Department of Electrical & Computer Engineering
Prairie View A&M University

Doctoral Preliminary Examination Fall 2015

Computer Networks
October 2015

Name of the student: _____

Signature of the student: _____

Date: _____

1	25	
2	25	
3	20	
4	18	
5	12	
Total	100	

Instructions:

This is a CLOSED BOOK Examination. You can use a calculator. You can access the Formulae sheet provided by the Graduate Coordinator who is administering the examination.

(25 pts) 1.

(a) (10 points) Mention some of the advantages of optical fiber over copper wire.

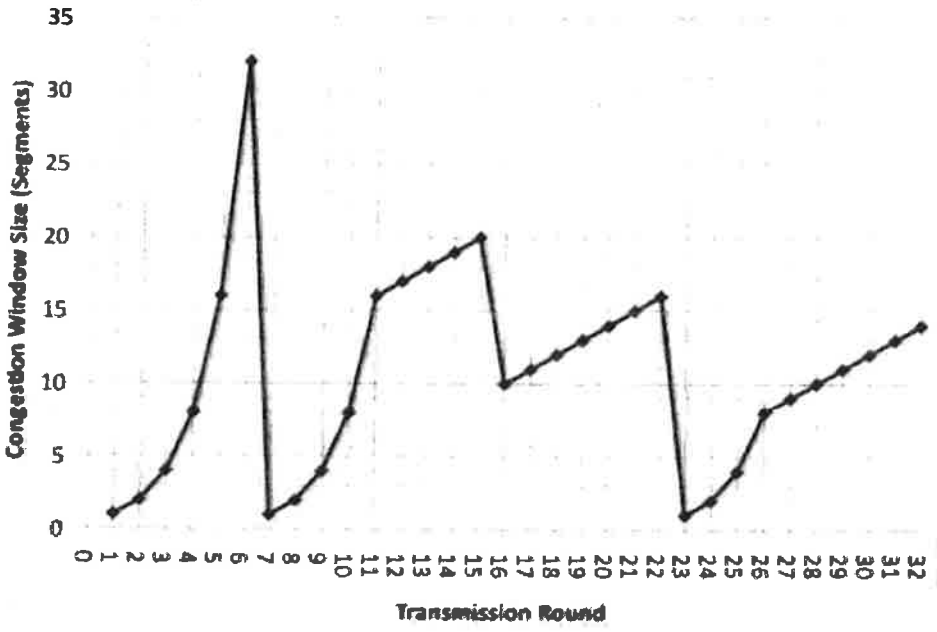
(b) (15 points) Two token rings operating at 16 Mbps are connected by a bridge. If each frame transmitted is 176 bits, calculate the number of frames/second the bridge can handle.

(25 pts) 2.

(a) (10 points) Describe the data link layer of the OSI model.

(b) (25 points) For the bit stream 01010110010, draw the NRZ coding. Repeat for Manchester coding.

(20 pts) 3. The Transmission Control Protocol (TCP) uses a method called congestion control to regulate the traffic entering a computer network. The behavior of TCP congestion control can be represented as a graph in which the x-axis indicates the time, and the y-axis indicates congestion window size. Please use the graph shown below to answer the following questions. Note that the graph does not explicitly show timeouts, but you should be able to figure out when timeouts happened based on the events shown.



(5 pts) (3.1). Slow Start: give some reason why slow start is used, and explain why it does a better job than congestion avoidance for that function. Identify the intervals of time in this graph when TCP slow start is operating.

(5 pts) (3.2). Congestion Avoidance: identify the intervals of time when TCP congestion avoidance is operating in this graph. Why should congestion avoidance be used instead of slow start during these intervals?

(5 pts) (3.3). After the 15th transmission round, is segment loss detected by a triple duplicate ACK or by a timeout? Explain why?

(5 pts) (3.4). Please summarize the mechanism used in TCP Congestion control.

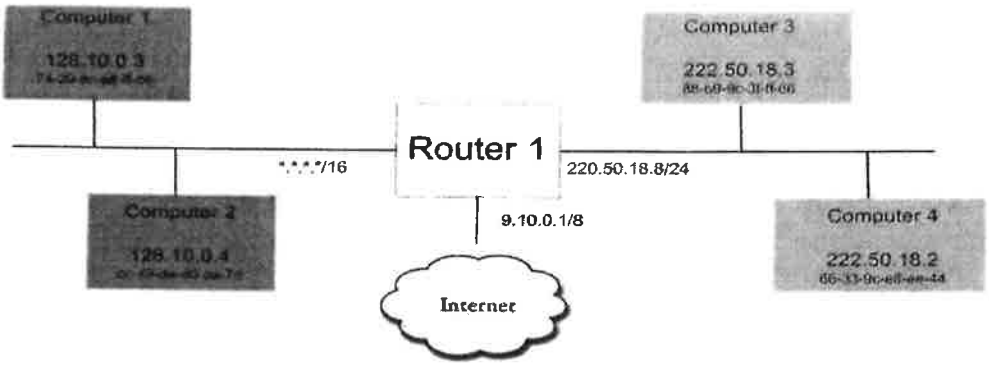
(18 pts) 4. Assume a local Internet Service Provider (ISP) has a Classless Inter-Domain Routing (CIDR) address block 135.244.160.0/21

(4 pts) (4.1) What is the address mask? What is the network address?

(6 pts) (4.2) How many hosts can the network accommodate? List the special address of such network. What will be the host address range?

(8 pts) (4.3) Suppose the ISP has 2 customers, customer A needs 15 IP addresses, customer B needs 288 IP addresses. Could you help the ISP (with the available address block 135.244.160.0/21) assign the IP addresses (address block) to the two customers, explain how.

(12 pts) 5. Consider the Network scenario below. Answer each question below



(4 pts) (5.1) Assign an IP address to the leftmost interface of Router 1, given that the NetID part of IP addresses are 16 bits (or slash notion /16).

(4 pts) (5.2) Suppose Computer 1 wants to send an IP datagram to Computer 2 and knows Computer 2's IP address. Must Computer 1 also know Computer 2's MAC address to send the datagram to Computer 2? If so, how does Computer 1 get this info? If not, explain why not.

(4 pts) (5.3) Suppose Computer 1 wants to send an IP datagram to Computer 3 and knows Computer 3's IP address. Must Computer 1 also know Computer 3's MAC address to send the datagram to Computer 3? If so, how does Computer 3 get this info? If not, explain why not.