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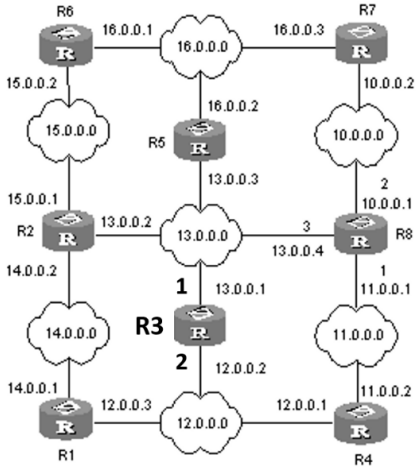
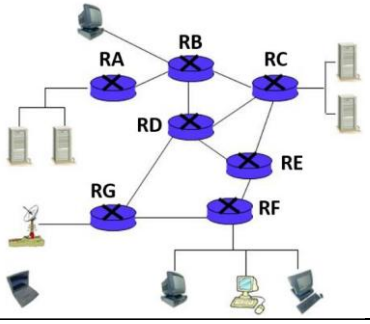
School of Computer Science and Engineering
B.Tech (Hons.)
CIE2 Question Paper – Set1 with Answer keys
Academic Year 2024-2025

Course: Network Security		**Course Code: CS3403**	**Semester: VI**
Time: 11:30am	**Duration: 90 minutes**	**Date: 18 Mar 25**	**Max Marks: 25**

Part – A (9 x 2 marks = 18 marks + 1 mark)

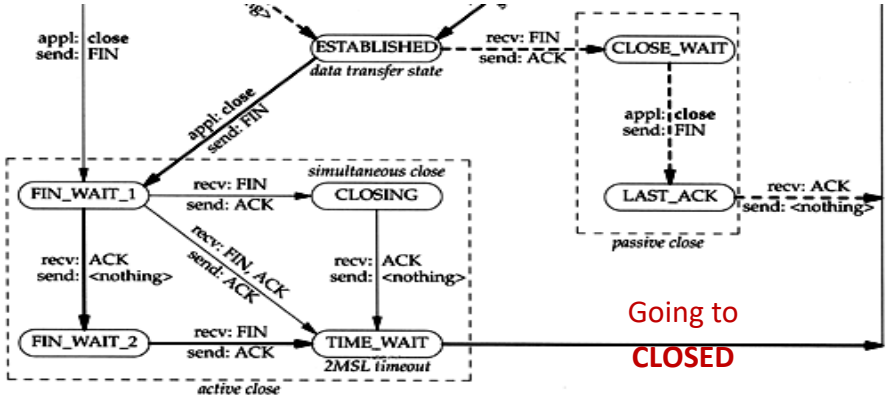
Sl. No.	Questions	Marks	L1-L6	CO
1.	Elaborate "**count-to-infinity**" problem in **Distance Vector Routing**.	2	L4	CO2
2.	Analyze the main **advantages** of using the **Link State Algorithm over the Distance Vector algorithm** in terms of **network convergence**	2	L3	CO2
3.	Explain how **routing protocols** that use **delay** as their **primary metric** determine the **best or preferred path**.	2	L3	CO2
4.	Describe the process that occurs when a **DHCP server** receives a request for an **IP address** from a **client device**.	2	L2	CO2
5.	Enlist what actions a router takes when it receives a packet destined for an IP address that is not present in its routing table.	2	L3	CO2
6.	Justify how **TCP** provides a **reliable connection** between two hosts with the help of **two of its header fields**.	2	L2	CO1
7.	Give the functionality of the below function calls. Which one is a blocking call? **socket.bind((HOST, PORT))** **socket.listen()**	2	L3	CO1
8.	Fill in the routing table of **R3** in the network below. Choose the directly connected **lower Router ID** when there **are two paths with the same distance** are available. Show both **directly connected (C)** entries and **Static (S)** entries and **interface number** in the Routing table  **Routing Table of R3** | Type | Dest NW | Next Hop | Interface | |---|---|---|---| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |	2	L3	CO1

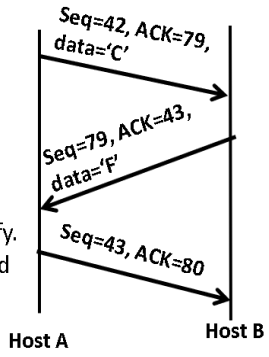
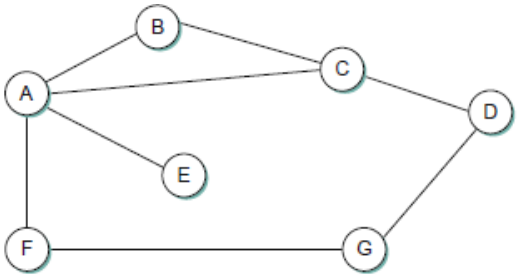
L1- Remember, L2- Understand, L3 – Apply, L4- Analyse, L5 – Evaluate, L6 – Create

9.	Assume a Distance Vector Algorithm is running in the network below. What is the **maximum hop distance after the convergence between any two routers** in the network? Give **a sample path** with **max hop distance**. 	2	L3	CO2
10	Briefly explain about the **Link State Routing protocols**.	1	L2	CO2

Part – B (2 x 3 marks = 6 marks)

Instructions: Answer any two questions. The **best two answers** will be **considered for evaluation**.

Sl. No.	Questions	Marks	L1-L6	CO
11.	Assume a TCP connection on a host is transitioning into different states as given below. **ESTABLISHED → FIN_WAIT_1 → FIN_WAIT_2 → TIME_WAIT → CLOSED** Give the possible **triggers/events/messages** that could make these **transitions happen**. 	3	L4	CO1

12.	Based on the TCP message exchanges between two hosts shown, during the middle of an established connection, answer the following: a) What are the values of **TCP data length** from **Host A** to **Host B** and **Host B** to **Host A**? b) Did the hosts receive the data without any errors or not? Justify. c) If the **Host A** sends **another byte of data** to **Host B**, what would be the **sequence number** associated with it? 	3	L4	CO1
13.	Assume **both the links** between **B and C**, also **A and C** have **failed**. Assume the **DVA** is running on this network and it has converged after the failures of both the links. Assume the **cost of each link** is set to **2**. Give the **RT** at **node G**. 	3	L4	CO2

Course Outcomes

1. Analyze the working principles and characteristics of TCP and its role in providing reliable networking applications.
2. Analyze the implementation details of RIP and OSPF routing protocols adapted by large enterprise networks.
3. Explain various multimedia transport protocols and the need for QoS in networks
4. Describe the working principles and the purpose of cryptographic algorithms used to provide secure communication
5. Apply IP security and Web security concepts in real-life scenarios for creating secure networks

Marks Distribution										
L1	L2	L3	L4	L5	L6	CO1	CO2	CO3	CO4	CO5
0	5	12	8	0	0	9	16	0	0	0

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

Answers

Part - A

1. **Elaborate "count-to-infinity" problem in Distance Vector Routing.**

The **count-to-infinity** problem arises when a router detects that a route to a destination is no longer valid (e.g., due to a network link failure), and routers begin to advertise incorrect distance information to their neighbors, causing the routers to repeatedly update their tables with higher and higher distance values for that destination. This leads to a situation where the routers keep counting up their distances to the destination, but they never converge on the correct (infinite or unreachable) distance.

2. **Analyze the main advantages of using the Link State Algorithm over the Distance Vector algorithm in terms of network convergence**

The **main advantage** of using the **Link State Algorithm** over the **Distance Vector algorithm** in terms of **network convergence** is that Link State Routing converges **faster** and more **accurately**. In Link State Routing, each router has a complete view of the network topology and uses Dijkstra's algorithm to independently calculate the shortest path, ensuring quick adaptation to network changes like link failures. On the other hand, **Distance Vector Routing** relies on periodic updates from neighbors, which can lead to slower convergence, as the routing information propagates gradually. Additionally, the Distance Vector algorithm is prone to **count-to-infinity** issues and routing loops, further delaying convergence. Therefore, Link State Routing provides more reliable and efficient convergence in dynamic networks.

3. **Explain how routing protocols that use delay as their primary metric determine the best or preferred path.**

Routing protocols that use **delay** as their primary metric determine the best or preferred path by selecting the route that offers the **lowest delay** in transmitting data from the source to the destination. In protocols that prioritize delay, routers measure the round-trip time (RTT) or the time it takes for data to travel between them and their neighboring routers. The path with the **least total delay** (i.e., the fastest route in terms of time) is preferred for forwarding traffic.

4. **Describe the process that occurs when a DHCP server receives a request for an IP address from a client device.**

When a **DHCP server** receives a request for an IP address from a **client device**, the process typically follows these steps: **IP Address Allocation**: The **DHCP server** that receives the **DHCP Request** verifies if the requested IP address is still available and not yet leased to another device. If the IP is available, it allocates the IP to the client for a specific lease time. The server then sends a **DHCP Acknowledgment (ACK)** message to the client. This message includes the assigned IP address, subnet mask, lease duration, and any other configuration information (e.g., default gateway, DNS server) needed by the client. Upon receiving the **DHCP ACK**, the client configures its network settings with the provided IP address and other parameters, allowing it to communicate on the network.

5. **Analyze what actions a router takes when it receives a packet destined for an IP address that is not present in its routing table.**

When a router receives a packet destined for an IP address that is not present in its routing table, it typically takes the following actions: The router first checks if there is a **default route** (gateway of last resort) in the routing table. If no matching entry is found in the routing table and there is no default route, the router

discards the packet. – **1 mark**
It then sends an **ICMP Destination Unreachable** message back to the source device, notifying it that the destination is unreachable. If the router uses **dynamic routing protocols** (such as OSPF, RIP, or BGP), it may request updated routing information from neighboring routers. – **1 mark**

6. TCP provides a reliable connetion between two hosts by guaranteeing data delivery through mechanisms like data sequencing, acknowledgments (ACK), retransmissions for the lost packets, and flow control. **Sequence numbers** along with **ACK** fields in the TCP header ensure that every byte of data is transmitted accurately and delivered to the application on running the host of the other end of the connection.

7. **socket.bind((HOST, PORT))**
   This call associates the socket with a specific network interface and port number. – **1 mark**
   socket.listen()
   This call informs the socket to start listening for any incoming connection requests from other machines. – **1 mark**

8. **For every wrong entry reduce 0.25 marks and round it off to higher 0.5 finally.**
   Note: For the directly connected entries mention the IP address of the interface which is on the destination network, but the packets will be directly delivered to the host on the network.

Routing Table of R3

Type	Dest NW	Next Hop	Interface
S	10.0.0.0	13.0.0.4	1
S	11.0.0.0	12.0.0.1	2
C	12.0.0.0	12.0.0.2	2
C	13.0.0.0	13.0.0.1	1
S	14.0.0.0	12.0.0.3	2
S	15.0.0.0	13.0.0.2	1
S	16.0.0.0	13.0.0.3	1

9. **Max hop distance is 4 (between RA and RF). – 1 mark**
   One sample path between **RA to RF: RA→RB→RC→RE→RF – 1 Mark**

Note: There is only one correct answer here. No grace marks here.

10. **Link State Routing** Protocols**: Any two points are sufficient:**
    - Link-state routing is the second major class of intra-domain routing protocol.
    - The starting assumptions for link-state routing are rather similar to those for distance-vector routing.
    - Each node is assumed to be capable of finding out the state of the link to its neighbors (up or down) and the cost of each link.
    - The aim of this protocol is to provide each node with enough information to enable it to find the least-cost path to any destination

    Note: Can be liberal here with the correction if approximate explanation is given.

PART - B

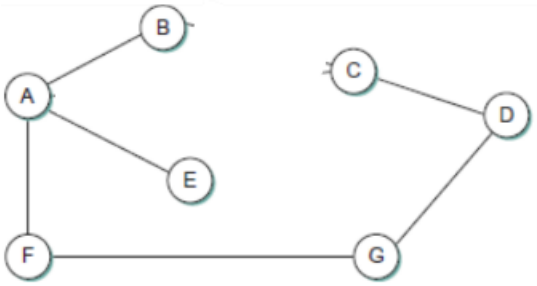
11. **ESTABLISHED → FIN_WAIT_1 → FIN_WAIT_2 → TIME_WAIT → CLOSED**
    When the application running on the host decided to close the connection, the ptocol stack generates a **FIN** message to other end and waits for its ACK from the other end, in the **FIN_WAIT_1** state. When this host receives the ACK for the FIN it sent, it moves to the **FIN_WAIT_2** state, waiting for the application on the other end of the connection to close.

When the other end application also closes the connection, this host receives a **FIN** message from the other end, for which an **ACK** is sent by this host and moves to **TIME_WAIT** state to wait for **2MSL** period before moving to the **CLOSED** state.
Note: Explanation should be correct to award marks here.

12. a) The **TCP data lengths** are both **one** from **Host A to Host B** as well **as Host B to Host A**. The data being shared is 'C'**. 0.5 + 0.5 = 1 mark**
b) **Both the hosts have received the data correctly** because both of them have **acknowledged** the data by **incrementing the Sequence numbers** originated from the hosts. – **1 mark**
c) The **next byte of data** from Host A would have the **sequence number 43**, which is given in the last message exchange from Host A to Host B. – **1 mark**
Note: No grace marks. Award marks only when the answer is exactly correct.

13. After the links between B and C, A and C have failed the converged **RT at Node G** would be:
The **Routing Table at the Router G** after the network has converged is given below.
If the student has not taken care of the cost of each link as 2 and all other entries are correct except the entries of the costs which are given as half of the correct answers, then overall reduce 1 mark.

Reduce 0.25 marks for every other wrong entry. Do not reduce any marks if rows are interchanged but the values are correct.



Destination	Cost	Next Hop
A	4	F
B	6	F
C	4	D
D	2	D
E	6	F
F	2	F

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