

CHAPTER 6:**Introduction to Computer Networks****SOLVED EXERCISE**

Tick (✓) the correct answer.

1. What is the primary objective of computer networks?
 - a) Increase computational power
 - b) Enable resource sharing and data communication
 - c) Enhance graphic capabilities
 - d) Improve software development
2. Which device is used to connect multiple networks and direct data packets between them?
 - a) Switch
 - b) Hub
 - c) Router
 - d) Modem
3. Which layer of the OSI model is responsible for node-to-node data transfer and error detection?
 - a) Physical Layer
 - b) Data Link Layer
 - c) Network Layer
 - d) Transport Layer
4. What is the function of the Domain Name System (DNS)?
 - a) Assign IP addresses dynamically
 - b) Translate domain names to IP addresses
 - c) Secure data communication
 - d) Monitor network traffic
5. Which method of data transmission uses a dedicated communication path?
 - a) Packet Switching
 - b) Circuit Switching
 - c) Full-Duplex
 - d) Half-Duplex
6. What is encapsulation in the context of network communication?
 - a) Converting data into a secure format
 - b) Wrapping data with protocol information
 - c) Monitoring network traffic
 - d) Translating domain names to IP addresses
7. Which protocol is used for reliable data transfer in the TCP/IP model?
 - a) HTTP
 - b) FTP
 - c) TCP
 - d) UDP
8. What is the main purpose of a firewall in network security?
 - a) Convert data into a secure format
 - b) Monitor and control network traffic
 - c) Assign IP addresses
 - d) Translate domain names

9. Which network topology connects all devices to a central hub?
 a) Ring b) Mesh c) Bus d) Star
10. What is a key benefit of using computer networks in businesses?
 a) Increase computational power
 b) Enable resource sharing and efficient communication
 c) Enhance graphic capabilities
 d) Improve software development

1	2	3	4	5	6	7	8	9	10
b	c	b	b	b	b	c	b	d	b

Short Answer Questions

1. Define data communication and list its key components.

Ans: Data communication involves the exchange of data between a sender and a receiver through a communication medium. Key components include the sender, receiver, message, protocol, and medium.

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

Ans: A router is a networking device that interconnects networks or allows devices to connect to it. It directs data packets between different networks. The main job of router is to find the best path for each data packet to deliver its destination.

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

Ans: The Network Layer is responsible for data transfer between different networks. It determines the best path for data to travel from the source to the destination. The Network Layer uses IP addresses to route data between networks.

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

Ans: Packet Switching

Packet switching is a data transmission method where data is broken into small packets, transmitted independently, and reassembled at the receiving end.

Circuit Switching

Circuit switching is a data transmission method where a dedicated communication channel is established between the sender and receiver before data transmission begins.

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

Ans: It is a network protocol which automatically assigns IP addresses to devices (e.g., computers, smartphones, printers) when they connect to a network. This eliminates the need for manual configuration.

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

Ans: Encapsulation is a fundamental concept in computer networking that makes secure communication by wrapping data in multiple layers of protocols, to make it difficult for unauthorized persons to access the data.

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

Ans: Transmission Control Protocol (TCP): Ensures reliable data transfer. User Datagram Protocol (UDP): Provides faster, but less reliable, data transfer.

8. Explain the importance of encryption in network security.

Ans: Encryption is a keystone of network security, playing a dynamic role in protecting data as it travels across networks. It ensures that sensitive information remains confidential, secure, and accessible only to authorized persons.

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

Ans:

- Star topology is easy to install and maintain, as all devices are connected to a central point called hub.
- If a single node or its cable fails, it does not affect the rest of the network.
- It easy to add or remove devices from the network without disrupting the entire network.

10. How do firewalls contribute to network security?

Ans: Firewalls help to protect systems and data by monitoring and controlling incoming and outgoing traffic based on predefined security rules. Firewalls prevent unauthorized access to network resources, reducing the risk of hacking and data breaches.

Long Questions

1. Discuss the objectives of computer networks and provide examples of how they facilitate resource sharing and data communication.

Ans: Objectives of Computer Networks

The primary objective of computer network is to enable resource sharing, data communication and collaboration: The Internet is the largest network, connecting all the networks worldwide!

Resource Sharing: Computer networks allow devices to share resources, such as printers and storage, reducing costs and improving efficiency.

Example: In an office network, multiple computers can share a single printer, reducing the need for multiple printers.

Data Communication: Networks facilitate data transfer, enabling communication through emails, instant messaging, and video conferencing.

Example: Employees in different locations can collaborate through video conferencing tools like Zoom or Microsoft Teams.

Connectivity and Collaboration: Networks connect devices, allowing for remote access and collaboration, improving productivity and flexibility.

Example: A team can work on a shared document in real-time using cloud based services like Google Drive.

2. In a Simplex communication system, assume data is transmitted at a rate of 500 bits per second (bps). Compute the time to transmit a message if: (a) It is of 10 kilobits. (b) It is of 10 kilobytes.

Ans: To compute the time to transmit a message in a simplex communication system, the formula is:

$$\text{Time} = \frac{\text{Message Size (bits)}}{\text{Data Rate (bps)}}$$

(a) Given that

Data rate = 500 bps

Message size = 10 kilobits = $10 \times 1000 = 10000$ bits

$$\text{Time} = \frac{10000 \text{ (bits)}}{500 \text{ (bps)}} = 20 \text{ Seconds}$$

(a) Given that

Data rate = 500 bps

Message size = 10 kilobytes = $10 \times 1000 \times 8 = 80000$ bits

$$\text{Time} = \frac{80000 \text{ (bits)}}{500 \text{ (bps)}} = 160 \text{ Seconds}$$

3. Describe how data is transmitted across computer networks using packet switching and circuit switching.

Ans: Packet Switching:

Packet switching is a method in which data is divided into smaller packets before transmission. Each packet is transmitted independently across the network and may take different paths to reach its destination.

How It Works:

- **Data Segmentation:** The data is broken into smaller, fixed-size packets. Each packet contains a header (with metadata like source and destination addresses, sequence number, etc.) and the payload (data).
- **Routing:** Each packet is routed independently across the network, potentially taking different paths. Routers determine the most efficient path for each packet based on network conditions.
- **Reassembly:** Once all packets arrive at the destination, they are reassembled in the correct order using the sequence numbers.

Circuit Switching

Circuit switching establishes a dedicated communication path (circuit) between the sender and receiver before data transmission begins. This path remains reserved until the communication session ends.

How It Works:

- **Connection Setup:** A dedicated circuit is established between the sender and receiver through intermediate switches.
- The entire path is reserved for the duration of the session.
- **Data Transmission:** Data is sent as a continuous stream along the established path.
- **Disconnection:** Once the communication is complete, the circuit is terminated, releasing the reserved resources.

4. Discuss the role and importance of protocols in data communication. Explain the functions of key protocols such as TCP/IP, HTTP, DNS, and DHCP.

Ans: **Role of Protocols in Data Communication**

1. Protocols establish a common language and set of rules for devices to communicate, ensuring compatibility and interoperability.
2. Protocols define the format of data transmission, including packet structure, header information, and error-checking mechanisms.
3. Protocols implement error-detection and correction mechanisms, such as checksums and acknowledgments, to ensure data integrity.
4. Protocols regulate the amount of data that can be sent at one time, preventing network congestion and ensuring reliable data transfer.
5. Protocols provide routing and addressing information, enabling data to be transmitted between devices on different networks.
6. Protocols implement security measures, such as encryption and authentication, to protect data from unauthorized access.

Functions of key protocols:

- **Transmission Control Protocol (TCP):** Ensures reliable data transfer.
- **Internet Protocol (IP):** Handles addressing and routing of data packets.
- **User Datagram Protocol (UDP):** Provides faster, but less reliable, data transfer.
- **Domain Name System (DNS):** Translates domain names to IP addresses, making it easier for users to access websites. Example: When you type `www.example.com` in a browser, DNS translates it to
- **Dynamic Host Configuration Protocol (DHCP):** DHCP automatically assigns IP addresses to devices on a network, simplifying network management.
- **HyperText Transfer Protocol (HTTP):** is used for transferring web pages over the internet.

5. Evaluate different methods of network security, including firewalls, encryption, and antivirus software.

Ans: Network Security Methods

Firewalls: Monitor and control incoming and outgoing network traffic.

Encryption: Protects data by converting it into a secure format.

Antivirus Software: Detects and removes malicious software.

Example: A combination of firewalls, encryption, and antivirus software provides robust network security.

Evaluation of Network Security Methods: Each method of network security has its advantages and disadvantages. Firewalls provide a barrier against unauthorized access, while encryption protects data confidentiality, integrity, and authenticity. Antivirus software detects and removes malware, but may not detect zero-day threats. A comprehensive network security strategy should include a combination of these methods to provide robust protection against various threats.

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

Ans: Real-World Applications of Computer Networks:

Business: In business, networks enable efficient communication, resource sharing, and data management.

- Companies use intranets to share information and resources securely within the organization and collaborate more effectively through email, instant messaging, and video conferencing.

- **E-commerce and Online Transactions:** Businesses use computer networks to facilitate online transactions, manage inventory, and track customer data.

Education: Educational institutions use networks to provide online learning platforms, virtual classrooms, and access to educational resources.

- Universities use Learning Management Systems (LMS) like Blackboard and Moodle to deliver course content and assessments, allowing students to access course materials, participate in discussions, and submit assignments remotely.

- Computer networks provide access to digital libraries, online resources, and educational databases, expanding students' access to information.

Healthcare: Healthcare networks facilitate the sharing of patient information, telemedicine, and access to medical databases.

- Hospitals use Electronic Health Records (EHR) systems to store and retrieve patient data efficiently.

- Computer networks enable the sharing and analysis of medical images, such as X-rays and MRIs, facilitating diagnosis and treatment.

Category	Applications	Real World Examples
Business	Communication, e-commerce, resource sharing, data management	Microsoft Team, Zoom, Slack, cloud storage services, Amazon
Education	E-learning, research access, student management, virtual classrooms	Coursera, Google Classroom, Blackboard, Graphic Software, Canvas LMS
Healthcare	EHR, telemedicine, IoT, imaging	Epic, Teladoc Health, PACS, Appointment Scheduling, Drug Development

7. Compare and contrast the different types of network topologies (star, ring, bus, and mesh).

Ans:

1. Star Topology

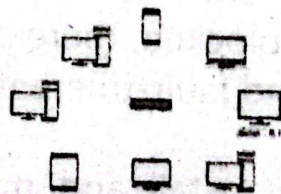
Definition: In a star topology each node in network communicates with the others via a central switch or hub. The hub works as a data flow repeater.

Example: Think of a school principal's office connected to all classrooms through intercoms. The principal's office is the hub, and the classrooms are the nodes.

Advantages: Easy to install and maintain, scalable, and fault-tolerant.

Disadvantages: Central device failure can bring down the entire network.

Diagram:



2. Ring Topology

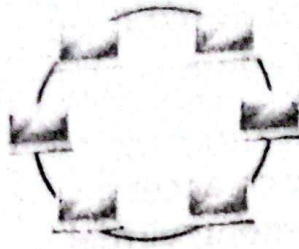
Definition: In a Ring topology, each device is connected in a circular pathway with other devices. Data travels in one direction, passing through each device.

Example: Consider a relay race where each runner passes the baton to the next runner in a circle until it reaches the starting point again.

Advantages: Efficient use of cables, easy to install, and provides a high level of security.

Disadvantages: Difficult to add or remove devices, and a single device failure can bring down the entire network.

Diagram:



3. Bus Topology

Definition: In a Bus topology, all devices share a single communication line called a bus. Each device is connected to this central cable which works as a backbone.

Example: Imagine a chalkboard in a classroom where every student can see the notes written by the teacher. Here, the chalkboard represents the shared communication line.

Advantages: Simple and inexpensive to install and easy to add or remove devices.

Disadvantages: Difficult to troubleshoot, and a single cable failure can bring down the entire network.

Diagram:



4. Mesh Topology

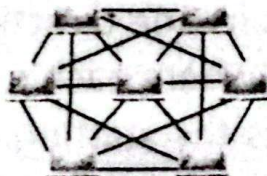
Definition: In a Mesh topology, each device is connected to every other device. This provides high redundancy and reliability.

Example: Imagine a city where every house is directly connected to every other house by roads. If one road is blocked, there are multiple alternative routes.

Advantages: Highly reliable and fault-tolerant, and provides multiple paths for data transmission.

Disadvantages: Expensive to install and maintain, and difficult to add or remove devices.

Diagram:



8. Consider a shift cipher with a shift amount of 4.

- Encrypt the message "SECURITY".
- Decrypt the message "WMXYVMI".

Ans: For Encrypted message

- Write the alphabet for reference:

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	A	B	C	D
5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	1	2	3	4

Shift each letter in the plaintext "SECURITY" by 4 positions to the right.

S → W

E → I

C → G

U → Y

R → V

I → M

T → X

Y → C

Encrypted Message:

"SECURITY" → "WIGYVMXC"

For Decrypted message

Now Reverse the shift for "WMXYVMI".

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	A	B	C	D

W → S

M → I

X → T

Y → U

V → R

M → I

I → E

Decrypted Message:

"WMXYVMI" → "SITURIE"

9. An IPv4 address is a 32-bit number. Calculate the total number of unique IPv4 addresses possible.

- Show the calculation for the total number of IPv4 addresses.
- How many addresses are left if 10% of the total addresses are reserved for special purposes?

Ans:

(a) Total Number of IPv4 Addresses

An IPv4 address is a **32-bit number**, meaning it has 2^{32} possible combinations, as each bit can be either 0 or 1.

Total Number of IPv4 Addresses = $2^{32} = 4294967296$

(b) Addresses Left after Reserving 10%

If **10%** of the total IPv4 addresses are reserved for special purposes, the remaining addresses will be **90%** of the total.

Reserved Addresses = $10\% \times 4294967296 = 0.1 \times 4294967296 = 429496729.6$

Rounded to the nearest whole number:

Reserved Addresses = 429496730

Addresses Left = Total Addresses - Reserved Addresses

= $4294967296 - 429496730 = 3865470566$

Additional Multiple Choice Questions (MCQs)

1. What is the primary purpose of a computer network?

- a) Data analysis
- b) Device linking
- c) Data exchange
- d) Software development

2. Which of the following is a component of a computer network?

- a) Switch
- b) Router
- c) Node
- d) All of the above

3. What does "LAN" stand for?

- a) Local Area Node
- b) Local Access Network
- c) Local Area Network
- d) Linked Access Node

4. Which device connects multiple nodes and forwards data?

- a) Router
- b) Switch
- c) Link
- d) Node

5. What is the role of a router?

- a) To connect devices within a network
- b) To connect different networks and direct packets
- c) To convert data into packets
- d) To examine MAC addresses

6. What is a real-world analogy for packet switching?

- a) Sending an email
- b) Air travel
- c) Delivering a package
- d) Driving a car

7. In a network switch, packets are forwarded based on what?

- a) MAC address
- b) IP address
- c) Data size
- d) Destination name

8. What type of connection does a link represent in a network?

- a) A logical connection between IP addresses
- b) A connection between applications
- c) A physical or wireless connection between nodes
- d) A backup network connection

9. What happens to data in packet switching?

- a) It is converted into signals.
- b) It is split into packets for transmission.
- c) It is encrypted and sent.
- d) It is stored temporarily.

10. Which of the following is an example of resource sharing in computer networks?

- a) Video conferencing
- b) Email communication
- c) Shared printer access
- d) Cloud storage

11. What is the primary objective of computer networks?

- a) Data storage
- b) Application development
- c) Device management
- d) data communication

12. What is the largest computer network globally?

- a) LAN
- b) WAN
- c) Internet
- d) Intranet

13. Which of the following is an example of data communication?

- a) Sharing a printer
- b) Collaborating on a document using Google Drive
- c) Sending an email through a network
- d) Accessing a local database

14. What tool can be used for real-time collaboration on documents?

- a) Microsoft Word
- b) Google Drive
- c) Adobe Photoshop
- d) VLC Media Player

15. How do networks improve collaboration?

- a) By enabling remote access to shared resources
- b) By providing additional storage space
- c) By reducing hardware costs
- d) By enhancing application speed

16. Which of these is NOT a benefit of computer networks?

- a) Connectivity
- b) Collaboration
- c) Resource sharing
- d) Individualized data silos

17. Which of the following is a component of data communication?

- a) Server
- b) Sender
- c) Database
- d) Software

18. What does data communication involve?

- a) Storage and retrieval of data
- b) Exchange of data between sender and receiver
- c) Transformation of data into signals
- d) Encryption of data for security

19. Which of the following is an example of a sender?

- a) A printer printing a document
- b) A computer sending an email
- c) A router forwarding packets
- d) A smartphone receiving a message

20. What role does the receiver play in data communication?

- a) Processes the message
- b) Transmits the message
- c) Sends acknowledgment
- d) Receives the data

21. What is an example of a protocol?

- a) Wi-Fi
- b) HTTP
- c) Ethernet cable
- d) Email content

22. Which of the following is a communication medium?

- a) Router
- b) Ethernet cable
- c) HTTP
- d) Sender

23. What does a message in data communication refer to?

- a) The device that sends the data
- b) The path through which data travels
- c) The data being communicated
- d) The set of rules for communication

24. Which is a wireless communication medium?

- a) Ethernet cable
- b) Fiber optic cable
- c) Wi-Fi
- d) USB cable

25. Which device connects wireless devices to a wired network?

- a) Switch
- b) Router
- c) Access Point
- d) Modem

26. What does a switch use to forward data to the correct device?

- a) IP address
- b) MAC address
- c) Routing table
- d) Protocol

27. What layer of the OSI model does a switch operate at?

- a) Physical Layer
- b) Data Link Layer
- c) Network Layer
- d) Transport Layer

28. Which device connects multiple networks and directs data packets?

- a) Switch
- b) Router
- c) Access Point
- d) Hub

29. What does a routing table do?

- a) Maps IP addresses to MAC addresses.
- b) Lists possible paths for data packets.
- c) Stores device names on the network.
- d) Configures wireless network settings.

30. What is the main function of an Access Point?

- a) To connect wired networks to the internet.
- b) To connect wireless devices to a wired network.
- c) To route data between different networks.
- d) To manage MAC addresses.

31. What type of waves do Access Points use to transmit data?

- a) Sound waves
- b) Light waves
- c) Radio waves
- d) Microwaves

32. Which device is often integrated into a home router?

- a) Hub and modem
- b) Switch and access point
- c) Gateway and repeater
- d) Firewall and VPN

33. Which network topology has all devices sharing a single communication line?

- a) Bus
- b) Star
- c) Ring
- d) Mesh

34. Which network topology uses a central switch or hub?

- a) Bus
- b) Star
- c) Ring
- d) Mesh

35. Which topology connects all devices in a circular pathway?
a) Mesh b) Bus c) Ring d) Star
36. In which network topology, each device is connected to every other device?
a) Mesh b) Bus c) Ring d) Star
37. In which network topology, if the main cable fails, the whole network goes down.
a) Bus b) Star c) Ring d) Mesh
38. Which topology provides high redundancy and reliability?
a) Ring b) Bus c) Mesh d) Star
39. Which topology can reroute data if one link fails?
a) Bus b) Mesh c) Star d) Ring
40. Which network communication mode allows for simultaneous data transmission in both directions?
a) Simplex b) Half-Duplex c) Full-Duplex d) None
41. Which of the following is an example of Simplex communication?
a) Telephone conversation b) Keyboard to computer
c) Walkie-talkie conversation d) Video call
42. In which communication mode does data flow only in one direction?
a) Simplex b) Half-Duplex
c) Full-Duplex d) Duplex
43. What is an example of Half-Duplex communication?
a) Keyboard to computer b) Internet browsing
c) Walkie-talkies d) Video call
44. Which communication mode allows simultaneous data transmission in both directions?
a) Simplex b) Half-Duplex c) Full-Duplex d) Multicast
45. Devices must wait for their turn to transmit data. It is a drawback of:
a) Simplex b) Half-Duplex c) Full-Duplex d) Multicast
46. Which communication mode is best for modern systems like video calls?
a) Simplex b) Half-Duplex c) Full-Duplex d) Multicast
47. Which layer of the OSI Model is responsible for establishing the physical connection between devices?
a) Physical Layer b) Data Link Layer
c) Network Layer d) Transport Layer
48. Which layer of the OSI Model ensures reliable data transfer?
a) Transport Layer b) Network Layer
c) Data Link Layer d) Physical Layer

- 49. Error detection and correction is the primary function of which Layer?**
a) Transport Layer
b) Network Layer
c) Data Link Layer
d) Physical Layer
- 50. Which layer determines the best path for data to travel?**
a) Network
b) Transport Layer
c) Physical
d) Presentation
- 51. The Transport Layer uses which protocol to ensure reliable data transfer?**
a) HTTP
b) IP
c) TCP
d) FTP
- 52. Which layer is involved in establishing and terminating communication sessions?**
a) Application Layer
b) Session Layer
c) Data Link Layer
d) Network Layer
- 53. What is the function of the Presentation Layer?**
a) Managing sessions
b) Routing data
c) Encrypting data
d) Controlling data flow
- 54. Which layer is closest to the end user?**
a) Transport Layer
b) Application Layer
c) Network Layer
d) Physical Layer
- 55. The analogy of traffic lights controlling data flow represent which OSI Layer?**
a) Physical Layer
b) Transport Layer
c) Data Link Layer
d) Network Layer
- 56. Which layer handles activities like email and web browsing?**
a) Network Layer
b) Presentation Layer
c) Application Layer
d) Session Layer
- 57. What does the Network Layer primarily use for addressing?**
a) MAC Addresses
b) TCP Protocols
c) IP Addresses
d) Physical Cables
- 58. Which version of IP address uses a 32-bit address scheme?**
a) IPv4
b) IPv6
c) IPv3
d) IPv5
- 59. Which version of IP address is designed to replace IPv4?**
a) IPv4
b) IPv6
c) IPv3
d) IPv5
- 60. What is the bit length of an IPv4 address?**
a) 16-bit
b) 32-bit
c) 64-bit
d) 128-bit
- 61. How are IPv6 addresses written?**
a) Dotted decimal format
b) Hexadecimal format
c) Binary format
d) Octal format

62. Which of the following is a valid IPv4 address?
a) 300.168.1.1
b) 192.168.1.1
c) 2001:0db8::1
d) FF02::1
63. What is the approximate number of unique addresses available in IPv6?
a) 4.3 billion
b) 1 trillion
c) Virtually unlimited
d) 2^{32}
64. Which of the following is a valid IPv6 address?
a) 192.168.1.1
b) 255.255.255.0
c) 2001:0db8:85a3:0000:0000:8a2e:0370:7334
d) 123.456.789.000
65. IPv4 addresses consist of how many octets?
a) 2
b) 4
c) 8
d) 16
66. Which protocol is used for transferring web pages over the internet?
a) FTP
b) TCP/IP
c) SMTP
d) HTTP
67. What is the primary function of DNS?
a) To assign IP addresses to devices
b) To translate domain names to IP addresses
c) To manage network traffic
d) To provide network security
68. What is the primary purpose of HTTP?
a) To send emails
b) To transfer web pages
c) To assign IP addresses
d) To secure a network connection
69. Which protocol translates domain names into IP addresses?
a) DNS
b) TCP
c) DHCP
d) HTTP
70. Which protocol is used to transfer files between devices?
a) SMTP
b) HTTP
c) FTP
d) DNS
71. Which protocol is used for sending emails?
a) HTTP
b) SMTP
c) DNS
d) DHCP
72. Which of the following is a type of network security threat?
a) Firewall
b) Encryption
c) Malware
d) Authentication
73. What does a firewall do?
a) Encrypts data
b) Manages internet protocols
c) Generates passwords
d) Monitors and controls network traffic
74. What is ciphertext?
a) Encrypted data
b) Plaintext data
c) Malicious software
d) Decrypted information
75. Which of the following is an example of malware?
a) Firewall
b) Virus
c) Encryption key
d) Password
76. What is a strong example of network authentication?
a) Using "12345" as a password
b) Ignoring password requirements
c) Biometric authentication
d) Disabling firewalls

- 77. Which attack involves intercepting communication between two parties?**
a) Phishing
b) Man-in-the-Middle
c) Malware
d) Denial of Service (DoS)
- 78. Which type of network connects personal devices within a short range?**
a) PAN
b) LAN
c) MAN
d) WAN
- 79. Which type of network spans a city or a large campus?**
a) LAN
b) MAN
c) WAN
d) CAN
- 80. What does a PAN connect?**
a) Devices within a city
b) Devices in a university campus
c) Personal devices like smartphones and laptops
d) Computers in an office building
- 81. Which network type is used in a school computer lab?**
a) PAN
b) LAN
c) WAN
d) MAN
- 82. Which network type connects multiple LANs within a university?**
a) PAN
b) LAN
c) CAN
d) WAN
- 83. What is the typical range of a PAN?**
a) A few kilometres
b) A few meters
c) Entire cities
d) Across countries
- 84. Which network type spans across countries?**
a) MAN
b) WAN
c) LAN
d) CAN
- 85. What type of network connects buildings within a business park?**
a) PAN
b) MAN
c) CAN
d) WAN
- 86. What is a common network application in business?**
a) Online learning
b) Intranets
c) Electronic Health Records
d) Virtual classrooms
- 87. Which of the following is an example of a network application in education?**
a) EHR
b) Intranets
c) Telemedicine
d) LMS
- 88. What do companies use to share information securely within an organization?**
a) EHR
b) VPN
c) Intranet
d) LMS
- 89. Which LMS is commonly used by universities?**
a) Blackboard
b) Spotify
c) Zoom
d) Microsoft Teams
- 90. Which system is used by hospitals for patient data management?**
a) VPN
b) EHR
c) LMS
d) DNS
- 91. Which protocol ensures reliable data transfer in the TCP/IP suite?**
a) TCP
b) IP
c) UDP
d) DNS
- 92. Which protocol handles addressing and routing of data packets in the TCP/IP suite?**
a) TCP
b) IP
c) UDP
d) DHCP

93. What does TCP stand for?
 a) Transmission Control Protocol
 b) Transfer Communication Protocol
 c) Time Communication Process
 d) Translated Control Packet
94. Which protocol is used for translating domain names into IP addresses?
 a) DHCP
 b) DNS
 c) UDP
 d) FTP
95. Which protocol automatically assigns IP addresses to devices?
 a) TCP
 b) DNS
 c) DHCP
 d) FTP
96. Which of the following protocols ensures reliable data transfer?
 a) UDP
 b) IP
 c) TCP
 d) DHCP
97. Which protocol is typically used for streaming services?
 a) TCP
 b) UDP
 c) FTP
 d) DHCP
98. Which network security measure monitors and controls incoming and outgoing network traffic?
 a) Encryption
 b) Firewall
 c) Antivirus software
 d) VPN
99. Which network security measure protects data by converting it into a secure format?
 a) Firewall
 b) Antivirus software
 c) Encryption
 d) DNS
100. Which of the following software detects and removes malware?
 a) Firewall
 b) Encryption
 c) Antivirus software
 d) VPN
101. Which tool acts as a barrier between internal and external networks?
 a) Antivirus software
 b) DHCP
 c) Encryption
 d) Firewall

Answers:

1	2	3	4	5	6	7	8	9	10	11	12
C	D	C	B	B	B	A	C	B	C	D	C
13	14	15	16	17	18	19	20	21	22	23	24
C	B	A	D	B	B	B	D	B	B	C	C
25	26	27	28	29	30	31	32	33	34	35	36
C	B	B	B	B	B	C	B	A	B	C	A
37	38	39	40	41	42	43	44	45	46	47	48
A	C	B	C	B	A	C	C	B	C	A	A
49	50	51	52	53	54	55	56	57	58	59	60
C	A	C	B	C	B	C	C	C	A	B	B
61	62	63	64	65	66	67	68	69	70	71	72
B	B	C	C	B	D	B	B	A	C	B	C

73	74	75	76	77	78	79	80	81	82	83	84
D	A	B	C	C	A	B	C	B	C	B	B
85	86	87	88	89	90	91	92	93	94	95	96
C	B	D	C	A	B	A	B	A	B	C	C
97	98	99	100	101							
B	B	C	C	D							

Topic Wise Additional Short Questions and Answers

6.1- Network as a System

1. What is a computer network?

Ans: A computer network is a system of interconnected computers and devices that communicate and share resources.

2. What are the primary components of a computer network?

Ans: Nodes, links, switches, and routers.

3. What is difference between nodes and links in a network?

Ans: • **Nodes:** Devices that are connected to the network, such as computers, smartphones, and printers.

• **Links:** The connections between nodes, which can be wired (like Ethernet cables) or wireless (like Wi-Fi).

4. What is the function of a switch in a network?

Ans: Switch is a network device that connects multiple network devices such as computers, printers, and servers, within a network and allows these devices to communicate with each other efficiently.

5. How switches are helpful in sending a file from one computer to a computer in another room?

- The file is split into packets, and each packet has the destination MAC address.
- The packets are sent to a network switch.
- The switch examines the MAC address and forwards the packets to the port of required computer.
- Once all packets are received, the required computer reassembles them into the original file.

6. How does air travel relate to packet switching? OR How switches relate to an air travel system?

Ans: Think of sending people via air travel. Here's how it relates:

- When traveling, passengers (data) might be split into groups (packets) and assigned different flights (paths). In packet switching each group has a ticket with the final destination (IP address).

• These groups might take different routes, through various airports (routers), to reach the final destination.

7. What is the function of a router in a network?

Ans: A router is a networking device that interconnects networks or allows devices to connect to it. It directs data packets between different networks

8. What is packet switching?

Ans: A method of transmitting data by splitting it into packets and routing each packet independently.

10. What are the primary objectives of computer networks?

Ans: Resource sharing, data communication, and collaboration.

11. How do computer networks enable resource sharing?

Ans: Computer networks allow devices to share resources, such as printers and storage, reducing costs and improving efficiency. **Example:** In an office network, multiple computers can share a single printer, reducing the need for multiple printers.

12. What are some examples of data communication in computer networks?

Ans: Networks facilitate data transfer, enabling communication through emails, instant messaging, and video conferencing. **Example:** Employees in different locations can collaborate through video conferencing tools like Zoom or Microsoft Teams.

13. How do computer networks facilitate connectivity and collaboration?

Ans: Networks connect devices, allowing for remote access and collaboration, improving productivity and flexibility. **Example:** A team can work on a shared document in real-time using cloud-based services like Google Drive.

14. Who invented the World Wide Web?

Ans: The World Wide Web (WWW) was invented by Tim Berners-Lee in 1989, revolutionizing how we access and share information.

6.2- Fundamental Concepts in Data Communication

15. What is data communication?

Ans: Data communication involves the exchange of data between a sender and a receiver through a communication medium.

16. What are the key components of data communication?

Ans: Key components include the sender, receiver, message, protocol, and medium

17. What is the role of the sender in data communication?

Ans: The device that sends the data. **Example:** A computer sending an email.

18. What is the purpose of a protocol in data communication?

Ans: To govern the rules of data communication.

19. What is an example of a medium in data communication?

Ans: Ethernet cable or Wi-Fi.

20. Who is the sender in data communication?

Ans: The device that sends the data, e.g., a computer sending an email.

21. Who is the receiver in data communication?

Ans: The device that receives the data. Example: A smartphone receiving the email.

The device that receives the data, e.g., a smartphone receiving an email.

22. What is the message in data communication?

Ans: The data being communicated, e.g., the content of an email.

23. What is a protocol in data communication?

Ans: A set of rules governing the exchange of data, e.g., HTTP for web communication.

24. What is the medium in data communication?

Ans: The physical or wireless path through which data travels, e.g., Ethernet cable or Wi-Fi.

6.3 Networking Devices:

25. Why switches are important in modern network?

Ans: Switches play an important role in modern networks by efficiently managing data traffic and ensuring that information reaches the correct device.

26. How does a Switch work?

Ans: A switch is used at the Data Link layer. It uses hardware address of a device called Media Access Control (MAC) addresses to forward data to the correct device. When a data packet reaches at the switch, it reads the destination MAC address and sends the packet only to the device with that address.

27. At which layer of the OSI model does a switch operate?

Ans: The Data Link Layer (Layer 2 of OSI model).

28. What is a SIM card and what is its purpose?

Ans: SIM stands for Subscriber Identity Module. A SIM card is a small card inserted into a mobile device that contains unique information to identify and authenticate the subscriber on a mobile network. It allows the device to connect to the network, make calls, send messages, and access Internet.

29. How does a Router work? OR What does a router use to decide the best path for data?

Ans: Each packet contains part of the data and the address of the destination. The main job of router is to find the best path for each data packet to deliver its destination. It uses a routing table to find the best path for data packets. This table lists the possible paths and helps the router make efficient decisions.

30. What is an Access Point (AP) in a network?

Ans: An Access Point (AP) is a networking device that facilitates the connection of wireless devices to a wired network. It works as a link between your computers and smartphones or any other wireless device and the internet.

31. How does an Access Point work?

Ans: An Access Point works by receiving data from the wired network and transmitting it wirelessly to your devices. It also receives data from your wireless devices and sends it to the wired network.

32. How do Access Points transmit data?

Ans: They use radio waves to send and receive data.

33. What are some ideal settings for placing an Access Point?

Ans: In a central location with good ventilation to ensure the best coverage and prevent overheating.

6.4- Network Topologies**34. What is a network topology?**

Ans: A Network topology is a method used to define the arrangement of different devices in a computer network, where each device is called a node.

35. What are the different types of network topologies?

Ans: Bus, Star, Ring, and Mesh.

36. What is a Bus topology?

Ans: In a Bus topology, all devices share a single communication line called a bus. Each device is connected to this central cable.

37. Give an example of Bus Topology.

Ans: Imagine a chalkboard in a classroom where every student can see the notes written by the teacher. Here, the chalkboard represents the shared communication line.

38. What is a major drawback of Bus Topology?

Ans: If the main cable fails, the entire network goes down.

39. What is Star Topology?

Ans: In a star topology each node in network communicates with the others via a central switch or hub. The hub works as a data flow repeater.

40. Give an example of Star Topology.

Ans: Think of a school principal's office connected to all classrooms through intercoms. The principal's office is the hub, and the classrooms are the nodes.

41. Define hub.

Ans: Hub is a networking device used to connect multiple computing devices in LAN-It always broadcasts data.

42. What is Ring Topology?

Ans: In a Ring topology, each device is connected in a circular pathway with other devices. Data travels in one direction, passing through each device.

43. Provide an example of Ring Topology.

Ans: Consider a relay race where each runner passes the baton to the next runner in a circle until it reaches the starting point again.

44. What happens if one connection fails in a Ring Topology?

Ans: The entire network is affected unless a two-way ring is implemented.

45. What is Mesh Topology?

Ans: In a Mesh topology, each device is connected to every other device. This provides high redundancy and reliability.

46. Give an example of Mesh Topology.

Ans: Imagine a city where every house is directly connected to every other house by roads. If one road is blocked, there are multiple alternative routes.

47. Why is Mesh Topology reliable?

Ans: Mesh topology is very reliable because if one link fails, data can be rerouted through other links.

6.5- Transmission Modes

48. What are the three primary network communication modes?

Ans: Simplex, Half-Duplex, and Full-Duplex.

49. What is Simplex Communication?

Ans: In Simplex communication, data transmission is unidirectional, meaning it flows in only one direction. A device can either send or receive data in this communication.

50. Give an example of Simplex Communication.

Ans: Keyboard to computer is an example of simplex communication.

51. What is the characteristic of Simplex communication?

Ans: In Simplex communication, the direction of data flow is fixed, making it useful for applications where only one-way communication is needed.

52. What is Half-Duplex Communication?

Ans: In Half-Duplex communication, data transmission can occur in both directions, but not simultaneously. One device must wait for the other to finish transmitting before it can start.

53. Provide an example of Half-Duplex Communication.

Ans: Walkie-talkies where one person speaks while the other listens.

54. What is the characteristic of Half-Duplex communication?

Ans: Bidirectional data transmission, but not simultaneously.

55. What is Full-Duplex Communication?

Ans: Full-duplex communication allows for simultaneous data delivery in both directions. Both devices may transmit and receive data simultaneously at the same time.

56. Give an example of Full-Duplex Communication.

Ans: Telephone conversations are an example of Full-Duplex communication. Both people can talk and listen at the same time without waiting for their turn.

57. What is the characteristic of Full-Duplex communication?

Ans: Simultaneous bidirectional data transmission.

58. Why is Full-Duplex Communication more efficient?

Ans: Full-Duplex communication allows for more efficient data transmission, making it ideal for modern communication systems like internet browsing and video calls.

6.6- The OSI Networking Model

59. What is the OSI Model?

Ans: The Open Systems Interconnection (OSI) Model is a framework used to understand how different networking protocols interact. It has 7 layers, each with a specific function.

60. How many layers are in the OSI Model?

Ans: 7 layers.

61. Write down the name of layers of OSI Model.

Ans: 1. Physical Layer 2. Data Link Layer 3. Network Layer
4. Transport Layer 5. Session Layer 6. Presentation Layer
7. Application Layer

62. What is the function of the Physical Layer?

Ans: The Physical Layer is liable for the actual connection between devices. The process of sending unprocessed data bits via a physical medium is the focus here. **Example:** The hardware that connects computers, like a Network interface cables, repeaters, hubs and connectors.

63. What is the function of the Data Link Layer?

Ans: Error detection and correction, as well as node-to-node data transport, are handled by the Data Link Layer. It ensures error-free data transmission from the Physical Layer. **Example:** Think of the Data Link Layer as traffic lights which manage the flow of cars to prevent collisions.

64. What is the function of the Network Layer?

Ans: The Network Layer is responsible for data transfer between different networks. It determines the best path for data to travel from the source to the destination. **Example:** Imagine a GPS system finding the best route for you to travel from home to school.

65. What is the function of the Transport Layer?

Ans: The Transport Layer ensures that data is transferred from one process running on source end system to a process sourcing on destination end system. It manages data flow control and error checking. **Example:** Think of the Transport Layer as a delivery service that ensures your package arrives safely and on time.

66. What is the function of the Session Layer?

Ans: The Session Layer manages sessions between applications. It establishes, maintains, and terminates connections between devices. **Example:** Imagine a phone call where the session layer sets up the call, keeps it connected, and ends it when you hang up.

67. What is the function of the Presentation Layer?

Ans: The Presentation Layer translates data between the application layer and the network. It formats and encrypts data to ensure it is readable by the receiving system. **Example:** Think of the Presentation Layer as a translator converting a book from one language to another so that more people can read it.

68. What is the function of the Application Layer?

Ans: The Application Layer is the closest to the end user. It provides network services directly to applications, such as email, web browsing, and file transfer. **Example:** Imagine the Application Layer as a waiter taking your order in a restaurant and bringing your food.

6.7- Ipv4 and Ipv6

69. What is an IP address?

Ans: Internet Protocol (IP) address is a unique identifier assigned to devices connected to the Internet.

70. What are the two primary versions of IP addresses?

Ans: IPv4 and IPv6.

71. What is the address scheme used by IPv4?

Ans: 32-bit address scheme.

72. How many unique addresses can IPv4 support?

Ans: Approximately 4.3 billion.

73. How can we find the total number of unique IPv4 addresses?

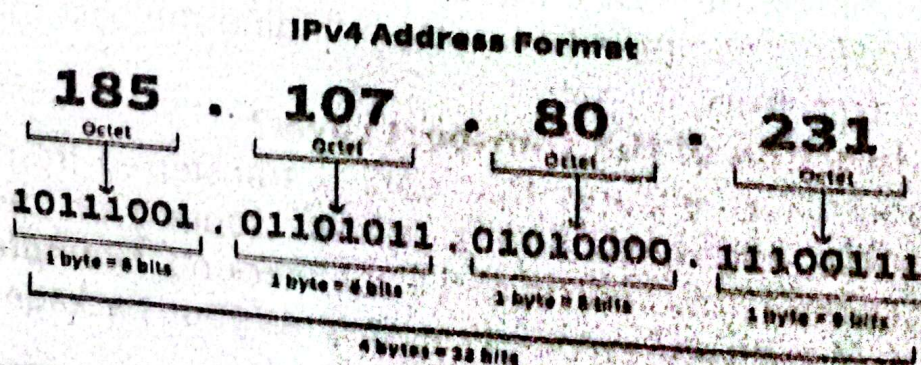
Ans: To find the total number of unique IPv4 addresses, we calculate 2^{32} , which represents all possible combinations of 32 bits, i.e., $2^{32} = 4,294,967,296$.

74. How are IPv4 addresses written?

Ans: IPv4 addresses are written in four sets of decimal numbers, each ranging from 0 to 255 (e.g., 192.168.1.1).

75. Write the format of IPv4 addresses.

Ans:



76. What is the address scheme used by IPv6?

Ans: 128-bit address scheme.

77. Why was IPv6 developed?

Ans: To address the depletion of IPv4 addresses due to the rapid growth of the internet and connected devices.

78. How can we find the total number of unique IPv6 addresses?

Ans: To find the total number of unique IPv6 addresses, we calculate 3.4×10^{38} , which represents all possible combinations of 128 bits.

79. How are IPv6 addresses written?

Ans: IPv4 addresses are written in eight sets of Hexadecimal numbers with colon sign (:) between them.

80. Write the format of IPv6 addresses.

Ans:

2001 : 0DC8: E004 : 0001 : 0000 : 0000 : 0000 : F00A

16 bits : 16 bits : 16 bits : 16 bits : 16 bits : 16 bits : 16 bits : 16 bits

128 Bits

81. Give an example of IPv6 address.

Ans: An example of an IPv6 address is 2001: 0000: 130 F: 0000: 0000: 0900: 876A: 130B.

82. What is one advantage of IPv6 over IPv4?

Ans: IPv6 provides a significantly larger address space and can support more devices.

6.8- Protocols and Network Services

83. What are protocols?

Ans: Protocols are sets of rules that govern data communication. Common protocols include TCP/IP, HTTP, FTP and SMTP.

84. What are some common protocols used in computer networking?

Ans: TCP/IP, HTTP, FTP, and SMTP.

85. What is the purpose of HTTP protocol?

Ans: HTTP stands for Hyper Text Transfer Protocol and it is used for transferring web pages over the internet.

86. What is the function of the Domain Name System (DNS)?

Ans: DNS translates domain names to IP addresses, making it easier for users to access websites. **Example:** When you type www.example.com in a browser, DNS translates it to the corresponding IP address.

87. What is the function of the Dynamic Host Configuration Protocol (DHCP)?

Ans: DHCP automatically assigns IP addresses to devices on a network, simplifying network management. **Example:** When a device connects to a Wi-Fi network, DHCP assigns it an IP address.

6.9- Network Security

88. What is network security?

Ans: Network security involves measures to protect data and prevent unauthorized access to computer networks.

89. Why is network security important?

Ans: Network security is important for following reasons:

- **Data Protection:** Ensuring that sensitive information is not accessed or altered by unauthorized users.
- **Preventing Attacks:** Defending against malicious attacks that can disrupt networks and steal data.
- **Maintaining Privacy:** Safeguarding personal and confidential information from being compromised
- **Ensuring Availability:** Ensuring that network resources are available and accessible to authorized users.

90. What is the purpose of firewall in network security?

Ans: Firewalls are security systems that monitor and control incoming and outgoing network traffic based on predetermined security rules. Firewalls act as barriers between trusted internal networks and untrusted external networks, like a security checkpoint.

91. What is difference between encryption and decryption?

Ans: **Encryption** transforms data into a secure format that can only be read or understood by authorized parties with the correct decryption key.

Decryption is the process of converting the encrypted data back to its original form.

92. Give an example of encryption and decryption.

Ans: Plain Text: Hello, World! Encrypted Text (using a simple shift cipher): Khoor, Zruog! where each letter in the plaintext is replaced by the letter that is 3 positions down the alphabet. Decryption: Converting "Khooor, Zruog!" back to "Hello, World!" using the same shift cipher in reverse,

93. How encryption is used in real-life scenarios to protect sensitive information.

Key Points

1. Countries exchange sensitive information securely using encryption.
2. The encrypted data is called ciphertext.
3. Only the intended recipient with the decryption key can read the ciphertext.

4. Encryption ensures national security and protects classified information.
5. Secure data exchange
6. Protection of sensitive information
7. Prevent from unauthorized access
8. Maintain national security and confidentiality

94. What is ciphertext.

Ans: The encrypted data is called ciphertext.

95. How do passwords enhance network security?

Ans: Passwords and authentication methods ensure that only authorized users can access network resources.

96. What are some common threats to network security?

Ans: Malware, phishing, denial of service (DoS) attacks, and man-in-the-middle attacks.

97. What is malware?

Ans: Malware is malicious software such as viruses, worms and ransomware that can damage or steal data.

98. What is phishing?

Ans: Phishing is an attempt to trick users into revealing sensitive information through deceptive emails or websites.

99. What happens in a Denial of Service (DoS) attack?

Ans: Overwhelming a network with traffic to disrupt its normal operation and make it unavailable.

100. What is Man-in-the-Middle Attacks?

Ans: Intercepting communication between two parties to steal information or alter messages.

6.10- Types of Networks

101. What are the different types of networks classified based on their size, range, and purpose?

Ans: PAN (Personal Area Network), LAN (Local Area Network), MAN (Metropolitan Area Network), WAN (Wide Area Network), and CAN (Campus Area Network).

102. What is PAN?

Ans: A PAN (Personal Area Network) is a small network used for communication between personal devices, such as smartphones, tablets, and laptops, within a short range.

Example: Bluetooth connections between a smartphone and a wireless headset form a PAN.

103. What is LAN?

Ans: A LAN (Local Area Network) is a network that connects computers and devices within a limited area, such as a home, school, or office building.

Example: The computer network in your school that connects all the computers in the lab is a LAN.

104. What is MAN?

Ans: A MAN (Metropolitan Area Network) is a network that spans a city or a large campus, connecting multiple LANs together.

Example: The network that connects various branches of a university across a city is a MAN.

105. What is WAN?

Ans: A WAN (Wide Area Network) covers a large geographical area, connecting multiple LANs and MANs. The internet is the largest example of a WAN.

Example: The network that connects different branch offices of a multinational company across countries is a WAN

106. What is CAN?

Ans: A CAN (Campus Area Network) is a network that connects multiple LANs within a limited geographical area, such as a university campus or a business park.

Example: The network that connects various departments and buildings within a university is a CAN.

107. What is the difference between a CAN and a MAN?

Ans: A CAN (Campus Area Network) is limited to a university or business campus, while a MAN (Metropolitan Area Network) spans a city.

108. Which network type is ideal for city-wide connectivity?

Ans: A MAN is ideal for city-wide connectivity.

6.11 Real-World Applications of Computer Networks:

109. How do networks benefit businesses? Give an example.

Ans: In business, networks enable efficient communication, resource sharing, and data management.

Example: Companies use intranets to share information and resources securely within the organization.

110. How do networks support education? Give an example.

Ans: Educational institutions use networks to provide online learning platforms, virtual classrooms, and access to educational resources.

Example: Universities use Learning Management Systems (LMS) like Blackboard and Moodle to deliver course content and assessments.

111. How do networks benefit healthcare? Give an example.

Ans: Healthcare networks facilitate the sharing of patient information, telemedicine, and access to medical databases.

Example: Hospitals use Electronic Health Records (EHR) systems to store and retrieve patient data efficiently.

112. Name an LMS used by universities.

Ans: Blackboard and Moodle are examples of Learning Management Systems.

113. What system do hospitals use to manage patient data?

Ans: Hospitals use Electronic Health Records (EHR) systems.

6.12- Standard Protocols in TCP/ IP Communications:

114. What is TCP/IP?

Ans: TCP/IP (Transmission Control Protocol/Internet Protocol) is the fundamental suite of protocols for internet communication.

115. What is the main function of TCP?

Ans: To ensure reliable data transfer.

116. What is the main function of IP?

Ans: To handle addressing and routing of data packets.

117. What is the main function of UDP?

Ans: To provide faster, but less reliable, data transfer.

118. What is the main function of DNS?

Ans: To translate domain names to IP addresses.

119. What is the function of DHCP?

Ans: DHCP automatically assigns IP addresses to devices on a network.

6.13- Network Security Methods:

120. What is the primary function of a firewall?

Ans: To monitor and control incoming and outgoing network traffic. They block unauthorized access to networks.

121. How does encryption protect data?

Ans: By converting data into a secure format that unauthorized users cannot read.

122. What is the function of antivirus software in network security?

Ans: To detect and remove malicious software.

123. Give an example of encryption in use.

Ans: HTTPS encrypts data exchanged between a browser and a server.

124. Name one antivirus software.

Ans: Norton, McAfee, or Avast.