UNIVERSITY OF RUHUNA

Faculty of Engineering

End-Semester 5 Examination in Engineering: December 2020

Module Number: EE5302   **Module Name: Computer Networks**

[Three Hours]

[Answer **all questions**, each question carries 10 marks]

Q1 a)   Explain the use of layering in computer networks.

[2.0 Marks]

b)   The following cases are to be responded using a protocol defined at one of the seven layers in Open System Interconnection (OSI) model. State with reasons which layer play the main role in each case.

i)   The network is used packet switching with packet length of 1024 bytes. A user wants to send a short message of 128 bytes each.

ii)   A user wants to get real-time data from a remote computer.

iii) A network offers a secure communication facility.

iv)   Traffic through a particular node is excessive thus congestion occurs in that part of the network.

v)   A user wants to have secure communication for selected messages only.

[6.0 Marks]

c)   Consider an application that transmits data at a steady rate (As an example, the sender generates an N-bit unit of data every k time units, where k is small and fixed). Also, when such an application starts, it will continue running for a relatively longer period of time. Would a packet-switched network or a circuit-switched network be more appropriate for this application? Explain why.

[2.0 Marks]

Q2 a)   With the assistance of annotated diagrams, explain the difference between Carrier Sense Multiple Access / Collision Detection (CSMA/CD) and CSMA/Collision Avoidance (CSMA/CA).

[3.0 Marks]

b)   Consider three LANs (Local Area Networks) interconnected by two routers, as shown in Figure Q2.

i)   Assign IP addresses to all end devices and interfaces.

Hint: Use addresses of the form 192.168.1.XXX for Subnet 1, addresses of the form 192.168.2.XXX for Subnet 2 and addresses of the form 192.168.3.XXX for Subnet 3.

ii) Assign Media Access Control (MAC) addresses to all adapters. Use your own method to name them.

iii) Suppose all Address Resolution Protocol (ARP) entries in tables are up to date. State all the steps in sending a data frame from Host E to Host B.

iv) Repeat part c), assuming that the ARP table in the sending host is empty whereas other tables are up to date.

[7.0 Marks]

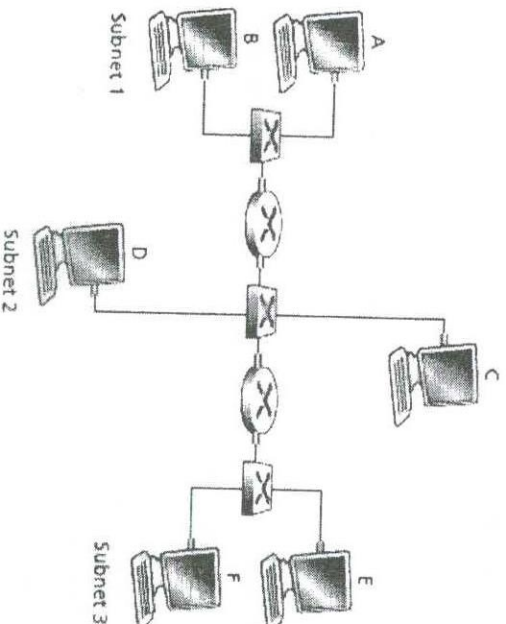

Figure Q2

Q3 a) Answer the following questions using your knowledge on the network layer of the OSI model.

i)   State 3 main characteristics of IP protocol and briefly describe each of them.

ii) State the difference between private and public IP addresses.

iii) Explain the difference between forwarding and routing in the network layer.

[3.0 Marks]

b) Apply the Dijkstra's link-state routing algorithm for the router topology given in Fig. Q3-I and fill the Table Q3-I. Accordingly, update the resulting forwarding table for router u in Table Q3-II. The numbers denoted on top of links between routers signifies the cost of the link.
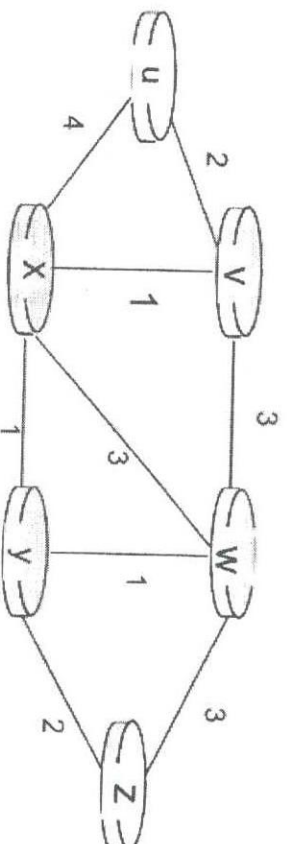

Figure Q3-I

Table Q3-I

Step	N'	D(v),p(v)	D(w),p(w)	D(x),p(x)	D(y),p(y)	D(z),p(z)
0	u	2,u				
1						
2						
3						
4						
5						

Table Q3-II

Destination	Outgoing link
v	
x	
y	
w	
z	

c)

i) Consider the IP address 172.24.216.0 and a subnet mask 255.255.248.0. Find the first and last usable host IP addresses in decimal form. What is the Broadcast address in decimal form? What is the number of valid hosts?

[3.5 Marks]

ii) You are given a network address of 192.168.10.0/24. Use variable length subnet masking to design a solution to accommodate host requirements of all the segments in the network given in Figure Q3-II. Calculate the network address and subnet mask for each segment. Provide explanations for your choices. (Assume that the relevant router interface is included in the number of hosts depicted at the figure).
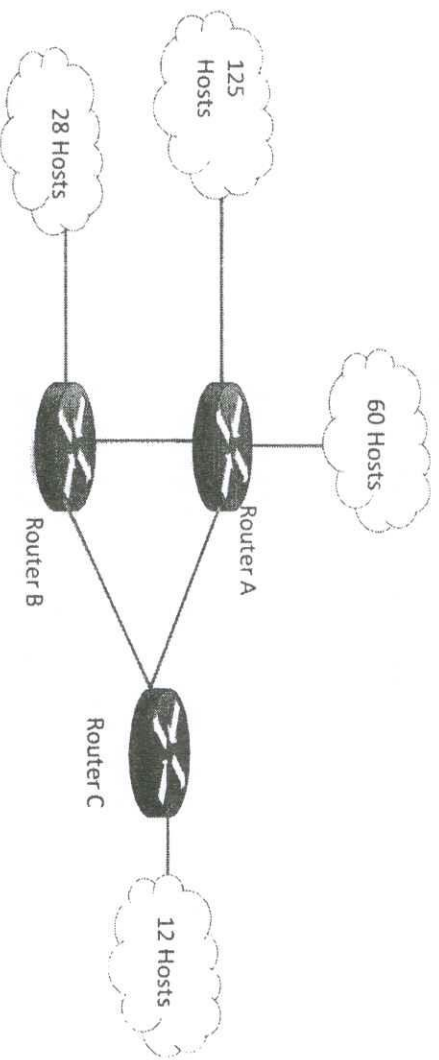

Figure Q3-II

[3.5 Marks]

Q4   a)   State 2 advantages and 2 disadvantages of using UDP as the transport layer
           protocol?   [2.0 Marks]

      b)   Briefly explain multiplexing and demultiplexing functions happening at the
           transport layer.   [2.0 Marks]

      c)   What are the parameters used to identify a TCP socket in connection-oriented
           demultiplexing?   [1.0 Mark]

      d)   Explain how TCP provides reliability for data transmissions at the transport
           layer? Can we provide reliability for an application using UDP, if yes, how?
                                                                                  [1.0 Mark]

      e)   Which type of applications are suited for TCP and UDP? Give 2 examples for
           each type.   [0.5 Marks]

      f)   Explain why flow control is required at the transport layer? How does TCP
           achieve flow control?   [1.0 Mark]
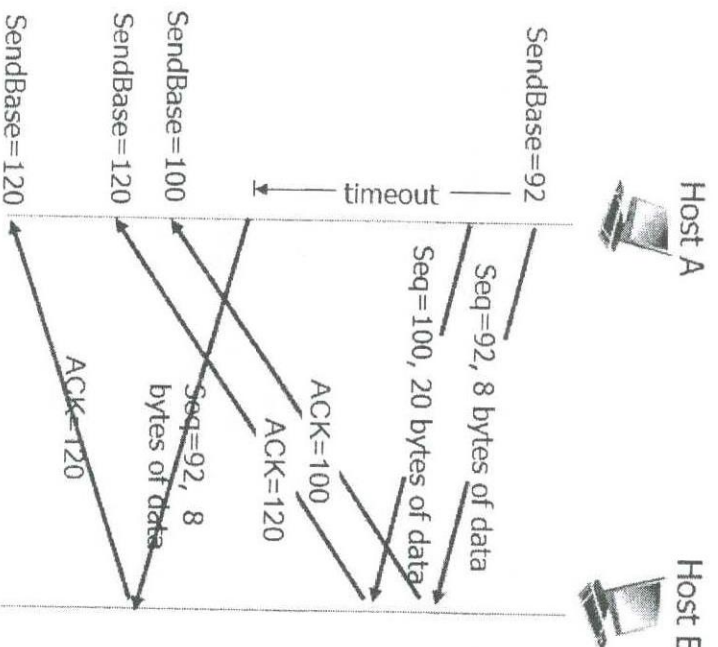
      g)   Answer the following questions based on the Figure Q4.

Figure Q4

      i)   What is Seq = 92 represent in the first arrow from Host A to Host B? Explain
            the use of such a number?

      ii)   What is ACK = 100 represent in the first arrow from Host B to Host A? What
            does the number 100 signify here?

      iii) In the third arrow from Host A to Host B, the same data stream with
            Seq = 92 is retransmitted. What is the reason for this?

iv) In the last arrow from Host B to Host A, the ACK = 120. What is the reason for using this number instead of ACK = 100?

v) Based on the feedback received from Host B, how can Host A avoid such unnecessary retransmissions in future?

[2.5 Marks]

Q5 a) What are the three main functions of the Application layer in OSI model?

[1.5 Marks]

b) What is peer to peer and client server application models? Give examples for each category.

[1.5 Marks]

c) When you type a web URL at the address bar of a browser, how does the network find out the destination IP address corresponding to that URL? Explain the process briefly.

[1.5 Marks]

d) What are the three main message types involved in Hypertext Transfer Protocol (HTTP)? Explain their usage.

[1.5 Marks]

e) How does a newly arrived client dynamically obtain an IP address from the network through Dynamic Host Configuration Protocol (DHCP)? Explain the steps involved in obtaining this IP address.

[1.5 Marks]

f) What is the other additional information that can be obtained from DHCP?

[1.0 Mark]

g) What are the advantages of using such dynamic address allocation compared to static allocation?

[1.5 Marks]