USN | | | | | | | | | | |

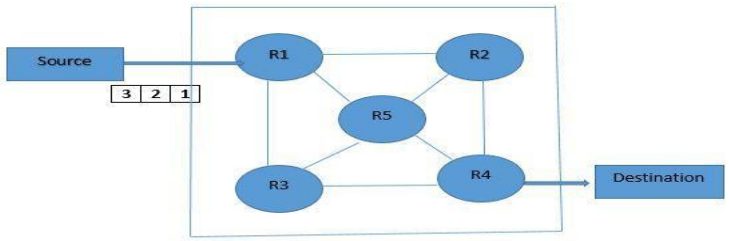
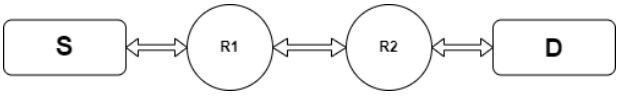
Internal Assessment Test 1 – December 2023

| Sub: | Computer Networks | | | | | Sub Code: | 21CS52 | Branch: | CSE | |
|---|---|---|---|---|---|---|---|---|---|---|
| Date: | 18/12/2023 | Duration: | 90 mins | Max Marks: | 50 | Sem /Sec: | V / A, B & C Sec | | | |

| | Answer all the questions from PART-A and answer any 4 questions from PART-B<br>**PART-A** | MARKS | CO | RBT |
|---|---|---|---|---|
| 1 | Segmentation and reassembly is the responsibility of<br>a.7th layer b. 6th Layer c. 5th Layer d. 4th layer | 1 | CO1 | L2 |
| 2 | Which one of the following tasks is not done by the data link layer?<br>A) framing B) channel coding C) flow control D) error control | 1 | CO1 | L2 |
| 3 | Which one of the following is not a client-server application?<br>(A) Internet Chat (B) Web Browsing (C) Email (D) ping | 1 | CO1 | L2 |
| 4 | How is a single channel shared by multiple signals in a computer network?<br>a). Multiplexing b). Phase modulation c) Analog modulation d) Digital Modulation | 1 | CO1 | L2 |
| 5 | Which of the following is an example of Bluetooth?<br>a) wide area network b) virtual private network<br>c) local area network d) personal area network | 1 | CO1 | L2 |
| 6 | Which of these is not a guided media?<br>A) Fiber optical cable B) Wireless LAN C) Copper wire D) Coaxial cable | 1 | CO1 | L2 |
| 7 | Match the following.<br>(P) SMTP (1) Data Link Layer<br>(Q) BGP (2) Transport layer<br>(R) TCP (3) Application layer<br>(S) PPP (4) Network layer | 1 | CO1 | L2 |
| 8 | In respect of OSI model, LAN implements<br>a. Lower 2 layers b. All seven layers c. Upper 5 layers d. None of the above | 1 | CO1 | L2 |
| 9 | The protocol data unit (PDU) for the application layer in the Internet stack is<br>a. Segment b. datagram c. message d. frame | 1 | CO1 | L2 |
| 10 | The address resolution protocol (ARP) is used for<br>(a) Finding the IP address from the DNS<br>(b) Finding the IP address of the default gateway<br>(c) Finding the IP address that corresponds to a MAC address<br>(d) Finding the MAC address that corresponds to an IP address | 1 | CO1 | L2 |

**PTO**

**PART – B**

| | | | | |
|---|---|---|---|---|
| 1 | Jhon wants to develop an application which needs a reliable transmission over the network. What are the design goals he has to set for successful message transmission over the network? | 6 | CO1 | L1 |
| 1b | What are the different addresses every message passing through the network is processed through? Explain the significance of each type of address | 4 | CO1 | L2 |
| 2 | Describe the following.<br>i. Alice wants to send a message to Bob. But he is worried about how to add the confidentiality to the message. Specify which layer of the OSI model facilitates the required service and how it is achieved?<br>ii. Alice also wants to confirm about the reception of the message at the receiver's end without any loss of data. What type of service needs to be enabled for confirming the transportation service by the network model? Which layer of the OSI ensures this service?<br>iii. How to route the packets across the internetwork. Illustrate the required service offered by the concerned layer.<br>iv. What is MAC layer? What are its functions? | 10 | CO1 | L1 |
| 3a | Why does internet use connectionless service? Is connectionless service and wireless communication same? justify | 6 | CO1 | L2 |
| 3b | Write short note on guided transmission media. | 4 | CO1 | L2 |
| 4 |  <br>For the above given diagram, explain how packets 1, 2, 3 are travels to the destination using connection oriented and connectionless service. (show with two different diagrams) | 10 | CO1 | L3 |
| 5 | Specify the unguided transmission service that supports long distance and short distance communication. Explain in detail. | 10 | CO2 | L2 |
| 6a | Assume that source S and destination D are connected through two intermediate routers labeled R. Determine how many times each packet has to visit the network layer and the data link layer during a transmission from S to D? Justify your answer.<br>  | 6 | CO2 | L3 |
| 6b | Choose the best match between Group 1 and Group 2. | 4 | CO1 | L2 |

| | | | | |
|---|---|---|---|---|
| | | | | |

| Group-1 | Group-2 |
|---|---|
| Data Link Layer | Allows end to end communication between two processes |
| Network Layer | Provides application service to the end user |
| Transport Layer | Routes the packets from one node to the other node over internet |
| Application Layer | Ensures reliable transmission of data over a point-to-point link |

CI: CCI: HOD:

Solutions:

Part-A

1. Segmentation and reassembly is the responsibility of

a.7th layer b. 6th Layer c. 5th Layer **d. 4th layer**

2. Which one of the following tasks is not done by the data link layer?

A) framing **B) channel coding** C) flow control D) error control

3. Which one of the following is not a client-server application?

(A) Internet Chat (B) Web Browsing (C) Email **(D) ping**

**4.** How is a single channel shared by multiple signals in a computer network?

**a). Multiplexing** b). Phase modulation c) Analog modulation d) Digital Modulation

5. Which of the following is an example of Bluetooth?

a) wide area network b) virtual private network

c) local area network **d) personal area network**

**6.** Which of these is not a guided media?

A) Fiber optical cable **B) Wireless LAN** C) Copper wire D) Coaxial cable

7. Match the following.

(P) SMTP (1) Data Link Layer

(Q) BGP (2) Transport layer

(R) TCP (3) Application layer

(S) PPP (4) Network layer

**P-3, Q-4, R-2, S-1**

**8.** In respect of OSI model, LAN implements

**Lower 2 layers** b. All seven layers c. Upper 5 layers d. None of the above

9. The protocol data unit (PDU) for the application layer in the Internet stack is

a. Segment b. datagram **c. message** d. frame

10. The address resolution protocol (ARP) is used for

(a) Finding the IP address from the DNS

(b) Finding the IP address of the default gateway

(c) Finding the IP address that corresponds to a MAC address

(d) **Finding the MAC address that corresponds to an IP address**

## PART-B

**1.** Jhon wants to develop an application which needs a reliable transmission over the network. What are the design goals he has to set for successful message transmission over the network?

Reliability is the design issue of making a network that operates correctly even though it is made up of a collection of components that are themselves unreliable. There is a chance that some of these bits will be received damaged (inverted) due to fluke electrical noise, random wireless signals, hardware flaws, software bugs and so on. One mechanism for finding errors in received information uses codes for error detection. Information that is incorrectly received can then be retransmitted. until it is received correctly. More powerful codes allow for **error correction**, where the correct message is recovered from the possibly incorrect bits that were originally received.

Another reliability issue is finding a working path through a network. Often there are multiple paths between a source and destination, and in a large network, there may be some links or routers that are broken. Suppose that the network is down in Germany. Packets sent from London to Rome via Germany will not get through, but we could instead send packets from London to Rome via Paris. The network should automatically make this decision. This **topic is called routing**.

A second design issue concerns the evolution of the network. Over time, networks grow larger and new designs emerge that need to be connected to the existing network. We have recently seen the key structuring mechanism used to support change by dividing the overall problem and hiding implementation details: **protocol layering**.

Since there are many computers on the network, every layer needs a mechanism for identifying the **senders and receivers that are involved in a particular message**. This mechanism is called addressing or naming, in the low and high layers, respectively.

Sometimes the problem is that the network is oversubscribed because too many computers want to send too much traffic, and the network cannot deliver it all. This overloading of the network is called **congestion**. One strategy is for each computer to reduce its demand when it experiences congestion. It, too, can be used in all layers.

fferent kinds of threats. One of the threats we have mentioned previously is that of eavesdropping on communications. Mechanisms that provide confidentiality defend against this threat, and they are used in multiple layers. Mechanisms for authentication prevent someone from impersonating someone else.

They might be used to tell fake banking Web sites from the real one, or to let the cellular network check that a call is really coming from your phone so that you will pay the bill.

1b. What are the different addresses every message passing through the network is processed through? Explain the significance of each type of address

1.**Physical Addresses**

- The physical address, also known as the link address, is the address of a node as defined by its LAN or WAN.
- The size and format of these addresses vary depending on the network. For example, Ethernet uses a 6-byte (48-bit) physical address.
- Physical addresses can be either unicast (one single recipient), multicast (a group of recipients), or broadcast (to be received by all systems in the network.
- Example: Most local area networks use a 48-bit (6-byte) physical address written as 12 hexadecimal digits; every byte (2 hexadecimal digits) is separated by a colon, as shown below: A 6-byte (12 hexadecimal digits) physical address **07:01:02:01:2C:4B**

**2. Logical Addresses:**

Logical addresses are used by networking software to allow packets to be independent of the physical connection of the network, that is, to work with different network topologies and types of media.

A logical address in the Internet is currently a 32-bit address that can uniquely define a host connected to the Internet. An internet address in IPv4 in decimal numbers 132.24.75.9

No two publicly addressed and visible hosts on the Internet can have the same IP address.

The physical addresses will change from hop to hop, but the logical addresses remain the same.

The logical addresses can be either unicast (one single recipient), multicast (a group of recipients), or broadcast (all systems in the network). There are limitations on broadcast addresses.

3. **Port Addresses**

- There are many application running on the computer. Each application run with a port no.(logically) on the computer.
- A port number is part of the addressing information used to identify the senders and receivers of messages.
- Port numbers are most commonly used with TCP/IP connections.
- These port numbers allow different applications on the same computer to share network resources simultaneously.
- The physical addresses change from hop to hop, but the logical and port addresses usually remain the same.
- Example: a port address is a 16-bit address represented by one decimal number **753**

**4. Application-Specific Addresses**

Some applications have user-friendly addresses that are designed for that specific application.

Examples include the e-mail address (for example, forouzan@fhda.edu) and the Universal Resource Locator (URL) (for example, www.mhhe.com). The first defines the recipient of an e-mail; the second is used to find a document on the World Wide Web.

Q2. Describe the following.

i. Alice wants to send a message to Bob. But he is worried about how to add the confidentiality to the message. Specify which layer of the OSI model facilitates the required service and how it is achieved?

ii. Alice also wants to confirm about the reception of the message at the receiver's end without any loss of data. What type of service needs to be enabled for confirming the transportation service by the network model? Which layer of the OSI ensures this service?

iii. How to route the packets across the internetwork. Illustrate the required service offered by the concerned layer.

iv. What is MAC layer? What are its functions?

i). Presentation Layer:

- The presentation layer prepares data for the application layer.
- It defines how two devices should encode, encrypt, and compress data so it is received correctly on the other end.
- The presentation layer takes any data transmitted by the application layer and prepares it for transmission over the session layer.

ii). Transport Layer:

- The transport layer takes data transferred in the session layer and breaks it into "segments" on the transmitting end.
- It is responsible for reassembling the segments on the receiving end, turning it back into data that can be used by the session layer.
- The transport layer carries out flow control, sending data at a rate that matches the connection speed of the receiving device, and error control, checking if data was received incorrectly and if not, requesting it again.
- Supports reliable (connection oriented) data transmission using the TCP protocol and unreliable (Connectionless) data transmission using UDP protocol.
- Flow control and error control is carried out using Automatic repeat Request protocols.

Network Layer:

The network layer has two main functions.

One is breaking up segments into network packets, and reassembling the packets on the receiving end.

The other is routing packets by discovering the best path across a physical network.

The major routing protocols used for routing are OSPF and RIP.

The network layer uses network addresses (typically IP addresses) to route packets to a destination node. IPv4 uses 32 bit IP address and IPv6 uses 128 bits IP address.

Internet Control Message Protocol (ICMP) is a supporting protocol for IP by sending control messages.

Data Link Layer:

**Data-link Layer:**

- The data link layer establishes and terminates a connection between two physically-connected nodes on a network.
- It breaks up packets into frames and sends them from source to destination.
- This layer is composed of two parts-
    - Logical Link Control (LLC) which identifies network protocols, performs error checking and

synchronizes frames.

Media Access Control (MAC) which uses MAC addresses to connect devices and define permissions to transmit and receive data.

3. Why does internet use connectionless service? Is connectionless service and wireless communication same? Justify

The term connectionless describes a type of communication service that enables data to be transferred between network endpoints. The sending endpoint does not try to establish a dedicated, end-to-end connection with the receiving endpoint or even try to ensure that the receiver is available to accept the data.

In telecommunications, connectionless describes communication between two network endpoints in which a message can be sent from one endpoint to another without prior arrangement. The device at one end of the communication transmits data to the other without first ensuring that the recipient is available and ready to receive the data. The device sending a message simply sends it addressed to the intended recipient. If there are problems with the transmission, the sender might need to resend the data several times.

Internet Protocol (IP) and User Datagram Protocol (UDP) are connectionless protocols that enable connectionless operations. But that leads to the following question: What is a connectionless service in a computer network?

The term *connectionless* describes a type of communication service that enables data to be transferred between network endpoints. The sending endpoint does not try to establish a dedicated, end-to-end connection with the receiving endpoint or even try to ensure that the receiver is available to accept the data.

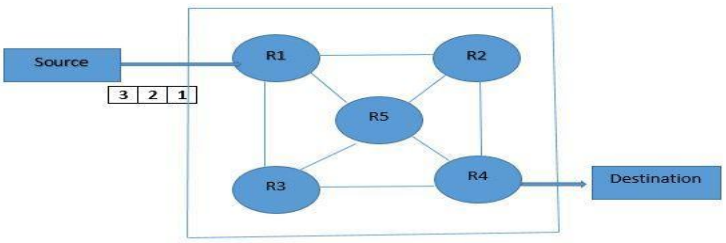
The sender transmits the data in a packet -- sometimes referred to as *datagrams*. Although the packets are addressed to the recipient, they're sent independently of each other and treated independently by the network. The packets might be routed along different paths or received in an order different from how they were sent. It's up to that endpoint to reassemble the packets in the correct order.

Connectionless network communications are carried out by connectionless protocols, such as the following:

- **IP.** Network layer protocol that addresses and routes data packets between network endpoints.

UDP. Transport layer protocol used primarily to establish low-latency and loss-tolerating connections between applications on the internet. Connectionlwss does not mean that it is wireless communication. Connectionless transmission can also be supported by both wired and wireless networks. The communication does not require the prior establishment of the logical connection between the two end points.

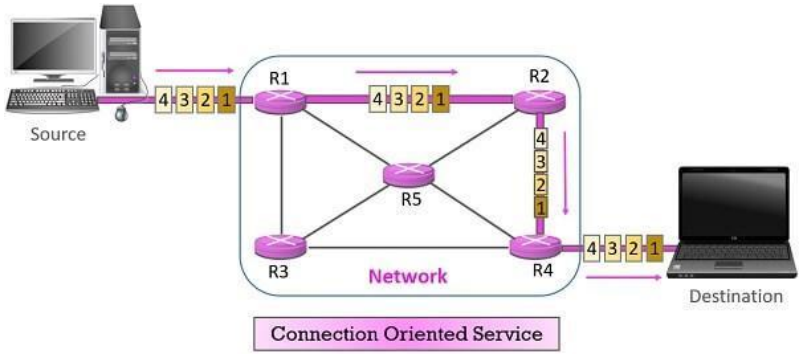
4. Consider the following figure.



For the above given diagram, explain how packets 1, 2, 3 are travels to the destination using connection oriented and connectionless service. (show with two different diagrams)

Connection oriented service is a data transfer method between two computers in a different network, which is designed after the **telephone system**. Like, in telephone system if we want to talk to someone, we just pick up the phone, dial the number of whom we want to talk with; after the connection is established we talk and lastly, we hang up the call.

Similarly, the connection oriented service first establishes the **virtual connection** between the source and the destination, then transfers all data packets belonging to the same message through same dedicated established connection and after all packets of a message is transferred it releases the connection.




To establish a connection a source sends a **request** packet to the destination. In response to which destination sends the **acknowledgement** packet to the source confirming that the destination is ready to accept the data from the source.

Meanwhile, the **routers** involved in the exchange of request and acknowledgement packet between source and destination, define the **virtual path** that will be **followed by all packets** belonging to the same message. So, we say that the **resources** involved in data transfer are **reserved** before transferring all packet in a message

As all the data packets in a message follow the same path their **order** is preserved as they reach the destination. After sending all data packets the source sends a special packet to **terminate** the connection. To which destination sends an acknowledgement confirming the termination of connection and all the router delete the path entry from routing table.

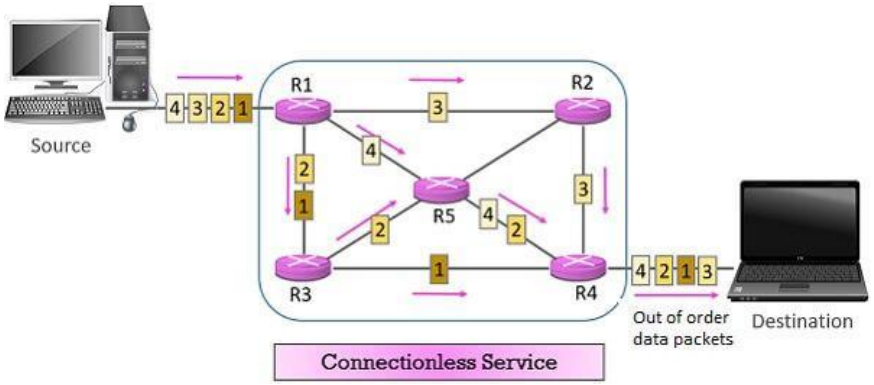
As connection oriented service provide acknowledgement at each action it provides **reliability** in the service. There are **fewer** chances of **packet loss** as they travel a predefined path. The connection oriented services are preferred over a **long and steady** conversation.

As the virtual path is predefined there are rare or no chances of **congestion**. If we talk about the delay in data transmission, there is no delay in the transmission of packets as there is a dedicated path for it. But, a substantial **delay** is introduced due to the acknowledgement process during connection establishment and termination.The **TCP** protocol is a **connection oriented** protocol.

Connectionless service is a method of data transmission between two computers in a different network. Connectionless service is also termed as **datagram service**. This service look-alike the **postal system** where each letter carries its source & destination address and each one of them is **routed** through a **different path.**

The source divides the message into small acceptable packets these packets known as a **datagram**. These

datagrams are individually pushed into the network; each datagram may travel a **different path**. The network considers each datagram or data packet as an **independent entity** i.e. **no relationship** is considered between the packets belonging to the same message.




Each datagram carries its **source** and **destination** address. The **router** uses the **destination** address to route the datagram to its destination. The packets received at the destination may be received **out of order**. Hence, the datagrams are assembled to recreate the original message. The **UDP** protocol is a **connectionless** protocol.

5. Specify the unguided transmission service that supports long distance and short distance communication. Explain in detail.

Long distance communication is supported by RADIO waves.

- Radio waves are electromagnetic signals used for various wireless communication technologies, such as Wi-Fi, Bluetooth and radio broadcasting. Electromagnetic waves ranging in frequencies between 3 kHz and 1 GHz are normally called radio waves.
- Radio waves are omni-directional. When an antenna transmits radio waves, they are propagated in all directions. This means that the sending and receiving antennas do not have to be aligned.
- A sending antenna sends waves that can be received by any receiving antenna.
- The omnidirectional property has a disadvantage, too. The radio waves transmitted by one antenna are susceptible to interference by another antenna that may send signals using the same frequency or band.
- The properties of radios waves vary according to their frequencies. However, radio waves at all frequencies are prone to interference from electrical equipments like motors etc.

**Low and Medium Frequency Radio Waves:**

- Low and medium frequency radio waves can pass through obstacles and have ground propagation. However, the power diminishes rapidly depending upon the distance from the source. This attenuation in power is called the path loss. AM radio uses LF and MF bands.

**High Frequency Radio Waves:**

High frequency radio waves travel in straight lines and have sky propagation.

However, they are affected by interferences and are affected by rains. The military communicates in the HF and VHF bands. They are also used for long distance broadcasting and FM radio.

Short distance communications are achieved by Microwaves and infrared waves.

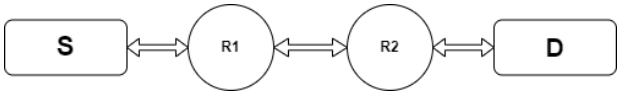
**Microwaves:**

- Electromagnetic waves having frequencies between 1 and 300 GHz are called microwaves.
- Microwaves are unidirectional.
- The sending and receiving antennas need to be aligned.
- The unidirectional property has an obvious advantage. A pair of antennas can be aligned without interfering with another pair of aligned antennas.
- Microwaves need unidirectional antennas that send out signals in one direction. Two types of antennas are used for microwave communications: the parabolic dish and the horn.
- Microwaves travel in a straight line, so if the towers are too far apart, repeaters are required periodically to amplify and regenerate the signal strength.
- The distance between repeaters goes up very roughly with the square root of the tower height. For 100-meter-high towers, repeaters can be 80 km apart.
- Unlike radio waves at lower frequencies, microwaves do not pass through buildings well.
- Some waves may be refracted off low-lying atmospheric layers and may take slightly longer to arrive than the direct waves. The delayed waves may arrive out of phase with the direct wave and thus cancel the signal. This effect is called multipath fading and is often a serious problem.
- Bands up to 10 GHz are now in routine use, but at about 4 GHz a new problem sets in: absorption by water. These waves are only a few centimeters long and are absorbed by rain.
- As with multipath fading, the only solution is to shut off links that are being rained on and route around them.

**Infrared waves:**

- Infrared waves, with frequencies from 300 GHz to 400 THz (wavelengths from 1 mm to 770 nm), can be used for short-range communication.
- Infrared waves, having high frequencies, cannot penetrate walls.
- This advantageous characteristic prevents interference between one system and another; a short range communication system in one room cannot be affected by another system in the next room. When we use our infrared remote control, we do not interfere with the use of the remote by our neighbours.
- Infrared signals useless for long-range communication.
- In addition, we cannot use infrared waves outside a building because the sun's rays contain infrared waves that can interfere with the communication. It is used in TV remotes, wireless mouse, keyboard, printer, etc.

6a. Assume that source S and destination D are connected through two intermediate routers labeled R. Determine how many times each packet has to visit the network layer and the data link layer during a transmission from S to D? Justify your answer.




Network layer is visited 4 times
Data link layer is visited by the packet 6 times

6b. Choose the best match between Group 1 and Group 2.

| Group-1 | Group-2 |
|---|---|
| Data Link Layer | Allows end to end communication between two processes |
| Network Layer | Provides application service to the end user |
| Transport Layer | Routes the packets from one node to the other node over internet |
| Application Layer | Ensures reliable transmission of data over a point-to-point link |

Answer:

Data Link Layer – Ensures reliable data transmission over a point to point network link

Network layer -Routes the packets from one node to the other node over internet.

Transport layer - Allows end to end communication between two processes.

Application Layer – Provides the application service to the end user.

**********