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

Doctoral Preliminary Examination

Computer Networks
Spring 2017

Name of the student: _____

Signature of the student: _____

1	35	
2	15	
3	25	
4	12	
5	13	
Total	100	

Instructions:

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

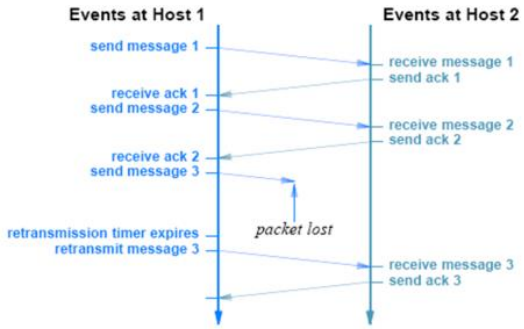
(35pts) 1.

(5 pts) (1.1) please briefly explain 5-layer Internet TCP/IP reference model. Sketch those layers and also sketch the associated packet (showing headers, payload, and Encapsulation concept).

(5 pts) (1.2) Assuming TCP/IP reference model is adopted, what layers of a protocol stack are used on a router? How about a host?

(5 pts) (1.3) Given an Ethernet frame, what fields must be examined to determine whether the frame carries a TCP segment.

(5 pts) (1.4) Please briefly explain the reason why "adaptive retransmission" is needed for TCP?



(5 pts) **(**1.5) Why do we need hierarchical routing in Internet? What is an autonomous system (AS)?

(5 pts) **(**1.6) Compare packet switching and circuit switching. Please explain why Internet is based on packet switching?

(5 pts) **(**1.7) The process of using a forwarding table to select a next hop for a given datagram is called "forwarding". To handle ambiguity that arises from overlapping address mask, Internet forwarding uses a "longest prefix match". Please briefly explain "longest prefix match" and fill the table accordingly following that algorithm.

Suppose the couple rows from a forwarding table are

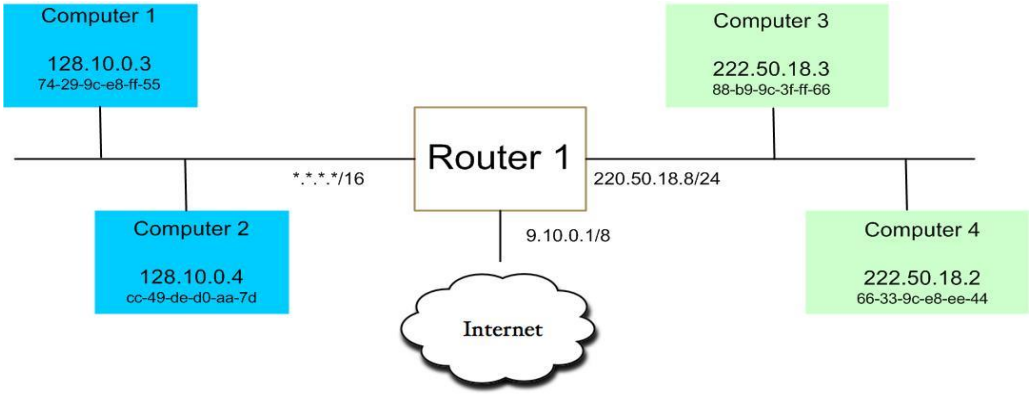
Prefix	Next hop
192.24.0.0/18	D
192.24.12.0/22	B

If the datagram has the following destination IP address, please fill in the next hop information (the first row is given as an example)

Destination IP address	Next hop
192.24.6.0	D
192.24.14.32	
192.24.54.0	

(15 pts) 2. Address Resolution

Consider the Network scenario below. Answer each question below *briefly*.



(5 pts) (2.1) Assign an IP address to the leftmost interface of Router 1, given that the subnet part of IP addresses are 16 bits (or slash notion /16).

(5 pts) (2.2) 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.

(5 pts) (2.3) 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 1** get this info? If not, explain why not.

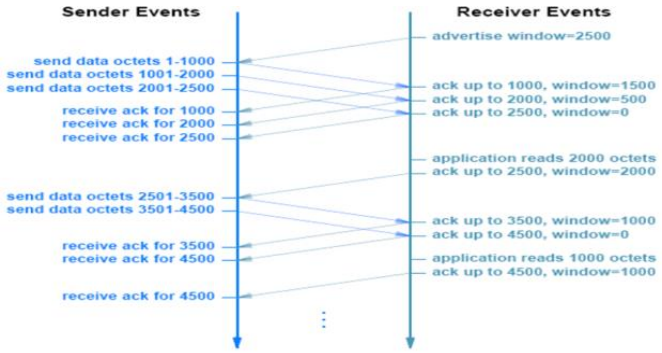
(25 pts) 3. Transport Layer

(5 pts) (3.1) please briefly explain the differencees between UDP and TCP.

(5 pts) (3.2) What is the difference between congestion control and flow control?

(5 pts) (3.3) Please briefly explain TCP congestion control, how to decide TCP congestion window size.

(10 pts) (3.4) Please briefly explain how to make the final decision of the window size for TCP based on Flow Control and Congestion Control (an example of flow control window is attached for reference).



Flow control

(12 pts) 4. IP Addressing

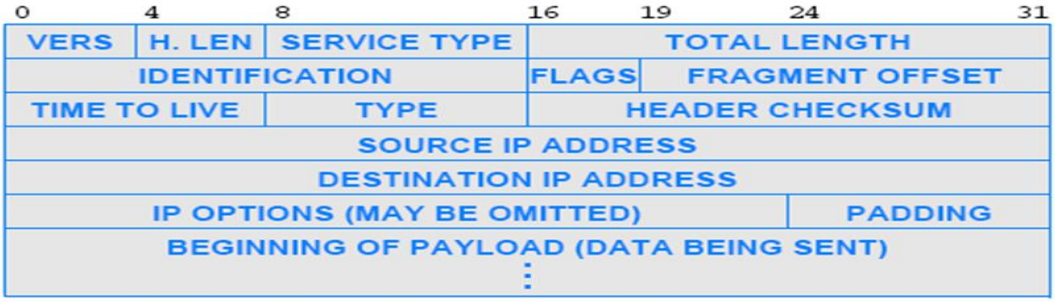
Assume a CIDR address 135.233.167.135/21 ,
(3 pts) (4.1) What is the address mask?

(3 pts) (4.2) How many hosts can that network accommodate? What will be the address range?

(6 pts) (4.3) Suppose the ISP has this address block. There are 2 customers applying for an address block. Customer A needs 21 IP addresses, customer B needs 288 IP addresses. Could you help the ISP assign the addresses to the two customers, explain how.

(13 pts) 5. IPv4 Datagram Format .

Consider the IPv4 datagram header as shown in the following figure, answer the questions.



(5 pts) (5.1) When router forwarding IP datagram, what fields could be changed by routers, please explain.

(8 pts) (5.2) At the IPv4 datagram header, there are 3-bit field (shown as FLAGS) with individual bits specifying whether the datagram is a fragment, while FLAG bit 0: Reserved, must be zero; FLAG bit 1: Don't Fragment (DF); FLAG bit 2: More Fragments (MF). And The FRAGMENT OFFSET specifies where in the original datagram the fragment belongs.

Consider a packet with a data size of 4,500 bytes, no options, and a header size of 20 bytes. Assume that the packet travel over a link with an MTU of 1,500 bytes. How many fragments are there? What would be the setting at FLAGS and FRAGMENT OFFSET fields respectively? Who will be responsible for reassemble?

Please fill the following table based on your answer.

Fragemet	**Total Bytes**	**Header Bytes**	**Data Bytes**	**FLAGs field setting**			**Fragment Offset (8 byte blocks)**
				Bit 0	Bit 1	Bit 2	