Jadavpur University
Bachelor of Information Technology
Part-1, 1st Semester Examination, 2009
Subject: Data Communication and Networking

Time: 3 Hours Full Marks: 100

Answer all questions

1. Answer any one question:
   a. (5+3+6+6)
      i. When transferring a file between two computers, two acknowledgement strategies are possible. In the first one, the file is chopped up into packets, which are individually acknowledged by the receiver, but the file transfer as a whole is not acknowledged. In the second one, the packets are not acknowledged individually, but the entire file is acknowledged when it arrives. Discuss the two approaches.

      ii. Is the data link layer necessary even if there were no bit errors or losses at the physical layer? Why or Why not?

      iii. Determine the total number of links needed for an N node connected as mesh topology, star topology, ring topology, and bus topology.

      iv. We need to use TDM and combine 25 digital sources, each of 100 kbps. Each output slot carries 1 bit from each digital source, but no extra bit is added to each frame for synchronization.

         a. What is the size of an output frame in bits?
         b. What is the duration of an output frame?
         c. What is the output data rate?

   b. (4+6+4+6)
      i. If the data link layer can detect errors between hops, why do you think that we need another checking mechanism at the transport layer?

      ii. What are the disadvantages of connectionless services? In spite of the disadvantages, why do you like to use connectionless services? What actions you would like to take to eliminate the problems, but still use connectionless services?

      iii. With a suitable diagram show how packet size affects the performance of a packet switched network.

      iv. Two channels, one with bit rate of 100 kbps, and another with a bit rate of 200 kbps, are to be multiplexed. How this can be achieved? What is the frame rate? What is the frame duration? What is the bit rate of the link?

2. Answer any one question:
   a. (5+3+7+5)
      i. Which of the following generator polynomial guarantees that a single bit error is caught? Explain your answer.
         - x^4
         - 1
         - x+1

      ii. What is the maximum effect of a 2-msec burst of noise on data transmitted at 2000 kbps rate?

iii. Consider a 100 kbps satellite link with 550 msec roundtrip propagation delay. A sliding window protocol with 5-bit sequence number is used on the link. The frame size is 1000 bits. Find out the percentage of time the sender is blocked.

iv. Assuming that each is correctly implemented, should the selective repeat protocol perform much better than go-back-n on a fiber optic link between two nodes about a half-mile apart?

b. (4+12+4)

i. A sender and a receiver use a Sliding window protocol with 5-bit sequence number. The sequence number starts from 0. What is the sequence number after sending 100 frames?

ii. To understand the effect of window size on the performance of sliding window protocol, consider an error free channel of 1 Mbps with 20 msec propagation delay. The frame size is 256 bytes with negligible header. Acknowledgement frames can be ignored. Calculate the performance of sliding window protocol for window sizes varying from 1 to 32 in steps of 5 and plot them.

iii. We almost always put the CRC at the end of a frame. What advantage do we get from this policy?

3. Answer any one question:

a. (10+4+3+3)

i. Consider a 30 station, 10 Mbps token passing bus system in which there are 15 active stations on average in any round of token passing. If the token is passed explicitly as a separate control packet with 10% size of the data frame, what are the channel utilizations and average token rotation time for the best and worst case of token passing? Consider the data frame to be 1500 bytes and the end-to-end propagation delay to be 10μs.

ii. Give the Manchester and Differential Manchester encoding for the following bit pattern.

1 0 0 0 0 1 0 1 1 1 1

iii. What advantage do you get by using binary exponential back off instead of fixed back off interval?

iv. Suppose a large network uses transparent bridges to connect all network segments. A computer on this bridged network sends out a packet to a device that is not present on the network. What do the bridges do with the packet?

b. (5+5+5+5)

i. The IT department of J.U. has 3 Ethernet segments, connected by two transparent bridges into a linear network. One day the network administrator quits and is replaced by a person from computer center who is an expert in token ring. The new administrator, noticing that the ends of the network are not connected, quickly orders a new transparent bridge and connects both loose ends to it, making a closed ring. What happens next?

ii. An Ethernet host joins the multicast group 225.128.47.81. The arrival of a frame with what MAC address will cause the NIC to interrupt the CPU?

iii. Prove the following statement:

"In slotted ALOHA, if the offered load is increased, the number of empties reduces but increases the number of collisions exponentially"

iv. In an 802.5 token ring, the sender removes its frame from the ring after the transmission is complete. What modifications would be necessary in the standard to have the receiver remove the frame instead? What would the consequence of this change be?

4. Answer any one question:

a. (10+3+2+2+3)

i. Suppose you are transferring a file of 10 MB over a network, which has a capacity of 20 MB and 50 msec one-way delay. The packet size used in network is 1 KB. The initial slow start threshold is set to 10 MB. What is the effective throughput achievable for TCP?

ii. What is delayed ACK and duplicate ACK?

iii. Give an example situation where PSH flag is used.

iv. What is the minimum size of TCP packet?

v. Calculate the maximum number of SACK blocks possible in a TCP SACK packet.

b. (4+7+6+3)

i. What do you mean by delay-bandwidth product? Do you think that delay-bandwidth product must be considered for designing new protocol?

ii. Consider a window controlled transfer over a connection with a RTT of 200 ms. The bottleneck link speed on the path is 2 Mbps. The data packet length is 1000 bytes. Assume that there is only one connection over the bottleneck link.

a. Determine the minimum window (in number of packets) required so that the bottleneck link is fully utilized (ignore the ACK transmission times).

b. If a window of 20 packets is used, determine the maximum possible utilization of the bottleneck link.

c. What happens if a window of 80 packets is used?

iii. What problem does TCP Reno have with multiple packet losses from a window? Give an example to illustrate.

iv. Lost TCP acknowledgements do not necessarily force retransmissions. Explain why?

5. Answer any one question:

a. (4+3+2+3+2+4+2)

i. Calculate the Goodput of a network that has an average packet length of 110 bytes, whose peak throughput is 9500 packets per second.

ii. Why do the different networks use different MTU?

iii. What is the destination physical address in an IP ARP request packet for device 192.168.44.64?

iv. Do you think the current IP addressing scheme could be redesigned to use device's hardware addresses instead of IP addresses? Explain your answer.

v. A network on the Internet has a subnet mask of 255.255.240.0. What is the maximum number of hosts it can handle?

vi. What is the difference between flow control and congestion control? What are the reasons for which congestion may occur in a network?

vii. Is there any difference between routing and forwarding?

b. (6+3+4+6)

i. The IP network 192.168.130.0 is using the subnet mask 255.255.255.224. What subnet are the following hosts on?

192.168.130.10, 192.168.130.67, 192.168.130.93, 192.168.130.199, 192.168.130.222, 192.168.130.250

ii. Can we use a single bit subnet? Explain.

iii. List two ways in which Distance Vector Routing and Link State Routing are the same. Now list two ways in which they differ.

iv. A router has the following routes in its routing table:

Route	Outgoing Interface
10.0.0.0/8	E0
10.0.0.0/16	E1
10.0.1.0/24	S0
10.1.1.0/24	S1
10.1.0.0/16	S0
10.1.0.0/24	E1
10.1.1.1/32	S2

A packet arrives at the router with a destination address of 10.1.1.1. Which interface will the router use to forward that packet?