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RV COLLEGE OF ENGINEERING®

(An Autonomous Institution affiliated to VTU)

IV Semester B. E. Examinations Oct/Nov-2022

Computer Science and Engineering

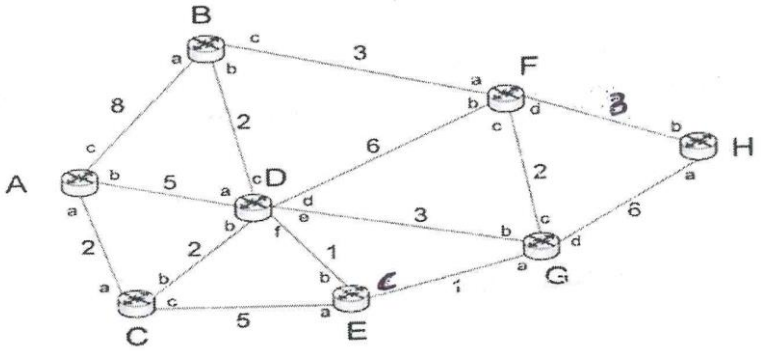
COMPUTER NETWORKS

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, 7 and 8 are compulsory. Answer any one full question from 3 and 4 & one full question from 5 and 6.

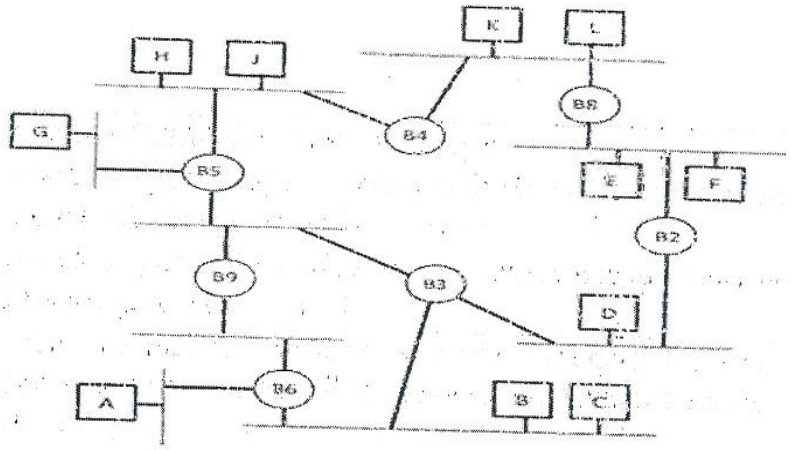
PART-A

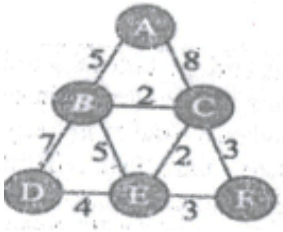
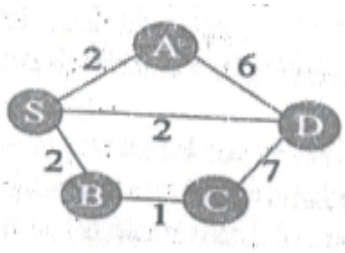
1	1.1	Specify the layers at which the following operate: a) Router b) Ethernet hub c) Bridge d) Web browser	02
	1.2	Several application layer protocols are there, HTTP, SMTP, IMAP, FTP and DNS. a) Which of these 5 protocols runs in a client server model? b) Which of these 5 protocols sends text-based messages? c) Which of these 5 protocols uses out of band communication? d) Which of these 5 protocols caches data to reduce the server loads?	02
	1.3	An organization is granted the block 202.16.170.0/24. The administrator wants to create 24 subnets. i) Find the number of addresses in each subset. ii) Find the first and last address in each subset.	02
	1.4	Suppose the following bits arrive at an HDLC receiver. What is the pay load of the frame? 0110 0111 1110 0101 1111 0110 1111 0101 0011 1111 0111 1101.	02
	1.5	My friend Ananya says that TCP header having a checksum field is redundant as IP header already has a checksum. Do you think Ananya is right? Yes/No. Justify your answer	02
	1.6	Draw the sink tree by reverse path forwarding for the following figure shown:  	02

	1.7	Packet switching and circuit switching are two ways of architecting data transfer in the core of a network. Suppose we have a simple 2-node network with a link in the middle connecting the 2 nodes. L users send data from one node to another through the link in the middle connecting the 2 nodes. L users send data from one node to another through the link in the middle. The bandwidth of the link is M bps. i) Give one difference between Packet switching and circuit switching. ii) Give the formula for the number of users N such a circuit switching network can serve (in terms of M and R)	02
	1.8	Show the shortest form of the following addresses: (a) 2340:1ABC: 119A:A000: 0000:0000:0000:0000 (b) 0000:00AA: 0000:0000:0000: 0000:119A: A231	02
	1.9	Convert the following IP address to binary and indicate its class: 111.56.45.78	02
	1.10	Consider a router containing a forwarding table as follows: Destination Prefix Interface 222.222.222.0/24 1 111.111.0.0/16 2 111.111.111.0/24 3 333.0.0.0/8 4 default 5 Now 4 packets come along with the following destination addresses. Based on the longest match principle, which interface will the 4 packets be forwarded to? a) 111.111.111.111 b) 222.222.222.222 c) 333.333.333.333 d)444.444.444.444	02

PART-B

2	a	Thae MAC protocol used in Ethernet is based on CSMA/CD, answer the following questions: i) Differentiate between 1 persistent and n persistent CSMA ii) Why is CSMA/CD not used for wireless links? iii) Describe how CSMA/CA works in principle? iv) What particular part of the mechanism is CSMA/CA is to ensure frames transmitted are indeed received by the receiver? What particular part of the mechanism in CSMA/CA is to reduce the bandwidth wastage due to collision?	10

	b	Consider the extended LAN shown below; circles correspond to learning bridges while squares are hosts. Assume all bridges were just turned on and no frames have been set.  i) Indicate which ports -if any- will be turned off in the final spanning tree. ii) What is the final configuration message being sent by B6? iii) Suppose the following frames (and only these frames) are sent are in the order indicated. For each frame, say which hosts will receive it. Frame | Recipients D sends a message to C | G sends a message to C | L sends a message to D |	06
3	a	i) Demonstrate the advantages of virtual circuits over data gram circuits ii) XYZ is starting a company aiming to provide teleconferencing service over the internet. With the service, multiple users can talk to and see each other interactively. Follow the steps below and come up with a suitable and feasible protocol stack: 1) List the application requirements. 2) With the application requirement, what transport layer service would be useful and why? 3) With the transport layer service of your pick, what functionalities you think are necessary to add at the application layer and why? 4) In addition to addressing, unicast routing, and forwarding, what additional network services do you see necessary and why?	10
3	b	Mention the steps in the Link State protocol. Harward implements the link-state routing protocol on a best- effort network with a non-zero packet loss rate. In an attempt to save bandwidth, instead of sending link-state advertisements periodically, each node sends an advertisement only if one of its links fails or when the cost of one of its links changes. The rest of the protocol remains unchanged. Will Hadward's implementation always converge to produce correct routing tables on all the nodes? Explicate.	06
		OR	

4	a	Consider the network shown in the Fig 4a. Each node implements Dijkstra's shortest path algorithm using the link costs shown in the figure.  Fig 4a i) Initially node B's routing table contains only one entry, for itself. When B runs Dijkstra's algorithm, in what order all nodes are added to the routing table? list all possible answers. ii) Now suppose the link cost for one of the links changes but all costs remain non negative. For each change in link cost listed below, state whether it is possible for the route at node B (i.e., the link used by B) for any destination to change, and if so, name the destination(s). whose routes may change. a) The cost of link (A, C) increases. b) The cost of link (A, C) decreases. c) The cost of link (B, C) increases. d) The cost of link (B, C) decreases.	10
	b	Anush implements the distance vector protocol on the network shown in Fig. 4b.  Fig 4b Each node has its own local clock, which may not be synchronized with any other node's clock. Each node sends its distance vector advertisement every 100 seconds. When a node receives an advertisement, it immediately integrates it. The time to send a message on a link and to integrate advertisements is negligible. No advertisements are lost. There is no HELLO protocol in this network. i) At time 0, all the nodes except D are up and running. At time 10 seconds, node D turns and immediately send a route advertisement for itself to all its neighbors. What is the minimum time at which each of the other nodes is guaranteed to have a correct routing table entry corresponding to a minimum cost path to reach D? Justify your answers. ii) If every node sends packets to destination D, and to no other destination, which link would carry the most traffic? Anush is unhappy that one of the links in the network carries a large amount of traffic when all nodes are sending packets to D. He decides to overcome this limitation with a New Vector Protocol (NVP). In NVP, S lies advertising a "path cost" for destination D that is different from the sum of the link costs along the path used to reach D. All the other nodes implement the standard distance vector protocol, not NVP. iii) What is the smallest numerical value cost that S should advertise for D along each of its links, to guarantee that only its own traffic for D uses its direct link to D? Assume that all advertised costs are integers; if two path costs are equal, one can't be sure which path will be taken.	06

5	a	I) Discuss the congestion control measurements in virtual circuits and data gram circuits. II) Suppose the capacity C of a link is 18. Assume that 4 sources – S1,S2, S3, and S4- are trying to send over the link at rates r1=2,r2=4, r3=5, and r4=8 respectively. What is the max-min fairness allocation? i) For each of the following, annotate it with "IS" if it applies to Integrated Services (IntServ). "DS" if it applies to Differential Services (DiffServ), and "BE" if it applies to best effort. (A given statement can apply to more than just one type of service). a) The service is provided end to end b) Among the three, requires the most state in routers. c) Is widely available in the Internet today d) Provides isolation and guarantees among aggregated flows but not individual corrections.	10
	b	Explicate delay jitter? Name two applications that are sensitive to delay jitter and What can the streaming media client do to compensate for the delay jitter? Discuss the impact in terms of delay loss when the playout delay is set too short?	06
		OR	
6	a	Demonstrate how token bucket algorithm solves the problems of leaky bucket algorithm, Computer A has 19.5MB to send on a network and transmits the data in a burst@6Mbps. The maximum transmission rate across routers in the network is 4 Mbps. If the computer A's transmission is shaped using leaky bucket, how much capacity must the queue in the bucket hold not to discard any data? (Show the working)	08
	b	Illustrate the two different types of fragmentation. An Ip router with a Maximum Transmission Unit (MTU) of 1500 bytes has received an IP packet of size 4404 bytes with an IP header of length 20 bytes. Compute the values of the relevant fields in the header of the third IP fragment generated by the router for this packet: MF bit, Datagram length and Offset.	08
7	a	I) RV college, CSE department has been allocated a class. A network address of 29.0.0.0. you need to create at least 20networks and each network will support a maximum of 160 hosts. Would the following two subnet masks Work? Showcase the same. Subnet masks: 255.255.0.0 and or 255.255.255.0 II) An IPv4 datagram has arrived with the following information in the header (in hexadecimal notation), answer the following 0 x 45 00 00 58 00 03 00 00 30 06 58 50 7C 4E 08 03 B4 0E 0F 09 a) Is the packet corrupted and are there any options? b) Is the packet fragmented and what is the size of the data? c) How many more routers can the packet travel to? d) What is the identification number of the packet? e) What is the source and destination IP address?	08
	b	Briefly describe the factors influencing the need to adopt IPv6 and replace IPv4 and demonstrate any two possible methods for enabling a smooth transition from IPv4 to IPv6. Briefly comment on their suitability.	08

8	a	TCP is a transport layer service that provides major functions. Based on TCP, address the following questions: i) In classic reliable data delivery mechanisms, packet losses are detected by timer timeout. Setting the timeout interval is a challenging task. Can you describe what will happen when the timeout interval is set too long? ii) In TCP, packet loses may be detected by a timeout or by receiving three duplicate acknowledgements, both events will trigger retransmissions. Why would the TCP use duplicate acknowledgements to trigger transmissions instead of simply waiting for timeout? Is it OK to remove the timeout mechanism and use three duplicate acknowledgements as the only way to detect packet loss? iii) Again, packet losses may be detected by a timeout or by receiving three duplicate acknowledgements, TCP's congestion control mechanism reduces window size 1 when the loss is detected by timeout and to its half when the loss is detected by duplicate acknowledgements. Why do you think TCP is designed with such difference? iv) The flow control and congestion control mechanisms in TCP are both to control the sending window size of the source. Which is the one that prevents the source from overwhelming the receiver's buffer? Which is the one that prevents the source from overwhelming the routers' buffer in the network? v) In the 3- way handshake mechanism for TCP's establishment or connection teardown? Why isn't it 2-way or 4-way?	08
	b	Suppose you are sending an email from Hotmail account to your friend, who reads his/her email from his/her mail server using IMAP. Briefy discuss how your email travels from your host to your friend's host. Also what are application layer protocols involved?	04
	c	Discuss the steps in fetching and displaying the webpages	04