Computer Networks: 5-Mark Answers (Q1–10)

1. Explain network protocol and its types with few examples.

A network protocol is a standardized set of rules that allow electronic devices to communicate over a network. It ensures reliable data transfer, error checking, and proper sequencing. There are several types of protocols based on function:
- Transmission protocols like TCP (reliable, ordered delivery) and UDP (faster, no guarantees),
- Internet protocols like IP (routing and addressing),
- Application protocols like HTTP (web), FTP (file transfer), and SMTP (email).
Each protocol plays a role at different layers of the OSI or TCP/IP models to ensure seamless data communication.

2. What is the working mechanism of a connection-oriented service? In what ways can it be done?

A connection-oriented service involves establishing a dedicated connection before data transfer begins. It works in three phases: setup, where a connection path is established; data transfer, where packets are reliably sent and acknowledged; and termination, when the connection is closed. This ensures data arrives in order, without duplication, and with error checking. It can be implemented via:
- Circuit Switching (physical path, e.g., phone calls),
- Virtual Circuit Packet Switching (logical path, e.g., Frame Relay),
- Or TCP (logical connection over the internet).

3. Explain the differences between types of network topologies in brief.

Network topology refers to the physical or logical arrangement of devices in a network.
- Bus Topology: All devices share a single communication line; cheap but prone to collisions.
- Star Topology: Devices connect to a central hub; easy to manage but has a single point of failure.
- Ring Topology: Devices form a closed loop; predictable flow but a break disrupts the network.
- Mesh Topology: Every device connects to all others; fault-tolerant but expensive.
- Tree Topology: Hierarchical star arrangement; scalable but complex.

4. Explain the different network types with their respective advantages and disadvantages.

There are four main types of networks:
- LAN (Local Area Network): Covers a small area like a building; high speed and low cost, but limited range.

- MAN (Metropolitan Area Network): Covers a city or campus; good for inter-branch communication, but more expensive than LAN.
- WAN (Wide Area Network): Covers large areas (e.g., the Internet); scalable and supports global access, but high maintenance cost.
- PAN (Personal Area Network): Very short range (e.g., Bluetooth); convenient for personal use, but not suitable for larger networks.

5. What are the different forms of ISP? Explain with their characteristics and usage cases.

ISPs are categorized into three tiers based on their infrastructure and reach:
- Tier 1 ISPs: Own global internet backbone infrastructure. They do not pay other ISPs for internet access and peer with other Tier 1s. Used by large corporations or Tier 2 ISPs.
- Tier 2 ISPs: Purchase access from Tier 1 ISPs but also peer with other Tier 2s. They resell services and support businesses needing high performance.
- Tier 3 ISPs: Provide internet to end-users (homes, small businesses). They buy access from Tier 2 ISPs and offer localized services like broadband and fiber.

6. What is an ISP? Why do we need it? Explain.

An Internet Service Provider (ISP) is a company that provides access to the internet and related services to individuals, businesses, and other organizations. ISPs manage infrastructure such as fiber optics, servers, and IP addressing to ensure internet connectivity. Without an ISP, users cannot access online resources like websites, emails, or cloud services. ISPs may offer additional services like domain registration, web hosting, and cybersecurity. For example, home users rely on retail ISPs (e.g., Airtel, Comcast), while businesses may use enterprise-grade ISPs with service-level guarantees.

7. If a small business needs reliable, high-speed internet with guaranteed uptime and private IP address, which tier of ISP should it approach and why?

A small business requiring reliability, guaranteed uptime, high-speed access, and a private/static IP should opt for a Tier 2 ISP. Tier 2 providers purchase bandwidth from Tier 1 but also peer with other networks, offering good performance and customer support. Unlike Tier 3 (retail) ISPs, Tier 2 ISPs offer Service Level Agreements (SLAs), dedicated support, redundancy, and static IP assignment, which are vital for hosting websites, remote access, or running mail servers. Tier 1 ISPs are costly and not usually service-focused for small businesses.

8. What are the different types of network devices? Explain any three of them in detail.

Common network devices include router, switch, hub, modem, bridge, firewall, and access point.
- Router: Connects different networks, routes data packets based on IP addresses. Essential for LAN-to-Internet communication.
- Switch: Operates at Layer 2 (Data Link Layer), connects multiple devices in a LAN, uses

MAC addresses to forward data efficiently.
- Firewall: Monitors and controls incoming/outgoing traffic based on security rules. Used to prevent unauthorized access.
These devices are crucial for building reliable, secure, and efficient networks.

9. What are the differences between guided and unguided media?

Guided media involves physical transmission mediums such as twisted-pair cables, coaxial cables, and fiber optics. It provides higher speed, reliability, and security, making it ideal for LANs.
Unguided media, or wireless media, includes radio waves, microwaves, and infrared, where signals are transmitted through the air. It offers mobility and ease of deployment but is prone to interference and has lower security.
Guided is better for structured, high-speed networks, while unguided is suitable for mobile or hard-to-wire environments like remote areas.

10. What do you understand by circuit switching? Explain in detail with its advantages and disadvantages.

Circuit switching is a communication method where a dedicated physical path is established between sender and receiver for the duration of the session. It was traditionally used in telephone networks. Once connected, the entire bandwidth is reserved, ensuring no interference.
Advantages:
- Reliable, real-time communication
- Guaranteed bandwidth and low latency
Disadvantages:
- Inefficient use of resources (idle time wastes bandwidth)
- Expensive and inflexible
Modern networks prefer packet switching for data due to better efficiency and scalability.