

Indian Institute of Engineering Science and Technology, Shibpur
B.Tech CST 6th Semester Final Examinations, May 2023

Data Communication and Computer Network CS-3202

Full Marks: 50

Time: 3 hours

*Attempt mandatory question 1 and any five (5) from the rest (from 2 to 8)
All parts of the same question must be answered together*

1) Mandatory Question (Total Marks 20)

a) Assume that A and B are the only two stations on an Ethernet. Each has a steady queue of frames to send. Both A and B attempt to transmit a frame, collide, and A wins the first backoff race. At the end of this successful transmission by A, both A and B attempt to transmit and collide. What is the probability that B wins the second backoff race? Explain.

[3]

b) In classful addressing, find the Class of following IPv4 addresses

(i) 01000001 10101011 00001011 11101111, (ii) 190.5.51.121, (iii) 15.33.120.10

[2]

c) Each of the following IPv4 addresses belong to a block. Find the first and last usable IP address of each block – (i) 27.23.71.18/24 and (ii) 100.33.61.181/28

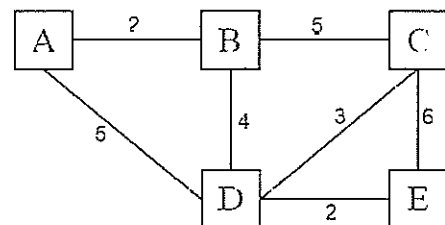
[2]

d) An ISP is granted the block 80.70.90.128/25 IPv4 address. The ISP needs to allocate address among three organizations, Org-A, Org-B and Org-C with 56, 22 and 30 IP addresses respectively. For every organization, find the following with brief explanation:

(i) Network Id, (ii) Netmask, (iii) Range of IP addresses, (iv) Directed broadcast IP address

[6]

e) A five-node autonomous system (AS) is shown using the following graph, where the nodes of the graph represent routers. The cost of the individual link between the routers is mentioned in the graph itself. The Link State Routing protocol is used as the intra-AS routing protocol, and each router shares LSP packet periodically. Answer the following questions:



(i) Mention initial Link State knowledge of every router upon completion of the neighbor discovery procedure. Also, mention the final routing table of each router after convergence.

(ii) Illustrate the step-by-step process of calculating the shortest path tree (using the *Dijkstra* algorithm) only from node E to the rest of the nodes.

[4+3]

2) Describe briefly the functionality of the following network devices:

a) Repeater, b) Hub, c) L2-switch, d) Router.

Also mention at which layer of the OSI model each device works.

[6]

- 3) A host S needs to send a message consisting of 7 packets to host R using a sliding window and Selective-Repeat/Reject ARQ error control strategy, with window size set to 3. Note that all packets are ready and immediately available for transmission.

a) Illustrate the data packets transmitted by S and the acknowledgments transmitted by R for sending the entire message, assuming no data packet or acknowledgment gets lost.
b) Now consider that every 4th packet that S transmits gets lost, but no acknowledgments from R ever get lost. Illustrate the process in this modified scenario.

[3+3]

- 4) a) What is Packet Switched network?
b) Mention the advantages and disadvantages of Virtual Circuit and Datagram approaches in Packet Switched network.

[2+4]

- 5) a) In the context of Distance Vector Routing, explain the algorithm used by a router A to update its routing tables on receiving the distance vector from another router B. The RIP protocol can be used as a reference to explain the algorithm.

b) What is Count-to-Infinity problem?

[4+2]

- 6) An IP datagram has arrived and following is the initial few bytes of the header (in hexadecimal) 47 00 00 E4 63 A8 20 96 04 11 7D 58 . . . Answer the following questions with brief justification:

- i. What is the header size?
- ii. Are there any options bytes in the packet?
- iii. What is the size of network layer payload?
- iv. What is the transport layer protocol used?
- v. Is the packet fragmented?
- vi. How many more routers can the packet travel to?
- vii. Do you have any other important observations?

[6]

- 7) Two hosts are connected in an Ethernet LAN and run TCP applications in a client-server model. The Client connects to the Server over a TCP connection. The Client site's initial sequence number (ISN) is 2500, and the Server's is 1000. The Client opens the connection, sends 3500 bytes of data, and closes the connection. Assume that the Server has a large enough receive buffer and no packet drop in the network.

What is the value of the sequence number (SN) and acknowledgment number (ACK) in each of the following segments sent by the Client and Server? Explain with brief justifications. You may represent the sequence of segments exchanges pictorially.

- i. The SYN segments during connection establishment
- ii. The data segment(s) during data transfer
- iii. The FIN segments during connection termination

[6]

- 8) Write short note on any 2 from the following:

- a) Dynamic Host Configuration Protocol (DHCP)
- b) User Datagram Protocol (UDP)
- c) Hierarchical Routing in IPSs

[3x2]