

# Exercise

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## Multiple Choice Questions (MCQs) – Answers with Explanations

1. **What is the primary objective of computer networks?**  
**Answer: (b) Enable resource sharing and data communication**  
✓ Networks allow computers and devices to share files, printers, internet, and communicate efficiently.
  2. **Which device is used to connect multiple networks and direct data packets between them?**  
**Answer: (c) Router**  
✓ A router connects different networks and sends data to the correct destination.
  3. **Which layer of the OSI model is responsible for node-to-node data transfer and error detection?**  
**Answer: (b) Data Link Layer**  
✓ It ensures error-free data transfer between directly connected devices.
  4. **What is the function of the Domain Name System (DNS)?**  
**Answer: (b) Translate domain names to IP addresses**  
✓ DNS converts website names like [www.google.com](http://www.google.com) into IP addresses.
  5. **Which method of data transmission uses a dedicated communication path?**  
**Answer: (b) Circuit Switching**  
✓ Circuit switching creates a fixed path for the whole message (like in old telephone systems).
  6. **What is encapsulation in the context of network communication?**  
**Answer: (b) Wrapping data with protocol information**  
✓ Encapsulation adds headers to data for routing and handling during transmission.
  7. **Which protocol is used for reliable data transfer in the TCP/IP model?**  
**Answer: (c) TCP**  
✓ TCP ensures that all data packets are received in the correct order.
  8. **What is the main purpose of a firewall in network security?**  
**Answer: (b) Monitor and control network traffic**  
✓ A firewall blocks unauthorized access and protects the network.
  9. **Which network topology connects all devices to a central hub?**  
**Answer: (d) Star**  
✓ In star topology, all devices are connected to a central hub or switch.
  10. **What is a key benefit of using computer networks in businesses?**  
**Answer: (b) Enable resource sharing and efficient communication**  
✓ Networks help businesses save costs and improve collaboration.
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**Short Questions – Answers**

1. **Define data communication and list its key components.**

**Answer:**

Data communication is the exchange of data between devices through a transmission medium.

**Key components:** Sender, Receiver, Message, Medium, and Protocol.

2. **Explain the role of routers in a computer network.**

**Answer:**

Routers connect different networks and send data packets to the correct destination using IP addresses.

3. **What are the main functions of the Network Layer in the OSI model?**

**Answer:**

The Network Layer handles routing, logical addressing (IP), and forwarding of data between networks.

4. **Describe the difference between packet switching and circuit switching.**

**Answer:**

- **Packet Switching:** Data is broken into packets and sent independently.
- **Circuit Switching:** A dedicated path is reserved for the entire communication session.

5. **What is the purpose of the Dynamic Host Configuration Protocol (DHCP)?**

**Answer:**

DHCP automatically assigns IP addresses to devices in a network.

6. **How does encapsulation ensure secure communication in a network?**

**Answer:**

Encapsulation adds headers to data, making sure it reaches the correct destination and is handled properly.

7. **Differentiate between TCP and UDP in terms of data transfer reliability.**

**Answer:**

- **TCP:** Reliable, ensures all data is received correctly.
- **UDP:** Fast but not reliable; used for streaming and real-time data.

8. **Explain the importance of encryption in network security.**

**Answer:**

Encryption protects data by converting it into unreadable form for unauthorized users, ensuring privacy.

9. **What are the advantages of using a star topology in a network?**

**Answer:**

- Easy to add or remove devices
- Failure in one device doesn't affect the entire network
- Central control through the hub

**10. How do firewalls contribute to network security?****Answer:**

Firewalls block harmful traffic and unauthorized access, acting as a protective barrier.

**● Long Questions – Answers****1. Discuss the objectives of computer networks and provide examples of how they facilitate resource sharing and data communication.****Answer:**

Objectives include:

- **Resource Sharing:** Sharing printers, files, internet, and applications.  
*Example:* Office computers accessing a single printer.
- **Data Communication:** Sending emails, messages, or video calls.  
*Example:* A school's announcement sent to all students via network.

**2. Simplex communication system at 500 bps. Calculate transmission time:**

- **(a) For 10 kilobits (10,000 bits):**  
 $\text{Time} = \text{Data} \div \text{Speed} = 10,000 \div 500 = \mathbf{20 \text{ seconds}}$
- **(b) For 10 kilobytes (80,000 bits):**  
(1 Byte = 8 bits)  $\rightarrow 10 \text{ KB} = 80,000 \text{ bits}$   
 $\text{Time} = 80,000 \div 500 = \mathbf{160 \text{ seconds}}$

**3. Describe how data is transmitted using packet switching and circuit switching.****Answer:**

- **Packet Switching:** Data is split into packets; each may take different paths; reassembled at destination.  
*Example:* Email or browsing.
- **Circuit Switching:** A fixed path is set before data transfer begins.  
*Example:* Traditional telephone call.

**4. Discuss the role and importance of protocols in data communication. Explain functions of TCP/IP, HTTP, DNS, and DHCP.****Answer:**

Protocols are rules for data transmission.

- **TCP/IP:** Ensures reliable data transfer and addressing.
- **HTTP:** Used to load web pages over the internet.
- **DNS:** Converts domain names to IP addresses.
- **DHCP:** Automatically gives IP addresses to devices.

## 5. Evaluate methods of network security (firewalls, encryption, antivirus):

Answer:

- **Firewalls:** Block harmful traffic.
- **Encryption:** Protects data from being read by outsiders.
- **Antivirus:** Detects and removes malware.

All work together to ensure data safety.

## 6. Describe real-world applications of networks in business, education, and healthcare.

Answer:

- **Business:** Share files, emails, online meetings.
- **Education:** Online classes, digital libraries, portals.
- **Healthcare:** Patient records, online appointments, telemedicine.

## 7. Compare and contrast star, ring, bus, and mesh topologies:

Topology	Description	Advantage	Disadvantage
Star	Devices connect to central hub	Easy to manage	Hub failure affects all
Ring	Devices form a circle	Equal access	One failure breaks network
Bus	Single cable connects all	Cost-effective	Cable failure crashes network
Mesh	Every device connects to every other	Very reliable	Expensive and complex

## 8. Shift cipher with shift 4:

### • (a) Encrypt "SECURITY":

Shift each letter by +4:

S → W, E → I, C → G, U → Y, R → V, I → M, T → X, Y → C

**Encrypted Message: "WIGYVMXC"**

### • (b) Decrypt "WMXYVMI":

Shift each letter by -4:

W → S, M → I, X → T, Y → U, V → R, M → I, I → E

**Decrypted Message: "SITURIE"**

## 9. IPv4 is a 32-bit address.

### • (a) Total unique addresses:

$2^{32} = 4,294,967,296$  addresses

### • (b) 10% reserved:

10% of 4,294,967,296 = 429,496,730

Remaining addresses = 4,294,967,296 – 429,496,730 = **3,865,470,566**