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

There are **3 (Three)** questions. Answer **all 03 questions**. All questions are of values indicated on the right-hand margin.

Q1.

a) Describe two features of TCP that aren't available in UDP. [2]

b) What is a stop-and-wait protocol? What are the disadvantages of using stop-and-wait protocols for transferring data? [2]

c) With the aid of a diagram, display the main difference between GBN and Selective Repeat protocols. [2]

d) What is flow control in TCP? Why do we need flow control in TCP? [2]

e) Consider the following TCP data transfer sequence diagram:
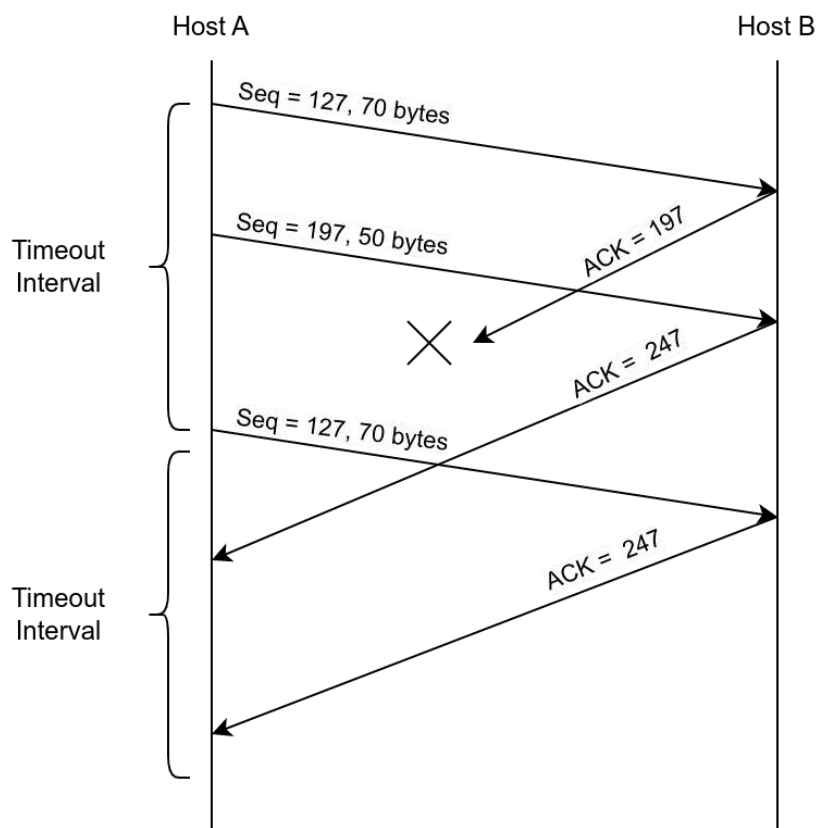
Now answer the following questions:

   i. What will be the new value of SendBase (Sequence number of next packet to be sent) at Host A after receiving the ACK #247? [1]

   ii. What will be the change in the given sequence diagram if the second ACK (#247) comes before the first timeout interval? Draw the diagram with changes [2]

   iii. If instead of the first ACK (#197), the first data segment (SEQ #127, 70 bytes) is lost, what will be the ACK number of the ACK sent by host B for the second segment (SEQ #197, 50 bytes) sent by Host A? [1]

f) Host A wants to create a new connection with Host B using TCP. There are 3 steps (step 1, 2, and 3) in the 3-way handshaking connection establishment phase. [1 x 3 = 3]

   iv.   In which steps SYN bit is 1?
   v.   In which steps ACK bit is 1?
   vi.   If the initial sequence number (Seq#) of Host A in Step 1 is 2023, what will be the acknowledgment number (ACK#) sent by Host B in Step 2?

Q2.

a) Write down the following IPv6 address in compressed format

   2001:0db8:0000:000b:0000:0000:0000:001A   [1]

b) Your host machine which is behind a NAT router, is running CSGO game on host port 3301 and FaceTime video chat on 3302 and its given private IP address is 10.0.0.1. The public IP address of the NAT router is 138.76.29.7 and it can use port number in [5001, 5999] for the NAT mechanism.

   Your friend Arthur's host machine (with private IP address 10.0.0.2), behind a different NAT router, is just running FaceTime on port 4501. The public IP address of this NAT router is 137.91.12.44 and it can use port numbers from [7001, 7999] for the NAT mechanism. You and Arthur are communicating via FaceTime. You are sending a packet (denoted by PKT) to Arthur.

   Now complete the following diagram for the packet flow:
   • how your NAT router will modify the PKT?
   • how Arthur's NAT router will interpret and modify and ultimately his host is going to see it?

   You need to show the ordered steps and source IP, source port, destination IP, and destination port for the packet for each of these steps.   [5]
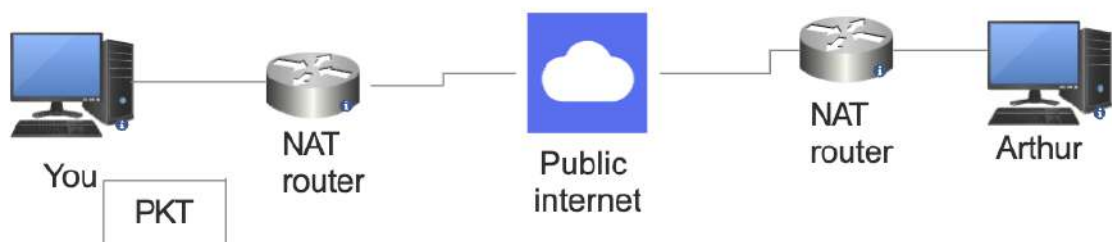
c) An IP router with a Maximum Transmission Unit (MTU) of 1500 bytes has received an IP packet of size 4000 bytes with an IP header of length 20 bytes. How will this packet fragmented? Show each of the fragmented packets' length, fragflag and offset fields. [2]

d) You are a newly connected host in a certain LAN and the IP address of the DHCP server is 223.1.2.5. Explain the four steps of the DHCP process for allocating IP address for your host with the aid of a diagram.

Now, there's another DHCP server with IP address 222.1.2.2. What will change in this scenario and how will you get a proper IP address? [3 + 2]

e) In the following diagram, each node represents routers and the edges link cost. The source router is S. Find the shortest link cost path from router S to every other router.

For each of these paths, show the path and path cost.
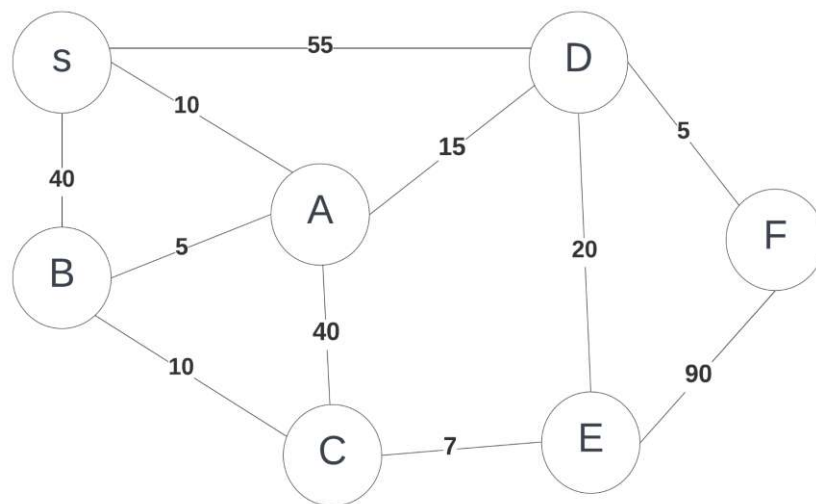
Now, A is a hostile router. You must avoid A for any path and you don't need to reach A either. You are only allowed to modify the link costs for the edges, you can't add or remove any links or routers. What and how will you modify to achieve this? [5 + 1]

Q3.

a) What is the purpose of an ARP table? [2]
b) The following figure shows four computers connected by a shared LAN connection.
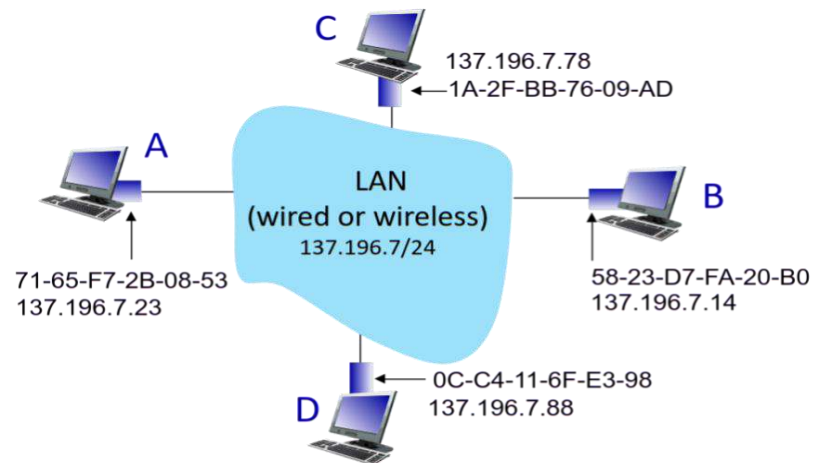
Suppose that PC A wants to communicate with PC D, but PC A only knows PC D's IP address. On the basis of the diagram shown above, using figures, show how PC A uses ARP to find the MAC address of PC D. [4]

←End of Paper – Thank You→