Subject: Computer	**Chapter:** Unit 01
Class: **9th**	Teacher: **Javaid Iqbal**
School: Innovative Higher Secondary School	

FBISE SLO-Aligned

MCQs From Chapter & Exercise

1. The brain of the computer is the:
    a. Keyboard
    b. *Monitor*
    c. **CPU**
    d. Mouse
2. Computers that use vacuum tubes belong to which generation?
    a. **First generation**
    b. Second generation
    c. Third generation
    d. Fourth generation
3. ALU stands for:
    a. Automatic Logic Unit
    b. **Arithmetic Logic Unit**
    c. Added Logic Unit
    d. Advanced Logical Utility
4. Which one is an example of primary memory?
    a. USB
    b. Hard Disk
    c. **RAM**
    d. CD-ROM
5. Which part of CPU controls the execution of instructions?
    a. ALU
    b. Register
    c. **Control Unit**
    d. Cache
6. A system which exists in nature is known as:
    a. Auxiliary system
    b. **Natural system**
    c. Artificial system
    d. Closed system
7. The information processed by a computer is called:
    a. Instruction
    b. **Data**
    c. System
    d. Code
8. Cache memory is located between:
    a. CPU and Input devices
    b. Hard disk and RAM
    c. Keyboard and Monitor
    d. **CPU and RAM**
9. The smallest unit of data in the computer is:

a. Byte
b. **Bit**
c. KB
d. MB

10. Which device is an input device?
    a. Monitor
    b. Printer
    c. Speaker
    d. **Keyboard**
11. Which of the following is NOT a system software?
    a. Operating System
    b. Compiler
    c. **MS Word**
    d. Device Driver
12. Which memory is volatile?
    a. ROM
    b. **RAM**
    c. Flash Memory
    d. Hard Disk
13. A machine that follows instructions and processes data is called:
    a. Robot
    b. **Computer**
    c. Calculator
    d. Server
14. Which of the following is an example of application software?
    a. Windows
    b. **MS Excel**
    c. Linux kernel
    d. BIOS
15. Von Neumann Architecture is related to:
    a. **Computer system design**
    b. Office management
    c. Database security
    d. Artificial Intelligence
16. Which of these stores data permanently?
    a. RAM
    b. **Hard Disk**
    c. Cache
    d. Registers
17. The full form of BIOS is:
    a. Basic Internal Output System
    b. **Basic Input Output System**
    c. Binary Input Output System
    d. Basic Integrated Output System
18. A computer program that translates code written in high-level language into machine language is called:
    a. **Compiler**
    b. Browser
    c. Text editor
    d. Operating System
19. Which memory is the fastest?
    a. RAM
    b. **Cache**

c. Hard Disk
d. DVD

20. ROM stands for:
    a. Random Only Memory
    b. **Read Only Memory**
    c. Read Official Memory
    d. Random Operating Memory
21. The temporary memory that holds current instructions and data is called:
    a. Hard Disk
    b. **RAM**
    c. CD
    d. SSD
22. What is the speed of data transfer measured in?
    a. Watts
    b. Kilograms
    c. **Bits per second**
    d. Bytes per inch
23. Which of the following is a type of system software?
    a. **Operating System**
    b. MS PowerPoint
    c. Adobe Photoshop
    d. MS Access
24. Which port is used to connect computer to the internet via landline?
    a. USB
    b. **Ethernet port**
    c. VGA port
    d. HDMI port
25. The Central Processing Unit does not include:
    a. ALU
    b. CU
    c. Registers
    d. **Monitor**
26. Which network topology has a central hub?
    a. Ring
    b. Mesh
    c. **Star**
    d. Bus
27. Which one of the following is a secondary storage device?
    a. **DVD**
    b. Cache
    c. Register
    d. Control Unit
28. Which language is easier for humans to understand?
    a. Machine Language
    b. Assembly Language
    c. **High-level Language**
    d. Binary Code
29. The devices that are not essential for the computer to function are called:
    a. System units
    b. **Auxiliary components**
    c. Primary components
    d. RAM

30. A closed system:
    a. Interacts with environment
    b. **Does not interact with environment**
    c. Is a natural system
    d. Performs only arithmetic

31. ---

32. (More MCQs – Continue)

33. A group of interconnected computers is known as:
    a. Database
    b. **Network**
    c. Software
    d. Server
34. Packet switching is a method used in:
    a. **Data communication**
    b. Hard Disk
    c. Cache Memory
    d. Computer generation
35. Which is NOT a function of Operating System?
    a. File management
    b. **Creating slide shows**
    c. Memory management
    d. Device management
36. What is the full form of ALU?
    a. Automatic Logic Utility
    b. **Arithmetic Logic Unit**
    c. Auto Link Unit
    d. Arithmetic Listing Unit
37. Which port is used for display on monitors?
    a. USB
    b. **VGA / HDMI**
    c. Audio Jack
    d. RJ-45
38. In binary system, base is:
    a. 10
    b. **2**
    c. 16
    d. 8
39. Which one is NOT a programming language?
    a. Java
    b. Python
    c. **MS Excel**
    d. C++
40. The generation of computers using microprocessors is:
    a. First
    b. Second
    c. Third
    d. **Fourth**
41. Registers are located in the:
    a. **CPU**
    b. RAM
    c. Hard disk
    d. Monitor

42. The physical parts of computer are called:
    a. Software
    b. **Hardware**
    c. Data
    d. Process

43. ---

44. (10 More MCQs)

45. A collection of programs designed to work together is called:
    a. Hardware
    b. **Software package**
    c. Operating System
    d. ROM
46. GUI stands for:
    a. General User Input
    b. Graphical Ultra Interface
    c. **Graphical User Interface**
    d. Global Unit Interface
47. What is the name given to the smallest piece of data handled by computer?
    a. **Bit**
    b. Byte
    c. Record
    d. Element
48. Which network device repeats and regenerates signals?
    a. Switch
    b. **Repeater**
    c. Modem
    d. Router
49. The function of Control Unit is to:
    a. Perform calculation
    b. **Control all activities**
    c. Store data
    d. Display output
50. Which of the following has highest storage capacity?
    a. Floppy Disk
    b. CD
    c. **Hard Disk**
    d. Cache
51. Which network mode allows communication both ways but not simultaneously?
    a. Simplex
    b. **Half Duplex**
    c. Full Duplex
    d. Multiplex
52. The abbreviation CPU stands for:
    a. Compute Processing Unit
    b. Computer Power Unit
    c. **Central Processing Unit**
    d. Core Power Unit
53. A system made by humans is called:
    a. **Artificial system**
    b. Natural system
    c. Closed system
    d. Database system

54. Hard disk is an example of:
    a. Primary memory
    b. **Secondary storage**
    c. Cache memory
    d. Input device
55. **1. What computing machine was capable of taking input from punch cards and storing data in memory?**
    a) Abacus
    b) Analytical Engine
    c) Tabulating Machine
    d) Differential Analyzer
56. **2. What technology replaced vacuum tubes in second-generation computers?**
    a) Transistors
    b) Integrated Circuits (ICs)
    c) Microprocessors
    d) Magnetic tapes
57. **3. Which computer generation introduced the use of Integrated Circuits (ICs)?**
    a) First Generation
    b) Second Generation
    c) Third Generation
    d) Fourth Generation
58. **4. Which of the following is an example of a natural system?**
    a) Telephone network
    b) Human body
    c) Database
    d) Automobile
59. **5. Which component of the microprocessor controls the working of input/output devices and storage devices?**
    a) Arithmetic Logic Unit (ALU)
    b) Control Unit (CU)
    c) Memory Address Register (MAR)
    d) Data Register (DR)
60. **6. Which type of memory retains data even when the computer is turned off?**
    a) RAM
    b) ROM
    c) Cache
    d) Register
61. **7. What is the main purpose of Cache memory?**
    a) Store program instructions
    b) Provide high-speed storage
    c) Control input/output devices
    d) Perform arithmetic operations
62. **8. What is the smallest unit of memory in a digital computer?**
    a) Kilobyte
    b) Bit
    c) Byte
    d) Megabyte
63. **9. Which memory type uses laser beams to read and write data?**
    a) RAM
    b) Optical memory
    c) Cache memory
    d) ROM

64. **10. In Von Neumann architecture, where are instruction data and program data stored?**
    a) In separate memory units
    b) In the same memory unit
    c) In the processor's registers
    d) In the cache memory
65. **11. What is the primary function of the buses in a computer's memory system?**
    a) Control memory operations
    b) Display graphics
    c) Transmit data between components
    d) Perform arithmetic operations
66. **12. What is the primary function of the Presentation Layer in the OSI model?**
    a) Establishing connections between computers
    b) Converting data into a standard format
    c) Deciding the physical path of data
    d) Sending data in both directions simultaneously
67. **13. In which network topology is data transmission unidirectional, like radio or television broadcasts?**
    a) Star Topology
    b) Bus Topology
    c) Mesh Topology
    d) Ring Topology
68. **14. Which data communication standard is used for transferring web pages and related data on the World Wide Web?**
    a) TCP/IP
    b) HTTP
    c) FTP
    d) SMTP
69. **15. Which network architecture requires each computer to act as either a server or a client but not both simultaneously?**
    a) Client/Server Network
    b) Peer-to-Peer Network
    c) Metropolitan Area Network (MAN)
    d) Wide Area Network (WAN)

SHORT QUESTIONS (2 MARKS)

1. What is meant by a computer system?
A computer system is a complete set of hardware and software that work together to perform input, processing, output and storage tasks.

---

2. Differentiate between natural and artificial systems with one example each.
Natural systems exist in nature on their own (e.g., solar system). Artificial systems are man-made systems created to solve problems (e.g., banking system or computer system).

---

3. What is the significance of Von Neumann Architecture?
Von Neumann Architecture defines a computer design model where program and data are stored in the same memory and CPU processes instructions sequentially. It is the foundation of modern computer systems.

4. Write two important functions of Control Unit.
The Control Unit manages the execution of instructions by generating control signals and coordinates all components of the CPU.

---

5. Why is ALU called the core of processing?
ALU is called the core because it performs all arithmetic (like addition, subtraction) and logical operations (comparison, decision-making).

---

6. Differentiate between cache memory and RAM.
Cache is faster and smaller, located inside or near CPU, used for frequently used data. RAM is larger, slower than cache, used to store running programs and data temporarily.

---

7. Define bit and byte.
Bit is the smallest unit of data that stores 0 or 1. A group of 8 bits makes one byte, which can store one character.

---

8. What is binary system and why is it used in computers?
Binary system uses only two digits 0 and 1. Computers use it because digital circuits can easily represent two states: ON and OFF.

---

9. What is meant by system software? Give two examples.
System software controls and manages computer hardware, e.g., Operating System, Device Drivers.

---

10. Name any two application software used in daily life.
Examples include MS Word, Excel, PowerPoint, Adobe Photoshop etc.

---

11. Differentiate between compiler and interpreter.
Compiler translates whole program at once into machine code. Interpreter translates one line at a time while executing it.

---

12. Name any two registers of CPU and their purpose.
Examples: Instruction Register holds current instruction, Program Counter holds address of next instruction.

13. Write two features of third generation computers.
They used Integrated Circuits (ICs), were smaller, faster and more reliable than second generation computers.

---

14. Why is ROM called non-volatile memory?
Because it retains data even when power is turned off. Data in ROM is permanent or semi-permanent.

---

15. What do you understand by hierarchical memory system?
Hierarchy of memories arranged by speed and cost from fastest (registers, cache) to slowest (hard disk) is memory hierarchy.

---

16. Define software engineering and hardware engineering.
Software engineering deals with development of software programs, while hardware engineering deals with design and manufacturing of computer hardware components.

---

17. Write two responsibilities of an operating system.
OS manages files, runs programs, handles input and output devices and controls memory usage.

---

18. What is meant by system bus?
System bus is a communication pathway used for data transfer among components like CPU, memory and peripherals.

---

19. Explain the term network protocol.
Protocol is a set of rules that controls how data is transmitted and received over a network.

---

20. What is packet switching?
Packet switching breaks data into small packets and sends them independently over network; packets may take different routes.

---

21. Differentiate between simplex and duplex modes of transmission.
Simplex: data travels in one direction only (like TV broadcast). Half duplex: both directions but one at a time (walkie-talkie). Full duplex: both directions simultaneously (telephone).

---

22. Write two advantages of wireless networks.
No cables required, mobility, easier installation, and flexible coverage.

---

23. Define topologies in networking and write any two examples.
Topology is layout of network connections. Examples: Star topology, Bus topology.

---

24. What is the difference between LAN and WAN?
LAN covers small area like a building or school, while WAN covers large areas like cities or countries (e.g., Internet).

---

25. Distinguish between primary memory and secondary memory with respect to volatility.
Primary memory like RAM is volatile, loses data when power off. Secondary like hard disk is non-volatile, stores data permanently.

---

26. What are necessary components of computer?
Necessary components include CPU, memory, motherboard, power supply, input and output devices.

---

27. What are auxiliary components? Give examples.
Components not required for basic function, but useful e.g. printer, scanner, speakers, webcam.

---

28. Explain the role of modem in data communication.
Modem modulates digital data into analog signals and demodulates analog back to digital so computers can communicate over phone lines.

---

29. Differentiate between CPU and system unit.
CPU is the chip that performs processing. System unit is the whole box containing motherboard, CPU, memory, etc.

---

30. Define the term operating system and state its two types.
Operating system is software that manages hardware and runs applications. Types: single-user OS, multi-user OS.

---

31. Explain the difference between input and output devices with examples.
Input devices send data to computer (keyboard, mouse). Output devices display or print results (monitor, printer).

---

32. Why is internet called the largest network?
Because it connects millions of computers worldwide, used globally for communication and information sharing.

---

33. What is a GUI and how does it help users?
GUI is a visual interface with icons and windows, making computer easier to use without typing commands.

---

34. Write two uses of spreadsheets in daily life.
Used for calculations, budgeting, data analysis, graphs, attendance sheets etc.

---

35. Define application software and give two examples related to education.
Application software helps users perform tasks; educational examples include MS PowerPoint for presentations, Google Classroom, etc.

---

36. Why is cache memory faster than RAM?
Because it is built using expensive high-speed memory and is located closer to CPU, reducing access time.

---

37. Differentiate between price and speed with respect to memory hierarchy.
As speed increases (like cache, registers), cost per bit increases. As speed decreases (like hard disk), cost decreases and storage capacity increases.

---

38. What does the term 'data bus' refer to?
Data bus carries data between CPU, memory and other components; it is part of system bus.

---

39. What is the difference between generation of computers and types of computers?
Generations refer to time-based development (vacuum tubes, ICs). Types refer to sizes and capacity (desktop, laptop, mainframe).

---

40. What is encapsulation in data communication?
Encapsulation is the process of wrapping data with protocol information before transmission across the network layers.

---

41. How are high-level languages beneficial compared to low-level?
High-level languages are easier to understand, closer to English, portable across machines, require less effort to write programs.

EXERCISE QUESTIONS

i. What is the function and significance of Napier's Bone in early computing?
Napier's Bones was a manual calculating device made in the early 17th century by John Napier, used to perform multiplication and division quickly using rods marked with numbers. It helped simplify long calculations.

---

ii. How did Charles Babbage's Difference Engine differ from the Analytical Engine?
The Difference Engine could only perform automatic calculations of polynomial functions. The Analytical Engine was designed to be programmable and could perform any calculation using punched cards, making it more general-purpose.

---

iii. What is the primary goal of fifth-generation computers?
To create machines that use Artificial Intelligence, can understand natural language, make decisions, and mimic human thinking.

---

iv. Name the three types of memory mentioned on the motherboard in the Von Neumann architecture.
RAM (main memory), ROM, and cache memory.

---

v. Differentiate between volatile and non-volatile memory.
Volatile memory loses data when power is off (like RAM). Non-volatile memory keeps data even without power (like ROM, hard disk).

---

vi. Show memory hierarchy with the help of diagram.
(Write in exam as small diagram):
Registers → Cache → RAM → Hard disk
(Speed decreases downward, capacity increases)

---

vii. Why is the word size of a processor important, and how does it affect the computer's performance?
Word size shows how many bits the CPU can process in one operation. A larger word size means the CPU can handle more data and instructions at once, so performance is faster.

---

viii. What is pipelining, and how does it improve the efficiency of a CPU?
Pipelining is a CPU technique where multiple instructions are processed in stages at the same time. It increases efficiency and speed by overlapping execution.

---

ix. Imagine you are building a custom computer for a friend. Give three considerations you would take into account when choosing the type and size of memory for this computer.

- RAM size depending on use (e.g., 8GB or 16GB for gaming).
- Speed of RAM (higher MHz for better performance).
- SSD or HDD type for storage speed and capacity.

---

x. You are a computer technician tasked with upgrading an older computer with a slow CPU. How might you improve its performance without replacing the entire CPU?

- Add more RAM or upgrade to faster RAM.
- Use SSD instead of HDD.
- Clean up unnecessary software or upgrade cooling to enable faster clock speed.

---

xi. Your school is planning to purchase new printers for the computer lab. Give three advantages and disadvantages of impact and non-impact printers to help them make a decision.
Impact printer:
Advantages: cheap, can print multiple carbon copies.
Disadvantages: noisy, slower, lower quality.

Non-impact printer:
Advantages: quiet, fast, better print quality.
Disadvantages: more expensive, cannot print carbon copies.

---

xii. Define "protocol" in the context of data communication.
Protocol is a set of rules that define how data is sent, received and interpreted between devices on a network.

---

xiii. Define simplex, half-duplex, and full-duplex modes of communication with one example each.
Simplex: one-way (TV broadcast).
Half-duplex: both directions but not simultaneously (walkie-talkie).
Full-duplex: both directions at same time (telephone call).

xiv. What are start and stop bits, and where are they used in data transmission?
Start and stop bits are control bits used in asynchronous serial communication to mark the beginning and end of each character.

---

xv. How does a switch differ from a hub in a network?
A hub sends data to all devices, causing collisions. A switch sends data only to the intended device, making it faster and more efficient.

---

xvi. How does asynchronous transmission differ from synchronous transmission, and in what situations are they typically used?
Asynchronous transmission sends data one byte at a time using start and stop bits (used in keyboard communication). Synchronous sends blocks of data with synchronization signal (used in high-speed data transfers like LAN).

---

xvii. Explain the concept of a peer-to-peer network and its limitations compared to a client/server network.
In peer-to-peer, all computers share resources equally without a central server. It is simple and cheap but less secure, difficult to manage, and not scalable for large networks.

---

xviii. Compare and contrast the star and ring network topologies.
Star: all nodes connected to a central hub. Easy to manage, one failure doesn't affect others. More cable required.
Ring: each node connected in a circular manner. Less cabling, but if one node fails, whole network stops.

---

xix. Why is mesh topology considered the most reliable but also the most expensive to implement?
Because in mesh every device is connected to every other device, so if one link fails data can still travel through another path. But it needs many cables and ports making it expensive.

---

xx. What is the role of the Application Layer in the OSI model?
Application layer is the top layer that interacts with user software and provides services like email, file transfer, and web browsing.

LONG QUESTIONS (6 MARKS)

Describe different generations of computers.
Answer:
The history of computers is divided into five generations. First generation (1940-1956) used vacuum tubes and

were huge and produced heat. Second generation (1956-1963) used transistors, smaller and less heat. Third generation (1964-1971) used integrated circuits, became even smaller, faster and more reliable. Fourth generation (1971-present) use microprocessors that place thousands of ICs on a single chip, making computers extremely powerful and portable. Fifth generation (present and beyond) uses artificial intelligence and advanced processing to make machines that can think, reason and learn.

Explain the components of CPU and their functions.
Answer:
The CPU consists of the Arithmetic Logic Unit (ALU), Control Unit (CU) and registers. ALU performs arithmetic operations like addition and subtraction, and logical operations like comparison. The Control Unit controls and coordinates all components of the computer, interprets instructions and sends signals for execution. Registers are small memory units inside the CPU which hold data and instructions temporarily while processing. Together they perform all processing tasks of the computer, making CPU the brain of the computer.

Differentiate between Primary, Secondary and Cache memory.
Answer:
Primary memory includes RAM and ROM. RAM is volatile, temporary and stores current data and instructions, ROM is permanent and holds boot instructions. Secondary memory like hard disk, CD, USB is non-volatile, used for long term storage, cheap and large in capacity but slower. Cache memory is very fast memory placed between CPU and RAM, stores frequently accessed data temporarily to speed up processing. Cache is faster than RAM but smaller in size and more expensive. These memories together make memory hierarchy based on speed and cost.

What is operating system? Explain its main functions.
Answer:
Operating system is a system software that manages computer hardware, software resources and provides services to user. Its functions include process management (running programs), memory management (allocating RAM), file management (creating/opening/saving files), device management (controlling hardware like keyboard and printer), and providing user interface (GUI or CLI). It also provides security, handles errors and allows multi-tasking. Without OS, the computer cannot work properly.

Explain computer network and its advantages and disadvantages.
Answer:
A computer network is a group of interconnected computers that share data and resources. Advantages include resource sharing (like printers and files), communication like email and chat, data sharing and internet access. It saves cost and time. Disadvantages include security risks such as viruses, hacking and data theft. Network may fail due to technical issues and it needs proper maintenance which can be costly. Despite disadvantages, networks are essential for modern communication and information sharing.

Differentiate between application software and system software with examples.
Answer:
System software runs the computer and manages hardware, for example operating systems like Windows and

device drivers. Application software performs specific tasks for users like MS Word, Excel, games, photo editors. System software works in background and is essential for basic functioning of computer while application software can be installed as needed. System software is general-purpose and interacts with hardware; applications are user-oriented and solve specific problems. Both are important parts of computer software category.

Q1. Describe the evolution of computer generations from the first generation to the fourth generation, highlighting the key technological developments and their impact on computing.

The development of computers is divided into generations based on important technological developments.
The **first generation (1940–1956)** used vacuum tubes for circuitry and magnetic drums for memory. These computers were very large, expensive, produced a lot of heat, and were slow.
The **second generation (1956–1963)** used transistors instead of vacuum tubes. They were smaller, reliable, faster, and cheaper in cost compared to the first generation. Programming languages like COBOL and FORTRAN were introduced.
In the **third generation (1964–1971)**, integrated circuits (ICs) replaced transistors. This reduced the size and increased the speed and reliability of computers. They became more efficient for commercial use, and operating systems were introduced.
The **fourth generation (1971–present)** began with the invention of microprocessors. All the main components of the CPU were placed on a single chip. Computers became much smaller, faster, more powerful and affordable. Personal computers and laptops became common.

Q2. Discuss the importance of categorizing and understanding different types of systems, both natural and artificial, and provide examples of each type.

A system is a group of related parts working together toward a common goal. Categorizing systems into **natural** and **artificial** helps us better understand how things work and how to improve them.
Natural systems exist in nature without human involvement, such as the **solar system**, **water cycle**, and **human body**. These systems are important in science, biology and geography, and observing them helps us learn natural laws.
Artificial systems are man-made systems created to solve problems or perform tasks efficiently — for example, the **computer system**, **education system**, or **banking system**. Understanding artificial systems allows us to design, control, and improve machines and processes.
By studying systems, students learn how input, processing, and output work together. Understanding systems helps in areas such as engineering, management, and technology development.

Q3. Explain the characteristics and potential challenges associated with fifth-generation computers that aim to understand natural languages and possess thinking capabilities. What are the implications of such advancements in computing on society?

Fifth-generation computers use **artificial intelligence (AI)**, which means the ability to think, learn and make decisions like humans. They can understand **natural language**, recognize speech and images, and solve complex problems. They use technologies like **expert systems, neural networks**, and **robotics**.
However, challenges include high cost, complexity of design, more power consumption, and the fear that machines might replace humans in many jobs. There are also ethical issues and privacy concerns.
The impact on society is huge: communication becomes easier, healthcare improves with intelligent diagnosis, education becomes more interactive, and industries become more automated. But it may cause unemployment

and make people overly dependent on machines. Proper use of AI can benefit society but misuse can cause problems.

Q4. Explain the fundamental components of network communication, and how do they work together to facilitate data transfer?

Network communication consists of several key components:

- **Sender**: The device or computer that sends the message.
- **Receiver**: The device that receives the message.
- **Medium or Transmission Channel**: The physical path such as copper cable, fiber optic, or wireless through which data travels.
- **Message**: The actual data or information to be transferred.
- **Protocols**: Rules and procedures that control how data is sent and received.
- **Devices**: Such as hubs, switches, routers for directing data.

They work together as follows: The sender converts data into signals and sends it through the medium. The medium carries the data. Routers and switches help direct the data to the correct destination. The receiver accepts and interprets the data. Protocols ensure that data is transmitted accurately and in the correct order. Without these components working together, data transfer would not be possible.

Q5. Describe the roles of common communication devices like hubs, switches, routers, and gateways in data communication. How do they contribute to the functionality of a network?

- **Hub**: A hub is a basic networking device that connects multiple computers in a LAN. It broadcasts data to all connected devices but causes congestion and collisions.
- **Switch**: A switch is more intelligent than a hub. It sends data only to the device that is the intended recipient using MAC addresses, reducing collisions and improving performance.
- **Router**: A router connects different networks together (e.g., a home network to the internet). It uses IP addresses and routing tables to decide the best path for sending data.
- **Gateway**: A gateway converts one protocol to another so that systems using different protocols can communicate. It connects networks that use different architectures or data formats.

Each device has a specific role: hubs and switches manage data on local networks, routers connect networks, and gateways provide a bridge between dissimilar networks. Together they make communication between computers efficient and possible over long distances.

Q6. Discuss the advantages and limitations of different network topologies, including bus, star, ring, and mesh. When should each topology be used in a network design?

- **Bus topology**: All devices share a single communication line. It is easy and cheap to set up. However, if the main cable fails, the entire network stops working and it can be slow with heavy traffic. Used in small networks or temporary setups.
- **Star topology**: All devices are connected to a central hub or switch. It is easy to manage and one failed computer does not affect all others. But if the central hub fails, the network goes down. Used in schools, offices, and modern LANs.

- **Ring topology**: Data travels in one direction around a circle. It is efficient for small networks and uses less cable. But if one device fails, entire network fails. Used in limited specialty networks.
- **Mesh topology**: Every device is connected to every other device. It is reliable since multiple paths exist and one failure does not affect network. But it is very costly and complex. Used in critical systems like military networks where reliability is essential.

Q7. What is the OSI model, and how does it help in understanding the process of data communication? Explain each of the seven layers and their functions.

The OSI (Open Systems Interconnection) model is a conceptual framework of seven layers that explains how data travels from one computer to another over a network. It helps in understanding and designing communication systems.

1. **Physical Layer**: Deals with the physical medium, such as cables and voltages.
2. **Data Link Layer**: Handles error detection and framing of data.
3. **Network Layer**: Responsible for addressing and routing data between networks.
4. **Transport Layer**: Ensures complete data transfer and error recovery.
5. **Session Layer**: Manages communication sessions between two devices.
6. **Presentation Layer**: Translates and converts data between different formats (encryption, compression).
7. **Application Layer**: Provides services to the user (like email, web browsers).

Each layer has a specific role and interacts with the layer above and below. It makes network communication more organized, standardized, and easier to troubleshoot.

Q8. Explain the evolution of the Internet from its origins to the modern-day global network. What major technological advancements contributed to its growth?

The Internet started as ARPANET in the late 1960s by the U.S. Department of Defense for military and research institutions. In the 1970s, protocols like TCP/IP were developed, which became the standard communication protocols and allowed different systems to connect.

In the 1980s, more universities and research centers joined and networks expanded globally. In the 1990s, the **World Wide Web (WWW)** was introduced by Tim Berners-Lee, making the Internet easy to use with web browsers like Mosaic and Netscape. Commercial Internet Service Providers (ISPs) emerged, giving access to the public.

Technological advancements such as high-speed fiber optic cables, wireless networks (Wi-Fi, 4G/5G), search engines, cloud computing, and smartphones contributed to the growth of Internet. Today the Internet is a global network connecting billions of devices.

Q9. Discuss the advantages and disadvantages of the Internet, considering factors like global connectivity, information access, privacy concerns, and digital addiction.

Advantages:

- Provides global communication and connectivity through email, social media, messaging.
- Gives quick access to information and educational resources.
- Helps in online banking, e-commerce, remote work, and entertainment.

Disadvantages:

- Privacy concerns including hacking, data theft and cybercrime.
- Spreads false information and fake news.
- Can lead to digital addiction, wasting time on games and social media.
- Exposure to harmful content for children.

The Internet is very useful but should be used wisely to avoid its negative effects.

Q10. Explore common applications of the Internet and their impact on various aspects of society, including communication, education, business, entertainment, and research.

The Internet provides many important applications:

- **Communication**: Email, WhatsApp, social media make it easy to communicate globally. Families and businesses connect instantly.
- **Education**: Students use online classes, e-books, research portals, and educational videos. It helps distance learning and global education.
- **Business**: Online banking, marketing, e-commerce enable companies to reach more customers. Businesses operate globally through websites and online payments.
- **Entertainment**: People watch movies, play games, listen to music, and stream videos online using YouTube, Netflix, etc.
- **Research**: Scientists and students access online journals, research papers, and share knowledge internationally.