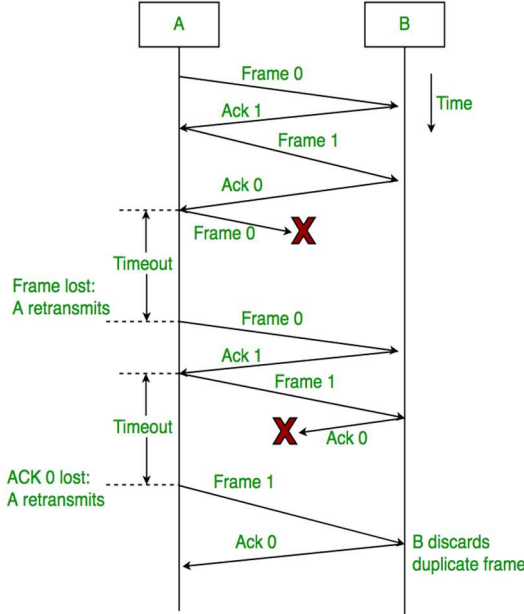
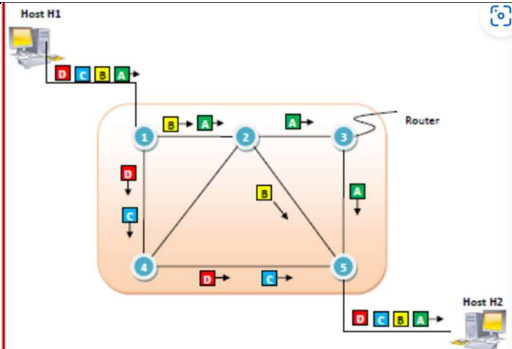
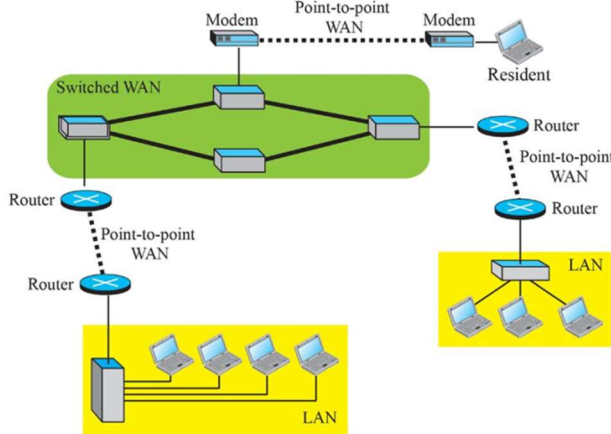
	R V College of Engineering Department of Computer Science and Engineering CIE - I : Question Paper		
Course : (Code)	Computer Networks(21CS45)	Semester : IV	
Date : /06/2023	Duration : 90 minutes	Staff : SCN/MM/PH/Sushmita/Narasimha swamy	
Name :	USN :	Section :	A/B/C/ISE/AIML

Sl.no		Marks	*L1-L6	*CO
1a	Network layer provides services to transport layer. In this case what are the goals that should be considered while designing?	03	1	3
1b	With a neat flow diagram, explain the process of data transmission in CSMA/CA.	07	2	2
2a	Match the following functions to one or more layers of the TCP/IP protocol suite. <ul style="list-style-type: none"> i. transforming bits to electromagnetic signals ii. route determination iii. end to end error detection and correction iv. providing services for the end user v. handling flow control 	05	2	1,2
2b	 <p>Observe the figure above and identify the protocol whose working is represented in this diagram. Also explain the communication scenario of the diagram.</p>	05	3	5
3.a	Differentiate between Circuit-Switched and Packet Switched Network?	05	2	1
3.b.	Implement bit/byte stuffing for following bit streams: <ul style="list-style-type: none"> i. 00 011111 110 011111 0100 011111 1111 10000111 ii. Unstuff the following frame payload in which E is the escape byte, F is the flag byte, and D is a data byte other than an escape or a flag character. EEDE FDDE FEED DD 	05	3	3
4a	Design Routing tables for nodes 1,2, 3,4,5 for performing routing in the given datagram network across Host H1 and Host H2.	05	3	1

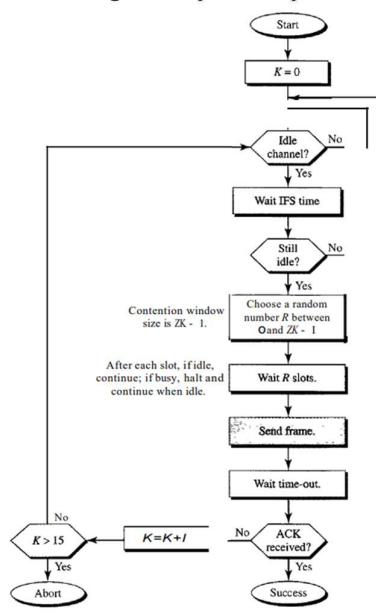
																																								
4b	 <p>Examine the above diagram and explain all the components involved and their functions.</p>	05	2	1																																				
5a	Explain the PPP frame structure showing the fields of the frame.	06	2	3																																				
5b	Identify the frame to which the given control fields belong and explain the same.	04	2	2																																				
	<table><tr><td>i.</td><td><table><tr><td>0</td><td></td><td></td><td></td><td>P/F</td><td></td><td></td><td></td></tr><tr><td colspan="4">N(S)</td><td></td><td colspan="3">N(R)</td></tr></table></td></tr><tr><td>ii.</td><td><table><tr><td>1</td><td>0</td><td></td><td></td><td>P/F</td><td></td><td></td><td></td></tr><tr><td colspan="4">Code</td><td></td><td colspan="3">N(R)</td></tr></table></td></tr></table>	i.	<table><tr><td>0</td><td></td><td></td><td></td><td>P/F</td><td></td><td></td><td></td></tr><tr><td colspan="4">N(S)</td><td></td><td colspan="3">N(R)</td></tr></table>	0				P/F				N(S)					N(R)			ii.	<table><tr><td>1</td><td>0</td><td></td><td></td><td>P/F</td><td></td><td></td><td></td></tr><tr><td colspan="4">Code</td><td></td><td colspan="3">N(R)</td></tr></table>	1	0			P/F				Code					N(R)					
i.	<table><tr><td>0</td><td></td><td></td><td></td><td>P/F</td><td></td><td></td><td></td></tr><tr><td colspan="4">N(S)</td><td></td><td colspan="3">N(R)</td></tr></table>	0				P/F				N(S)					N(R)																									
0				P/F																																				
N(S)					N(R)																																			
ii.	<table><tr><td>1</td><td>0</td><td></td><td></td><td>P/F</td><td></td><td></td><td></td></tr><tr><td colspan="4">Code</td><td></td><td colspan="3">N(R)</td></tr></table>	1	0			P/F				Code					N(R)																									
1	0			P/F																																				
Code					N(R)																																			

COURSE OUTCOMES:

CO1.	Apply the algorithms/techniques of routing and congestion control to solve problems related to Computer Networks.
CO2.	Analyse the services provided by various layers of TCP/IP model to build effective solutions
CO3.	Design sustainable networking solutions with societal and environmental concerns by engaging in lifelong learning for emerging technology.
CO4.	Exhibit network configuration, protocol usage and performance evaluation in networks.
CO5.	Demonstrate the solutions using various algorithms/protocols available to address networking issues using modern tools by exhibiting team work and effective communication.

	L1	L2	L3	L4	L5	L6	CO1	CO2	CO3	CO4	CO5
Marks	3	32	15	-	-	-	17	14	14	-	5

Scheme and Solution

Qn o		Mark s
1a	<p>Network layer provides services to transport layer. In this case what are the goals that should be considered while designing?</p> <ol style="list-style-type: none"> The services should be independent of the router technology The transport layer should be shielded from the number, type and topology of the routers present. The network addresses made available to the transport layer should use a uniform numbering plan, even across LANs and WANs. 	3m
1b	<p>With a neat flow diagram, explain the process of data transmission in CSMA/CA.</p>  <pre> graph TD Start([Start]) --> K0[K = 0] K0 --> Idle{Idle channel?} Idle -- No --> Idle Idle -- Yes --> WaitIFS[Wait IFS time] WaitIFS --> StillIdle{Still idle?} StillIdle -- No --> Idle StillIdle -- Yes --> ChooseR[Choose a random number R between 0 and 2K - 1] ChooseR --> WaitR[Wait R slots.] WaitR --> SendFrame[Send frame.] SendFrame --> WaitTO[Wait time-out.] WaitTO --> ACK{ACK received?} ACK -- Yes --> Success([Success]) ACK -- No --> Kplus1[K = K + 1] Kplus1 --> Kgt15{K > 15} Kgt15 -- Yes --> Abort([Abort]) Kgt15 -- No --> Idle </pre> <p>Contention window size is $2K - 1$.</p> <p>After each slot, if idle, continue; if busy, halt and continue when idle.</p> <p style="text-align: right;">Diagram-----2m</p> <p>Explanation of Interframe Space, Contention Window, Acknowledgement- -----5m</p>	7M
2a	<p>Match the following functions to one or more layers of the TCP/IP protocol suite.</p> <ol style="list-style-type: none"> transforming bits to electromagnetic signals-physical layer route determination—network layer end to end error detection and correction-data link layer providing services for the end user-application layer handling flow control-datalink layer & transport layer 	05

	<p>ii. Unstuff the following frame payload in which E is the escape byte, F is the flag byte, and D is a data byte other than an escape or a flag character.</p> <p>EEDE FDDE FEED DD</p> <p>Unstuff the following frame payload in which E is the escape byte, F is the flag byte, and D is a data byte other than an escape or a flag character.</p> <p>EEDE FDDE FEED DD</p> <p>EDFDDFEDDD-----</p> <p>2m</p>																																																																									
4a	<p>Design Routing tables for nodes 1,2, 3,4,5 for performing routing in the given datagram network across Host H1 and Host H2.</p> <div><div><div><p>1's Routing Table</p><table><thead><tr><th>DEST</th><th>NEXT</th></tr></thead><tbody><tr><td>1</td><td>-</td></tr><tr><td>2</td><td>2</td></tr><tr><td>3</td><td>2</td></tr><tr><td>4</td><td>4</td></tr><tr><td>5</td><td>2</td></tr></tbody></table></div><div><p>2's Routing Table</p><table><thead><tr><th>DEST</th><th>NEXT</th></tr></thead><tbody><tr><td>1</td><td>1</td></tr><tr><td>2</td><td>-</td></tr><tr><td>3</td><td>3</td></tr><tr><td>4</td><td>4</td></tr><tr><td>5</td><td>3</td></tr></tbody></table></div><div><p>3's Routing Table</p><table><thead><tr><th>DEST</th><th>NEXT</th></tr></thead><tbody><tr><td>1</td><td>2</td></tr><tr><td>2</td><td>2</td></tr><tr><td>3</td><td>-</td></tr><tr><td>4</td><td>5</td></tr><tr><td>5</td><td>5</td></tr></tbody></table></div><div><p>4's Routing Table</p><table><thead><tr><th>DEST</th><th>NEXT</th></tr></thead><tbody><tr><td>1</td><td>1</td></tr><tr><td>2</td><td>1</td></tr><tr><td>3</td><td>1</td></tr><tr><td>4</td><td>-</td></tr><tr><td>5</td><td>5</td></tr></tbody></table></div><div><p>2's Routing Table</p><table><thead><tr><th>DEST</th><th>NEXT</th></tr></thead><tbody><tr><td>1</td><td>1</td></tr><tr><td>2</td><td>-</td></tr><tr><td>3</td><td>3</td></tr><tr><td>4</td><td>4</td></tr><tr><td>5</td><td>5</td></tr></tbody></table></div><div><p>1's Routing Table</p><table><thead><tr><th>DEST</th><th>NEXT</th></tr></thead><tbody><tr><td>1</td><td>-</td></tr><tr><td>2</td><td>2</td></tr><tr><td>3</td><td>2</td></tr><tr><td>4</td><td>4</td></tr><tr><td>5</td><td>4</td></tr></tbody></table></div></div><p>Each table carries 1m</p></div>	DEST	NEXT	1	-	2	2	3	2	4	4	5	2	DEST	NEXT	1	1	2	-	3	3	4	4	5	3	DEST	NEXT	1	2	2	2	3	-	4	5	5	5	DEST	NEXT	1	1	2	1	3	1	4	-	5	5	DEST	NEXT	1	1	2	-	3	3	4	4	5	5	DEST	NEXT	1	-	2	2	3	2	4	4	5	4	05
DEST	NEXT																																																																									
1	-																																																																									
2	2																																																																									
3	2																																																																									
4	4																																																																									
5	2																																																																									
DEST	NEXT																																																																									
1	1																																																																									
2	-																																																																									
3	3																																																																									
4	4																																																																									
5	3																																																																									
DEST	NEXT																																																																									
1	2																																																																									
2	2																																																																									
3	-																																																																									
4	5																																																																									
5	5																																																																									
DEST	NEXT																																																																									
1	1																																																																									
2	1																																																																									
3	1																																																																									
4	-																																																																									
5	5																																																																									
DEST	NEXT																																																																									
1	1																																																																									
2	-																																																																									
3	3																																																																									
4	4																																																																									
5	5																																																																									
DEST	NEXT																																																																									
1	-																																																																									
2	2																																																																									
3	2																																																																									
4	4																																																																									
5	4																																																																									
4b	<div><p>Examine the above diagram and explain all the components involved and their functions.</p><p>Explanation of following elements to be done:</p><p>i. Switch</p></div>	5																																																																								

	<div>ii. Router</div> <div>iii. LAN</div> <div>iv. WAN</div> <div>v. MODEM -----1m each</div>																																			
5a	<div>Explain the PPP frame structure showing the fields of the frame.</div> <div><table><tr><td>Flag</td><td>Address</td><td>Control</td><td>Protocol</td><td>Data & Padding</td><td>FCS</td><td>Flag</td></tr><tr><td>1 Byte</td><td>1 Byte</td><td>1 Byte</td><td>1 to 2 Bytes</td><td>Variable</td><td>2 or 4 Bytes</td><td>1 Byte</td></tr></table><div><div>↑</div><div>All Stations accept the frame</div></div><div><div>↑</div><div>Unnumbered Frame</div></div></div> <div>Frame format –2m</div> <div>Explanation of each field- 4m</div>	Flag	Address	Control	Protocol	Data & Padding	FCS	Flag	1 Byte	1 Byte	1 Byte	1 to 2 Bytes	Variable	2 or 4 Bytes	1 Byte	06																				
Flag	Address	Control	Protocol	Data & Padding	FCS	Flag																														
1 Byte	1 Byte	1 Byte	1 to 2 Bytes	Variable	2 or 4 Bytes	1 Byte																														
5b	<div>Identify the frame to which the given control fields belong and explain the same.</div> <div><div><div>i.</div><div><table><tr><td>0</td><td></td><td></td><td></td><td>P/F</td><td></td><td></td><td></td></tr><tr><td colspan="4">N(S)</td><td></td><td colspan="4">N(R)</td></tr></table></div></div><div><div>ii.</div><div><table><tr><td>1</td><td>0</td><td></td><td></td><td>P/F</td><td></td><td></td><td></td></tr><tr><td colspan="4">Code</td><td></td><td colspan="4">N(R)</td></tr></table></div></div></div> <div><div>i. I frame-----2m</div><div>ii. S frame -----2m</div></div>	0				P/F				N(S)					N(R)				1	0			P/F				Code					N(R)				04
0				P/F																																
N(S)					N(R)																															
1	0			P/F																																
Code					N(R)																															



R V College of Engineering
Department of Computer Science and Engineering
CIE 2 : Question Paper

**Course :
(Code)**

Computer Networks(21CS45)

Semester : IV

Date : 29 /08/2023

Duration : 120 minutes

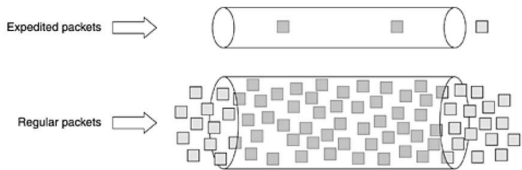
Staff : SUN

Sl.no.	Part A	Marks	BT	CO
1	What is the main objective of hierarchical routing in computer networks? Mention the advantages.	02	L1	
2	Explain the concept of "split horizon" in Distance Vector Routing	02	L2	
3	Explain the concept of "congestion collapse" in computer networks. Mention the disadvantages.	02	L2	
4	Mention when can Flow-Based QoS and Class-Based QoS be used?	02	L2	
5	With a diagram explain Expedited Forwarding	02	L2	
Part B				
1a	Explain the Count-to-Infinity Problem.	03	L2	CO1
1b	Apply shortest path algorithm to the below graph. Show the steps in detail.	07	L3	CO1
2a	For the below given network, write all the possible link state packets.	03	L2	CO1

COURSE OUTCOMES:

CO1.	Apply the algorithms/techniques of routing and congestion control to solve problems related to Computer Networks.
CO2.	Analyse the services provided by various layers of TCP/IP model to build effective solutions
CO3.	Design sustainable networking solutions with societal and environmental concerns by engaging in lifelong learning for emerging technology.
CO4.	Exhibit network configuration, protocol usage and performance evaluation in networks.
CO5.	Demonstrate the solutions using various algorithms/protocols available to address networking issues using modern tools by exhibiting team work and effective communication.

	L1	L2	L3	L4	L5	L6	CO1	CO2	CO3	CO4	CO5
Marks	7	25	14	4	-	-	27	3	14	6	-

COMPUTER NETWORKS Scheme and Solution		
SL No.	Answer	Marks
1	The main objective of hierarchical routing is to divide a large network into smaller, manageable subnetworks or domains to improve scalability and reduce the complexity of routing.	02
2	Split horizon is a technique used in Distance Vector Routing protocols to prevent routing loops. It involves a router not advertising a route back to the neighbour from which the route was learned. This helps to avoid incorrect routing information from being propagated and reduces the likelihood of loops in the network	02
3	Congestion collapse refers to a severe degradation in network performance caused by excessive congestion. It occurs when the network becomes overwhelmed with traffic, leading to packet loss, long delays, and reduced throughput. Congestion collapse can significantly impact the quality of service for users and applications.	02
4	<p>Flow-based QoS is suitable when there is a need to provide highly differentiated treatment to individual flows. It is often used for real-time applications like VoIP and video conferencing, where each flow requires specific QoS guarantees.</p> <p>Class-based QoS is more commonly used when traffic can be aggregated into classes with similar requirements. It is efficient for prioritizing different types of traffic in a more general way, such as giving higher priority to mission-critical applications or bulk data transfers.</p>	02
5	<p>Two classes of services are available: regular and expedited. The vast majority of the traffic is expected to be regular, but a small fraction of the packets are expedited. The expedited packets should be able to transit the subnet as though no other packets were present.</p> <p><i>Figure 5-39. Expedited packets experience a traffic-free network.</i></p>  <p>The diagram shows two horizontal pipes representing network paths. The top pipe is labeled 'Expedited packets' and contains only two small squares (packets) moving quickly through it. The bottom pipe is labeled 'Regular packets' and is filled with many small squares, representing congestion. An arrow points from the congested pipe to the expedited pipe, indicating that expedited packets bypass the congestion.</p>	02
1a	<p>The "Count-to-Infinity" problem is a scenario that can occur in computer networking protocols, particularly in distance-vector routing algorithms such as the Routing Information Protocol (RIP). It arises when there is a network topology change, but the routing information does not propagate quickly or efficiently throughout the network. This can result in routers incorrectly believing that they have found the shortest path to a destination and creating routing loops.</p> <p>The Count-to-Infinity problem can result in significant network instability, increased network traffic, and delayed convergence. It is a fundamental limitation of distance-vector routing algorithms that do not have mechanisms to detect and prevent routing loops.</p>	03

1b	<div><p>Shortest Path A-B-D-E-G length 9 hours</p><p>Tree structure showing paths from A to G:</p><ul style="list-style-type: none">A → B (4) → D (5) → E (7) → G (9) [Shortest Path]A → D (7) → E (9) → G (11)A → C (3) → D (6) → E (8) → G (10)A → B (4) → F (8) → D (5) → E (7) → G (9)A → D (7) → F (14) → E (9) → G (11)A → C (3) → D (6) → F (13) → E (8) → G (10)</div>	07																																																																																				
2a	<div><p>Link State Packets</p><table><tr><th colspan="2">A</th><th colspan="2">B</th><th colspan="2">C</th><th colspan="2">D</th><th colspan="2">E</th><th colspan="2">F</th></tr><tr><th>Seq</th><th>Age</th><th>Seq</th><th>Age</th><th>Seq</th><th>Age</th><th>Seq</th><th>Age</th><th>Seq</th><th>Age</th><th>Seq</th><th>Age</th></tr><tr><td>B</td><td>3</td><td>A</td><td>2</td><td>A</td><td>2</td><td>A</td><td>5</td><td>B</td><td>4</td><td>C</td><td>1</td></tr><tr><td>C</td><td>2</td><td>D</td><td>2</td><td>D</td><td>2</td><td>B</td><td>1</td><td>D</td><td>3</td><td>E</td><td>2</td></tr><tr><td>D</td><td>5</td><td>F</td><td>4</td><td>F</td><td>1</td><td>C</td><td>2</td><td>F</td><td>2</td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td><td>E</td><td>3</td><td></td><td></td><td></td><td></td></tr></table></div>	A		B		C		D		E		F		Seq	Age	Seq	Age	Seq	Age	Seq	Age	Seq	Age	Seq	Age	B	3	A	2	A	2	A	5	B	4	C	1	C	2	D	2	D	2	B	1	D	3	E	2	D	5	F	4	F	1	C	2	F	2									E	3																	
A		B		C		D		E		F																																																																												
Seq	Age	Seq	Age	Seq	Age	Seq	Age	Seq	Age	Seq	Age																																																																											
B	3	A	2	A	2	A	5	B	4	C	1																																																																											
C	2	D	2	D	2	B	1	D	3	E	2																																																																											
D	5	F	4	F	1	C	2	F	2																																																																													
						E	3																																																																															
2b	<div><div><p>Full table for B</p><table><tr><th>Dest.</th><th>Line</th><th>Hops</th></tr><tr><td>A</td><td>A</td><td>1</td></tr><tr><td>B</td><td>—</td><td>—</td></tr><tr><td>C</td><td>C</td><td>1</td></tr><tr><td>D</td><td>D</td><td>1</td></tr><tr><td>E</td><td>D</td><td>2</td></tr><tr><td>F</td><td>D</td><td>2</td></tr><tr><td>G</td><td>D</td><td>3</td></tr><tr><td>H</td><td>D</td><td>4</td></tr><tr><td>I</td><td>D</td><td>5</td></tr><tr><td>J</td><td>D</td><td>5</td></tr><tr><td>K</td><td>D</td><td>6</td></tr><tr><td>L</td><td>D</td><td>6</td></tr><tr><td>M</td><td>C</td><td>4</td></tr><tr><td>N</td><td>C</td><td>3</td></tr><tr><td>O</td><td>C</td><td>4</td></tr><tr><td>P</td><td>C</td><td>2</td></tr><tr><td>Q</td><td>C</td><td>3</td></tr></table></div><div><p>Hierarchical Table for B</p><table><tr><th>Dest.</th><th>Line</th><th>Hops</th></tr><tr><td>A</td><td>A</td><td>1</td></tr><tr><td>B</td><td>—</td><td>—</td></tr><tr><td>C</td><td>C</td><td>1</td></tr><tr><td>2</td><td>D</td><td>1</td></tr><tr><td>3</td><td>D</td><td>4</td></tr><tr><td>4</td><td>C</td><td>3</td></tr><tr><td>5</td><td>C</td><td>2</td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr></table></div></div>	Dest.	Line	Hops	A	A	1	B	—	—	C	C	1	D	D	1	E	D	2	F	D	2	G	D	3	H	D	4	I	D	5	J	D	5	K	D	6	L	D	6	M	C	4	N	C	3	O	C	4	P	C	2	Q	C	3	Dest.	Line	Hops	A	A	1	B	—	—	C	C	1	2	D	1	3	D	4	4	C	3	5	C	2							
Dest.	Line	Hops																																																																																				
A	A	1																																																																																				
B	—	—																																																																																				
C	C	1																																																																																				
D	D	1																																																																																				
E	D	2																																																																																				
F	D	2																																																																																				
G	D	3																																																																																				
H	D	4																																																																																				
I	D	5																																																																																				
J	D	5																																																																																				
K	D	6																																																																																				
L	D	6																																																																																				
M	C	4																																																																																				
N	C	3																																																																																				
O	C	4																																																																																				
P	C	2																																																																																				
Q	C	3																																																																																				
Dest.	Line	Hops																																																																																				
A	A	1																																																																																				
B	—	—																																																																																				
C	C	1																																																																																				
2	D	1																																																																																				
3	D	4																																																																																				
4	C	3																																																																																				
5	C	2																																																																																				
3a	<table><tr><th>Parameter</th><th>Leaky Bucket</th><th>Token Bucket</th></tr><tr><td>Token Dependency</td><td>Token independent.</td><td>Dependent on Token.</td></tr><tr><td>Filled bucket for token</td><td>When bucket is full, data or packets are discarded.</td><td>If bucket is full, token are discard not packets.</td></tr><tr><td>Packet transmission</td><td>Leaky bucket sends packets at constant rate.</td><td>Token bucket can send large burst of packets at faster rate.</td></tr><tr><td>Condition for packet transmission</td><td>In Leaky bucket algorithm, Packets are transmitted continuously.</td><td>In Token bucket algorithm, Packets can only transmit when there is enough token.</td></tr><tr><td>Token saving</td><td>It does not save any token.</td><td>It saves token for the burst of packet transmission.</td></tr><tr><td>Restrictive Algorithm</td><td>Leaky bucket algorithm is more restrictive as compared to Token bucket algorithm.</td><td>Token bucket algorithm is less restrictive as compared to Leaky bucket algorithm.</td></tr></table>	Parameter	Leaky Bucket	Token Bucket	Token Dependency	Token independent.	Dependent on Token.	Filled bucket for token	When bucket is full, data or packets are discarded.	If bucket is full, token are discard not packets.	Packet transmission	Leaky bucket sends packets at constant rate.	Token bucket can send large burst of packets at faster rate.	Condition for packet transmission	In Leaky bucket algorithm, Packets are transmitted continuously.	In Token bucket algorithm, Packets can only transmit when there is enough token.	Token saving	It does not save any token.	It saves token for the burst of packet transmission.	Restrictive Algorithm	Leaky bucket algorithm is more restrictive as compared to Token bucket algorithm.	Token bucket algorithm is less restrictive as compared to Leaky bucket algorithm.	04																																																															
Parameter	Leaky Bucket	Token Bucket																																																																																				
Token Dependency	Token independent.	Dependent on Token.																																																																																				
Filled bucket for token	When bucket is full, data or packets are discarded.	If bucket is full, token are discard not packets.																																																																																				
Packet transmission	Leaky bucket sends packets at constant rate.	Token bucket can send large burst of packets at faster rate.																																																																																				
Condition for packet transmission	In Leaky bucket algorithm, Packets are transmitted continuously.	In Token bucket algorithm, Packets can only transmit when there is enough token.																																																																																				
Token saving	It does not save any token.	It saves token for the burst of packet transmission.																																																																																				
Restrictive Algorithm	Leaky bucket algorithm is more restrictive as compared to Token bucket algorithm.	Token bucket algorithm is less restrictive as compared to Leaky bucket algorithm.																																																																																				

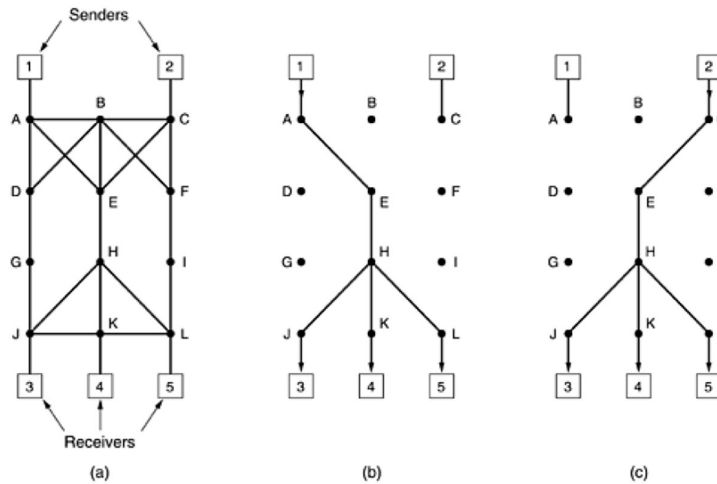
3b

RSVP—The Resource reSerVation Protocol

RSVP stands for "Resource Reservation Protocol." It is a signalling protocol used in computer networks to establish and maintain resource reservations for specific data flows, ensuring Quality of Service (QoS) guarantees in IP-based networks. RSVP is a crucial component of the Integrated Services (IntServ) architecture, which aims to provide end-to-end QoS for individual data flows.

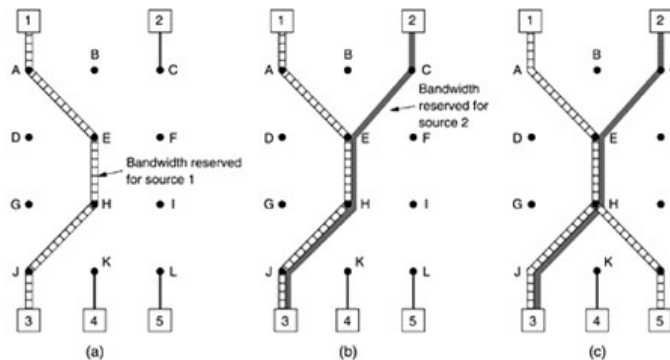
Exp-04

(a) A network. (b) The multicast spanning tree for host 1. (c) The multicast spanning tree for host 2.



Diag-02

(a) Host 3 requests a channel to host 1. (b) Host 3 then requests a second channel, to host 2. (c) Host 5 requests a channel to host 1.



Explanation -

4

Quality of Service (QoS) refers to a set of techniques and mechanisms that are used to manage and improve the performance of data transmission in a network. It is a crucial aspect of computer networking, especially in scenarios where different types of traffic need to be prioritized based on their importance, characteristics, or requirements.


Techniques (explain)

1. Overprovisioning
2. Buffering
3. Traffic Shaping
4. The Leaky Bucket Algorithm
5. The Token Bucket Algorithm
6. Resource Reservation
7. Admission Control
8. Proportional Routing
9. Packet Scheduling

02

08

5a	<div data-bbox="477 107 1166 344" data-label="Diagram"> </div> <p><u>Step 1</u> classify the packets into one of the four priority classes. This step might be done on the sending host (as shown in the figure) or in the ingress (first) router. The advantage of doing classification on the sending host is that more information is available about which packets belong to which flows there.</p> <p><u>Step 2</u> mark the packets according to their class. A header field is needed for this purpose.</p> <p><u>Step 3</u> pass the packets through a shaper/dropper filter that may delay or drop some of them to shape the four streams into acceptable forms.</p>	01 02
5b	<p>Congestion occurs</p> <p>Congestion Control in Virtual-Circuit Subnets</p> <p>Congestion Control in Datagram Subnets - Warning Bit, Choke Packets, Hop-by-Hop Choke Packets</p>	01 02 04

	R V College of Engineering Department of Computer Science and Engineering CIE - III: Question Paper			
Course: (Code)	Computer Networks(21CS45)			Semester: IV
Date: Sept 2023	Duration: 90 minutes	Staff: SCN/MM/PH/SUN/NS		
Name:	USN:	Section:	A/B/C/ISE/AIML	

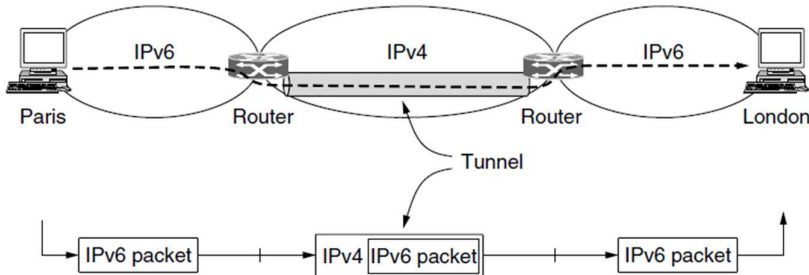
Sl. No	Questions	Marks	BTL	CO
1a	Compare and contrast Inter-domain Routing and Intra-domain Routing	04	3	5
1b	Briefly explain the concept of tunneling.	06	2	2
22a	Outline the different types of fragmentation.	05	1	4
2b	Describe the different types of ICMP messages.	05	2	2
3	How do IP addresses get mapped onto data link layer addresses, such as Ethernet? With a neat sketch explain the protocol used for this purpose.	10	2	1
4	With a neat diagram, explain the protocol used to determine the best paths for routing data packets between routers within an Autonomous System.	10	2	5
5a	Differentiate between UDP and TCP.	05	3	2
5b	Write a note on TCP Service Model.	05	1	2

COURSE OUTCOMES

CO1.	Apply the algorithms /techniques of routing and congestion control to solve problems related to Computer Networks.
CO2.	Analyze the services provided by various layers of TCP/IP model to build effective solutions
CO3.	Design sustainable networking solutions with societal and environmental concerns by engaging in lifelong learning for emerging technology.
CO4.	Exhibit network configuration, protocol usage and performance evaluation in networks.
CO5.	Demonstrate the solutions using various algorithms/protocols available to address networking issues using modern tools by exhibiting team work and effective communication.

	L1	L2	L3	L4	L5	L6	CO1	CO2	CO3	CO4	CO5
Marks	05	31	05	-	-	-	10	21	-	05	14

Computer Networks CIE III Scheme and Solution

Q No.	Answers	Marks																								
1a	<table border="1"> <thead> <tr> <th>Feature</th><th>Intra-domain Routing</th><th>Inter-domain Routing</th></tr> </thead> <tbody> <tr> <td>Scope</td><td>Within a single Autonomous System (AS)</td><td>Between different Autonomous Systems (ASes)</td></tr> <tr> <td>Purpose</td><td>Establish routes within the same network domain</td><td>Facilitate communication between different networks</td></tr> <tr> <td>Protocols</td><td>OSPF, RIP, IS-IS, EIGRP (for some vendors)</td><td>BGP (Border Gateway Protocol)</td></tr> <tr> <td>Metric Calculation</td><td>Typically uses link metrics (e.g., bandwidth)</td><td>Path attributes (e.g., AS path, preference, MED)</td></tr> <tr> <td>Administrative Control</td><td>Managed by a single administrative entity</td><td>Involves coordination between multiple administrative entities</td></tr> <tr> <td>Scalability</td><td>Suitable for large-scale networks</td><td>Handles global internet-scale routing</td></tr> <tr> <td>Convergence Speed</td><td>Generally faster convergence due to smaller network size and frequent updates</td><td>Slower convergence due to the complexity of inter-domain paths</td></tr> </tbody> </table>	Feature	Intra-domain Routing	Inter-domain Routing	Scope	Within a single Autonomous System (AS)	Between different Autonomous Systems (ASes)	Purpose	Establish routes within the same network domain	Facilitate communication between different networks	Protocols	OSPF, RIP, IS-IS, EIGRP (for some vendors)	BGP (Border Gateway Protocol)	Metric Calculation	Typically uses link metrics (e.g., bandwidth)	Path attributes (e.g., AS path, preference, MED)	Administrative Control	Managed by a single administrative entity	Involves coordination between multiple administrative entities	Scalability	Suitable for large-scale networks	Handles global internet-scale routing	Convergence Speed	Generally faster convergence due to smaller network size and frequent updates	Slower convergence due to the complexity of inter-domain paths	04
Feature	Intra-domain Routing	Inter-domain Routing																								
Scope	Within a single Autonomous System (AS)	Between different Autonomous Systems (ASes)																								
Purpose	Establish routes within the same network domain	Facilitate communication between different networks																								
Protocols	OSPF, RIP, IS-IS, EIGRP (for some vendors)	BGP (Border Gateway Protocol)																								
Metric Calculation	Typically uses link metrics (e.g., bandwidth)	Path attributes (e.g., AS path, preference, MED)																								
Administrative Control	Managed by a single administrative entity	Involves coordination between multiple administrative entities																								
Scalability	Suitable for large-scale networks	Handles global internet-scale routing																								
Convergence Speed	Generally faster convergence due to smaller network size and frequent updates	Slower convergence due to the complexity of inter-domain paths																								
1b	<p>A technique of internetworking called Tunneling is used when the source and destination networks of the same type are to be connected through a network of a different type.</p> <p style="background-color: yellow;">Tunneling is a way to move packets from one network to another. Tunneling works via encapsulation: wrapping a packet inside another packet.</p>  <p style="text-align: center;">Figure 5-40. Tunneling a packet from Paris to London.</p> <p>Diagram -1M Explanation -4M</p>	06																								
2a	<ol style="list-style-type: none"> Nontransparent Fragmentation: Nontransparent fragmentation refers to a method where the responsibility for packet fragmentation lies with the sending device or host. When a data packet is larger than the MTU of the outgoing network link, the sending device is responsible for breaking down the packet into smaller fragments that fit within the MTU size. Transparent Fragmentation: Transparent fragmentation, on the other hand, refers to a method where the network devices and routers in the path of the packet take responsibility for fragmentation. When a data packet is larger than the MTU of an outgoing network link, the intermediate network devices along 	04																								

the path will detect the oversize packet and fragment it into smaller pieces that fit within the MTU size of the outgoing link.

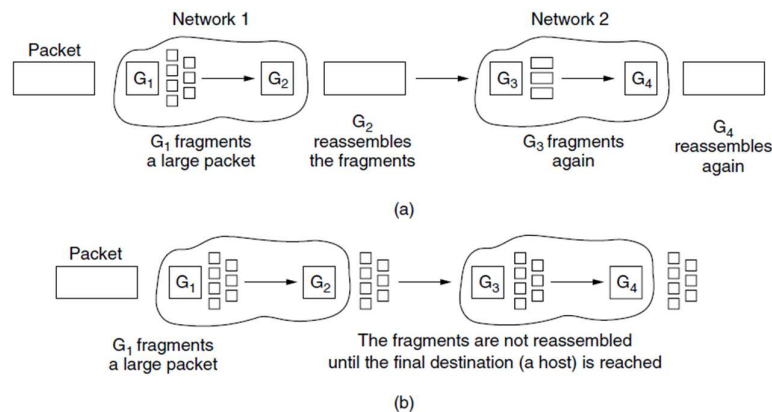


Figure 5-42. (a) Transparent fragmentation. (b) Nontransparent fragmentation.

2b

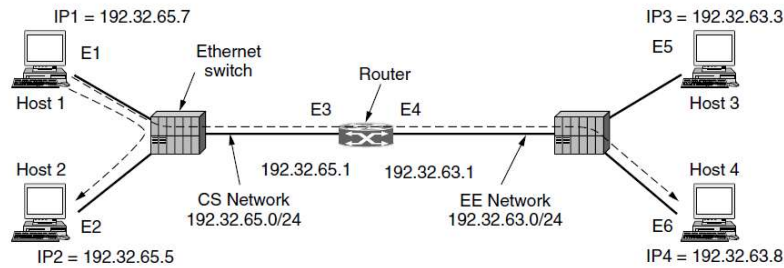
1. **Echo Request and Echo Reply (Ping):** ICMP Echo Request (Type 8) is used to request an "echo" from a target host, often referred to as "pinging." The target host responds with an ICMP Echo Reply (Type 0), indicating its availability and responsiveness.
2. **Destination Unreachable (Type 3):** This message type is used to indicate that a destination host or network is unreachable for various reasons, such as network congestion, unreachable host, or protocol unreachable.
3. **Time Exceeded (Type 11):** This message type is used to indicate that a packet has exceeded its time-to-live (TTL) value while traversing through routers. It is often used to detect routing loops or network issues.
4. **Redirect Message (Type 5):** A router can send an ICMP Redirect message to inform a host that a better route is available for a specific destination.
5. **Router Advertisement and Router Solicitation (Type 9 and Type 10):** These messages are used in the context of IPv6 to facilitate the autoconfiguration of network interfaces and to discover routers on the local network.
6. **Parameter Problem (Type 12):** This message is used to indicate that a problem has been detected with the IP header, such as an unrecognized option or an incorrect length.
7. **Timestamp Request and Timestamp Reply (Type 13 and Type 14):** These messages are used to request and respond with timestamps for diagnostic and timing purposes.
8. **Address Mask Request and Address Mask Reply (Type 17 and Type 18):** These messages are used to determine the subnet mask of a network, particularly in older versions of ICMP.

01

05

9. **Source Quench (Type 4):** This message type is used to indicate to a sender that its traffic is causing congestion and should slow down.

The Address Resolution Protocol



Frame	Source IP	Source Eth.	Destination IP	Destination Eth.
Host 1 to 2, on CS net	IP1	E1	IP2	E2
Host 1 to 4, on CS net	IP1	E1	IP4	E3
Host 1 to 4, on EE net	IP1	E4	IP4	E6

Figure 5-61. Two switched Ethernet LANs joined by a router.

Diagram- 03 M
Explanantion-07M

OSPF- Interior Gateway Routing Protocol

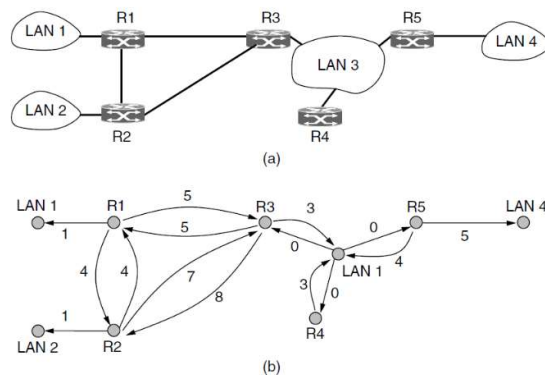


Figure 5-64. (a) An autonomous system. (b) A graph representation of (a).

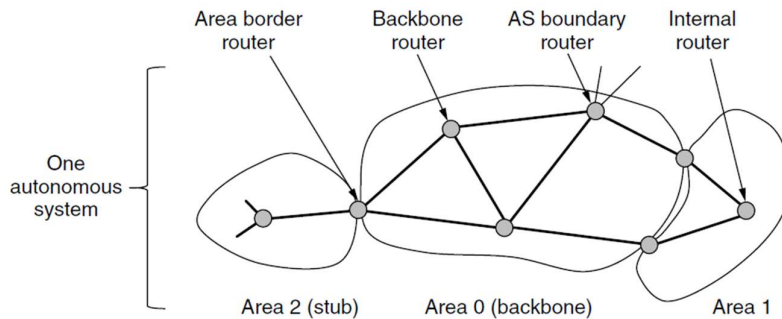


Figure 5-65. The relation between ASes, backbones, and areas in OSPF.

Diagram- 03 M
Explanantion-07M

5a	<table><tr><th>Aspect</th><th>TCP</th><th>UDP</th></tr><tr><td>Connection</td><td>Connection-oriented</td><td>Connectionless</td></tr><tr><td>Reliability</td><td>Reliable</td><td>Unreliable</td></tr><tr><td>Ordering</td><td>Maintains order of data</td><td>No guarantee of order</td></tr><tr><td>Error Checking</td><td>Yes (Checksum)</td><td>Limited (Checksum optional)</td></tr><tr><td>Flow Control</td><td>Yes (Congestion control)</td><td>No</td></tr><tr><td>Acknowledgments</td><td>Yes (Acknowledgment packets)</td><td>No acknowledgments</td></tr><tr><td>Header Size</td><td>Larger (20-60 bytes)</td><td>Smaller (8 bytes)</td></tr><tr><td>Overhead</td><td>Higher</td><td>Lower</td></tr><tr><td>Speed</td><td>Slower (due to overhead)</td><td>Faster (less overhead)</td></tr><tr><td>Use Cases</td><td>Reliable data transfer</td><td>Real-time applications, video streaming, online gaming</td></tr><tr><td>Example Protocols</td><td>HTTP, FTP, SMTP, SSH</td><td>DNS, VoIP, streaming, IoT</td></tr></table>	Aspect	TCP	UDP	Connection	Connection-oriented	Connectionless	Reliability	Reliable	Unreliable	Ordering	Maintains order of data	No guarantee of order	Error Checking	Yes (Checksum)	Limited (Checksum optional)	Flow Control	Yes (Congestion control)	No	Acknowledgments	Yes (Acknowledgment packets)	No acknowledgments	Header Size	Larger (20-60 bytes)	Smaller (8 bytes)	Overhead	Higher	Lower	Speed	Slower (due to overhead)	Faster (less overhead)	Use Cases	Reliable data transfer	Real-time applications, video streaming, online gaming	Example Protocols	HTTP, FTP, SMTP, SSH	DNS, VoIP, streaming, IoT	
	Aspect	TCP	UDP																																			
	Connection	Connection-oriented	Connectionless																																			
	Reliability	Reliable	Unreliable																																			
	Ordering	Maintains order of data	No guarantee of order																																			
	Error Checking	Yes (Checksum)	Limited (Checksum optional)																																			
	Flow Control	Yes (Congestion control)	No																																			
	Acknowledgments	Yes (Acknowledgment packets)	No acknowledgments																																			
	Header Size	Larger (20-60 bytes)	Smaller (8 bytes)																																			
	Overhead	Higher	Lower																																			
	Speed	Slower (due to overhead)	Faster (less overhead)																																			
	Use Cases	Reliable data transfer	Real-time applications, video streaming, online gaming																																			
Example Protocols	HTTP, FTP, SMTP, SSH	DNS, VoIP, streaming, IoT																																				
5b	<table><tr><th>Port</th><th>Protocol</th><th>Use</th></tr><tr><td>20, 21</td><td>FTP</td><td>File transfer</td></tr><tr><td>22</td><td>SSH</td><td>Remote login, replacement for Telnet</td></tr><tr><td>25</td><td>SMTP</td><td>Email</td></tr><tr><td>80</td><td>HTTP</td><td>World Wide Web</td></tr><tr><td>110</td><td>POP-3</td><td>Remote email access</td></tr><tr><td>143</td><td>IMAP</td><td>Remote email access</td></tr><tr><td>443</td><td>HTTPS</td><td>Secure Web (HTTP over SSL/TLS)</td></tr><tr><td>543</td><td>RTSP</td><td>Media player control</td></tr><tr><td>631</td><td>IPP</td><td>Printer sharing</td></tr></table>	Port	Protocol	Use	20, 21	FTP	File transfer	22	SSH	Remote login, replacement for Telnet	25	SMTP	Email	80	HTTP	World Wide Web	110	POP-3	Remote email access	143	IMAP	Remote email access	443	HTTPS	Secure Web (HTTP over SSL/TLS)	543	RTSP	Media player control	631	IPP	Printer sharing	05						
	Port	Protocol	Use																																			
	20, 21	FTP	File transfer																																			
	22	SSH	Remote login, replacement for Telnet																																			
	25	SMTP	Email																																			
	80	HTTP	World Wide Web																																			
	110	POP-3	Remote email access																																			
	143	IMAP	Remote email access																																			
	443	HTTPS	Secure Web (HTTP over SSL/TLS)																																			
	543	RTSP	Media player control																																			
	631	IPP	Printer sharing																																			
	Explanantion-04M																																					

USN

--	--	--	--	--	--	--	--	--	--

RV COLLEGE OF ENGINEERING®
(An Autonomous Institution Affiliated to VTU)
IV Semester B. E. Examinations Oct-2023
Common to CS / IS / AIML
COMPUTER NETWORKS

Time: 03 Hours**Maximum Marks: 100****Instructions to candidates:**

1. Answer all questions from Part A. Part A questions should be answered in first three pages of the answer book only.
2. Answer FIVE full questions from Part B. In Part B question number 2 is compulsory. Answer any one full question from 3 and 4, 5 and 6, 7 and 8, 9 and 10.

PART-A

1	1.1	What do you mean by fragmentation and where it is performed in the layered architecture?	01
	1.2	What is the difference between Point to Point and Multi-Point connection.	01
	1.3	Write the functions of the Network Layer.	01
	1.4	List the components of the Data Communication.	01
	1.5	_____ is the length of the <i>IPv6</i> address.	01
	1.6	Differentiate Interior and Exterior gateway protocol.	01
	1.7	What do you mean by Remote Procedure Call?	01
	1.8	_____ is the port number of the <i>HTTP</i> Protocol.	01
	1.9	Consider two Networks N_1 and N_2 , which use the <i>IPv6</i> addressing mode. However, intermediate routers between N_1 and N_2 use the <i>IPv4</i> addressing mode. Illustrate, how communication happens between the networks N_1 and N_2 ,	02
	1.10	Jack wants to share an important file with John, Identify and justify the application requirements of the same.	02
	1.11	Write the I-frame and S-frame format.	02
	1.12	Identify the properties of a Routing Algorithm.	02
	1.13	Illustrate the functioning of the <i>DHCP</i> protocol.	02
	1.14	Consider the following network with routers <i>A, B, C, D, E</i> and <i>F</i> . Construct the forwarding table for routers <i>A</i> and <i>E</i> .	02

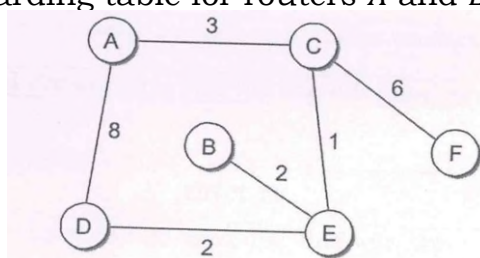
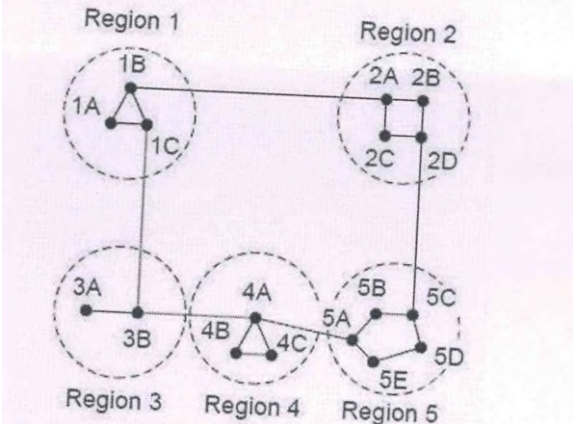


Fig 1.14

PART-B

2	a	Discuss Stop and Wait Protocol in detail.	08
	b	With an example illustrate various Transmission modes.	08
3	a	Analyze the problem associated with the Distance Vector Routing Protocol and provide the solution for the same.	08

b	<p>Consider the following hierarchical network and construct the Full routing Table and Hierarchical routing table for the figure 3b.</p>  <p>Fig 3b</p> <p>OR</p>	08
4	a	08
b	Compare the Virtual Circuits and Datagram Subnets. Consider any sample network and analyze the Multicast routing protocol.	08
5	a	08
b	Discuss Explicit Congestion Notification and Hop-by-hop Back Pressure in detail. How, Random Early Detection (<i>RED</i>) is useful in handling the congestion occurred in the networks.	08
	OR	
6	a	08
b	Summarize the use of Leaky Bucket and Token Bucket Algorithms in Traffic Shaping. Discuss Expedited Forwarding and List the advantages of it.	08
7	a	08
b	What makes internetworking is more difficult than operating within a single network. Discuss the IPv4 header Format with a neat diagram.	08
	OR	
8	a	08
b	Discuss the Border Gateway Protocol with the Propagation of <i>BGP</i> route advertisements. Discuss Internet Control Message Protocol (<i>ICMP</i>) along with its message types.	08
9	a	08
b	Illustrate the relationship between the network, transport and application layers. Discuss the connection establishment and connection release in <i>TCP</i> Protocol.	08
	OR	
10	a	08
b	Analyze the state diagram for a simple connection management scheme. Summarize the <i>TCP</i> Header Segment.	08