


The LNM Institute of Information Technology
Department of Computer Science and Engineering
Computer Networks (CSE 332)
End Term

Max. Time: 180 minutes**Date:** 05/05/2018**Max. Marks:** 80

Instruction: The question paper has 4 pages and 7 questions. Each question must be answered in the answer book on a separate page and all sub-parts of a question should be answered together in a sequence. Otherwise, your answer may not get evaluated.

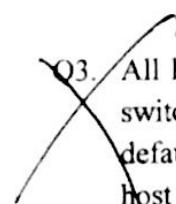
Q1. An organization is granted the block 130.34.12.64/26. It needs to have four subnets (viz subnet A, B, C, D): two subblocks of six addresses each, one subblock of 12 addresses and one subblock of 10 addresses. Design the subblocks by specifying

- The maximum number of valid hosts in each subnet. [2]
- Network address and broadcast address in each subblock. Write these addresses with subnet mask and also in x.y.z.t/n format. [8]
- How many addresses are left in reserve? What are their ranges? [2]

 d. Let us suppose that the subnetworks are connected to a router (R1) with four interfaces as shown in Figure 1. Design the forwarding table for the router. Show the forwarding process if a packet with destination address 130.34.12.83 arrives at R1. [4+2]

Q2. Consider a network with 6 routers R1 to R6 connected with links having weights as shown in Figure 2. All the routers use link state routing algorithm. [6+2 = 8]

- Calculate the forwarding tables for nodes R3 and R6.
- Which links in the network will never be used for carrying any data? Why?

 Q3. All hosts in the network given in Figure 3 are active. Hosts A, B & C are in one LAN using switches SW1 and SW2. All hosts have been configured with an IP address, mask and working default gateway address. Host A has not yet sent any traffic, so that its ARP cache is empty. Then host A connects to the web server (host E), using its web browser. Host A had sent no other traffic into the network before connecting to this server. Which of the following is/are true/false about what should occur in this scenario? Give reasons. [6]

- Host A will send an ARP request looking for server E's MAC address
- Host A will receive an ARP reply from R1, listing R1's MAC address
- Server E may be in the same subnet as Host A
- Host A will send an ARP request looking for SW1's MAC address
- Host A must know a route for server E's subnet before the successful web connections was made
- Server E will need to send an ARP to learn host A's MAC address

Q4. Answer the following: [2+2+2+2+4+4 = 16]

a. Bit-stuff the following frame payload:

000111111100111110100011111111110000111

b. Octets of an Ethernet frame in hexadecimal are given below. The preamble and start delimiter octets are not included. Identify the various fields.

00 00 66 33 B5 49 00 00 A7 12 36 B7 00 60 AA AA 03 00 00 00 08 00 48 45 4C 4C

c. A link has transmission speed of 106 bits/sec. It uses data packets of size 1000 bytes each. Assume that the acknowledgement has negligible transmission delay, and that its propagation delay is the same as the data propagation delay. Also assume that the processing delays at nodes are negligible. The efficiency of the stop-and-wait protocol in this setup is exactly 25%. What is the value of one way propagation delay (in milliseconds) for above case?

d. What is the maximum effect of a 2-ms burst of noise on data transmitted at 100kbps?

e. Suppose we want to transmit the message 11100011 and protect it from errors using the CRC polynomial $x^3 + 1$. (i) Use polynomial long division to determine the message that should be transmitted. (ii) Suppose the leftmost bit of the message is inverted due to noise on the transmission link. What is the result of the receiver's CRC calculation? How does the receiver know that an error has occurred?

An acknowledgment number in the Go-Back-N protocol defines the next packet expected, but an acknowledgment number in the Selective-Repeat protocol defines the sequence number of the packet to be acknowledged. Can you explain the reason?

Q5. A client residing on a host with IP address 123.45.67.8 with port number 52000 wants to connect with a HTTP server with IP address 210.32.43.5. The client opens a TCP connection and sends 100 integers (of 4 bytes each) in two TCP segments of equal size and closes the connection. Then the server computes the result based on this data and sends the result which is 32 bytes in size and closes the connection. The initial sequence numbers (ISN) from client and server sides are 4500 and 1000 respectively. Similarly the initial window size advertised by client and server are 300 and 500 respectively. [2+12 = 14]

a. Draw a TCP header format.

b. Depict the composition of each TCP segment communicated between the server and the client showing value of each field including status of flag bits. Ignore checksum calculation and assume piggyback communication whenever possible. Assume the communication is in a noiseless channel.

Q6. Answer the following. [3+4+3 = 10]

a. Explain Static, Active and Dynamic web documents with reference to client's request message.

- b. Explain the stages of email communication between two users, belonging to two different email servers, having email-ids as *abc@first.com* and *xyz@last.com*. Also state which protocols are used at what stage.
- c. A lost ACK may lead to deadlock in TCP connection. Explain how it is possible and discuss a solution to avoid it.

Q7. Consider Figure 4 showing plot of TCP congestion window size as a function of time. In this problem let's assume that the TCP sender is sending large files. Answer the following:
[1+1+1+1+1+1+2 = 8]

- a. Identify the intervals of time when TCP slow start is operating.
- b. Identify the intervals of time when TCP congestion avoidance is operating (AIMD).
- c. After the 16th transmission round, is segment loss detected by a triple duplicate ACK or by a timeout?
- d. What is the initial value of *ssthresh* at the first transmission round?
- e. What is the value of *ssthresh* at the 18th transmission round?
- f. During what transmission round is the 70th segment sent?
- g. 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 *ssthresh*?

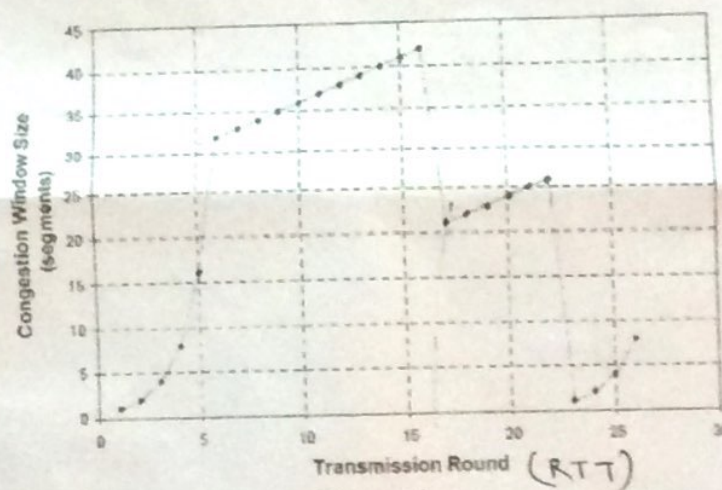


Figure 4