



AUTUMN END SEMESTER EXAMINATION-2023

5th Semester B.Tech

COMPUTER NETWORKS

IT 3009

(For 2022 (L.E), 2021 & Previous Admitted Batches)

Time: 3 Hours

Full Marks: 50

Answer any SIX questions.

Question paper consists of four SECTIONS i.e. A, B, C and D.

Section A is compulsory.

Attempt minimum one question each from Sections B, C, D.

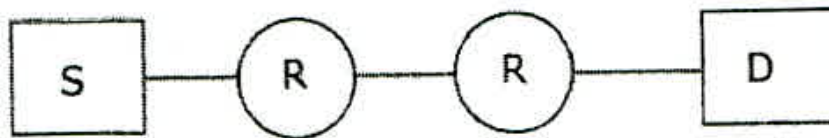
The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable and all parts of a question should be answered at one place only.

SECTION-A

1. Answer the following questions. [1 × 10]
 - (a) Suppose you wanted to do a transaction from a remote client to a server as fast as possible. Would you use UDP or TCP? Why?
 - (b) Assume a sender sends 6 packets: packets 0, 1, 2, 3, 4, and 5. The sender receives an ACK with ackNo = 3. What is the interpretation if the system is using GBN or SR?
 - (c) Consider four components that constitute delay for a packet network: queueing delay, processing delay, propagation delay, and transmission delay. Describe circumstances where the processing delay for one packet type varies significantly from the mean processing delay of a packet.
 - (d) In the transfer of file between PC and server, if the transmission rates along the path is 15Mbps, 50Mbps, and 16Mbps. Calculate the traffic of the network.

- (e) Discuss the impact of a stable end-to-end latency by explaining the difference between flow control and congestion control.
- (f) 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 transmission from S to D.



- (g) Identify the correct sequence (sequence are- HTTP GET request, DNS query, TCP SYN) in which the following packets are transmitted on the network by a host when a browser requests a webpage from a remote server, assuming that the host has just been restarted.
- (h) Consider a TCP client and a TCP server running on two different machines. After completing data transfer, the TCP client calls close to terminate the connection and a FIN segment is sent to the TCP server. Server-side TCP responds by sending an ACK which is received by the client-side TCP. As per the TCP connections state diagram (RFC 793), in which state does the client-side TCP connection wait for the FIN from the server-side TCP?
- (i) Consider an IP packet with a length of 4,500 bytes that includes a 20-byte IPv4 header and a 40-byte TCP header. The packet is forwarded to an IPv4 router that supports a Maximum Transmission Unit (MTU) of 600 bytes. Assume that the length of the IP header in all the outgoing fragments of this packet is 20 bytes. Assume that the fragmentation offset value stored in the first fragment is 0. The fragmentation offset value stored in the third fragment is _____.
- (j) What are the disadvantages of Stop and wait protocol.

SECTION-B

2. (a) What is the formula to calculate the number of redundancy bits required to correct a bit error in a given number of data bits? Explain an error correction technique on the following data: Data send 1001101 and data received 1000101. [4]
- (b) In a Stop-and-Wait system, the bandwidth of the line is 1 Mbps, and 1 bit takes 20 milliseconds to make a round trip. What is the bandwidth-delay product? If the system data packets are 1,000 bits in length, [4]
- (1) What is the utilization percentage of the link?
- (2) What is the utilization percentage of the link in (1) if we have a protocol that can send up to 15 packets before stopping and worrying about the acknowledgments?
3. (a) Consider the host mine.ja.net, with a local DNS server dns1.ja.net. [4]
- (i) Host mine.ja.net asks server dns1.ja.net to resolve the hostname yours.foobar.com. Assume there are no cached entries relevant to this request. Write down the steps taken to resolve yours.foobar.com and respond to mine.ja.net.
- (b) What is the CRC obtained by dividing Data word 100100 by the generator polynomial $x^3 + x^2 + 1$? [4]

SECTION-C

4. (a) Here are four options for improving web page performance. [4]
- Option 1: HTTP Caching with a Forward Proxy
- Option 2: CDN using DNS

Option 3: CDN using anycast

Option 4: CDN based on rewriting HTML URLs

You have been asked to help reduce the costs for networking at KIIT University.

The delivery of online courses has become a tremendous success – but this has led to a significant increase in network costs for the University.

You must select one of the options above to minimize server load. Compare the operation of each option and justify a selection that provides the finest granularity of control over load to the content servers and a selection that will serve each customer from the closest CDN server.

- (b) Consider different activities related to email. [4]

m1: Send an email from a mail client to a mail server

m2: Download an email from the mailbox server to a mail client

m3: Checking email in a web browser

Explain the application-level protocol used in each activity.

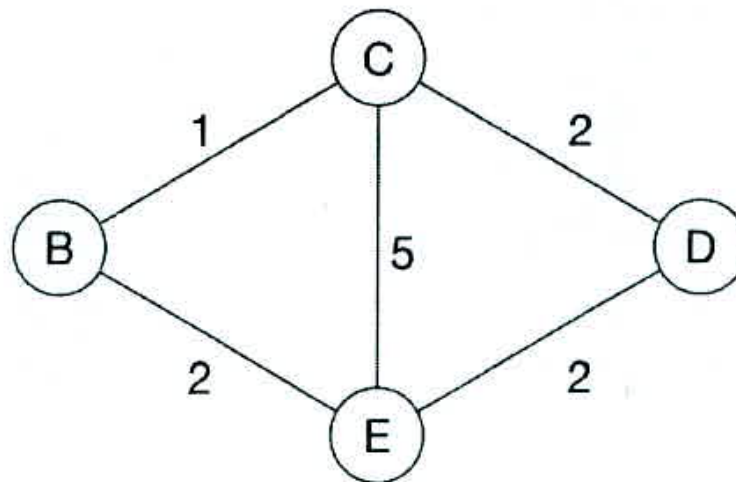
5. (a) ARP provides a service to the network layer, so it is [4]

part of the data link layer.” Whether he is correct or not explain.

- (b) An Internet Service Provider (ISP) has the following [4]

chunk of CIDR-based IP addresses available with it: 245.248.128.0/20. The ISP wants to give half of this chunk of addresses to Organization A and a quarter to Organization B while retaining the remaining with itself. Explain the process to find out a valid allocation of address to A and B.

6. (a) Consider the network shown in the figure below with four nodes. Cost links are shown in the diagram. Give the distance-vector routing tables for node C in the following two consecutive steps. [4]



Step 0: C knows the distances to its immediate neighbours and

Step 1: information from step 0 is exchanged as per the distance-vector algorithm.

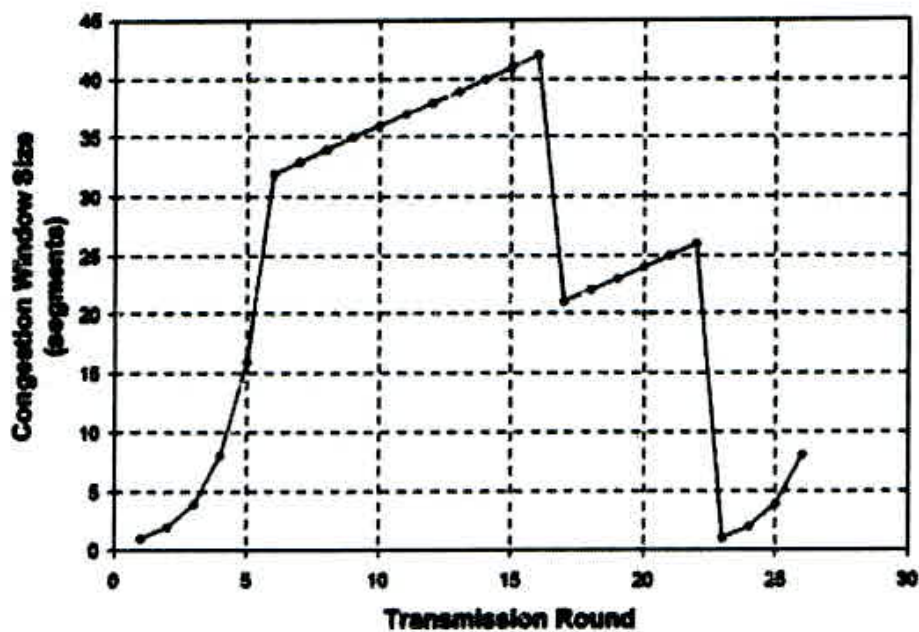
- (b) An organization is granted a block of addresses with the beginning address 14.24.74.0/24. The organization needs to have 3 subblocks of addresses to use in its three subnets: one subblock of 10 addresses, one subblock of 60 addresses, and one subblock of 120 addresses. Design the subblocks. [4]

SECTION-D

7. (a) Consider an instance of TCP's Additive Increase Multiplicative decrease (AIMD) algorithm where the window size at the start of the slow start phase is 2 MSS and the threshold at the start of the first transmission is 8 MSS. Assume that a timeout occurs during the fifth transmission. Find the congestion window size at the end of the tenth transmission. Explain the answer systematically. [4]

- (b) Consider the following plot of TCP window size as a function of time.

[4]



Assuming TCP Reno is the protocol experiencing the behavior shown above, answer the following questions. In all cases, you should provide a short discussion justifying your answer.

- What is the initial value of Threshold at the first transmission round?
- Identify the intervals of time when TCP congestion avoidance is operating.
- After the 16th transmission round, is segment loss detected by a triple duplicate ACK or by a timeout?
- Assuming a packet loss is detected after the 26th round by the receipt of a triple duplicate ACK, what will be the values of the congestion-window size and of Threshold?

8. (a) (i) Explain the single-bit parity error-detection code using a single byte of data. How many bit errors can this code detect?

[4]

(ii) Based on the single-bit parity error-detection code devise a new code to detect and correct a single 1-bit error in 4 bytes of data. How many parity bits do you require? You may assume that parity bits are error-free.

(b) Write short notes on any 2 of the followings:

[4]

- i) Piggybacking.
- ii) Checksumming technique.
- iii) Congestion control.
- iv) RIP and OSPF.
