - 1st



COMPUTER FUNDAMENTALS

Notes - 1

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Brief History of Development of Computers

The development of computers did not happen overnight – it took several centuries of inventions, ideas, and improvements. From simple counting tools to today's supercomputers, the journey of computers shows how human intelligence evolved with technology.

1. Early Calculating Devices

Before modern computers, people used simple tools to perform calculations.

(a) Abacus (around 3000 B.C.)

The Abacus was the first known calculating device, invented by the Chinese.

It had a wooden frame with beads arranged on rods.

The beads were moved to perform addition, subtraction, multiplication, and division.

It is still used in some places to teach basic arithmetic.

(b) Napier's Bones (1617)

Invented by John Napier, a Scottish mathematician.

It used rods inscribed with multiplication tables to make multiplication and division easier.

It was an early form of a manual calculator.

(c) Pascal's Calculator (1642)

Invented by Blaise Pascal, a French mathematician.

It could perform addition and subtraction using gears and wheels.

It was the first mechanical calculator.

(d) Leibniz's Calculator (1671)

Invented by Gottfried Wilhelm Leibniz.

It could perform addition, subtraction, multiplication, and division.

It was an improvement over Pascal's machine.

(e) Difference Engine and Analytical Engine (1822–1833)

Invented by Charles Babbage, known as the Father of the Computer. The Difference Engine was designed to calculate mathematical tables. Later, Babbage designed the Analytical Engine, which had:

- Memory (Store)
- Processor (Mill)
- Input/Output system

It was the first concept of a programmable computer. His assistant Ada Lovelace is called the First Programmer for writing algorithms for this machine.

(f) Hollerith's Tabulating Machine (1890)

Invented by Herman Hollerith. Used punch cards to store and process data. Helped in the U.S. Census and laid the foundation for IBM (International Business Machines).

Concept of Computer System

A computer system is an electronic system that takes data as input, processes it according to given instructions, and produces output. It performs various operations like calculation, comparison, data storage, and information retrieval.

A computer system is not just the computer machine – it is a combination of hardware, software, and user working together to perform tasks.

Components of Computer System

Hardware:

The physical parts of a computer (e.g., CPU, monitor, keyboard, mouse, printer).

Software:

The set of programs or instructions that tell the hardware what to do (e.g., Windows, MS Word, browsers).

Data:

The raw facts and figures given to the computer for processing (e.g., numbers, text, images).

User (Peopleware):

The person who uses and controls the computer system.

Procedures:

The step-by-step instructions that describe how to use the hardware and software together.

Characteristics of Computer System

Computers have some unique characteristics that make them powerful and useful.

(a) Speed

Computers perform millions of calculations in a second.

Speed is measured in microseconds (μs) or nanoseconds (ns).

Example: Calculations that take hours for humans are done in seconds by computers.

(b) Accuracy

Computers are highly accurate and give correct results if the input and program are correct.

Errors occur only due to human mistakes (called GIGO – Garbage In, Garbage Out).

(c) Storage

Computers can store a huge amount of data permanently or temporarily.

Data can be easily accessed, modified, or deleted.

Example: Hard disk, SSD, pendrive, etc.

(d) Diligence

Computers do not get tired, bored, or lose concentration.

They can work continuously without any performance drop.

(e) Versatility

A single computer can perform various tasks – like playing music, creating documents, designing, or performing scientific calculations. It is a multi-purpose device.

(f) Automation

Once a program is started, the computer performs tasks automatically without further human help until the job is done.

(g) Reliability

Computers provide consistent and dependable results over time. They are not affected by emotions, fatigue, or distractions.

(h) Communication

Computers can easily communicate and share data with other computers via networks (LAN, WAN, Internet).

This feature enables online work, video calls, emails, etc.

(i) No Intelligence

A computer has no thinking power or common sense.

It only follows instructions given by the user or programmer.

(j) Multitasking

A computer can run multiple programs or perform several operations at the same time (e.g., browsing, downloading, and typing).

Capabilities of Computers

A computer is an extremely powerful and versatile electronic machine. It can perform many tasks that humans cannot do as fast or as accurately.

Let's understand its main capabilities (what a computer can do):

(a) Speed

Computers can perform millions of operations per second.

They process data much faster than humans.

Example: A task that might take hours for a human can be done in seconds by a computer.

(b) Accuracy

Computers give 100% accurate results if input and program are correct.

Errors only occur due to wrong data or instructions (known as Garbage In, Garbage Out or GIGO).

(c) Storage Capacity

Computers can store huge amounts of data and retrieve it quickly whenever required.

Example: Hard disks, SSDs, and cloud storage can store terabytes of data.

(d) Diligence

Unlike humans, computers never get tired or bored. They can perform repetitive tasks for hours without losing accuracy or speed.

(e) Versatility

A single computer can do many different types of work – typing, calculations, designing, playing games, programming, or managing databases.

(f) Automation

Once instructions are given, a computer works automatically without human help until the job is finished.

(g) Connectivity and Communication

Computers can connect and communicate over networks like the Internet.

They share data, messages, and files instantly across the world.

(h) Multitasking

A computer can run multiple programs at the same time.

Example: Listening to music while writing a document and downloading files simultaneously.

(i) Reliability

Computers give consistent and dependable results every time, provided they are properly maintained.

Limitations of Computers

Although computers are very powerful, they also have some limitations – things they cannot do on their own.

(a) No Intelligence

A computer has no brain or thinking power.

It cannot make decisions or judgments by itself – it only follows user instructions.

(b) No Feelings or Emotions

Computers do not have emotions like humans.

They cannot feel happiness, fear, or creativity – they just follow logic.

(c) Dependence on Human Instructions

A computer depends completely on human input (data and programs).

Without instructions, it cannot work on its own.

(d) Lack of Common Sense

A computer cannot understand real-life situations.

If given wrong instructions, it will still execute them blindly, producing wrong results.

(e) High Cost and Maintenance

Modern computers and their components can be expensive.

Regular maintenance and updates are required for smooth performance.

(f) Environmental and Health Issues

Continuous use of computers may lead to e-waste, power consumption, and health problems (like eye strain, poor posture).

Types of Computers

Computers are classified in different ways based on purpose, data handling, and size or capacity.

Let's understand all the main types one by one in an easy and clear way.

1. Based on Data Handling

(a) Analog Computer

Analog computers work with continuous data.

They measure physical quantities such as temperature, pressure, voltage, or speed.

They do not give exact numbers but show results in graph or dial form.

Used mainly in engineering and scientific applications.

Examples:

Speedometer, Thermometer, Flight simulator, Analog weather forecasting system.

(b) Digital Computer

Digital computers work with discrete data (0s and 1s).

They process data in binary form (0 and 1).

They are used for calculations, data storage, communication, and logical operations.

Almost all modern computers are digital.

Examples:

PCs, Laptops, Smartphones, Calculators.

(c) Hybrid Computer

Hybrid computers combine the features of analog and digital computers.

They can process both continuous and discrete data.

Used where both measurement and calculation are needed.

Examples:

Hospitals (for monitoring heart rate and performing calculations),

Weather forecasting systems,

Scientific research instruments.

2. Based on Purpose

(a) General Purpose Computer

Designed to perform a wide variety of tasks.

Can run different programs and applications.

Used in schools, offices, homes, and businesses.

Examples:

Personal computers, Laptops, Desktops.

(b) Special Purpose Computer

Designed to perform one specific task only.

Faster and more efficient for that particular purpose.

Cannot be used for general tasks.

Examples:

Automatic washing machines, Traffic control systems,

ATM machines, Airplane navigation systems.

3. Based on Size and Performance

(a) Micro Computer

The smallest type of computer.

Based on microprocessors.

Used by individuals for daily tasks like word processing, browsing, gaming, etc.

Easy to use and affordable.

Examples:

Desktop PCs, Laptops, Tablets, Smartphones.

(b) Mini Computer

More powerful than microcomputers but smaller than mainframes.

Can support multiple users at once (10–100 users).

Used in small organizations for database management or small-scale business applications.

Examples:

PDP-11, IBM AS/400.

(c) Mainframe Computer

Large and very powerful computers.

Can handle hundreds or thousands of users at the same time.

Used by banks, government departments, large companies for bulk data processing and large database management.

Examples:

IBM Z Series, UNIVAC 9400.

(d) Supercomputer

The fastest and most powerful type of computer.

Used for complex scientific and engineering calculations, weather forecasting, nuclear research, and space exploration.

Very expensive and requires special cooling systems.

Examples:

PARAM (India), CRAY, IBM Summit, Fugaku (Japan).

Generations of Computers

The history of computers is divided into five generations, based on the technology used, size, speed, and efficiency.

Each generation marked a major advancement in computer design and capability.

First Generation (1940–1956) – Vacuum Tube Technology

Technology Used:

Used vacuum tubes as main electronic components.

Magnetic drums were used for memory.

Characteristics:

Very large in size and produced a lot of heat.

Very slow and consumed a lot of electricity.

Used machine language (binary code 0s and 1s).

Required air-conditioning and frequent maintenance.

Examples:

ENIAC (Electronic Numerical Integrator and Calculator)

EDVAC (Electronic Discrete Variable Automatic Computer)

UNIVAC I (Universal Automatic Computer)

Second Generation (1956–1963) – Transistor Technology

Technology Used:

Transistors replaced vacuum tubes.

Characteristics:

Smaller, faster, cheaper, and more reliable.

Generated less heat and required less power.

Used assembly language and high-level languages like COBOL and FORTRAN.

Used magnetic tape and magnetic disks for storage.

Examples:

IBM 1401, IBM 7090, CDC 1604

Third Generation (1964–1971) – Integrated Circuit (IC) Technology

Technology Used:

Used Integrated Circuits (ICs) – many transistors on a single silicon chip.

Characteristics:

Computers became smaller, faster, and more reliable.

Consumed less power.

Supported multiple programs (Multiprogramming).

Used keyboards, monitors, and operating systems.

Examples:

IBM System/360, PDP-8

Fourth Generation (1971–1980) – Microprocessor Technology

Technology Used:

Used microprocessors, which contained thousands of ICs on a single chip.

Example: Intel 4004 – the first microprocessor (1971).

Characteristics:

Personal computers (PCs) became popular.

Very small, fast, and affordable.

Used high-level programming languages like C, BASIC, and Pascal.

Used hard disks for storage and graphical user interfaces (GUI).

Examples:

IBM PC, Apple II, Altair 8800

Fifth Generation (1980–Present) – Artificial Intelligence (AI) Technology

Technology Used:

Based on Artificial Intelligence (AI), Machine Learning, and Neural Networks.

Uses Very Large Scale Integration (VLSI) and Ultra Large Scale Integration (ULSI) chips.

Characteristics:

Focus on parallel processing, voice recognition, natural language processing, and quantum computing.

Extremely fast and powerful.

Used in robotics, data analysis, and smart systems.

Examples:

AI Robots, Quantum Computers, Smartphones, Laptops, Supercomputers (PARAM, CRAY)

Types of Personal Computers (PCs) and Their Characteristics

A Personal Computer (PC) is a small, single-user computer designed for individual use such as studying, office work, internet browsing, entertainment, and programming.

Personal computers come in different forms based on size, performance, and purpose.

Let's look at the main types of PCs and their characteristics.

Desktop Computer

Description:

A stationary computer designed to be placed on a desk.

Consists of a CPU cabinet, monitor, keyboard, mouse, and other peripherals.

Characteristics:

Larger in size but powerful and reliable.

Suitable for home, office, and educational use.

Upgradeable (RAM, storage, graphics).

Needs a continuous power supply.

Cheaper than laptops with the same performance.

Examples: HP Pavilion, Dell OptiPlex, Lenovo ThinkCentre.

Laptop Computer

Description:

A portable computer that can be easily carried anywhere.

All components (screen, keyboard, battery, storage) are built into one compact unit.

Characteristics:

Lightweight and battery-powered (portable).

Slightly less powerful than desktops.

Has built-in Wi-Fi, Bluetooth, camera, and speakers.

Used by students, professionals, and travelers.

Examples: Dell Inspiron, HP Envy, Apple MacBook.

Notebook Computer

Description:

A smaller and lighter version of a laptop.

Mainly designed for note-taking, browsing, and simple computing tasks.

Characteristics:

More energy-efficient and portable than laptops.

Usually has smaller storage and lower performance.

Suitable for students and business meetings.

Examples: Lenovo IdeaPad, HP Stream Notebook.

Palmtop Computer (Handheld PC)

Description:

A tiny computer that fits in your palm or pocket.

Operated using a touchscreen or stylus.

Characteristics:

Extremely portable and battery-powered.

Limited memory and processing power.

Used for basic tasks – managing contacts, notes, schedules, and emails.

Gradually replaced by smartphones and tablets.

Examples: PDA (Personal Digital Assistant), early Palm Pilot devices.

Workstation

Description:

A high-performance personal computer designed for professional or technical work.

Used for engineering, 3D modeling, animation, scientific research, and graphic design.

Characteristics:

Has powerful processors (multi-core) and large memory (RAM).

Equipped with high-end graphics cards.

Supports multiple monitors.

Expensive but delivers excellent speed and performance.

Examples: Dell Precision, HP Z Series, Lenovo ThinkStation.

Other Modern Personal Computing Devices

(a) *Tablet PC*

Portable device with a touchscreen instead of a keyboard.

Can be used for reading, browsing, sketching, and media consumption.

Example: Apple iPad, Samsung Galaxy Tab.

(b) *Smartphone*

A handheld mini-computer used for calling, messaging, and computing tasks.

Runs on mobile operating systems like Android or iOS.

Practice Questions

1. Explain the brief history of the development of computers.
2. Describe the main components and characteristics of a computer system.
3. What are the capabilities and limitations of computers? Explain with examples.
4. Differentiate between Analog, Digital, and Hybrid computers.
5. Distinguish between General Purpose and Special Purpose computers with examples.
6. Explain the different generations of computers along with their main features and technologies used.
7. Write short notes on Micro, Mini, Mainframe, and Supercomputers.
8. Explain the different types of Personal Computers (Desktop, Laptop, Notebook, Palmtop, Workstation) and their characteristics.
9. What are the main differences between Desktop computers and Laptops?
10. Discuss the major technological changes that occurred from the first generation to the fifth generation of computers.

Check the answer in the Practice Questions section on our website.



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Thank You