

BBA 2309
Computer Application in Business
Study Module

স্কুল অব বিজনেস
SCHOOL OF BUSINESS



বাংলাদেশ উন্মুক্ত বিশ্ববিদ্যালয়
BANGLADESH OPEN UNIVERSITY

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Computer Application in Business

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Unit Highlights

- BASIC ORGANIZATION OF COMPUTER
- TYPES OF COMPUTER

Technologies Used for Content Delivery

- ❖ BOUTUBE
- ❖ BOU LMS
- ❖ WebTV
- ❖ Web Radio
- ❖ Mobile Technology with MicroSD Card
- ❖ LP+ Office 365
- ❖ BTV Program
- ❖ Bangladesh Betar Program

Lesson – 1: Basic Organization of Computer

After completion of this lesson you will be able to –

- Define computer
- Understand the basic organization of computer

Computer:

The word "computer" derives from the verb "to compute," which implies to perform a calculation. It is an electrical device that can take in data (input), process it by rules, generate information (output), and store the information for later use. It does all of this while running programs that are kept in its memory.

Basic Organization:

The four fundamental functions of input, processing, output, and storage (IPOS) can be carried out by any computer. The IPOS cycle is made up of several processes. Even while the fundamental functions of a computer stay the same, different systems may have different internal designs or structures. A computer block diagram is shown in Figure 1. The functional components of a computer that perform the fundamental tasks are all shown in the figure. The Control Unit and the Arithmetic/Logical Unit jointly direct the flow of control in the central processing unit, while the lines in the image show the flow of data and instructions.

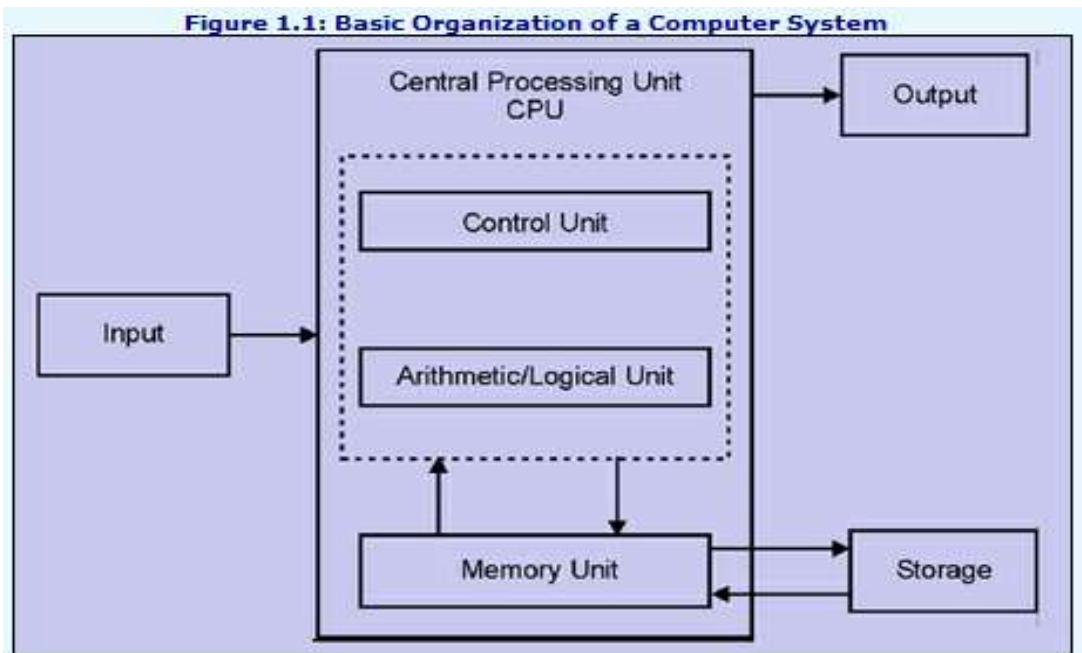


Figure 1: Basic organization of computer
(Source: expertminds.com) year, 2021

Input Unit: Through the input unit, instructions and data are entered into the computer to be converted into information. Data entry involves the use of input devices like a keyboard, mouse, or microphone. Depending on the kind of input device, the data is entered in different formats. For example, a mouse is a device that contains an on-screen pointer that allows users to pick items and choose options; a keyboard may be used to input characters, numbers, and certain symbols; a microphone can be used if the user wants to enter instructions by speaking.

The input interfaces translate inputs into binary codes, or 0s and 1s, regardless of how the input devices get the data because the computer's central memory is only meant to handle this type of data. With gadgets like cordless keyboards, optical mouse, laser mouse, cordless mouse, etc., hitting the market, input device technology has advanced significantly.

Central Processing Unit: The Central Processing Unit (CPU), also known as the computer's brain, is where the real data processing happens. The Random Access Memory (RAM), the computer's primary memory, is where the CPU stores and processes the data and instructions. The two subcomponents of the CPU are the Control Unit (CU) and the Arithmetic Logic Unit (ALU). While the CU obtains and interprets data from the storage unit, the ALU performs arithmetic and logical processes. Additionally, the CPU is made up of circuitry components known as registers and cache.

Arithmetic logic unit: The ALU processes the data and commands that are kept in the RAM. The results of the arithmetic and logical operations carried out on the data by the ALU are momentarily retained in the RAM. The final outcomes of the processing are released by an output device and kept in the secondary memory, or storage unit.

Control unit: The CU receives the program's instructions from the computer's main memory, decodes them, and then sends signals that cause the instructions to be executed. It guides the system's overall activities and aids in preserving order. It chooses, deciphers, and guarantees that the program's instructions are carried out correctly.

Processors: Some computers use more than one processor for processing in order to reduce the load on a single processor.

Output Unit: Through output devices such as a printer and monitor, among others, the output unit distributes the computed results to the public. The processed data is finally shown on a monitor, and a printer can be used to print the output in a format that can be read by hand. Users and computers are connected by means of these output devices. The computer's binary code is transformed into a human-readable format by the output interfaces.

Storage Unit: The data and commands that enter the computer system must be internally stored before any processing occurs. Additionally, before being transferred to the output unit, the computer's processed final results must be stored. A computer system's storage unit is made to hold the data produced throughout different processing phases.

Lesson 2: Type of Computer

After completion of this lesson you will be able to –

- *Identify types of computer*
- *Understand generations of computer*

Types of Computer: Computers are classified based on

1. Data processing
2. Size
3. Functionality

Types of Computer based on data processing: Based on the data processing, computers can be categorized as Digital, Analog, and Hybrid.

Digital Computer: One type of digital computer is a personal computer. Only 0s and 1s are accepted as input by these computers. Binary input is processed by the computer, which then outputs the result. Every mathematical and logical operation is handled by these computers. The computer initially converts any input, regardless of language, into binary code before processing the data. Examples include desktops, laptops, PCs, and mobile phones.

Analog Computer: Analog data is processed by these computers. Analog data is always changing. It lacks a distinct value as a result. They read the input's continual change, process it, and then deliver the result. Analog computers operate with the same accuracy and attention. However, compared to digital computers, they are slower. They're also a tad less accurate. Analog computers measure a capacitor's resistance and are used for speedometer, temperature, frequency, and voltage signals.

Hybrid Computer: Analog and digital computing are combined to create hybrid computers. These machines are capable of complex calculations. Computers that are hybrids are fast and effective. They receive analog input, transform it into digital form, and process the resultant output. Hybrid computers are also used by scientists to perform intricate computations. For instance, at research facilities to gauge earthquakes and other natural disasters, and in hospitals to gauge the heart rates of their patients.

Types of computer based on size:

Microcomputer: Personal computers are the same as microcomputers. Systems consist of a single chip. These are good for home usage and are capable of carrying out all the standard computer functions. Microcomputers are relatively cheap and take up very little space. These machines have the least amount of I/O device requirements. and install every component on a single PCB. Examples include IBM PC, IBM PC/XT, IBM PC/AT

Minicomputer: In the 1960s, minicomputers first appeared. It is small mainframes with restricted capabilities. Compared to mainframe computers, its cost is lower. Small computers have less processing power than mainframes. Between 10 and 100 users can be supported at once. The processor used in the 1970s was either 8 or 12 bits. The required architecture is gradually increasing to 16 and 32 bits. Known as super mini computers, minicomputers are invented. Example: IBM AS400

Mainframe Computer: Mainframe computer is a very strong computer that can handle thousands of users at once. It has a robust data processing system. It can run more than one operating system. It has the capacity to process 100 million commands every second. Large, costly computers with great processing speeds and a lot of internal storage are called mainframes. Mainframes are utilised by businesses that need to execute a lot of transactions online and need computers with a lot of processing and storage power. Mostly used to manage

large amounts of information and data for processing. Multiple user terminals are connected to a centrally located mainframe system. It requires vast chambers with carefully controlled temperature and humidity due of its larger size. Two prominent mainframe suppliers are IBM and DEC. Example: MEDHA, SPERRY, IBM, DEC, HP, HCL.

Super Computer: Supercomputers are the largest and fastest types of computers. In a matter of seconds, these computers are capable of doing billions of operations. MPIS, or million instructions per second, is typically used to gauge how well they function. These computers are specifically designed for scientific applications such as –

1. Encryption decryption of passwords
2. Weather forecasting
3. Testing of nuclear weapons
4. Scientific research of earth and other planetary systems, etc.

Examples – PARAM supercomputer series, Gravity Pipe for astrophysics, Deep Crack for deciphering codes, etc.

Types of Computers Based on the Functionality:

Workstation: Workstation computers are intended for individual use and business use. These are similar to our entry-level laptops and desktop computers but with better features added. A dual-processor motherboard, an additional graphics card, ECC RAM, etc. are a few examples. In comparison to standard PCs, the workstations have greater power. These are able to perform demanding tasks. such as professional gaming, CAD, animation, and audio and video editing. Example: SPARC CPU, MIPS CPU, Apple PowerBook G4, etc.

Servers: These are parts, either software or hardware, designed to help other computers, referred to as clients. This architecture collectively is referred to as the client-server model. The server receives a request from the client and returns a response or a workaround. This demonstrates the higher power of these server machines over desktop counterparts. These computers' primary function is to exchange resources and data with other computers. Various kinds of servers are beneficial for various applications and requirements. Cloud servers, application servers, database servers, file servers, etc. are a few examples. Every one of these servers serves a distinct function for various client requirements.

Embedded: The majority of these computers are microcontroller-based devices. utilised to process particular jobs. Hardware and software are both present in embedded computers. but typically form a component of a bigger system. Every one of its parts is created from the ground up with a specific function or mission in mind. One more feature that sets them apart from a typical PC is that every component is incorporated into a single motherboard or PCB. Their greatest utility is in industrial settings. This is a result of their rough nature.

Digital watches, electronic calculators, fitness trackers, centralized heating systems, GPS systems, and so forth are some examples.

Information Appliances: This category mostly includes portable gadgets made for certain purposes. They are designed to do highly specific activities, such as text editors, music players, photographers, videographers, and so on. Mobile phones are a prime example. There are also a lot of wearable gadgets on the market.

Generation of Computer: Over time, there have been numerous changes to computers. There have been five generations of computers up until 2023, with the first one beginning around 1940. Over a lengthy period of time, beginning in the 16th century, computers underwent constant improvement in terms of speed, accuracy, size, and cost to become the computers of today.

First Generation of Computers: The first generation was constructed between 1946 and 1959

Activity: Identify three computers from your nearby computer shop and determine the types of those computers.

and employed vacuum tube technology. Due to the high cost and high heat output of vacuum tubes, only large organizations could afford these computers. These computers could not multitask since the programming language they utilized was machine language. Built in 1943 for military computations, the ENIAC was the first electronic general-purpose computer, utilizing 18,000 vacuum tubes. The Manchester Mark 1, Mark 2, EDVAC, IBM-650, IBM-701, and other models are examples of the first generation.

Second Generation of Computers: In the late 1950s and early 1960s, the second generation of computers was developed. These computers used transistors in favor of vacuum tubes, which allowed them to be quicker, more compact, and more efficient. Transistors were chosen over vacuum tubes because they produced less heat, needed less maintenance, and were more dependable.

A broader range of people could use second-generation computers since they were more portable and smaller. In this generation, magnetic core memory was also introduced; it was more dependable and speedier. This set the stage for later advancements, opening the door for the third generation of integrated circuits.

Third Generation of Computers: Between 1964 and 1971, the third generation of computers was developed. Using integrated circuits, or microchips, this generation was able to produce computers that were significantly quicker, more affordable, and smaller.

The computing times of the third generation of computers were slashed from microseconds to nanoseconds, making them significantly faster than the previous generations. Punch cards and other antiquated methods were superseded by newer input devices like the mouse and keyboard. The introduction of new features like time-sharing, multiprogramming, and remote processing made it possible to employ computer resources more effectively.

Fourth Generation of Computers: In 1972, fourth generation computers—which utilised microprocessors—were developed in response to the third generation. They made use of Very Large Scale Integrated (VLSI) circuits, which included roughly 5000 transistors and could carry out intricate calculations and operations.

In addition to being smaller, lighter, and requiring less power than their predecessors, fourth generation computers were also faster, more dependable, more versatile, and had greater primary storage capacity. The first business to create a microprocessor utilized in a fourth-generation computer was Intel.

The computer industry underwent a transformation as a result of the remarkably powerful yet compact fourth generation computers, which employed LSI chip technology. This generation was capable of many precise computations, used sophisticated programming languages like C, C++, and DBASE, and had the first supercomputers.

Fifth Generation of Computers After the fourth generation, the fifth generation of computers appeared, and development is now ongoing. Fifth-generation computers employ artificial intelligence (AI) for a variety of functions. These computers accept input in the form of programming languages like Python, R, C#, Java, etc.

In order to carry out scientific calculations and create AI software, fifth generation computers make use of ULSI (Ultra Large Scale Integration), parallel processing, and AI. Complex tasks like picture identification, natural language understanding, and human speech interpretation can be executed by them. Fifth generation devices include Chrome books, laptops, desktop computers, and notebooks, among others.

Activity: Determine the generation of the computer that you are using.

Discussion Questions:

1. Define computer. Explain the basic organization of computer.
2. Explain the types of computer based on data processing.
3. Explain the types of computer based on size.
4. Explain the types of computer based on functionality.
5. Explain the generations of computer.

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Unit Highlights

- ORGANIZATION OF MICROCOMPUTER
- LOGIC FUNCTION, LOGIC GATES AND HARDWARE

Technologies Used for Content Delivery

- ❖ BOUTUBE
- ❖ BOU LMS
- ❖ WebTV
- ❖ Web Radio
- ❖ Mobile Technology with MicroSD Card
- ❖ LP+ Office 365
- ❖ BTV Program
- ❖ Bangladesh Betar Program

Lesson 1: Organization of Microcomputer

After completion of this lesson you will be able to –

- Define microcomputer.
- Explain organization of microcomputer.

Microcomputer: A micro-computer is a small and relatively inexpensive computer with a central processing unit (CPU) made up of a microprocessor. The computer also includes Micro and input and output (I/O) circuit. It is a complete computer utilized on a small scale and designed for a single person.

Microcomputer Organization:

The basic components of a microcomputer are:

- 1) CPU
- 2) Program memory
- 3) Data memory
- 4) Output ports
- 5) Input ports
- 6) Clock generator.

These components are shown in figure 1 below:

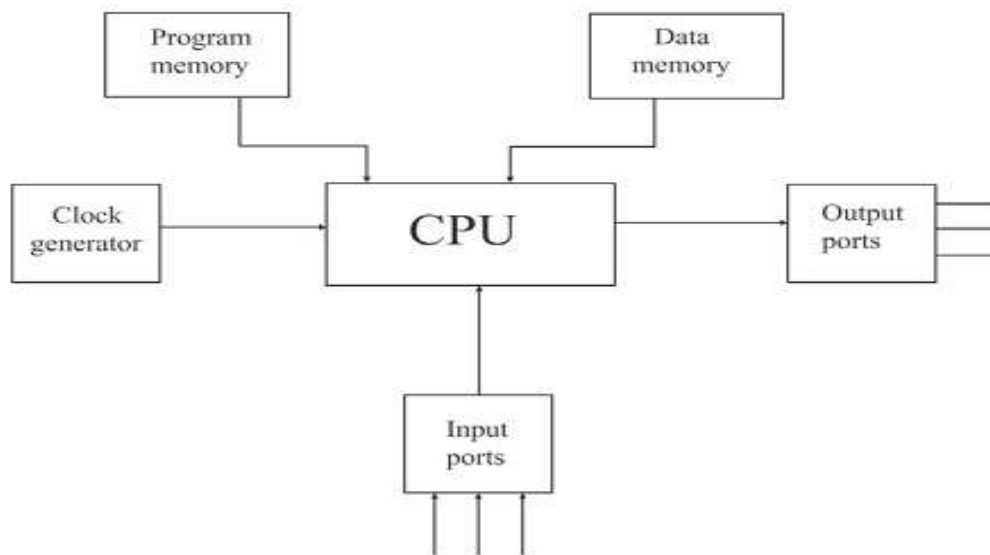


Figure 1: Microcomputer organization

Central Processing Unit: The CPU consists of ALU (Arithmetic and Logic Unit), Register unit and control unit. The CPU retrieves stored instructions and data word from memory; it also deposits processed data in memory.

a) ALU (Arithmetic and Logic Unit): Data processing operations are carried out in this segment. Arithmetic operations like addition and subtraction as well as logical operations like AND, OR, rotate, etc. are examples of these functions. The output devices receive the results, which are either transmitted to registers, memory, or both.

b) Register Unit: There are different registers in it. Mostly, the registers are used to temporarily store data while a program is running. Through instructions, the users can access certain of the registers.

c) Control Unit: It gives the microcomputer the timing and control signals needed for every operation. It regulates data flow between the peripherals (memory, input, and output) and the Processor. The clock that the control unit receives sets the processor's speed.

The CPU has three basic functions

- 1) It fetches an instructions word stored in memory.
- 2) It determines what the instruction is telling it to do. (Decodes the instruction)
- 3) It executes the instruction.

Program Memory: A microcomputer system's primary responsibility is to make sure that its CPU carries out the intended instruction sequence and the program as intended. Upon initialization, the processor begins by executing the instruction sequence in a predefined position in program memory. This typically involves a power up and manual reset. In a typical μ p basic system, the initial instruction of the program should therefore be in this location; this is because the program to be executed is a fixed one that never changes. As a result, program are stored on ROM, PROM, EPROM, or EEPROM. Only the monitor program is stored in ROM in the trainer kit. Because it does not require permanent storage, the user program is not kept in ROM.

A microcomputer modifies data using the algorithm specified by the program's instructions stored in the program memory. The functional block in μ C has the same internal register, which can also be used for such storing if available. If the storage requirements are higher, external data memory is required. These instructions may require the interim results to be stored. In addition to serving as intermediate storage, the data memory may also be utilized to store some of the program's output and supply data that the program requires. Except from program storage, all storage needs are met by data memory. They therefore need to have RAM or RWM with head write functionality.

It keeps the data involved as well as the program's instructions to be followed. It typically has read-only memory, or ROM. The ROM is non-volatile, meaning that its data are retained even after the power is switched off. It can only be read; it cannot be written into. Usually, data and instructions that don't change are stored in a ROM. For instance, on a microcomputer, it saves the monitor program.

A RWM allows one to write into or read from it. Because the RWM is volatile, when the power is switched off, its contents are lost. User program and data that are transient and may change while a program is running are stored there. RAM (random access memory) is what both ROM and RWM are. RWM is in accordance with. The information at the specified location is not lost when a memory read operation is performed. The specified location's original content is erased during a unit operation.

Each word in which ROM and RWM are organized has a distinct address. A word's address, which is its memory location, is enclosed in parenthesis. Consequently, (X) is the content of address X, and X is an address.

The time it takes for the address to decode an address acquired from the control unit, choose the correct memory location, and retrieve its contents is known as the memory's access time. The computer's speed is impacted by the access time, and it needs to retrieve instructions and data from memory. RAM is typically used in computer memory to ensure that all memory locations have equal access times. The computer has to wait for the memory to shine because

memory access times typically vary depending on how many usage the unit receives. Sections of memory were frequently separated into components called pages.

A page containing between 256 and 4k words could involve millions of cables throughout the entire memory region. By initially lowering a specific page and then accessing a point on that page, the computer can obtain a memory location. The benefit of paging is that the computer can access several sites on a single page by simply using the address listed there. It works similarly to describing a street address by first identifying the feature and then providing the numbers.

The control section transfers data to or from memory as follows.

1. The control section reads an address to the memory.
2. The control section sends a read and write signal to the memory to indicate, the direction of the transform.
3. The control section waits until transfer has been completed. This delay precedes the actual data's transfer in the input case and follows it in the output case.

Input/ Output Ports: The microcomputer can interact with the outside world through its input and output ports. Data can flow from the external environment into the input ports, where it can be manipulated by the microcomputer to deliver information to output devices. Through input devices such keyboards, basic switches, CRTs, disc drives, tape or card readers, the user can input data and instructions (i.e., programs) into memory. Physical quantities like temperature, pressure, speed, etc. are likewise measured and controlled by computers.

Transducers are utilized to convert physical quantization into proportionate electrical signals for these uses. Electrical signals are converted into digital signals using A/D computers and then supplied to the computer.

The output devices, such as LEDs, CRTs, D/A converters, printers, etc., get the computing results from the computer. The computer can interact with the outside world thanks to these I/O devices. Peripherals are I/O device types.

Clock Generator: By definition, operations in the p and other regions of the c are synchronized. The correct clock periods, during which the CPU executes instructions, are generated by the clock generator. This need makes sure that things can happen in many system paths in a methodical way.

To provide a clock signal, certain microprocessors are equipped with an inbuilt clock generator circuit. For these microprocessors to determine the operating frequency (e.g., 8085), an external crystal or RC network must be connected at the proper pins. An external clock generator is necessary for certain microprocessors (e.g. 8086). Other components of the microcomputer system can use the output clock signal from these microprocessors to synchronize and time their own operations.

Lesson 2: Logic Function, Logic Gates and Hardware

After completion of this lesson you will be able to –

- Understand computer bus, logic function and logic gate
- Understand motherboard and adapter

Computer Bus: The electrically conducting path along which data is transmitted inside any digital electronic device. A Computer bus consists of a set of parallel conductors, which may be conventional wires, copper tracks on a printed circuit board, or microscopic aluminum trails on the surface of a silicon chip. Each wire carries just one bit, so the number of wires determines the largest data word the bus can transmit: a bus with eight wires can carry only 8-bit data words, and hence defines the device as an 8-bit device.

There are three main types of buses:

1. A data bus can transfer data to and from the memory of a computer, or into or out of the central processing unit (CPU).
2. An address bus transfers information about where the data should go.
3. A control bus is a computer bus that is used by the CPU to communicate with devices that are contained within the computer.

Logic Function: Spreadsheets utilize logic functions to determine if an entry is true or not. It may decide to take one course of action or another based on the test results. These choices can be made in order to conduct tests, present data, or calculate different variables.

Logic Gate: Switches that open or close in response to user actions are called logic gates. These constitute the fundamental components of computer operation. These four primary gates are examples of logic function gates: NOT, AND, OR, and XOR. Moreover, NAND, NOR, and XNOR are exclusive gates. These are also known as Booleans logic gates.

NOT Gate: There isn't a practical gateway available for converting digital input signals. Because of this, the NOT gate is occasionally referred to as an inverter (which should not be mistaken with a power converter). The NOT gate always produces a high output (logic 1) if the input value is low (logic 0). On the other hand, if the input is high (logic 1), a logical NOT gate always produces a low output (logic 0).



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A	Y
0	1
1	0

Figure 1: Not gate and its truth table

Source: BYJUS.com, 2022

If the binary input gate NOT input is considered A, then the binary output gateway will be $\bar{A}$. Since the inactivity icon is a bar or over line (-). If the value of A is 1. then $\bar{A} = 0$ and vice versa.

Its Boolean Expression is usually denoted by a bar or over line ($\bar{}$) the input symbol that represents the function of the inverter, (hence the name inverter).

AND gate: A logical gateway with one input and two or more outputs is called an AND gate. AND Gate follows sensible repeat policies. The output of this gate is also low (0) if the other input is low. The output is also high if all of the inputs are high (1). The most popular AND gates have two or three inputs.



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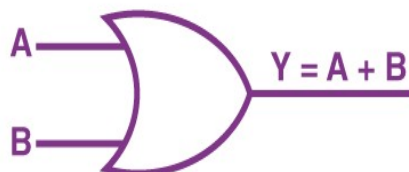
A	B	Y
0	0	0
0	1	0
1	0	0
1	1	1

Figure 2: AND gate and its truth table

Source: BYJUS.com, 2022

The logical equation of AND gate can be represented as $Z = AB$, All multiplication combinations of A and B can be represented in the form of a table in the truth table. The truth table lists the output of a particular digital logic function circuit in all possible combinations of its inputs.

OR gate: The OR gate has one exit signal and two or more inputs. The reason it is called a OR gate is that only when one or more of the input signals are high, then the exit signal will be high.



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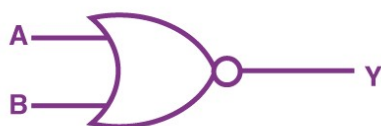
A	B	Y
0	0	0
0	1	1
1	0	1
1	1	1

Figure 3: OR gate and its truth table

Source: BYJUS.com, 2022

It can be seen from the truth table that when the input of the OR gate is low, that is, 0, the output will be 0. If either or both inputs of the OR gate are 1, that is, it is high, and the output will be high, that is 1.

NOR Gate: The NOT gate and the OR gate are combined to create the NOR gate. It is also known as a negative OR gate. The output of the NOR gate is only true or high when both outputs are false or low. Retractable or "compatible" integrated gate OR is known as a logic NOR gate.



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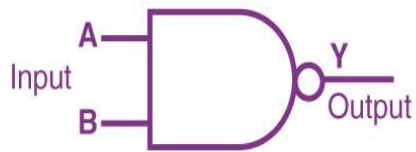
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A	B	Y
0	0	1
0	1	0
1	0	0
1	1	0

Figure 4: Nor gate and its truth table

Source: BYJUS.com, 2022

NAND Gate: Combining the AND and NOT gates results in the NAND gate. They have a cascading connection between them. Likewise known as the negative AND gate. Only when both outputs are true or high does the NAND gate produce a false or low output. The NAND gate is essential because it can be used to perform a variety of Boolean computations.



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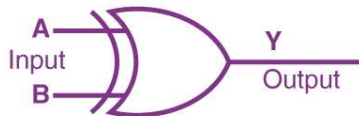
A	B	Y
0	0	1
0	1	1
1	0	1
1	1	0

Figure 5: NAND gate and its truth table**Source:** BYJUS.com, 2022

The NAND gate has a fully functional area. Completeness of functions means that any type of gate can be operated using the NAND gate. Using different combinations, it can perform the functions of NOT, OR, and AND gateways.

Exclusive-OR gate (XOR Gate)

In an XOR gate, the output of a two-input XOR gate attains state 1 if one adds only input and attains state 1.



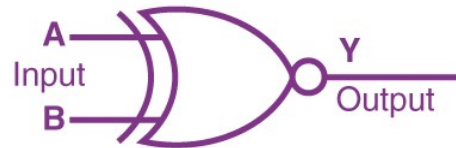
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A	B	Y
0	0	0
0	1	1
1	0	1
1	1	0

Figure 6: X-OR gate and its truth table**Source:** BYJUS.com, 2022

Exclusive-NOR Gate (XNOR Gate)

In the XNOR gate, the output is in state 1 when both inputs are the same, that is, both 0 or both 1.



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A	B	Y
0	0	1
0	1	0
1	0	0
1	1	1

Figure 7: X-NOR gate and its truth table

Source: BYJUS.com, 2022

Application of Logic Gates

There are many uses for logic gates, but they are mostly determined by their truth table or mode of operation. Circuits for safety thermostats, push-button locks, automated irrigation systems, light-activated burglar alarms, and many other electronic devices frequently contain basic logic gates.

The ability to use simple logic gates in a variety of ways with advanced operations is one of the main advantages. Furthermore, the quantity of gates that can be incorporated into a single device is infinite. The actual space allotted in the gadget, however, may limit it. Logic gate area units are found in array form in digital integrated circuits (ICs).

De Morgan's Theorem

The first theorem – It states that the NAND gate is equivalent to a bubbled OR gate.

$$\overline{A \cdot B} = \bar{A} + \bar{B}$$

The second theorem – It states that the NOR gate is equivalent to a bubbled AND gate.

$$\overline{A + B} = \bar{A} \cdot \bar{B}$$

Important Conversions

1) **The 'NAND' gate:** From 'AND' and 'NOT' gates.

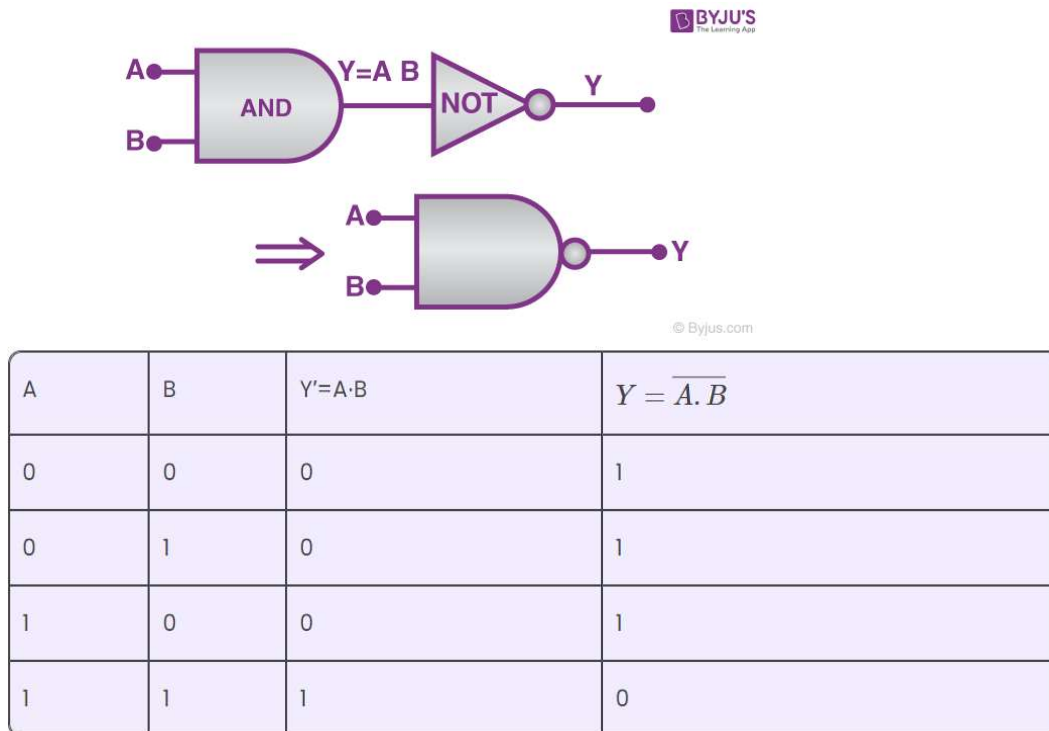


Figure 8: NANO Gate
Source: BYJUS.com, 2022

(2) The 'NOR' gate: From 'OR' and 'NOT' gates.

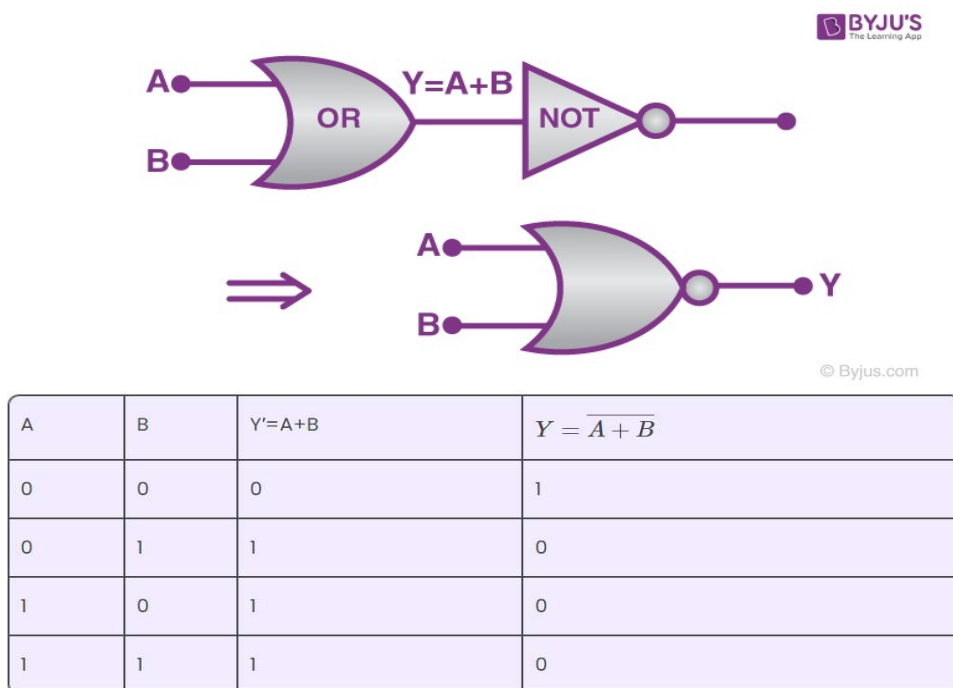
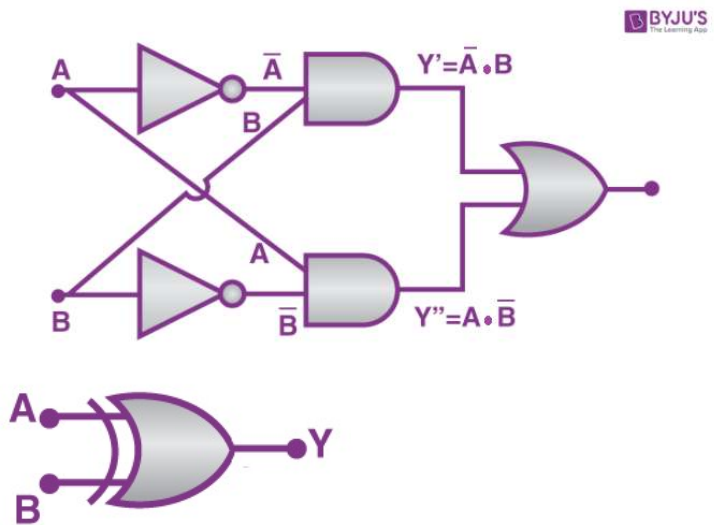


Figure 9: NOR Gate
Source: BYJUS.com, 2022

(3) **The 'XOR' gate:** From 'NOT', 'AND' and 'OR' gates.

Known as the exclusive OR gate or XOR gate, this logic gate produces a high output (i.e., 1) if either input A or input B is high but not both are (i.e., 1). It should be noted that the XOR gate's output is low (i.e., 0) if both of its inputs are high.



Boolean expression and truth table

$$A \cdot \bar{B} + \bar{A} \cdot B$$

or

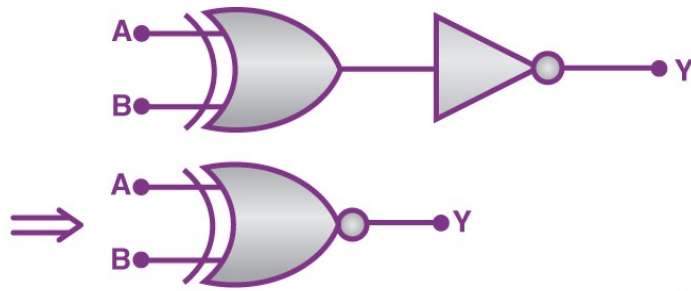
$$Y = A \oplus B$$

A	B	Y
0	0	0
0	1	1
1	0	1
1	1	0

Figure 10: XOR Gate

Source: BYJUS.com, 2022

(4) The Exclusive-nor (XNOR) gate XOR + NOT



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Boolean expression

$$Y = (A \oplus B)$$

A	B	Output
0	0	1
0	1	0
1	0	0
1	1	1

Figure 11: XNOR Gate**Source:** BYJUS.com, 2022

Motherboard: Every component of a computer is connected to one another via the motherboard. It either directly or by cables connects the CPU, RAM, hard drives, optical drives, sound card, video card, and other ports and expansion cards. It is regarded as the backbone of a computer.

Group activity: Discuss with your fellow mates about the differences among logic gates.

Features of Motherboard:

- Motherboards differ widely in their ability to accommodate different kinds of components.
- A single CPU type and a small number of memory types are supported by motherboards.
- For optimal operation, sound cards, hard drives, and video cards must be compatible with the motherboard.
- For a system to function effectively, motherboards, cases, and power supplies must be compatible.

Adapter: When it comes to technology, programming, computing, and communications, an adapter is a hardware or software element that makes it possible for several systems or parts to function together. By bridging the gap between incompatible formats, protocols, or interfaces, it makes compatibility and communication easier. There are many different types of adapters, such as programming interfaces, software libraries, and physical connectors.

The USB-to-Ethernet adapter is a popular example of a physical adapter. If you need to connect to a wired network but your computer doesn't have an Ethernet connection, you can use a USB-to-Ethernet adapter. This adapter features two ports: one for USB that connects to the USB port on your computer, and the other for Ethernet that may be connected to an Ethernet cable. Connecting to the network is made possible by the adapter, which transforms USB signals into Ethernet signals.

Activity: Discuss how motherboard and adapter used in computer.

Discussion Question:

1. Define microcomputer. Explain the organization of microcomputer.
2. Write short notes on computer bus and logic function.
3. Define logic gate. Explain types of logic gates.
4. Write short notes on motherboard and adapter.
5. Explain De-Morgan Theorem.

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Input and Output Devices

3

Unit Highlights

- DEVICES OF COMPUTER

Technologies Used for Content Delivery

- ❖ BOUTUBE
- ❖ BOU LMS
- ❖ WebTV
- ❖ Web Radio
- ❖ Mobile Technology with MicroSD Card
- ❖ LP+ Office 365
- ❖ BTV Program
- ❖ Bangladesh Betar Program

Lesson 1: Devices of Computer

After completion of this lesson you will be able to –

- *Understand use of input devices in the computer.*
- *Understand use of output devices in the computer*

The Input devices are the devices which are used to enter the data in the computer system.

- Keyboard, mouse, scanner, microphone are the example of input devices. It accepts the data from the outside worlds. Then it converts that data into computer coded information. Finally it supplies this data to Central Processing Unit for further processing.

Following are some of the important input devices which are used in a computer –

- Keyboard
- Mouse
- Joy Stick
- Light pen
- Track Ball
- Scanner
- Graphic Tablet
- Microphone
- Magnetic Ink Card Reader (MICR)
- Optical Character Reader (OCR)
- Bar Code Reader
- Optical Mark Reader (OMR)

Keyboard: When entering data onto a computer, the most popular and widely used input device is a keyboard. Although some additional keys are offered for additional tasks, the keyboard layout is similar to that of a typical typewriter. There are now keyboards with 104 or 108 keys available for Windows and the Internet in addition to the two standard keyboard sizes of 84 or 101/102 keys.

The keys on the keyboard are as follows –

Typing Keys: These keys consist of the digit keys (09) and letter keys (A–Z), which often provide a layout similar to typewriters.

Numeric Keypad: It's utilized for cursor movement or numeric data entry. As with most adding machines and calculators, it is typically composed of a set of 17 keys arranged in the same way.

Function Keys: The keyboard has twelve function keys, which are located at the top of the keyboard in a row. Every function key has a distinct purpose and has a distinct significance.

Control keys: These keys control the screen and the cursor. Four directional arrow keys are included. In addition, there are the following control keys: Escape (Esc), Home, End, Insert, Delete, Page Up, Page Down, and Control (Ctrl).

Special Purpose Keys: Special purpose keys on the keyboard include Enter, Shift, Caps Lock, Num Lock, Space bar, Tab, and Print Screen.

Mouse: The most widely used pointing device is the mouse. This well-known cursor control device is a small, palm-sized box with a spherical ball at the base that detects mouse movement and, when the mouse buttons are pressed, transmits signals to the CPU in response.

Activity: Identify the keys of your keyboard.

It typically features two buttons, referred to as the left and right buttons, with a wheel situated in between them. The position of the cursor on the screen can be adjusted using a mouse, but text entry into a computer cannot be done with one.

Joystick: A joystick can also be used as a pointing tool to move the cursor around a computer screen. A spherical ball is attached to the bottom and higher ends of the stick. Moving within a socket is the lower spherical ball. There are four directions in which the joystick can be manipulated. A joystick and a mouse have comparable functions. Playing video games and using computer assisted design (CAD) are its primary uses.

Light pen: A light pen is a pen-like pointing tool. It can be used to pick an item from the menu that is visible or to draw images on the monitor screen. It is comprised of an optical system and a photocell housed in a tiny tube. A light pen's photocell sensor element locates the screen when the pen tip is moved over the monitor screen and the pen button is pressed; the CPU receives the appropriate signal.

Track ball: A track ball is a type of input device that is typically used in place of a mouse in notebook or laptop computers. This is a ball that is partially inserted, and the pointer may be moved by dragging fingers across the ball. A track ball takes up less room than a mouse because the device as a whole remains stationary. There are several shapes for a track ball, including square, ball, and button.

Scanner: An input device that functions more like a photocopier is a scanner. It is utilized when data that is now on paper needs to be moved to the computers hard drive so that it can be further edited. Images are taken by the scanner and transformed into a digital format that may be saved on the disc. Before they are printed, these pictures can be edited.

Digitizer: A digitizer is a type of input device that transforms analog data into digital representation. A digitizer can transform a signal from a camera or television into a string of numbers that can be kept in a computer. The computer may utilize these to make an image of whatever was in the camera's field of view. Because it transforms visuals and pictorial data into binary inputs, the digitizer is sometimes referred to as a tablet or graphics tablet. For intricate drawings and image editing software, a graphic tablet is utilized as the digitizer.

Microphone: Microphone is an input device to input sound that is then stored in a digital form. The microphone is used for various applications such as adding sound to a multimedia presentation or for mixing music.

Magnetic Ink Card Reader (MICR): Since banks handle a lot of cheques every day, MICR input devices are typically used there. The cheques are produced with a unique kind of ink that contains machine-readable magnetic material particles along with the bank's code number and check number. The technology used for this reading is known as Magnetic Ink Character Recognition (MICR). MICR's primary benefits are its speed and low error rate.

Optical Character Reader (OCR): An input device called OCR is used to read printed text. Character by character, OCR optically reads the text, translates it into a machine-readable code, and stores the text in the system memory.

Bar code reader: A bar code reader is a tool for reading data that has been bar coded, or data represented by light and dark lines. Typically, bar coded data is utilized for numbering books, marking products, etc. It could be built into a fixed scanner or be a handheld scanner. A bar code reader works by scanning an image of a bar code and translating it into an alphanumeric value that is sent to the linked computer.

Optical Mark Reader (OMR): OMR is a unique kind of optical scanner that can identify the kind of mark left by a pen or pencil. When one choice needs to be chosen and marked out of several, it is utilized. It is specifically intended to review exam answer sheets for multiple-choice problems.

Activity: Go to computer lab and identify the features of input devices available in the lab.

Output Devices: An output device is a hardware component of a computer system that displays information to users. Following are some of the important output devices used in a computer.

- Monitors
- Graphic Plotter
- Printer

Monitor: A computer's primary output device is a monitor, often known as a visual display unit (VDU). It creates images by arranging small dots, known as pixels, in a rectangular pattern. The number of pixels determines the image's sharpness.

There are two kinds of viewing screen used for monitors.

- Cathode-Ray Tube (CRT)
- Flat-Panel Display

Cathode-Ray Tube (CRT) Monitor: The tiny visual components known as pixels make up the CRT display. The clarity or resolution of the image improves with smaller pixels. A character, like the letter "e" in the word "help," is made up of many lit pixels. A screen can only hold a limited amount of characters at once. A sequence of character boxes, or fixed spots on the screen where a standard character can be positioned, can be seen dividing the screen. The majority of screens can display data in the form of 80 characters horizontally and 25 lines vertically.

There are some disadvantages of CRT –

- Large in Size
- High power consumption

Flat-Panel Display Monitor: In contrast to CRTs, a type of video devices known as flat-panel displays require less weight, power, and volume. Anyone can wear them on your wrists or hang them from walls. These days, flat-panel displays are used in laptop computers, video games, monitors, calculators, and graphical displays.

The flat-panel display is divided into two categories –

- **Emissive Displays** – Emissive displays are devices that convert electrical energy into light. For example, plasma panel and LED (Light-Emitting Diodes).
- **Non-Emissive Displays** – Non-emissive displays use optical effects to convert sunlight or light from some other source into graphics patterns. For example, LCD (Liquid-Crystal Device).

Plotter: In essence, a plotter is a kind of printer. Using this computer output device, one can produce large-format, high-quality photos, diagrams, and drawings on flat surfaces or paper. Printing on flat surfaces is made easier by its flatbed. Vector graphics are used by this device

Activity: Identify the type of monitor you are using for studies.

to operate. Plotters employ pens, pencils, or other drawing tools to travel over the paper, producing continuous, detailed lines. They are not likely to be your average, deskjet or LaserJet printer, which create images by spraying small droplets of ink on paper or toner. Using one or more automatic multi coloured pens, this device reads commands from a computer and draws lines on paper. Straight from vector graphic files, a plotter can create continuous point-to-point lines.

Printers: Printer is an output device, which is used to print information on paper.

There are two types of printers –

- Impact Printers
- Non-Impact Printers

Impact Printers: Impact printers print the characters by striking them on the ribbon, which is then pressed on the paper.

Characteristics of Impact Printers are the following –

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

These printers are of two types –

- Character printers
- Line printers

Character Printers

Character printers are the printers which print one character at a time.

These are further divided into two types:

- Dot Matrix Printer(DMP)
- Daisy Wheel

Dot Matrix Printer (DMP): Dot matrix printers are among the most widely used printers on the market. These printers are well-liked due to their affordability and convenience of use for printing. The device is named a "dot matrix printer" because each character printed is in the shape of a pattern of dots, and the head is made up of a matrix of pins with sizes ranging from 5*7 to 9*9. These pins come out to form a character.

Daisy Wheel: Daisy Wheel Printer gets its name from the fact that the head is positioned on a wheel and the pins that represent the characters are shaped like the petals of a Daisy flower. In offices where occasional high-quality letters need to be transmitted, these printers are typically utilised for word processing.

Line Printers: Line printers are the printers which print one line at a time.

These are of two types –

- Drum Printer
- Chain Printer

Drum Printer: This printer gets its name from the fact that it resembles a drum. The drum's surface is separated by several tracks. The total number of tracks on a drum is equal to the width of the paper (i.e., 132 tracks for a paper width of 132 characters). The track has an embossed character set. There are three different character sets on the market: 48, 64, and 96 characters. One line is printed by one drum spin. Drum printers print 300–2000 lines per minute at a high pace.

Chain Printer

In this printer, a chain of character sets is used, hence it is called Chain Printer. A standard character set may have 48, 64, or 96 characters.

Non-impact Printers: Characters are printed by non-impact printers without the need for ribbons. These printers are also known as page printers because they print one entire page at a time.

These printers are of two types –

- Laser Printers
- Inkjet Printers

Laser Printers: These are non-impact page printers. They use laser lights to produce the dots needed to form the characters to be printed on a page.

Inkjet Printers

Inkjet printers are non-impact character printers based on a relatively new technology. They print characters by spraying small drops of ink onto paper. Inkjet printers produce high quality output with presentable features.

Their numerous printing modes and lack of pounding result in reduced noise levels. Printing in color is also an option. Inkjet printer devices with numerous printout capabilities are also available.

Activity: Identify the printer used in your nearest printing shop.

Discussion Questions:

1. Define Keyboard. Explain keys of keyboard.
2. Write Short notes on the followings:
a. mouse ; b. Joy Stick; c. Light pen; d. Track Ball
3. Write Short notes on the followings:
a. Scanner; b. Graphic Tablet; c. Microphone; d. Magnetic Ink Card Reader (MICR)
4. Write Short notes on the followings:
a. Optical Character Reader (OCR); b. Bar Code Reader; c. Optical Mark Reader (OMR)
5. Define Monitor. Explain types of monitor.
6. Define Printer. Explain types of printer.

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Memory Organization

4

Unit Highlights

- MEMORIES OF COMPUTER

Technologies Used for Content Delivery

- ❖ BOUTUBE
- ❖ BOU LMS
- ❖ WebTV
- ❖ Web Radio
- ❖ Mobile Technology with MicroSD Card
- ❖ LP+ Office 365
- ❖ BTV Program
- ❖ Bangladesh Betar Program

Lesson 1: Memories of Computers

After completion of this lesson you will be able to –

- *Identify various memories of computer.*
- *Understand memory organization in the computer.*

A memory is just like a human brain. Instructions and data are stored there. Computer memory is the area within the computer's storage where instructions needed for processing data are kept and data to be processed is kept. The memory is made up of many tiny components known as cells. A unique address, which ranges from zero to memory size minus one, is assigned to each place or cell. For instance, this memory unit holds $64 * 1024 = 65536$ memory places if the machine has 64k words. These locations range in address from 0 to 65535.

Memory is primarily of three types –

- Cache Memory
- Primary Memory/Main Memory
- Secondary Memory

Cache Memory: A particularly fast semiconductor memory that can accelerate the CPU is called cache memory. It serves as a divider between the main memory and the CPU. It is meant to store the sections of the program and data that the CPU uses most frequently. The operating system moves the relevant portions of the programs and data from the disk to cache memory so that the CPU may access them there.

Advantages:

The advantages of cache memory are as follows –

- Compared to main memory, cache memory is faster.
- Its access time is lower than that of main memory.
- Short-run programs are stored there for quick execution.
- Data is temporarily stored for use.

Disadvantages

The disadvantages of cache memory are as follows –

- Cache memory has limited capacity.
- It is very expensive

Primary Memory (Main Memory): The only data and instructions kept in primary memory are those used by the computer at the moment. Data is lost when the power is turned off, and its capacity is restricted. Usually, semiconductor devices make up this system. Compared to registers, their memories are not as quick. Main memory holds the information and instructions that must be processed. Two subcategories, RAM and ROM, make up this category.

Characteristics of Main Memory:

- These are semiconductor memories.
- It is known as the main memory.
- Usually volatile memory.
- Data is lost in case power is switched off.
- It is the working memory of the computer.
- Faster than secondary memories.
- A computer cannot run without the primary memory.

Random Access Memory (RAM): The internal memory of the CPU used to store data, programs, and program results is called RAM (Random Access Memory). It is a read/ write memory that holds data while the computer is operating. Data is deleted as soon as the system is turned off.

All storage locations within RAM have the same access time and are equally accessible, meaning that access times are not affected by the address. RAM costs a lot of money, yet it allows for random access to data.

RAM is a volatile memory type, meaning that data saved within is lost in the event of a power outage or machine shut down. Consequently, computers are frequently utilized with a backup Uninterruptible Power System (UPS). RAM is modest in terms of the quantity of data it can store as well as its physical dimensions.

RAM is of two types –

- Static RAM (SRAM)
- Dynamic RAM (DRAM)

Static RAM (SRAM): The term "static" denotes that the memory holds onto its data as long as power is applied. But because data is volatile, it is lost when the power goes off. With no capacitors, SRAM chips employ a matrix of six transistors. SRAM does not need to be updated frequently because transistors do not need electricity to stop leakage.

Because the matrix has more space than DRAM, SRAM requires more chips to provide the same amount of storage capacity, which raises the cost of manufacture. SRAM has extremely quick access and is hence employed as cache memory.

Characteristic of Static RAM:

- Long life
- No need to refresh
- Faster
- Used as cache memory
- Large size
- Expensive
- High power consumption

Dynamic RAM (DRAM): It takes constant refreshing to keep the data in DRAM, as opposed to SRAM. Rewriting the data many hundred times per second is accomplished by placing the memory on a refresh circuit. Because DRAM is inexpensive and compact, it is typically utilized for system memory. A single transistor and one capacitor make up each memory cell that makes up a DRAM.

Characteristics of Dynamic RAM:

- Short data lifetime
- Needs to be refreshed continuously
- Slower as compared to SRAM
- Used as RAM
- Smaller in size
- Less expensive
- Less power consumption

Read Only Memory (ROM): Read Only Memory is referred to as ROM. the memory that we are only able to read and not write on. Memory of this kind is not volatile. During manufacturing, the data is permanently saved in these types of memory. Such instructions,

which are necessary for a computer to boot up, are stored in a ROM. We call this process bootstrapping. Not only do computers employ ROM chips, but other electronic devices like microwaves and washing machines also do.

MROM (Masked ROM): A preprogrammed collection of data or instructions was stored in the first ROMs, which were hardwired devices. These ROMs are inexpensive and referred to as masked ROMs.

PROM (Programmable Read Only Memory): PROM is read-only memory that a user can only edit once. Using a PROM program, the user purchases a blank PROM and inputs the desired contents. Small fuses that are burned open during programming are located inside the PROM chip. It is not erasable and can only be programmed once.

EPROM (Erasable and Programmable Read Only Memory): It is possible to erase EPROM by subjecting it to ultraviolet radiation for up to forty minutes. Usually, this is accomplished with an EPROM rubber. An electrical charge is imprisoned in an insulated gate region during programming. Due to the lack of a leaking path, the charge is kept for longer than ten years. Ultraviolet light is directed through a quartz crystal window (lid) in order to erase this charge. The charge is dissipated by this ultraviolet light exposure. The quartz cover is sealed with a sticker when in use.

EEPROM (Electrically Erasable and Programmable Read Only Memory): EEPROM is programmed and erased electrically. It can be erased and reprogrammed about ten thousand times. Both erasing and programming take about 4 to 10 ms (millisecond). In EEPROM, any location can be selectively erased and programmed. EEPROMs can be erased one byte at a time, rather than erasing the entire chip. Hence, the process of reprogramming is flexible but slow.

Advantages of ROM:

The advantages of ROM are as follows –

- Non-volatile in nature
- Cannot be accidentally changed
- Cheaper than RAMs
- Easy to test
- More reliable than RAMs
- Static and do not require refreshing
- Contents are always known and can be verified

Secondary Memory: This type of memory is also known as external memory or non-volatile. Compared to the main memory, it operates more slowly. These are employed for long-term data and information storage. These memory are accessible through input-output procedures rather than directly by the CPU. The CPU can access secondary memory after its contents have been moved to main memory. As an illustration, consider a disc, CD-ROM, DVD, etc.

Activity: Identify the differences between RAM and ROM

Characteristics of Secondary Memory

- These are magnetic and optical memories.
- It is known as the backup memory.
- It is a non-volatile memory.

- Data is permanently stored even if power is switched off.
- It is used for storage of data in a computer.
- Computer may run without the secondary memory.
- Slower than primary memories.

The most common forms of auxiliary memory are flash memory, optical discs, magnetic disks and magnetic tape.

Flash memory: An electrically erasable and reprogrammable non-volatile computer storage device that functions without the need for moving parts. Solid state devices, flash drives, and memory cards are a few examples of this. Numerous Apple notebooks use a variation of this.

Optical disc: A storage medium that lasers can read and write data to. Compared to most portable magnetic media, including floppies, optical discs have a significantly larger data storage capacity of up to 6 gigabytes. Three fundamental categories of optical drives exist: WORM (write-once, read-many), EO (erasable optical drives), and CD-ROM (read-only).

Magnetic Disc: A circular plate made of metal or plastic that has been covered in magnetized material is called a magnetic disc. With read/write heads accessible on both surfaces, many discs can be stacked on a single spindle and utilized from both sides. Tracks are the concentric circles along which bits are stored in locations on the magnetized surface. Sectors are the terms used to group sections of tracks together. Hard discs are discs that are affixed permanently and are not removable by sporadic users. A floppy disc drive is a type of disc drive that has removable discs.

Magnetic tape: To supply the parts and control mechanism for a magnetic tape unit, a magnetic tape transport is made up of electric, mechanical, and electronic components. The tape is actually a plastic strip with a magnetic recording medium applied on it. Magnetic spots on tape are used to record bits along many tracks. A character is recorded using seven or nine bits in addition to a parity bit. In order to record and read data as a series of characters, R/W heads are installed in each track.

Currently the most common forms of secondary storage device are:

- Floppy disks
- Hard disks
- Optical Disks
- Magnetic Tapes.
- Solid State Devices

Floppy disk: A removable, flexible magnetic storage device that may hold computer files or other electronic data is called a floppy disc. It is composed of a flexible and thin magnetic storage disc that is enclosed inside a rectangular plastic carrier that has a fabric lining for increased sturdiness. Data can be read and written because the disc is magnetic. Writes and reads floppy discs with a floppy disc drive (FDD). For main data storage, backup, and data transfers between computers, floppy discs were a nearly ubiquitous data format from the 1970s until the 1990s.

Floppy disks were created by IBM in the early 1970s to protect data even when the computer was off. For more than 40 years, the floppy disc served as the main and most dependable method of data storage. Like most innovations, the floppy disc began large and became smaller over time as advancements in technology were made.

Although larger floppy disks have been around since the 1970s, the 3.5-inch models with hard plastic case gained popularity in the 1980s. The most common floppy disc size, measuring 3.5 inches and holding 1.44 MB, was in use.

The 3.5-inch floppy disc icon persists in modern software despite the fact that floppy discs have mostly become outdated and are no longer a common part of new computer systems. Instead, they have come to represent file storage.

Hard Disc: Hard disc, a computer's magnetic storage device. Hard discs are round, flat plates with a magnetic coating that are composed of glass or aluminum. Personal computer hard drives have a capacity of terabytes, or trillions of bytes, for storing data. On their surfaces, information is kept in circular tracks. By magnetizing tiny spots on a spinning disc in various orientations, a tiny electromagnet known as a magnetic head writes a binary number (1 or 0) and reads digits by detecting the direction in which the spots are magnetized. The hard drive in a computer is a device that is made up of many hard discs, read/write heads, a drive motor that spins the discs, and a tiny amount of circuitry. The metal shell around the discs keeps dust out of the drive. The phrase "hard disc" can apply to any internal data storage space inside a computer as well as the discs themselves. Solid-state drives (SSDs), which store data on flash memory chips rather than hard discs, were first used in personal computers and laptops in the early 21st century.

Optical Disk: An optical disk is primarily used as a portable and secondary storage device. It can store more data than the previous generation of magnetic storage media, and has a relatively longer lifespan. Compact disks (CD), digital versatile/video disks (DVD) and Blu-ray disks are currently the most commonly used forms of optical disks. These disks are generally used to:

- Distribute software to customers
- Store large amounts of data such as music, images and videos
- Transfer data to different computers or devices
- Back up data from a local machine

Magnetic Tape: In magnetic tape, data is stored on just one side of the ribbon. It's a sequential memory using a magnetic oxide-coated thin plastic ribbon that stores data. Sequential access causes slower read and write speeds for data. It requires a magnetic tape drive to write and read data, yet it is quite dependable. The width of the ribbon varies from 4mm to 1 Inch and it has storage capacity 100 MB to 200 GB.

Solid state storage devices: Solid state storage devices, in contrast to the other storage systems that have been covered thus far, are devoid of moving parts and store and retrieve data in a manner akin to that of computer memory. They exist in many shapes and sizes and are occasionally marketed under several names, such as USB discs, pen drives, flash discs, etc. In order to sell these gadgets, manufacturers frequently include components like MP3 players inside of them. Nonetheless, they are all dependable devices with respectable storage capacities that consume very little power when operating. The typical storage size is between 32 MB and 1 GB.

Activity: Identify the secondary memory you use most.

Discussion Questions:

1. Define cache memory. Explain its advantages and disadvantages.
2. Define RAM. Explain the types of RAM.
3. Define ROM. Explain the types of ROM.
4. Write short notes on the followings:
 - a. floppy disk; b. Hard disk; c. Optical Disk; d. Magnetic Tape; e. Solid State Devices

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Computer Software

5

Unit Highlights

- SOFTWARE AND OPERATING SYSTEM
- APPLICATION PACKAGE PROGRAM

Technologies Used for Content Delivery

- ❖ BOUTUBE
- ❖ BOU LMS
- ❖ WebTV
- ❖ Web Radio
- ❖ Mobile Technology with MicroSD Card
- ❖ LP+ Office 365
- ❖ BTV Program
- ❖ Bangladesh Betar Program

Lesson 1: Software and Operating System

After completion of this lesson you will be able to –

- *Understand use of system software.*
- *Understand functions and types of operating system.*
- *Know about utility programs.*
- *Know about programming languages.*

The electronic commands and processes that direct and regulate a computer's operations are referred to as computer software. Software provides instructions to the computer.

Types of Software:

There are mainly two types of software.

- System Software
- Application software

System Software: Software that allows a computer to function and manages attached devices is referred to as system software. The computer system's software is responsible for carrying out duties linked to its performance. It is a group of applications made to control computer functions and make user-accessible computer resources available.

Functions of system software:

- Booting the computer
- Making sure that all hardware elements are working properly
- Performing operations such as retrieving, loading, executing and storing application programs
- Storing and retrieving files
- Performing a variety of system utility functions.

Categories of System Software:

There are three categories of system software.

- Operating system
- Utility programs
- Programming

Operating System: An operating system is a kind of system software that manages a computer's everyday functions. The computer resources are managed by these programs.

Types of operating system:

- Stand-alone operating system
- Network operating system
- Embedded operating system

Examples: Windows operating system, Chrome operating system, Linux , Unix, Ubuntu Operating System, Android for mobile phones

Functions of operating system:

- It facilitates time sharing and other forms of multitasking processor management.
- Regulate how you use auxiliary devices.

- It offers a setting in which application software installation is possible.
- Oversees the computer's booting procedure.
- Keeps track on system efficiency.
- Assists in managing security measures.
- It facilitates file management.
- It facilitates device configuration, which involves connecting devices to function with computers.
- In charge of organizing computer jobs and tasks.
- Facilitates the creation of network connections.

Utility Software: These are components of system software that are intended to maintain, analyze, optimize, and configure a computer.

Activity: Determine the operating system you use in your computer and its functions.

Functions of Utility software:

- It finds computer viruses and guards against them.
- By using a screen saver, it lessens screen burnout (ghosting).
- It compresses data files to save up desk space.
- It examines disc problems and occasionally corrects them.
- It stores the system functionality (i.e. system store)
- It allows computers to arrange files alphabetically.
- It allows the user to combine files.
- Hard discs are defragmented by it.
- It allows the user to encrypt data.

Programming Languages: These are the languages that are used to write program software, or computer instructions.

Activity: Determine the utility programs which are installed in your computer and in which purpose you use those programs.

Types of Programming Language:

Programming languages are of two types

- Low level programming language
- High level programming language

Low level programming language: These are programming languages, like Assembly and Binary (machine code) that depend on machines. These programming languages are the most effective means of directly providing signals, or Binary Instructions, to a computer since computers can only understand Binary language, which consists of instructions in the form of 0s and 1s (signals, which can be either High or Low).

Because computers can read these signals directly, Machine Code (Binary Language) does not require an interpreter or compiler to transform language in any form. Therefore, in order for a computer to comprehend instructions written in Assembly, the Assembly language must be translated into an equivalent Binary code. An assembly code can be converted to its equivalent

binary code using an assembler. These kinds of languages make it difficult to develop, read, edit, and comprehend the code; also, the programs are not transferable to other computer systems.

Middle level programming language: Although there isn't a category specifically for computer programming languages, this category includes languages that combine elements of high- and low-level programming.

It is possible to refer to computer languages that combine elements of both Low and High Level languages as "Middle Level" programming languages.

Because it combines elements of both low-level and high-level programming languages, C is the best example of a low-level programming language.

High level programming language: These are the easily readable, editable, and machine-independent programming languages. Languages like Java, Net, Pascal, COBOL, C++, C, C#, and others are widely used these days to create applications for end users. These languages fall into the category of high level programming languages. With the use of certain unique keywords, functions, and class libraries found in high level programming languages, creating computer programs is made simple. Computers can only interpret machine code; programs created in these languages are not immediately understood by them. Therefore, in this case, translating high-level programs into their equivalent machine code requires programming translators.

System software that translates a program written in one programming language into its equivalent machine code is known as a programming translator. Examples of these translators include compilers and interpreters.

Features of High-level Programming Language: Because the programs are autonomous and written in High Level programming languages, they can be executed on other systems.

Simple to understand: Because these programming languages share English-word-like keywords, functions, and class libraries, we can quickly grasp the meaning of any given term associated with that language.

Simple to read, write, and edit: High Level programming languages provide programs that are simple to write, read, and edit.

Even though High Level language programs are slower than Low Level language programs, we can still readily edit programs developed by other programmers with only a basic understanding of that programming language. Despite this, High Level programming languages are still widely used to develop User End Applications.

Language processors: These need to convert high-level languages into processor-understandable machine code. They are programs made to convert high-level languages into lower-level ones.

Examples of language processors:

A compiler: a compiler is a program which translates a whole source program from high level language to low level language which can easily be understood by the computer.

An interpreter: This is a program that translates the source program line by line while the program is running from high level language to low level language.

The assembler: This translates assembler instructions from assembly language to machine code language or the binary code.

The linkers: These combine compiled programs and determine where the program will be located in the memory.

Common terms used in programming:

Source code: A programmer's source code is a text file containing program instructions that, before being executed, must be converted into object code by a compiler, interpreter, or assembler.

The Execution is the process by which a computer system performs the instructions of a computer program.

Object code is a program code in machine language that is ready for execution by the computer.

Bug is a logical problem in the program source code that stops the program to give wrong results/ from running.

Debugging is the process of detecting, checking and identifying problems and errors in the source code. A computer cannot comprehend source code until it has been converted to machine code.

High Level Languages

There are several high level programming languages in use. Following computer languages are popular and have widespread applications:

- BASIC
- C
- FORTRAN
- PASCAL
- COBOL
- C++

BASIC: It stands for Beginner's All-Purpose Symbolic Instruction Code in short. For a beginner, the language is relatively simple. At first, microcomputers are typically programmed in BASIC. In 1964, Thomas Curtz and J.G. Kemeny of Dartmouth College in the United States invented it. There exist a multitude of versions of BASIC in use. Standard BASIC is one of them, but it's so basic that it's not in use today. The majority of microcomputers run on a BASIC developed by Microsoft. Microcomputers come with QBASIC, which is now widely used. Compared to other computer languages, BASIC offers the following advantages:

- It is simple to use and learn.
- It is intended for interactive use rather than batch processing mode; it offers some potent additional facilities not found in many other languages.
- Errors can be fixed by the user when they appear during program execution. On all computers, the language is easily customizable.
- Students and other non-professionals can easily learn BASIC.

C: The C language was created in the mid-1970s by Dennis Ritchie, a programmer at AT & T Bell Laboratories in the USA. It is a popular language that proved suitable for writing programs that had previously been written exclusively in assembly languages, including the AT & T UNIX operating system. It is portable to microcomputers, and the majority of PC applications and system programmes are written in C.

C++: Bjarne Stroustrup founded the object-oriented programming (OOP) language C++, which is an expansion of the C language. Because it has both high-level and low-level linguistic elements, C++ is regarded as an intermediate level language. Its original name was "C" with classes since it has all of the features of the C language along with the idea of classes. Then, in

1983, it was called C++. C++'s primary feature is its library of predefined classes. Polymorphism, inheritance, virtual and friend functions, namespaces, and pointers are among C++'s primary characteristics. One of the most widely used programming languages for creating client-server applications, system/application software, and CGI scripts is C++.

FORTRAN: Formula Translation is referred to as Fortran. IBM created it as their first programming language in 1957. Numerous changes have been made to it, and newer versions have been dubbed FORTRAN II and FORTRAN-IV. the most widely used version, created in 1966. FORTRAN 77 and FORTRAN 90 are the most recent additions. FORTRAN has highly strict syntax. It is widely used in scientific and engineering computations.

Pascal: For small computers, Pascal is widely used. Nicholas Writhe created Pascal with the purpose of instructing pupils in computer programming. It is a part of the ALGOL group. For structured programming, nested blocks make up a Pascal program.

COBOL: Common Business Oriented Language is what it stands for. It is a widely used business language for processing data. The goal of its invention in the late 1960s was to give corporate applications a standard language. Due to COBOL's independence from particular computer systems, programmes built in the language can be moved to other computers with just minor modifications.

Some Other High Level Languages

ALGOL: Is a short name for Algorithmic Language. Originally developed in 1958, it is more precision language than FORTRAN for scientific and numeric calculations.

Forth: Is a powerful language designed only for fourth generation computers. Useful in home computing.

RPG: Stands for Report Program Generator. It is a commercial language specially developed for reporting.

ADA: Designed by U.S. Defense Department for its real-time applications and is also suitable for parallel processing.

PL/I: (Programming Languages/I), which combines the features of both COBOL and FORTRAN and can be used for scientific as well as business applications. It was introduced in the late 1960s by IBM. Its application is limited to only IBM computers. **Snobol:** was developed in 1962. It is quite different from other languages in the sense that it can be used for processing messages, patterns and strings.

LISP: stands for List Processor. It is an artificial intelligence programming language.

Activity: Determine which programming language is used most nowadays and its features.

Lesson 2: Application Package Program

After completion of this lesson you will be able to –

- *Understand application software.*
- *Know about the use of various application package programs.*

Application Software: This software application carries out a certain, user-specified task. On an operating system, application software is installed. Programs created specifically to carry out particular duties for end users make up application software. Putting in a letter, for instance.

Application Package Programs: Software suppliers promote packaged programs, which are created by skilled programmers for commonly used applications. The bundle generally succeeds in lowering costs and lowering the possibility of mistakes.

An appropriate application package should always be used instead of developing a program, if possible.

Multiple applications are combined into a single program package through integrated packages. Microsoft Office, Microsoft Word, Microsoft Excel, Microsoft Power Point, Microsoft Access, WordPerfect, Lotus 1-2-3, and Symphony are well-known examples of integrated products. Numerous common applications, including word processing, spreadsheet analysis, and databases, are included in the packages. The integrated package's programs can interchange data with ease. For instance, using a word processor to compose a standard letter and send it to

Examples of Package Program

Categories	Popular Package Programs
Word Processors	Word, WordStar, WordPerfect, Latex etc.
Spreadsheets	Lotus 1-2-3, Excel, Quicken, QuattroPro, SuperCalc.
Data Management	dBASE, ORACLE, FoxBASE+, Idealistic, SuperBase
Professional	MS Foxpro, MS Access etc.
Integrated Software	PFS: First Choice, Microsoft Works, Enable/OA,
Graphics	PC Paintbrush, CorelDRAW, Harvard Graphics,
Freelance	Graphics etc.
CAD	AutoCAD, Generic CADD, ORCAD, MiniCAD plus.
Communications	PROCOMM PLUS, CrossTalk, PFS: First Choice;
	Apple Works GS, MicroPhone 11,

Microsoft Word: Microsoft Word (MS Word) possesses a wide range of powerful and easy-to-use features. Word is popular among PC and Mac users. With Microsoft Word, one can integrate text with graphics and revise information within a document. Microsoft Word has special features such as print preview, side-by-side columns, built-in outlining, and automatic pagination. Word for Windows allows to open multiple windows on the currently open document or more than one document at one time. Word is designed to help print reports, memos, and documents and performs all the basic word processing techniques, such as deleting, italicizing and highlighting. Word also has flexible tabs to produce greatlooking tables and can mix fonts and font sizes easily. Microsoft Word has spelling checker, thesaurus, equation editor, sorting facility, drawing facility, spreadsheet facility to generate graphs and an

undo command. Many users prefer Word because of its compatibility to other systems. Using word it is possible to share data between PC and Mac systems. It is also compatible with WordPerfect for Windows, PageMaker and many other windows based software.

WordPerfect: WordPerfect (WP) is another most popular word processing package. A full-featured word processor with an extensive range of features, WordPerfect appeals to users who demand many sophisticated tasks from their word processor. Easy text entry, powerful thesaurus and spellchecking routines, support for a wide range of fonts and printers, capability to create customs dictionaries, on-screen formatting, print preview, graphics interfacing and the column creating facilities are the main features of this program. WordPerfect also has a master document features for assembling one large document from a series of subdocuments, and a tutorial to help the inexperienced users. One also can use WordPerfect to program, to plan, and to draft writing projects. WordPerfect for windows is available for microcomputer users.

Microsoft Excel: Microsoft Excel is one of the most popular spreadsheet packages originally available only for the Macintosh. Microsoft - Excel for other microcomputers works with Microsoft Windows. Many operations that require typing in other applications can be handled with the mouse in the Excel. It also has options for producing a variety of reports in different fonts, a feature usually limited-or unavailable in many other spreadsheets packages.

Lotus 1-2-3: Another most popular spreadsheet package is Lotus 1-2-3. It combines three main features: spreadsheet, database and graphics. With lotus 1-2-3, users can create simple or complex spreadsheets, use the spreadsheet as a database, or graph spreadsheet information. A wide range of people use Lotus 1-2-3. From accounts to financial planners, business owners, and managers, Lotus 1-2-3 is the spreadsheet package of choice. 1-2-3's many features include an easy-to-use spreadsheet layout, an understandable control panel, a wide range of functions, easy printing procedures, graph creation and printing and macro capability. Lotus 1-2-3 for windows is available.

dBASE: The dBASE is an integrated software package; which has menu oriented database processing and programming facilities. It is a data manager; a piece of software that lets the user has freedom in the conceptualization and creation of database for all types of business applications. Since business depends on timely information dissemination, the value of a powerful programmable utility for database generation, maintenance, and query cannot be overstated. The dBASE can be executed on a variety of microcomputers, under any one of the popular operating systems. Different version of dBASE is known as dBASE III and dBASE III +, dBASE IV etc.

FoxBASE+: FoxBASE+ is a popular relational database program available for microcomputers including the Macintosh. Similar to the popular dBASE, FoxBASE+ is a user-friendly, intuitive program that operates faster thanmany other database programs. This program enables us to create forms, link databases, enter data, and design custom reports easily. FoxBASE+ can be used to add special touches to databases by changing colour, font, size and style settings.

Microsoft Works: Microsoft Works is an integrated program that combines: word processing, spreadsheet, database and communications. Microsoft Works has enthusiastic following in both the PC and the Mac worlds. Because of easy features and friendly user interface, the applications in Microsoft Works are easy to understand and use. Its word processor enables one to enter, edit, save, and print texts and reports. Specialized search-and-replace features, thesaurus and spelling checker also help to ensure the accuracy of work.

Simple or complex works, perform what-if calculations, and use formulas to take the drudgery out of bookkeeping chores. The data manager gives a great deal of flexibility in generating data-entry forms, working with fields, displaying data, and generating reports. The communications module accesses the world outside computer by transferring files to and from remote computers. Finally, the features in Microsoft Works can be used to format, merge data between applications, and exchange information with other programs and modules.

PFS: First Choice: PFS: First Choice, one of the most popular integrated packages for microcomputers combines the following applications:

- Word processing
- Database management
- Communications
- Spreadsheet
- Graphics.

It has a multitude of users from sophisticated business managers to the hobbyists. Some users include business people who can type correspondence, balance books, and manage files, and business owners and managers who can analyze and maintain information. Other users include support staff working in data entry, creating visual presentations, or producing reports. PFS: First Choice automates many business tasks traditionally done by hand. With this program, one can perform accounting tasks, such as analyzing data and creating and printing spreadsheets. The word processor can be used to type correspondence, produce manuals, print documents, create presentations, and so on. PFS: first Choice also enables one to graph data, print graphs, plot graphs, create slide shows, and perform basic data-entry tasks. With the database management part of PFS: First Choice, one can design database forms, create mailing labels, edit and analyze data, update files, retrieve files, and create and print database reports.

PageMaker: PageMaker is a most popular desktop publishing software package for microcomputers. Also called a page-composition program, PageMaker enables one to combine text and graphics on a page to compose documents. PageMaker accept text from a variety of popular word processing programs and graphics in popular file formats. Page Maker can be used to format a page in a number of columns and formats, use different fonts, import sophisticated graphics, create on-screen graphics, create master pages, and perform many high-end functions. Although it is a high-end desktop publishing program, many people find the program easy to learn and use. Used with Microsoft Windows, PageMaker has familiar menus, pop-up dialog boxes, and a Mac-like display that most find easy to understand and use.

Harvard Graphics: Harvard Graphics is a popular presentation graphics program for PC users. Used primarily in business, Harvard Graphics is a feature-laden program with many enhancement options, but most users can find their way around easily. A comprehensive help system assists in learning the use of the software. Few features of the program are:

- The Chart Gallery, offering several chart types in a variety of formats.
- The Draw utility, which can add customize art to charts.
- The ability to put charts in an automated sideshow.
- The choice of animating arts giving the illusion of real animation in presentations.
- Supports for data imported from a variety of spreadsheet programs, such as Lotus 1-2-3 and Microsoft Excel.
- Output on display, printer, plotter, or film recorder devices.
- Templates and macro creating facility.

AutoCAD: AutoCAD is one of the best CAD programs in the market. It offers the following features:

- An easy-to-use interface with pull-down menus and dialog boxes.
- Support for a mouse or digitizer.
- Capability to layer, rotate, copy, mirror, move, stretch, and scale.
- 3-D wire frame modeling.
- Up to 16 different views.

The version of AutoCAD which can be used with Microsoft Windows is easy-to-use.

Activity: Determine the application software's which are installed in your computer and their features.

Discussion Questions:

1. Define System Software. Explain the functions of system software.
2. Define operating system. Explain the functions of operating system.
3. Define utility program. Explain the functions of utility programs.
4. Explain the types of programming languages.
5. Explain the types of language processors.
6. Write short notes on the followings:
 - a. BASIC; b. C; c. FORTRAN; d. PASCAL; e. COBOL ; e. C++
7. Write short notes on the followings:
 - a. Microsoft word; b. word perfect; c. Microsoft excel; d. lotus 1-2-3.
8. Write short notes on the followings:
 - a. Dbase; b. Foxbase; c. page maker; d. AutoCAD; e. PFS- First choice.

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System Software and Operating Systems

6

Unit Highlights

- BASICS OF SYSTEM SOFTWARE AND OPERATING SYSTEM

Technologies Used for Content Delivery

- ❖ BOUTUBE
- ❖ BOU LMS
- ❖ WebTV
- ❖ Web Radio
- ❖ Mobile Technology with MicroSD Card
- ❖ LP+ Office 365
- ❖ BTV Program
- ❖ Bangladesh Betar Program

Lesson 1: Basics of System Software and Operating System

After completion of this lesson you will be able to –

- *Know about functions of operating system.*
- *Get knowledge about various operating system.*

System Software: Software that acts as a platform for other software is known as system software. Operating systems, antivirus programs, disc formatting programs, computer language interpreters, etc. are a few examples. Usually, computer makers prepare these. This software is made up of low-level language programs that interface with the hardware in a very basic way. The interaction between the hardware and the end users is provided by system software.

The set of applications and software elements that allow a computer or other computing device to operate correctly is referred to as system software. By serving as a bridge between the user and the hardware of the computer, it enables interaction with the hardware and the use of different apps and programs. Operating systems (like Windows, macOS, or Linux), device drivers, utility apps, programming languages, and system libraries are a few examples of common kinds of system software.

Operating System: An operating system (OS) serves as a conduit between the hardware and the user of a computer. An operating system is a piece of software that handles all the routine functions, including managing files, memory, processes, input and output, and peripheral devices like printers and disc drives.

Following are some of important functions of an operating System.

- Memory Management
- Processor Management
- Device Management
- File Management
- Network Management
- Security
- Control over system performance
- Job accounting
- Error detecting aids
- Coordination between other software and users

Memory Management: Primary memory, often known as main memory, is managed under the term memory management. Every word or byte in main memory has an address, making it a vast array.

Fast storage is offered via main memory, which the CPU can access directly. A program needs to reside in the main memory in order to be executed. An operating system manages memory by performing the following tasks:

- Maintains track of the primary memory, including which parts are used by whom and which are not.
- The operating system determines which process, and how much, gets memory while multiprogramming.
- RAM is allocated in response to a process' request.
- When a process is ended or no longer requires memory, it is de-allocated.

Processor Management: The operating system (OS) controls which process uses the processor when and for how long in a multiprogramming environment. We refer to this

function as "process scheduling." An operating system manages processors by performing the following tasks:

- Monitors the processor and the state of the process. The traffic controller programme is in charge of carrying out this function.
- Assigns a process to the processor (CPU).
- When a process is finished, the processor is released from its allocation.

Device Management: Through the drivers for each device, an operating system controls device connectivity. It performs the subsequent tasks related to device management.

- Records all of the gadgets.
- The I/O controller program is in charge of this task.
- Determines which process will use the device and when it will do so.
- Distributes the device in an effective manner.
- De-allocates devices.

File Management: Typically, a file system is arranged into directories for convenience of use and navigation. Files and further instructions might be found in these directories. The following tasks are performed by an operating system for file management:

- Records data, including location, uses, and status. The term "file system" refers to the group of facilities.
- Determines who is given the resources.
- Divides up the resources.
- De-allocates resources.

Security: Programs and data are protected from unauthorized access through the use of passwords and related measures.

Control over system performance: Keeping track of the time lag between a service request and the system's answer.

Job accounting: Monitoring the amount of time and resources that different users and jobs consume.

Error detecting aids: Creation of error messages, traces, dumps, and other tools for debugging and error detection.

Coordination between other software's and users: Assigning and coordinating the use of assemblers, interpreters, compilers, and other software to the different computer system users.

Types of Operating Systems: Operating systems are there from the very first computer generation and they keep evolving with time. Some of the important types of operating systems which are most commonly used is given below:

Batch operating system: In a batch operating system, users do not communicate directly with the machine. On an offline device, such as punch cards, each user prepares his work and submits it to the computer operator. Jobs with comparable demands are grouped together and processed collectively to expedite processing. Programmers hand over their code to the operator, who groups programs with similar specifications into batches. The problems with Batch Systems are as follows—

- Insufficient communication between the user and the task.
- Because the mechanical I/O devices operate at a slower pace than the CPU, the CPU is frequently idle.
- Giving the appropriate priority is difficult.

Time-sharing operating systems: Time-sharing is a method that allows multiple users to access a specific computer system simultaneously from different terminals. Multiprogramming makes sense to extend to time-sharing or multitasking. Time-sharing is the practice of sharing a processor's time across several users at once.

The primary distinction between Time-Sharing Systems and Multi programmed Batch Systems is that the goal of Time-Sharing Systems is to minimize response time, whereas the goal of Multi programmed Batch Systems is to maximize processing utilization.

The CPU alternates between multiple jobs to execute them, but the switches happen so often. As a result, the user can get a prompt response. In a transaction processing scenario, for instance, the processor runs each user program in a brief computational burst. In other words, any user can obtain a time quantum if n users are present. The response time is at most a few seconds after the user submits the command.

The operating system allots a small amount of time to each user through multiprogramming and CPU scheduling. Time-sharing systems have been added to computer systems that were originally intended to be batch systems.

Advantages of Timesharing operating systems are as follows –

- Provides the advantage of quick response.
- Avoids duplication of software.
- Reduces CPU idle time.

Disadvantages of Time-sharing operating systems are as follows –

- Problem of reliability.
- Question of security and integrity of user programs and data.
- Problem of data communication.

Distributed operating System: Multiple central processors are used by distributed systems to support numerous users and real-time applications. The processors are assigned tasks based on how much data has to be processed.

Via a variety of communication channels, including telephone lines and high-speed buses, the processors can interact with one another. We refer to these as dispersed systems or loosely connected systems. The size and functionality of processors in a distributed system can differ. We refer to these processors as computers, sites, nodes, and so forth. The advantages of distributed systems are as follows –

- A user at one location may be able to use resources at another with the help of resource sharing facilities.
- Accelerate the data transfer between each other via email.
- In a distributed system, the sites that remain online may be able to continue functioning even if one of them fails.
- Improved customer service.
- Decrease in the host computer's workload.
- Reduction of processing data latency.

Network operating System: A server that has a Network Operating System installed on it can handle data, users, groups, security, apps, and other networking-related tasks. Allowing shared file and printer access across several computers in a network—usually a local area network (LAN), a private network, or to other networks—is the main function of the network operating system.

Novell NetWare, BSD, UNIX, Linux, Mac OS X, and Microsoft Windows Server 2003 and 2008 are a few examples of network operating systems.

The advantages of network operating systems are as follows –

- Servers that are centralized are very reliable.
- Server management is used for security.
- The system may be readily updated to use new hardware and technologies.
- It is feasible to access servers remotely from many locations and system kinds.

The disadvantages of network operating systems are as follows –

- Expensive to purchase and maintain a server.
- Reliance on one location for the majority of business.
- Updates and maintenance must be done on a regular basis.

Real time operating system: A real-time system is characterized as a data processing system that can regulate its environment in such a short amount of time as to process and react to inputs. Response time is the amount of time it takes for the system to process an input and show the necessary updated information. Hence, in comparison to online processing, this method's response time is extremely short.

Real-time systems can be employed as a control device in a specific application or when there are strict time constraints on the processor's operation or the data flow. Time limits that are precise and well-defined are essential for preventing system failure in real-time operating systems.

Activity: Select a business organization and go there. Determine what types of operating systems they use in the organization and why.

Operating system- Services: An Operating System provides services to both the users and to the programs.

- It provides programs an environment to execute.
- It provides users the services to execute the programs in a convenient manner.

Following are a few common services provided by an operating system –

- Program execution
- I/O operations
- File System manipulation
- Communication
- Error Detection
- Resource Allocation
- Protection

Program Execution: Operating systems manage a wide range of tasks, including system and user programs as well as file servers, printer spoolers, name servers, and other programs. Every one of these tasks is contained within a process.

The entire execution context—code to run, data to manipulate, registers, and OS resources in use—is included in a process. The principal functions of an operating system concerning program management are as follows:

- Loads a program in memory.
- Carries out the program.
- Controls the program's operation.
- Offers a means of achieving process synchronization.
- Offers a means of communicating processes.
- Offers a method for handling deadlocks.

I/O Operation: I/O devices and the driver software for them make up an I/O subsystem. Drivers shield users from the quirks of a particular piece of hardware.

The interaction between device drivers and users is controlled by an operating system.

- Read and write operations with any file or particular I/O device are referred to as I/O operations.
- When needed, the operating system grants access to the necessary I/O device.

File system manipulation: A collection of related information is represented as a file. For long-term storage, computers can store files on the disk (also known as secondary storage). Magnetic tape, magnetic disks, and optical disk drives like CDs and DVDs are a few types of storage media. Every one of these media types has unique characteristics, such as data transfer rates, capacities, and access methods. Typically, a file system is arranged into directories for convenience of use and navigation. Files and further instructions might be found in these directories.

Following are the major activities of an operating system with respect to file management –

- A program must either write or read a file.
- The operating system grants the program authorization to run on a file. Permission can be refused, read-only, read-write, or any combination of these.
- The operating system gives the user a file creation and deletion interface.
- The operating system gives the user a way to add and remove folders.
- An interface for creating file system backups is provided by the operating system.

Communication: The operating system controls all process communications in distributed systems, which are collections of processors without shared memory, peripherals, or a clock. Through communication channels in the network, several processes can exchange information with one another.

Contention and security issues, as well as routing and connection techniques, are handled by the OS. Following are the major activities of an operating system with respect to communication

- Data must frequently be transmitted between two processes.
- The two processes are linked by a computer network, regardless of whether they are running on the same machine or separate ones.
- There are two ways to implement communication: message passing and shared memory.

Error handling: Errors can happen anywhere, at any moment. Errors might arise in the memory hardware, I/O devices, or CPU. The principal functions of an operating system concerning error handling are as follows:

- The OS looks for potential problems all the time.
- To guarantee accurate and reliable computing, the operating system takes the necessary measures.

Resource Management: Resources such as main memory, CPU cycles, and file storage must be assigned to each user or task in a multi-user or multi-tasking environment. The primary functions of an operating system concerning resource management are as follows:

- Schedulers are used by the OS to manage a variety of resources.
- Algorithms for CPU scheduling are used to maximize CPU utilization.

Protection: When numerous users and processes are running simultaneously on a computer system, the different processes need to be shielded from one another's actions.

A strategy or approach to regulate a program's, process', or user's access to the resources specified by a computer system is called protection. The primary functions of an operating system concerning security are as follows:

- The operating system makes sure that all system resource access is managed.
- The OS makes sure that unauthorized access attempts are prevented from external I/O devices.
- Passwords are used by the OS to provide authentication functionality for each user.

Activity: Determine what services you have taken from the operating system you use in your computer.

Operating System- Process: An entity that symbolizes the fundamental work unit to be implemented in the system is called a process.

Four components make up a program once it is loaded into memory and turns into a process: stack, heap, text, and data.

Stack: The process Stack contains the temporary data such as method/function parameters, return address and local variables.

Heap: This is dynamically allocated memory to a process during its run time.

Text: This includes the current activity represented by the value of Program Counter and the contents of the processor's registers.

Data: This section contains the global and static variables.

Process Life Cycle: A process goes through several phases as it runs. The titles of these states are also not standardized, and these stages may vary between operating systems.

A process can, in general, be in any one of the following five states at once.

Start: This is the initial state when a process is first started/created.

Ready: Assigning a processor to the process is pending. Waiting to be assigned a processor by the operating system, ready processes are waiting to begin operations. This state may be reached by the process either after it has entered the Start state or during its execution, but it may be stopped by the scheduler to free up CPU for another process.

Running: The OS scheduler sets the process state to running and the processor starts carrying out the instructions after it has been assigned to a processor.

Waiting: If a process needs to wait for a resource, like user input or the availability of a file, it enters the waiting state.

Terminated or Exit: The process is relocated to the terminated state, where it waits to be removed from main memory, once it has completed its execution or has been terminated by the operating system.

Popular Operating System: There are plenty of Operating Systems available in the market which include paid and unpaid (Open Source). Following are the examples of the few most popular Operating Systems:

- **Windows:** This is one of the most popular and commercial operating systems developed and marketed by Microsoft. It has different versions in the market like Windows 8, Windows 10 etc. and most of them are paid.

- **Linux:** This is a Unix based and the most loved operating system first released on September 17, 1991 by Linus Torvalds. Today, it has 30+ variants available like Fedora, OpenSUSE, CentOS, Ubuntu etc. Most of them are available free of charges though you can have their enterprise versions by paying a nominal license fee.
- **MacOS:** This is again a kind of Unix operating system developed and marketed by Apple Inc. since 2001.
- **iOS:** This is a mobile operating system created and developed by Apple Inc. exclusively for its mobile devices like iPhone and iPad etc.
- **Android:** This is a mobile Operating System based on a modified version of the Linux kernel and other open source software, designed primarily for touchscreen mobile devices such as smartphones and tablets.

Some other old but popular Operating Systems include Solaris, VMS, OS/400, AIX, z/OS, etc.

Activity: Determine which operating systems are used mostly in business.

Discussion Questions:

1. Define operating system. Explain the important functions of operating system.
2. Explain the types of operating systems
3. Explain the services provided by operating system.
4. Explain popular operating systems.

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Database Concepts

7

Unit Highlights

- BASICS OF DATABASE

Technologies Used for Content Delivery

- ❖ BOUTUBE
- ❖ BOU LMS
- ❖ WebTV
- ❖ Web Radio
- ❖ Mobile Technology with MicroSD Card
- ❖ LP+ Office 365
- ❖ BTV Program
- ❖ Bangladesh Betar Program

Lesson 1: Basics of Database

After completion of this lesson you will be able to –

- Understand database relation and use of database
- know how database can be created by database software
- Know about SQL
- Know about RDBMS

Database: A database is, literally speaking, a collection of data. However, a database is a piece of software used in computer science that has the ability to create, update, delete, and store enormous amounts of data. It can also process and search through data.

A database management system is a software or program designed to oversee and manage databases. Relational databases and NoSQL databases are the two general categories of databases. Despite being the most used database technology, relational databases remain relevant even though they were developed over 50 years ago. Although NoSQL databases are a relatively new idea, their use in web-based applications is expanding daily. The NoSQL database isn't as popular for all kinds of applications because of a few drawbacks.

Relational Database: Data is kept in one or more tables in relational databases. There may be relationships between some tables. For instance, a school's database may contain details about the instructors and pupils there. Exam scores, attendance records, and lesson plans can all be kept in that database. Usually, the same kind of data is entered into the same table. There is a teacher table and a student table for the information of the teachers and students, respectively. Exam results can be stored in a result table, which will be related to the student table so that we can access both the result and personal information about a student in one step. A school database has all of these.

The table header and table body are the two components of a database table. The column names and data types are listed in the table header, and the actual data is found in the table body. Every row in the table has a specific set of data. Prior to anything else, we need to choose the data and data types that will be kept in a table. Assume that a student's table includes their name, contact information, address, class, roll number, and parents' name.

Different kinds of data are possible. As seen, there are various data types in C programming; likewise, a relational database contains a set of defined data types. While the definitions of data types vary among database developers, basic data types—such as text, integer, decimal, and date—are shared by all databases.

Now let us look at an example of a database table:

Student's Name (Text)	Roll Number (Integer)	Class (Integer)	Section (Text)	Parents Name (Text)	Contact Number (Text)
Arun Pal	1	6	A	Asim Pal	01712565275
Ridita Hasan	2	6	B	Habib Hasan	01512122712
Babu Ali	1	7	A	Harun Ali	01514123832
Ritu Jabin	4	7	B	Hasina Begum	

The heading of the student's table is located in the first row. This row's cells are all columns, and each column has a specific data type. The name of the student is a column, and text is the

type of data it contains. Each cell in this column will have text data along with the name of a student. Each row beneath the header has the details of a certain student. The details of a student called Arun Pal, including his roll number, class, section, and parent information, are listed in the second row. In the same way, each row will only ever have one student's information; no row will ever contain the information of several students. Records are another term for each row in the table. The table's cells are referred to as fields.

Relational database systems including Oracle, MySQL, Microsoft SQL Server, PostgreSQL, Microsoft Access, and SQLite are among the most widely used ones worldwide. Three of these databases are open source and free: MySQL, PostgreSQL, and SQLite. This indicates that using these databases is free of cost and that anyone can access their source codes.

Null Value: Numerous times, the value of some records in the database will be unknown; in these situations, the null value is used. There is a phone number column in the student database, but not every student will have one. Here, Ritu Jabin's phone number is absent, hence the entry is left unfilled. The record will have a null value added by the database. Assume that the table has an additional column in it called monthly family income. If someone chooses not to reveal their income due to privacy concerns, they will enter a null number in place of an O. You just need to keep in mind not to enter 0 or an empty string in the field if you don't have a value. You just need to keep in mind not to enter 0 or an empty string in the field if you don't have a value. The database will handle the record as a null value if it is black.

Primary Key: A relational database table's main key, also known as the primary keyword, is a column that is unique for every entry in the table. It's a distinctive identity, like a phone number with area code, driver's license number, or vehicle identification number (VIN). A primary key can only be present in one relational database. Each row of data cannot include a null value; all rows must have a primary key value.

An administrator's preference is often the deciding factor when selecting a primary key in a relational database. If a user's specific needs change, it is feasible to modify the primary key for that database. For instance, a town's residents may be uniquely identifiable in a single application based on their driver's license numbers. For example in one application, the residents of a town might be uniquely identifiable by their driver's license numbers, but in another, it might be more practical to identify them by their phone numbers.

Database Relation: In actuality, a database relation is the relationship between database tables. One or more tables can be found in a database. There are typically relationships between tables when there are multiple of them. These relations can be of three types:

1. One to one
2. One to many
3. Many to many

One to one: A row in one table may only relate to one row in the other if there is a one-to-one relationship between the two tables. The tables will look like this if we have two tables: student_info, which holds the general information about the students, and student_contact, which holds the contact details.

Student_info		
Roll (Integer, Primary key)	Name (Text)	Class (Integer)
1	Arpita Das	6
2	Nitu Ahmed	7
3	Safir Ahmed	6

Student_Contact

ID (Integer, Primary Key)	Roll (Integer)	Phone (Text)	Email (Text)	Address (Text)
1	1	01712667325	Arpita10@yahoo.com	Badda, Dhaka
2	2	01842567734	Nitu08@gmail.com	Adabor, Dhaka
3	3	01927866112	Safir56@gmail.com	Mirpur, Dhaka

There is a one-to-one relationship between the two tables mentioned above. For instance, the student_info table has data about a particular student in each row. Roll number is the table's primary key; for the sake of this example, we'll pretend that it is, even though roll number isn't the best column to use as a primary key.) Each row in the student_info table now corresponds to a matching row in the student_contact table. While roll number serves as the primary key in the student_info table, it functions as a foreign key in the student_contact table. A foreign key is created when we use the main key from one table to another. The relationship between two tables is created via a foreign key.

One to many Relation: Let's assume all of the student exam results are stored in a database table named result that we established. The exam results for a single subject will be listed in each row of the table.

Result

ID (Integer, Primary Key)	Roll (Integer)	Subject (Text)	Marks (Decimal)
1	1	Bangla	78
2	1	English	80
3	2	Bangla	85
4	2	English	79

It is evident from this that every row in the student-info table corresponds to several rows in the outcome table. The results of two subjects are displayed in two separate rows of the result table for the student whose roll number is 1. Since one row in the student_info table is related to two or more rows in the result table, this relationship is known as a one-to-many relationship. The result table's foreign key is roll.

Many to many: A relation is referred to be many to many when two database tables are associated in such a way that one row in one table is related to many rows in another table, and one row in the second table is related to numerous rows in the first table.

Assume, for example, that the school offers numerous clubs for various interests, such as chess, physics, sports, and cricket. It is possible for a student to belong to many clubs. In a similar vein, a club may include one or more students. Now let's examine the club table.

Club

Name (Text)	Moderator (Text)	Established (Text)
Cricket Club	Md Al- Amin	1/1/2023
Football Club	Md Shahidul Alam	2/10/2022
Debating Club	Sujit Nath	2/3/2022
Chess Club	Shamir Ahmed	2/1/2020

The primary key of the club table is name, as no two clubs can have the same names. Now we need to create another table to establish the relationship between the student_info table and the club table.

Student_Club

Roll (Integer)	Club_name (text)
1	Cricket Club
2	Cricket Club
2	Football Club
2	Chess Club
2	Debating Club

We need to create separate tables to establish many to many relationships between two tables.

SQL: Programming languages called SQL, or Structured Query Language, are used in relational databases to read, write, create, update, and delete data. Various commercial databases employ their own query languages, which are extremely similar to the standard SQL, even if the SQL has its own language and structure.

SQL can be divided into several parts. Most important of these are Data Definition Language or DDL and Data Manipulation Language or DML.

Data Definition Language: DDL is primarily used to create, delete and index database tables.

Data manipulation Language: DML is used to write queries to retrieve data from a table.

Creating Database

SQLite: Is it a Topic or any example? A free and open source database is called SQLite. Applications for the web, desktop, and mobile platforms use this database. Because SQLite is somewhat simpler to learn than other traditional databases, it is a popular database.

Installing Process: Downloads for SQLite are available at [https:// www.sqlite.org/download.html](https://www.sqlite.org/download.html), the program's official website.

You can install it once the download is finished. You can use SQLite from a terminal or command line. Using SQLite is made simpler by certain software programs that include graphical user interfaces. SQLite Database Browser These are the kinds of programs that are available for free download on the internet, such as SQLiteStudio. Installing SQLite on an Android phone allows you to use it with various apps. With order to create a new database with SQLite, you must first open a terminal window and type the database name followed by the command "sqlite3".

```
$ sqlite3 school.db
```

The same command can be used to access the school.db database using SQLite if you have already created it. Once the program is running, you can use the terminal to input various commands. For example, to exit the program, type quit.

```
sqlite> .quit
```

Using Query:

Creating table: We will create several tables into the school database. In the first table, we are going to create is the student table. What data do we want to store in the student table?

Student name

Student's class

Roll number

Section

Use the CREATE TABLE query to create the table. The syntax is like this-

```
CREATE TABLE table_name (column_name column_type, ...);
```

Replace the table_name with what you want as the table name. Inside the first bracket write the name of each column and its data type separated by spaces. Each column information will be separated by commas.

So, to create the table of table we need to write:

```
CREATE TABLE student (name TEXT, class INTEGER, roll  
INTEGER, section TEXT);
```

To delete a table we need to use the DROP TABLE query:

```
DROP TABLE [Name of table];
```

Now you can create the table again using the CREATE TABLE query.

NOTE: You can use both capital letters or small letters while writing SQL queries. CREATE and create both are valid. But the general tradition is to use "all Caps".

Storing and Retrieving Data from Tables: The INSERT query is used to store data into a table. If we want to insert a student named Mizanur Rahman who is in Class 9 morning section and has roll number 3, we have to write:

```
INSERT INTO student (name, class, roll, section) VALUES  
( 'Mizanur Rahman', 9, 3, 'morning');
```

SELECT query is used to retrieve data form table

```
SELECT * FROM student;
```

To see an organized output from the SELECT query add these two lines before the query.

```
sqlite> .mode column  
sqlite> .headers on  
sqlite> select * from student;
```

If we only want to see names and class, we can write:

```
sqlite> SELECT name, class FROM student;
```

Let us insert some more data into the student table for later use:

```
INSERT INTO student (name, class, roll, section) VALUES
('Mosharraf Hossain', 9, 4, 'morning');
INSERT INTO student (name, class, roll, section) VALUES
('David Pandey', 9, 2, 'morning');
INSERT INTO student (name, class, roll, section) VALUES
('Promila Gosh', 8, 2, 'day');
INSERT INTO student (name, class, roll, section) VALUES
('Bazlur Rahman', 8, 1, 'day');
INSERT INTO student (name, class, roll, section) VALUES
('Sourav Das', 9, 1, 'day');
INSERT INTO student (name, class, roll, section) VALUES
('Tamanna Nishat', 10, 1, 'morning');
INSERT INTO student (name, class, roll, section) VALUES
('Maysha', 10, 1, 'day');
```

After the insert, use the SELECT query to see if all the data are inserted properly or not. While retrieving data using SELECT query, you can also add some conditions. Write the conditions after WHERE. If you want to see the data from only class 9 students you have to write:

```
SELECT * FROM student WHERE class = 9;
```

Here only those rows will be retrieved where the value of the class column is 9. You can use the following operators to write conditions.

Operator	Description
=	Equal
<>	Not equal
>	Greater than
>=	Greater or equal
<	Less than
<=	Less or equal

To retrieve the data of the students from morning section, we have to write:

```
SELECT * FROM student WHERE section = 'morning';
```

NOTE: While working with text type data use quotes. Do not write queries like the following:

```
sqlite> SELECT * FROM student WHERE section = morning;
Error: no such column: morning
```

Use AND and OR to combine multiple conditions. If we want to retrieve the data for class 9 morning section students, we have to write:

```
SELECT * FROM student WHERE class = 9 AND section = 'morning';
```

To retrieve data of students that are either in class 9 or in morning section:

```
SELECT * FROM student WHERE class = 9 OR section = 'morning';
```

To retrieve data of students that are not in class 9 but in morning section:

```
SELECT * FROM student WHERE class <> 9 AND section = 'morning';
```

To retrieve data for students that are in class 8,9,10:

```
SELECT * FROM student WHERE class = 8 OR class = 9 OR class = 10;
```

Alternatively we can write:

```
SELECT * FROM student WHERE class IN (8, 9, 10);
```

Deleting and updating data: Let's assume we are inserting a new record into the student table

```
INSERT INTO student (name, class, roll, section) VALUES ('Fardeen Munir', 10, 1, 'day');
```

Now there are two students in the class 10 day section who have the same roll numbers.

```
sqlite> SELECT name FROM student WHERE class = 10 AND roll = 1 AND section = 'day';  
Maysha  
Fardeen Munir
```

To either the old or the new entry is incorrect and now we have to delete one of them, to delete the record for the student named FARDEEN MUNIR we have to write a delete query.

```
DELETE FROM student WHERE name = 'Fardeen Munir';
```

A reminder that the above query will delete all the records that have Fardeen Munir in their name column. We have to be a bit careful when we want to delete a single record. For extra precaution, we can add some more conditions.

```
DELETE FROM student WHERE name = 'Fardeen Munir' AND class = 10 AND roll = 1 AND section = 'day';
```

Sometimes we will need to change or edit a record, for this we will have to use the UPDATE query. For example if we know the entry for Fardeen Munir is wrong and his roll number would be 3 we can write an UPDATE query like this:

```
UPDATE student SET class = 10, roll = 3 WHERE name =  
'Fardeem Munir';
```

Joining Multiple Tables: Relational tables can have multiple tables storing data and if needs arise we can retrieve data from multiple tables. This operation is called 'a join'. This is an important feature of the relational database system.

Let's say we create two tables called student_info and result.

```
CREATE TABLE student_info (roll INTEGER, name TEXT;  
CREATE TABLE result (roll INTEGER, subject TEXT, marks REAL;
```

We can see that there is a relation between these two tables using the roll column. The student_info table contains each student's roll and name. The result table contains each student's roll, and marks from different subjects of the exams. So the relation between student_info and result is one to many.

Let's insert some data first.

```
INSERT INTO student_info (roll, name) VALUES (1, 'Mizanur  
Rahman');  
INSERT INTO student_info (roll, name) VALUES (10, 'Mosharraf  
Hossain');  
INSERT INTO student_info (roll, name) VALUES (2, 'Maysha');  
INSERT INTO result (roll, subject, marks) VALUES (1,  
'Bangla', 79.0);  
INSERT INTO result (roll, subject, marks) VALUES (1,  
'English', 76.0);  
INSERT INTO result (roll, subject, marks) VALUES (1,  
'Mathematics', 74.0);  
INSERT INTO result (roll, subject, marks) VALUES (10,  
'Bangla', 82.0);
```

```
INSERT INTO result (roll, subject, marks) VALUES (10,  
'English', 70.0);  
INSERT INTO result (roll, subject, marks) VALUES (10,  
'Mathematics', 98.0);  
INSERT INTO result (roll, subject, marks) VALUES (2,  
'Bangla', 75.0);  
INSERT INTO result (roll, subject, marks) VALUES (2,  
'English', 80.0);  
INSERT INTO result (roll, subject, marks) VALUES (2,  
'Mathematics', 100.0);
```

As we know, to get the data from the student whose roll number is 1, we have to write the following query.

```
SELECT roll, subject, marks FROM result WHERE roll = 1;
sqlite> SELECT roll, subject, marks FROM result WHERE roll =
1;
roll          subject          marks
-----
1             Bangla          79.0
1             English         76.0
1             Mathematics    74.0
```

This query doesn't show us the student name because the result table does not have a student name column. To get a student name we have to query the student_info table too. The query would be like the following:

```
sqlite> SELECT name, result.roll, subject, marks FROM
result, student_info WHERE result.roll = 1 AND result.roll =
student_info.roll;
name          roll          subject          marks
-----
Mizanur Rahman 1             Bangla          79.0
Mizanur Rahman 1             English         76.0
Mizanur Rahman 1             Mathematics    74.0
```

Note that we wrote result.roll instead of roll in the query as both tables have a column named roll. The result.roll = student_info.roll part joins the two tables. If we want to see every student data, we have to omit the result.roll = 1 part. Then the query would look like this;

```
SELECT name, result.roll, subject, marks FROM result,
student_info WHERE result.roll = student_info.roll;
```

Activity: Prepare a database by using SQLite.

Data Security: The process of preventing unwanted access, misuse, or destruction of private information kept in a database is known as database security. It entails a variety of methods and approaches intended to guarantee that the data kept in the database may only be accessed and utilized by authorized people or organizations.

Data Encryption: Database encryption is widely understood to be the process of converting data recorded in a database into "cipher text" that cannot be decrypted and is therefore unintelligible. Thus, it may be claimed that the goal of database encryption is to prevent those with perhaps "malicious" intents from accessing the data kept in a database. Since "meaningless" encrypted data requires additional steps for hackers to retrieve, encrypting a database also lessens the motivation for people to attack the aforementioned database.

RDBMS (Relational Database Management System): While DBMS can employ many data organization models and may not impose strict links between data entities, RDBMS is a type of DBMS that organizes data in a tabular fashion with linkages between tables.

Data is kept in tables within an RDBMS; each table corresponds to a particular notion or object. The individual instances of the entity are represented by rows, which are sometimes referred to as tuples in RDBMS or records, and the characteristics or properties of the entity are defined by columns in the tables.

Using keys, the relational model makes it easier to establish associations between tables. While foreign keys create associations across tables by referencing the primary key of another table, primary keys uniquely identify each row in a table.

Example: Oracle, Microsoft Access, MySQL, SQL Server, IBM Db2 etc.

Characteristics of RDBMS:

- One of the ACID qualities in relation to RDBMSs is atomicity, which guarantees that a database transaction is handled as a single, indivisible unit of work. Atomicity ensures that either every modification performed during a transaction is saved in the database, or none of it is.
- One of the ACID features in relation to RDBMSs is consistency, which guarantees that the database is in a legitimate and expected state both before and after a transaction is executed. It ensures that the data complies with all pre-established guidelines, limitations, and connections specified in the database schema. Consistency makes ensuring that any modifications made to the database during a transaction respect the established guidelines and maintain these integrity limitations.
- One of the ACID qualities in relation to RDBMSs is durability, which guarantees that, once a transaction is committed, its consequences are recorded indefinitely and will withstand any subsequent failures, including power outages, system crashes, or other disastrous incidents.
- Under RDBMS, data consistency is the condition under which the information in a database is true, legitimate, and complies with established guidelines and standards. It guarantees that the information is consistent and trustworthy throughout the database. Preserving the integrity of the connections and interdependencies between the data components in a database is known as data consistency.
- The capacity to quickly and effectively change the arrangement and structure of data to satisfy changing business needs is referred to as data flexibility. It has to do with the RDBMS's capacity to adapt to changes in the database design, data models, and data relationships without seriously affecting already-running applications or data access.

Activity: Determine the RDBMS software installed in your computer and its features.

Discussion Questions:

1. Write short notes on the followings:
a. database; b. Relational database; c. null value; d. primary key
2. Explain the types of database relation.
3. Define SQL. Explain the types of SQL.
4. Write short notes on the followings:
a. Data security; b. Data encryption.
5. Define RDBMS. Explain the characteristics of RDBMS.

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Computer Networks and the Internet

8

Unit Highlights

- COMPUTER NETWORK
- COMPUTER INTERNET

Technologies Used for Content Delivery

- ❖ BOUTUBE
- ❖ BOU LMS
- ❖ WebTV
- ❖ Web Radio
- ❖ Mobile Technology with MicroSD Card
- ❖ LP+ Office 365
- ❖ BTV Program
- ❖ Bangladesh Betar Program

Lesson 1: Computer Network

After completion of this lesson you will be able to –

- *Know about computer network.*
- *Understand network topology.*
- *Determine types of area network.*

A group of linked computers or other devices that share resources is called a computer network. A node is any device that has the ability to send and receive data. Channels are the means by which data or information spreads; they can be either guided or unguided.

How does Computer Network work?

Nodes and Links are the fundamental components that make up a computer network. A network node can be represented as either data terminal equipment, such as linking two or more computers, or as data communication equipment, such as modems and routers. A link in a computer network is any wire, cable, or open area used for wireless networks.

Simply expressed, protocols or regulations that facilitate data transmission and reception over the links that enable computer networks to communicate can be used to describe how computer networks operate. Every device has an IP address, which aids in device identification.

Basic Terminologies of Computer Networks

- **Network:** A network is a collection of computers and devices that are connected together to enable communication and data exchange.
- **Nodes:** Nodes are devices that are connected to a network. These can include computers, Servers, Printers, Routers, Switches, and other devices.
- **Protocol:** A protocol is a set of rules and standards that govern how data is transmitted over a network. Examples of protocols include TCP/IP, HTTP, and FTP.
- **Topology:** Network topology refers to the physical and logical arrangement of nodes on a network. The common network topologies include bus, star, ring, mesh, and tree.
- **Service Provider Networks:** These types of Networks give permission to take Network Capacity and Functionality on lease from the Provider. Service Provider Networks include Wireless Communications, Data Carriers, etc.
- **IP Address:** An IP address is a unique numerical identifier that is assigned to every device on a network. IP addresses are used to identify devices and enable communication between them.
- **DNS:** The Domain Name System (DNS) is a protocol that is used to translate human-readable domain names (such as www.google.com) into IP addresses that computers can understand.
- **Firewall:** A firewall is a security device that is used to monitor and control incoming and outgoing network traffic. Firewalls are used to protect networks from unauthorized access and other security threats.

Transmission modes in computer network: Data transfer between two devices is referred to as transmission mode. It goes under the name "communication mode" as well. The purpose of buses and networks is to facilitate communication between connected individual devices.

There are three types of transmission mode:-

1. **Simplex mode:** Similar to a one-way street, communication in the Simplex mode is unidirectional. In a link, only one device can send data; the other can only receive it.

The channel's whole capacity can be used by the simplex mode to convey data in a single direction.

For instance, a keyboard and monitor. The monitor can only display the result; the keyboard can only introduce input.

2. **Half-duplex mode:** Every station can send and receive in half-duplex mode, but not simultaneously. One device can only receive when it is sending, and vice versa. When simultaneous communication in both directions is not required, the half-duplex mode is employed. For every direction, the channel's complete capacity can be used. As an illustration, consider a walkie-talkie that can transmit messages both ways and one at a time.
3. **Full- duplex mode:** Both stations are able to send and receive concurrently when in full-duplex mode. Signals traveling in one direction share the link's capacity with signals traveling in another direction when in full duplex mode. This sharing can happen in two ways: Two physically distinct transmission paths—one for sending and the other for receiving—must be present on the link. Alternatively, signals moving in both directions split the available capacity. When constant bidirectional communication is needed, full-duplex mode is employed. That being said, the two directions must share the channel's capacity. Example: A telephone network allows two people to communicate with each other across a phone line while simultaneously speaking and listening.

Network Topology: There are numerous ways in which distinct components of a computer network might be joined to one another. The structure and connections between these elements are defined by the network topology.

The arrangement of a network that comprises nodes and connecting lines via sender and receiver is referred to as **Network Topology**. The various network topologies are:

- Point to Point Topology
- Mesh Topology
- Star Topology
- Bus Topology
- Ring Topology
- Tree Topology
- Hybrid Topology

Point to Point Topology: Point-to-Point Topology is a kind of topology that affects how well the sender and receiver function. When two nodes—one acting as the sender and the other as the recipient—communicate, it is at its most basic. Broadband is abundant with point-to-point.



Figure 1: Point-to-Point Topology

Source: <https://www.geeksforgeeks.org/>

Mesh Topology: Every device in a mesh topology is linked to every other device over a specific channel. Ad Hoc Configuration Protocols (AHCP), Dynamic Host Configuration Protocols (DHCP), and other protocols are utilized in Mesh Topology.

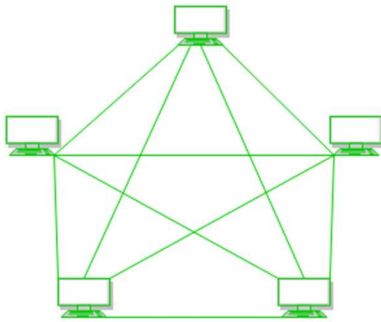


Figure 2: mesh Topology

Source: <https://www.geeksforgeeks.org/>

Figure: Specific channels are used to link each device to the others. We refer to these pathways as connections.

In a mesh topology, where N devices are connected to each other, the total number of ports needed by all the devices is $N-1$. Since there are five devices linked together in Figure 1, each device needs a total of four ports. $N * (N-1)$ is the total number of ports needed. Assuming a mesh topology with N devices connected to one another, the total number of dedicated links needed to interconnect them is $NC2$, or $N(N-1)/2$. Since there are five connected devices in Figure 1, a total of five times four divided by two is ten links needed.

Star Topology: In a star topology, a single hub is reached via a cable connecting each device. Every other node is connected to this hub, which serves as the center node. The hub may be intelligent, also referred to as an active hub, or it may be passive, i.e., not intelligent, like broadcasting devices. Repeaters are located within active hubs. Computer connections are made using coaxial or RJ-45 wires. Numerous widely used Ethernet LAN protocols, such as CD (Collision Detection) and CSMA (Carrier Sense Multiple Access), are employed in the Star Topology.

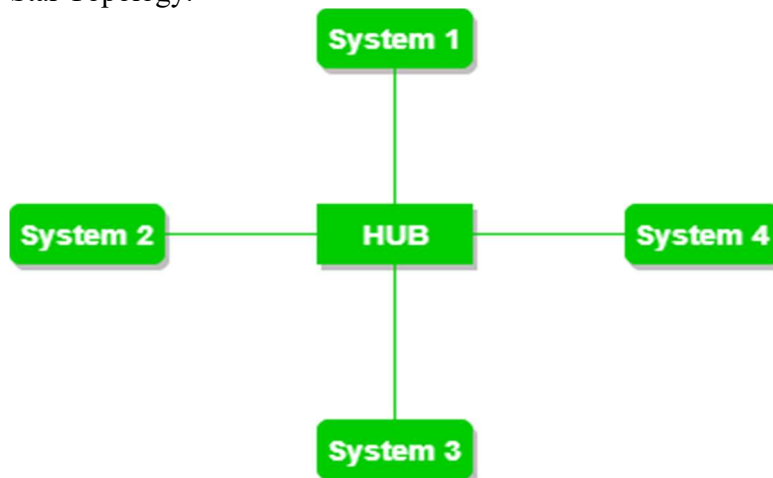


Figure 3: Star Topology

Source: <https://www.geeksforgeeks.org/>

Bus Topology: A network type known as bus topology connects each computer and network device to a single wire. It can go both ways. It has a multi-point connection and a non-robust topology since the topology collapses in the event that the backbone fails. LAN ethernet connections on a bus topology adhere to several MAC (Media Access Control) protocols, such as TDMA, Pure Aloha, CDMA, Slotted Aloha, etc.

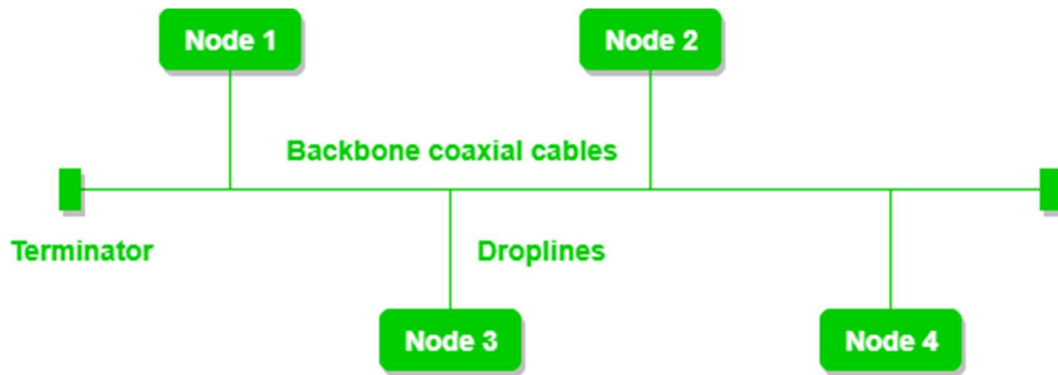


Figure 4: Star Topology

Source: <https://www.geeksforgeeks.org/>

Ring Topology: It creates a ring in a ring topology, joining devices that have exactly two neighbors. In a ring topology with 100 nodes, if someone wants to send some data to the last node, it will need to go via 99 nodes in order to reach the 100th node. For this reason, a lot of repeaters are utilized. Therefore, repeaters are utilized in the network to prevent data loss.

Data travels unidirectional, however it may be made bidirectional by using Dual Ring Topology, which has two links between each Network Node. The workstations employ the Token Ring Passing protocol in the In-Ring Topology to transmit data.

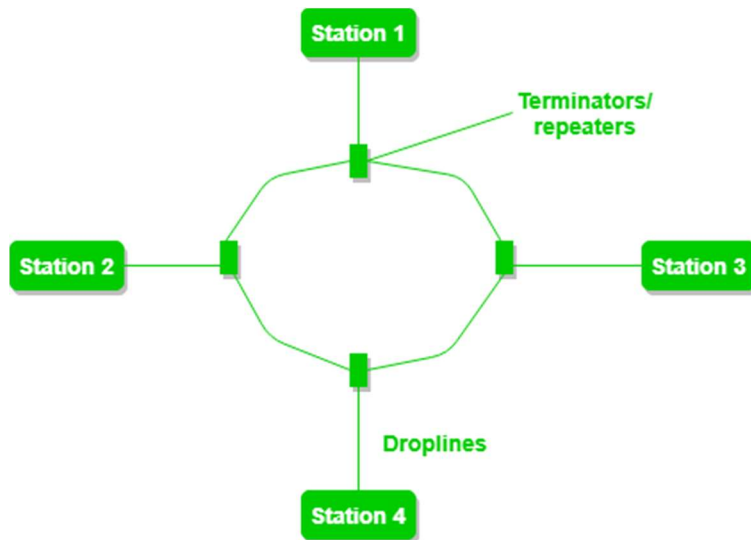


Figure 5: Ring Topology

Source: <https://www.geeksforgeeks.org/>

The most common access method of ring topology is token passing.

- **Token passing:** It is a network access method in which a token is passed from one node to another node.
- **Token:** It is a frame that circulates around the network.

Tree Topology

This topology is the variation of the Star topology. This topology has a hierarchical flow of data. In Tree Topology, protocols like DHCP and SAC (Standard Automatic Configuration) are used.

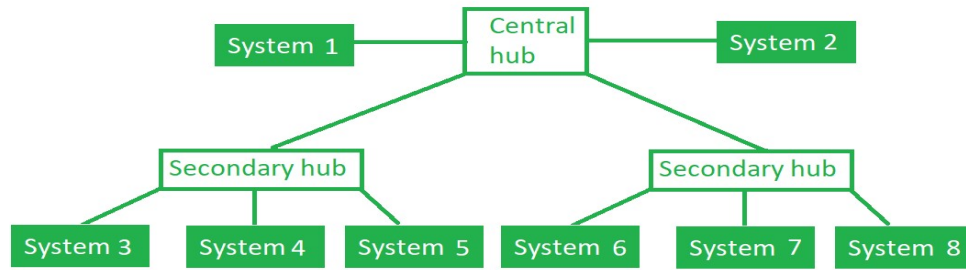


Figure 6: Tree Topology

Source: <https://www.geeksforgeeks.org/>

Hybrid Topology: The amalgamation of all the many kinds of topologies we have previously explored is this topological technology. When the nodes are free to take on any shape, hybrid topology is employed. This means that these can be single topologies like the Ring or Star topology, or they can be a mix of the several topologies that were previously mentioned. Every single topology makes use of the previously covered protocol.

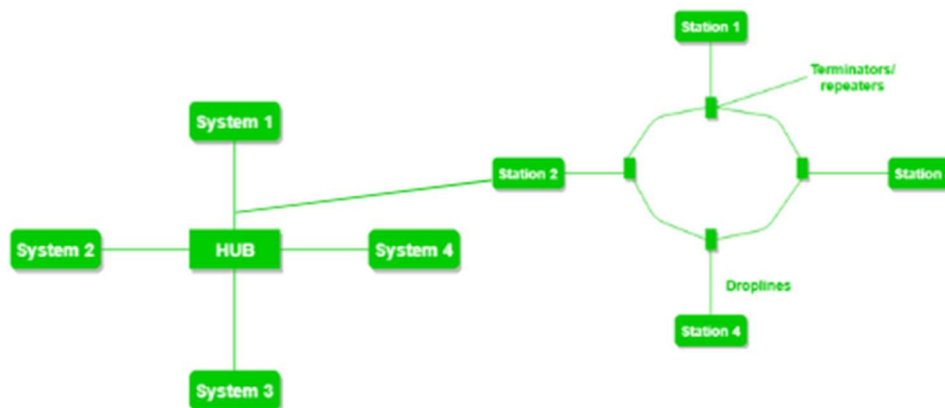


Figure 7: Hybrid Topology

Source: <https://www.geeksforgeeks.org/>

Types of Area Network: Computers can connect to the network and exchange data with other computers through any kind of communication channel. The three main types of networks that are intended to function over the area they span are LAN, MAN, and WAN. Both of them have certain parallels and differences. The geographic region that each of them covers—LANs cover the smallest area, MANs cover an area greater than LANs, and WANs cover the largest area—is one of their main differences.

There are other types of Computer Networks also, like:

- PAN (Personal Area Network)
- SAN (Storage Area Network)

- EPN (Enterprise Private Network)
- VPN (Virtual Private Network)

Personal Area Network (PAN): A personal area network, or PAN, is a short-range communication system made up of connected personal technology devices. It only takes up about 33 feet, or less than 10 meters, of space. Compared to other networks like LAN, WAN, etc., PAN has fewer users. Usually, PAN makes use of wireless technology. Data transmission between information devices, including cellphones, tablets, and PCs, is a component of PAN.

Local Area Network (LAN): By connecting network devices, a LAN, or local area network, allows workstations and personal computers to share files, applications, and other resources. A switch, or stack of switches, connects the collection of devices and computers together using a private addressing scheme that is specified by the TCP/IP protocol. A private address is distinct from other machines on the same local network. Routers link LANs to the wider. Wide Area Network (WAN) at their perimeter.

Since there are only a certain number of linked computers, data transfers extremely quickly. High-speed, reasonably priced hardware—such as hubs, network adapters, and Ethernet cables—is a prerequisite for the connections. A smaller geographic area is covered by LANs (Size is restricted to a few kilometers).

LANs are privately owned and have a smaller geographic coverage area—just a few kilometers. It can be used for a house, hospital, school, office building, etc. LANs are simple to create and manage. Coaxial and twisted-pair cables make up a LAN communication medium. Because it travels a small distance, there is less mistake and noise.

Data rates for early LANs ranged from 4 to 16 Mbps. These days, typical speeds are 100 or 1000 Mbps. In a LAN, the propagation delay is quite short. While larger LANs can support thousands of computers, the smallest LAN might only use two. Up to 2 kilometers is the range of LAN. Although wireless connections can be a part of a LAN, wired connections are usually the main source of speed and security for a LAN. A local area network (LAN) has higher fault tolerance and lower network congestion. As an illustration A group of students in the same room playing Counter-Strike (without internet).

Metropolitan Area Network (MAN): The Metropolitan Area Network, or MAN, has a broader coverage than a LAN and a more condensed coverage area than a WAN. The range of MAN is 5–50 kilometers. It links two or more geographically separated computers that live in the same or different cities. It may function as an ISP and covers a big geographic area (Internet Service Provider). MAN is intended for users that require fast internet access. MAN speeds are expressed in Mbps. Creating and managing a Metropolitan Area Network is challenging.

A MAN has lower fault tolerance, and network congestion is also higher. It is expensive and might not belong to a single company. Both the propagation latency and the data transfer rate of MAN are reasonable. The devices utilized for data transfer using MAN are the wire/cable and modem. A cable TV network in a city or a portion of the phone company network that can offer a high-speed DSL line to the consumer are examples of a MAN.

Wide Area Network (WAN): Wide Area Networks, or WANs, are computer networks that span a wide geographic region, often even inside the borders of a single state or nation. WAN can cover more than 50 kilometers. A wide area network (WAN) can be a LAN that is connected to other LANs using radio waves and phone lines. It can be public or restricted to an enterprise (a business or organization). The technology is reasonably priced and operates at a fast speed.

Switched WAN and Point-to-Point WAN are the two varieties of WAN. WAN design and maintenance are challenging. Comparable to a MAN, a WAN has lower failure tolerance and higher network congestion. PSTN is one communication medium utilized for WAN. A WAN communication media is a satellite link or PSTN. Long-distance communication causes greater noise and errors in WANs.

Activity: Select a business organization and determine which network topology they use in their organization

Because WANs require longer transmission distances, more servers, terminals, etc., their data rates are slower than that of a tenth of a local area network. A few kilobits per second (Kbps) to megabits per second (Mbps) are the ranges of WAN speeds. One of the main issues here is

Activity: Determine what type of area network is used in a business organization and why.

propagation latency. Satellites, microwaves, and optical cables are the devices that are utilized to transfer data over wide area networks. The asynchronous transfer mode (ATM) network is an example of a switched WAN, and a dial-up connection connecting a home computer to the Internet is an example of a point-to-point WAN.

Lesson 2: Computer Internet

After completion of this lesson you will be able to –

- *Gather knowledge about internet*
- *Determine different types of internet protocols.*

Introduction to Internet: The Internet can be defined as a global network made up of smaller networks connected by standard communication protocols. The Internet protocol suite is the framework that the Internet standards define. This paradigm separates techniques into a hierarchical protocol framework.

These layers are as follows:

1. Application layer (highest) – concerned with the data (URL, type, etc.). This is where HTTP, HTTPS, etc., comes in.
2. Transport layer – responsible for end-to-end communication over a network.
3. Network layer – provides data route.

Numerous information and communication tools are available on the Internet, including email, databases, forums, hypertext, and more. It comprises of a wide range of electronic, wireless, and optical networking technologies connecting local to worldwide commercial, public, academic, corporate, and government networks.

Types of Internet Protocols: A set of rules known as internet protocols controls data flow and communication over the network. To communicate data, the sender and recipient must adhere to the same protocols. To gain a better understanding, let us use an example of a language. If we wish to converse in any language, we must be familiar with its unique vocabulary and grammar. Similar to this, every time we browse a website or exchange data with another device via the internet, these operations are controlled by a set of guidelines known as internet protocols.

Internet Protocols are of different types having different uses. These are mentioned below:

1. TCP/IP(Transmission Control Protocol/ Internet Protocol)
2. SMTP(Simple Mail Transfer Protocol)
3. PPP(Point-to-Point Protocol)
4. FTP (File Transfer Protocol)
5. SFTP(Secure File Transfer Protocol)
6. HTTP(Hyper Text Transfer Protocol)
7. HTTPS(HyperText Transfer Protocol Secure)
8. TELNET(Terminal Network)
9. POP3(Post Office Protocol 3)
10. IPv4
11. IPv6
12. ICMP
13. UDP
14. IMAP
15. SSH
16. Gopher

TCP/IP (Transmission Control Protocol/ Internet Protocol): These are a set of common rules that enable communication between various computer kinds. Every machine connected to the Internet is assigned an IP address, or unique serial number, by the IP protocol. TCP defines the structure of IP packets and how data is transferred over the internet. Additionally, it verifies that the packets contain information about the message's source, destination, and the order in which it should be reassembled. Finally, it assesses if the message was sent accurately to the intended location. Another name for the TCP is a connection-oriented protocol.

SMTP (Simple Mail Transfer Protocol): It's crucial to follow these procedures while sending and forwarding emails. This protocol adds the email to the queue of outgoing mail after obtaining the recipient's email address from the header. Additionally, it deletes the email from the outgoing list as soon as it is delivered to the recipient's email address. Text, video, image, and other media may be taken into consideration in the message or email. It assists in configuring a few rules for the communication server.

PPP (Point-to-Point Protocol): It is a protocol for communication that establishes a direct line of communication between two devices. The rules by which two devices will communicate information and authenticate with one another are outlined in this protocol. For instance, a user utilizes PPP in addition to connecting his PC to an Internet service provider's server. In a similar vein, PPP is used to link two routers for direct communication.

FTP (File Transfer Protocol): The purpose of this protocol is to move files between systems. This utilizes a client-server architecture. The File Transfer Officer (FTO) initiates a connection and verifies each machine's identity using its password and ID when it receives a file transfer request from another system. Additionally, the intended file transfer occurs between the two computers.

SFTP (Secure File Transfer Protocol): File Transfer Protocol (FTP) over Secure Shell (SSH) is referred to as SFTP, or SSH FTP, because it encrypts data and commands during transmission. Files and data are encrypted and sent over a secure shell data stream via SFTP, which functions as an extension for SSH. Using this protocol, one can execute commands from the command line and establish a remote connection to another system.

HTTP (Hyper Text Transfer Protocol): The www (world wide web) defines this protocol, which is used to send hypertexts via the internet for information transfer. This protocol specifies the format and transmission requirements for the data. Additionally, it specifies the different responses that web browsers ought to give when a request is made to view a specific webpage. Since HTTP is the protocol used to share text, photos, and other multimedia items on the World Wide Web, users will inadvertently use it every time they open a web browser.

HTTPS (HyperText Transfer Protocol Secure): The Hypertext Transfer Protocol (HTTP) has an extension called HTTPS. With the SSL/TLS protocol for authentication and encryption, it is utilized for safe communication over a computer network. A website typically uses the HTTP protocol, but in order to increase security, an SSL certificate must be placed if the website handles sensitive data like credit card numbers, debit card numbers, OTPs, etc. Therefore, it is important to verify that a link is HTTPS before entering any sensitive information on a website. It could not be secure enough to enter important information if it is not HTTPS.

TELNET (Terminal Network): TELNET is a standard TCP/IP protocol used for virtual terminal service given by ISO. This enables one local machine to connect with another. The computer which is being connected is called a remote computer and which is connecting is called the local computer. TELNET operation lets us display anything being performed on the

remote computer in the local computer. This operates on the client/server principle. The local computer uses the telnet client program whereas the remote computer uses the telnet server program.

POP3 (Post Office Protocol 3): POP3 stands for Post Office Protocol version 3. It has two Message Access Agents (MAAs) where one is client MAA (Message Access Agent) and another is server MAA (Message Access Agent) for accessing the messages from the mailbox. This protocol helps us to retrieve and manage emails from the mailbox on the receiver mail server to the receiver's computer. This is implied between the receiver and the receiver mail server. It can also be called a one-way client-server protocol. The POP3 WORKS ON THE 2 PORTS I.E. PORT 110 AND PORT 995.

IPv4: The fourth and initially widely used version of the Internet Protocol is called IPv4 (Internet Protocol version 4). It is the most popular version of the Internet Protocol and is in charge of distributing data packets throughout the network. Maximum unique addresses for IPv4 are 4,294,967,296 (2³²), which are possible due to the use of 32-bit addresses. The network address and the host address are the two components of each address. The host address identifies a particular device within the network, whereas the network address identifies the network to which the host belongs. In the "dotted decimal" notation, which is the standard for IPv4 addresses, each octet (8 bits) of the address is represented by its decimal value and separated by a dot (e.g. 192.168.1.1).

IPv6: The most recent version of the Internet Protocol, IPv6, was created to address the IPv4 protocol's drawbacks. A maximum of 4.3 billion unique addresses are possible with IPv4's 32-bit addresses. Contrarily, IPv6 uses 128-bit addresses, which enable a significantly greater number of unique addresses. This is significant because IPv4 addresses were running out and there are an increasing number of devices that require internet access. Additionally, IPv6 offers enhanced security features like integrated authentication and encryption as well as better support for mobile devices. IPv6 support has spread among websites and internet service providers, and it is anticipated to gradually displace IPv4 as the main internet protocol.

ICMP: ICMP (Internet Control Message Protocol) is a network protocol that is used to send error messages and operational information about network conditions. It is an integral part of the Internet Protocol (IP) suite and is used to help diagnose and troubleshoot issues with network connectivity. ICMP messages are typically generated by network devices, such as routers, in response to errors or exceptional conditions encountered in forwarding a datagram. Some examples of ICMP messages include:

- Echo Request and Echo Reply (ping)
- Destination Unreachable
- Time Exceeded
- Redirect

ICMP can also be used by network management tools to test the reachability of a host and measure the round-trip time for packets to travel from the source to the destination and back. It should be noted that ICMP is not a secure protocol, it can be used in some types of network attacks like DDoS amplification.

UDP: UDP (User Datagram Protocol) is a connectionless, unreliable transport layer protocol. Unlike TCP, it does not establish a reliable connection between devices before transmitting data, and it does not guarantee that data packets will be received in the order they were sent or that they will be received at all. Instead, UDP simply sends packets of data to a destination

without any error checking or flow control. UDP is typically used for real-time applications such as streaming video and audio, online gaming, and VoIP (Voice over Internet Protocol) where a small amount of lost data is acceptable and low latency is important. UDP is faster than TCP because it has less overhead. It doesn't need to establish a connection, so it can send data packets immediately. It also doesn't need to wait for confirmation that the data was received before sending more, so it can transmit data at a higher rate.

IMAP: IMAP (Internet Message Access Protocol) is a protocol used for retrieving emails from a mail server. It allows users to access and manage their emails on the server, rather than downloading them to a local device. This means that the user can access their emails from multiple devices and the emails will be synced across all devices. IMAP is more flexible than POP3 (Post Office Protocol version 3) as it allows users to access and organize their emails on the server, and also allows multiple users to access the same mailbox.

SSH: SSH (Secure Shell) is a protocol used for secure remote login and other secure network services. It provides a secure and encrypted way to remotely access and manage servers, network devices, and other computer systems. SSH uses public-key cryptography to authenticate the user and encrypt the data being transmitted, making it much more secure than traditional remote login protocols such as Telnet. SSH also allows for secure file transfers using the SCP (Secure Copy) and SFTP (Secure File Transfer Protocol) protocols. It is widely used in Unix-based operating systems and is also available for Windows. It is commonly used by system administrators, developers, and other technical users to remotely access and manage servers and other network devices.

Gopher: Gopher is a type of file retrieval protocol that provides downloadable files with some description for easy management, retrieving, and searching of files. All the files are arranged on a remote computer in a stratified manner. It is an old protocol and it is not much used nowadays.

Intranet: An intranet allows information to be shared within a single organization and is owned by that entity. It's the kind of private Internet that people utilize. Since the intranet is a private network, anyone without a working username and password is unable to access it. Compared to the internet, there are fewer linked devices on an intranet. The intranet has few users and is extremely secure. It is utilized to obtain phone directories, employee information, etc.

Extranet: An organization or several organizations may be the owners of an extranet. It is a mechanism for information sharing between internal and external members and is administered according to contracts between organizations. Similar to an intranet, an extranet is a private network accessible only to individuals with a working account and password. You can send messages, place orders, view data, and check status using the extranet.

Discussion Questions:

1. Define computer network. How does computer network work?
2. Define transmission mode. Explain the types of transmission mode.
3. Explain the types of network topology.
4. Explain the types of area network.
5. Explain the types of internet protocol.
6. Explain intranet and extranet.

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Information Technology: IT Concepts and Applications

9

Unit Highlights

- INFORMATION TECHNOLOGY
- ELECTRONIC COMMERCE

Technologies Used for Content Delivery

- ❖ BOUTUBE
- ❖ BOU LMS
- ❖ WebTV
- ❖ Web Radio
- ❖ Mobile Technology with MicroSD Card
- ❖ LP+ Office 365
- ❖ BTV Program
- ❖ Bangladesh Betar Program

Lesson 1: Information Technology

After completion of this lesson you will be able to –

- *Understand multimedia and how to use it.*
- *Know about data elements of multimedia.*
- *Know about multimedia system development.*

Multimedia Basics: Text, visual art, audio, animation, and video components are all combined to create multimedia.

Multimedia is defined as "comprehensive material, presented in a combination of text, graphics, video, animation, and sound" in the IBM dictionary of computing. A multimedia system is any device that can display multimedia content.

A pointing device, keyboard, or voice command can all be used by the user to enter data into a multimedia program. Using multimedia technologies for business, education, and pleasure is known as multimedia applications. Nowadays, standard computer platforms include multimedia.

Multimedia Elements: The utilization of moving pictures, such as video and image animation, as well as sound (from the video images as well as superimposed voice by a narrator) coupled with document images and graphical text displays is necessary for high-impact multimedia applications, such as presentations, training, and messaging.

Applications involving multimedia necessitate the dynamic management of data that includes voice, text, audio, video, and animated images. Sections of all or any of these components can be cut and pasted into a new document or another application, such as an animated series of events, a desktop publishing system, or a spreadsheet, because of integrated multimedia applications.

The components that fall under our definition of multimedia are:

Data elements for Multimedia Systems:

Facsimile: The first viable method for sending document images over phone lines was facsimile transmissions. Today's common technology has advanced to enable higher scanning densities for fax quality that is better.

Document images: Business papers that must be kept on file for extended periods of time or that may need to be accessed by several individuals are stored as document images. Giving users access to these documents in a multimedia format eliminates the need to make multiple copies of the original for distribution or storage.

Photographic images: Numerous applications exist for photographic photographs. such as medical case histories, real estate systems with images of houses in the database containing house descriptions, staff records for rapid identification at a security desk, and so forth.

Geographic information systems map (GIS): Maps produced with a GIS system are widely utilized for urban planning, wildlife management, and natural resource management. These systems record the map's geographical data in addition to a database that links the highlighted map features to item or statistical data, such as details about the inhabitants of a building or its floors, rooms, and employees.

Voice commands and voice synthesis: A computer software can be operated hands-free via speech commands and voice synthesis. The process of giving the user the outcomes of an action in a synthesized voice is called voice synthesis. These capabilities will be most useful for

applications like a surgical theater's patient monitoring system. The user can operate a computer by speaking commands via voice commands.

Audio message: Annotated voice mail already uses audio or voice message as attachments to memos and documents such as maintenance manuals.

Video messages: Video messages are being used in a manner similar to annotated voice mail.

Holographic images: All of the technologies so far essentially present a flat view of information. Holographic images extend the concept of virtual reality by allowing the user to get "inside" a part, such as, an engine and view its operation from the inside.

Fractals: Fractals started as a technology in the early 1980s but have received serious attention only recently. This technology is based on synthesizing and storing algorithms that describes the information.

Activity: Explain the features of data elements of multimedia you have used in your life.

Multimedia system development

- Defining the system
- System Design
- Tools selection
- Authoring/rendering
- Testing

Defining the system to be developed

To develop a multimedia presentation or program, it is valuable to understand precisely who the user is. To compose a multimedia program the developer should consider the following:

- Level of understanding of the audience
- The expectation of the users
- The goal of presentation (training/entertainment)
- Allocated time
- Type of presentation required (text, graphics, sound, video, animation, or combination)
- Interactive/non-interactive presentation
- Impact of the presentation to the audience (instant or long-term).

Having all these details firmly in hand will help the multimedia developer to create a successful product.

System Design

One of the most crucial stages in the Multimedia System Development Life Cycle (MSDLC) is this one.

Making an outline of the information locks and sequences that will be displayed on the screen is the most popular method of getting started with a design. This establishes how much text, image, and interactive object content will be displayed on each screen.

It's also time to set up a user-friendly navigation system. The developer must choose if users will be able to navigate through the entire program by clicking on text or objects, or if there will be a navigation bar with arrows that travel from scene to scene.

The storyboard can be used for numerous scenes or a large amount of animation. Using sketches of the scenes and activities, storyboards are used by film directors for everything from feature-length movies to 30-second TV advertisements.

Putting a storyboard on paper aids the writer in identifying logical errors. There are programs for creating and arranging storyboard frames that can be drawn and arranged.

Tools Selection: A word processor is frequently needed to create text, graphics software is needed to work with digital images, a video capture program and editing software is needed to use video, and sound editing software is frequently needed for multimedia products.

The content is created using all of these applications. When the material is prepared, it must be put together through a procedure known as multimedia authoring.

Another kind of software is needed for this process; it must be able to comprehend various media formats, mix them, manage the order in which they appear, and develop user interface navigation aids. The range of media to be included determines in great part the technologies used for multimedia. When creating a straightforward text-and-graphics slide show, presentation software

The range of media to be included determines in great part the technologies used for multimedia. A basic presentation consisting of a text and graphic slide show should just require a presentation software package.

Adding preexisting images from the hundreds of commercially available CD-ROM collections of clip art, clip sound, and clip video would spice up the offering. These clip collections hold short fields for usage in a variety of multimedia applications in the appropriate file formats.

A user can electronically add sound effects or splice parts together by using a sophisticated sound edition application. For instance, sounds that reverberate. The same type of electronic video editing is available to users.

Macromedia Director is the most widely used application for putting together the components of a multimedia presentation. The multimedia author in Director puts together all of the elements—text, images, audio, and video—into distinct "tracks."

The author can synchronize all the elements with the program's assistance. For example, when the two animated objects clash, a crash sound effect is audible. The director creates files with the whole multimedia presentation, ready to be played online, on an integrated television, or distributed on a disk or CD-ROM.

Authoring/Rendering: It is necessary to assemble the contents once they have all been created. A proficient multimedia developer or programmer typically handles the multimedia writing for a complex product made with the use of a sophisticated tool, such as a director.

Testing: The people should test the multimedia product. Through this testing, the developer can identify any bugs in advance and fix them before releasing the final product. The developer ought to take into account the following during the test:

- Is it a product to read? (If it's a descriptive text)
- Is it easy to use?
- Is it simple to use and interactive?

There are frequently differences in viewpoints between the creator and the intended audience. The program's developer has to learn to take user-reported issues as helpful feedback. Because it is too simple to lose sight of the audience once heavy-duty authoring gets underway, testing is extremely helpful.

Activity: Develop a multimedia system
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Lesson 2: Electronic Commerce

After completion of this lesson you will be able to –

- *Define E-commerce*
- *Get knowledge about different types of E-commerce*

E-Commerce: The term "e-commerce" describes businesses and individuals who transact in goods and services via the internet. Computers, tablets, smartphones, and other smart devices can be used for e-commerce, which is available in a variety of market categories. E-commerce offers almost any goods and services that can be imagined, including financial services like online banking and stock investing, as well as books, music, and airline tickets. It is seen as a very disruptive technology as a result.

Types of E-commerce: Depending on the goods, services, and organization of an ecommerce company, the business can opt to operate several different ways. Here are several of the popular business models.

Business-to-Consumer (B2C): B2C e-commerce businesses sell products directly to consumers. A business-to-consumer (B2C) company conducts interactions with the consumer who will ultimately use the good, as opposed to distributing goods to an intermediary.

This kind of business plan can be used to sell goods (like the website of your neighborhood sporting goods store) or services (like a mobile app for lawn care that allows you to schedule landscaping services). This is the most popular business model, and when most people hear the term e-commerce, they probably think of this idea.

Business-to-Business (B2B): An e-commerce company can offer products to a user directly, just like a B2C company. However, that user can be a different firm rather than a customer. Larger quantities, more exacting standards, and extended lead times are typical features of B2B transactions. If the purchase is for repeating manufacturing operations, the ordering business might additionally need to set recurring goods.

Business-to-Government (B2G): Certain organizations focus on serving as government contractors, offering products and services to departments or offices. The business creates valuable products and sends those products to an entity, just like in a business-to-business transaction.

B2G e-commerce businesses frequently have to comply with government RFP rules, obtain bids for projects, and meet extremely strict product or service standards. Furthermore, collaborative government efforts might be made to request a single contract via a government-wide purchase contract.

Consumer-to-Consumer (C2C): Only well-established businesses are able to make sales. Digital marketplaces and other e-commerce platforms allow users to interact with other users who are able to list and sell their own products.

These C2C platforms could be Craigslist ads, eBay auctions, or auction-style advertisements that demand more conversation about the good or service being offered. C2C e-commerce systems, made possible by technology, enable individuals to purchase and sell without the assistance of businesses.

Consumer-to-Business (C2B): In particular, when it comes to gigs, short-term contracts, or freelance opportunities, modern platforms have made it easier for customers to interact with businesses and offer their services. Take Upwork listings, for instance.

Customers can contact with businesses that require certain tasks completed or request bids. The e-commerce platform facilitates the connection between freelancers and enterprises, giving customers more control over scheduling, pricing, and employment expectations.

Consumer-to-Government (C2G): Through C2G collaborations, users can communicate with administrations, agencies, or governments in a way that is less like typical e-commerce. These alliances frequently involve an obligation-based transaction rather than a service exchange.

For instance, submitting your federal tax return to the Internal Revenue Service's (IRS) online platform is an electronic commerce transaction involving the sharing of data. As an alternative, you can send your county assessor your property tax assessments or pay your university's tuition online.

Activity: Select an e-commerce organization and explain the characteristics of it.

Discussion Questions:

1. Define Multimedia. Explain the data elements of multimedia.
2. Explain multimedia system development.
3. Define E- commerce. Explain the types of E-commerce

Reference:

- Avison, D., & Fitzgerald, G. (2003). *Information systems development: methodologies, techniques and tools*. McGraw-Hill.
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Unit Highlights

- COMPUTER ACCESS, SECURITY AND MAINTENANCE

Technologies Used for Content Delivery

- ❖ BOUTUBE
- ❖ BOU LMS
- ❖ WebTV
- ❖ Web Radio
- ❖ Mobile Technology with MicroSD Card
- ❖ LP+ Office 365
- ❖ BTV Program
- ❖ Bangladesh Betar Program

Lesson 1: Computer access, security and maintenance

After completion of this lesson you will be able to –

- *Know about the positive and negative impact of computer in the society.*
- *Know about computer access, security and privacy.*

It is common knowledge that we live in the age of computers, with the vast majority of people using them. The advancement of science and technology directly impacts both our society and everyday lives. Communication across the globe may now happen in a matter of seconds because to computer technology. While they are in one region of the world, they can observe the transactions taking place in another. One of the major scientific advances of the 20th century is the invention of computers. In addition to being used in education, computers are employed in many other disciplines. These are a few of the most significant effects of computers on society.

Positive Impacts:

- After learning how to use a computer, any professional, including doctors, engineers, businesspeople, etc., experiences a change in their working style.
- A person's decision-making skills improve as a result of computers because they promptly supply all the information needed to make decisions. Any person or organization can succeed as a result fairly quickly.
- The manager's reliance on entry-level employees, such as clerks and accountants, decreases. Their ability to access the information is much increased. This enhances their productivity and work habits, which is advantageous to the company and eventually has a good impact on society.
- In everyday life, computer technology also benefits an individual. People who visit computerized airports, hospitals, banks, and department stores receive prompt treatment because of the computer technology.
- New job categories have been made possible by computers. These jobs are in the fields of teaching, manufacturing, and designing, among others.

Negative Impacts:

- The person in charge of the computer will have to put up with a lot if the data contained on it is lost for any reason.
- Common arithmetic is performed without the use of the mind, which causes people's numerical aptitude to steadily decline.
- In the modern world, people without computer literacy are viewed as second-class citizens.
- Parents worry that their growing children's complete reliance on computers may cause them to lose their common sense skills, such as math aptitude.
- As a result of computerization, employee workloads have decreased significantly. Consequently, a lot of companies could need to fire a few staff members. Employee unhappiness and a sense of insecurity result from it. Employees do not have a sense of corporate belonging as a result. Consequently, the outcome can be disastrous.
- When new technology is implemented in an organization, it may need to invest a significant sum of money in employee training.

Access, Security and privacy: Protecting digital information and guaranteeing the confidentiality, integrity, and availability of data in a computing environment are the main

goals of computer security and privacy, two ideas are intimately tied to one another. Despite having different objectives, they frequently coincide and enhance one another.

1. **Computer Security:** Computer security refers to the protection of computer systems, networks, and data from unauthorized access, damage, theft, or disruption. It involves measures and strategies to safeguard the technology infrastructure from various threats, including:
2. **Malware:** Protection against viruses, worms, Trojans, and other malicious software.
3. **Unauthorized Access:** Preventing unauthorized users from gaining access to sensitive data or systems.
4. **Firewalls and Intrusion Detection Systems:** Implementing these tools to monitor and filter network traffic.
5. **Encryption:** Using encryption algorithms to secure data at rest and during transmission.
6. **Password and Access Control:** Ensuring strong password policies and controlling access to resources.
7. **Patch Management:** Keeping software and systems up to date to address vulnerabilities.
8. **Security Auditing:** Regularly evaluating and auditing the security measures in place. Computer security aims to protect against external and internal threats, whether they are the result of cybercriminals, malware, or accidental user actions.
9. **Computer Privacy:** Computer privacy, on the other hand, is primarily concerned with protecting individuals' personal information and data from unauthorized access and misuse. It focuses on ensuring that people have control over who can access their digital data and how it's used.
10. **Data Protection:** Safeguarding personal data, such as financial records, health information, and online activity.
11. **Consent and Transparency:** Ensuring that individuals understand how their data is collected and used and that they have a say in the matter.
12. **Regulatory Compliance:** Complying with privacy laws and regulations, such as the General Data Protection Regulation (GDPR) in Europe or the Health Insurance Portability and Accountability Act (HIPAA) in the United States.
13. **Anonymity and Pseudonymity:** Allowing individuals to use digital services without revealing their true identity when necessary.
14. **Data Encryption:** Protecting the confidentiality of sensitive information by encrypting it.
15. **Opt-Out Options:** Giving individuals the ability to opt out of data collection or request the deletion of their data. Computer privacy is primarily about respecting individuals' rights and preferences regarding the handling of their personal information and ensuring that data is not misused or disclosed without consent.

In summary, computer security is about protecting systems and data from a wide range of threats, while computer privacy focuses on safeguarding individuals' personal data and giving them control over how their information is handled. These two concepts are intertwined, as a

Activity: Explain what type of computer security you maintained in your computer.
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breach in security often results in a breach of privacy. Protecting both is critical in our increasingly digital world.

General Maintenance: The upkeep of computer hardware to guarantee optimal performance is referred to as computer maintenance. Typically, IT service providers, the ESN, or digital service providers handle this purpose. These businesses offer both remote and on-site services. All of the operations required to keep or restore the IS in working order are included in IT maintenance.

Predictive Maintenance: This kind of maintenance is done with diagnostic tools to try to prevent failures before they happen by foreseeing potential issues. Computer system monitoring is one of the most significant methods used to perform this kind of maintenance. In this manner, one or more operators manage the appropriate operation of devices and systems by utilizing instruments like monitoring software to regulate a wide range of factors, including CPU temperature, battery life, and numerous others.

Preventive Maintenance: This kind of maintenance is done with diagnostic tools to try to prevent failures before they happen by foreseeing potential issues. Computer system monitoring is one of the most significant methods used to perform this kind of maintenance. In this manner, one or more operators manage the appropriate operation of devices and systems by utilizing instruments like monitoring software to regulate a wide range of factors, including CPU temperature, battery life, and numerous others.

Corrective maintenance: This kind of maintenance is performed frequently with the goals of extending the useful life of the system's various components as well as preventing potential faults and improving system performance.

There are numerous benefits to preventive maintenance. It can, for instance, cut down on the frequency of repairs or system outages. It can also identify weak places in the system that could compromise its functionality.

When preventive and predictive maintenance have not prevented the breakdown or have not functioned as intended, this is the remedy that needs to be used. Sometimes a computer or system malfunctions (maybe as a result of a hardware issue), but we still want it to function as best it can when it does. The next step will involve either replacement or repair work, based on each case's requirements.

Evolutionary maintenance: The goal of this kind of maintenance is to expand the available computer capacity rather than to fix or stop any malfunctions. As technology is always changing, so too are the instruments at users' disposal and their needs. Depending on the capabilities of each business and organization, evolutionary maintenance aims to keep computer systems updated and prevent them from becoming outdated, giving users the greatest possible technological options. Depending on the needs, this kind of maintenance could involve anything from software updates to a total system or equipment replacement.

Activity: Select a business organization and explain their computer maintenance.
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Discussion Questions:

1. Explain positive and negative impacts of computer in the society.
2. Explain computer access, security and privacy.
3. Explain computer maintenance.

Reference:

- Cohen, D. I., & Cohen, D. I. (1986). *Introduction to computer theory*. New York, USA: Wiley.
- Morley, D., & Parker, C. S. (2014). *Understanding computers: Today and tomorrow Comprehensive, Morley, Deborah & Charles S. Parker. 15th Edition*. (15th ed.). Cengage Learning.
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Unit Highlights

- WINDOWS

Technologies Used for Content Delivery

- ❖ BOUTUBE
- ❖ BOU LMS
- ❖ WebTV
- ❖ Web Radio
- ❖ Mobile Technology with MicroSD Card
- ❖ LP+ Office 365
- ❖ BTV Program
- ❖ Bangladesh Betar Program

Lesson 1: Windows

After completion of this lesson you will be able to –

- *Determine features of WINDOWS 365 and utilize it.*
- *Understand different types of web browser.*

Microsoft created the operating system Windows. It is the operating system that grants you access to a computer. The majority of brand-new personal computers (PCs) have Windows preinstalled, which contributes to its status as the most widely used operating system worldwide.

Windows enables us to finish a wide range of routine computer chores. Windows allows us to perform a lot of things, such check email, edit digital images, play games, listen to music, and explore the Internet.

Windows 365: A new kind of Windows virtual machine (Cloud PC) is automatically created for your end customers by Windows 365, a cloud-based service. Every Cloud PC is a specialized Windows computer that is assigned to a certain user. The security, collaboration, and productivity features of Microsoft 365 are available with Windows 365.

Windows 365 is available in multiple editions:

- Designed primarily for smaller businesses (up to 300 seats), **Windows 365 Business** offers ready-to-use Cloud PCs with straightforward management options.
- Larger businesses looking to create Cloud PCs with an infinite number of seats might go for **Windows 365 Enterprise**. It comes with greater management tools, full integration with Microsoft Intune, and the ability to build custom Cloud PCs based on your own device images.
- **Windows 365 Government** is a service that spans across a regulated US Government Community Cloud (GCC) and a public facing cloud.
- **Windows 365 Frontline** helps organizations save costs by providing a single license to provision up to three Cloud PCs for non-concurrent use. These are meant for cases where the user needs Cloud PC access for a limited time per day.

Web browsers: A Web Browser is a piece of software that allows users to access content on the World Wide Web. The webpage is displayed on the user's screen once the web browser retrieves the requested data from a web server.

Types of Web Browser

The functions of all web browsers are the same. Thus, more than the different types there are different web browsers which have been used over the years.

Discussed below are different web browser examples and their specific features:

1. WorldWideWeb

- The first web browser ever
- Launched in 1990
- It was later named “Nexus” to avoid any confusion with the World Wide Web
- Had the very basic features and less interactive in terms of graphical interface
- Did not have the feature of bookmark

2. Mosaic

- It was launched in 1993
- The second web browser which was launched

- Had a better graphical interface. Images, text and graphics could all be integrated
- It was developed at the National Center for Supercomputing Applications
- The team which was responsible for creating Mosaic was lead by Marc Andreessen
- It was named “the world’s first popular browser”

3. Netscape Navigator

- It was released in 1994
- In the 1990s, it was the dominant browser in terms of usage share
- More versions of this browser were launched by Netscape
- It had an advanced licensing scheme and allowed free usage for non-commercial purposes

4. Internet Explorer

- It was launched in 1995 by Microsoft
- By 2003, it has attained almost 95% of usage share and had become the most popular browsers of all
- Close to 10 versions of Internet Explorer were released by Microsoft and were updated gradually
- It was included in the Microsoft Windows operating system
- In 2015, it was replaced with “Microsoft Edge”, as it became the default browser on Windows 10

5. Firefox

- It was introduced in 2002 and was developed by Mozilla Foundation
- Firefox overtook the usage share from Internet Explorer and became the dominant browser during 2003-04
- Location-aware browsing was made available with Firefox
- This browser was also made available for mobile phones, tablets, etc.

6. Google Chrome

- It was launched in 2008 by Google
- It is a cross-platform web browser
- Multiple features from old browsers were amalgamated to form better and newer features
- To save computers from malware, Google developed the ad-blocking feature to keep the user data safe and secure
- Incognito mode is provided where private searching is available where no cookies or history is saved
- Till date, it has the best user interface

Apart from these, Opera Mini web browser was introduced in 2005 which was specially designed for mobile users. Before the mobile version, the computer version “Opera” was also released in 1995. It supported a decent user interface and was developed by Opera Software.

Activity: Which type of web browser do you use? Explain its features.

Discussion Questions:

1. Explain features of WINDOWS 365.
2. Define web browser. Explain the types of web browser.

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- Cohen, D. I., & Cohen, D. I. (1986). *Introduction to computer theory*. New York, USA: Wiley.
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Practical application of Microsoft Office

12

Unit Highlights

- APPLICATION OF MICROSOFT OFFICE
- APPLICATION OF MICROSOFT EXCEL
- APPLICATION OF MICROSOFT POWERPOINT

Technologies Used for Content Delivery

- ❖ BOUTUBE
- ❖ BOU LMS
- ❖ WebTV
- ❖ Web Radio
- ❖ Mobile Technology with MicroSD Card
- ❖ LP+ Office 365
- ❖ BTV Program
- ❖ Bangladesh Betar Program

Lesson 1: Application of Microsoft Office

After completion of this lesson you will be able to –

- *Know about features of Microsoft word*
- *Gain practical knowledge of Microsoft word.*

Microsoft Word: Without data or information, which is typically transferred from one person to another or from one organization to another, no business can succeed. The way that information is processed and distributed is what keeps any business alive. Because of this, communication in business is crucial. If there is no communication, there will be no purchasing, selling, or providing of services. There must be a sender, a process, and a recipient in any communication.

If the recipient is unable to decode (understand) what has been sent, there cannot be any communication. While written communication—which mostly necessitates the use of a personal computer—is the focus of this course material, all kinds of communication are significant in business.

Letters, memoranda, reports, minutes, invoices, newsletters, flyers, tables, charts, and diagrams are examples of written communication in business. These are the several formats that are available for sending messages between sources. The presentation of these documents conveys information about the company.

The most commonly used business documents are:

- Letters;
- Memoranda;
- Reports;
- Minutes;
- Invoice;
- Newsletters and
- Flyers.

In the process of producing these documents other functions may be required. For example there might be need to create a table, use charts and diagrams for illustrations. In this instance it becomes necessary to know how personal computer can be used to create these documents.

Letters:

There are four types of letters. They are:

- i. business letters
- ii. Circular letters
- iii. personal-business letters
- iv. Personal letters

We would start the discussion from the bottom.

Personal Letters: These are letters from friends and family that have been sent or received. This kind of letter can be shown in any way. In business, we often don't worry about this kind of correspondence. The term "personal letters" comes from the fact that they are not considered official correspondence.

Personal-business letters: These are customized letters that borrow certain elements from business letters. The salutation and complimenting close are the main distinctions between commercial and personal-business letters. The salutation and the closing are formal in a business letter. The customary salutation is "Dear Sir/Dear Ma'am/Sir/Madam," followed by

"Yours faithfully" as the complimenting closing. However, in personal business letters, the salutation includes the name of the recipient (e.g., Dear Mr. Adil/Dear Kaira), and the closing is followed by "Yours sincerely." When a letter is written in this format, it is assumed that the writer knows the recipient. The topic under discussion or the subject of the mails will be well-known. This approach helps you establish a more personal connection with your clients, which is helpful at particular points in your business journey. Your use of everyday language when speaking with them helps the clients feel understood and content.

Circular Letters: These are letters meant for several recipients. For instance, the salutation might include "Dear Customers" if firm XYZ wanted to let them know that the closing time has changed. This means that the letter's contents apply to every client of the business. Government officers also utilize this type of communication to advise other authorities on what has to be done. This type of letter is nonspecific and doesn't take a person's interests into account.

The most crucial point to remember is that circular letters lack the addressee's address, include a general salutation, a complimentary closing that is occasionally removed ("Yours sincerely"), and a general identification (e.g., "Management").

Business Letter: We must first examine the main components of a business letter. The numerous components of a business letter are necessary for it to be standard and acceptable, just as human bodies have pieces that are necessary for the full being to function.

How to format a business letter using MS word:

1. Choose a template: Using an MS Word template with the right margins, fonts, and alignment is the simplest method to format a business letter. You can search for "business letter" or "letter" among the various templates found under the File menu's New section. An alternative is to get a template from a reliable website, like the Microsoft Office website. After choosing a template, you can add your own text and customizations to make it uniquely yours.

2. Write the heading: A business letter's heading includes the recipient's address, the date, and your address. Typically, it is centered to the left, with one space between each line. To change the heading's alignment and indentation, use the ruler or the tab key. The current date can also be inserted in the format of your choice by using the Insert menu's Date and Time section. Make sure the month is spelled correctly and that the addresses are punctuated correctly.

3. Write the salutation: Your business letter's salutation is the greeting that goes first. A colon and a blank line come after it. If you know the receiver, you should address them by name and title. If not, feel free to use a general greeting like "To Whom It May Concern" or "Dear Sir or Madam". Formal salutations like "Hello" or "Hi" are inappropriate for a business letter, so you should refrain from using them.

4. Write the body: A business letter's body is where you primarily communicate your message and goals. Three paragraphs often make up this type of essay: an introduction, a main body, and a conclusion. Your motivation for writing should be stated in the introduction, and the facts and supporting data for your argument should be presented in the main body of the letter. Your message should be summed up and a request or plan of action should be suggested in the conclusion. There should be one space between each paragraph and it should be polite, succinct, and clear. Additionally, you want to speak in a serious, businesslike manner; slang, jargon, and emotive language should be avoided.

5. Write the closing: A business letter's ending, which conveys your gratitude and goodwill, comes last. There is a comma and four blank lines where you sign your name after that. A

courteous and considerate ending, like "Sincerely," "Yours truly," or "Regards," is appropriate. Closings that are too casual or conversational, like "Cheers," "Take care," or "See you soon," should not be used in professional letters.

6. Add your signature and enclosures: Your signature verifies your identity and authority and can be written by hand or electronically. Using a pen or a digital tool, sign your name in the empty place beneath the closing. Below your signature, aligned to the left margin, you should also type your name, title, and contact details. You should add any enclosures you are sending with your letter, such as papers or attachments, underneath your name. Use the word "Enclosure" or "Encl." followed by a colon and the things you have.

Activity: Create a business letter by using MS Word.

Creating Memos using MS Word:

1. Click START, then point to Programs and MS-Office.
2. Click MS-Word.
3. Click on File > New.
4. From the available Templates, click Memos.
5. Select the Memo style of your choice. Preferred styles are Contemporary or Elegant.
6. Double-click the memo style to download it. Your memo will download to Word.
7. Click next to TO: and press the TAB key (left side of keyboard) to put in a protected space. Then type in your professor's name. TO indicates the person to whom the memo is addressed.
8. Click next to FROM: and press the TAB key (left side of keyboard) to put in a protected space. Then type in your name. FROM indicates the author of this memo.
9. International students: Click next to CC: and press the TAB key (left side of keyboard) to put in a protected space. Then type in your Academic English professor's name.
10. Click next to DATE: and press the TAB key (left side of keyboard) to put in a protected space. Then put in the date.
11. Click next to RE: and press the TAB key (left side of keyboard) to put in a protected space. Then type in the topic of this memo, e.g. Stakeholder Memo. RE: means regarding, concerning, or subject.
12. Important note: Make sure that all text after TO, FROM, CC, DATE, and RE is exactly aligned. By using the TAB key after TO, FROM, CC, DATE, and RE you are manually aligning the text.
Suggestion: The TAB key protects the margin, whereas the spacebar does not. Instead, it creates jagged edges.
13. Highlight and delete information that you do not wish to be on your memo, e.g. "company name" or "confidential".
14. Type in the headings of your memo, e.g. Introduction, Conclusion, etc. and bold them.
15. Double-space under each heading and type a paragraph, with no indentation and single-spaced.
16. Save the file on the network drive or save it on the desktop and email it to yourself.

Activity: Create a Memo by using MS Word.

Creating Business report using MS Word:

- Reports are vital in an organisation. The report of a committee helps in decision making. The way reports are typed indicates the type of understanding the readers would receive. A good report must reflect the following:
 - The body that constitute the committee
 - The date the committee was constituted
 - Members of the committee
 - The terms of reference
 - Procedure
 - Findings
 - Recommendations

These often serve as a report's main headings. The headings may be displayed as side or shoulder headings. The most advised heading is the shoulder one. Reports should be typed in Times New Roman, Arial, or any other font type that falls within the same range, with a single line spacing or, at most, a one and a half line spacing. When tables and charts are used for illustrations, they should be placed appropriately between sentences or paragraphs.

Minutes: Minutes are entered into side or shoulder headings. A tabular format for the minutes could be used. Depending on the style of the home. Nonetheless, making sure that the main headers are clearly stated is crucial, regardless of whether it is typed in tabular or plain form.

Invoices: In a company setting, invoices are essential. Depending on the business, this could change. Determine the essential terms needed to characterize the goods that will be traded in the business first and foremost. The invoice is displayed using a combination of tabulation and simple type.

Activity: Create a business report using MS Word

Newsletter:

- Open Word and create a new document. Choose the page size and orientation that best suits your newsletter.
- Create a header with an attractive title and add branding elements such as logos or images.
- Add content using text boxes to organize and arrange the text. Take advantage of Word's formatting options to style font, size, color, and alignment.
- Make the newsletter more visually interesting by inserting images or illustrations.
- Create distinct sections in the document with page breaks or dividers for better navigation.
- Proofread the newsletter before sending; use Word's spell check and ask colleagues or friends for feedback.

By following these steps and employing Word's creative formatting options, you can produce a captivating newsletter that conveys your message.

Mail merge: Mail Merge is a useful tool that allows you to produce multiple letters, labels, envelopes, name tags, and more using information stored in a list, database, or spreadsheet.

Steps:

Step 1:

- Open MS Word and click on the command sequence: Mailings tab → Start mail merge group → Select recipients button → Type new List.
- A dialog namely “New Address List” will pop up(as shown in the below image). Type here the desired data under the given headings. To add a new record, click on the “New Entry” button at the bottom of the dialog and click OK when you are done.

Step 2: Prepare Master Letter

- The second step is to prepare our master letter for use in the mail merge. Before we enter all the letter text we’d like to link this Word file to our list of names.
- Create a blank word document.

Click Mailings tab → Start Mail Merge group → Start Mail Merge → Letters command.

- Then click the Mailings tab → Start Mail Merge group → Select Recipients button → Use Existing List command.
- Now we can start typing the letter.
- Now we would like to add the name and address and other details for the people on the list.
- Mailings tab→ Write & Insert Field group → Insert Merge Field button.
- A pop-down will appear showing all the table headings, so choose Title and press the spacebar to create a space.

Then do this again and choose FirstName, followed by a space (i.e., press only spacebar key and no other key); then choose LastName but this time press the Enter key to create a new line. Then repeat the steps to choose the Address field, and press enter key.

Step 3:

Before we actually carry out the merge, we must first preview what the merged letters will look like.

- Mailings tab→ Preview Results group → Preview Results button
- Once we are happy with the preview, you can carry out the actual mail merge.
- To do this you click the Mailings tab → Finish group → Finish & Merge button and choose Edit Individual Documents.
- Once we are happy with the preview, you can carry out the actual mail merge.
- To do this you click the Mailings tab → Finish group → Finish & Merge button and choose Edit Individual Documents.
- Once we are happy with the preview, you can carry out the actual mail merge.
- To do this you click the Mailings tab → Finish group → Finish & Merge button and choose Edit Individual Documents.

Macro: A macro is a series of commands that are recorded and saved, so that they can be easily run again on demand.

Activity: Do mail merge using MS Word.

Step 1: Open the new or an existing Word document.

Step 2: Click on the **View** tab on the Ribbon and click on the drop-down icon associated with the **Step 3:** Click on the **Record Macro** from the drop-down menu. the **Macros** in the **Macros** section.

Step 4: A Record Macro dialog box will appear on the screen in which do the following -

1. **Enter the Name** for the macro in the Macro name text field.
2. To use the same macro for the further document, click on the **All Documents (Normal.dotm)** option from the **Store macro in** drop-down menu.
3. Click on the **Button** icon in the Assign macro to section to run your macro.

Step 5: A Word Options window will appear on the screen with highlighted Quick Access Toolbar at the left pane.

- Click on the new macro name (Normal.NewMacros.MyMacro) on the left side of the screen.
- Click on the Add button to add the macro on the Quick Access Toolbar at the right side of the screen.
- Click on the Modify button, as shown in the below screenshot.

Step 6: Select macro that you want to record from the Modify Button dialog box, type the Display name, and click on the OK button.

Step 7: Click on the OK button at the Word options window.

Step 8: Now, click on the View tab and click on the Macros drop-down menu. Click on the Stop Recording Macro from the drop-down menu.

Now, you can see that recorded macro will appear on the Quick Access Toolbar.

Activity: Do macro using MS word.
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Lesson 2: Application of Microsoft Excel

After completion of this lesson you will be able to –

- *Know about the features of Microsoft Excel.*
- *Get practical knowledge of Microsoft Excel.*

Microsoft Excel:

Worksheets: Worksheets are the pages that are used in an Excel workbook. Each Excel workbook opens with 3 worksheets. Worksheets allow you to have multiple spreadsheets related to one subject in one document. You will find the worksheet tabs at the bottom of the document.

• **Renaming a Worksheet:** To rename a worksheet, double-click on the worksheet name from the tabs at the bottom of the document. Once the worksheet name is highlighted, you can simply type over it to rename the sheet.

• **Adding New Worksheet:** There are times that you may wish to have more than three worksheets in your workbook. Simply go to the Insert menu at the top of the page, and then choose Worksheet (If you do not see this option immediately, click on the double arrow at the bottom of the Insert menu to display the remainder of your options.).

Formulas:

Finding the Sum of Selected Cells:

- Excel is very helpful with numbers. Excel can be set to add, subtract, or average certain cells. To find the sum of a column of numbers, click a cell below the column. For example, if you want the sum of cells B5-9 to display in cell B11, select the cell B11. Next, click the AutoSum button.
- Once the AutoSum button is clicked, Excel guesses which cells you want included in the sum. It selects the cells by showing a box around the cells. If the “wrong” cells were selected, you can modify the selection by clicking and dragging to make a box around the appropriate cells.
- Press Enter on your keyboard to set the formula.

Averaging Cells:

- Finding the average of cells is very similar to finding the sum of cells. First, select the cell where the average is to appear. Then, click the small arrow that is next to the AutoSum button.
- Click the Average button.
- Next, select the cells to be averaged by clicking and highlighting those cells.
- Press Enter on your keyboard to set the formula.
- The same steps will apply to entering any other basic formula.

Activity: Do sum and average using MS Excel.

Entering Your Own Formula

Basic Formula Rules

- Every formula entered in Excel must start with an Equal sign.
- Every cell must be identified by column and row (in that order).

- If you want to set a range of cells use a colon to identify that you want all cells between two included.

Example: B2:B10 signifies to Excel that you mean cells B2 through cell B10.

- Use + for addition, - for subtraction, * for multiplication, and / for division.
- Words are used to perform certain functions. To see a list of functions go to the Insert menu and choose Function.
- If you want to write a formula for figuring the sum of one set of cells, and then subtracting the sum of another set of cells you could use the following formula.
=(SUM(B2:B10))-(SUM(C2:C10))
- Excel also allows you to use data from another worksheet of your workbook. To pull data from another worksheet into a formula, identify it in the formula by using 'SheetName'!Cell
- There are many capabilities of the functions that can be performed in Microsoft Excel. For more information on functions, visit the Microsoft Office Excel site at <http://office.microsoft.com/en-us/excel/default.aspx> and then searching for functions.

Charts: Excel has a fantastic capability of translating data into charts and graphs through the Chart Wizard.

- First, highlight the information to be included in the graph.
- Then click on the Chart Wizard button (looks like a bar graph). The Chart Wizard will walk you through creating a graph.

The first screen that appears allows you to select the type of graph you wish to create. If you want to create a bar graph, select the first choice, and then click Next.

- On the next screen, you will see a preliminary graph of the data in the selection. You can choose to create the chart from the information in the rows of your spreadsheet or the information in the columns. Simply click the option and it will show you a preview of the chart. Once you have decided on your options click Next.
- Next, you will be able to edit the titles on your chart. You can title your chart, the x axis (bottom of graph) and y axis (left side of graph).
- There are also other options on this menu. Click on the tabs at the top to see your different choices. Once you have made your selections click Next.
- On the next screen, you can either choose to include the graph as an object on an existing sheet or on a new one.
- Click Finish, and the graph will display on the sheet. If you want the graph in a different location on the sheet, just click and drag the chart to a different place on the sheet.

Activity: Prepare charts using MS Excel.

Vlookup: The **VLOOKUP** function is a premade function in Excel, which allows searches across columns.

Steps:

- Select a cell (H4)
- Type =VLOOKUP
- Double click the VLOOKUP command
- Select the cell where search value will be entered (H3)
- Type (,)
- Mark table range (A2:E21)

- Type (,)
- Type the number of the column, counted from the left (2)
- Type True (1) or False (0) (1)
- Hit enter
- Enter a value in the cell selected for the Lookup value H3(7).

Activity: Do VLOOKUP using MS Excel

Lesson 3: Application of Microsoft Powerpoint

After completion of this lesson you will be able to –

➤ *Know about practical application of MS Powerpoint.*

Microsoft PowerPoint: PowerPoint, a member of the Microsoft Office suite of applications, is a presentation processor that allows you to produce professional looking visuals containing text and graphics.

Starting PowerPoint: To start PowerPoint click on the Start Button at the bottom left of the screen and select PowerPoint from the available choices.

Creating a simple presentation: Once you start the PowerPoint application as detailed earlier, you can then create a PowerPoint presentation. The section that follows explains step-by-step creation, saving and running of a presentation.

Creating a New Slide:

- 1) Choose Blank Presentation from the right panel. (Alternatively you could choose File -> 'Menu from the menu.). This will display the various option from which to choose the slide type.
- 2) Click on to click to add a subtitle to add a title.
- 3) Add a sub-title to a slide.
- 4) You can add more slides by clicking on New Slide as shown below. (Alternatively you could choose Insert -> New Slide from the menu.)
- 5) You can also select the desired slide format (from the various types available). Selected below is the Title and bulleted text type.

As you add/insert more slides, the number of slides and the current slide you are working on is displayed in the left panel. The left panel, in this case, shows that you have two slides in your presentation and the current slide, you are working on, is slide number 2.

You can add as many slides as you want in the manner explained above with each slide of the type you want it to be.

Deleting a Slide:

- 1) Choose the slide in the left panel and press the Delete key. (Alternatively you could choose Edit -> Delete Slide from the menu.) You can use the Up or Down arrow keys to select the slide or click on it using the mouse. You will notice that the number of slides as displayed in the left panel will change from 3 to 2.

Numbering Slides:

- 1) Select View -> Header Footer... from the menu. This displays a dialogue box for selecting options for slides in terms of Date and Time, Slide Numbers and Footer (if required).
- 2) Click on the Slide number check box.
- 3) Click on the Apply to All button to apply this to all the slides. In case you click on the Apply button only, the numbering will apply only to the current slide. A) You could optionally click on the Date and Time check box to have a date and time displayed on each slide. You will notice a number on each of the slides.

Saving a Presentation Select File :

- 1) Save from the menu. Optionally, you can click on the save icon in the standard toolbar. A down 2) This displays a dialogue box for typing in the name of the presentation.
- 3) Type in the name of the file in the dialogue box. Note that you need not give an extension to the file name. By default presentations are saved with a .ppt extension.
- 4) Click on the Save button. This will save the file in the directory displayed in the dialogue box. A) In case you wish to save the file in another directory, specify the desired path and directory here.

Activity: Prepare Slides using MS Powerpoint.
--

Discussion Questions:

1. Explain how to prepare Letters using MS Word.
2. Explain how to prepare Memoranda using MS Word.
3. Explain how to prepare Memoranda using MS Word.
4. Explain how to prepare Reports using MS Word
5. Explain how to prepare Minutes, Invoice, Newsletters and Flyers using MS Word.
6. Explain the use of mail merge and macro in MS Word.
7. Explain the steps of VLookup in MS Excel.
8. Explain how to use formula and function in MS Excel
9. Explain how to prepare slides using MS Powerpoint.

Reference:

Lambert, J., & Frye, C. (2022). *Microsoft Office: Step by step (office 2021 and Microsoft 365)*. Redmond: Microsoft Press.

Unit Highlights

➤ **BASIC OF C PROGRAMMING**

Technologies Used for Content Delivery

- ❖ BOUTUBE
- ❖ BOU LMS
- ❖ WebTV
- ❖ Web Radio
- ❖ Mobile Technology with MicroSD Card
- ❖ LP+ Office 365
- ❖ BTV Program
- ❖ Bangladesh Betar Program

Lesson 1: Basic of C Programming

After completion of this lesson you will be able to –

➤ *Basic knowledge of C Programming*

Dennis Ritchie developed the general-purpose programming language C in the Bell Laboratories in 1972. Despite its age, this language is still highly popular. The primary explanation of its widespread use is that it is an essential language in computer science. Since C was created to write the UNIX operating system, the two are closely related.

Why Learn C?

- It is one of the most popular programming languages in the world
- If you know C, you will have no problem learning other popular programming languages such as Java, Python, C++, C#, etc, as the syntax is similar
- C is very fast, compared to other programming languages, like Java and Python
- C is very versatile; it can be used in both applications and technologies.

Some C Programs:

1. C program to Check Whether a Number is Positive or Negative or Zero

```
#include <stdio.h>
```

```
int main()
{
    int A;

    printf("Enter the number A: ");
    scanf("%d", &A);

    if (A > 0)
        printf("%d is positive.", A);
    else if (A < 0)
        printf("%d is negative.", A);
    else if (A == 0)
        printf("%d is zero.", A);

    return 0;
}
```

Input: A = 2

Output: 2 is positive

Input: A = -554

Output: -554 is negative

2. Even or Odd Number

```
// C program for the above approach
#include <stdio.h>
```

```

// Function to check if a
// number is even or odd
void checkEvenOdd(int N)
{
    // Find remainder
    int r = N % 2;

    // Condition for even
    if (r == 0)
    {
        printf("Even");
    }

    // Otherwise
    else
    {
        printf("Odd");
    }
}

// Driver Code
int main()
{
    // Given number N
    int N = 101;

    // Function Call
    checkEvenOdd(N);

    return 0;
}

```

3. C program to Find the Largest Number Among Three Numbers

```

// C program to find the maximum number out of the three
// given numbers using if-else statement
#include <stdio.h>

```

```

int main()
{
    int A, B, C;

    printf("Enter the numbers A, B and C: ");
    scanf("%d %d %d", &A, &B, &C);

    // finding max using compound expressions
    if (A >= B && A >= C)
        printf("%d is the largest number.", A);
}

```

```

    else if (B >= A && B >= C)
        printf("%d is the largest number.", B);

    else
        printf("%d is the largest number.", C);

    return 0;
}

```

4. C Program to Calculate Sum of Natural Numbers

```

// C Program to demonstrate
// Sum of Natural Numbers
// using while loops

```

```

#include <stdio.h>
int main()
{
    int i, s = 0;
    int n = 10;
    i = 1;

    // while loop executes
    // the statements until the
    // condition is false
    while (i <= n) {

        // adding natural numbers
        // up to given number n
        s += i;
        i++;
    }
    // printing the result
    printf("Sum = %d", s);
    return 0;
}

```

5. Leap Year Program in C

```

// C program to check if a given
// year is leap year or not
#include <stdbool.h>
#include <stdio.h>

```

```

bool checkYear(int year)
{
    // If a year is multiple of 400,
    // then it is a leap year
    if (year % 400 == 0)
        return true;
}

```

```

// Else If a year is multiple of 100,
// then it is not a leap year
else if (year % 100 == 0)
    return false;

// Else If a year is multiple of 4,
// then it is a leap year
else if (year % 4 == 0)
    return true;
// if no above condition is satisfied, then it is not
// a leap year
return false;
}

// Driver code
int main()
{
    int year = 2000;

    if (checkYear(year)) {
        printf("Leap Year");
    }
    else {
        printf("Not a Leap Year");
    }
    return 0;
}

```

6. Factorial Program in C

/ C program to implement the above approach
#include <stdio.h>

```

// Function to find factorial of given number
unsigned int factorial(unsigned int n)
{
    int result = 1, i;

    // loop from 2 to n to get the factorial
    for (i = 2; i <= n; i++) {
        result *= i;
    }

    return result;
}

// Driver code
int main()

```

```
{  
    int num = 5;  
    printf("Factorial of %d is %d", num, factorial(num));  
    return 0;  
}
```

Discussion Questions:

1. Explain the need of learning C programming.
2. Do a C program to Check Whether a Number is Positive or Negative or Zero
3. Do a C program to check Even or Odd Number
4. Do a C program to find the Largest Number among Three Numbers
5. Do a C Program to Calculate Sum of Natural numbers
6. Do a C program to determine leap year.
7. Do a C program to determine Factorial.

Reference:

Deitel, H., & Deitel, P. (1992). *C How to Program* (9th ed.). Prentice Hall.