United International **University** (**UIU**)

Dept. of Computer Science and Engineering (CSE)

Final Exam Year: **2024** Semester: **Fall**

Course: **CSE 3711** Title: **Computer Networks (Section – B/C/E/F)**

Marks: **40** Time: **2 Hours**

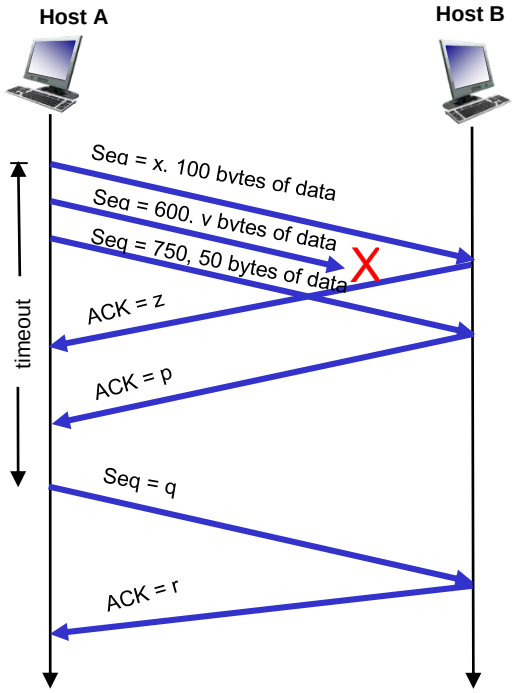
[Any examinee found adopting unfair means will be expelled from the trimester/program as per UIU disciplinary rules.]

There are **4 (Four)** questions. Answer **all 4 (Four)** questions.

Q.1 a) List **3 examples of features** provided by **TCP** that are not provided by **UDP**. **[2]**

b) List **3 distinct differences** between **Go-Back-N** and **Selective-Repeat** protocol. **Which one** makes more efficient use of **network bandwidth**? **Why**? **[2 + 1 + 1 = 4]**

c) Consider the **following diagram** that shows data transfer using TCP. Now, answer the **questions i, ii & iii**:



i. **Find** the values of **x, y, z, p, q & r**. **[3]**

ii. Suppose, the **first segment (Seq # x)** sent by host A to host B has **source port # 9999** & **destination port # 8080**. For the **second segment** sent from Host A to B, what are the **source** and **destination port number**? **[1]**

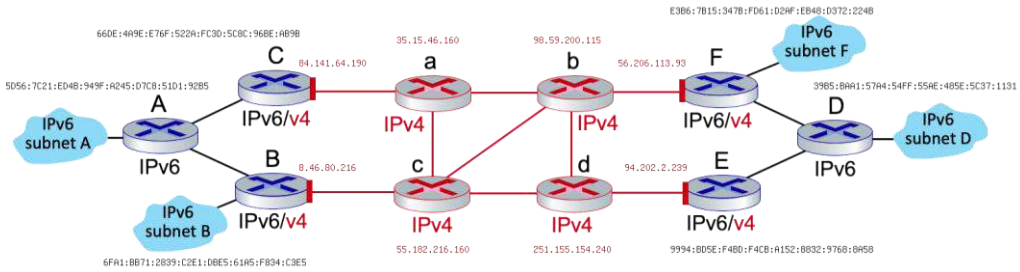
iii. **List source and destination port numbers** for all three segments/ACKs sent by host B to host A. **[1]**

d) What is **flow control** in transport layer? Illustrate with **an example**. **[2]**

Q.2 a) Why **routing** is considered '**global**' and **forwarding** is considered '**local**' in network layer functions? **Justify** with an **example**. **[2]**

b) Give **two significant reasons** explaining why fragmentation/reassembly is done only at the **end hosts**? Let an **IP datagram** with the following data and header sizes be sent through a network of **MTU 500 bytes**. Consider **IP header = 40 bytes**, **TCP header = 60 bytes**, and **application Data = 900 bytes**. With a diagram show different fragments including the **length, ID, *flag*** and **offset** values. **[1 + 2 = 3]**

c) Consider the network shown below which contains **4 (four) IPv6 subnets**, connected by a mix of **IPv6-only** routers, **IPv4-only** routers and **dual-capable IPv6/IPv4 routers**.



Suppose that a host of **subnet A** wants to send an **IPv6 datagram** to a host on **subnet F**. Assume that the forwarding between these two hosts goes along the path: ***A --> C --> a --> c --> b --> F*** **[0.5 x 4 = 2]**

i. Is the datagram being forwarded from **A** to **C** as an IPv4 or IPv6 datagram?

ii. Is the datagram being forwarded from **C** to **a** as an IPv4 or IPv6 datagram?

iii. What is the **source & destination address** of the datagram from **A** to **C**?

iv. What is the **source & destination address** of the datagram from **C** to **a**?

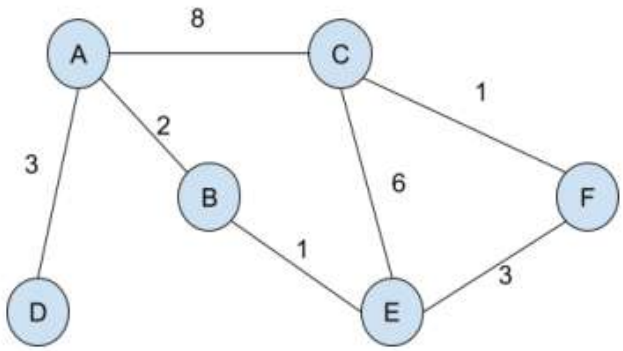
Q.2 d) Suppose, a NAT capable router has a single **public address 98.5.23.7,** which it uses for all communication with hosts in the Internet from the private network **172.16.100.0/24**. Assume that the router multiplexes the public address using ports starting from 8001 and stores the private-to-public IP/port # mappings in a **NAT translation table**. The LAN interface of the router has an IP address of **172.16.100.254,** which is the **default gateway** of that LAN.

i. Suppose, a host **172.16.100.5** with **port # 9000** sends a message to **132.239.8.45** with **port # 80**. Show all 4 (four) steps of NAT process specifying **source/destination IP/Port** in **each step**. **[2]**

ii. Now, assume 2 different hosts (172.16.100.5 & 172.16.100.6) communicates with a web server (100.10.10.11, port # 8080) and an FTP server (89.88.77.11, port # 21) simultaneously. Assume client port numbers as needed. **Show** the corresponding entries in the **NAT translation table**. **[2]**

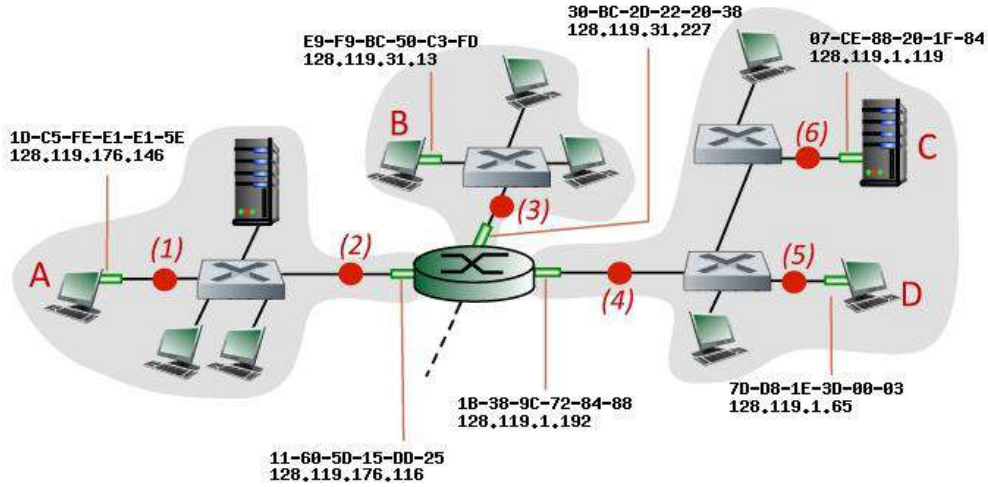
Q.3 a) What is the **fundamental difference** between the **Distance Vector** Routing Protocol and the **Link State** Routing Protocol? Briefly **explain**. **[2]**

b) Consider the network shown in the following diagram as a graph $G = (N, E)$, where $\boldsymbol{N}$ is the set of routers and $\boldsymbol{E}$ is the set of links, use **Dijkstra's link-state routing algorithm** to compute the least cost path from **node F** to all other nodes and show the resulting **forwarding table** for **F**. **Show all calculations** to get full credit. **[5]**



Q.4 a) Briefly describe **any 4 (four) services** provided by data link layer. **[2]**

b) Consider the figure below. The **IP and MAC addresses** are shown for nodes **A, B, C** and **D**, as well as for the **router's interfaces**. Consider **an IP datagram** being sent from node **D** to node **B**. Assume, **ARP tables** are **empty**.



i. Will **host D** run **ARP protocol**? **Why**? **[1]**

ii. If **host D** runs the **ARP protocol**, what would be the **source/destination IP addresses** and **source/destination MAC addresses** of the **ARP Request packet**? **Justify** your answer. **[2]**

iii. **Which node or nodes** will receive the **ARP request** sent by **D**? **[1]**

iv. **Which IP address** will send **ARP reply** to the ARP request sent by **D**? **[1]**

v. Give the **source and destination MAC addresses**, as well as the **source and destination IP addresses** encapsulated within the **Ethernet data frame** from D to B at points ***(5),(4)*** and ***(3)*** in the figure. **[2]**