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

Doctoral Preliminary Examination

Computer Networks
Fall 2016

Name of the student: _____

Signature of the student: _____

1	25	
2	25	
3	25	
4	25	
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.

(25pts) 1.

(10 pts) **(**1.1) List the 5-layer in the TCP/IP Internet reference model, give a brief explanation of each.

(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) List and describe the three primary measures of network performance.

(5 pts) (1.4) Please give at least two technologies for (a) home Internet access and (b) Internet access in the Enterprise scenario, respectively.

(25 pts) 2. Suppose there are ten users sharing a 2Mbps link, and user 1 suddenly generate **one thousand 2000-bit packets**, while other users remain quiescent and do not generate packet.

(8 pts) (2.1) Assume under Time division multiplexing (TDM) circuit switching with 10 slots per frame and user 1 is allocated one time slot. How long does it take to transmit the **one thousand 2000-bit packets (2 million bits)** data for user 1?

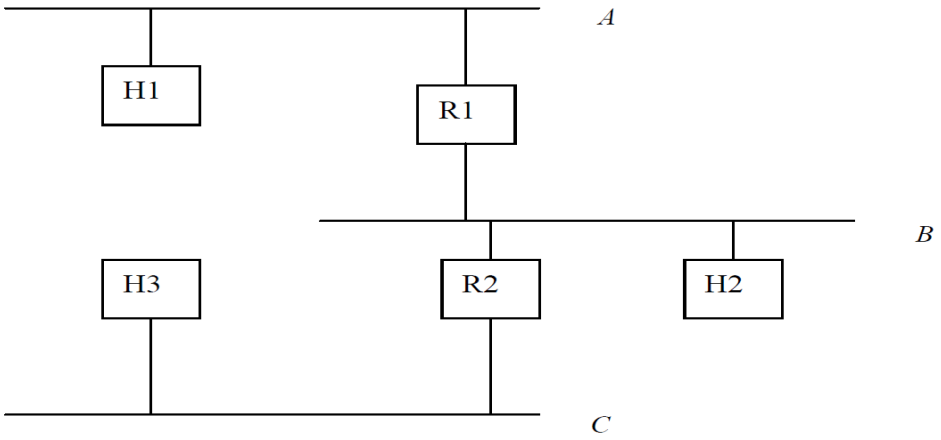
(8pts) (2.2) How about using packet switching, how long it will take to transmit the **one thousand 2000-bit packets (2 million bits)** data for user 1?

(9pts) (2.3) Briefly explain the difference between circuit-switching and packet-switching**.** Please explain what scheme is Internet based?

(25 pts) 3.

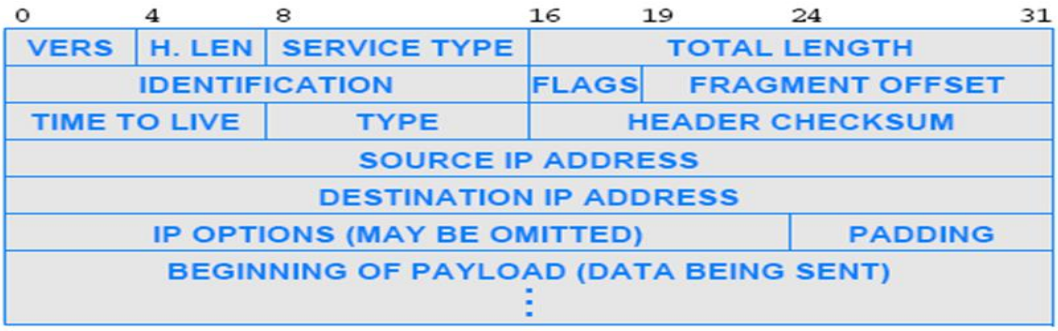
(8 pts) (3.1) The range of IP addresses blocks available for company M are 221.65.192.0/23 and a brief architecture of the network for company M is shown below. There are three Local Area Networks (LANs) (A, B, C), and each LAN need at most 254 IP addresses.

As the network administrator of company M, please find an assignment of unique subnet numbers and subnet masks for each LAN segment and unique IP addresses for each host and router interface shown in the figure below, where R1 and R2 are routers, H1, H2, and H3 are hosts.



(4 pts) (3.2) What are the key functions of the network layer?

(13 pts) (3.3) Based on the IP addresses you assigned on the previous sub-problem (3.1), assume that we are using protocol IPv4 and the header format of IPv4 is shown as follows:



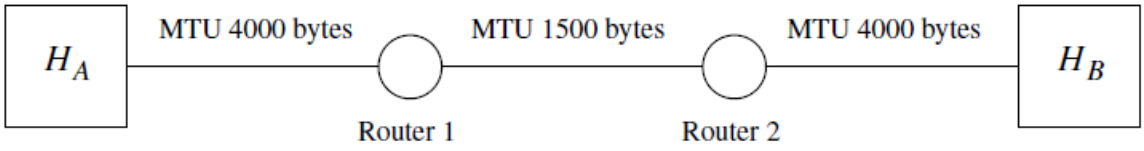
(4pts) (i) If Host H3 wants to send a packet to Host H2, what would be the SOURCE ADDRESS and DESTINATION ADDRESS for such packet?

(4pts) (ii) Assume that the packet will be forwarded by router R2, will R2 change the header field SOURCE ADDRESS and DESTINATION ADDRESS?

(5 pts) (iii) Fill the forwarding table for Router R2 below.

Destination	Address Mask	Next Hop

(25 pts) 4. The diagram below shows a TCP connection between Hosts H_A and H_B passing through networks with different values of Maximum Transmission Unit (MTU) shown. IPv4 is in use.



(10 pts) (4.1). H_A chooses a TCP segment size of **3000 bytes of data** (TCP and IP headers are each 20 bytes in size).
(i) Describe the way in which fragmentation takes place as H_A sends data to H_B. Explain the process, such as which router will perform the fragmentation?
(ii) Who will be responsible for reassembly?
(iii) Then fill the table below to show the arithmetic used to calculate fragment sizes.

Fragment #	Total Bytes	Header Bytes	Data Bytes	Fragment Flag	Fragment Offset (8 byte blocks)

(5 pts) (4.2). What are the differences between TCP and UDP if they both operate at the transport layer?

(5 pts) (4.3). What information is used by a process running on one host to identify a process running on another host?

(5 pts) (4.4). What three packets are exchanged between two hosts when establishing a TCP connection (Show the packet flows for TCP connection)?