Master of Business Administration (MBA)

Computer Application in Management (DMBACO104T24)

Self-Learning Material

(SEM 1)

Jaipur National University

Centre for Distance and Online Education

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PREFACE

As a learner in the modern era, you must have used, observed, or read about computers. It is because we cannot think about our lives without computers. Let's begin by explicitly defining the term "computer."

A computer is a machine that can calculate, according to the dictionary. Modern computers, go beyond the calculators. Computers are electronic devices which receive the input, process it and generated the desired information.

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Unit: 1

Introduction of Computer

Learning Objectives:

- Define a computer, identify its characteristics and functions;
- Understand the evolution of computers
- Learn about the Generations of Computers
- Describe the different classifications of computers

Structure:

1.   Introduction to Computers

The word "computer" is derived from the verb "to compute," which implies to perform calculations. Computers have a huge, obvious impact on all aspects of our daily lives. In this module, you will learn how computers operate, how they evolved, and different classifications.

1.1 Computer?

A computer is an electrical machine that can receive in sequence or data and carry out a number of tasks in line with an established set of tasks. Data or information is produced as a result of this. A computer is a device that can act on data and solve issues. It accepts the input, goes through various mathematical and logical processes to process it, and then produces the desired result.

Thus, a computer can be defined as a device of electronic equipment that converts data into information. The capabilities of a computer can also be used to characterise it. High speed, precision, diligence, adaptability, and storage are key attributes of a computer.

1.2 Computer Organisation

In general, a computer performs five main tasks, which are:

(1) Accepting data or instructions via input;

(2) Storing data;

(3) Processing data following user requirements;

(4) Providing results in the form of output; and

(5) Regulating all computer-related actions.

We go over each of these operations below.

1. INPUT: Entering data and information into the computer system.
2. CONTROL UNIT (PCU): This unit is in charge of overseeing the input, output, processing, and storage processes. It determines when data is to be received, when it is to be stopped, where data is to be stored, etc. It handles the step-by-step processing of all computer processes.
3. MEMORY UNIT: Data and instructions are stored in the computer's memory unit.
4. OUTPUT: This process generates information-rich outcomes from the data.

A computer system's central processing unit (CPU) refers to both the ALU and the CU.

1.3 Characteristics of a Computer

Let's examine some of a computer's qualities to understand better.

- **Accuracy** -Computers display a very high level of precision. Most errors are caused by human error, whether erroneous data, improper instructions, or a chip flaw.
- **Reliability** – Computers can consistently perform the same tasks without making mistakes brought on by fatigue or boredom, which are highly common in humans.
- **Versatility**: Computers are capable of doing a wide range of tasks, from simple mathematical calculations and buying tickets to sophisticated calculations and ongoing astronomical observations. The computer will function if you input the required data and follow the instructions.
- **Storage Capacity** – Computers can store enormous amounts of data at a fraction of the price of conventional file storage. Additionally, data is protected from paper's typical wear and tear.

1.4 Evolution of Computers

Man has always needed to count things, do calculations, or analyse data.

1.4.1 Early Developments

The ABACUSis a rack of wood that contains parallel rods on which beads are strung. It is theearly computing device. Addition and subtraction was possible by this tool.   Abacus

French scholar Blaise Pascal (1623-1662) developed mechanical adding machine in 1642 which represented an important step in developing computer systems.

In 1671 Gottfried Wilhelm von Leibniz improved the formula by adding the ability to multiply, divide, and discover the square root.

First mechanical calculator was sold commercially in 1829. Charles Xavier Thomas created this. Multiplication, Division, Addition and Subtraction was possible through this desktop calculator. Better mechanical calculators came after that.
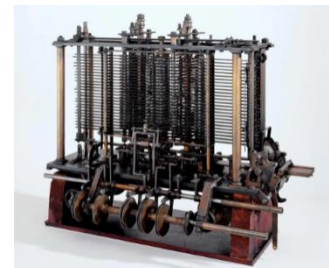
Charles Babbage created "difference engine," in 1822. It is a mechanical calculator that operates automatically. His "analytic machine" was a general-purpose, programmable,

Difference Engine automatic mechanical digital computer that went into production in 1833. He earned the title of "father of the modern computer" as well.

The development of punch cards, an automatic calculating employed for the first time by Herman Hollerith and James

1.4.2 Present-Day Developments

Numerous research teams put forth a lot of effort to create an autonomous digital computer by the late 1930s. ENIAC (Electronic Numerical Integrator and Calculator) was designed in 1942 by physicist John W. Mauchly and electrical engineer J. Presper of Eckert. In 1946, ENIAC began operating Relays were replaced by vacuum tubes as the logic components. It was, therefore, 1,000 times faster than its electromechanical forerunners.

However, the magnitude and complexity of ENIAC were unparalleled.

EDVAC (Electronic Discrete Variable Automatic Computer), a stored-program computer, followed ENIAC in 1950. in 1947 to produce computers for the market. The business created the UNIVAC I (Universal Automatic Computer) in 1951 for the US Census Bureau.

1.5 Generations of Computer

Every generation has smaller and more advanced circuitry than the one before it.

Today,. Additionally, it may be used to edit or make presentations, videos, and spreadsheets. However, this complicated system has been developing ever since the first generation of computers was introduced in the 1940s.

1.5.1 The First Generation: 1946- 1958 (Vacuum Tubes)

The first generation of computers was characterised by size, speed, and reliability issues. They occupied entire rooms, relied on vacuum tubes for their circuitry and magnetic drums for their memory. They were quite expensive and produced lot of heat.

Examples: NIAC, EDVAC, UNIVAC, IBM-701, IBM-650

Features:

- "Vacuum tube technology"
- Unreliable
- Supported Machine language only
- Very costly
- Huge size

1.5.2 "The Second Generation: 1959-1964 (Transistors)"

The second generation of computers was powered by transistors, which replaced vacuum tubes. Vacuum tubes were surpassed by transistors. This made these computers smaller and cheaper. They were more dependable than their first-generation forebears. In place of the opaque binary machine language, Symbolic, or assembly, languages were introduced in second-generation computers. It helped programmers to define commands in words. COBOL and FORTRAN (High-level programming languages), were also introduced.

Magnetic core technology was used instead of a magnetic drum for storing instructions.

Few Examples are: IBM 7094, Honeywell

Important Features:

- Use of transistors
- Reliable
- Small Size
- Generate less heat
- Consumption of Less Electricity
- Fast.

1.5.3 Third Generation: 1965-1970 (Integrated Circuits IC)

The improvement of the built-in route distinguished the third generation of computers. Smaller semiconductors were used in these computers. Keyboard and monitors were used to interact with the system. These systems were interfaced with an operating system. Because they were lighter and less expensive than their forerunners, computers, for the first time, were affordable to spectators. Few Examples are: PDP-8, PDP-11, ICL 2900, IBM 360, IBM 370

Features:

- Use if Integrated Circuits
- Reliability
- Compact Size
- Less heat was generated
- Fast
- Low maintenance required
- Less electricity was consumed

- high level languages were supported

1.5.4 The Fourth generation: 1971- today (Microprocessors)

All computer components such as central processing unit, memory, and input/output controllers, were housed on a single chip (Intel 4004 chip), which was created in 1971. In "1981 IBM released its first personal computer for home use.In 1984 Apple released the Macintosh. These computers were connected together which eventually gave birth to the Internet". GUIs, the mouse, and handheld devices were all developed in conjunction with the fourth generation of computers. This generation used all high-level languages, such as C and C++, DBASE, etc.

Few Examples are: IBM 4341, DEC 10, STAR 1000, PUP 11

Features:

- VLSI technology used
- Very Affordable
- Portable and reliable
- Very small size
- Introduction of "Internet".

1.5.5 FIFTH GENERATION

1980 and beyond are called the fifth generation phase. Some applications, such as speech recognition, are currently in use, but the fifth generation of computer devices based on artificial intelligence is still being developed. Superconductors and parallel processing are accelerating the development of artificial intelligence. The goal of fifth-generation computing was to develop systems that could learn, self-organize, and respond to natural language inputs.

This generation uses all higher-level languages like C and C++, Java,.Net, etc.

Few Examples are: Desktop, Laptop, NoteBook, UltraBook, Chromebook

Features:

- True Artificial Intelligence
- ULSI technology

- Parallel Processing
- Natural language processing
- Superconductor technology
- User-friendly interfaces and multimedia features

1.6 Major Type of Computers

We can divide these electronic devices as follows:

1. Digital Computers

2. Analog Computers

3. Hybrid Computers

1.6.1 Digital Computers

Instead of the actual quantities utilized in analogue computers, a digital computer works with data that is represented as digits. This means that its input must be precise rather than continuous and may include different sets of integers, letters, and special symbols that are expressed in the proper programming language.

1.6.2 Analog Computers

They use physical quantities like electric current, voltage, resistance, mechanical motions, etc., to represent numerical magnitudes. These are devices made to carry out mathematical operations.

These devices are used where temperatures, force, and liquid flow must be continuously monitored, like petrol pumps, where they translate fuel flow measurements into quantities and prices.

The inability to store vast amounts of data, the lack of analytical capabilities, and the fact that only arithmetic operations could be performed on them are some drawbacks of using them.

1.6.3 Hybrid Computers

These computers are a cross between the two categories mentioned above. Analogue or digital data may be used or produced by a hybrid computer. It is achieved by linking a digital and analogue computer together using a hybrid interface or by having the unit of analogue built into a digital computer's core CPU, which finally facilitates for direct getting of input and output.

Scientific applications and industrial process control require the use of hybrid computers. In either of the case, a user can use the machine's capacity for processing discrete and continuous data.

1.7 Type of Computers Based on Size

The following classification would apply if we were to group computers according to their sizes:

1. Supercomputers
2. Mainframe Computers
3. Super Mini Computers
4. Mini Computers
5. Micro Computers/Personal Computers

1.7.1 Supercomputers

A supercomputer has multiple processing units that work in parallel to increase speed. They are employed for more complex applications since they are, in fact, extremely large computers. Among major super computers in India, one of them was used by the meteorological service for weather forecasting.

1.7.2 Mainframe Computer

It is different from supercomputers because it may be linked to other computers for sharing their sources the airline reservation system is an example of an everyday application. At their headquarters, the airlines have a mainframe computer where they keep data on all flights. Small systems are connected to the main data bank so that the most recent flight information is available.

1.7.3 Super Mini Computers

These are hybrids of supercomputers and minicomputers. They are frequently employed as single-purpose computers to perform one processing task at a time.

1.7.4 Mini Computers

They are slower and have less storage than mainframe computers. They can also accommodate different terminals. Actually, they can accommodate as many as 100 terminals.

Minicomputers can accommodate several users thanks to their operating systems' multitasking and network features. The primary applications for these systems are in local government and education, as well as front-end processors for main-frame computers. Additionally, word processing uses it. They are used in business for things like billing, inventory management, payroll, sales analysis, etc.

1.7.5 Micro Computers and Personal Computers

Digital computers, known as microcomputers, have processing units with one or more microprocessors, I/O devices, and enough memory for operations. These devices often have a monitor, a keyboard, and storage for tapes and diskettes. They can be desktop or portable. They are mainly intended for individual operation, although they can be utilised as workstations in terminal emulation mode.

Type of Micro Computers

- Desktop microcomputers
- Notebook or laptop microcomputers
- Tablet and Smartphone microcomputers
- Mini Tower and Full Tower micro computers

1.8 Summary

- ➢ A computer is a device that can act on data and solve issues.
- ➢ CPU refers to ALU and CU.
- ➢ Fourth generation of computers used integrated circuits.
- ➢ The goal of fifth-generation computing was to develop systems that could learn, self-organize, and respond to natural language inputs.
- ➢ Analogue computers are extensively employed in manufacturing facilities where temperatures, pressure, or liquid flow must be continuously monitored
- ➢ For scientific applications or for industrial process control Hybrid computers are used.
- ➢ A supercomputer has multiple processing units that work in parallel to increase speed.
- ➢ Minicomputers can accommodate several users thanks to their operating systems' multitasking and network features.

1.9 Keywords

- Iteration: the repetition of a process

- Forerunner: a person or thing that precedes the coming or development

- Reliability: performing consistently well

- Handheld devices: They are the portable devices.

- quantum: a required or allowed amount

- magnitude; a numerical quantity or value

1.10 Self-Assessment Questions

- 'Computers have a huge, obvious impact on all aspects of our daily lives'. Give reasons to justify this statement.

- Briefly explain the characteristics of a computer.

- Write a brief note on evolution of computers.

- How the computers in each generation different from one another?

- What is the purpose of third generation of computers?

- What is the history of computers, generation by generation?

1.11 Case Study

For a long time, computer science and programming were not taught as official disciplines in New Zealand schools; instead, the emphasis in computing classes was on teaching students how to utilise computers. The newly introduced curriculum offers to explore a variety of computer science topics such as human-computer interaction, algorithms and complexity, artificial intelligence, encryption, formal languages, computer graphics, etc. ICT (Information and Communication technology) was defined within a wide and literal domain, when in 1995 the school curriculum adopted and included "technology" as a learning subject.

Questions

- Discuss how the school would have implemented the new ICT curriculum.

- Do you think it would be easy for junior and senior learners to adapt to the new curriculum?

Unit: 2

Computer Interface

Learning Objectives:

- To understand the concept and function of computer interface
- Learn about Data Processing and Block Diagram
- Analyse the Computer System Architecture
- Learn about the different Input and Output Devices

Structure:

2. Introduction

The art of linking computers and devices is known as computer interfacing. Even though the PC has many plug-and-play internal hardware options, connecting various external devices requires technical expertise. The interface is the link and interaction between the user, the software, and the hardware. It needs to be created, tested and then redesigned.

Hardware Interfaces: They are the cables, sockets, plugs, and electrical impulses. Examples include ATA/IDE, Ethernet, FireWire,

Software/Programming Interfaces: They are the languages, codes, and messages that are used to communicate. Examples include the Windows, Mac, and Linux operating systems,

2. 1 Function of Computer Interface

Every interface implies a structure and function. Electronic signals engage hardware-level processes; data is read, written, sent, received, error-checked, etc. Instructions at the software level turn on the hardware. At higher levels, the data being transported or communicated might even make a function request (client/server, program to program, etc.).

User Interfaces: A "user interface" is the layout of the user's interaction with a computer. "Protocols" are the agreements, forms, and interactions between the various parts of a communications system or network. Keyboards, Mouse, commands, and menus are examples of user interfaces that you use to interact with a computer.

2.2 Data Processing

These systems are referred as Information systems. Data are most valuable when displayed correctly. These systems typically modify raw data into information.

Data is the figures or lettering. It represents capacity from the genuine globe. A datum refers single real-world capacity. Measured information is algorithmically derived, logically inferred, or statistically calculated from various data.

Although, data conversion would be the most natural and accurate phrase, "data processing" can refer to any operation that transforms data between different formats.

The process of transforming information into data and then back into information is known as data processing.

2.2.1 Data

Data is any unprocessed information such as facts, figures, and text. It comprises:

- Information about operations or transactions. For example sales, costs, inventories, payroll, and accounting.
- Information including industry sales, forecasts, and macroeconomic information.
- Metadata is information about the data, such as definitions from a data dictionary or a logical database design.

2.2.2 Information

These data's patterns, interactions, and affiliations may have information. For instance, analysing transaction data from retail point-of-sale systems might reveal when products are selling.

2.3 Block Diagram

Every time a computer is used, there are three fundamental stages it must go through in order to finish any task. Input, processing, and output are these. These steps are completed by a computer executing a agenda. A program is a set of detailed instructions that specify the processing of computer to get the desired result.

2.3.1 Input

Intake of data by a computer is the focus of the input stage of computing. This is accomplished using input devices. The keyboard and mouse are the two most often utilised input methods.

2.3.2 Processing

The application includes instructions on how to handle the input. The computer uses the recently input data to execute these instructions during processing. The output quality that the computer generates after this phase depends on the program's instructions.

2.3.3 Output

It is the processed data in the form of information. This information is valuable to the user. It is done using output devices.

2.4 Computer System Architecture

The computer's 'brain' is located here. All of the searching, sorting, maths, and decision-making happen here. By executing software instructions, the CPU takes the input from the

devices (Keyboard, mouse etc) and transforms it into relevant information. After this the output data is transferred to printers and monitors.

The central processing unit (CPU) is a silicon chip microprocessor made up of micro electrical switches known as "transistors." Megahertz (MHz) or Gigahertz (GHz) are units used to express how quickly a processor performs its tasks. The processing speed of the computer increases with the MHz value. Today's typical CPU operates at 3 GHz or more.

2.5 Input Devices

Before processing the data it must be converted into device legible form and to be entered into the PC by a put in devices Several input devices will be introduced in this section.

2.5.1 Keyboard

It is the most popular input device for entering data and commands into computers. It is organised into four primary regions, each with a set of alphabetic, numeric, and function keys:

Function keys are on the top, letter keys are in the middle portion. There is a numeric keypad to the right. Keys for editing and cursor movement are also there.

A QWERTY keyboard is the configuration of the keys on a keyboard. It is used in many nations. QWERTY is in the first six keys on the top row of the alphabetic characters. Other keyboards include incorporated wrist support, while others offer additional Internet keys.

Hundreds of times every second, the computer's processor checks the keyboard to determine whether any keys have been pressed.

Advantages:
- Is commonly attached to computers.
- It is the means for text and number data input.
- Data can be entered quickly by a proficient typist.
- There are specialty keyboards available.

Disadvantages:
- Mistakes might happen while entering data
- It may be quite time-consuming process
- Entering data, such as the specifics of diagrams and images, is particularly challenging

2.5.2 Mouse

The most common pointing device you will encounter is a mouse. You can slide it about the desk to adjust the on-screen cursor's position and movement.

The mouse's buttons allow you to click and drag items about the screen and choose options from menus. 'Mouse click' is the sound made when a mouse button is pressed. The terms "double click," "click and drag," and "drag and drop" may be familiar to you.

Most mice move in the direction using a little ball that is situated underneath them. Two rollers inside the mouse rotate. One is for recording in an east-west direction. The computer moves the pointer based on information the mouse gives to it about how far and in which direction the ball is turning.

Advantages:

- They work well with desktop computers
- Most computer users are accustomed to using them.

Disadvantages:

- They require a flat surface area next to function
- It is difficult to operate the mouse with a laptop, notebook, or palmtop. Touch sensitive pad is required.

2.5.3 Trackball

The pointer on the screen is moved when you turn the ball with your hand. It operates with extremely minimum room requirements and frequently works in conjunction with computer-aided design. It features buttons like a regular mouse. Instead of a traditional mouse, you will frequently find a little trackball incorporated into laptop computers.

Advantages:

- It is helpful with laptops as they can be integrated into the keyboard.
- It is useful where flat space next to the computer is restricted.

Disadvantage:

- Not included as standard, thus they cost extra

2.5.4 Joystick

It is similar to tracker ball, with the exception that you move the stick rather than a rolling ball. Computer games require joysticks to be played. An ordinary joystick has eight directions in which it can be moved.

The computer uses the information provided by the joystick, which indicates the direction in which it is being moved, to, for instance, drive a racing vehicle on the screen. Several buttons on a joystick may also be used to initiate activities like firing a missile.

Advantage:

- When you shift the stick, a direction change is immediately felt.

Disadvantages:

- It can break easily.
- Some people may find it challenging to use

2.5.5 Touch Screen

These screens serve the same purpose as concept keyboards. The screen has a grid of thin wires or light beams running over it. When you press the screen the computer senses it since the rays are blocked.

Since they are user-friendly and convenient, touch screens are frequently used as input devices in public locations including airports, museums, ATMs, etc.

Advantages:

- Easy to use
- No further peripherals are required beyond the touch screen display itself
- Neither computer system proficiency nor expertise required to use it.

Disadvantages:

- It is quite expensive
- Entering large data is not possible
- Does not work with accuracy
- Touch displays are not reliable

2.5.6 Digital Camera

A digital camera resembles a traditional camera. It makes use of several light sensors. When a photograph is taken, sensors that are at the behind of lens convert the colors that make up the image into digital signals (binary).

Digital cameras allow to view the image instantly and you can erase it if you don't like it.. The image can be uploaded to a computer and can be edited by using photo editing software. The resolution of each image determines how much memory it uses. The number of dots that make the image determines the resolution. More the dots sharper the image is.

Advantages:

- Photographs can be printed, distributed via email, or uploaded to websites.
- Unwanted photographs can be immediately erased.
- Editing or enhancing images is possible

Disadvantages

- They are typically more expensive than conventional cameras
- Photographs take up too much memory space

2.5.7 Scanner

A scanner captures still images and text that can be used on a computer. During scanning beam of light shines onto the surface of the object. The reflected light builds up the image.

Commonly used scanners are Flatbed and Handheld

Most popular one is flatbed. It is similar to a Xerox machine. Flatbed scanners are more accurate.

Handheld scanners are rolled across the image which is to be scanned.

Advantages:

- Flat-bed scanners are more accurate as compared to a digital camera
- Image in Computer Format

Disadvantages:

- Scanned images consume memory space.
- Quality of image largely depends upon the original image..

2.5.8 Graphics Tablets

They are used by designers and illustrators. A graphics tablet has a flat pad (the tablet) on which a drawing can be made by using a special pen. Image is created on the screen when you draw. It produces accurate screen design. It is accurate to within hundredths of an inch. Device called puck is used to draw on the graphics tablet.

Advantage:

- It is the most efficient tool for accuracy.

Disadvantage:

- Clicking on the tools is sometimes difficult.

2.6 Output Devices

2.6.1 Monitor

Very first window that we see just after loading operating system is called as monitor.It displays the output on the screen.

Measures of a monitor are 17 inches, 19 inch, 20 inch and 21 inches. Output quality depends upon the resolution, contras, viewing angle and how fast it refreshes the screen.

The picture on a monitor is made up of pixels. The quality of the picture on a monitor depends on pixels. Denser pixels give the clarity to the screen image.

Matrix of dots of Red, Green and Blue (RGB) displays millions of colors.

The two most common types of monitor are:

1. Cathode-ray tube (CRT): Used in computer monitors and Televisions.
2. Liquid crystal display (LCD): Used in Portable electronic games, Video projection systems etc

Advantages of monitors

- Affordable
- More Reliable

- Display in a wide range of colours

Disadvantages of monitors:
- Results disappear when the computer is switched off
- Limited information can be displayed at once.
- Fragile glass screens

2.6.2 Printers

Printers produce outputs on papers. Output can be in the form of a text or image on paper. Colour Printers gives the colored outputs. Special paper can be used for generating photographs also.

There are three main types of printers. Classification is based on purchase costs, running costs, quality and speed.

- Laser
- Dot Matrix
- Inkjet

2.6.3 Plotter

A plotter is a type of output device used to produce high-quality, large-scale graphics such as architectural blueprints, engineering designs, maps, and other technical drawings.

Advantage:
- Larger paper sizes than those found on most printers can be used.

Disadvantages:
- Plotters are slower than printers.
- Cost is more as compared to printers.

2.7 Summary
- ❖ CPU takes the input from the devices (Keyboard, mouse etc) and transforms it into relevant information
- ❖ Data must be converted into machine-readable form and to be entered into the computer by a input devices

❖ Very first window that we see just after loading operating system is called as monitor

❖ Printers produce outputs on papers. Output can be in the form of a text or image on paper.

2.8 Key words

- Input
- Output
- Pixels

2.9 Self Assessment Questions

- Explain the difference between data and information.
- Explain the examples of input, output and processing devices.
- Write a short note about the architecture of a computer system.
- Give three examples of input devices and explain advantages and disadvantages of the same.
- Discuss how plotter is different from a printer?

Unit: 3

Number System

Learning Objectives:

- To understand the Number system.
- To understand the binary addition, binary subtraction.
- To understand Floating Point representation of numbers.

Structure:

3.1 Introduction to Number System

Decimal number takes up ten values i.e. from 0, 1, 2, 3, 4, 5, 6, 7, 8 and 9. On the other hand binary number takes only two values i.e. zeros and ones.

3.1.1 Description of Number System

(a) Binary Number System

Its base is '2' and digits used are 0 & 1.

(b) Octal Number System

Its base is '8' and digits used are 0 to 7.

(c) Hexa Decimal Number System

Its base is '16' and digits used are 0 to 9 with letters A to F.

3.2 Representation of Integers

Integers and floating-point numbers are treated differently in computers.

There are two representation schemes for integers:

Zero and positive integers are represented by *Unsigned Integers*

Zero, positive and negative integers are represented by *Signed Integers.* For signed integers three representation schemes had been proposed which are given below:

Representation of Sign-Magnitude

Representation of 1's Complement

Representation of 2's Complement

3.3 Octal and Hexadecimal representation of numbers

3.3.1 Octal Number System

- It has eight digits, 0, and 1,2,3,4,5,6,7.
- It has base 8
- Example Octal Number: 125708

3.3.2 Hexadecimal Number System

- It has 16 digits – 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, F.

- It has values from 0-9. After this A = 10, B = 11, C = 12, D = 13, E = 14, F = 15.
- It has base 16
- Example 16 X where X represents the last position - 1.

3.4 Decimal to Binary conversion

Let's understand the conversion with the help of an example:

Convert $(101.101)_2 = (?)_{10}$

101.101

$= 1 \times 2^2$

$+0 \times 2^1$

$+ 1 \times 2^0$

$.1 \times 2^{-1} + 0 \times 2^{-2} + 1 \times 2^{-3}$

$= 1 \times 4 + 0 \times 2 + 1 \times 1.1 \times (1/2) + 0 \times (1/4) + 1 \times (1/8)$

$= 4 + 0 + 1.(1/2) + 0 + (1/8)$

$= 5 + 0.5 + 0.125$

$= 5.625$

Therefore $(101.101)_2 = (5.625)_{10}$

3.5 Binary Addition

The following is the binary addition table

A+B	SUM	CARRY
0+0	0	0
0+1	1	0
1+0	1	0
1+1	0	1

Example :

Add (1010)₂ and (0011)₂

    1010 (Augends)

    0011 (Addend)

——— ——— ——— ——— ——

    1101 (sum)

——— ——— ——— ——— ———

The addition is operated above as following .

Step-1:   The least significant bits are added, i.e. 0+1=1 with a carry of 0

Step-2:   The carry in the previous is added to the next higher significant bits, i.e.
0+1+1=0 with a carry 1.

Step-3:   The carry in the previous is added to the next higher significant bits, i.e.
1+0+0=1 with a carry 0.

Step-4:   The preceding carry is added to the most significant bit i.e. 0+1+0 = 1 with a
carry 0.

Thus the sum is 1101.

3.6 Subtraction of Numbers

The following is table for Binary Subtraction

A+B	DIFFERENCE	BORROW
0-0	0	0
0-1	1	1
1-0	1	0
1-1	0	0

Example:

<div align="center">

Subtract (0101)2 from (1011)2

1011 (Minuend)

0101 (Subtrahend)

—— —— —— —— — ——

0110 (Difference)

—— —— —— —— — ——

</div>

Steps:

Step-1:   The LSB in the first column are 1 and 1. Thus, the difference is 1 - 1 = 0

Step-2:   The column, the subtraction is performed as 1-0=1

Step-3:   In the third column, the difference is given by 0-1=1

Step- 4:   In the fourth column (MSB), the difference is given by 0-0 = 0 since 1 is borrowed for the third column.

3.7 Binary Multiplication

The following is the Binary Multiplication table

A*B	PRODUCT
0*0	0
0*1	0
1*0	0
1*1	1

Example:

Multiplicand * Multiplier

10110.1x01001.1

_____

101101

101101

000000

000000

101101

000000

_____

011010101.11   (Final product)

_____

3.8 Binary Division

The following is the Binary Division table

A÷B	PRODUCT
0÷0	Undefined
0÷1	0
1÷0	Undefined
1÷1	1

Example:

Dividend ÷ Divisor

$$11011.1 \div 101$$

$$101.1 \quad \text{(QUOTIENT)}$$

DIVISOR 101 √11011.1   (DIVIDEND)

101

_____

111

101

_____

101

101

_____

0

_____

3.9 Floating Point Representation of Numbers

Example:

6.6310×10^{-34} (Planck's constant)

The first bit describes the non-zero part of the number which is known as the 'Mantissa', the second part describes how many positions the decimal point needs to be shifted. This is

known as the 'Exponent'. It can be positive when shifting the decimal point to the right and negative when shifting to the left.

6.63   x 10^{-34}

Mantissa   Exponent

If it is needed to write out that number in full, one will have to shift the decimal point in the exponent 34 places to the left, resulting in:

0.00000000000000000000000000000000663

This would need a significant amount of time to write and make it difficult for the naked eye to count the zeros. Planck's constant, for example, is a multi-digit quantity that can be stored in a small number of digits when we are willing to accept a particular level of accuracy (6.63 = 3 significant figures). You are constantly balancing the accuracy (number of significant bits) of the number with its scope (or range).

3.10 Summary

Binary System is very important technique. Computer can only understand language of 0 & 1 to respond to a command

3.11 Keywords

- Integers
- Floating Point representation of numbers
- Mantissa

3.12 Self-Assessment Questions

- Discuss the characteristics of the Octal Number System
- Explain binary division with the help of an example.
- Explain binary addition and subtraction.

3.13 Case Study

Mr. X from school ABC organised a game of binary calculation and several students participated in the same. He provided following equation to be calculated based on the basis of binary calculation: 0*1÷1+1-0 and asked to provide the correct answer for the same by following the BODMAS rule.

1. What is the correct answer for the same?

   Answer- 1

2. What is the answer of 1's complement?

   Answer- 0

Unit: 4

Computer Memory

Learning Objectives:

- Defining memory cell
- Comprehending the Characteristics of Memory Cell
- Understanding types if storage in a computer
- Read-Only Memory and types
- Random Access Memory and its types
- Serial Access Memory

Structure:

4.0   Introduction

4.1   What is Computer Memory?

4.2   Why is computer memory so important?

4.3   What is a memory cell?

4.4   Storage

4.5   Quantity Information

4.6   Types of Computer Memory

4.7   Output

4.8   Important Terms

4.9   Questions for Self-Assessment

4.0 Introduction

The maintenance of a computer's performance requires a variety of factors. Computers need memory to store data that the central processor unit uses to process and execute instructions in order to operate effectively. This chapter will explain to us what computer memory is, why it's crucial, and the various kinds of computer memory.

You need a way to store the data if you want to keep all your work on your computer. Many storage systems can take care of this for you. Hard disks, floppy disks, CD-ROMs, and DVDs are a few of the more popular types you have encountered.

When looking into SSDs or memory, you've encountered a memory cell. You may have also come across acronyms like SLC, MLC, or TLC. These words describe various memory cell types that are utilized by flash storage. Any time you purchase a USB flash drive, SD card, or SSD, you will discover these variations in your available alternatives.

4.1 What is Computer Memory?

Memory can be internal or external. It stores the data and instructions. It has memory cells with different identifying number.

Memory stores the instructions to be proceed, under processed and already processed.

4.2 Why is computer memory so important?

Computer memory is essential because without it, devices instructions cannot be processed. It manages the task and maintains your computer. You can also employ specific sorts of data to save information for later use.

4.3 What is a memory cell?

The tiniest data storage unit is a memory cell. Another name for it is a binary memory cell. One piece of data can be stored in a memory cell.

Although the computing industry uses various memory cell types, NVRAM (Non-Volatile Random Access Memory) cells are the most often employed in SSDs and other storage devices. Non-volatile cells retain the value they were given whilst in use, even after you turn them off.

A single memory cell:

A dynamic cell comprises a transistor and a capacitor.

A static RAM contains around five transistors.

4.3.1 Where are memory cells found?

Memory cells of any kind, whether RAM or ROM, can be found in almost every part of the computer.

Many little segments make up the memory. For instance, a memory unit holds $64 \times 1024 = 65536$ memory locations if the machine has 64k words. These places have addresses ranging from 0 to 65535.

There are mainly two types of memory.

- Internal Memory: Primary and cache memory
- External memory: Examples include Magnetic disks, optical disks, etc.

4.3.2 Characteristics of Memory Cell

Characteristics of the memory hierarchy are as follows:

The amount of storage capacity grows.

Storage becomes less expensive per bit.

The CPU's ability to access memory quickly reduces.

The CPU's access time increases.

4.4 Storage

Bytes measure a computer's storage capacity. The smallest data unit that can be stored is a byte consisting of 8 bits (also known as binary digits).

Binary numbers, such as 1 or 0, represent bits.

A keyboard letter, number, or symbol equals one byte (a binary term).

More storage is required to keep the work safe.

Typically, Kilobytes (kB), Megabytes (MB), and Gigabytes (GB) are used to describe a computer's storage capacity (or, on really big systems, Terabytes!).

4.5 Quantity Information

Bit: It is the smallest unit of data which is either a 0 or 1

Byte 8 bits: It is the series of 0s and 1s, e.g. 00111010

Each keyboard character = 1 byte

Kilobyte (kB): 1000 keyboard characters = 1000 bytes or 1 kB (kilobyte).

Megabyte (MB): 1000 kilobytes = 1 MB (1 million keyboard characters)

Gigabyte (GB): 1000 Megabytes = 1 GB (gigabytes or 1 billion characters)

4.6 Types of Memory

4.6.1 Internal

Where smaller bits of information are stored is called as internal memory. It is considered as primary memory. Chips comprise internal memory. RAM and ROM are the two primary types into which internal memory is separated.

4.6.2 Random Access Memory

Internal memory of CPU is called as RAM. It is temporary in nature.

RAM is also referred to as "volatile memory". When the device is turned off this memory is lost. The work done is saved in RAM..

The size of RAM has grown as operating systems and computer programs have become more complicated. Nowadays, most PCs come with 256MB or 512MB of RAM.

RAM is of two types

Static RAM

Dynamic RAM

4.6.2.1 DRAM, or dynamic RAM

DRAM- Dynamic random access memory is the type of RAM used in contemporary gadgets like laptops, desktop computers, portable electronics, and gaming systems. It produces high-capacity memory and is the less expensive of the two forms of RAM.

It is constructed of two parts—transistors and capacitors—that must be recharged periodically in order to maintain data retention. It has volatile memory, just as RAM, and loses data when the power goes out.

DRAM, needs to be refreshed. It rewrites the data many hundred times per second.

4.6.2.2 SRAM, or Static RAM

Static Random Access Memory (SRAM) stores the data as long as there is electricity in the system. It costs more than DRAM since it retains power for a longer period of time, which usually prevents it from being as popular. SRAM is quicker than DRAM because it is frequently used as cache memory by users

SRAM utilizes more chips because matrix has more room. It increases the cost of production.

4.6.3 Read-Only Memory (ROM)

Another type of primary internal memory is read-only memory (ROM), although unlike RAM, ROM is non-volatile and retains data over time. 'Non-volatile memory' is another name for this kind of memory.

A ROM chip is placed on the motherboard of a computer. The BIOS is another name for this program.

A ROM is an ideal option whenever any data needs to be permanently stored. For example many automotive computers will have ROM chips that are used to run the relevant engine.

The various ROM kinds are as follows.

4.6.3.1 Masked ROM (MROM)

Devices with a pre-programmed collection of data or instructions and had Hard-wired made up the earliest ROMs. These ROMs fall under the category of "masked ROMs." It is an affordable ROM.

4.6.3.2 PROM - Programmable Read-Only Memory

It is read-only memory. Blank PROM can be used to enter the desired data by using PROM application.

4.6.3.3 EPROM - Erasable Programmable Read-Only Memory

During programming, an electrical charge gets trapped in an insulated gate region. The charge lasts for more than ten years since it lacks an escape or leakage path. When in use, a sticker seals the quartz cover.

4.6.3.4 Electrically Erasable Programmable Read-Only Memory (EEPROM)

Electrical currents are used for programing and erasing the EEPROM. It has more than ten thousand reprogramming and wipe cycles.

4.6.4 Serial Access Memory

Sequential access requires the system to look through the storage device. It starts with the memory address till it locates the needed data. A Sequential Access Memory, or S, is a memory device that permits such access.

Data storage devices that read data sequentially are called serial access memory (SAM).

Sequential access memory allows for uncontrolled access by "seeking" the desired position. However, this process could be more efficient.

4.6.5 Cache Memory

It accelerate the CPU. It serves as a buffer when main memory is used.. Operating systems move data and program components from disk to cache memory so CPUs can access them.

Advantages

Faster than main memory

Takes less time to access

It keeps the programs that can run quickly in storage

Data is stored for short-term use

4.7 Summary

➢ The computing industry uses a variety of memory cell types.

➢ Non-volatile cells retain the value they were given whilst in use even after you turn them off.

➢ A cell in dynamic RAM memory has a transistor and a capacitor.

➢ A cell in static RAM memory contains roughly five transistors

➢ Memory cells of any kind, whether they are RAM or storage, can be found in almost every part of the computer.

➢ Bytes are used to measure a computer's storage capacity.

➢ Binary numbers, such as 1 or 0, are used to represent bits.

➢ Terabyte (TB) Equal to 1,099,000,000,000 bytes.

➢ CD ROM disks have a capacity of 650 MB.

➢ PROM is read-only memory that a user can only modify once.

➢ Electrical currents are used for programming and erasing the EEPROM.

➢ Random Access Memory, as opposed to ROM, is volatile memory.

➢ RAM is of two types: Static RAM and Dynamic RAM

➢ DRAM, is to be refreshed to keep the data.

➢ Serial Access Memory is frequently employed as supplementary storage in general-purpose computers

4.8 Keywords

● Non-volatile memory

- Volatile memory

- Byte

- Mounting

- Supplementary Storage

4.9 Self-Assessment Questions

1. Explain three ways in which RAM is different from ROM.

2. Differentiate between volatile and non-volatile memory using suitable examples.

3. Define the concept of memory storage and bytes. Name the different types of bytes.

4. What are the advantages of cache memory?

5. Differentiate between RAM and ROM. Also, state its different types.

6. Discuss how a computer's storage capacity affects its performance.

Unit: 5

Computer Hardware

Learning Objectives:

- To understand the concept of storage capacity
- Define Internal Computer Hardware Components
- Learn about Physical Devices used to Construct Memories
- Acquire knowledge about different types of data storage and storage devices

Structure:

5.0   Introduction

5.1   Internal Computer Hardware Components

5.2   Physical Devices Used to Construct Memories

5.3   External Memory

5.4   Output/Summary

5.5   Important Terma/Keywords

5.6   Questions for Self-Assessment

5.0 Introduction

Any sort of tangible component of a digital or analogue computer will be called as "computer hardware" altogether. The term "hardware" is tangible and term "Software" in non tangible. Software tells hardware what task is to be completed. A machine cannot work if there is no coordination between hardware and software.

5.1 Computer Hardware Components (Internal)

Inputs are stored and processed by these internal components. They are composed off:

Motherboard: It is a circuit board which is a hub for all other hardware components. It is mostly present inside the central processing unit (CPU) and is very important hardware.

CPU: It is responsible for processing and executing digital instructions from multi level programs. The CPU's clock frequency impacts the computer's overall performance and results of data processing.

RAM: RAM is an interim memory that provides programs on-the-spot access to data. Because RAM is eruptive memory and any stored data vanishes when the machine is closed.

Hard disk: This storage device, which functions a bit like a filing container, stores all applications and data. If a comparison is made in between floppy disk and hard disk in context to speedy data access, hard disk will result out as quicker option.

The whirring sound a hard drive generates is caused by the millions of times per minute it spins inside its metal case. Although external drives that plug into the computer are also available, most hard disks are installed inaccessibly inside computers.

SSD or solid-state disk: An SSD, or Solid State Drive, is a type of storage device that uses solid-state memory to store data persistently. Unlike traditional hard disk drives (HDDs), which use spinning disks and magnetic storage to store data, SSDs have no moving parts and store data electronically on interconnected flash-memory chips.

Heat sink: It reduces heat from the system's parts to control their temperature which in turn helps them to function normally. The heat sink is typically mounted on the top of the internal component.

Graphics Processor: It handles graphic data. It is chip based.

NIC or Network Interface Card (network adapter): It enables the computer to connect to a network. It facilitates the Ethernet network.

Semiconductors, transistors, power sources, and USB ports are also the Internal hardware's.

5.2 Physical Devices Used to Construct Memories

The amount of RAM installed in your computer is known as physical memory. The operating system, as well as particular apps and files, are loaded onto your computer using this RAM.

What are physical devices? They are any computing device that deals with input/output, storage, etc., such as a disk, printer, modem, or screen.

What is the physical memory of a computer? Physical memory is simply the computer's physical RAM, typically installed on motherboards as cards (DIMMs). It is the only storage type that the CPU can way in directly and is often referred to as primary memory. It contains the executable program instructions.

High physical memory utilization is due to a flaw in a process that would typically be much less resource-intensive or by running too many resource-intensive apps. Numerous factors might contribute to slow processing, some of which will be more challenging to address than others.

What are physical computer devices?

It is a collection of all the computer's touchable components, including the keyboard, mouse, display, etc.

Physical memory, often referred to as random-access memory (RAM), is a quick but unstable way to store data. Physical disks are frequently timed in milliseconds (10001), but RAM modules are commonly timed in nanoseconds (10003).

What kind of memory is used in a computer?

Memory in computing refers to the actual hardware used to temporarily or permanently store data, such as program state information or programs (order of commands) for use in a system or other digital electronic device.

5.3 External Memory

Secondary memory, also referred to as external memory, is memory that isn't directly connected to the CPU and which is removable as per the need. People use various types of External Memory in their gadgets.

Examples include CDs, flash drives, memory chips, and external hard drives. With the help of External Memory, data can be stored, transferred and accessed in any other suitable device.

Floppy Disk

Floppy disks, which have been around since about 1980, are among the earliest types of mobile storage devices still considered for usage.

You can create backup copies of your work to guard against losing it using the floppy disk drive to fetch micro files between different systems. The material used to create floppy disks is known as Mylar. They have a magnetic surface that enables data to be recorded. While the first (3 1/2 inch) floppy disks were actually "floppy," the ones we use today are covered in hard plastic. The read/write head may access the disk because the disk rotates in the drive. The maximum capacity of Floppy Disk is 1.44 Mb which equalizes to text of approximately 300 pages on an A4 size page. However, as graphic images are frequently quite huge, floppy disk are not suggested mediums to work on those files.

Prior to writing data to the disk, all disks must be formatted. The disk is divided into sectors during formatting so that data files can be put there. Pre-formatted floppy disks are frequently marketed.

Floppy Disks should be handled carefully to safeguard the data. You should avoid touching the disk's surface and keep it away from hot or cold places and strong magnetic fields like those that may be present next to speakers, as doing so could cause all of your data to be lost.

Zip Drive

The Zip drive resembles a floppy disk but has a storage capacity of 100 MB to 250 MB, which is approximately 70 times greater than a floppy.

The Zip disk requires a separate drive and is marginally thicker than a floppy disk. Zip disks are very helpful for recovering crucial data and for quickly transferring data between computers. Data is compressed to make big files to fit on a floppy disk smaller.

Magnetic Tape

Magnetic tapes are considered as the most popular media for bulk data holding, back-up, archiving, and exchange. Hard disk and tape have historically had a far higher capacity-to-price ratio than hard disk, but the two have moved closer together recently. Numerous formats exist, many exclusive to specific platforms or industries, such as mainframes or a specific type of personal computer.

Though entrance time on tape is slow, the rate of continuous exploration of data is quick as the tape is a sequential access medium.

Examples of organizations using this medium:-

- Space Borne Photography companies have a pile-up of many photographs.
- Film studios that store their digital films in archives
- Companies that specialize in architecture, automobiles, and design and hold hundreds of CAD drawings.
- Scientific institutions like CERN keep the outcomes of previous experiments.
- Weather service providers.

There are two types of magnetic tape:

- Tape reels: It can store huge data and used for backup data from mainframe systems.
- Cassettes or cartridges: It is small but stores enough data to back up the information stored on a personal computer or network.

Compact Disc

Compact discs hold the data that can be recovered or used at a later time. Software for your computer can be found on CDs. Storing music to play in a CD player and files to access on system.

A typical CD can store 650 MB of data or 72 minutes of music. Data on an 80-minute CD can be stored in 700 MB.

Compact Discs can be categorized on:

End-use: Video, Audio, Photo, Graphics

Operations: Read-Only, Recordable, Rewritable

Optical Drive

External memory known as an optical drive may store and read data using light. CDs, DVDs, and Blu-ray discs are the three most popular varieties. You insert the disc into the optical drive and the computer spins it so you can access the information on the disc.

It is scanned by an internal laser beam, which also downloads the data from the optical disk into the computer after receiving it. This sort of memory can be helpful because it often costs little, is simple to use, and holds a lot of data.

Magnetic Data Storage

Data is encoded as an electric current in magnetic storage devices, which have a covering of magnetic material. Small portions of a metal spinning disk are magnetized in this sort of memory using magnetic fields.

Each segment, which denotes a "1" or a "0," is quite large, frequently containing many terabytes of data. Users favor this sort of memory because it is inexpensive, robust, and capable of holding a large amount of data. Floppy disks, hard drives, and magnetic tape are examples of common magnetic storage media.

Solid State Drives

External memory in the form of solid-state drives makes use of silicon microchips. Solid-state drives are more contemporary than magnetic storage devices, but they share the ability to be removed from the device from which data is being stored or extracted.

The universal serial bus (USB) memory stick or USB flash drive are popular types.

Virtual Storage

Virtual memory transfers data to a paging file, a section of a hard drive that serves as an extension of RAM, when RAM space is running low. This is a transient process that ends once there is enough RAM space available.

5.4 Summary

- Storage capacity is determined in bytes.
- Kilobytes (KB), Megabytes (MB), and Gigabytes (GB) are common numbers used to describe a computer's storage capacity
- The Zip drive resembles a floppy drive but has a storage capacity of 100 MB, which is at least 70 times greater than a floppy
- Hardware for has internal and exterior parts. The whirring sound a hard drive generates is caused by the hundreds of times per minute that it spins inside its metal shell.
- You may quickly back up the work on DVDs for security.

5.5 Keywords

- Back-up

- Storage

- Hardware

5.6 Self-Assessment Questions

- Explain Storage Capacity? Discuss how it can be measured.

- Differentiate between RAM and ROM

- Differentiate between Megabyte and GigaByte

- Explain any three examples of storage devices.

- With the help of suitable examples discuss different types of files.

- Explain File Generations? Explain with the help of suitable examples.

Unit: 6

Programming Languages

Learning Objectives:

- Computer languages

- Classification of programming languages –machine, assembly, and high-level languages

- Common programming language tools

- Concepts of flowcharts and Decision Table

- Features of an Ideal Programming Language.

Structure:

6.0 Introduction

To do any task with the data supplied by the user, a computer needs instructions. A program is a combination of commands that are supplied to a device to carry out particular activities. The actions that are outlined by the software should be carried out by the computer. A program controls how a computer interprets and utilizes data.

set of instructions that carry out certain activities on a computer system is known as a program. Software instructs a machine to carry out a certain processing function or set of procedures. A combination of coding commands used to guide the device to perform sequence of calculations or operations is referred to as a program. The keyboard, a magnetic disk, or any other device can be used to enter these commands into the computer.

6.1 Features of Programming Languages

Programming Language is used as a tool to develop a Software program, which is a set of commands and grammar. Key characteristics of programming languages include:

- Syntax: A combination of protocols and structures used by computer language to write code.
- Data Types: Various types of values include booleans, strings, and numbers.
- Variables: Values can be stored in specific locations.
- Operators: Used for basic arithmetic operations on values.
- Control Structures: Guides the direction flow of a program, such as if-else statements, loops, and function calls
- Paradigms: It is a programming style which is used in the language, such as procedural, object-oriented, or functional

Some are JavaScript, Python, Ruby, C++, etc. Each language has its own advantages and disadvantages.

A programming language describes the sequence of commands for a computer to adhere in order to perform particular task.

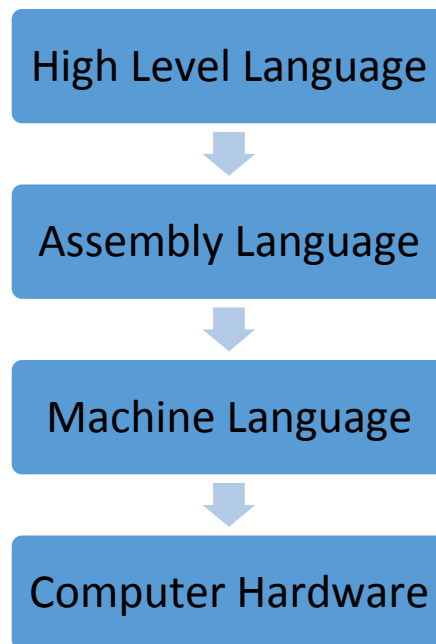**6.2 Computer language Hierarchy**

Figure 1: Hierarchy of Computer Languages

Few of the popular programming languages are mentioned below:

C and C++

Python, Java, SCALA

R, Ruby, Go, Swift, JavaScript

6.3 Programming Languages Characteristics

Features of an Ideal Programming Language are:

- Easy to learn
- Can be read by humans
- Can be translated into machine code
- Well organized.
- They have tools for testing.
- Should provide an integrated development environment (IDE)
- Should have the quality of 'abstraction' which increases usability

6.4 Benefits of Programming language

- Enhanced Productivity: Programming languages provides developers a combination of inputs that enable them to write code more rapidly and effectively.

- Portability/Flexibility: High-level programming languages are portable, meaning they may be used to create programs that run across a wide range of platforms and operating systems.

- Readability: Effective programming languages can help both the original author and other developers understand and read code more easily.

- Large Communities: There are sizable user and developer communities for many programming languages, which can offer assistance, libraries, and tools.

Programming language drawbacks

- Complexity: Particularly for beginners, learning some programming languages can be challenging and complex.

- Performance: High-level programming languages have a tendency to run programs more slowly than comparative minor-level languages.

- Limited Functionality: Few programming languages could lack native support for specific job types or might need additional libraries to carry out specific tasks.

- Programming language diversity may lead to division. It is hard to exchange code and work together with other developers.

6.5 The Need for Assembly Language

The computer directly decodes the 0-1 combinations that make up machine language code. However, the following issues exist with the machine language:

Writing in 0-1 Assembly Language forms is challenging for most people and heavily dependent on the machine.

DEBUGGING in programming is challenging as it's quite difficult to decipher the machine code. Thus, program logic will be challenging to comprehend.

To get around these issues, computer manufacturers created terms that sound like English and stand in for a machine's binary instructions. An instruction's symbolic code is known as a mnemonic. The letters that make up the mnemonic for a specific command suggest the action that instruction is supposed to take.

The mnemonic ADD is used, for example, to add two numbers. These mnemonics facilitate the symbolic representation of machine language instructions, with each machine instruction being represented by a single equivalent symbolic instruction. This is referred to as an assembly language.

6.6 Advantages of Using Assembly Language

Due to its ability to analyze the instruction set, addressing modes, interrupts, etc., assembly language gives you more flexibility over how to handle certain software and hardware components.

Assembler programming creates executable modules that are smaller and more compact. Because of this closer proximity to the machine, assembly programming may enable you to create highly optimized applications. As a result, programs run more quickly.

Programs written in assembly language have at least 30% more data in them than equivalent programs written in upper-level language. The reason behind this is that, in contrast to assembly language, which generates a single line of code for each instruction, compilers currently produce a lengthy list of code for each instruction. This will be especially true for programs that deal with strings in C.

Assembly language, on the other hand, is machine-dependent. There are unique sets of instructions for every CPU. Assembly programs are not portable as a result.

Assembly language has extremely few limitations or regulations; almost everything is up to the programmer's discretion. This allows programmers a great deal of flexibility when building their systems.

6.7 High Level and Low Level Languages

High-level Languages	Low-level Languages
It is a programmer-friendly language.	It is a machine friendly language.
High-level language is less memory efficient.	Low-level language is high memory efficient.
It is easy to understand.	It is tough to understand.
Debugging is easy.	Debugging is complex comparatively.
It is simple to maintain.	It is complex to maintain comparatively.
It is portable.	It is non-portable.
It can run on any platform.	It is machine-dependent.
It needs a compiler or interpreter for translation.	It needs an assembler for translation.
It is widely used for programming.	It is not used nowadays.

Figure 2: Table Illustrating the Difference Between High-level and Low-level Languages

6.8 Language Processors: Assembler, Compiler and Interpreter

Programs are created in high-level languages and are converted o machine code that a computer can read via compilers and interpreters.

Even though the mnemonics used to represent instructions in assembly language are not directly understandable by machines, a High-Level language is independent of machine. Machine code, or instructions that are expressed as 0s and 1s, is understood by computers.

System software called as language processor is used to translate programs written in high-level languages into machine code, where the program is then known as an object program or object code.

There are three different categories of language processors that can be used:

6.8.1 Compiler

A compiler is a language processor. It can read an entire high-level program written in source code and translate it into an equivalent machine code program in one sitting. For instance, C, C++, Java, and C#.

If there are no errors in the source code, a compiler can properly translate it into object code.

6.8.2 Assembler

The Assembler converts the Assembly language program into machine code. The source code is a set of assembly language instructions that is fed into an assembler. Assembler is required for humans and machines to connect with one another. The assembler can turn mnemonics (instructions) such as ADD, MUL, MUX, SUB, DIV, MOV etc into binary code.

6.8.3 Interpreter

It is a language processor which moves on to the next line after translating a single statement. If there is a problem in the statement the translator stops translating and creates an error message. After fixing the error the interpreter moves on to the next line. An interpreter reads the instructions line by line,

For instance, Python, Perl and Matlab.

6.9 Algorithm

Algorithms are used to describe a program's logic. It provides a step-by-step breakdown to solve a problem. It is the set of instructions which is carried out in the right order to produce the desired results.

An instruction set has following qualities:

- Every instruction needs to be clear and concise.
- Every instruction should be carried out in a set amount of time.
- A command or a series of commands shouldn't be repeated endlessly.
- The intended outcomes are attained when the instructions have been followed.

The verbose and confusing nature of natural language statements makes them unsuitable for complex or specialized algorithms.

Pseudocode and **flowcharts** are structured approaches to express algorithms that, while remaining independent of a specific implementation language, avoid numerous ambiguities present in regular language assertions.

Algorithm definition or documentation is frequently done using programming languages, which are primarily designed for expressing algorithms in a computer-executable form.

6.10 Flow Chart

An algorithm is depicted visually in a flowchart. In order to graphically organize the processes required to address an issue using a computer, programmers frequently use it as a

program planning tool. To indicate different types of instructions, it uses boxes with various shapes. Within these boxes, the real instructions are given in simple, direct language.

6.10.1 Symbol for flowcharts

In a flowchart, only a few symbols are required to represent the required steps in a process.

Terminal Symbol: denotes the start, stop, and halt points in the logic flow of a program. It is a flowchart's first and last symbol.

Input/Output Symbol: they represent all input/output functions in a program.

Processing Symbols: represent instructions for computation and data transport. This symbol also designates the logical operations that transfer data from one area of the main memory to another (assignment statement).

Decision Symbol: denotes a decision point, or a place where a line can split off and go in one of two or more different directions.

Arrowheads: The exact order in which the instructions are carried out is shown by flow lines with arrowheads, which also show the flow of operation. A flowchart typically moves from left to right and from top to bottom. Only when the standard flow is not followed do arrowheads become necessary.

Connectors: whenever a flowchart is too complicated connectors are used in place of flow lines or when the flowchart occupies more than one page.

6.11 Decision Table

The decision table represents the interaction of circumstances and actions. It is like the if/then rules set. The key advantage is that more than one condition determines the action in a decision table, and more than one action can be connected to each set of criteria. The appropriate action or acts are only possible if the necessary requirements are fulfilled.

6.12 Summary

- A computer program is a set of instructions to carry out certain activities on a computer system.
- Few of the popular programming languages are Ruby, JavaScript, C++, Python, and Java.
- Programming languages have their own advantages and disadvantages.

- High-level programming languages have a tendency to run programs more slowly than lower-level languages.

- Some programming languages could lack native support for specific job types or might need additional libraries to carry out specific tasks.

- Programs written in assembly language have at least 30% more data as compared to high-level language

- Programming languages are either high-level languages or low-level languages.

- Programs created in high-level languages are converted into machine code that a computer can understand via compilers and interpreters

- Algorithms describe a program's logic.

- Pseudocode and flowcharts are structured approaches to express algorithms.

6.13 Keywords

- Complexity
- Diversity
- Computer-understandable
- Mnemonics
- Perplexing

6.14 Self-Assessment Questions

1. Briefly explain a computer program and features of programming languages.
2. Write a short note describing the characteristics of programming languages.
3. What are the benefits of programming languages?
4. Why do we need to use Assembly Language? What are the Advantages of Using Assembly Language?
5. Differentiate between Languages of the High-Level and Low Level
6. Explain Language Processors: Assembler, Compiler and Interpreter
7. Define (1) Algorithm (2) Flow Chart (3) Decision Table

Unit: 7

Software

Learning Objectives:

- To understand the concept of a computer program

- Grasp the meaning of the terms 'Program' and 'Software'

- Learn about the different types of Software, their Functions and Features

- Know more about Programming Software and Components of a Programming Software

- Learn about Application Software: It's Functions & Features

- Differentiate between System Software and Application Software

Structure:

7.0   Introduction

A computer system's two main parts are software and the other is hardware. Software is a collective term for a group of computer programs. It instructs a computer what to do. It tells hardware what to do.

Let's begin by understanding the difference between a program and software.

Program Vs Software

SOFTWARE	PROGRAM
The collection of all programs that are run either concurrently or sequentially to complete a certain task is known as software. The outcome of multiple programs combined is this.	A collection of computer code lines that process input and carry out commands to generate output is called a program.

Software is an assemblage of scripts, instructions, and procedures that tell computers what to do. System software and application software make up the majority of it.

System software keeps the system updated and directs a running path for application software. It is important to understand that system cannot function without system software. It is multifunctional software.

7.1 Types of Software
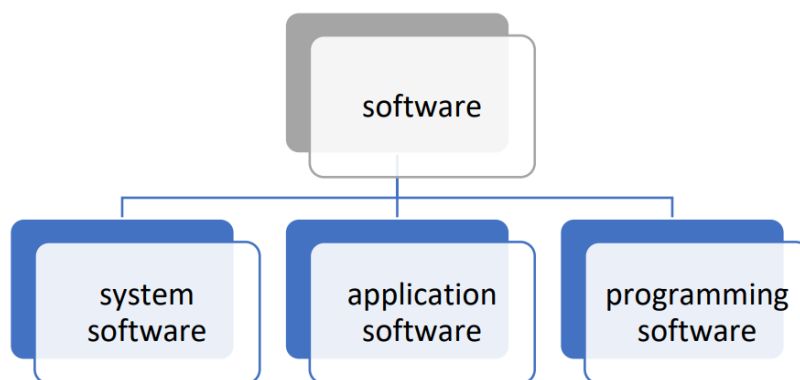
7.2 System Software

System software is the interface between system and application softwares. They are developed by using low-level programming languages. They provide running path for application software.

Example: The Basic Input/Output System (BIOS). It regulates the exchange of data among the operating system and other connected devices. The software also includes tools like the disk defragmenter and system restore.

7.2.1 Main functions of System Software

- Memory Management
- Processor Management
- File Management
- Security
- Error Detection

7.2.2 Features of System Software

- A low-level language is meant to create system software.
- The system software has a minimized file size.
- Comprehending system software is difficult.
- Hardware components are present close to system software.

7.2.3 Types of System Software

Operating System: It acts as an interpreter between software and hardware. For example when print command is given Operating System takes the instruction to printer for printing the document.

Language Processor: human-readable language is converted into machine language by language processor. It converts computer programs into commands that are understandable by machines

Device Driver: It is a system that works with a device to complete specific tasks. Before you can execute the software, a driver must be installed.

7.3 Programming Software

It consists of the programs and apps that software engineers use as tools to build, test, support, and maintain other programs and applications. The components of programming software are a compiler, a debugger, an interpreter, a linker, and a text editor.

Components of a Programming Software

Compiler- Converts High-Level language program into Low- Level language program.

Assembler- Converts an Assembly Language program into Low-Level language programs.

Interpreter- Processes high-level language line by line and simultaneously produces low-level programs.

Linker- Most low-level languages enable programmers to create big programs with many modules. All of the modules produced by the language translator have their object code organized by the linker into a single program.

Debugger- Software used to find programming faults and errors. It identifies the location of computer code faults.

Text editor- Enables computer users to work with texts.

7.4 Application Software

They are the kind of programs that functions when the user requests it. The application software is developed using high-level programming languages with a pre-specified function. The primary difference between system software and application software is that, the High-level maintenance system can always functions without application software but the System cannot function in its absence.

A few examples are word processors, presentation programs, data management tools, desktop publishing applications, and web browsers.

7.4.1 Application Software Functions

- Information and Data Management
- Document Management
- Images and Videos Creation
- Processing of Collaborative communication tools.
- Payroll Management ,Accounting and Financial management
- Management of Resource through ERP and CRM

7.4.2 Features of Application Software

- Application software are written in High-level languages
- More storage space is needed for application software than for system software.
- Each application software program completes a specific task.
- In comparison to system software, application software is simpler to develop.

7.4.3 Types of Applications Software

General-Purpose Software: They are used forvariety of jobs; Major examples include MS Word, MS Excel, etc.

Customized Software: is used to carry out duties created for certain businesses. As an illustration, consider the reservation systems for railroads and airlines.

Utility Software: They are required to perform highly specialized tasks.Example: Partition of Drives in computer.

7.5 Difference between System Software and Application Software

System Software	Application Software
Low-level languages are used to write the system software.	High-level languages are used to write application software.
It is general-purpose software.	It is a specific purpose software.
A system cannot function without system software.	Application software does not interrupt the working of the system.
The system software operates in the background till computer shuts down	Application software runs in the front end as per the user's request.

7.6 Summary

- Software is the set of instructions required to complete a certain task. It is the result of several programs combined.
- A program is a collection of lines of computer code that processes input and executes instructions to produce output.
- System Software is the interface between application software and the hardwares.

- System software uses a language processor to translate human-readable language into machine readable language.
- The components of programming software are a compiler, a debugger, an interpreter, a linker, and a text editor.

7.7 Keywords

- Disk defragmenter
- Memory Management
- Processor Management
- File Management
- Error Detection

7.8 Self-Assessment Questions

1. Differentiate between System Software and Application Software
2. Describe the features and functions of Application Software.
3. Explain the components of programming software with suitable examples.
4. What are the salient features and different types of System Software?

Unit: 8

Operating System

Learning Objectives:

- Understanding the concept of an OS
- Learning about the Objectives of the OS
- Knowledge of the various views of Operating System

Structure:

8.0   Introduction to Operating System

8.1   Functions of the Operating System

8.2   View of Operating System

8.3   Important Terms/Keywords

8.4   Questions on Self-Assessment

8.5   Case Study

8.0 Introduction

An operating system is a bridge that is between computer hardware, software and users. An OS is software responsible for managing all the functions, including handling of input and output, controlling memory and processes, monitor extensions like disc drives and printers.

Definition: An OS manage the execution of all types of functions.
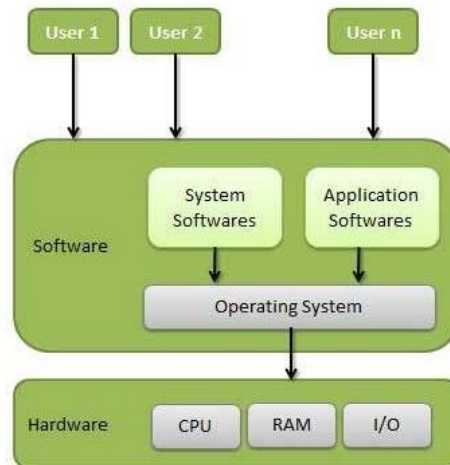
Figure 1: Overview of an Operating System

Most frequently used Operating Systems are Linux, Windows, VMS, etc.

Two goals of the operating system include:

(1) Controlling the hardware of the computer, and

(2) Giving the user a user-interactive interface and interpreting user commands so that the operating system may interact with the hardware.

An essential component of practically every computer system is the operating system.

8.1 Functions of the Operating System

8.1.1 Managing Hardware

Managing and controlling a computer system's different hardware resources is the operating system's primary goal.

The processor, RAM, disc space, and other hardware resources are included.

The monitor displays the output result. The operating system offers an error management process, displays an error notification, and connects with the hardware.

The operating system cannot communicate with a device that is not running properly.

8.1.2 Providing an Interface
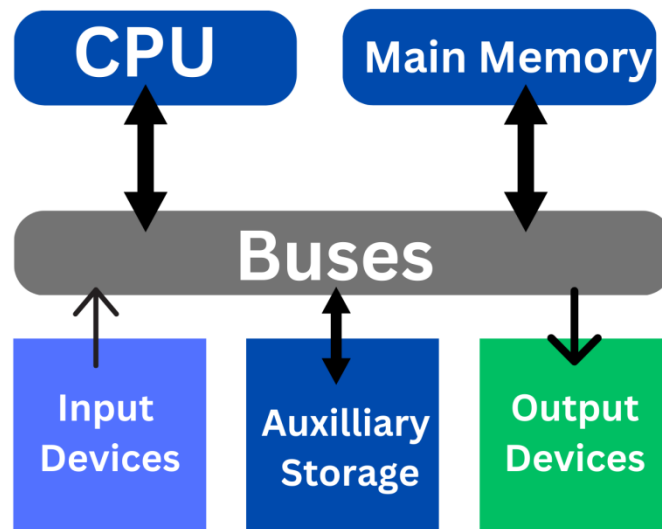
Figure 2: Operating System Serving as an Interface

The operating system arranges programs to make it simple for users to access, utilise, and save them.

It gives apps a consistent and reliable mechanism to interact with the hardware without requiring the user to know specific device information.

The application shows the relevant error message when a program isn't working correctly.

Five main parts of computers are:

➢ Operating System

➢ Utilities

➢ Application Programs

➢ Computer Hardware

➢ End User

An operating system is considered as the first program encoded with the computer, which stays in the memory forever. It regulates and programs different users.

8.1.3 System Goals

The primary goal of an operating system is to run programs and to make the computer system user-friendly. One of its secondary goals is to use the computer hardware best.

8.2 View of the Operating System

An operating system is an interpreter between user's hardware and software. It creates a

platform for various programs to carry out specific tasks.

You can view the operating system from the perspective of the user or the system.
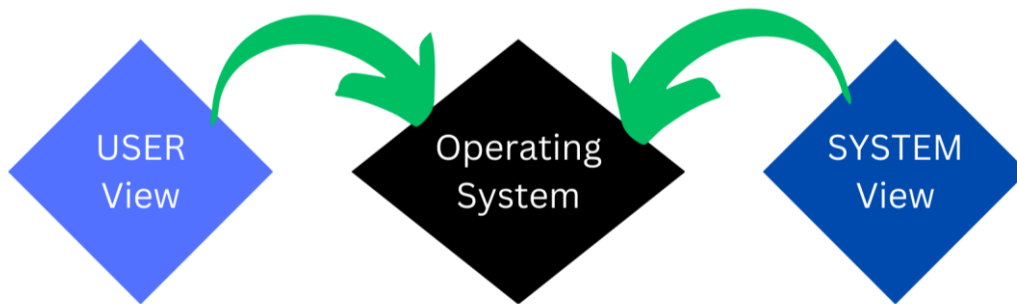
Figure 3: Views of Operating System

8.2.1 User View

Depending on the interface employed, different users see computers differently. Consider Windows XP, Vista, Windows 7, and more versions as examples.

User View is reflected by the system interface used by users. The various user view experiences can be explained in the following ways:

- If the user uses a personal system, the OS is primarily meant to simplify interaction. The system's performance is important, but the OS is not concerned about resource use due to the lack of resource sharing and the fact that the personal computer uses each and everything.

- If the user is using a system connected to a mainframe or a minicomputer, the operating system is mostly focused on resource utilisation. This is due to the possibility of several terminals linked to the mainframe and the operating system's careful distribution of all resources including CPU, memory, and I/O devices among them.

- Workstation must share files and other resources with other workstations on the network in addition to using only its own resources, this occurs.

- In case of using a cell phone or other portable micro sized computer, the OS manages the device with remote operations. The device's battery life is also taken into consideration.

Given that there is no user contact, some gadgets have very little or no user view. Examples include **embedded computers** in household appliances, vehicles, etc.

8.2.2 System view

The OS functions are given below:

- Interface between software and hardware.
- It controls the hardware

Following are some explanations of the various operating system view types:

- An operating system as a resource allocator. Processes require many resources to function, including as CPU time, memory, file storage, I/O devices, and more. The operating system distribute resources efficiently among processes to increase system performance.

- A control program is included into the operating system. It looks for every process and I/O device to guarantee that the computer system runs efficiently. It ensuresthat the I/O devices work properly without generating problems.Operating systems simplifying the use of hardware.

- In order to quickly resolve user issues, computers were necessary. However, working directly with computer hardware is not simple. Thus, operating systems were created to interact with hardware simply.

- An operating system can also be thought of as the **kernel**, a program that runs continuously in the background of a computer system and manages all application programs. The definition of an operating system that is typically used is as follows.

An operating system has hardware and software resources which include CPU, memory space, file storage space, time and I/O devices that may be necessary to address an issue. As a result of this, the operating system manages these resources.

Essential duties of an operating system are:

- **Security**: It uses passwords and similar methods to check unauthorized entry.
- **Monitoring:** Ensures that the system responds after receiving a request.
- **Tracking:** It keeps track of the time and resources of various jobs and users.
- **Error-detecting:** It employs debugging tools and monitors the creation of dumps, traces, and error messages.
- **Coordination:** It coordinates between users and other software. It distributes compilers, interpreters, assemblers, and other software to the system users.

8.3 Keywords

- Conducive

- Embedded computer

- Resource allocator

- Kernel

8.4 Self-Assessment Questions

1. State the relationship between operating systems and computer hardware?

2. What inconveniences can a user face while interacting with a computer system?

3. Explain the meaning and purpose of 'Views' in Operating Systems.

4. Write a brief summary about the Functions of Operating Systems.

8.5 Case Study

Title: Choosing the Right OS

Introduction

The introduction of various new versions of OS has increased competition within industries and companies in order to increase efficiency at various levels. The problem statement in this scenario is the target of updating the operating systems on 5000 computers in the Soap-n-Suds international soap manufacturing company.

Case Study:

Before installing a specified OS, there is a requirement to compare the different systems capable of running on various desktop types. Hardware components and their software requirements specification are to be considered.

Microsoft Windows – One of the most commonly used OS around the globe. It is easier to use and offers various graphical interfaces which are more efficient than competitors in use.

Mac OS – This OS is offered by Apple Inc. technology Firm. It provides various products and services within its OS. It includes including graphical interface design and shared application frameworks.

Linux OS – This open-source software operating system has numerous versions and is offered for free on the worldwide software provisional platform.

Question: Discuss the different concerns that should be considered before final implementation.

Unit: 9

Types of Operating Systems

Learning Objectives:

- Types of Operating Systems
- Operating System Management Tasks
- Memory Management

Structure:

9.0   Introduction

The operating system manages all fundamental functions, like controlling files, processing, and memory management, which means that the operating system, or resource manager, is responsible for managing all resources. The operating system acts as an interface between the user hardware and software. Following are the different operating systems, which are listed below.

9.1 Classification of Operating Systems

9.1.1 Batch Operating System

It does not allow for the direct user-computer interaction. Punch is an offline device where user finishes the task and sends it to the computer. Jobs which have comparable requisitions are batched together for processing. When programmers hand over their code, the operators arrange the programs that have comparable requirements into batches.

The following points find out the issues with batch operating systems:

    User and the task don't interact more.
     Mechanical input / output devices operate at a slower speed and the CPU is in idle state.
    Desired priority is difficult to be provided.
    Operating systems which are considered as Time-sharing

9.1.2 Multiprogramming or Time-sharing Operating System

Time-sharing or multitasking is the logical outcome of Multiprogramming. Time-sharing is allotting a processor's time simultaneously to some users. Several tasks by switching back and forth between them are done by CPU, yet this happens so frequently. By this process user can get a fast reply. Time-sharing systems have been added to computers originally designed as batch systems.

Advantages
- quick response time
- avoids software duplication
- reduces CPU idle time

Disadvantages
- Reliability issue

- Integrity and security of data compromised

- Data communication issue

9.1.3 Distributed Systems Operating System

By many communication lines, the processors can communicate with each other. These are referred to as distributed or loosely linked systems. Distributed system might vary in size and functionality of the processors. To describe the processors used sites, nodes, computers, and other terms.

The following are some benefits of distributed systems:

Communication speeds up

Even if one site fails, the remaining sites may be work.

Improved customer service

Reduction the workload of the host computer

Shorter processing times for data

9.1.4   The Real-Time Operating System

Real-time data processing is when where processing and reaction takes short amount of time that affects the environment. Here reaction time of a system means how long time takes to process user input and presents the necessary, latest information. A real-time operating system required clear, fixed time limits.

Following are the two types of real-time operating systems.

1. **Hard Real Time Systems:** Here important tasks finish on time. Hard real-time system Data is saved in ROM because of constraints of secondary storage. Virtual memory is missing in such systems.

2. **Soft Real Time Systems:** in the systems where using soft real-time are low constrained. In this priority is given to an important task and is maintained until it is finished.

9.2 Operating System Management Tasks

9.2.1 Processor Management

3. A program is useless till CPU processes the instructions. A word processor is time-shared user software that that is utilized only by one person. A process is considered

as a system task. For example generation of output from a printer. The process to finish the work requires a large amount of resources, including CPU time, input, output devices, memory files, etc. These resources are provided to the process during its formation or while it is running. These process management tasks are managed by the operating system.

- Creating and eliminating system and user processes
- Stopping & starting processes
- Providing a way of synchronizing processes
- Providing a process mechanism

9.2 2 Memory Management

In the modern computer system functions main memory is essential. In the main memory words or bytes with different sizes ranging from tens of thousands to billions.

The CPU can directly address & access is typically the main memoryis the only significant storage device. CPU processes data from a disc. The CPU cannot execute instructions unless they are in primary/main memory. The Operating system is responsible for following tasks related to management of memory.

- Monitoring the memory users
- Identify which applications to launch into main memory when memory space available or not.
- Assigning & releasing main memory space as necessary

9.2.3 File Management

A system may store data on various media types; making file management is the most crucial parts of the operating system. The most usable mediums are magnetic tape, magnetic disc, and optical disc. These features include access mode (random or sequential), capacity, data transfer rate, and access speed.

Following file management tasks is in charge of operating system:

- Adding and deleting files / folders
- File mapping for secondary storage
- Backing up data to non-volatile storage

9.2.4 Storage Management

The Basic function of computers is to run programs from the main memory. To protect primary memory, the computer system must offer auxiliary storage. The following disc management tasks fall under the purview of the operating system.

- Unrestricted space usage
- Storage management
- Disc Planning

9.2.5   The Batch Processing

It gathers the programs and data in a batch before processing starts. The following operations related to batch processing are performed by an OS:

- The OS identify a job—a predetermined commands, programs, and data—as a separate entity.
- The OS retains a various tasks in memory and handles their implementation without any input.
- Jobs are handled first come first basis.

Advantages

- Batch Processing increases performance as a new operation starts as soon as the preceding job is finished, without any manual involvement.

Disadvantages

- The program is difficult to debug, there is no protection against a batch job affecting pending jobs, and a job could go into an infinite loop.

9.2.6 Multitasking

When the CPU switches between several tasks at once, this is known as multitasking. The frequency of switches allows users to interact with each running program.

The OS performs and manages multitasking in a way that allows it to handle numerous tasks or run multiple programmes simultaneously. It is also known as time-sharing systems. These operating systems enable interactive computer use at a reasonable cost. Every user receives a little fraction of a time-shared CPU by applying the multiprogramming and CPU scheduling concepts in a time-shared operating system.

Computer systems designed in starting as Computers as batch systems are now modified to time-sharing systems.

Advantages

- Fast response

- Duplication of software is not there

- CPU idle time is reduced

Disadvantages

- Not reliability

- Security and integrity of user programs and data is a problem

- The issue of data communication

9.2.7 Multiprogramming

Multiprogramming is the term for CPU sharing when two or more programmes run simultaneously in memory. Multiprogramming relies on a solitary shared processor. The CPU is used more frequently through many programs because there is always a job for it to complete.

An OS performs the following multiprogramming-related tasks.

- Several tasks are kept running in the OS memory at once.

- Jobs kept in the job pool are a subset of this set of occupations.

- The OS chooses and launches the execution of each task stored in memory.

Advantages

- high and effective CPU usage

- many programs can be allotted to the CPU simultaneously

Disadvantages

- CPU scheduling is required.

- Memory management is needed to accommodate all jobs.

9.2.8 Interactivity

The skill of people to communicate with a computer system is referred to as interactivity. Following interactive tasks perform by an OS:

- Gives the user a way to communicate with the system

- Controls input devices to receive user input

- Controls output devices so that users can see outputs

9.3 Memory Management

Internal memory is the Main Memory.. Only data stored in primary memory can be changed. So, every operation we execute and every file we access must be copied from a storage device to the ROM.

Some functions that come under memory management are as follows:

9.3.1 Swapping

Foe execution a process must be kept in memory. In some of the cases, internal memory is essential for storing all active processes in a timesharing system. Swapping loads each technique into internal memory, runs it for a moment, and then returns it to the disk.

9.3.2 Memory Protection

This phenomenon is used when user wants to manage a computer's memory access. Main aim is to restrict processes from accessing memory that has not been assigned to them. Hence process defect from damaging the operating system is prevented. It sends a storage violation exception to the process, which terminates it.

9.3.3 Contiguous Memory Allocation

Memory is composed of several fixed-size segments. "Memory holes refer to available empty blocks. To select the best hole to allocate, a variety of holes is searched".

9.3.4 Memory Allocation

Computer programs are given memory or space through a procedure known as memory allocation. There are three varieties:

- First Fit: The first sufficiently large hole is allotted to the program.
- Best Fit: assigned to fill the smallest large enough void.
- Worst Fit: assigned the most significant gap that can be filled.

9.3.5 Fragmentation

Fragmentation happens when most available free blocks are too tiny to accommodate requests. Inability to employ the available memory is the common term used to describe it. Internal fragmentation makes it possible for the RAM to receive memory that is slightly more than what was requested.

9.3.6 Paging

For fragmentation problem Paging is one solution. Paging ia a memory management approach that allows a process's physical address space to be non-contagious. Physical memory is divided into Pages. Pages are identically sized pieces.

A specific process's pages are loaded into the available memory frames.

9.3.7 Segmentation

"It is a approach that shows memory can be segmented". Segmentation allows the division of single process virtual address space into smaller chunks. They can be readily stored in different memory locations.

9.4 Summary

- Operating system (OS) acts as an interface between computer hardware, software and users.
- OS is software that provides help in managing all the fundamental functions, including managing memory and processes, handling input and output and controlling peripherals like disc drives and printers.
- Multiprogramming logically provides time-sharing or multitasking.
- A data processing system is considered to be real-time if processing and reaction takes short amount of time that it affects the environment
- A process is a time-shared user program.
- In the main memory words or bytes with different sizes ranging from tens of thousands to billions.
- The primary memory is lost when the power is cut.
- Multitasking operating systems are often known as time-sharing systems.
- Multiprogramming is the term for sharing the CPU more than one programs are run simultaneously in memory.

9.5 Keywords

- Conducive: making a certain situation or outcome likely or possible
- Employed: make use of
- Embedded computer: a combination of computer hardware and software designed for

a specific function

- Resource allocator: optimise business activities
- Kernel: the central or most important part of something

9.6 Self-Assessment Questions

1. What are the advantages of multiprogramming?
2. Differentiate between 'Real-Time Processing System' and 'Batch processing system'.
3. Differentiate between the 'Time Sharing System' and 'Real-Time System'
4. Explain Real Time and Distributed operating systems and their characteristics.
5. Differentiate between:

   (a) Multiprocessing and multiprogramming

   (b) Paging and segmentation

9.7 Case Study

Title: Monopolistic Approach

Introduction

In a market with a monopoly, one company controls the market because it is the only seller, giving it the advantage of setting prices, whereas in a market with perfect competition, many companies are active and selling their products there without having any control over the market. In light of this, Microsoft's Vista operating system represents the company's most effective setup. As there is no other firm that can compete with Microsoft in delivering Vista, the companies that are incorporating Vista as the operating system in the computers that they create are under Microsoft's control.

Since no other company can provide Vista at a price lower than Microsoft's, Microsoft controls the businesses that incorporate it as the operating system in the PCs they make. In fact, Microsoft pursues monopolistic entries, and by creating Vista, the company ensured that the money was well spent because all Vista users must pay Microsoft and no one else in order to use this operating system. If Microsoft had not been granted a patent for Vista, any business would likely not have invested the time, money, and resources necessary to create and market copies of the complicated service, with the understanding that others would also profit from it.

Question: Discuss the pros and cons of the given case study.

Unit: 10

Data Communication

Learning Objectives:

- Data and Information
- Types of Network Communication
- Internet and World Wide Web.
- Define protocols and Standards in networking

Structure:

10.1 Data & Information

Data are the unprocessed facts that are gathered, whereas information are the processed facts that allow us to make decisions. For example, when the results of a particular test are released, the data of all students is included. When you locate the marks you received, you have the knowledge necessary to determine whether you passed or failed the test.

Any information that is displayed in a way that its authors and users have approved is referred to as data.

10.2 Data Communication

Data communication is the process of sending data or information between two devices across a transmission media, as in computer networks. A hardware and software-based communication system is used in this procedure. A sender, a receiver, and intermediate devices that the data flows through are all parts of the hardware. Certain rules that define what must be communicated, how it must be communicated, and when it must be communicated are included in the software component. It also goes by the name of a protocol.

10.3 Characteristics of Data Communication

Data communications system must possess the four key essential qualities to function effectively:

- **Delivery**: The data must be sent to the right user and destination.
- **Accuracy**: The data is to be sent precisely and without errors being introduced by the communication technology. The correctness of the transmitted data may be impacted by data corruption that occurs during transmission.
- **Timeliness**: Real-time data transmission refers to the requirement that audio and video data be transmitted promptly and without delay.
- **Jitter**: This is a difference in data packet arrival times. The timeliness of data transmission may be impacted by uneven Jitter.
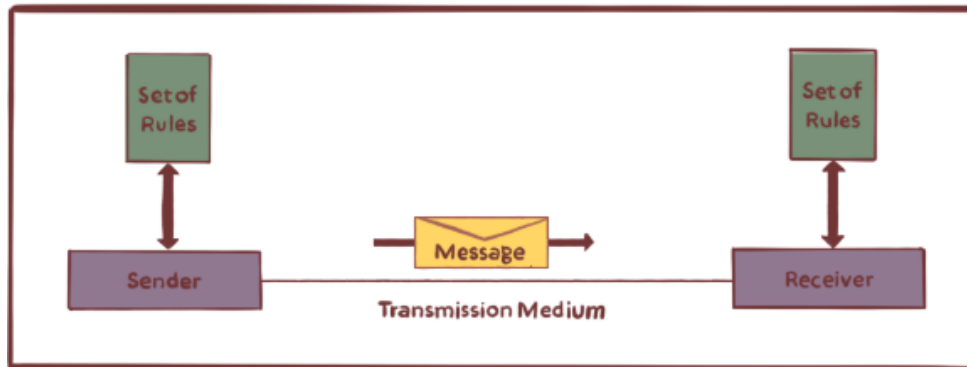
10.4 Components of Data Communication

Figure 1: Data Communication system

- **Message**: The message is the information or data that will be sent. Text, numbers, images, sound, video, or any mix of these can all be included.

- **Sender**: The sender of a communication is the machine or computer that creates and sends it.

- **Receiver**: The message is received by a computer or other device. The sender computer's location is typically different from the recipient computer's location. The sort of network that is used in between will determine how far apart the sender and recipient are.

- **Medium**: The physical road or channel used to transmit a message from one party to another. The medium can be wireless like a laser, radio waves, or microwaves or wired like twisted pair wire, coaxial cable, or fibre-optic cable.

- **Protocol**: Data communications cannot take place without a protocol; otherwise, it would be like two people attempting to communicate in two distinct languages without having any knowledge of one another's languages.

10.5 Data Representation

Data is a collection of unprocessed facts that are used to deduce information. Data representations can take a variety of shapes. The following are some examples of data types used in communications:

1. **Text**: Text contains combinations of upper- and lower-case alphabets. It is kept as a little pattern. Common encoding schemes include ASCII and Unicode.

2. **Numerical:** Combinations of digits from 0 to 9 make up numbers. It is kept as a little pattern. Common encoding schemes include ASCII and Unicode.

3. **Images**: Images are digitally saved in computers. The smallest part of an image is called a pixel. A picture or image is simply a matrix of pixel components, to put it simply. Bits are used to represent the pixels. Each pixel would need a varied number of bits to indicate the value of a pixel depending on the type of image (colour or black and white).

An image's size is determined by the number of pixels (also known as resolution) and the bit pattern used to represent each pixel's value. For example, if an image is merely black and white (two colours), each pixel can be represented by a value of 0 or 1. As a result, storing an image made up of 10 by 10 pixel parts would only require 100 bits in memory.

In contrast, a grayscale image might use two bits to indicate each pixel value (00 for black, 01 for dark grey, 10 for light grey, and 11 for white). Thus, the identical 10 by 10 pixel image would now need to be stored in 200 bits of RAM.

Popular image formats include jpg, png, bmp, etc.

4. **Audio:** Sound is another form of data that may be recorded and distributed. An illustration of a source of data or information is what we hear on the radio. Audio data is not discrete; it is continuous.

5. **Video:** Data streaming in the form of an image or a movie is referred to as video.

10.6 Data Flow

Devices exchange data in order to communicate with one another. The following methods exist for transferring data between the two devices.

1. Simplex

2. Half Duplex

3. Full Duplex

10.6.1 Simplex
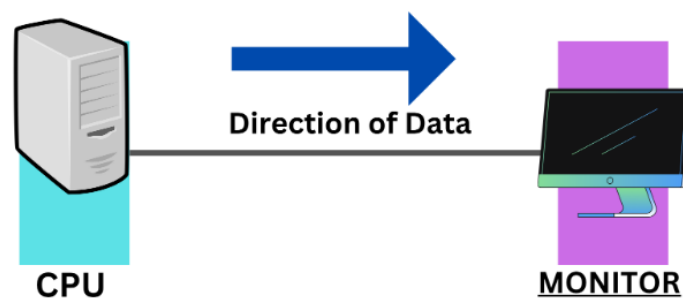
Figure 2: Simplex Mode of Communication

Communication in Simplex is unidirectional. 'Only one' of the devices transmits data, and 'only one' of the devices receives data.

For example, a CPU sends data in the figure above, whereas a monitor just receives data.
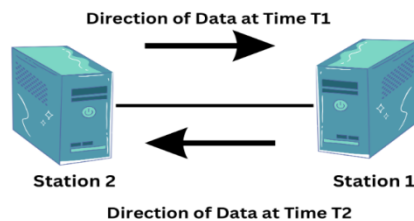
10.6.2 Half Duplex

Figure 3: Half Duplex Mode of Communication

In a half-duplex system, both stations can broadcast and receive, but not simultaneously. As depicted in the above image, when one device is sending, the other can only receive. Example: A walkie-talkie
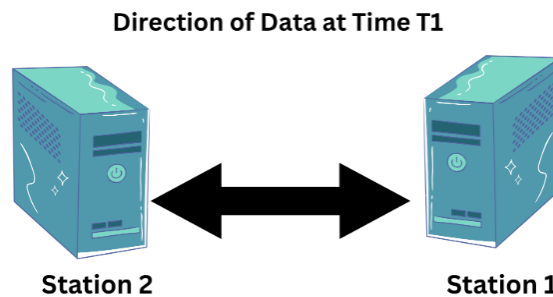

10.6.3 Full Duplex

Figure 4: Full Duplex Mode of Communication

In full duplex mode, both stations can transmit and receive data simultaneously. Example: cell phones.

10.7 Computer Network

Any device that can send or receive data can be a node. A group of nodes can be referred to as a computer network. Links are required to connect the communicating nodes.

10.7.1 Types of Network

- **Local Area Networks (LAN):** A LAN is often confined to a smaller region. A LAN is a network made up of all the computers in a building, and it can be privately owned and be located inside an office on one of the floors.

- **Wide Area Network (WAN)**: A WAN is a set of all the networks in a sizable geographic area. Rajasthan's complete statewide network can be considered a WAN.

- **Metropolitan Area Network (MAN)**: A MAN spans the LAN and WAN in terms of scale. Although smaller than WAN, it is bigger than LAN. It might include the whole network in a metropolitan place like Delhi.
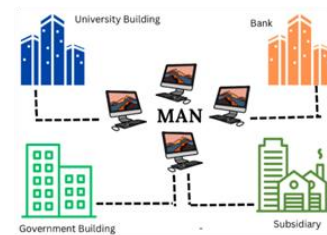
10.7.2 Protocol

A data communications system includes a protocol as one of its elements. Protocol is necessary for communication to take place. Data cannot simply be sent from one device to another and expect the other to receive it and accurately interpret it.

When a message is transmitted, it may contain text, numbers, graphics, and other data that is broken down into bits and arranged into blocks to be conveyed. Control information is frequently also included to aid the recipient in deciphering the data.

The sender and the recipient must agree to a set of guidelines known as protocol for communication to be successful. A protocol is described as a collection of guidelines for controlling data transmission.

What should be conveyed, how it should be communicated, and when it should be communicated are all outlined in a protocol.

10.7.3 Elements of a Protocol

A protocol has three essential components:

Syntax: It refers to the format or structure of Data.

Semantics: It explains each bit's meaning and provides an interpretation for each portion.

Timing: It informs the sender whether or not the recipient is ready to receive the data.

10.8 Standards in Networking

To guarantee connectivity and compatibility across diverse networking hardware and software components, standards are required in networking. Without standards, we would have exclusive goods that would segregate user communities and prevent them from connecting.

10.8.1 Concept of Standard

Standards offer rules to vendors and product manufacturers to ensure interoperability on a global scale.

Two sorts of data communication standards are distinguished:

1. De facto Standard

These are the standards that have been historically applied and are meant by fact or by convention. No formal organisation has approved these standards; instead, they have been widely accepted.

2. De jure Standard

This refers to standards set by law or regulation. These standards have been enacted into law and authorised by a recognized body.

10.8.2 Standard Organizations in field of Networking

Government regulatory organisations, forums, and standards creation groups all produce standards. Examples of Standard Creation Committees:

- ➢ Institute of Electrical & Electronics Engineers (IEEE)
- ➢ American National Standards Institute (ANSI)
- ➢ Electronic Industries Associates (EIA)
- ➢ International Telecommunications Union – Telecommunications Standard (ITU-T)
- ➢ International Organization for Standardization (ISO)

Examples of Forums: ATM Forum, Frame Relay Forum

Examples of Regulatory Agencies: Federal Communications Committee (FCC)

10.9 Internet & World Wide Web

The internet is a system of networks that is interconnected on a global level and uses different mediums to deliver data. The internet is a network of international exchanges that connects guided, wireless, and fibre-optic technologies. These technologies include private, public, business, academic, and government networks.

While "internet" and "World Wide Web" are often used interchangeably, they don't represent precisely the same concept. The web is just one of the services offered through the internet. The term "internet" encompasses the entire global communication network, including its hardware and infrastructure.

The backbone of communications and the main component of the internet is Internet Protocol (IP). Because there are hardware and software layers on the internet, address schemes and distinctive connected devices are identified using the IP communication standard. Internet Protocol version 4 (IPv4) and Internet Protocol version 2 (IPv2) are prominent IP versions used for communications.

The following services are available on the internet:

- Data transfer/file-sharing
- Financial services
- Online shopping
- Email
- Online movies and gaming
- Instant messaging / Social networking
- Web-enabled audio/video conferencing services

10.9.1 History of Internet

Starting in 1960, The Advanced Research Projects Agency Network (ARPANET) was developed. It served as the very first functional prototype of the Internet. ARPANET first supported by the US Department of Defense. It used packet switching to enable multi-computer communication across a single network.

The Transmission Control Protocol and Internet Protocol (TCP/IP) was created by researchers Robert Kahn and Vinton Cerf in the 1970s. It is a communications model that established guidelines for how data may be sent between various networks. TCP/IP helped the technology advance further in the next decade. Later, the World Wide Web was created in 1989 by computer scientist Tim Berners-Lee.

10.9.2 World Wide Web

The 'World Wide Web', or simply put, the Web, is an information system where web resources and documents are identified by Uniform Resource Locators (URLs), which are

linked together by hypertext, and are accessible through the Internet. A computer program called a web browser allows users to access the resources of the WWW.

The World Wide Web has been instrumental to the growth of the Information Age and is the main platform for interaction on the Internet.

10.10 Summary

- Data are the unprocessed facts that are gathered, whereas information are the processed facts that assist us in making decisions.
- Data communications system must possess the four key essential qualities: Delivery, Accuracy, Timeliness& Jitter
- Data is a collection of unprocessed facts that are used to deduce information.
- Images are digitally saved on computers.
- An image's size is determined by the number of pixels (also known as resolution).
- Sound is another form of data that may be recorded and distributed.
- Protocol is necessary for communication to take place.
- A protocol has three essential components: Syntax, Semantics and Timing
- The internet is a network of international exchanges that connects guided, wireless, and fibre-optic technologies.
- The world's most economical mode of communication is the internet,
- The 'World Wide Web' was created in 1989 by English scientist Tim Berners-Lee.

10.11 Keywords

- Unprocessed facts
- Transmission
- Unidirectional
- World Wide Web

10.12 Self-Assessment Questions

- What are the differences between data and information.

- Explain the features of data communication.

- What are the components of a data communication system?

- Define computer network and categorise.

- Give the detailed note on protocols.

10.13 Case Study

In-depth research was done on a renowned Swedish supplier of ICT services in the health and welfare industries. The end-user application is an Android software that enables mobile workers in the health and care industries. The program is essential for workers because it allows them to easily access information while they are on the job.

Application Structure:

The business has developed a native Android application, which it then sells to different other businesses and municipalities engaged in the Swedish home care industry as a package solution. In this industry, field workers go out to people's homes and offer assistance to the elderly and disabled so they can stay in their own homes rather than being placed in nursing facilities. Cleaning, meals, social interaction, links to doctors, personal hygiene assistance, and even help getting out of bed are all provided by the staff. The employees' employers have provided them with mobile Android phones and an existing native Android application so they may carry out and record their everyday chores.

This application establishes connections with numerous different systems using a web service. The databases used by the solution to manage scheduling, paperwork, notes, client data, and field workers' daily schedules.

The native program offers features like Bluetooth door unlocking, GPS location tracking, writing and reading of documents, daily calendars for the worker whose phone it is, and a wealth of client information. The information can include contact information for doctors, instructions not to pet the dog because it bites, shower schedules, personal contacts, hair appointments, and anything else a worker may require to know. It is crucial that information be current and accurate because there are frequently several employees or even substitute employees who are unfamiliar with the specific client.

Question: Discuss the pros and cons of the service provide

Unit: 11

Computer Network Topologies

Learning Objectives:

- Computer Network Topologies
- Allocation of Channel
- Physical Communication Media
- Communication Protocols

Structure:

11.0 Computer Network Topologies

The arrangements of computer systems or network devices are known as topology. It specifies a network's logical and physical aspects.

11.1 Type of Connection

A network connects more than two devices through links. The link is a path that transfers data from one System to another System. Following are the two types of connections

11.1.1 Point-to-Point: The connection provides a dedicated link between two devices. While physical cables or wires are frequently used in point-to-point communications, alternative options such as microwave or satellite links are also feasible.

An infrared remote control and the television's control system create a point-to-point link when you use it to change the station on the television.

11.1.2 Multipoint: A multipoint connection connects two or more devices with a unified link. The capacity of the channel is shared, either temporarily or spatially, in a multipoint setting. It's a spatially shared connection of multiple devices that can use it at the same time.
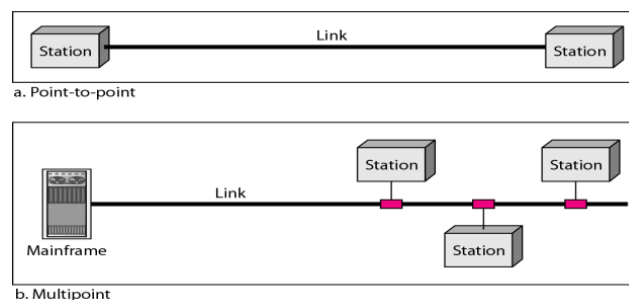
Figure 1: Types of Connection

11.2 Physical Topology

It means how a network is configuring physically. More than two devices connect to a link. A graphical representation of all the links and links that link devices (also referred to as nodes) to one another is a network's topology. There are four basic topologies possible: mesh, star, bus, and ring.
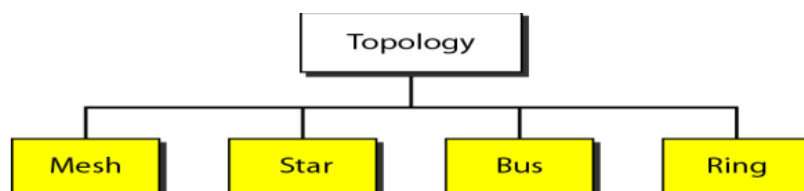

Figure 2: Physical Topology

11.2.1 MESH: Every node is connected to each other node in the network is known as mesh topology .
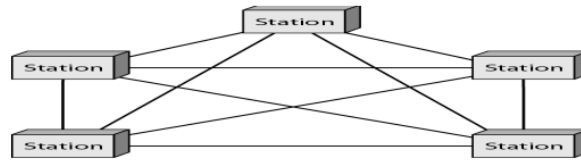

Figure 3: Mesh Topology

A 'Mesh Topology' is fully or partially connected. Each system in the network is connected to each system in the network.

Advantages

- Manage high volumes of traffic
- Device failure does not interrupt data transfer.
- Easy addition of devices

Disadvantages

- Time-Consuming
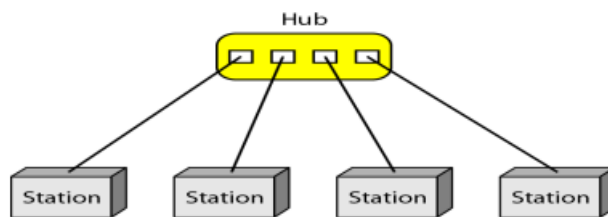- High Cost.
- Decreased efficiency.

11.2.2 STAR

Figure 4: Star Topology

Star network is among the most typical configuration of networks. In this setup, every node is connected to a switch, hub or computer that serves as the hub of the network. The main network device serves as a server while the other network nodes function as clients.

Advantages

- Centralised network
- Simple Adding new computers
- Useful in Local-area networks (LANs)

Disadvantages

- Expensive
- The performance support are determined by the central network
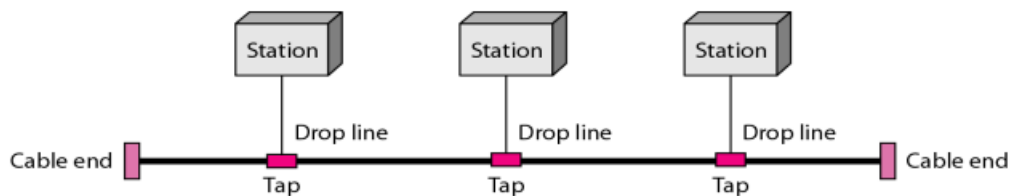- More change of failure.

11.2.3 BUS

Figure 5: Bus Topology

When all the devices share a single communication line, it is known as a 'Bus Topology'. It encounters issues when hosts are sending data. Therefore, Bus topology uses CSMA/CD technology to find out the problem.

Advantages

- Simplest network
- Useful in small networks.
- Required less Cable as compare to start topology.

Disadvantages

- Troubleshooting individual device problems can be challenging.
- Not suitable for large networks.
- Addition of devices may slow the network speed.
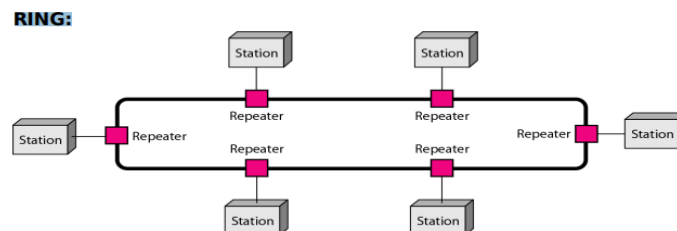- In the case of damage of main cable, the network fails.

11.2.4 RING:

Figure 6: Ring Topology

In topology, systems connections form a circular data channel in the network setup. Data packets in this topology transfer from one device to the next until they arrive at their final station. Unidirectional ring networks used by most ring topologies allow packets to move only in a single direction.

Advantages

- required single direction,

- Network communication in the workstations managed without a network server.

- Fast data transfer

- High performance of network

Disadvantages

- Slow Speed of data transfer.

- One device failure affect entire network.

- Expensive.

11.2.5 Hybrid Topology

For example, in a Bus Topology, we can have a Primary Star Topology where each branch connects to several stations. Such networks are called Hybrid Networks.
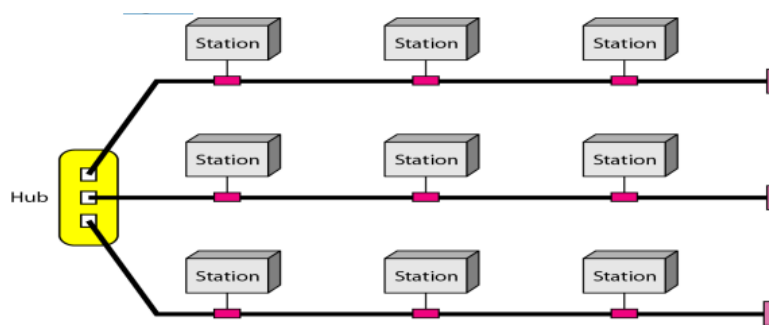
Figure 7: Hybrid Topology

11.3 Channel Allocation Strategies in Computer Network

It means allocating the available channels in various cells. Utilizing channel allocation algorithms, users' demands are fulfilled when they make call requests. The frequencies, time slots, and bandwidth are all used effectively by channel allocation strategies.

11.3.1 Types of Channel Allocation Strategies:

These include borrowing channel allocation, fixed channel allocation, dynamic channel allocation, and hybrid channel allocation.

Fixed Channel Allocation (FCA):

A particular number of channels are assigning to the cells under this Channel Allocation technique. The channels cannot be changed once allocating to the specific cells. Channel allocation in FCA is done to maximize frequency reuse.

Advantages

- Easy implementation
- Easy to manage
- Require Easy equipment or algorithms

Disadvantages

- Limited channel utilisation
- Vulnerable to congestion and interference.

Dynamic Channel Allocation (DCA):

Dynamic channel allocation (DCA) is a technique used in telecommunications and networking to efficiently allocate communication channels based on demand and availability. Instead of assigning fixed channels to users or devices, DCA dynamically assigns channels as needed, reallocating resources in real-time to optimize performance and accommodate varying traffic patterns.

Advantages

- Effective use of bandwidth.
- Improve call quality

Disadvantages

- Complex algorithms.
- call drops or poor quality

Hybrid Channel Allocation (HCA):

FCA and DCA are both components of hybrid channel allocation. Voice channels are separated into a total number of fixed and dynamic channels. The first fixed sets of channels are used when a user makes a call. Dynamic sets are used when all of the fixed sets are full. HCA's primary motive is to operate effectively in busy traffic.

Advantages

- FCA and DCA Benefits
- Optimum allocation of resources

Disadvantages

- Requires tough algorithms.
- Not efficient at all levels.

11.4 Transmission Media
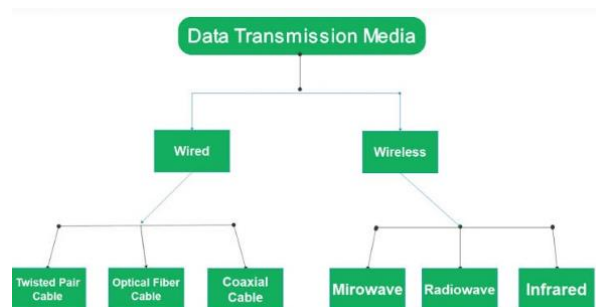
Following are types of transmission media:

Figure 8: Types of Transmission Media

11.4.1 Guided Media:

It is also referred to as "wired" and "bounded" .Signals that are being transferred along a brief journey are guided and constrained by physical links..

Features

- Fast Speed
- safe
- suitable for comparatively shorter distances

Types of Guided Media

(i)   **Twisted Pair Cable:** It is made up of two conductor wires that have been wound around one another. Several of these pairs are usually enclosed in a protective sheath. These are the most often used transmission media. Twisted Pair is available in two types:

A. Unshielded Twisted Pair (UTP):

The cable is capable of blocking interference by itself and doesn't require a physical shield for it. It finds its applications in telephone communication.

Benefits (1) Lowest cost; (2) Simple installation; and (3) Fast speed

B. Shielded Twisted Pair (STP):

The cable has a unique covering to prevent outside interference. It is utilised in telephone lines' voice and data channels and fast-data-rate Ethernet.

Advantages: (1) More effective performance than UTP at greater data rates (2) Removes crosstalk (3) Relatively quicker

(ii) Coaxial Cable: This has an insulated protective cover on the plastic outer shell that holds the two parallel conductors. Coaxial cable transmits data in two different ways: in broadband mode (various ranges of cable bandwidth) and in baseband mode (dedicated cable bandwidth). Analogue television networks and cable TVs frequently employ coaxial connections.

Benefits include increased bandwidth, cost-effectiveness, ease of installation, and better noise immunity.

(iii) Optical Fibre Cable (OFC): An optical fiber cable is a type of cable made up of one or more optical fibers (thin strands of glass or plastic) that are used to transmit light signals over long distances. These cables are designed to carry a large amount of data with minimal loss and are commonly used in telecommunications networks, internet connections, and various other applications where high-speed data transmission is required.

11.4.2 Unguided Media

the transmission medium through which signals travel freely, without the use of any physical conductor or pathway. Unlike guided media, which use cables or wires to direct signals, unguided media rely on methods like air, space, or water to propagate signals. Common examples of unguided media include wireless communication technologies such as radio waves, microwaves, and infrared signals.

Types of unguided media

(i) Radio Waves - These are easy to produce and can penetrate walls effortlessly. Antennas for transmission and reception don't require precise placement. Their frequency spectrum ranges from 3KHz to 1GHz. Radio Waves find application in transmitting audio for technologies like AM, FM, and cordless phones.

(ii) Microwaves: Since this type of communication relies on line-of-sight, the sending and receiving antennas must be correctly positioned. The height of the antennas has an inverse relationship with the signal range. With Frequency Range of 1 GHz to 300 GHz, these are mostly used for the mobile phone and TV Communication.

(iii) Infrared – It is useful in short distance communication. They cannot pass through barriers. Range of frequencies: 300GHz to 400THz. Example: TV Remote.

11.5 Communication Protocols

Let's start with understanding protocols. Regarding governments, protocol refers to a rigidly adhered-to protocol in political situations. For instance, in India president is the head of state, etiquette governs how he or she may participate in official activities. These procedures outline the President's seating plan, who will accompany the President, how dignitaries will be introduced, etc. In other words, they outline the acceptable behaviour in specific circumstances. Aspects of appearance (dress code), greetings, conversation, and eating manners may be included. All of these guidelines support effective collaboration and communication.

The term "protocol" is frequently used in both computer and communication contexts. Computer protocols deal with message exchange, process interaction, and other issues. Here are some key distinctions between the two. While computing protocols specify guidelines for communication between computer processes, communication protocols specify guidelines for communication between computers. However, they both involve information sharing. Typically, protocols are computer programs that carry out communication standards. Some protocol functions, particularly those involving the transfer of bits and bytes, are implemented in hardware.

11.5.1 Computing Protocols

The rules and processes that control all aspects of information management are defined by computing and communication protocols.

The output of a computer's processing of data is referred to as information. It is possible to say that computers produce information in this sense. However, protocols may be used to control information generated by machines.

Storage, retrieval, and processing are among the various tasks that fall under the purview of computer protocols. Acquisition, transmission, and dissemination make up the remaining tasks, which are classified as communication protocols. Information dissemination is the umbrella term encompassing transmission and distribution activities.

11.5.2 Communication Protocols: IP, UDP, TCP

Internet Protocol (IP)

The Internet runs on the Internet protocol (IP), which is essential to its functionality.

IP is used by the internet to send and receive packets. Without the IP running on it, no computer can be linked to the Internet. As a result, IP is included with all computer operating systems like Windows. Most IP software is memory-resident. IP lays out in detail how a packet must be created and how an Internet router ought to handle it.

User Datagram Protocol (UDP)

UDP is a more advanced protocol than IP. In this case, a user asks UDP to send their complete message to the given destination. User datagrams differ from IP datagrams in several ways. User datagrams do not follow the IP standard. They are simply informational pieces of any size. To create a UDP datagram, UDP wraps the user datagram in its own header. A user datagram may be divided up by UDP into several IP-compliant UDP datagrams.

Transmission Control Protocol (TCP)

TCP is a service that focuses on connections. It is more advanced and makes use of IP. In actuality, UDP and TCP are on par. TCP offers delivery assurance. TCP allows for trustworthy and error-free communication. It does it in four different ways:

Recognises errors in datagrams and applies the ARQ technique to recover from errors.

Identifies duplicate datagrams and eliminates all but one of them;

Finds lost datagrams and retransmits them.

Sequences out-of-sequence received datagram

11.6 Summary

- The configuration of how computer systems or network devices are connected to one another is known as a topology.
- A link is a communications pathway that transfers data from one device to another.
- Physical topology refers to the way in which a network is laid out physically.
- A mesh topology is the one where every node is connected to every other node in the network.
- Every node in the star topology setup is connected to a hub, switch, or computer that serves as the hub of the network.
- All devices in a bus topology share a single communication line or cable.
- Channel allocation refers to distributing the available channels among the cells.
- Channel Allocation Strategies: Fixed channel allocation, Dynamic channel allocation, and Hybrid channel allocation.
- Transmission Media can be Guided or Unguided
- The rules and processes that control all aspects of information management are defined by computing and communication protocols.

11.7 Keywords

- Topologies
- Time shared connection
- Bus Master
- Ethernet cards

11.8 Self-Assessment Questions

1. Differentiate between computing and communication protocols
2. Explain the concept of Computer Network Topologies.
3. What are the different types of network connections?
4. Categorically describe Physical Topology.
5. Write a short note on (1) Transmission Media (2) Communication Protocols

11.9 Case Study

According to a senior official, a small incident that appeared to be the outcome of a mistake that happened during regularly scheduled system maintenance, affected thousands of flights throughout the U.S..

The official claimed that an engineer "replaced one file with another," unaware that a mistake had been made. The FAA personnel worked furiously to determine what went wrong as the systems started to exhibit issues and ultimately failed. The mistaken engineer was unaware of what had happened.

Departures were delayed and the FAA had ordered airlines to pause all domestic departures until 9 a.m. The official claimed, "It was an honest mistake that cost the government millions, and the employee his job."

Question: Discuss the case study and find out what went wrong and how it could have been different.

Unit: 12

Network Types

Learning Objectives:

- Networks type
- Local Area Networks
- ATM Networks
- Interconnecting Networks

Structure:

12.0 Types of Networks

A computer network is a data communications system that connects two or more computing devices located throughout a space, such as a room, a campus, a continent, or even an entire planet. A network can be as tiny as one system or as vast as the user desires. The nodes are divided into different categories. These consist of the following:

- Hardware for Networking
- Servers
- Personal Computers
- Basic Hosts

12.1 Types of Network

12.1.1 Local Area Network(LAN) –

- More than two personal computers can be connected
- small network in a building or small office is made of Wires or cables that function as nodes
- It is affordable and forms Ethernet or Token-ring technology.
- Data transfer is quick and highly rated.

12.1.2 Personal Area Network (PAN) –

- A smallest computer network.
- Bluetooth or other infrared-enabled technologies can be used to connect devices.
- It can connect a range of up to 10 metres and 30 feet.

12.1.3 MAN (Metropolitan Area Network)

- An example is cable TV, of the network that can be connected inside of a city
- Ethernet, ATM, Token-ring are the example of a greater range.
- To link people with different organisations, this kind of network can be utilised.
-

12.1.4 Wide Area Network -WAN

- A network that spans a whole nation or a greater population;
- WAN connects the telephone lines
- WAN is the largest Internet in the world

- WAN is also primarily used to handle data and information by the Government organizations

12.2 Networking Topologies

Following are the types of Network Topologies:

- **Point - Point Topology** – A most basic topology that connects two nodes directly together with a common link.
- **Bus Topology** – All the nodes are connected only to bus in a single line.
- **Mesh Topology** – It comprises of at least two nodes which contain two or more paths between them.
- **Ring Topology** –Every node has exactly two branches connected to it. The ring gets broken and become functionless if any one of the nodes of the ring fails.
- **Star Topology** – Central node is connected to the peripheral nodes , which is responsible for rebroadcasting all the transmissions received from any peripheral node to all peripheral nodes available on the network, including the originating node.
- **Tree Topology** –Here all the nodes are linked in the form of a tree.
- **Line Topology** – Linkage between all the nodes are in a straight line.
- **Hybrid Topology** – Hybrid topology is formed by combining two or more types of topologies.

12.3 Networking Devices

Following are the network related devices -

- **Network Repeaters** – it is used to produce incoming electrical, wireless or optical signals.
- **Network Hubs** –A device which creates a small network segment by joining multiple systems.
- **Network Switches** – A hardware device meant for joining multiple computers together with a single LAN.
- **Network Routers** – It provides connectivity at three levels
  - Inside Enterprises
  - Between Enterprises
  - Within the ISP

- **Network Bridges** – The outermost section of the data packet is read to tell where the message is going to reduce traffic on other network.
- **Modem** – Modem is connected between a telephone and a computer system. This device converts digital signals into analog signals.

12.4 Asynchronous Transfer Mode (ATM)

ATM is a switched data transfer technique in which switches establish a fictitious link or a circuit between the call's sender and recipient that is switched or permanent for the duration of the call. A small-packet switching system that divides messages into tiny, predetermined-length packets called cells.

Although an ATM may theoretically transmit data at a rate of up to 2.4 Gbps, its actual transmission rates often range from 45 to 622 Mbps.

A technology that has a connection orientation, which means that each data movement requires to establish a connection between two sites. Each cell contains a header that is the connection of the cell to which it belongs; the cells are automatically routed after the connection has been made.

Any protocol is transparent to the ATM. The ATM node passes the load of every cell,without being read at the binary level. Opposite to a traditional switched packet network, which employs error control and internal flow, ATM does not examine the data load for faults and leaves it to the final terminal device hence is uses the idea of error control and flows be.

The ATM (Asynchronous Transfer Mode) is compatible with two types of connections.

- Point-Point Links: It connects two end systems in either a single directional or dual directional fashion.
- Multi level point links: It links one ATM in a single direction to a variety of destination ATMs.

12.4.1 ATM Features

ATM has the following features:

1. **Connection-oriented protocol**, before data transfer can occur, a link must be established between the sending and receiving machines. It is necessary to identify and notify each intermediate switching point of the connection. It ensured that every cell would reach its destination in the same order that it left, but it did not ensure that

every cell would arrive; in cases of extreme congestion, it was deemed acceptable to lose a small number of cells.

2. **Full-duplex,** transmission through one pair of threads and reception through a different set of threads for making nearly full use of both pairs and enabling high continuous data transmission.

3. **Dedicated bandwidth**: ATM offers various service characteristics, it allocates bandwidth to each of the running stations. For each connection, the station requests the necessary amount of bandwidth, which the network then provides to the user automatically.

4. **ATM leaves the medium open**; point-to-point and full-duplex communications are both conceivable using wires that resemble fibre optics. The primary speed is 155.52 Mbps, and the backup speed (SONET compatible) is 622.08 Mbps.

12.4.2 Issues in using ATM networks
- Telephone networks are expensive and only support single level of service.
- Internet is adaptable and affordable but compromises with service quality.
- ATM networks were built to replace both telephone network and Internet by providing a multiple service quality at a reasonable price.

12.4.3 Applications for ATMs
- ATM WANs:
  - The ATM is used as a WAN to share cells over better range, with a router acting as a final point between the networks. It can be applied where it contains more than one stacks of the protocol.
- Virtual private networks for media and managed services:
  - In addition to providing complete service VPN, which enables combined access to multimedia, it assists in managing all associated services.
- Frame-relay ATM service and Internetworking services look promising by frame-relay backbone services, which are employed as a networking infrastructure for a multipleof data services.
- The networking setup for the construction of residential internet services in the hunt for high level solutions is provided by residential broadband networks, or ATM.

- ATM infrastructure for telephonic and private-line traffic will enable the carrier infrastructure to make better use of SONET/SDH fibre infrastructures.

12.5 Interconnection Network Design

Each source node can share data to any selected destination node over an interconnection network in a parallel machine as quick as possible simultaneously economically also. The sharing of information from the source node to the destination node is done through Links and switches in the network.

Following are the defining factors-

- Topology
- Algorithm of Routing
- Scheme of Switching
- Mechanism of Flow Control

Interconnection networks are made up of the three following fundamental elements:

Links – A link is a cable made up of one or more optical fibres or electrical wires that is connected to a switch or network interface port at each end via a connector. To obtain the original digital information stream, an analog signal is delivered from one end and received at the other using this method.

Switches - A switch is made up of input and output ports, an internal "cross-bar" that connects all input to all output, internal buffering, and control circuitry that determines how the input-output connection is made at each instant in time. In most cases, the quantity of input ports equals the quantity of output ports.

Network Interfaces - The network interface can be connected via specialised links and functions very differently from switch nodes. The network interface creates routing and control information as well as formats the packets. Unlike a switch, it might feature input and output buffering. It may carry out flow control and end-to-end error checking. Therefore, its processing complexity, storage capacity, and port count have an impact on its price.

12.6 Summary

- Types of Network: LAN, PAN, WAN, MAN
- ATM is a dedicated connection-oriented switched data transfer technique in which switches establish a fictitious link or circuit between the call's sender and recipient that is switched or permanent for the duration of the call.
- The ATM (Asynchronous Transfer Mode) is compatible with two different types of connections: Point-to-Point and Multipoint links.
- Links and switches are responsible for transferring the information from the source node to the destination node.
- The network interface creates routing and control information as well as formats the packets.

12.7 Keywords

- Basic Hosts
- Interpreter
- Token-ring technology
- Rebroadcasts
- Hybrid topology

12.8 Self-Assessment Questions

1. What are the Data Transmission Modes in a network?
2. Explain network topology and the categorization of network topology.
3. How many types of physical topologies are there?
4. With respect to network topologies answer the following questions:
5. Which topology requires a central controller or hub?
6. Which topology consists of a direct link between two computers?
7. Which topology combines two or more than two topologies?
8. Which topology has a root node?

12.9 Case Study

A company named Mittal Pvt. Ltd. has four sections of buildings: B1,B2, B3 and B4.

The centre to centre distance between the various section is as follows:

B1 TO B3: 50M

B1 TO B2: 60 M

B2 TO B4: 25M

B3 TO B4: 170M

B2 TO B3: 125M

B1 TO B4: 90M

Number of Computers in each section is as follows:

B1: 150

B2: 15

B3: 15

B4: 25

Computers in each block are networked but blocks are not networked. The company has now decided to connect the blocks also.

Question: Discuss and suggest the best topology for the connections between the blocks.

Unit: 13

MS Word 2007

Learning Objectives:

- Introduction to MS-word 2007
- Windows 2007 Interface
- Document Views
- Basic Formatting in MS Word 2007
- Navigating through a Word Document
- Mail Merge
- Macros, Printing Documents, Print Preview

Structure:

13.0 Introduction to MS WORD 2007

13.1 Windows User Interface

13.2 Microsoft Word

13.3 Features of MS Word

13.4 Document Views

13.5 Formatting Text

13.6 Mail Merge

13.7 Print Preview

13.8 "Summary"

13.9 "Keywords"

13.10   Self-Assessment Questions

13.11   Case Study

13.0 Introduction

We will learn about Introduction to Microsoft Word 2007 in this unit. "MS Windows is a multitasking operating system created by the Microsoft Corporation that communicates with users through a graphical user interface. Originally known as "Traf-O-Data" in 1972, Microsoft changed its name to "Micro-soft" in November 1975, and finally to "Microsoft" on November 26, 1976". 'Bill Gates and Paul Allen' created Microsoft; its flagship product is the Windows operating system.

13.1 Windows User Interface

The following are the primary components of GUI (Graphic User Interface) components:

1. Desktop: As soon as Windows is launched, you will see this screen. The "My Computer," "My Documents," "Start Menu," "Recycle Bin," and any shortcuts you may have created for apps, are all visible.

2. Taskbar: Task bar option available in bottom side. Programs you commonly used programs can be pinned to the taskbar.

3. Start Menu: At the bottom left corner of the Windows OS GUI, start menu is reflected. Here in control panel the applications can be repaired or uninstalled. The user can complete many tasks by just searching the start menu.

4. My Computer: You may access the control panel tools and all of your computer's drives by double-clicking the "My Computer" menu.

5. Recycle Bin: when you apply "delete" option or just right clicking with "delete". It is instead sent to Windows' "Recycle Bin" folder. If you delete something, you can restore it, but if you choose to delete somewhat from this sheet, it will be permanently lost. Using the combination of keys "Shift+Del" you can eradicate the thing without transferring it to the "recycle bin".

13.2 Microsoft Word

"MS-WORD" is a word processor to accepts keyboard input. Its objective is to enable user to create and "save documents". Open MS-WORD by: Click on the menu items in the order given below:
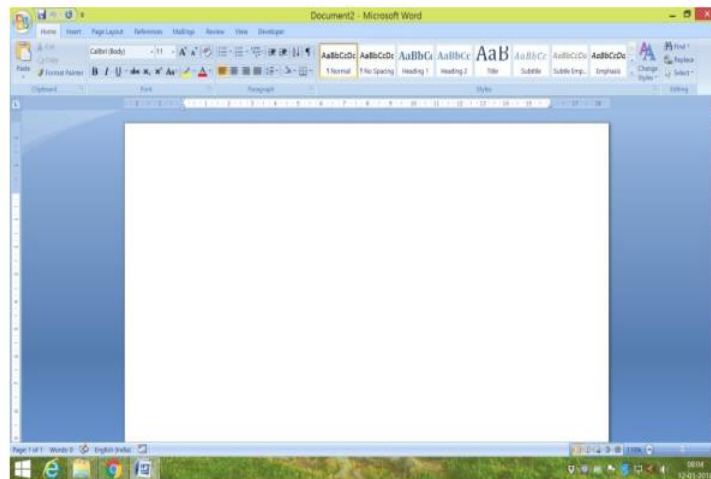
START – Programs – MS OFFICE - Word

Figure 1: MS Word Window

13.3 Features of MS Word

1. File: It helps in working with New files, such as, Open (which opens an existing document), Save "which saves a document), History, Print, Share, Export, Info, etc".

2. Home: Home tab is comprised of Clipboard, Font, Paragraph, Style, and Editing groups, the default tab for Microsoft Word. In addition to copying, pasting, and

3. Insert: The second tab on the list of options has many option related to insert.

4. Draw: A third tab on the ribbon in Microsoft Word, it is used for freehand drawing. It offers different variety of pens.

5. Design: The fourth option on menu bar. You will find many option related to design.

6. Layout Its fifth option related to layout you will reframe and correct the layout.

7. References: :sixth option is reference you can make summary.

.8. Mailings: The least used tab of the menu bar. Used for creating labels and paste them on envelopes, perform mail merging operations, etc.

9. Review: eighth tab of the menu bar is review there you may find the option for spell check, grammer.

10. View: 9th tab that can customise pages and header footer, full screen outlook, and other kind are present.

13.4 Microsoft Word: Document Views

Five alternative document views are available in Microsoft Word, and each one offers advantages over the others. The names of some of them allow us to infer functions. You can

alter the perspective you have of a document in one of two ways. Use the view buttons, or click the View tab and select a specific. We'll now explore the various Word perspectives.

13.4.1 Print Layout View

Document opens automatically in this view. When your document contains elements like photos, headers and footers, columns, etc., this view should be used. These elements will all be visible. You can see in this view

13.4.2 Full Screen Reading View

Full Screen view is used for viewing a file in full view. In the Full Screen Reading option, you may alternatively decide to see the document as it would appear in print page. View it in full display mode To make the most of the gap obtainable for understanding or comment on the paper.

13.4.4 Outline View

By using outline view the document appears with summarize and display, the "outlining tools". This is helpful in changing pieces of your file or creation an chart.

13.4.5 Draft View

To easily alter the text, see the document as a draft by using draft view. Headers and footers, for example, won't be seen in this view of the document.

13.5 Formatting Text in MS Word 2007

You need to be able to format text if you want to design and develop documents that are effective. Formatted text can help you deliver your message and improve the appearance of your paper. It can also direct the reader's attention to particular sections of the content.

You will learn how to format your text in this session, as well as how to change font size, style, and colour of text.

13.5.1 to Format Font Size:

- First choose the file you want to change
- Then Click on the Home option

- Now move your cursor over the various available font sizes in the drop-down menu. You will see a live preview in the document.
- Finally, choose the required font type and the font size

13.5.2 To Format Font Style and Colour:

Similar steps as given above need to be followed for changing font style and font colour. Text colour choices aren't limited to the options displayed in the drop-down menu. You can access the Colours dialog box for more colour options.

13.5.4 To modify the manuscript box:

Choose the words

"Select the change case command"

13.5.5 To "Change Text Alignment":

On the Home tab from the Paragraph group, choose one of the four alignment options.

To "align all of the selected text to the left margin use Left align"

To aligns all of the selected text to the right margin use- Align Text Right

13.6 Mail Merge

"Mail Merge" is a option that make it simple to make letters,and other documents. It will develop additional wizard capabilities and will help you learn to utilise the "Mail Merge" for generate a records and form a letter. You may also learn to access Mail Merge functions outside of the wizard by using Ribbon commands.

use following steps-

- Select
- Start function key
- Steps
- window displays plus walks you through the six stages necessary to finish a combine. Throughout the process, you will need to make a number of decisions.

13.7 Print Preview

You can do a lot of things in print preview format, like:

- Modifying page orientation

- Modifying page size

- Zoom in and not in of the page

- Viewing multiple pages

13.7.1 Steps to Print a Document:

- Click on the Microsoft Office button

- Open- Print dialog box

- Select the pages

- Define the number of copies

- Click OK after selecting a printer from the drop-down list- Print

13.8 Macro in MS-Word

The Macro tool in Microsoft Word is one of its distinguishing characteristics. A Macro is a collection of commands and instructions you combine into one command to carry out a task automatically. A macro tool is used to apply customised shortcuts to a document instead of the default ones. By writing and using macros, you can automate routine processes. For example, select the paragraphs you wish to have the same colour from a list and use the shortcut.

13.8.2 Steps to create a Macro:

To start a macro recording, select View > Macros.

Give the macro a name.

Select the Keyboard or Button to assign a macro.

Select Keyboard to assign via the keyboard.

Type your unique keyboard shortcut and click "Assign."

Run a macro: to launch it , Quick Access Toolbar button, keyboard shortcut, or selecting the macro from the Macros can be used.

13.9 Summary

- Microsoft Windows is a multitasking operating system created for the communication with users through a graphical user interface.

- Microsoft Corporation was created by 'Bill Gates and Paul Allen', with its flagship product as Windows operating system.

- Microsoft Word (MS-WORD) is a graphical word processor that accepts keyboard input. Its objective is to enable users to create and save documents.

- Formatted text can help you deliver your message and improve the appearance of your paper

- to carry out a task automatically a Macro is used as a collection of commands and instructions into one command.

13.10 Keywords

- Flagship product

- Watermark

- Paragraph indentation

- Citation

- Bibliography

13.11 Self-Assessment Questions

1. Which button is used to save our documents?
2. Write about the "Mail Merge".
3. Write a short note on MS word.
4. Discuss the various alignments and text formatting in MS Word.
5. Explain all steps involved in making and saving a file in MS word.
6. How will you take out the hard copy of your document from the MS office? Explain.

13.12 Case Study

'Amit has to submit his resume for interview screening to a high-profile company. But he isn't sure about the formatting and design aspect of it.

Formatting a resume is an important but often overlooked aspect of job search success. An effective resume should be easy to read and easy to scan quickly by hiring managers and recruiters. The layout of a resume should be neat, organised, and tailored to the job being applied for while highlighting the individual's skills, experience, and credentials.

The objective of formatting a resume is to make it easier for hiring managers and recruiters to quickly scan the document, understand the skills and qualifications of the candidate, and draw out information that will help them decide whether the person is a good fit for the role.

The resume should also show that the individual has invested their time and energy into creating an effective document that properly represents them and their experience.'

Question: Discuss and draft an effective resume format that is optimised for readability.

Unit: 14

MS Excel 2007

Learning Objectives:

- Introduction to Ms Excel 2007
- Concept of Workbook and Worksheet
- Formatting in Excel
- Working with formulas
- Printing worksheets.

Structure:

14.0 Introduction to Microsoft Excel 2007

An online spreadsheet program that enables users to store, arrange, compute, and edit data using formulae in a spreadsheet with rows and columns. You can perform numerical calculations and analysis using Excel, a highly potent tool. An example of simple database is Excel, but it is a different class. In this unit, we will look at how to start with Excel and show you around the application.

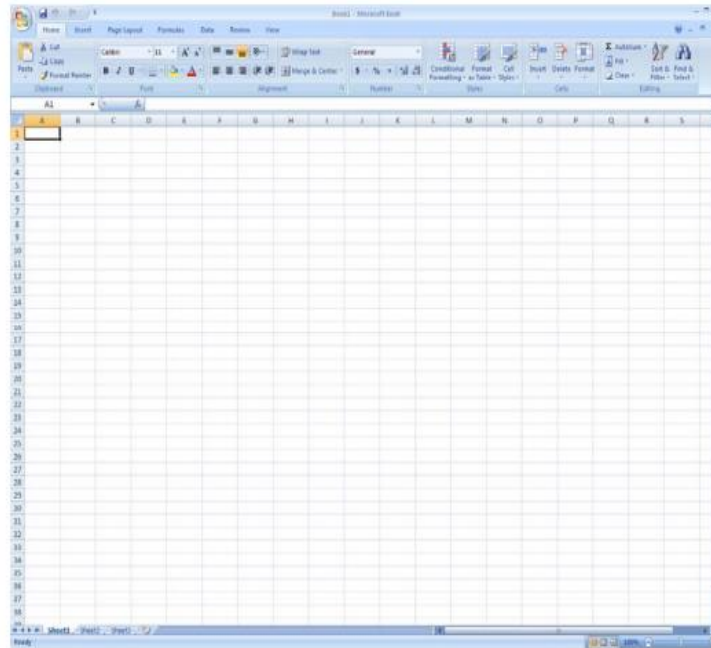While starting Excel first you will see this type of workbook:


Figure 1: Ms Excel Screen

Collection of spreadsheets is called as a workbook. There are three worksheets at the bottom of the window which are named as sheet 1, sheet2 and sheet3. U ser can add more sheets and can delete as per the requirement. You can also rename the name of a sheet.

Columns, Rows, and Cells

- Columns are vertical. They are represented by alphabets such as A, B, C, and so on.

- The rows are horizontal. They are represented by numbers such as 1, 2, 3 and so on.

- Cells are the intersection points of rows and columns. They are named as A1, B3, and C2 and so on.

    Understanding of Cell reference is very important. The cell reference is the cell name, which we can easily locate in the toolbar.

14.1 Understanding the Excel Program Screen
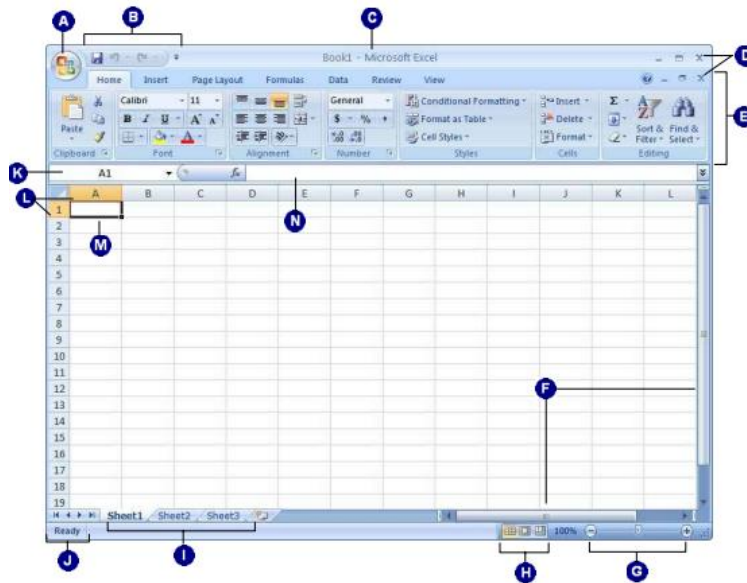
(A) **Office Button**: To replace the File menu found in previous edition of Excel.

(B) **View Button**: It is used to move between various aspects of a page including Normal View, Page Layout View, and Page Break Views.

(C) **Quick Access Toolbar**: It contains general commands such as Undo and save. More commands can be added as per requirement.

(D) **Worksheet tabs:** By default, workbooks have three worksheets. Worksheets can be added, removed or renamed.

(E) **Title bar**: Name of the workbook on which you are working is displayed.

(F) **Status bar:** Status of excel is displayed here.

(G) **Close button**: It is used to exit from the excel.

(H) **Name box**: Displays the active cell addresses or object name.

(I) **Ribbon:** The menus and toolbars seen in earlier Excel versions have been replaced by the tabs and groups on Ribbon.

(J) **Row and column headings:** Every row and column has a heading.

(K) **Scroll bars**: These bars are used to move horizontally and vertically in the worksheet.

(L) **Active cell:** Cell is considered as active when cursor is placed on it.

(M) **Formula Bar:** This is the area where we can apply formulas. For example: =A1+A2

14.1.1 Ribbon: Multiple commands are contained in this tab of ribbon. Various tabs of ribbon are shown below:
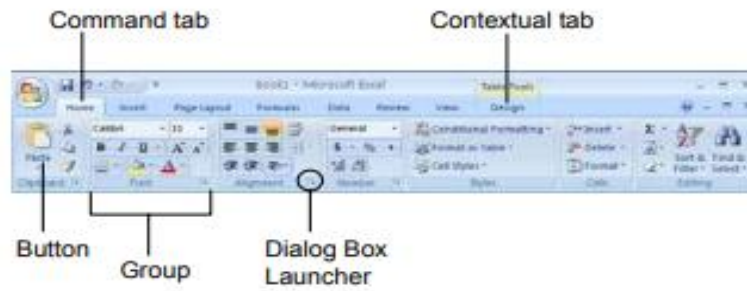
Figure 2: Ribbon Elements

14.1.2 Tabs: There are three different types of tabs:

- **Command tabs**: The default tabs in Excel are Home, Insert, Page Layout, Formulas, Data, Review, and View.

- **Contextual tabs:** Contextual tab comes into picture when you do a specific job and offer commands related to that task. For example the Design tab displays on the Ribbon whenever you insert a table.

- Program tabs: Go to a different authoring mode. The program tabs replace the default command tabs that display on the Ribbon.

14.2   How to use Buttons of Office and Quick Access Toolbar

At the Ribbon on top you have tools to give commands in 'Excel 2007'. They are:

- ➢ The Office Button
- ➢ Quick Access Toolbar

Office Button: It is at the upper-left corner. It has basic file management command such as New for creating a new file.

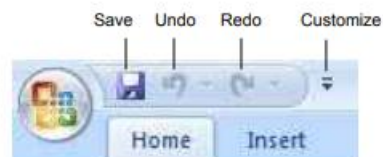**The Quick Access Toolbar**

Figure 3: Quick Access Toolbar

For frequently used commands Quick Access Toolbar makes the tool bar very simple. It is at the right side of Office Button. Some buttons can be added or removed depending upon the ease of user. These buttons are: The Save, Undo, and Redo buttons.

14.3 Keyboard Commands

Two important keyboard commands are **keystroke shortcuts** and **Key Tips**.

In Excel 2007, easiest way to give the command is through keystroke shortcuts. Example of such a command is "Saving a Workbook"

Combination of keys can be used to give commands Some combinations are given below:

Common Keystroke Shortcuts	
<Ctrl> + <O>	Opens a Workbook
<Ctrl> + <N>	Creates a New Workbook
<Ctrl> + <S>	Saves the Current Workbook
<Ctrl> + <P>	Prints the Worksheet
<Ctrl> + <B>	Toggles bold font formatting
<Ctrl> + <I>	Toggles italic font formatting
<Ctrl> + <X>	Cuts the selected cell, text or object
<Ctrl> + <C>	Copies the selected cell, text or object

Figure 4: Common Keystroke Shortcuts

14.4 MS Excel Workbook

A fundamental Excel commands is making a new workbook. A new workbook automatically appears upon starting Excel. New workbook can also be created

14.4.1 Creating Blank Workbook which is New

Select New in the office button.

Click on Create.

Alternate way is to press s <Ctrl> + <N>.

14.4.2 Opening a Workbook

You can edit a workbook that has already been created and saved by you or someone else by opening it. You can open an Excel workbook from within the Excel application

Click Open from Office Button.

Dialogue box will appear.

Give the path of the file which is to be opened.

14.5 Navigating a Worksheet

It is the area that you use to input data. Each worksheet functions as a massive table for organising data with 1048576 rows and 16384 columns. A workbook typically has numerous worksheets with connected content, but only one of them is open at any given moment.

14.5.1 Entering Labels

There are two different type information that can be entered in a cell:

- **Labels**: A text information
- **Values**: Numerical data
- Click a cell where you want to add a label.
- Type the label in the cell.
- Press the 'Enter'
- Once the cell entry is confirmed, the next cell below becomes active.

14.5.2 Entering Values

- Click on a cell and type a value.
- Press 'Enter' to confirm the entry.

14.5.3 Steps for Selecting a Cell Range

This requires understanding of selecting multiple cells.

1. Hold the mouse button while selecting a cell.
2. Multiple cells are selected by dragging and they will be highlighted.
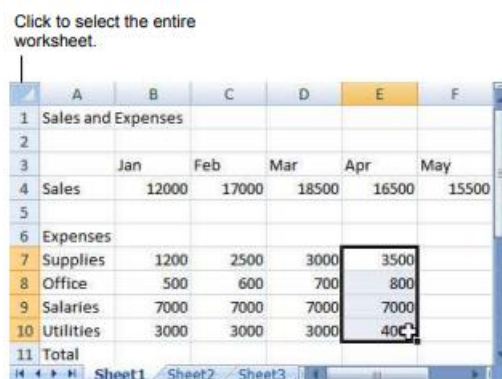3. Range will be selected on release of mouse.

Figure 5: Selecting a Cell Range

14.6 Formulas and Using AutoSum

14.6.1 Formula

The difference between a formula and an ordinary value is that a formula contains the information needed to conduct a mathematical operation like adding, subtracting, or multiplying. A formula always begins with the equal sign (=).

Example: =A1+A2+D3

14.6.2 Functions are pre-defined formulas that can be used to conduct more complex calculations.

14.6.3 AutoSum: Range of cells can be added by using this option. It is used for addition.

14.6.4 Entering Formulas

Every formula in excel starts with "=" mark. For example =sum(A1+D5+H6)

14.6.5 Using AutoFill

It is also called as custom auto fill. For example if you write January in one cell, then on dragging rest of the months name will appear. Some of the lists are by default. A user can create the own series as well.

14.7 Previewing and Printing a Worksheet

Before taking the final print of a document it is advised to have a look at preview. It gives an idea how a page will look after printing. We can adjust the size, margins and other features of a page before taking a printout. It will save the printing cost as well.

14.7.1 Steps to Preview a Worksheet

- Choose the Office Button and point to the Print arrow.
- In the right pane of the Office Button, a list of print options appears.
- Click on Print Preview.
- Click the Close Print Preview button

14.7.2 Print a worksheet

Select the area to be printed by using a mouse. From the file tab click on "Print". The selected documented will be printed. Short cut is Ctrl+P

14.8 Ms Excel Formatting

14.8.1 How to Edit Cell Contents

- To edit cell contents: Double-click the cell you want to edit or press F2.
- To replace the cell contents, select the cell (as above) and type new text or data –
- Press 'Enter'.
- The newly typed information replaces the previous cell contents.
- To clear cell contents, select the cell and Press 'Delete'.

14.8.2 To cut, copy, and paste in cells: Simply select the data in cells. Either select cut or copy from the options and move the contents to new loications. Cut and copy options are available when you right click on mouse.

Paste Special Command: This command removes the formula out of which the value has aroused. If we change the formula value will not be changed. In the file menu click on "Paste Special" data will be copied without associated formula.

14.8.3 How to Insert Cells, Rows, and Columns:

To insert cells:

- Choose the cell where you want to insert cells.
- Click the Home tab on the Ribbon and Select Insert Cells.
- The Insert dialog box will appear. Now, tell Excel how do you want to move the existing cells to make room for the new cells. This can be done by selecting "Shift cells right" or "Shift cells down".
- You can also select options like "Entire row" or "Entire column" in the Insert dialog box mentioned above to insert an entire row or column.
- Click OK.

14.8.4 Deleting Cells, Rows, and Columns: It is very easy to delete the rows and columns. Simply right click on the rows and columns and click delete. Steps are give below:

- Select the cell, column or row you need to delete.

- Click the Home tab on the Ribbon and select the button Delete Cells.

14.9 Summary

- Microsoft Excel is a very useful tool for numeric computations and analysis.
- A workbook is a collection of worksheets (spreadsheets) and macros.
- Columns are the vertical markers in the worksheet and are denoted by the alphabet i.e. A, B, C.
- Rows are the horizontal markers in the worksheet and are denoted by numbers i.e. 1, 2, 3.
- The Ribbon keeps commands visible while you work.
- Commands are organised into tabs on the Ribbon.
- The Quick Access Toolbar appears to the right of the Office.
- A group of cells arranged in rows and columns is referred to as a worksheet in Excel documents.
- Labels are used for worksheet, column, and row headings.

14.10 Keywords

- Excel Data Markers
- Arithmetic Operators
- Dialog box

14.11 Self-Assessment Questions

1. What is Microsoft Excel?
2. What are cells? Does each cell have a unique address? How can you add cells, rows or columns in Excel?
3. How would you format a cell?
4. Differentiate between a worksheet and workbook.

14.12 Case Study

Data processing is very important. Excel is the most commonly used tool for processing the data. If data is not processed it can lead to financial damages to an Organization. This is a point of concern.

For an Organization it is very important to keep the track of inventory, Orders Received, Shipment, Price Change etc. Whenever a customer has an enquiry about the product, price, delivery date, Invoice a company must be in a position to answer all the queries.

XYZ a logistics company has introduced the Excel spreadsheets. Using Excel automation, all the above queries are quickly responded by XYZ.However, some employees find it difficult and time-taking and also too much information inputs are needed.

Question: Discuss the benefits of this new approach for the business.

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