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(CDOE)

B.Sc - COMPUTER SCEINCE

SEMESTER - II

SKILL ENHANCEMENT COURSE (SEC): FUNDAMENTALS OF INFORMATION TECHNOLOGY

(Candidates admitted from 2024 onwards)

PERIYAR UNIVERSITY

CENTRE FOR DISTANCE AND ONLINE EDUCATION (CDOE)

B.Sc Computer Science 2024 admission onwards

SKILL ENHANCEMENT COURSE (SEC)

Fundamentals of Information Technology

Prepared by:

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SYLLABUS

FUNDAMENTALS OF INFORMATION TECHNOLOGY

Unit I: Introduction, Definition, .Characteristics of computer, Evolution of Computer, Block Diagram of a computer, Generations of Computer, Classification of Computers, Applications of Computer, Capabilities and limitations of computer

Unit II: Role of I/O devices in a computer system. Input Units: Keyboard, Terminals and its types. Pointing Devices, Scanners and its types, Voice Recognition Systems, Vision Input System, Touch Screen, Output Units: Monitors and its types. Printers: Impact Printers and its types. Non-Impact Printers and its types, Plotters, types of plotters, Sound cards, Speakers.

Unit III: Primary Vs Secondary Storage, Data storage & retrieval methods. Primary Storage: RAM ROM, PROM, EPROM, EEPROM. Secondary Storage: Magnetic Tapes, Magnetic Disks. Cartridge tape, hard disks, Floppy disks Optical Disks, Compact Disks, Zip Drive, Flash Drives

Unit IV: Software and its needs, Types of S/W. System Software: Operating System, Utility Programs Programming Language: Machine Language, Assembly Language, High Level Language their advantages & disadvantages. Application S/W and its types: Word Processing, Spread Sheets Presentation, Graphics, DBMS s/w

Unit V: Functions, Measuring System Performance, Assemblers, Compilers and Interpreters. Batch Processing, Multiprogramming, Multi-Tasking, Multiprocessing, Time Sharing, DOS, Windows, Unix/Linux.

UNIT – I

INTRODUCTION TO COMPUTERS

UNIT 1 - INTRODUCTION TO COMPUTERS
Introduction, Definition, .Characteristics of computer, Evolution of Computer, Block Diagram Of a computer, Generations of Computer, Classification Of Computers, Applications of Computer, Capabilities and limitations of computer

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UNIT OBJECTIVES

- In this unit aims to provide a comprehensive introduction to the fundamental concepts of computers.
- Learners will be able to understand the historical evolution and development of computers, elucidating the different generations and their respective advancements.
- Furthermore, this unit covers the classification and varied applications of computers, highlighting their capabilities and limitations.

1.1 INTRODUCTION

A Computer is a programmable machine designed to perform arithmetic and logical operations automatically and sequentially on the input given by the user and gives the desired output after processing. A computer is an electronic device, operating under the control of instructions (software) stored in its own memory unit, that can accept data (input), manipulate data (process), and produce information (output) from the processing. Generally, the term is used to describe a collection of devices that function together as a system.

- Computer components are divided into two major categories namely hardware and software.
- An electronic machine which helps in solving problems quickly and easily.
- It is a digital machine (that uses binary digits) used in all fields.
- It is a multipurpose electronic device that can receive, process and store data.

1.2 DEFINITION

A computer is an electronic device designed to perform a variety of tasks by executing programmed instructions. It processes data inputted by users, stores information, and produces outputs in the form of meaningful results. Modern computers consist of hardware components such as the central processing unit (CPU), memory (RAM and storage), and peripheral devices like monitors, keyboards, and printers. Software, including operating systems and applications, enables users to interact with the hardware to perform specific functions, from simple calculations to complex simulations.

1.3 CHARACTERISTICS OF COMPUTERS

Word Length: A digital computer operates on binary digits – 0 and 1. It can understand information only in terms of 0s and 1s. a binary digit is called a bit. A group of 8 bits is called a byte. The number of bits that a computer can process at a time in parallel is called its word length. Commonly used word lengths are 8, 16, 32 or 64 bits. Word length is the measure of the computing power of a computer. The longer the word length, the more powerful the computer is.

High Speed: Computers have the ability to perform routine tasks at a greater speed than human beings. They can perform millions of calculations in seconds.

Accuracy: Computers are used to perform tasks in a way that ensures accuracy. Errors that may occur are usually due to inaccurate data, wrong instructions or bug in chips – all human errors

Storage: Computers can store large amount of information. Any item of data or any instruction stored in the memory can be retrieved by the computer at lightning speeds.

Automation: Computers can be instructed to perform complex tasks automatically.

Diligence: Computers can perform the same task repeatedly & with the same accuracy without getting tired.

Versatility: Computers are flexible to perform both simple and complex tasks. Computers can carry out a wide range of work from data entry and ticket booking to complex mathematical calculations and continuous astronomical observations.

Cost effectiveness: Computers reduce the amount of paper work and human effort, thereby reducing costs.

Speed: Typically, a computer can carry out 3-4 million instructions per second.

Reliability: Computers can carry out same type of work repeatedly without throwing up errors due to tiredness or boredom, which are very common among humans.

1.4 EVOLUTION OF COMPUTERS

The evolution of computers spans several centuries and has undergone significant advancements in technology, design, and functionality. Here's an overview of the major milestones and stages in the evolution of computers:

1.4.1 Pre-20th Century

Abacus: The abacus, developed thousands of years ago, was one of the earliest devices used for mathematical calculations.

Mechanical Calculators: Mechanical devices such as the Pascaline (invented by Blaise Pascal in 1642) and the Difference Engine (designed by Charles Babbage in the 19th century) performed basic arithmetic operations.

1.4.2 20th Century

First Generation (1940s-1950s):

Vacuum Tube Computers: The first generation of computers, such as ENIAC (1946) and UNIVAC I (1951), used vacuum tubes for processing. They were large, expensive, and unreliable.

Second Generation (1950s-1960s):

Transistors: Transistors replaced vacuum tubes, leading to smaller, faster, and more reliable computers. Examples include IBM 1401 and IBM 7090.

Magnetic Core Memory: Introduced as a form of random-access memory (RAM) for storing data.

Third Generation (1960s-1970s):

Integrated Circuits (ICs): Integrated circuits, containing multiple transistors on a single chip, enabled further miniaturization and cost reduction. Mainframes and minicomputers like IBM System/360 and DEC PDP-8 were prominent.

Time-Sharing Systems: Multiple users could interact with a single computer simultaneously.

Fourth Generation (1970s-Present):

Microprocessors: The invention of the microprocessor (e.g., Intel 4004 in 1971) led to the development of personal computers (PCs) and embedded systems. The introduction of PCs, such as the Apple II (1977) and IBM PC (1981), revolutionized computing by bringing computing power to individuals and businesses.

1.4.3 21st Century

Mobile Computing: The proliferation of smartphones, tablets, and wearable devices has reshaped how people interact with computers and access information.

Cloud Computing: The rise of cloud computing enables users to access computing resources and services over the internet, leading to scalable and cost-effective solutions.

Artificial Intelligence (AI): Advances in AI and machine learning have enabled computers to perform tasks traditionally requiring human intelligence, such as image recognition, natural language processing, and decision-making.

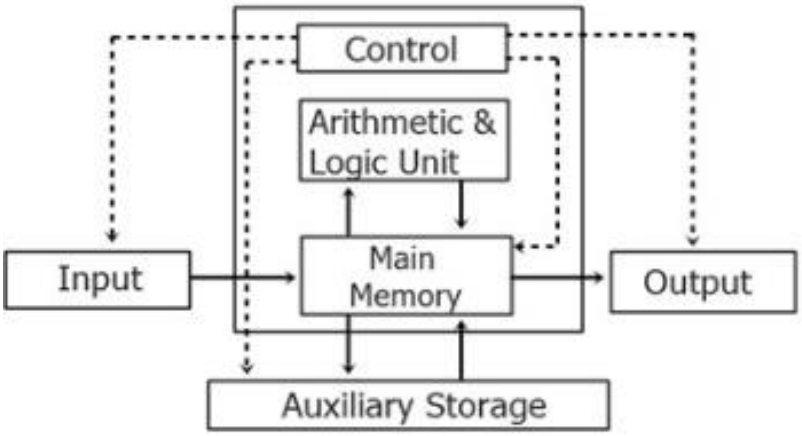
Internet of Things (IoT): The IoT connects everyday objects to the internet, allowing for data collection, analysis, and automation in various domains, including smart homes, healthcare, and transportation.

Let's Sum Up

To sum up, Computers have evolved from room-sized machines using vacuum tubes to today's compact, powerful devices with microprocessors. Each generation has brought significant advancements in size, speed, and functionality, culminating in modern computers that are integral to daily life, with vast processing power, storage capacity, and connectivity.

1.5 BLOCK DIAGRAM OF A COMPUTER

A block diagram of a computer typically outlines the major components and their interconnections. Here's a basic block diagram illustrating the key components of a computer system:



Block Diagram of Computer

Input Devices: Devices such as keyboard, mouse, touchpad, or touchscreen that allow users to interact with the computer system by providing input.

Central Processing Unit (CPU): The brain of the computer, responsible for executing instructions, performing calculations, and controlling the overall operation of the system.

Memory (RAM): Temporary storage that holds data and instructions that the CPU needs to access quickly. Random Access Memory (RAM) allows for fast read and write operations but is volatile (loses data when power is off).

Arithmetic Logic Unit (ALU): The part of the CPU that performs arithmetic and logical operations, such as addition, subtraction, AND, OR, etc.

Control Unit: Manages the execution of instructions, fetches instructions from memory, decodes them, and coordinates the operation of the other CPU components.

Cache Memory: High-speed memory located within or close to the CPU that stores frequently accessed data and instructions, speeding up access times.

Storage Devices: Devices such as Hard Disk Drives (HDDs), Solid State Drives (SSDs), or Flash drives used for long-term storage of data and programs.

Let's Sum Up

A computer's block diagram typically includes the central processing unit (CPU), memory (RAM and storage), input devices, output devices, and buses connecting these components. This structure allows for efficient processing, storage, and retrieval of data, enabling the execution of complex tasks and user interactions.

1.6 GENERATIONS OF COMPUTERS

Generation in computer terminology is a change in technology a computer is/was being used. Initially, the generation term was used to distinguish between varying hardware technologies. Nowadays, generation includes both hardware and software, which together make up an entire computer system. There are five computer generations known till date. Each generation has been discussed in detail along with their time period and characteristics. In the following table, an approximate date against each generation has been mentioned, which are normally accepted.

Following are the main five generations of computers.

1	***First Generation*** *The period of first generation: 1946-1959. Vacuum tube based.*
2	***Second Generation*** *The period of second generation: 1959-1965. Transistor based.*
3	***Third Generation*** *The period of third generation: 1965-1971. Integrated Circuit based.*
4	***Fourth Generation*** *The period of fourth generation: 1971-1980. VLSI microprocessor based.*
5	***Fifth Generation*** *The period of fifth generation: 1980-onwards. ULSI microprocessor based.*

1.6.1 First Generation

The period of first generation was from 1946-1959. The computers of first generation used *vacuum tubes* as the basic components for memory and circuitry for CPU (Central Processing Unit). These tubes, like electric bulbs, produced a lot of heat and the installations used to fuse frequently. Therefore, they were very expensive and only large organizations were able to afford it.

In this generation, mainly

- *Batch processing operating system* was used.
- *Punch cards, paper tape, and magnetic tape* were used as input and output devices.
- The computers in this generation used *machine code* as the programming language.

The main features of the first generation are:

- Vacuum tube technology
- Unreliable
- Supported machine language only
- Very costly
- Generated a lot of heat
- Slow input and output devices
- Huge size
- Need of AC
- Non-portable
- Consumed a lot of electricity

Some computers of this generation were:

- ENIAC
- EDVAC
- UNIVAC
- IBM-701
- IBM-650

1.6.2 Second Generation

The period of second generation was from 1959-1965. In this generation, transistors were used that were cheaper, consumed less power, more compact in size, more reliable and faster than the first generation machines made of vacuum tubes. In this generation, magnetic cores were used as the primary memory and magnetic tape and magnetic disks as secondary storage devices.

In this generation,

- Assembly language and high-level programming languages like FORTRAN, COBOL were used.
- The computers used batch processing and multiprogramming operating system.

The main features of second generation are:

- Use of transistors.
- Reliable in comparison to first generation computers.
- Smaller size as compared to first generation computers.
- Generated less heat as compared to first generation computers.
- Consumed less electricity as compared to first generation computers.
- Faster than first generation computers.
- Still very costly.
- AC required.
- Supported machine and assembly languages.

Some computers of this generation were:

- IBM 1620
- IBM 7094
- CDC 1604
- CDC 3600
- UNIVAC 1108

1.6.3 Third Generation

The period of third generation was from 1965-1971. The computers of third generation used *Integrated Circuits (ICs)* in place of transistors. A single IC has many transistors, resistors, and capacitors along with the associated circuitry.

- The IC was invented by Jack Kilby.
- This development made computers smaller in size, reliable, and efficient.
- In this generation *remote processing, time-sharing, multiprogramming operating system* were used.
- High-level languages (FORTRAN-II TO IV, COBOL, PASCAL PL/1, BASIC, ALGOL-68 etc.) were used during this generation.

The main features of third generation are −

- IC used
- More reliable in comparison to previous two generations
- Smaller size
- Generated less heat
- Faster
- Lesser maintenance
- Costly
- AC required
- Consumed lesser electricity
- Supported high-level language

Some computers of this generation were −

- IBM-360 series
- Honeywell-6000 series
- PDP (Personal Data Processor)
- IBM-370/168
- TDC-316

1.6.4 Fourth Generation

The period of fourth generation was from 1971-1980. Computers of fourth generation used Very Large Scale Integrated (VLSI) circuits. VLSI circuits having about 5000 transistors and other circuit elements with their associated circuits on a single chip made it possible to have microcomputers of fourth generation.

- Fourth generation computers became more powerful, compact, reliable, and affordable.
- As a result, it gave rise to Personal Computer (PC) revolution.
- In this generation, time sharing, real time networks, distributed operating system were used.
- All the high-level languages like C, C++, DBASE etc., were used in this generation.

The main features of fourth generation are −

- VLSI technology used
- Very cheap
- Portable and reliable
- Use of PCs
- Very small size
- Pipeline processing
- No AC required
- Concept of internet was introduced
- Great developments in the fields of networks
- Computers became easily available

Some computers of this generation were −

- DEC 10
- STAR 1000
- PDP 11
- CRAY-1(Super Computer)
- CRAY-X-MP(Super Computer)

1.6.5 Fifth Generation

The period of fifth generation is 1980-till date. In the fifth generation, VLSI technology became ULSI (Ultra Large Scale Integration) technology, resulting in the production of microprocessor chips having ten million electronic components.

- This generation is based on parallel processing hardware and AI (Artificial Intelligence) software.
- AI is an emerging branch in computer science, which interprets the means and method of making computers think like human beings.
- All the high-level languages like C and C++, Java, .Net etc., are used in this generation.

zThe main features of fifth generation are:

- ULSI technology
- Development of true artificial intelligence
- Development of Natural language processing
- Advancement in Parallel Processing
- Advancement in Superconductor technology
- More user-friendly interfaces with multimedia features
- Availability of very powerful and compact computers at cheaper rates

Some computer types of this generation are:

- Desktop
- Laptop
- Notebook

- Ultrabook
- Chromebook

Let's Sum Up

The evolution of computers is marked by distinct generations: the first generation used vacuum tubes, the second generation utilized transistors, the third generation incorporated integrated circuits, and the fourth generation saw the rise of microprocessors. Each generation brought significant advancements in size, efficiency, and processing power, culminating in today's powerful, compact, and interconnected devices.

1.7 CLASSIFICATION OF DIGITAL COMPUTERS

Computers can be classified, or typed, in many ways. According to data handling, computers are *analog, digital or hybrid*.

Analog computers	• Analog computers work on the principle of measuring, in which the measurements obtained are translated into data. • Modern analog computers usually employ electrical parameters, such as voltages, resistances or currents, to represent the quantities being manipulated. • Such computers do not deal directly with the numbers. They measure continuous physical magnitudes.
Digital computers	• Digital computers are those that operate with information, numerical or otherwise, represented in a digital form. • Such computers process data into a digital value (in 0s and 1s). • They give the results with more accuracy and at a faster rate.
Hybrid computers	• Hybrid computers incorporate the measuring feature of an analog computer and counting feature of a digital

	computer. • For computational purposes, these computers use analog components and for storage, digital memories are used.

1.7.1 Microcomputers

Microcomputers became the most common type of computer in the late 20th century. The term “microcomputer” was introduced with the advent of systems based on single chip microprocessors.

Desktop computers	A case put under or on a desk. The display may be optional, depending on use. The case size may vary, depending on the required expansion slots. Very small computers of this kind may be integrated into the monitor.
Rackmount computers	The cases of these computers fit into 19-inch racks, and may be space-optimized and very flat. A dedicated display, keyboard, and mouse may not exist, but a KVM switch or built-in remote control (via LAN or other means) can be used to gain console access.
In-car computers (carputers)	Built into automobiles, for entertainment, navigation, etc.
Game consoles	Fixed computers built specifically for entertainment purposes such as(video games).

1.7.2 Personal Computer

Personal computer a compact computer that uses a microprocessor and is designed for individual use, as by a person in an office or at home or school, for such applications as word processing, data management, financial analysis, or computer games.

Types	Usages
Desktop Computer	A personal or micro-mini computer sufficient to fit on a desk.
Laptop Computer	A portable computer complete with an integrated screen and keyboard. It is generally smaller in size than a desktop computer and larger than a notebook computer.
Palmtop Computer/Digital Diary /Notebook /PDAs	A hand-sized computer. Palmtops have no keyboard but the screen serves both as an input and output device.

1.7.3 Portable Computers

Portable computers, also known as mobile computers, are computing devices designed for mobility, allowing users to carry them and use them in different locations. Examples, Laptops, Notebooks, Ultrabooks, Tablets, and Smartphones.

1.7.4 Mini Computers

A midsized computer. In size and power, minicomputers lie between workstations and mainframes. In the past decade, the distinction between large minicomputers and small mainframes has blurred, however, as has the distinction between small minicomputers and workstations. But in general, a minicomputer is a multiprocessing system capable of supporting from 4 to about 200 users simultaneously.

1.7.5 Super Computers

The fastest and most powerful type of computer Supercomputers are very expensive and are employed for specialized applications that require immense amounts of mathematical calculations. For example, weather forecasting requires a supercomputer. Other uses of supercomputers include animated graphics, fluid dynamic calculations, nuclear energy research, and petroleum exploration.

The chief difference between a supercomputer and a mainframe is that a supercomputer channels all its power into executing a few programs as fast as possible, whereas a mainframe uses its power to execute many programs concurrently.

1.7.6 Main Frames

A very large and expensive computer capable of supporting hundreds, or even thousands, of users simultaneously. In the hierarchy that starts with a simple microprocessor (in watches, for example) at the bottom and moves to supercomputers at the top, mainframes are just below supercomputers. In some ways, mainframes are more powerful than supercomputers because they support more simultaneous programs. But supercomputers can execute a single program faster than a mainframe.

Let's Sum Up

Computers can be classified based on several criteria, including size, purpose, and functionality, ranging from supercomputers and mainframes to personal computers, laptops, tablets, and smartphones. They can also be categorized by their use, such as general-purpose computers for everyday tasks or specialized computers for scientific research, industrial control, and gaming.

1.8 APPLICATIONS OF COMPUTERS

1.8.1 Business and Finance

- **Data Management:** Computers are used to store, manage, and analyze large amounts of data, helping businesses make informed decisions.
- **Accounting and Financial Analysis:** Software applications like QuickBooks and Excel streamline accounting tasks, financial analysis, and reporting.
- **E-commerce:** Online shopping platforms like Amazon and eBay rely on computers for transaction processing, inventory management, and customer service.

1.8.2 Education

- **E-Learning:** Online education platforms like Coursera, Khan Academy, and edX offer courses and learning resources accessible from anywhere.
- **Research:** Computers facilitate academic research through data analysis, simulations, and access to digital libraries and databases.
- **Administrative Tasks:** Schools and universities use computers for student registration, grade management, and communication.

1.8.3 Healthcare

- **Medical Imaging:** Computers are essential in processing and analyzing medical images (e.g., X-rays, MRIs, CT scans) for accurate diagnosis.
- **Electronic Health Records (EHRs):** EHR systems store patient information, improving accessibility, coordination, and care quality.
- **Telemedicine:** Computers enable remote consultations, diagnostics, and monitoring, expanding access to healthcare services.

1.8.4 Entertainment

- **Video Games:** Computers power sophisticated video games, offering immersive experiences with advanced graphics and gameplay.
- **Digital Media:** Computers are used for creating, editing, and distributing digital media, including music, movies, and animations.
- **Virtual Reality (VR) and Augmented Reality (AR):** These technologies rely on computers to create interactive and immersive environments.

1.8.5 Communication

- **Email and Messaging:** Computers facilitate instant communication through email, chat applications, and social media platforms.
- **Video Conferencing:** Tools like Zoom, Microsoft Teams, and Skype enable virtual meetings and collaboration across distances.
- **Social Networking:** Platforms like Facebook, Twitter, and LinkedIn connect people and communities worldwide.

1.8.6 Manufacturing and Industry

- **Automation and Robotics:** Computers control automated systems and robots in manufacturing, improving efficiency and precision.
- **Supply Chain Management:** Software applications optimize logistics, inventory management, and production planning.
- **Quality Control:** Computers analyze data from sensors and production lines to ensure product quality and consistency.

1.8.7 Government and Public Services

- **E-Government:** Governments use computers to provide online services, such as tax filing, license renewals, and public records access.
- **Public Safety:** Law enforcement agencies use computers for crime data analysis, surveillance, and emergency response coordination.
- **Voting Systems:** Computers are used in electronic voting systems to facilitate elections and improve vote tallying.
-

1.8.8 Transportation

- **Traffic Management:** Computers help monitor and manage traffic flow, reducing congestion and improving safety.
- **Navigation Systems:** GPS and mapping software assist in route planning and navigation for vehicles, ships, and aircraft.
- **Autonomous Vehicles:** Self-driving cars and drones rely on advanced computing systems for navigation, control, and decision-making.

Let's Sum Up

Computers are utilized in a numerous of applications, including business operations, scientific research, education, healthcare, entertainment, and communication, driving efficiency and innovation across these fields. They enable tasks such as data analysis, digital communication, online learning, and multimedia creation, transforming how we work, learn, and interact daily.

1.9 CAPABILITIES AND LIMITATIONS OF COMPUTER

1.9.1 Capabilities of Computer

Based on the characteristics, the common capabilities of computer are:

1. Can solve complex calculations quickly which takes a long time to solve manually.
2. Capable of handling and processing large calculations at a single time.
3. All Electronic Items have some form of computing functions.
4. It works faster than a man.

Computer and man are capable in giving data and information in the form of communication.

1.9.2 Limitations of Computer

Programmed by Human: Though computer is programmed to work efficiently, fast and accurately but it is programmed by human beings to do so. Without a program, computer cannot perform any task. A program is a set of instructions. Computer only follows these instructions. If the instructions are not accurate, the working of computer will not accurate.

Thinking: The computer cannot think itself. The concept of artificial intelligence shows that the computer can think. But still this concept is dependent on set of instructions provided by the human beings.

Self-care: Computer cannot care itself like a human. A computer is dependent still to human beings and it's environment for this purpose.

Retrieval of memory: Computer can retrieve data very fast but this technique is linear. A human being's mind does not follow this rule.

Feelings: One of the main limits in the computer is of feeling. A computer cannot feel about some like a human. A computer cannot meet human in respect of relations.

1.10 Unit Summary

- Computers are programmable electronic devices that process data to produce results.
- A computer is a machine that executes instructions to process data accurately and quickly.
- Key characteristics include speed, accuracy, automation, storage, versatility, and connectivity.
- A computer comprises input devices, a central processing unit (CPU), memory, storage devices, output devices, system bus, motherboard, and peripheral devices, interconnected to facilitate data processing and communication.
- Computers are classified into generations based on their underlying technology, from vacuum tubes to integrated circuits.
- They are categorized based on size, purpose, and processing power into mainframe computers, minicomputers, microcomputers (personal computers), and supercomputers.

1.11 Glossary

- ICs - Integrated Circuits
- RAM - Random Access Memory
- PC - Personal Computer
- AI - Artificial Intelligence
- IoT - Internet of Things
- CPU - Central Processing Unit
- ALU - Arithmetic Logic Unit
- HDD - Hard Disk Drives
- SSD - Solid State Drives
- IC - Integrated Circuits
- VLSI - Very Large Scale Integrated
- ULSI - Ultra Large Scale Integration
- VR - Virtual Reality
- AR - Augmented Reality

1.12 Check your Progress

1. What is the primary function of a CPU?

   a) Input data into the computer b) Store data for future use

   c) Perform arithmetic and logic operations d) Display output to the user

2. Which component of a computer is responsible for storing data permanently?

   a) CPU b) RAM c) Hard disk d) Optical drive

3. What does RAM stand for?

   a) Random Access Memory b) Read-Only Memory

   c) Rapid Access Memory d) Random Allocation Memory

4. Which of the following is NOT a type of computer software?

   a) Operating system b) Web browser

   c) Keyboard d) Word processor

5. Which type of computer memory is non-volatile and retains its data even when the power is turned off?

   a) RAM b) ROM c) Cache memory d) Virtual memory

6. What does the acronym CPU stand for?

   a) Central Processing Unit b) Computer Processing Unit

   c) Control Processing Unit d) Central Program Unit

7. Which generation of computers used vacuum tubes for processing?

   a) First generation b) Second generation

   c) Third generation d) Fourth generation

8. Which generation of computers utilized transistors instead of vacuum tubes, leading to smaller and more reliable systems?

a) First generation b) Second generation

c) Third generation d) Fourth generation

9. The period of which decade marks the approximate timeframe for the first generation of computers?

a.) 1940s b) 1950s c) 1960s d) 1970s

10. What innovation allowed the second generation of computers to be smaller, faster, and more reliable than their predecessors?

a) Vacuum tubes b) Transistors c) Integrated circuits d) Microprocessors

1.13 Self-Assessment Questions

Short Answers: (5 Marks)

1. Define a computer and explain its main characteristics.
2. What are the main capabilities and limitations of a computer system?
3. Outline the key applications of computers in various fields.
4. Explain the classification of computers based on performance.
5. Explain the difference between Shared memory multiprocessor and Distributed memory multicomputer.

Long Answers: (10 Marks)

1. Discuss the evolution of computers, highlighting the key developments in each generation.
2. Explain in detail the block diagram of a computer, including the role of each component.
3. Classify computers based on their purpose and provide examples for each category.
4. Examine the various characteristics of computers that distinguish them from other electronic devices.

1.14 Activity: "Computer Evolution Timeline Project"

Objective: To help students understand the historical development and classification of computers.

Instructions:

1. **Form Groups:** Divide the class into small groups (3-4 students per group).
2. **Research Task:** Each group will be assigned a specific topic from the unit (e.g., Evolution of Computers, Generations of Computers, Applications, etc.).
3. **Timeline Creation:** Using poster boards or digital tools, each group will create a visual timeline or infographic that includes:
    a. **Key Events/Definitions:** Major milestones in computer evolution, definitions of computer generations, classifications, or applications.
    b. **Illustrations/Images:** Include pictures or diagrams such as the block diagram of a computer or images of early computer models.
4. **Presentation:** Groups will present their timelines to the class, explaining the characteristics, capabilities, and limitations of the computers from their assigned period or classification.
5. **Discussion:** After the presentations, have a class discussion on how the characteristics and applications of computers have evolved over time, and how these changes have impacted society.

Outcome: This activity will reinforce students' understanding of the evolution, classification, and capabilities of computers, while also enhancing their research and presentation skills.

1.15 Answers for check your progress

1. c) Perform arithmetic and logic operations
2. c) Hard disk
3. a) Random Access Memory
4. c) Keyboard
5. b) ROM
6. a) Central Processing Unit
7. a) First generation
8. c) Third generation
9. a) 1940s
10. b) Transistors

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UNIT - I COMPLETED

UNIT – II

BASIC COMPUTER ORGANIZATION

UNIT 1 - BASIC COMPUTER ORGANIZATION

Role of I/O devices in a computer system. Input Units: Keyboard, Terminals and its types. Pointing Devices, Scanners and its types, Voice Recognition Systems, Vision Input System, Touch Screen, Output Units: Monitors and its types. Printers: Impact Printers and its types. Non-Impact Printers and its types, Plotters, types of plotters, Sound cards, Speakers.

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UNIT OBJECTIVES

- This unit aims to provide a comprehensive understanding of the various input and output (I/O) devices integral to a computer system.
- Learners will explore different input units, and output units
- Learners will have a thorough knowledge of the functionalities and types of these devices, enabling them to appreciate their roles in enhancing computer system interactions and performance.

2.1 ROLE OF I/O DEVICES IN A COMPUTER SYSTEM

I/O (Input/Output) devices play a crucial role in a computer system, acting as the interface between the user and the computer's internal processes. They facilitate the interaction by allowing data to be input into the system and output from it. Key Functions of I/O Devices.

Input Devices: These devices allow users to input data and commands into the computer. Common examples include keyboards, mice, scanners, and microphones. They translate user actions into signals that the computer can process.

Output Devices: These devices present data from the computer to the user in a human-readable form. Examples include monitors, printers, speakers, and projectors. They convert digital information into visual, printed, or auditory output.

Storage Devices: These serve as both input and output devices, as they store data that can be read (input) and written (output). Examples include hard drives, SSDs, USB flash drives, and CDs/DVDs.

Communication Devices: These devices enable data exchange between computers and other devices over networks. Examples include network interface cards (NICs), modems, and routers.


Keyboard


Mouse


Joy Stick


Mic


Barcode Reader


Stylus/Pen


Web Camera


Touch pad


Touch Screen


Finger Print reader

2.2 INPUT UNITS: KEYBOARD

Keyboard is the most common and very popular input device which helps to input data to the computer. The layout of the keyboard is like that of traditional typewriter, although there are some additional keys provided for performing additional functions.

Keyboard

Keyboards are of two sizes 84 keys or 101/102 keys, but now keyboards with 104 keys or 108 keys are also available for Windows and Internet.

Key Types	Description
Typing Keys	These keys include the letter keys (A-Z) and digit keys (09) which generally give the same layout as that of typewriters.
Numeric Keypad	It is used to enter the numeric data or cursor movement. Generally, it consists of a set of 17 keys that are laid out in the same configuration used by most adding machines and calculators.
Function Keys	The twelve function keys are present on the keyboard which are arranged in a row at the top of the keyboard. Each function key has a unique meaning and is used for some specific purpose.
Control keys	These keys provide cursor and screen control. It includes four directional arrow keys. Control keys also include Home, End, Insert, Delete, Page Up, Page Down, Control(Ctrl), Alternate(Alt), Escape(Esc).
Special Purpose Keys	Keyboard also contains some special purpose keys such as Enter, Shift, Caps Lock, Num Lock, Space bar, Tab, and Print Screen.

2.3 TERMINALS AND ITS TYPES

The terminal is the device you use to interact with your computer system. It is composed of a display (or monitor), a keyboard, and sometimes a mouse. There are several types of terminals: dumb terminals, smart terminals, and graphics terminals. The following illustration shows a typical terminal setup.

Dumb Terminal

A dumb terminal (or nonprogrammable terminal) cannot do any processing on its own. This means the terminal itself cannot run programs but has another computer do its processing while it displays the results. This type of terminal is common in multiuser or networked systems.

Smart Terminal

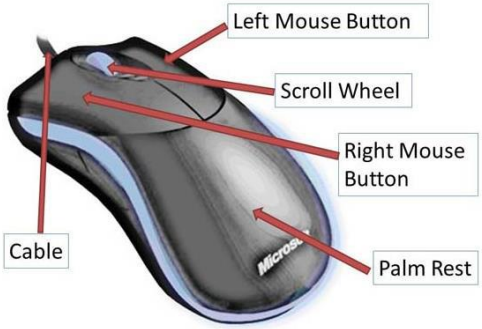
A smart terminal (or programmable terminal) does some processing on its own and sometimes has a device (a disk drive, for example) for reading and writing files. This type of terminal is also common in multiuser or networked systems.

Graphics Terminal

A graphics terminal is a smart terminal with special hardware that allows it to display pictures. If you work in a windows interface, you need a special type of graphics terminal known as an X terminal.

2.4 POINTING DEVICES

Mouse is the most popular pointing device. It is a very famous cursor-control device having a small palm size box with a round ball at its base, which senses the movement of the mouse and sends corresponding signals to the CPU when the mouse buttons are pressed.



Mouse and its Parts

Generally, it has two buttons called the left and the right button and a wheel is present between the buttons. A mouse can be used to control the position of the cursor on the screen, but it cannot be used to enter text into the computer. Most mice are now optical which means they use a laser to detect and track movement across the surface. Mice can be wired or wireless.

Mouse operations

- Click: pressing and releasing a button.
- (left) Single-click: clicking the main button.
- (left) Double-click: clicking the button two times in quick succession counts as a different gesture than two separate single clicks.
- (left) Triple-click: clicking the button three times in quick succession counts as a different gesture than three separate single clicks. Triple clicks are far less common in traditional navigation.
- Right-click: clicking the secondary button, or clicking with two fingers. (This brings a menu with different options depending on the software)
- Middle-click: clicking the tertiary button.
- Drag and drop: pressing and holding a button, then moving the mouse without releasing.

2.5 SCANNERS AND ITS TYPES

A scanner is an input device that scans documents such as photographs and pages of text. When a document is scanned, it is converted into a digital format. This creates an electronic version of the document that can be viewed and edited on a computer.

Most scanners are flatbed devices, which mean they have a flat scanning surface. This is ideal for photographs, magazines, and various documents. Most flatbed scanners have a cover that lifts up so that books and other bulky objects can also be scanned. Another type of scanner is a sheet-fed scanner, which can only accept paper documents. While sheet-fed scanners cannot scan books, some models include an automatic document feeder, or ADF, which allows multiple pages to be scanned in sequence.

Types of Computer Scanners

- Sheet fed scanner - scans paper by feeding it into the scanner
- Handheld scanner - scans text and images by dragging the device over the page you want to scan
- Card scanner - designed to scan business cards

Prominent features of a scanner include:

Reliability - Unlike certain forms of data transmission, scanning involves only transfer of hard images to digital forms. The role of the end-user is limited in case of scanning. And as they are not dependent on two-way communication, they can also help in storing important information or transmitting important information.

Efficiency - Modern scanners are built for efficiency and speed. And it comes with ease of use as well as convenience.

Quality - Scanning ensures the best resolution possible for digital images. Compared to fax machines, which may find it difficult to reproduce the accurate details, scanners can reproduce images with high resolution and precisions. They are quite useful for photography and engineering arenas.

Cost saving-One of the biggest advantage of scanning is the replacement of physical files/forms with digital ones. Along with saving physical space, which has to be used for storage, there are also environmental benefits by using scanner.

2.6 VOICE RECOGNITION SYSTEMS

Voice recognition is a computer software program or hardware device with the ability to decode the human voice. Voice recognition is commonly used to operate a device, perform commands, or write without having to use a keyboard, mouse, or press any buttons.

2.7 VISION INPUT SYSTEM

A vision input system is a type of input device that uses cameras and image processing technologies to interpret visual information from the real world. These systems enable computers to understand and react to visual inputs, making them integral in various fields such as automation, robotics, and human-computer interaction. Here are some key components and applications of vision input systems:

Key Components of Vision Input Systems

Standard Camera: Captures images or videos in the visible spectrum.

Infrared Camera: Captures images using infrared light, useful in low-light or thermal imaging applications.

Depth Camera: Captures depth information, allowing the system to understand the distance of objects from the camera.

Image Sensor: Converts light into electrical signals that can be processed by the computer. Common types include CCD (Charge-Coupled Device) and CMOS (Complementary Metal-Oxide-Semiconductor) sensors.

Processor: Handles the computation and analysis of the captured images. This can be done using dedicated image processing chips or general-purpose processors.

Examples of Vision Input Systems

Google Lens: Uses image recognition to provide information about objects, translate text, and more.

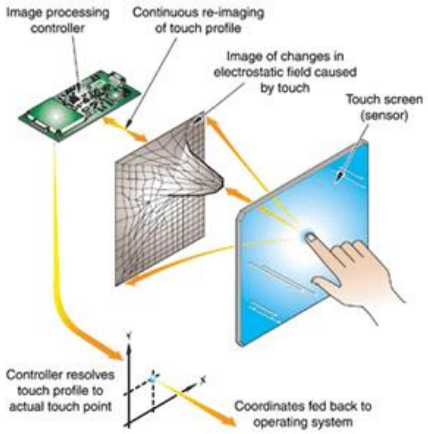
Apple Face ID: Uses depth-sensing cameras and machine learning for secure facial recognition on iPhones.

Tesla Autopilot: Uses cameras and image processing to navigate and drive autonomously.

2.8 TOUCH SCREEN

A touchscreen is a display device that allows the user to interact with a computer by using their finger. They can be quite useful as an alternative to a mouse or keyboard for navigating a graphical user interface (GUI). Touchscreens are used on a variety of devices

such as computer and laptop monitors, smartphones, tablets, cash registers, and information kiosks. Some touchscreens use a grid of infrared beams to sense the presence of a finger instead of utilizing touch-sensitive input.



- A Touchscreen is an input device and normally layered on the top of an electronic visual display of an information processing system.
- A user can give input or control the information processing system through simple or multi-touch gestures by touching the screen with a special stylus or one or more fingers.
- Some touch screens use ordinary or specially coated gloves to work while others may only work using a special stylus or pen.
- The touchscreen enables the user to interact directly with what is displayed, rather than using a mouse, touchpad, or other such devices
- Touchscreens are common in devices such as game consoles, personal computers, electronic voting machines, and point-of-sale (POS) systems.

Touchscreens have the same common functions:

Tap - A single touch or tap on the screen with a finger opens an app or select an object.

Double-tap - A double-tap can have different functions depending on where it is utilized.

Touch and hold - Pressing and holding your finger to a touchscreen selects or highlights an object.

Drag - If you press and hold your finger on an object (such as an app shortcut) on the screen, you can move your finger to "pull" the object to a different location.

Swipe - Swiping your finger across the screen can be used to scroll in a certain direction or change pages.

Pinch - Placing two fingers on the screen in different spots and then pinching them together zooms out.

Let's Sum Up

Input devices are essential components of a computer system, facilitating interaction and data entry. Common input devices include keyboards, mice, scanners, and microphones, each serving specific functions. Keyboards and mice allow users to input commands and navigate interfaces, while scanners and microphones enable the digitization of physical documents and audio input, respectively. These devices form the bridge between human users and the digital world, enabling efficient data entry and manipulation in various computing environments.

2.9 OUTPUT UNITS

An output device is any device used to send data from a computer to another device or user. Most computer data output that is meant for humans is in the form of audio or video. Thus, most output devices used by humans are in these categories. Examples include monitors, projectors, speakers, headphones and printers. The following list contains many different output devices.

Let's Sum Up

Output devices are essential components of a computer system that display or provide data processed by the computer. Common output devices include monitors, printers, speakers, and projectors, each serving specific purposes in conveying information to users. Monitors display visual output, while printers produce hard copies of documents. Speakers generate audio output, and projectors display visuals on larger screens for presentations. Together, these devices facilitate communication and interaction between users and computers, playing crucial roles in both personal and professional computing environments.

2.10 MONITORS AND ITS TYPES

Monitor is the most commonly used output device used to display results of processing. Pictures on monitor are formed with picture elements called PIXEL.

2.10.1 Classification of Monitors

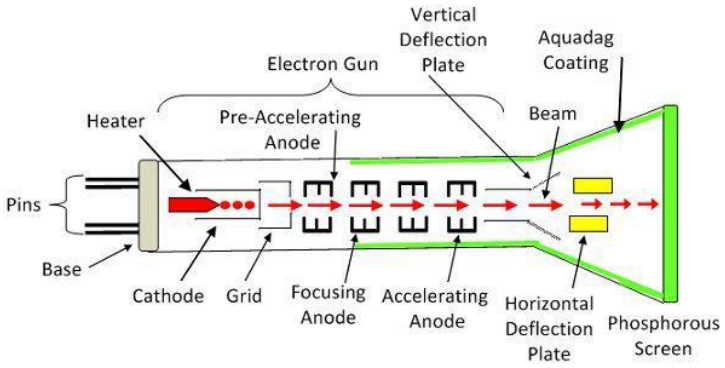
CRT Monitor: CRT is Cathode Ray Tube is a big size and takes up a lot of desk space. It uses cathode ray tube to display video and graphics on the screen.

LCD Monitor: LCD is Liquid Crystal Display uses a special type of liquid crystal to display video and graphics on the screen. It consumes very less power than CRT monitor. It is very lighter and more portable than the CRT monitor.

LED Monitor: LED is Light Emitting Diodes. LED is the advance application of LCD. The LED monitor consumes lesser power.

Digital Monitor: A digital display that uses liquid crystal cells that change reflectivity in an applied electric field; used for portable computer displays and watches etc. active matrix screen. a type of LCD screen used for some portable computers; there is a separate circuit for each pixel.

Analog Monitor: An analog monitor is a monitor capable of accepting continuously varying or analog signals from the video adapter for an infinite range of different colors. The majority of all CRT monitors are analog monitors and all flat-panel displays are digital.



Cathode Ray Tube

Circuit Globe

2.10.2 Characteristics of Monitor

Size	The most important aspect of a monitor is its size. Screen sizes are measured in diagonal inches, the distance from one corner to another opposite corner diagonally.
Resolution	The resolution of a monitor indicates how density the pixels are packed. Pixel is short short for picture element.
Band Width	The amount of data that can be transmitted in a fixed amount of time. For digital devices, the band width is usually expressed in bits or bytes per second (bps). For analog devices it is expressed in cycle per second or Hertz (Hz).
Refresh Rate	Display monitors must be refresh many times per second. The refresh rate determines how many times per seconds the screen is to be red drawn. The refresh rate of a monitor is measured in Hertz. The faster the refresheris, the less the monitor flickers.
Interlacing	It is a technique in which instead of scanning the image one line at a time, it scans alternately i.e. alternate lines are scanned at each pass.
Dot per Inch	It is measured for the actual sharpness of the on screen image. This depends on both the resolution & the size of the image. Practical experience shows that a smaller screen has a sharper image at the same resolution than does a large screen.
Dot Pitch	A measurement that indicates the vertical distance between each pixel on a display screen. It is measured in millimetre.
Storage	The Computer has an in-built memory where it can store a large amount of data.

Let's Sum Up

Monitors are essential output devices that display visual information generated by computers. They come in various types, including CRT (Cathode Ray Tube), which was common until LCD (Liquid Crystal Display) and LED (Light Emitting Diode) monitors replaced them due to their thinner profiles, higher resolutions, and energy efficiency. These advancements have led to sharper images, better color reproduction, and reduced power consumption in modern computing setups.

2.11 PRINTERS

Printers are used to produce hard copy output. They print processing results on paper. Printers are divided into two main categories: Impact Printers & Non-Impact printers.

2.11.1 Impact Printers and its types

Impact printers print the characters by striking them on the ribbon, which is then pressed on the paper. These printers are of two types like, Dot Matrix Printer and Daisy Wheel Printer.

2.11.1.1 Dot Matrix printer

A dot matrix printer is an impact printer that creates characters and images by striking a print head, which contains a grid of small pins, against an ink ribbon to transfer ink onto paper. This process forms patterns of dots that collectively represent text and graphics. Known for their robustness and ability to print on multi-part forms and carbon copies, dot matrix printers are often used in environments where continuous, reliable printing is required, such as in warehouses, retail settings, and logistics.

2.11.1.2 Daisy wheel printers

Daisy wheel printers are impact printers that produce high-quality text by striking a wheel-shaped print head, known as a daisy wheel, against an ink ribbon to print characters on paper. Each "petal" of the daisy wheel contains a single character, and the wheel spins to position the correct character before it strikes. Commonly used in the 1970s and 1980s,

these printers were known for their precision and ability to produce crisp, typewriter-like text, making them popular for professional and office use.

Characteristics of Impact Printers are the following –

- Very low consumable costs
- Very noisy
- Useful for bulk printing due to low cost
- There is physical contact with the paper to produce an image

These printers print with striking of hammers or pins on ribbon.

2.11.2 Non-impact Printers and its Types

Non-impact printers print the characters without using the ribbon. These printers print a complete page at a time, thus they are also called as Page Printers. These printers do not use striking mechanism for printing. They use electrostatic and laser technology. Quality and speed of these printers is better than Impact printers. These printers are of two types namely Laser printer and Inkjet Printer.

2.11.2.1 Laser Printers

Laser printers are a ubiquitous technology in modern offices and homes, offering fast and high-quality printing solutions. Utilizing a laser beam to create an electrostatic image on a rotating drum, they employ toner, a fine powder, to transfer the image onto paper through a process of electrostatically charged rollers. The paper is then fused with heat to produce crisp, smudge-resistant prints. Laser printers excel in handling large volumes of text documents and graphics with sharp detail and consistent output. Their efficiency, speed, and relatively low cost per page make them ideal for businesses and individuals seeking reliable printing solutions.

2.11.2.2 Inkjet Printers

Inkjet printers represent a ubiquitous technology in modern printing, employing microscopic droplets of ink to produce high-quality prints. These printers work by propelling tiny droplets of ink onto paper, creating text, images, or graphics with precision and vibrancy. They are favored for their versatility, capable of producing everything from documents to photographs with impressive detail and color accuracy. Inkjet printers find extensive use in homes, offices, and commercial settings due to their affordability, ease of use, and ability to produce both black-and-white and color outputs.

Characteristics of Non-impact Printers

- Faster than impact printers
- They are not noisy
- High quality
- Supports many fonts and different character size

2.12 PLOTTER

A plotter is a computer hardware device used for printing vector graphics. Unlike traditional printers, which use dots to create images, plotters draw continuous lines to form high-resolution, large-format graphics such as architectural blueprints, engineering designs, and other CAD (Computer-Aided Design) applications. Plotters can handle large paper sizes and provide precision and detail that standard printers cannot match.

2.12.1 Types of Plotters

1. Drum Plotter: The drum plotter consists of a drum or cylinder that rotates to move the paper while one or more pens move linearly across the paper to draw images. The paper is wrapped around the drum.
2. Flatbed Plotter: In a flatbed plotter, the paper remains stationary on a flat surface while the pen(s) move in both the X and Y directions to draw images. This type of plotter typically supports larger paper sizes and thicker media.
3. Electrostatic Plotter: Electrostatic plotters use a process similar to photocopying. They generate images on specially coated paper using electrostatic charges.
4. Inkjet Plotter: Inkjet plotters use inkjet technology to spray tiny droplets of ink onto the paper to form images. They are versatile and can produce a wide range of colors and fine details.
5. Cutting Plotter: A cutting plotter is similar to other plotters but instead of drawing with a pen, it uses a sharp blade to cut out shapes from materials such as vinyl, paper, or cardstock.

Let's Sum Up

Printers are essential peripherals that produce hard copies of digital documents and images. Common types include inkjet printers, which are versatile and suitable for everyday use, and laser printers, known for their speed and high-quality output, particularly for text documents in office environments. Other specialized types include photo printers for high-resolution image printing and 3D printers, which create physical objects from digital models using additive manufacturing techniques. Each type serves distinct purposes, catering to various needs from personal to industrial applications.

2.13 SOUND CARD

A sound card, also known as an audio card, is an internal expansion card that provides input and output of audio signals to and from a computer under the control of computer programs. It enhances the audio quality and capabilities of a computer system, making it possible to enjoy high-quality sound in games, music, movies, and other audio applications.

2.14 SPEAKERS

Speakers are output devices that convert electrical signals into audible sound, allowing us to hear music, dialogue, sound effects, and other audio content from computers, smartphones, TVs, and audio systems. They are essential for audio playback in various applications, from entertainment to communication.

2.15 Unit Summary

- Input and output (I/O) devices facilitate communication between users and computers, enabling data entry and presentation of results.
- These include keyboards, terminals, pointing devices, scanners, voice recognition systems, vision input systems, and touch screens, allowing users to input data through various means.
- Monitors display visual output, while printers, including impact and non-impact printers, produce physical copies of data. Plotters create large-scale graphical outputs.
- Sound cards enable computers to process and output sound, while speakers produce audio output, enhancing multimedia experiences.
- Understanding the diverse range of input and output devices is crucial for efficient data entry, processing, and output presentation in computer systems.

2.16 Glossary

- CCD - Charge-Coupled Device
- CMOS - Complementary Metal-Oxide-Semiconductor
- GUI - Graphical User Interface
- POS - Point-of-sale
- CRT - Cathode Ray Tube
- LCD - Liquid Crystal Display
- LED - Light Emitting Diodes
- CAD - Computer Aided Design

2.17 Check your Progress

1. Which input device is used to capture images or documents into digital format?

a) Mouse b) Keyboard c) Scanner d) Joystick

2. What is the primary function of a keyboard?

a) Displaying output b) Entering data

c) Pointing and clicking d) Listening to audio

3. Which input device is used to provide navigation and selection on a graphical user interface (GUI)?

a) Mouse b) Keyboard c) Joystick d) Scanner

4. What is the purpose of a stylus as an input device?

a) Entering text b) Selecting options

c) Drawing or writing on a touch screen d) Scanning documents

5. Which input device is used to detect and convert physical touch or gestures into digital signals?

a) Mouse b) Keyboard c) Touchscreen d) Trackball

6. Which of the following is an example of an output device?

a) Keyboard b) Monitor c) Mouse d) Scanner

7. Which output device is used to produce hard copies of documents?

a) Monitor b) Printer c) Projector d) Plotter

8. What output device is commonly used for displaying graphics, text, and video on computers?

a) Printer b) Scanner c) Projector d) Monitor

9. Which output device is used to produce large-scale prints of technical drawings and architectural designs?

a) Printer b) Scanner c) Projector d) Plotter

10 Which of the following is a type of monitor technology that uses liquid crystals to display images?

a) CRT b) LCD c) LED d) Plasma

2.18 Self-Assessment Questions

Short Answers: (5 Marks)

1. Describe any five input devices.
2. Explain how a computer mouse works.
3. Explain various types of scanners.
4. Write a difference between voice recognition and vision input systems.
5. Write a brief note on different types of printers.

Long Answers: (10 Marks)

1. Explain the role of I/O devices in a computer system with relevant examples.
2. Differentiate between impact and non-impact printers, providing two examples of each type.
3. Describe the types of monitors available and discuss the advantages and disadvantages of each type.

4. What are the different types of scanners? Discuss their uses and differences.
5. Write short notes on the following:
   - Graphic card.
   - Sound card
   - Blu-ray
   - Speakers

2.19 Activity: "Create a Peripheral Device Handbook"

Objective:

To help students understand the different types of input and output devices used in computer systems, their functions, and categories.

Instructions:

1. **Group Assignment:** Divide the students into small groups of 3-4 members.
2. **Device Allocation:** Each group will be assigned one category of I/O devices from the following list:
   - **Input Devices:**
     - Group 1: Keyboards and Terminals
     - Group 2: Pointing Devices and Scanners
     - Group 3: Voice Recognition Systems and Vision Input Systems
     - Group 4: Touch Screens
   - **Output Devices:**
     - Group 5: Monitors and Printers
     - Group 6: Plotters, Sound Cards, and Speakers
3. **Research and Documentation:**
   - Each group will research the assigned category, including definitions, types, functions, and practical applications.
   - The groups should create a well-organized document or presentation with diagrams and real-world examples. They can use the internet or textbooks to find information about the latest devices and technologies in their assigned category.

4. **Presentation:**
    - Each group will present their findings to the class in a 5-10 minute session. The presentation should include:
        - An overview of the devices.
        - Types and features.
        - Usage scenarios in different fields (e.g., education, business, gaming).
5. **Handbook Compilation:**
    - After all presentations, compile all the documents/presentations into a single "Peripheral Device Handbook" for the class. This can be shared digitally or printed as a reference guide for students.

Outcome:

Students will gain a deeper understanding of various input and output devices, their functionality, and their relevance in different domains. The activity will also foster teamwork, research skills, and presentation abilities.

2.20 Answer for Check your Progress

1. c) Scanner
2. b) Entering data
3. a) Mouse
4. c) Drawing or writing on a touch screen
5. c) Touchscreen
6. b) Monitor
7. b) Printer
8. d) Monitor
9. d) Plotter
10. b) LCD

2.21 References and Suggested Readings

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UNIT - II COMPLETED

UNIT – III

STORAGE FUNDAMENTALS

UNIT III - STORAGE FUNDAMENTALS
Primary Vs Secondary Storage, Data storage & retrieval methods. Primary Storage: RAM ROM, PROM, EPROM, EEPROM. Secondary Storage: Magnetic Tapes, Magnetic Disks. Cartridge tape, hard disks, Floppy disks Optical Disks, Compact Disks, Zip Drive, Flash Drives

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UNIT OBJECTIVES

- This unit aims to provide a comprehensive understanding of the fundamental concepts of data storage, focusing on the distinctions between primary and secondary storage.
- Learners will explore various types of primary storage, including RAM, ROM, PROM, EPROM, and EEPROM, as well as secondary storage options such as magnetic tapes, magnetic disks, optical disks, and flash drives.
- This unit also covers the methods of data storage and retrieval, highlighting the characteristics and uses of different storage media.

3.1 PRIMARY VS. SECONDARY STORAGE

3.1.1 Primary Storage

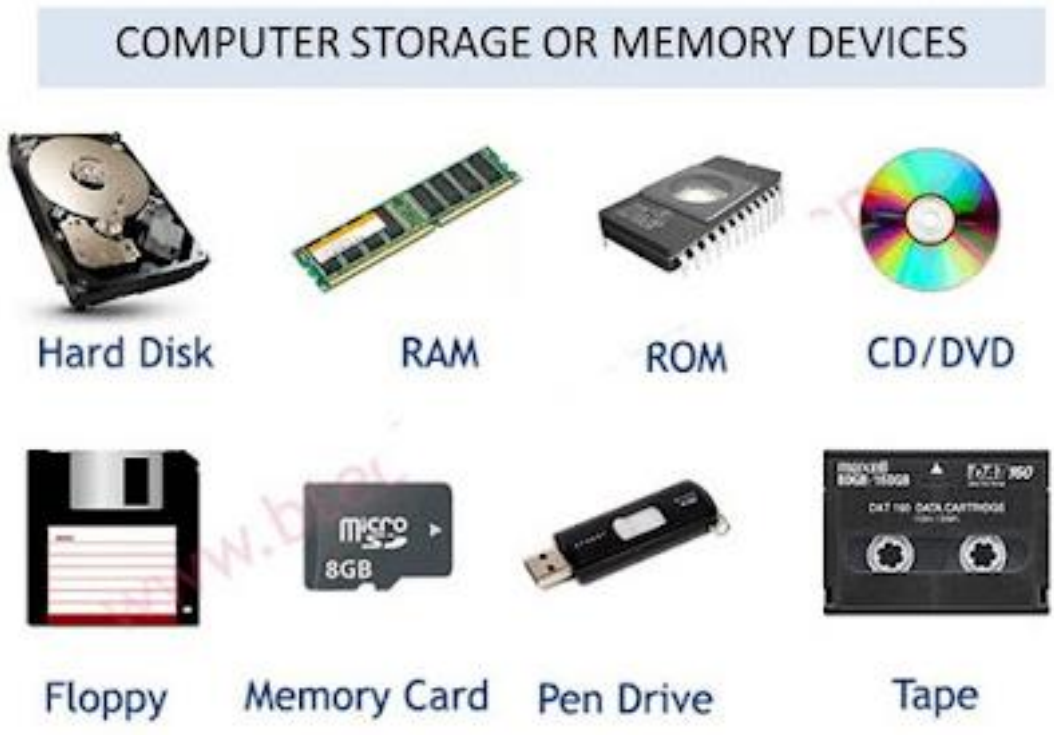
Definition: Primary storage, also known as main memory, is the computer's immediate storage area used to hold data that is actively being processed. It includes:

RAM (Random Access Memory):

- **Description:** Volatile memory that temporarily stores data and instructions the CPU needs while performing tasks.
- **Uses:** Holds data that is being used or processed by applications and the operating system.
- **Speed:** Extremely fast, allowing for quick read and write access.

Cache Memory:

- **Description:** A smaller, faster type of volatile memory located inside the CPU or close to it, used to speed up the processing by storing frequently accessed data and instructions.
- **Uses:** Improves processing speed by providing quick access to commonly used data.
- **Speed:** Faster than RAM, but limited in size.



3.1.2 Secondary Storage

Definition: Secondary storage, also known as external or auxiliary storage, is used to store data permanently. It includes:

Hard Disk Drives (HDDs):

- Description: Magnetic storage devices that use spinning disks to read/write data.
- Uses: General-purpose storage for operating systems, applications, and user data.
- Speed: Slower than RAM, but provides larger storage capacity.

Solid State Drives (SSDs):

- Description: Flash-based storage devices with no moving parts, providing faster data access than HDDs.
- Uses: Used for storing the operating system, applications, and frequently accessed data.
- Speed: Faster than HDDs, slower than RAM.

Optical Discs:

- Description: Includes CDs, DVDs, and Blu-ray discs, which use lasers to read/write data.
- Uses: Used for media distribution, backups, and data transfer.
- Speed: Generally slower than HDDs and SSDs.

External Storage:

- Description: Includes USB drives, external hard drives, and network-attached storage (NAS).
- Uses: Used for backups, data transfer, and additional storage capacity.
- Speed: Varies based on connection type and device (e.g., USB 3.0 is faster than USB 2.0).

Comparison Summary

Feature	Primary Storage	Secondary Storage
Volatility	Volatile (data lost when power off)	Non-volatile (data retained when power off)
Speed	Very fast	Slower
Capacity	Limited (GB range)	Large (TB or PB range)
Examples	RAM, Cache	HDDs, SSDs, Optical Discs, External Drives
Use Cases	Active processes, running applications	Long-term data storage, backups, data transfer

Let's Sum Up

Primary storage, also known as main memory, includes RAM (Random Access Memory) which temporarily holds data and instructions that the CPU (Central Processing Unit) needs to access quickly. Secondary storage, such as hard drives and SSDs (Solid State Drives), provides long-term storage for data and programs even when the computer is turned off, offering larger capacities but slower access speeds compared to primary storage. Together, these storage types form the backbone of a computer's ability to store and retrieve information efficiently for both immediate and long-term use.

3.2 DATA STORAGE & RETRIEVAL METHODS

3.2.1 Data Storage Methods

Data storage and retrieval are fundamental aspects of computing, enabling the preservation and access of information in various formats. The choice of storage and retrieval method impacts the performance, efficiency, and scalability of data management systems.

Data Storage Methods

- **Primary Storage (Volatile):**
  - Description: Temporary storage that is directly accessible by the CPU. It includes RAM (Random Access Memory) and cache memory.
  - Characteristics: Fast access speed, used for active processes and data, loses data when power is turned off.
- **Secondary Storage (Non-volatile):**
  - Description: Long-term storage that retains data even when the computer is turned off. It includes hard drives (HDD), solid-state drives (SSD), and optical discs.
  - Characteristics: Slower access speed compared to primary storage, used for persistent data storage.
- **Tertiary Storage:**
  - Description: Storage that involves removable media such as tapes, CDs, DVDs, and Blu-ray discs, often used for archival purposes.
  - Characteristics: Typically slower access speed, used for long-term storage and archiving.
- **Cloud Storage:**
  - Description: Online storage services provided by third-party providers, allowing data to be stored and accessed over the internet.
  - Characteristics: Accessible from anywhere with an internet connection, scalable, managed by service providers.
- **Network Attached Storage (NAS):**
  - Description: A dedicated file storage device connected to a network, allowing multiple users and devices to access and share data.

- Characteristics: Provides centralized storage, accessible over a local network, supports multiple users.

3.2.2 Data Retrieval Methods

- **Sequential Access:**
  - Description: Data is accessed in a specific linear order. Common in tape storage where the read/write head moves sequentially through the data.
  - Characteristics: Slower access for large datasets, simple to implement.
- **Direct Access:**
  - Description: Data can be accessed directly at any point without going through other data first. Common in hard drives and SSDs.
  - Characteristics: Faster access compared to sequential access, allows quick retrieval of specific data.
- **Indexed Access:**
  - Description: Uses an index to keep track of where data is stored, allowing quick lookup and retrieval.
  - Characteristics: Efficient for large datasets, improves retrieval speed, requires additional storage for indexes.
- **Random Access:**
  - Description: Data can be read or written in any order, typically used in RAM.
  - Characteristics: Very fast access times, used for temporary and frequently accessed data.

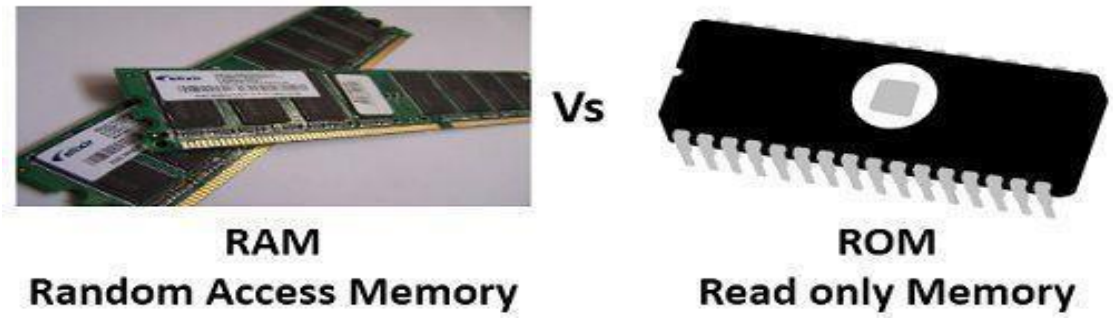
Let's Sum Up

Data storage and retrieval methods have evolved from magnetic tapes and disks to modern solid-state drives (SSDs) and cloud storage, providing faster access and greater reliability. Advances in technology have also enabled sophisticated data retrieval techniques, such as database management systems and search algorithms, ensuring efficient and accurate access to stored information.

3.3 Primary Storage

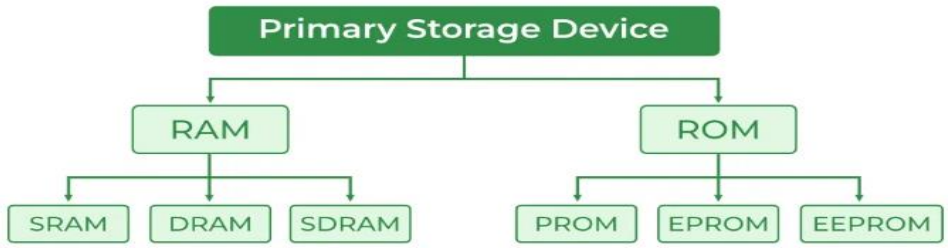
3.3.1 RAM (Random Access Memory)

- The primary storage is referred to as Random Access Memory (RAM) because it is possible to randomly select and use any location of the memory directly to store and retrieve data.
- It takes same time to any address of the memory as the first address It is also called read/write memory.
- The storage of data and instructions inside the primary storage is temporary. It disappearsfrom RAM as soon as the power to the computer is switched off.
- The memories, which lose their content on failure of power supply, are known as volatile memories. So now we can say that RAM is volatile memory.



A RAM constitutes the internal memory of the CPU for storing data, program and program result. It is read/write memory. It is called random access memory (RAM). Since access time in RAM is independent of the address to the word that is, each storage location inside the memory is as easy to reach as other location & takes the same amount of time. It canreach into the memory at random & extremely fast but can also be quite expensive.

RAM is volatile, i.e. data stored in it is lost when we switch off the computer or if thereis a power failure. Hence a backup uninterruptible power system (UPS) is often used with computers. RAM is small both in terms of its physical size and in the amount of data it can hold.



Static RAM (SRAM)

The word static indicates that the memory retains its contents as long as power remains applied. However, data is lost when the power gets down due to volatile nature. SRAM chips use a matrix of 6-transistors and no capacitors. Static RAM is used as cache memory needs to be veryfast and small.

Dynamic RAM (DRAM)

DRAM, unlike SRAM, must be continually refreshed in order for it to maintain the data. This is done by placing the memory on a refresh circuit that rewrites the data several hundred times per second. DRAM is used for most system memory because it is cheap and small. All DRAMs are made up of memory cells.

3.3.2 ROM (Read Only Memory)

There is another memory in computer, which is called Read Only Memory (ROM). Again it is the ICs inside the PC that form the ROM. The storage of program and data in the ROM is permanent. The ROM stores some standard processing programs supplied by the manufacturers to operate the personal computer. The ROM can only be read by the CPU but it cannot be changed. The basic input/output program is stored in the ROM that examines and initializes various equipment attached to the PC when the switch is turned ON. The memories, which do not loose their content on failure of power supply, are known as non-volatile memories. ROM is non-volatile memory. ROM stands for Read-Only Memory. It is a non-volatile memory that is used to stores important information which is used to operate the system.

3.3.3 PROM (Programmable read-only memory)

PROM is a form of digital memory. In this type of ROM, each bit is locked by a fuse or anti-fuse. The data stored in it are permanently stored and cannot be changed or

erasable. Itis used in low-level programs such as firmware or microcode.

There is another type of primary memory in computer, which is called Programmable Read Only Memory (PROM). You know that it is not possible to modify or erase programs stored in ROM, but it is possible for you to store your program in PROM chip.Once the programs are written it cannot be changed and remain intact even if power isswitched off. Therefore, programs or instructions written in PROM or ROM cannot be erasedor changed.

3.3.4 EPROM (Erasable programmable read-only memory)

EPROM also called EROM, is a type of PROM but it can be reprogrammed. The data stored in EPROM can be erased and reprogrammed again by ultraviolet light. Reprogrammed of it is limited. Before the era of EEPROM and flash memory, EPROM was used in microcontrollers.

EPROM chip can be programmed time and again by erasing the information stored earlier in it. Information stored in EPROM can be erased by exposing it to ultraviolet light. This memory can be reprogrammed using a special programming facility. When the EPROM is in use, information can only be read.

3.3.5 EEPROM (Electrically erasable programmable read-only memory)

EEPROM (also E2PROM) stands for Electrically Erasable Programmable Read-Only Memory and is a type of non-volatile memory used in computers, integrated in microcontrollersfor smart cards and remote keyless system, and other electronic devices to store relatively small amounts of data but allowing individual bytes to be erased and reprogrammed.

Let's Sum Up

RAM (Random Access Memory) and ROM (Read-Only Memory) are essential types of primary storage in computers. RAM provides fast, temporary storage for data and program instructions during operation, while ROM retains crucial firmware and instructions that remain intact even when the computer is powered off, ensuring essential functions like booting up and system initialization.

3.4 Secondary Storage

3.4.1 Magnetic Tapes

Magnetic tape is a type of secondary storage medium that uses a thin, magnetically coated ribbon of plastic to store digital data. It is one of the oldest forms of data storage and has been used for decades in various industries for its reliability, durability, and cost-effectiveness. Despite advancements in storage technology, magnetic tapes continue to be used today, particularly for long-term archival and backup purposes.

3.4.2 Magnetic Disk

A magnetic disk is a type of secondary storage device that uses magnetic storage to store and retrieve digital data. It consists of one or more thin circular disks coated with a magnetic material, typically iron oxide. Magnetic disks are a fundamental component of many computer systems and are used for both internal and external storage purposes

3.4.3 Cartridge tape

Cartridge tape, often referred to simply as tape or magnetic tape, is a type of secondary storage medium used for data storage and backup. It consists of a long strip of plastic film coated with a magnetic material, typically iron oxide or metal particles, which can store digital data in the form of magnetic patterns.

3.4.4 Hard Disk

Hard Disk is a storage device (HDD) that stores and retrieves data using magnetic storage. It is a non-volatile storage device that can be modified or deleted n number of times without any problem. Most computers and laptops have HDDs as their secondary storage device. It is actually a set of stacked disks, just like phonograph records. In every hard disk, the data is recorded electromagnetically in concentric circles or we can say track present on the hard disk, and with the help of a head just like a phonograph arm(but fixed in a position) to read the information present on the track. The read-write speed of HDDs is not so fast but decent. It ranges from a few GBs to a few and more TB.

3.4.5 Floppy Disks

Floppy Disk is also known as a floppy diskette. It is generally used on a personal computer to store data externally. A Floppy disk is made up of a plastic cartridge and secured with a protective case. Nowadays floppy disk is replaced by new and effective storage devices like USB, etc.

3.4.6 Optical disks

Optical disks are storage media that use optical technology to read and write data. They consist of a flat, circular disc made of a polycarbonate substrate coated with a reflective layer and protected by a clear plastic cover. Optical discs store data as microscopic pits and lands on the surface of the disc, which are read by a laser beam.

3.4.7 Compact Disks

- **CD:** It is known as Compact Disc. It contains tracks and sectors on its surface to store data. It is made up of polycarbonate plastic and is circular in shape. CD can store data up to 700MB. It is of two types.
  - **CD-R:** It stands for Compact Disc read-only. In this type of CD, once the data is written can not be erased. It is read-only.
  - **CD-RW:** It stands for Compact Disc Read Write. In this type of CD, you can easily write or erase data multiple times.
- **DVD:** It is known as Digital Versatile Disc. DVDs are circular flat optical discs used to store data. It comes in two different sizes one is 4.7GB single-layer discs and another one is 8.5GB double-layer discs. DVDs look like CDs but the storage capacity of DVDs is more than as compared to CDs. It is of two types:
- **Blu-ray Disc:** It is just like CD and DVD but the storage capacity of blu ray is up to 25GB. To run a Blu-ray disc you need a separate Blu-ray reader. This Blu-ray technology is used to read a disc from a blue-violet laser due to which the information is stored in greater density with a longer wavelength.

3.4.8 Zip Drives

Zip drives are removable storage devices introduced by Iomega in the 1990s. They were popular during the 1990s and early 2000s as a higher-capacity alternative to floppy disks. Zip drives initially offered capacities of 100 MB and later increased to 250 MB and 750 MB versions. These capacities were much larger than the 1.44 MB maximum capacity of floppy disks at the time,

making them useful for storing larger files. Zip drives used removable Zip disks, which resembled floppy disks but were thicker and housed in a plastic case. These disks contained magnetic media for data storage. It typically connected to computers via parallel ports, SCSI (Small Computer System Interface), or later versions through USB (Universal Serial Bus). Zip drives were used for backing up files, transferring large data sets between computers, and storing multimedia files such as images and videos. They were commonly used by professionals in graphic design, desktop publishing, and other fields requiring large file storage.

3.4.9 Flash Drives

Flash drives, also known as thumb drives, pen drives, or memory sticks, are portable data storage devices that use flash memory for data storage. They were introduced in the late 1990s and quickly became one of the most popular forms of removable storage. USB flash drives are available in a wide range of capacities, from a few megabytes to multiple terabytes. Common capacities include 4 GB, 8 GB, 16 GB, 32 GB, 64 GB, and 128 GB.

Let's Sum Up

Secondary storage devices like floppy disks, SSDs, hard disks, and magnetic disks play crucial roles in storing and retrieving data in computers. They vary in capacity, speed, and durability, offering diverse options to meet the needs of different computing tasks, from archival storage to high-speed data access in modern computing environments.

3.5 Unit- Summary

- Primary storage, like RAM and ROM, is volatile and directly accessible by the CPU, while secondary storage, such as magnetic disks and optical disks, is non-volatile and used for long-term storage.
- Data can be stored and retrieved using various methods, including sequential access (e.g., tapes), random access (e.g., disks), and optical access (e.g., CDs, DVDs).
- ROM (Read-Only Memory) for storing permanent instructions, PROM (Programmable ROM), EPROM (Erasable PROM), and EEPROM (Electrically EPROM) for programmable and re-writable memory.
- Secondary storage devices include magnetic tapes, magnetic disks, optical disks, and newer technologies like Zip drives and Flash drives.

3.6 Glossary

- RAM - Random Access Memory
- ROM - Read Only Memory
- PROM - Programmable Read-Only Memory
- EPROM - Erasable Programmable Read-Only Memory
- EEPROM - Electrically Erasable Programmable Read-Only Memory
- CD - Compact Disc
- DVD - Digital Versatile Disc

3.7 Check your Progress

1. What is the primary function of primary storage devices in a computer system?

   a) Long-term data storage b) Temporary data storage

   c) Input/output operations d) System power management

2. Which of the following is an example of volatile primary storage device?

   a) HDD b) SSD c) RAM d) ROM

3. Which primary storage device retains data even when the power is turned off?

   a) RAM b) ROM c) Cache memory d) Register

4. Which primary storage device is directly accessible by the CPU for data processing?

   a) Hard disk drive b) Cache memory c) Optical disc d) Magnetic tape

5. Which of the following primary storage devices typically has the largest capacity?

   a) RAM b) Cache memory c) ROM d) HDD

6. Which of the following is a type of secondary storage device?

   a) RAM b) CPU c) Hard Disk Drive (HDD) d) Cache Memory

7. Which secondary storage device is commonly used in digital cameras and smartphones for storing photos and videos?

a) USB Flash Drive b) Optical Disc Drive

c) Solid State Drive d) Memory Card

8. Which of the following is NOT a type of optical disc?

a) CD-ROM b) DVD-RW c) Blu-ray Disc d) SSD

9. Which secondary storage device has the highest storage capacity among the options listed below?

a) USB Flash Drive b) Magnetic Tape

c) Optical Disc Drive d) External Hard Disk Drive

10. Which secondary storage device is commonly used for transferring data between computers and for portable storage?

a) Solid State Drive b) Magnetic Tape

c) USB Flash Drive d) Optical Disc Drive

3.8 Self-Assessment Questions

Short Answers: (5 Marks)

1. Write short note on basic memory organization.
2. Distinguish between RAM and ROM.
3. Write short note on flash memories.
4. What are the advantages and disadvantages of using magnetic tapes for data storage?
5. What is the role of cache memory in computer systems?
6. How virtual memory improves the performance of a computer system?

Long Answers: (10 Marks)

1. Explain in detail about Read Only Memories.
2. Elaborate various secondary storage devices.
3. **Analyze the importance of secondary storage in a computing environment. Discuss the role of hard disks and flash drives in modern computing.**
4. **Describe the structure and operation of magnetic disks, and explain how data is stored, read, and written on these devices.**

3.9 Case Study: Choosing the Right Storage Solution for a Healthcare Data Management System

Background: A healthcare organization needs to upgrade its data management system to handle the increasing volume of patient records, medical imaging, and research data. The system must ensure fast data access for real-time patient care while securely storing vast amounts of historical data and backups.

Objectives:

- To identify the appropriate combination of primary and secondary storage solutions.
- To optimize for speed, reliability, and cost-effectiveness.
- To ensure compliance with data security and privacy regulations.

Scenario: The healthcare organization has the following requirements:

1. **Real-time Data Access:** Medical professionals need rapid access to current patient records and diagnostic data, which include high-resolution images and lab reports.
2. **Secure Long-term Storage:** Historical patient data and research archives must be stored securely for at least ten years due to legal requirements.
3. **Backup and Recovery:** Regular backups are essential to prevent data loss from system failures or cyber-attacks.

Exercise: Based on the scenario, answer the following questions:

1. **Identify the Storage Types Needed:**
   - Which types of primary storage devices would you recommend for real-time data access? Justify your choice considering speed and volatility.
2. **Data Retrieval Methods:**
   - Discuss the data retrieval methods for primary and secondary storage in this system. How would medical professionals access data stored in RAM versus data archived in cloud storage?
3. **Cost-Benefit Analysis:**
   - Consider the costs associated with each storage type. What trade-offs are acceptable between speed, cost, and capacity? Which storage combination provides the best balance for the organization?
4. **Data Security Considerations:**
   - What security measures should be implemented for both primary and secondary storage to protect sensitive patient information?

Expected Outcome: Students will gain an understanding of how to evaluate and choose appropriate storage solutions based on specific organizational needs, taking into account factors such as speed, capacity, cost, and security. This exercise will also highlight the importance of aligning technology choices with business and regulatory requirements.

3.10 Answers for check your progress

1. b) Temporary data storage
2. c) RAM
3. b) ROM
4. b) Cache memory
5. d) HDD
6. c) Hard Disk Drive (HDD)
7. d) Memory Card
8. d) SSD
9. b) Magnetic Tape
10. c) USB Flash Drive

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UNIT - III COMPLETED

UNIT – IV

SOFTWARE

UNIT IV - SOFTWARE
Software and its needs, Types of S/W. System Software: Operating System, Utility Programs Programming Language: Machine Language, Assembly Language, High Level Language their advantages & disadvantages. Application S/W and its types: Word Processing, Spread Sheets Presentation, Graphics, DBMS s/w

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UNIT OBJECTIVES

- This unit aims to provide a foundational understanding of software and its various categories, emphasizing their specific needs and applications.
- It explores the distinctions and purposes of system software, such as operating systems and utility programs, alongside programming languages.
- Furthermore, this unit delves into different types of application software, including word processing, spreadsheets, presentation, graphics, and DBMS.

4.1 SOFTWARE AND ITS NEEDS

Software is a set of programs, which is designed to perform a well-defined function. A program is a sequence of instructions written to solve a particular problem.

4.1.1 Needs of Software

1. Hardware Compatibility: Software needs to be compatible with the underlying hardware components of the computer system.

2. Operating System Support: Compatibility with the operating system (OS) environment where the software will be installed and executed.
3. User Interface Design: Intuitive and user-friendly interface design to facilitate interaction between users and the software.
4. Functionality and Features: Providing the necessary features and functionalities to fulfil the intended purpose of the software.
5. Performance Optimization: Optimizing software performance to ensure efficient execution and responsiveness.
6. Security Measures: Implementing security measures to protect the software and its data from unauthorized access, malware, and cyber threats.
7. Scalability and Flexibility: Designing software to accommodate changes in workload, user base, and functionality over time.
8. Maintenance and Updates: Providing mechanisms for software maintenance, bug fixes, and updates to address issues and improve functionality.
9. Documentation and Support: Offering comprehensive documentation and user support to assist users in installing, configuring, and using the software effectively.

4.2 TYPES OF SOFTWARE

There are two types of software:

- System Software
- Application Software

Application Software vs. Operating System

4.3 SYSTEM SOFTWARE

- The system software is a collection of programs designed to operate, control, and extend the processing capabilities of the computer itself.

- System software is generally prepared by the computer manufacturers. These software products comprise of programs written in low-level languages, which interact with the hardware at a verybasic level.
- System software serves as the interface between the hardware and the end users. System software is a type of computer program that is designed to run a computer's hardware and application programs.
- If we think of the computer system as a layered model, the system software is the interfacebetween the hardware and user applications.
- Some examples of system software are Operating System, Compilers, Interpreter, Assemblers, etc.

Let's Sum Up

Computer software can be broadly categorized into system software and application software. System software, such as operating systems and utility programs, manages hardware and provides a platform for running application software. Application software includes programs designed for end-users, like word processors, web browsers, and games, tailored to specific tasks or functionalities.

4.4 OPERATING SYSTEM

An operating system is a program that acts as an interface between the software and the computer hardware. It is an integrated set of specialized programs used to manage overall resources andoperations of the computer. It is specialized software that controls and monitors the execution of all other programs that reside in the computer, including application programs and other system software.

Examples of computer operating systems

- Microsoft Windows 10
- Apple macOS
- Ubuntu Linux

- Google Android
- iOS

4.5 UTILITY PROGRAMS

Utility programs are software tools designed to perform specific tasks or functions that assist in managing, optimizing, and maintaining a computer system. These programs provide essential services to users and help enhance the efficiency, security, and performance of the system. Here's an overview of utility programs and some common examples.

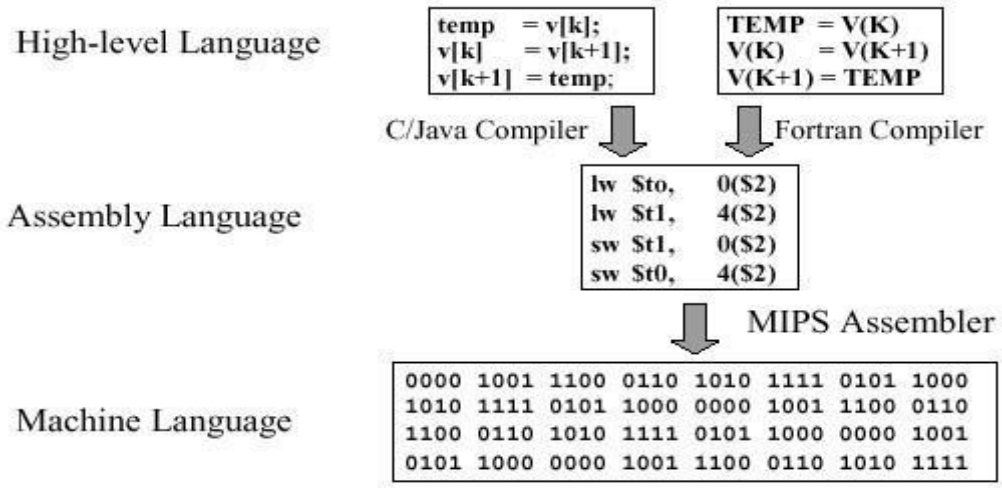
Common Examples of Utility Programs:

- **Antivirus Software:**
  - Protects the computer system from viruses, malware, spyware, and other malicious threats by scanning and removing infected files.
- **Disk Cleanup and Optimization Tools:**
  - Removes temporary files, caches, and unnecessary data to free up disk space and optimize disk performance.
  - Example: Windows Disk Cleanup, CCleaner.
- **Disk Defragmenters:**
  - Rearranges fragmented files on the hard disk to improve access speed and system performance by reducing disk fragmentation.
  - Example: Windows Disk Defragmenter, Defraggler.
- **Backup and Recovery Tools:**
  - Creates backup copies of important files and system configurations to prevent data loss and facilitates recovery in case of system failures or data corruption.
  - Example: Windows Backup and Restore, Mac Time Machine.
- **File Compression and Extraction Utilities:**
  - Compresses files and folders to reduce storage space and facilitates the transfer of large files over the internet.
  - Example: WinRAR, 7-Zip, macOS Archive Utility.
- **System Monitoring and Diagnostic Tools:**
  - Monitors system performance, resource usage, and hardware components to identify and troubleshoot issues.
  - Example: Task Manager (Windows), Activity Monitor (macOS), Resource Monitor (Windows).
- **Firewall Software:**
  - Controls incoming and outgoing network traffic to protect the computer from unauthorized access and cyber threats.
  - Example: Windows Firewall, Norton Firewall, ZoneAlarm.

- **Password Managers:**
  - Stores and manages user passwords securely, allowing users to generate strong, unique passwords and access them with a master password.
  - Example: LastPass, Dashlane, KeePass.
- **Registry Cleaners:**
  - Scans and cleans the Windows registry to remove obsolete, invalid, or corrupt entries, potentially improving system performance and stability.
  - Example: CCleaner, Wise Registry Cleaner.
- **Uninstallers:**
  - Removes unwanted or unused programs and associated files from the system, freeing up disk space and improving system performance.
  - Example: Revo Uninstaller, Windows Add or Remove Programs.

4.6 PROGRAMMING LANGUAGES

A programming language is a set of commands, instructions, and other syntax use to create a software program. Languages that programmers use to write code are called "high-level languages." This code can be compiled into a "low-level language," which is recognized directly by the computer hardware.



4.6.1 Machine Language

Machine language is the lowest-level programming language that computers can understand and execute directly. It consists of binary code, represented by combinations of 0s and 1s, which correspond to specific instructions that the computer's CPU (Central

Processing Unit) can execute. Each instruction in machine language corresponds to a specific operation that the CPU can perform, such as arithmetic calculations, data movement, or control flow. In machine language, a simple instruction might be represented as a sequence of binary digits like "10110010," which the CPU interprets as a specific operation.

Characteristics:

- Low-Level: Directly manipulates hardware components and registers.
- Machine-Dependent: Instructions are specific to the CPU architecture.
- Difficult to Read and Write: Composed of binary digits, making it challenging for humans to understand and write directly.
- Fast Execution: Executes directly by the CPU with minimal translation or interpretation overhead.

4.6.2 Assembly Language

Assembly language is a low-level programming language that provides a symbolic representation of machine language instructions. It uses mnemonic codes to represent machine instructions, making it easier for humans to read and write compared to machine language. Assembly language instructions are mnemonic representations of machine language instructions. Each mnemonic corresponds to a specific machine instruction. Instead of writing binary code directly, programmers write assembly language code using mnemonics like "MOV" for move, "ADD" for addition, etc.

Characteristics:

- Human-Readable: Uses mnemonic codes and symbols that are easier for humans to understand compared to binary code.
- Platform-Specific: Assembly language instructions are specific to the CPU architecture and platform.
- Low-Level: Provides direct control over hardware components and registers.
- Assembler Required: Assembly code needs to be translated into machine code using an assembler before it can be executed by the CPU.
- Close to Hardware: Allows programmers to access and manipulate hardware resources directly, offering fine-grained control.

4.6.3 High level language

A high-level language is a computer programming language that isn't limited by the computer, designed for a specific job, and is easier to understand. It is more like human language and less like machine language. However, for a computer to understand and run a program created with a high-level language, it must be compiled into machine language. High-level languages are,

- BASIC
- C
- C++
- COBOL
- FORTRAN
- Java
- Pascal Perl
- PHP
- Python
- Rub
- Visual Basic

Advantages

1. Readability and Ease of Use: High-level languages use natural language constructs and abstract away complex machine-level details, making them easier to understand and write.
2. Portability: High-level languages are often platform-independent or have minimal platform dependencies, allowing programs to be written once and run on multiple platforms with minimal modifications.
3. Productivity: High-level languages typically require fewer lines of code to accomplish tasks compared to low-level languages, resulting in faster development cycles and increased productivity.
4. Abstraction and Modularity: High-level languages support abstraction and modular programming techniques, allowing complex systems to be broken down into smaller, more manageable components.
5. Rich Standard Libraries: High-level languages often come with extensive standard libraries that provide pre-written code for common tasks, reducing the need to reinvent the wheel and speeding up development.

Disadvantages

1. Execution Speed: High-level languages are generally slower in terms of execution speed compared to low-level languages due to the additional overhead of translation and interpretation.
2. Resource Consumption: High-level languages may consume more system resources (memory, CPU) compared to low-level languages, leading to potential performance bottlenecks, especially in resource-constrained environments.
3. Less Control Over Hardware: High-level languages abstract away low-level hardware details, limiting the programmer's control over hardware-specific optimizations and system-level operations.
4. Learning Curve for Optimization: Optimizing performance and memory usage in high-level languages often requires advanced knowledge of language-specific features, algorithms, and optimization techniques.

Let's Sum Up

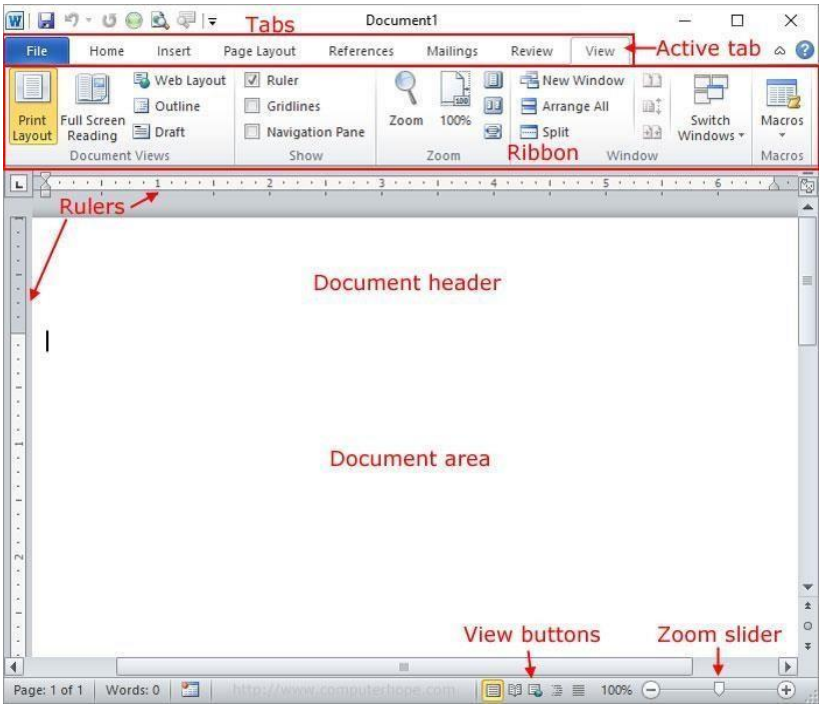
Programming languages can be broadly categorized into low-level and high-level languages. Low-level languages, such as assembly and machine code, are closer to the hardware and provide more control but are complex and harder to understand. High-level languages, like Python, Java, and C++, are more abstract, user-friendly, and efficient for developers, allowing them to write code that is easier to read, maintain, and debug.

4.7 APPLICATION SOFTWARE AND ITS TYPES

- Application software products are designed to satisfy a particular need of a particular environment.
- All software applications prepared in the computer lab can come under the category of Application software.
- Application software may consist of a single program, such as Microsoft's notepad for writing and editing a simple text. It may also consist of a collection of programs, often called a software package, which work together to accomplish a task, such as a spreadsheetpackage.

4.7.1 Word Processing

A word processor is a software program capable of creating, storing, and printing typed documents. Today, the word processor is one of the most frequently used software programs on a computer. Word processors can be used to create multiple types of files, including Text files (.txt), Rich Text files (.rtf), HTML files (.htm & .html), and Word files (.doc & .docx). In a word processor, you are presented with a blank white sheet as shown below. The text is added to the document area and after it has been inserted formatted or adjusted to your preference. Below is an example of a blank Microsoft Word window with areas of the window highlighted.

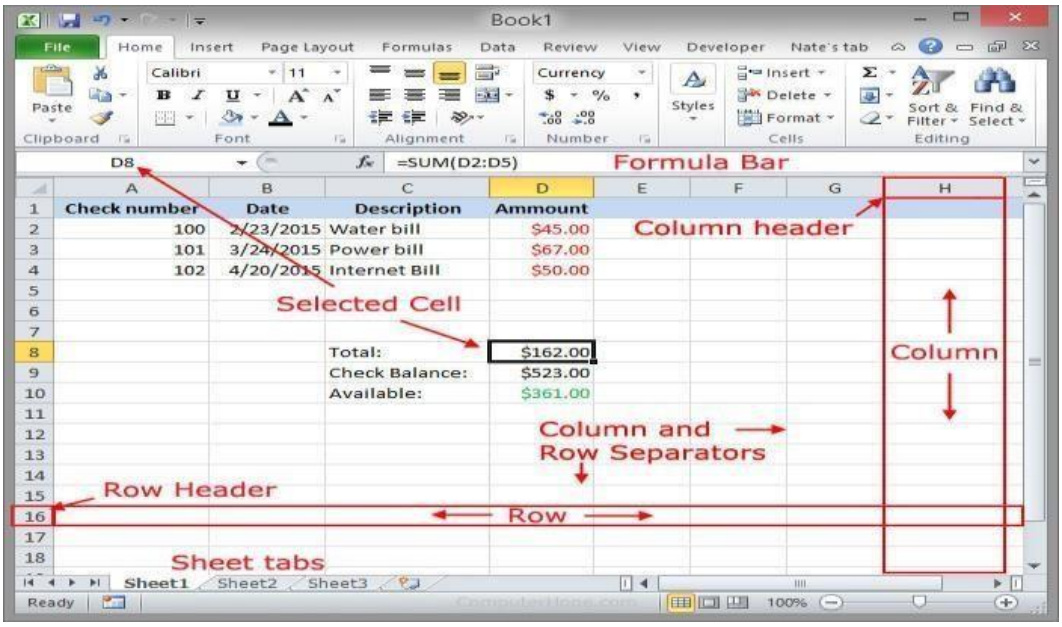


Features of a word processor

Text formatting	Changing the font, font size, font color, bold, italicizing, etc.
Multimedia	Insert clip art, charts, images, pictures, and video into a document.
Spelling and Grammar	Have the ability to look for spelling and grammar errors in adocument.
Adjust the layout	Capable of modifying the margins and layout of a document.
Indentation and lists	Set and format tabs, bullet lists, and number lists.
Insert tables	Add tables to a document.
Header and footer	Being able to adjust and change text within the header and footer of adocument.
Thesaurus	Look up alternatives to a word without leaving the program.
Auto Correct	Automatically correct common errors (e.g., typing "teh" and having itautocorrected to "the").
Mailers and labels	Create mailers or print labels.
Import data	Import and format data from CSV, database, or another source.
Macros	Setup macros to perform common tasks.

4.7.2 Spreadsheets

A spreadsheet is an interactive computer application for organization, analysis and storage of data in tabular form. A worksheet or a spreadsheet is a file made of rows and columns that help sort data, arrange data easily, and calculate numerical data. What makes a spreadsheet software program unique is its ability to calculate values using mathematical formulas and the data in cells. A good example of how a spreadsheet may be utilized is creating an overview of yourbank's balance.



4.7.3 Presentation

Presentation software is a category of application program used to create sequences of words and pictures that tell a story or help support a speech or public presentation of information. Presentation software can be divided into business presentation software and more general multimedia authoring tools, with some products having characteristics of both. Business presentation software emphasizes ease- and quickness-of-learning and use. Business presentation software usually enables you to include images and sometimes audio and video developed with other tools. Multimedia authoring software enables to create a more sophisticated presentation that includes audio and video sequences.

Some very popular presentation software are:

- Microsoft's PowerPoint
- Lotus's Freelance Graphics
- Corel Presentations

4.7.4 Graphics

Graphics play a pivotal role in modern computing, serving as a visual medium to convey information, enhance user experiences, and facilitate interaction with digital content. From vibrant user interfaces to immersive virtual environments, graphics

technology encompasses a broad spectrum of applications. Through techniques such as rendering, animation, and image processing, computers generate and manipulate graphical elements to create realistic simulations, compelling visuals, and intuitive interfaces. Whether in entertainment, design, education, or scientific visualization, graphics empower users to communicate, explore, and innovate in an increasingly visual world.

4.7.5 DBMS

A database management system (DBMS) is system software for creating and managing databases. The DBMS provides users and programmers with a systematic way to create,retrieve, update and manage data.

A DBMS makes it possible for end users to create, read, update and delete data in a database. The DBMS essentially serves as an interface between the database and end users or application programs, ensuring that data is consistently organized and remains easily accessible.

Let's Sum Up

Software applications serve various functions, enhancing productivity and enabling complex tasks across different domains. Types include content management systems like WordPress for web development, spreadsheets like Excel for data analysis, presentation software like PowerPoint for creating slideshows, and database management systems (DBMS) for organizing and managing data efficiently. Each type of software addresses specific needs, streamlining processes and improving efficiency in personal, educational, and professional settings.

4.8 Unit- Summary

- Software encompasses system software, including operating systems and utility programs, as well as programming languages and application software like word processing, spreadsheets, presentations, graphics, and database management systems (DBMS).
- System software, including operating systems and utility programs, provides essential functionalities for computer operation, management, and optimization.

- Programming languages range from low-level machine language and assembly language to high-level languages, each with its advantages and disadvantages in terms of readability, and portability.
- Application software serves specific user needs, including word processing, spreadsheets, presentations, graphics, and database management systems (DBMS), enabling users to create, manipulate, and manage data and information efficiently.

4.9 Glossary

- HTML – Hypertext Mark-up Language
- OS – Operating System
- DBMS - Database Management System
- BIOS - Basic Input/Output System

4.10 Check your Progress

1. Which of the following is not a type of software?

a) System software b) Application software

c) Middleware d) Hardware

2. Which type of software is responsible for controlling and managing computer hardware resources?

a) Application software b) Firmware

c) System software d) Utility software

3. Which of the following is an example of application software?

a) Operating System b) Device Drivers

c) Microsoft Word d) BIOS

4. Which software type is designed to perform specific tasks such as antivirus scanning, disk cleanup, or file compression?

a) System software b) Application software

c) Utility software d) Middleware

5. Which type of software acts as an intermediary between different software applications and facilitates communication and data exchange?

a) System software b) Application software

c) Middleware d) Firmware

6. Which of the following languages is closest to the computer's native instruction set?

a) Assembly language b) Machine language

c) High-level language d) Binary language

7. What is the primary advantage of using high-level languages over assembly language?

a) Greater control over hardware resources b) Improved performance

c) Faster development and readability d) Closer proximity to machine architecture

8. Which of the following is NOT a high-level programming language?

a) C b) Java c) Assembly d) Python

9. Which of the following is an example of a high-level language compiler?

a) GCC b) NASM

c) Microsoft Macro Assembler (MASM) d) Turbo Pascal

10. What is the primary advantage of using machine language over high-level languages?

a) Portability b) Readability

c) Speed and efficiency d) Ease of debugging

4.11 Self-Assessment Questions

Short Answers: (5 Marks)

1. Write a short note on system software.
2. Distinguish High-level languages and Machine languages.

3. What are the functions of an operating system?
4. Describe the role of utility programs in system software.
5. What is the purpose of graphics software?

Long Answers: (10 Marks)

1. Compare and contrast machine language, assembly language, and high-level language in terms of syntax, usage, and advantages.
2. Classify operating systems
3. Explain the different types of application software with suitable examples. Discuss the importance of each type in modern computing.
4. Explain in detail about Data Base Management Software. What are the key features and types of DBMS used in different applications?

4.12 Case Study: Software Implementation in a Small Business

Background: ABC Enterprises, a small manufacturing company, faced challenges in managing its business processes. The company struggled with manual documentation, inefficient inventory management, and lack of data insights. To address these issues, the company decided to implement various software solutions to streamline operations and improve productivity.

Software Needs:

1. **System Software Needs:**
   - An efficient **Operating System (OS)** was required for both servers and workstations to support business operations.
   - **Utility Programs** for system maintenance, data backup, and security were essential to ensure smooth functioning.
2. **Programming Languages Needs:**
   - The company needed custom software solutions for unique business processes. They considered various programming languages:

- A **High-Level Language** (e.g., Python, Java) was chosen for software development due to ease of use, readability, and faster development.

3. **Application Software Needs:**
    - **Word Processing Software:** To create documents such as business reports, proposals, and communication letters.
    - **Spreadsheet Software:** To manage and analyze financial data, budgets, and sales records.
    - **Presentation Software:** For preparing presentations for internal meetings and client interactions.
    - **Graphics Software:** For creating marketing materials, product designs, and website graphics.
    - **Database Management System (DBMS) Software:** To manage inventory, customer data, and sales records efficiently.

Implementation:

1. **Operating System:** Windows Server was selected for the company's server needs due to its compatibility and ease of use. For workstations, Windows 10 was chosen for a familiar user interface and wide application support.
2. **Utility Programs:** Norton Antivirus was deployed for security, and Acronis Backup was used for data protection.
3. **Programming Language:** Python was chosen for developing custom applications for inventory tracking and automation of repetitive tasks.
4. **Application Software:**
    - **Microsoft Office Suite** was chosen for Word Processing (Word), Spreadsheet (Excel), and Presentation (PowerPoint) needs.
    - **Adobe Photoshop** and **Illustrator** were selected for graphics design.
    - **Microsoft Access** was used initially for DBMS needs, but later the company transitioned to **SQL Server** for better performance and scalability.

Outcome: The implementation of these software solutions significantly improved ABC Enterprises' operational efficiency. Inventory management errors were reduced by 50%, document preparation time decreased by 30%, and the company gained valuable insights through data analysis using spreadsheet and DBMS software.

Conclusion: This case study demonstrates the importance of choosing the right combination of software to meet the specific needs of a business. A well-implemented software strategy can lead to significant improvements in productivity and business outcomes.

4.13 Answers for Check your Progress

1. d) Hardware
2. c) System software
3. c) Microsoft Word
4. c) Utility software
5. c) Middleware
6. b) Machine language
7. c) Faster development and readability
8. c) Assembly
9. a) GCC
10. c) Speed and efficiency

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UNIT - IV COMPLETED

UNIT – V

OPERATING SYSTEM

UNIT V - OPERATING SYSTEM
Functions, Measuring System Performance, Assemblers, Compilers and Interpreters. Batch Processing, Multiprogramming, Multi-Tasking, Multiprocessing, Time Sharing, DOS, Windows, Unix/Linux.

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UNIT OBJECTIVES

- This unit aims to provide a comprehensive understanding of the roles of assemblers, compilers, and interpreters in program execution.
- Learner will learn to measure system performance effectively while exploring various processing techniques such as batch processing, multiprogramming, multitasking, multiprocessing, and time-sharing.
- Additionally, the unit aims to familiarize students with the key features and differences of major operating systems such as DOS, Windows, and

5.1 OPERATING SYSTEM FUNCTIONS

An operating system (OS) is a crucial software component that manages hardware and software resources and provides services for computer programs. Here are some brief notes on OS and its functions:

1. Resource Management: OS manages hardware resources such as CPU, memory, disk space, and peripherals efficiently to ensure optimal utilization and fairness among competing processes.
2. Process Management: It creates, schedules, and terminates processes, enabling multitasking and ensuring that each process gets its fair share of CPU time.
3. Memory Management: OS allocates and deallocates memory space for processes, handles virtual memory, and prevents processes from accessing each other's memory space.
4. File System Management: It organizes and controls access to files and directories on storage devices, ensuring data integrity and providing mechanisms for file manipulation.
5. Device Management: OS interacts with hardware devices such as printers, scanners, and network interfaces, managing device drivers and providing a uniform interface for applications to access devices.
6. User Interface: It provides a user-friendly interface for interacting with the computer, including graphical user interfaces (GUIs), command-line interfaces (CLIs), and touch-based interfaces.
7. Security and Protection: OS enforces security policies, controls access to system resources, and protects against unauthorized access, viruses, and other security threats.
8. Error Handling: It detects and handles errors that occur during system operation, including hardware failures, software faults, and user errors, to ensure system stability and reliability.
9. Networking: OS provides networking capabilities, allowing computers to communicate with each other over local area networks (LANs) or the internet, and managing network protocols and connections.
10. System Administration: It includes tools and utilities for system configuration, monitoring, and maintenance, allowing administrators to manage users, install software, and troubleshoot problems.

5.2 MEASURING SYSTEM PERFORMANCE

Measuring system performance involves assessing various aspects of a computer system's behavior to gauge its efficiency, reliability, and responsiveness. Here are some key metrics and techniques used for measuring system performance:

1. Response Time: This measures the time it takes for a system to respond to a user request. It includes processing time, I/O time, and any waiting time in queues.
2. Throughput: Throughput measures the rate at which a system can process tasks or transactions over a period of time. It is often expressed in terms of tasks per second or transactions per second.
3. Resource Utilization: Monitoring CPU, memory, disk, and network utilization provides insights into how efficiently system resources are being utilized. High utilization may indicate potential bottlenecks.
4. Latency: Latency measures the delay between initiating a request and receiving a response. It is particularly critical in real-time systems and network communication.
5. Concurrency and Scalability: Evaluating how well a system handles concurrent users or tasks and how it scales with increasing load or resources can indicate its performance limits and potential for expansion.
6. Benchmarking: Benchmarking involves running standardized tests or workloads on a system to measure its performance against predefined criteria or against other systems. Common benchmarks include SPEC CPU benchmarks for CPU performance and TPC benchmarks for database performance.
7. Profiling and Tracing: Profiling tools analyze the behavior of software applications or system components to identify performance bottlenecks, hotspots, or inefficiencies.
8. Monitoring and Logging: Continuous monitoring of system metrics and logging of events and errors help identify trends, anomalies, and performance degradation over time. Tools like Prometheus and Grafana are commonly used for monitoring and visualization.
9. Capacity Planning: Predicting future system requirements based on historical data and growth projections helps ensure that the system can handle expected workloads without performance degradation.

10. End-to-End Testing: Evaluating system performance under realistic conditions, including user interactions, network latency, and external dependencies, provides a more comprehensive understanding of overall system behavior.

Let's Sum Up

Operating systems (OS) are the fundamental software that manage computer hardware and software resources, providing services for computer programs. Key topics include process management, memory management, file systems, and user interfaces, which collectively ensure efficient and user-friendly operation of a computer.

5.3 ASSEMBLERS

An assembler is a software tool that translates assembly language code into machine code. It performs a one-to-one mapping of assembly instructions to machine instructions, typically without any optimization. The output of an assembler is a binary file containing machine code instructions that can be executed directly by the CPU.

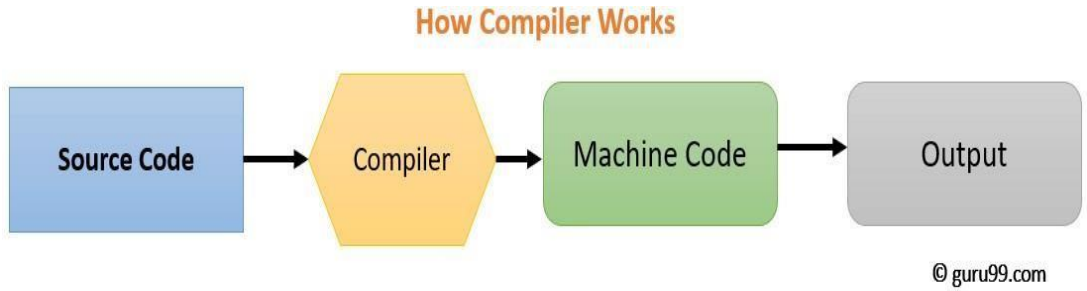
Functions of an Assembler:

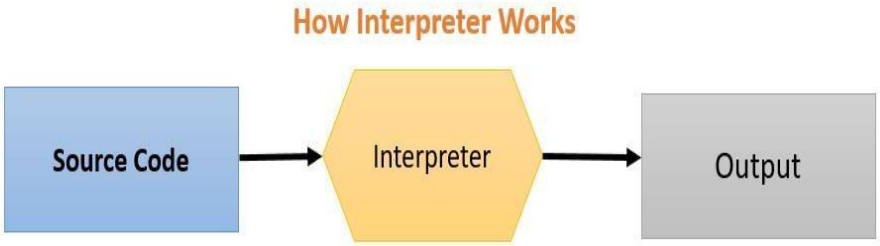
1. Parsing: The assembler reads the assembly language source code and parses it into meaningful tokens, such as instructions, labels, operands, and directives.
2. Symbol Resolution: It resolves symbolic names (labels) to memory addresses or offsets in the binary code.
3. Code Generation: The assembler translates each assembly language instruction into the corresponding machine code instruction, based on the CPU architecture and instruction set.
4. Error Handling: Assemblers perform basic error checking and report syntax errors, undefined symbols, or other issues encountered during assembly.
5. Output Generation: Finally, the assembler generates a binary executable file containing the translated machine code, along with any necessary metadata or debugging information.

5.4 COMPILERS AND INTERPRETERS

5.4.1 Compilers

A compiler is a program that converts instructions into a machine-code or lower-level form so that they can be read and executed by a computer. A compiler is a software program that transforms high-level source code that is written by a developer in a high-level programming language into a low level object code (binary code) in machine language, which can be understood by the processor. The process of converting high-level programming into machine language is known as compilation An interpreter is a computer program that is used to directly execute program instructions written using one of the many high-level programming languages.





5.4.2 Interpreters

An interpreter is a computer program that is used to directly execute program instructions written using one of the many high-level programming languages The interpreter transforms the high-level program into an intermediate language that it then executes, or it could parse the high-level source code and then performs the commands directly, which is done line by line or statement by statement

Feature	Assembler	Compiler	Interpreter
Input	Low-level assembly language code	High-level source code in a specific language	High-level source code in a specific language or script
Output	Machine code specific to the target CPU	Machine code or intermediate code	Intermediate code or executed instructions
Execution Speed	Fast, as it directly translates assembly instructions to machine code	Generally slower than assembler but faster than interpreter	Generally slower than both assembler and compiler
Efficiency	Produces highly optimized machine code	Produces optimized machine code for entire program	Interprets code line-by-line, no optimization before execution
Error Checking	Minimal error checking during assembly	Comprehensive error checking during compilation	Error checking occurs during interpretation or just-in-time compilation
Portability	Not portable; machine code is specific to CPU architecture	Can be portable depending on the target platform	Platform-independent, as the interpreter itself runs on different platforms
Debugging	Difficult, as debugging is done at the machine code level	Easier, as source-level debugging is possible	Relatively easy, as errors are reported during execution
Examples	NASM (Netwide Assembler), MASM (Microsoft Macro Assembler)	GCC (GNU Compiler Collection), Clang, Microsoft Visual C++	Python interpreter, Ruby interpreter, JavaScript interpreter

Let's Sum Up

A compiler translates an entire high-level programming code into machine code before execution, optimizing performance and allowing for error checking ahead of runtime. An assembler converts assembly language code directly into machine code,

closely aligning with the computer's hardware instructions. An interpreter, on the other hand, translates and executes code line-by-line, making it easier to debug but generally slower in execution compared to compiled programs.

5.5 BATCH PROCESSING

Batch processing in operating systems refers to the execution of a series of tasks (jobs) without manual intervention. It involves collecting similar jobs into batches and executing them one after another. Examples: Some examples of batch processing systems include IBM's Job Control Language (JCL) for mainframe computers, Unix/Linux shell scripts, Windows Task Scheduler, and modern job scheduling software like Apache Airflow and Jenkins.

5.5.1 Advantages

Efficient use of resources: Batch processing allows for the efficient use of system resources by executing multiple jobs sequentially.

Automation: It automates repetitive tasks and reduces the need for manual intervention, improving productivity.

Scalability: Batch processing systems can scale to handle large volumes of data or tasks without requiring additional user interaction.

5.5.2 Disadvantages

Lack of interactivity: Batch processing is not suitable for tasks requiring real-time interaction or immediate user feedback.

Processing delays: Jobs may experience delays in execution if the system is busy or if higher-priority jobs are queued ahead.

Error handling complexity: Managing errors and exceptions in batch processing systems can be complex, especially for long-running jobs with multiple dependencies.

Let's Sum Up

Batch processing involves executing a series of tasks or programs on a computer without manual intervention, typically all at once or at scheduled times. It is commonly used for large-scale data processing, such as payroll, end-of-day transactions, and data analysis, where efficiency and resource management are critical.

5.6 MULTIPROGRAMMING

Multiprogramming is a technique used by operating systems to maximize CPU utilization by concurrently executing multiple programs. Instead of waiting for one program to complete its execution before starting another, the operating system switches between different programs, allowing them to progress simultaneously. In a multiprogramming environment, the operating system maintains a pool of processes (or jobs) in memory. Each process represents a program that is loaded into memory and is ready to execute. The operating system's scheduler selects processes from this pool and allocates CPU time to each process in a time-sharing manner.

5.6.1 Benefits

Improved CPU utilization: Multiprogramming allows the CPU to remain busy by switching between processes.

Responsiveness: Users experience shorter response times as the operating system quickly switches between processes, giving the illusion of simultaneous execution.

Efficient resource utilization: Multiprogramming optimizes resource utilization by allowing multiple programs to share system resources such as CPU, memory, and I/O devices.

5.6.2 Challenges

Overhead: Context switching and managing multiple processes incur overhead, which can affect system performance.

Synchronization: Multiprogramming introduces the need for synchronization mechanisms to ensure proper coordination between concurrent processes and prevent data corruption or race conditions.

5.7 MULTITASKING

Multitasking is the ability of an operating system to execute multiple tasks simultaneously or quasi-simultaneously on a single processor. It enables users to perform multiple activities or run multiple programs concurrently without interference. In a multitasking environment, the operating system manages multiple processes or tasks by allocating CPU time to each process in a time-sharing manner. Each process is given a small time slice during which it can execute before being preempted to allow another process to run.

Preemptive Multitasking: The operating system can preempt a running process and allocate CPU time to another process, ensuring fair allocation of resources and preventing any single process from monopolizing the CPU.

Cooperative Multitasking: Processes voluntarily yield CPU control to other processes, relying on cooperation rather than preemption. While less common in modern operating systems, it was prevalent in early systems and certain specialized environments.

5.8 MULTIPROCESSING

Multiprocessing is the concurrent execution of multiple processes or threads across multiple processors or CPU cores within a single system. It enables parallelism and can significantly improve system performance by distributing the workload among multiple processing units. In a multiprocessing system, multiple processes or threads can execute simultaneously on different processors or CPU cores. This allows tasks to be divided into smaller units of work that can be executed concurrently, leading to faster execution and improved throughput.

5.9 TIME-SHARING

Time-sharing, also known as multitasking, is a technique used by operating systems to allow multiple users or processes to access and utilize system resources

concurrently. Instead of dedicating the entire system to one user or process at a time, the operating system divides the CPU's time into small time intervals, called time slices or time quanta, and allocates each user or process a portion of CPU time during which it can execute. Examples: Time-sharing is a fundamental feature of modern operating systems such as Unix/Linux, Windows, and macOS.

5.9.1 Benefits

Increased system throughput: Time-sharing enables efficient utilization of system resources by allowing multiple users or processes to share them concurrently.

Enhanced user experience: Users benefit from shorter response times, seamless multitasking, and interactive computing environments.

Improved resource utilization: Time-sharing maximizes resource utilization by dynamically allocating resources based on demand and priority, reducing idle time and improving system efficiency.

Let's Sum Up

Multiprogramming involves running multiple programs on a single processor by rapidly switching between them to maximize CPU utilization. Multiprocessing uses two or more processors to execute multiple processes simultaneously, enhancing performance and reliability. Multitasking allows a single CPU to execute multiple tasks by rapidly switching between them, giving the illusion that tasks are running concurrently.

5.10 DOS (Disk Operating System)

DOS is a family of operating systems, primarily known for MS-DOS (Microsoft Disk Operating System), developed by Microsoft. It was popular during the 1980s and early 1990s, especially on IBM PC-compatible computers.

User Interface: DOS primarily features a command-line interface (CLI) where users interact with the system by typing commands. It lacks a graphical user interface (GUI) found in modern operating systems.

Functionality: DOS provides basic file management, disk utilities, and limited multitasking capabilities. It is a single-user, single-tasking operating system, meaning it can run only one program at a time.

Legacy: Although largely obsolete for mainstream computing, DOS remains influential in the history of personal computing and embedded systems. Some DOS-based applications and games are still in use today.

5.11 WINDOWS

Windows is a family of graphical operating systems developed by Microsoft. It dominates the desktop and laptop market, offering various versions tailored to different use cases, including home, professional, and server environments. User Interface: Windows features a graphical user interface (GUI) characterized by windows, icons, menus, and pointers (WIMP). Users interact with the system using mouse and keyboard inputs.

Functionality: Windows provides a wide range of features and capabilities, including multitasking, multi-user support, networking, device management, multimedia support, and a vast ecosystem of software applications.

Versions: Windows has evolved through numerous versions over the years, with notable releases such as Windows 95, Windows XP, Windows 7, Windows 10, and Windows 11. Each version introduces new features, improvements, and changes to the user interface and underlying architecture.

5.12 UNIX/LINUX

Unix and its open-source variant Linux are powerful, multi-user, multitasking operating systems known for their stability, security, and flexibility. Unix was developed in the late 1960s, while Linux was created in the early 1990s by Linus Torvalds. User Interface: Unix/Linux systems offer both command-line interface (CLI) and graphical user interface (GUI) options. The CLI, accessed through a terminal, provides powerful text-based tools and utilities, while the GUI, such as GNOME or KDE, offers a desktop environment similar to Windows.

Functionality: Unix/Linux systems excel in networking, server applications, programming, and development environments. They provide robust multitasking, multi-user support, file system management, and a vast array of free and open-source software packages.

Variants: Unix has several commercial variants, including IBM AIX, HP-UX, and Solaris, while Linux has numerous distributions (distros) such as Ubuntu, Fedora, Debian, and CentOS. Each variant or distribution may target different audiences and use cases while sharing common Unix/Linux principles and tools.

Let's Sum Up

Operating systems (OS) serve as crucial software that manage computer hardware and provide a user interface. Windows and macOS are prominent commercial OSs known for their user-friendly interfaces and broad software compatibility. Linux, an open-source OS, offers robust customization and is widely used in server environments due to its stability and security features. DOS, though largely obsolete, laid foundational principles for modern OS development, influencing subsequent systems with its command-line interface and simplicity. Each OS type caters to different user needs, ranging from everyday personal computing to specialized server operations.

5.13 Unit- Summary

- Functions are modular blocks of code that perform specific tasks and promote code reuse and organization within a program.
- System performance metrics such as response time, throughput, and resource utilization are essential for evaluating the efficiency and effectiveness of computer systems.
- These are software tools used to translate high-level programming languages into machine code.
- Assemblers convert assembly language code, compilers translate entire programs, and interpreters execute code line by line.
- These are techniques used in operating systems to optimize resource utilization and improve system efficiency by allowing multiple tasks to be executed concurrently.
- These are examples of different operating systems, each with its own features, user interfaces, and functionalities, catering to various user needs and preferences.

5.14 GLOSSARY

- JCL - Job Control Language
- DOS - Disk Operating System
- GUI - graphical user interface
- CLI - command-line interface

5.15 Check your Progress

1. What does "DOS" stand for?

a) Disk Operating System b) Dual Operating System

c) Dynamic Operating System d) Data Operation System

2. Which company developed MS-DOS?

a) Apple Inc. b) Microsoft Corporation c) IBM d) HP

3. What is the characteristic user interface of Windows?

a) Command-Line Interface b) Graphical User Interface

c) Voice Recognition Interface d) Virtual Reality Interface

4. Which version of Windows introduced the Start Menu?

a) Windows 3.1 b) Windows 95 c) Windows XP d) Windows 7

5. What are some distinguishing features of Unix/Linux operating systems?

a) Proprietary licensing model b) Closed-source codebase

c) Monolithic kernel architecture d) Multi-user and multi-tasking capabilities

6. Which of the following is a popular Linux distribution targeted at beginners and desktop users?

a) Ubuntu b) CentOS c) Debian d) Fedora

7. Which of the following translates assembly language code into machine code?

a) Assembler b) Interpreter c) Compiler d) Linker

8. Which of the following translates high-level language code into machine code line by line and executes it immediately?

a) Assembler b) Interpreter c) Compiler d) Linker

9. Which of the following translates entire high-level language code into machine code before execution?

a) Assembler b) Interpreter c) Compiler d) Linker

10. What is the primary goal of multiprogramming?

a) To improve CPU utilization b) To reduce memory usage

c) To enhance disk performance d) To optimize network bandwidth

5.16 Self-Assessment Questions

Short Answers: (5 Marks)

1. Explain the key difference between an interpreter and a compiler.
2. List the system performance measuring techniques.
3. List and briefly explain the key features of the Unix/Linux operating system.
4. Define and differentiate between assemblers, compilers, and interpreters. Provide examples for each

Long Answers: (10 Marks)

1. Describe the functions of Operating System.
2. What is the difference between multiprogramming and multitasking? Provide examples of each.
3. Explain the concept of batch processing and discuss its advantages and disadvantages.
4. What are the key features of a time-sharing operating system? How does it allocate CPU time among multiple users or tasks?
5. Give a short notes on the following
   - DOS
   - Windows
   - Unix

5.17 Activity: System Performance Comparison

Objective: To understand and compare different operating systems and processing techniques.

Instructions:

1. **Research Assignment:**
   - Divide students into groups and assign each group one of the following operating systems: DOS, Windows, Unix/Linux.
   - Each group should research their assigned operating system's architecture, including how it handles processes (e.g., batch processing, multiprogramming, multitasking, multiprocessing, time sharing).
2. **Performance Measurement:**
   - Each group should identify key performance metrics (e.g., response time, throughput, resource utilization) relevant to their operating system.
   - They should create a table to summarize these metrics, highlighting the strengths and weaknesses of their assigned system compared to the others.
3. **Presentation:**
   - Groups will present their findings to the class, focusing on how their operating system manages processes and system performance.
4. **Class Discussion:**
   - After all presentations, facilitate a class discussion comparing the different systems. Discuss which system might be best suited for specific applications and why.

Outcome: Students will gain a deeper understanding of various operating systems and their approaches to system performance and process management.

5.18 Answers for Check your Progress

1. a) Disk Operating System
2. b) Microsoft Corporation
3. b) Graphical User Interface
4. b) Windows 95
5. d) Multi-user and multi-tasking capabilities
6. a) Ubuntu
7. a) Assembler
8. b) Interpreter
9. c) Compiler
10. a) To improve CPU utilization

5.19 References and Suggested Readings

1. Anoop Mathew, S. KavithaMurugeshan (2009), — Fundamental of Information Technology‖, Majestic Books.
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UNIT - V COMPLETED