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School of Computer Science and Engineering

B.Tech (Hons.)

Midterm Question Paper (Set-1)

Academic Year 2024-2025

Course: Computer Networks		**Course Code:** CS2120	**Semester:** IV
Time:	**Duration:** 90 minutes	**Date :**	**Max Marks:** 25

Notes/ Instructions:

a) Answer all questions

Sl. No.	PART A – 1M*5=5M	Marks	L1-L6
1.	In the context of network performance, how would you define the concept of latency? *Latency is the time delay between sending a packet from the source and receiving it at the destination.* *Equation for latency*	**1**	**L2**
2.	What are the main disadvantages of Bus and Star topology? *Bus Topology: If the main cable (backbone) fails, the entire network goes down* *Star Topology: If the central hub or switch fails, the entire network becomes inoperable.* *OR* *any other significant disadvantages*	**1**	**L2**
3.	Explain the difference between datagram-based networks versus virtual circuits. *Datagram-Based Networks (Connectionless): Each packet is treated independently and may take different paths to the destination.* *Virtual Circuits (Connection-Oriented): A pre-established path is created before data transmission. All packets follow the same route, ensuring ordered delivery.*	**1**	**L2**
4.	Identify the type of the following MAC addresses *a. 00:1A:2B:3C:4D:5E - Unicast MAC Address* *b. 10:20:30:40:50:60 - Unicast MAC Address* *c. FF:FF:FF:FF:FF: FF - Broadcast MAC Address* d. *01:00:5E:7F:FF:FA – multicast MAC Address*	**1**	**L2**
5.	In CSMA/CD, what happens when a collision is detected? *The transmitting devices stop sending data immediately.* *A jam signal is sent to alert all devices of the collision.*	**1**	**L2**

Sl. No.	PART B – 5M*4=20M	Marks	L1-L6
6.	*Compare and contrast the OSI and TCP/IP models and their functions.* *Comparison Diagram: **2Marks***	**5**	**L2**

L1- Remember, L2- Understand, L3 – Apply, L4- Analyse, L5 – Evaluate, L6 – Create

	Comparison: ***3 Marks*** *Number of Layers: OSI has 7, TCP/IP has 4.* *Implementation: OSI is mostly a reference model, while TCP/IP is used in real networks.* *7 layers (detailed and modular)* — *4 layers (simplified)* *1.* ***Application*** *(User interface & protocols like HTTP, FTP)* *2.* ***Presentation*** *(Data formatting, encryption)* — *1.* ***Application*** *(Combines OSI's Application, Presentation, Session)* *3.* ***Session*** *(Session management)* — *2.* ***Transport*** *(Handles communication using TCP/UDP)* *4.* ***Transport*** *(Reliable/unreliable delivery, e.g., TCP/UDP)* — *3.* ***Internet*** *(IP addressing & routing)* *5.* ***Network*** *(Routing & IP addressing)* — *4.* ***Network Access*** *(Combines OSI's Data Link & Physical)* *6.* ***Data Link*** *(MAC addressing, framing)* *7.* ***Physical*** *(Transmission over media)*		
7.	In a modern smart home, multiple devices like smartphones, laptops, and IoT gadgets seamlessly connect to the internet without physical cables. How does IEEE 802.11 enable such connectivity? How does it differ from IEEE 802.3? *IEEE 802.11 (Wi-Fi) is a wireless networking standard that allows devices like smartphones, laptops, and IoT gadgets to connect to the internet without physical cables. It enables connectivity through the following mechanisms:* *Wireless Transmission – Uses radio waves (2.4 GHz, 5 GHz) to transmit data between devices and access points (APs).* *Access Point (AP) Role – Acts as a central hub, allowing multiple devices to connect wirelessly and forward data to the router. 2mark* *The backbone structure is called a Wireless distribution system. Diagram. – 1 mark.* *Difference: - 2 mark* *Wifi uses CSMA/CA but ethernet uses CSMA/CD (Detects and resolves collisions).* *In Ethernet Devices are fixed to wired connections. It uses a Wired medium - coaxial, twisted pair.*	**5**	**L2**
8.	*Explain the differences between synchronous and asynchronous communication in networking with suitable example technologies.* *Synchronous Communication: Data is transmitted at* ***regular intervals*** *using*	**5**	**L2**

	*a synchronized clock. Sender and receiver must be **in sync** before data transfer.Serial communication with a clock signal (I2C).* *I²C (Inter-Integrated Circuit) is a synchronous, serial communication protocol used for short-distance communication between microcontrollers and peripherals. It Uses a shared clock signal for data transmission.* *Two-Wire Interface:* *SDA (Serial Data Line) – Transfers data.* *SCL (Serial Clock Line) – Synchronizes communication.* *Master-Slave Architecture: One master device controls communication with multiple slave devices.* *Asynchronous Communication: No fixed timing; data is sent whenever ready. Sender and receiver operate independently. Sender and receiver operate independently. No shared clock; Can transmit and receive data simultaneously. Typically used for **one-to-one** communication. Serail, Start Bit & Stop Bit.*		
9.	Host **A** needs to send a large data packet of **4000 bytes** to Host **B** over a network that has an MTU (Maximum Transmission Unit) of **1500 bytes**. Since the packet size exceeds the MTU, fragmentation is required. Given that the IPv4 header size is **20 bytes**, consider the following: **a.** Determine the Payload Size in Each Fragment - Each fragment will carry 1480 bytes of actual data payload, except possibly the last fragment. (Table must be drawn) **a.** Determine the Number of Fragments - **3 fragments**. **b.** The flags values of MF, DF. DF (Don't Fragment) Flag: Since fragmentation is required, DF = 0 (fragmentation is allowed). MF (More Fragments) Flag: Fragment 1: MF = 1 (More fragments are coming). Fragment 2: MF = 1 (More fragments are coming). Fragment 3 (Last Fragment): MF = 0 (Last fragment, no more data to send).	**3** **1** **1**	**L3**

Course Outcomes

1. Elaborate distance-based classification of networks and various mobile communication technologies in the Networking domain
2. Analyze the system requirements of Internet and its design parameters for supporting different types of applications
3. Demonstrate the role of Spanning Tree Protocol in removing loops within a LAN
4. Differentiate classful and CIDR schemes of IPv4 addressing and understand the functioning of Routing protocols used in the Internet
5. Comprehend L4 protocols and working principles of VLAN, VPN, NAT and VoIP used by various Networking applications

Marks Distribution									
L1	L2	L3	L4	L5	L6	CO1	CO2	CO3	CO4
-	20	5				7	6	7	5

L1- Remember, L2- Understand, L3 – Apply, L4- Analyse, L5 – Evaluate, L6 – Create

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Midterm Question Paper (Set-2)

Academic Year 2024-2025

Course: Computer Networks		**Course Code:** CS2120	**Semester:** IV
Time:	**Duration:** 90 minutes	**Date :**	**Max Marks:** 25

Notes/ Instructions:

a) Answer all questions

Sl. No.	PART A – 1M*5=5M	Marks	L1-L6
1.	In CSMA/CD, what happens when a collision is detected during data transmission? *They immediately stop transmitting to avoid further interference.* *They send a jam signal to notify all nodes about the collision*.	**1**	**L2**
2.	Define any **two** network performance parameters. Definition of throughput/latency/packet loss/jitter.	**1**	**L2**
3.	Explain the primary difference between hub and switch in a network. *A **hub** broadcasts data to all connected devices, leading to network congestion and collisions, while a **switch** intelligently forwards data only to the intended recipient using MAC addresses, improving efficiency. Switches operate at the **Data Link Layer (Layer 2)**, whereas hubs function at the **Physical Layer (Layer 1)** of the OSI model.*	**1**	**L2**
4.	Interpret the role of the Transport Layer in the OSI model and identify a protocol associated with it. *Any 2 of the following* *End-to-end communication between devices.* *Segmentation and reassembly of data.* *Flow control to prevent data overflow.* *Error detection and correction for reliable transmission.* *And* *TCP OR UDP*	**1**	**L2**
5.	Illustrate the structure of an 802.3 Ethernet frame, specifying the width of each field. *Draw with width* *Field* — *Size (Bytes)* *Preamble* — *7* *Start Frame Delimiter (SFD)* — *1* *Destination MAC* — *6* *Source MAC* — *6* *EtherType/Length* — *2*	**1**	**L2**

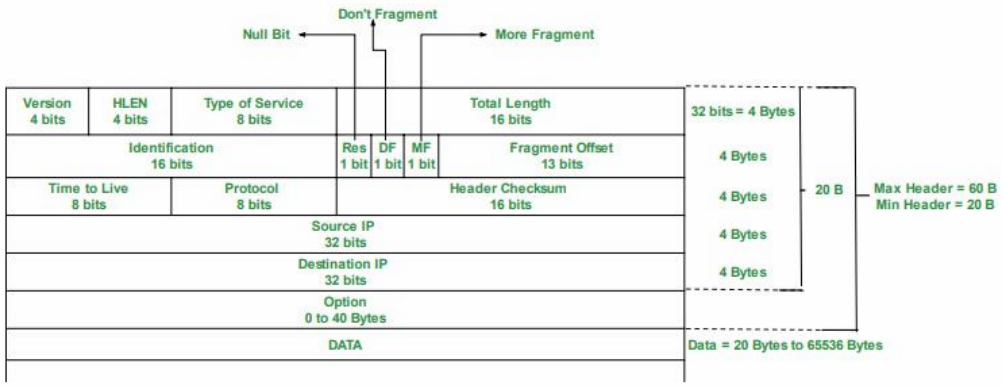
L1- Remember, L2- Understand, L3 – Apply, L4- Analyse, L5 – Evaluate, L6 – Create

	Payload (Data) *FCS (Frame Check Sequence)*	*46-1500* *4*		

Sl. No.	PART B – 5M*4=20M	Marks	L1-L6
6.	A company is setting up a new office network and needs to choose the best topology. As a network specialist, evaluate different topologies with their advantages and disadvantages to find the most suitable option. *Bus Topology, Star Topology, Ring Topology, Mesh Topology.* *All the topologies have at least one advantage and a disadvantage of each*.	**5**	**L2**
7.	Compare and contrast the Datagram and Virtual Circuit switching techniques in packet-switched networks. Discuss their advantages and disadvantages. *Datagram Switching: Each packet is treated independently and can take different paths to the destination.* *Example: IP-based networks (Internet, UDP communication).* ***Advantages**:* *Flexible routing: Packets can take the best available path.* *Fast transmission: No need to establish a connection before sending packets.* *Fault tolerance: If a link fails, packets can take alternate routes.* *Disadvantages: Unreliable delivery: Packets may arrive out of order or be lost.* *Virtual Circuit Switching: A logical path (virtual circuit) is established before data transmission, and all packets follow the same route.* *Example: MPLS, ATM, TCP-based communication.* ***Advantages:*** *Reliable delivery: Packets arrive in order and at a consistent speed.* *Lower overhead: Addressing is only needed during connection setup.* *Disadvantages:* *Connection setup time: Requires extra time before data transfer begins.* *Less fault tolerance: If a link in the virtual circuit fails, entire communication is disrupted.*	**5**	**L3**
8.	A network communication system uses checksum error detection to ensure data integrity. A sender transmits the data 0x1234 and 0xAB00, but the receiver receives 0x1334 and 0xAB00. As a network specialist, compute the checksum and determine whether the receiver will detect the error in transmission. Explain your findings. *Step 1: divide data into k segments of n bits* *Step2: Sum the segmented values* *Step3:Compute the 1's Complement (Checksum)* *Thus, the computed checksum at the sender = 0x42CB.* *Repeat the same process at Receiver.* *Add sum with checksum received.* *Since the sum is not all 1s (0xFFFF), an error is detected.*	**5**	**L3**
9.	A network engineer is analyzing an IPv4 packet to understand how the packet is processed by routers and delivered to its destination, they need a detailed breakdown of the IPv4 header fields. Describe the function of each field in the IPv4 header and explain how these fields contribute to routing and data delivery across a network?	**5**	**L3**

Diagram- 2Marks

Explanation of at least 6 fields(including IP address)- 3Marks



- ***VERSION:*** *Version of the IP protocol (4 bits), which is 4 for IPv4*
- ***HLEN:*** *IP header length (4 bits), which is the number of 32 bit words in the header. The minimum value for this field is 5 and the maximum is 15.*
- ***Type of service:*** *Low Delay, High Throughput, Reliability (8 bits)*
- ***Total Length:*** *Length of header + Data (16 bits), which has a minimum value 20 bytes and the maximum is 65,535 bytes.*
- ***Identification:*** *Unique Packet Id for identifying the group of fragments of a single IP datagram (16 bits)*
- ***Flags:*** *3 flags of 1 bit each : reserved bit (must be zero), do not fragment flag, more fragments flag (same order)*
- ***Fragment Offset:*** *Represents the number of Data Bytes ahead of the particular fragment in the particular Datagram. Specified in terms of number of 8 bytes, which has the maximum value of 65,528 bytes.*
- ***Time to live:*** *Datagram's lifetime (8 bits), It prevents the datagram to loop through the network by restricting the number of Hops taken by a Packet before delivering to the Destination.*
- ***Protocol:*** *Name of the protocol to which the data is to be passed (8 bits)*
- ***Header Checksum:*** *16 bits header checksum for checking errors in the datagram header*
- ***Source IP address:*** *32 bits IP address of the sender*
- ***Destination IP address:*** *32 bits IP address of the receiver*
- ***Option:*** *Optional information such as source route, record route. Used by the Network administrator to check whether a path is working or not.*

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-	20	5				6	11	3	5