Name:
Student ID:

21/01/2022

Q 1	Q 2	Q 3	Q 4	Q 5	Total

BLG 433E – Computer Communications
2021 – 2022 FALL
Final Exam

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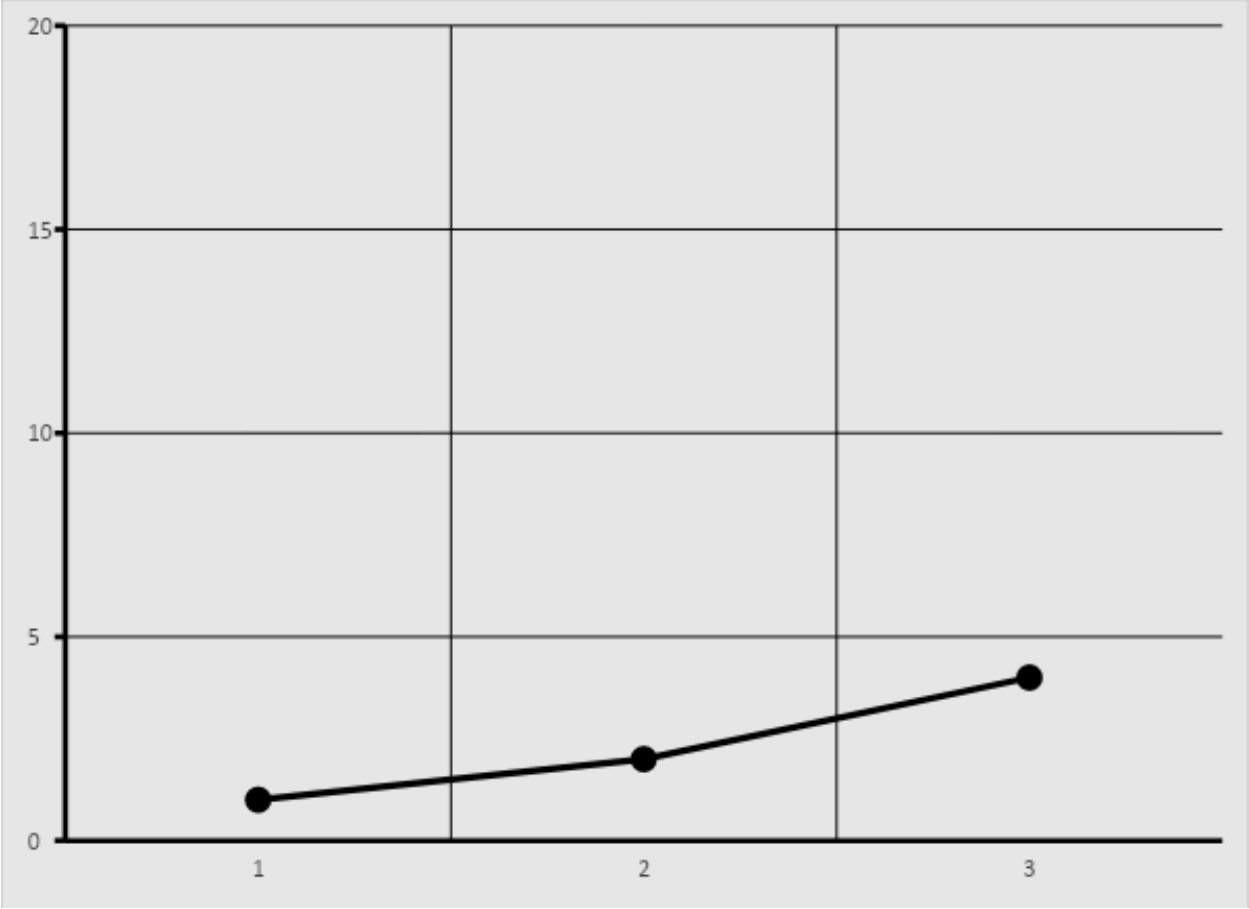
Please, answer the following questions.

Q1. (25pt.) A large number of consecutive IP addresses are available starting at 180.55.0.0. Suppose that four organizations, **A**, **B**, **C**, and **D**, request 32000, 4000, 8000, and 32000 addresses, respectively, and in **that order**. For each of these, give ***the first IP address*** assigned, ***the last IP address*** assigned, and the **subnet mask** in the **w.x.y.z/s** notation.

Q2. (20pt.) Please plot the congestion window for the TCP Reno with initial slow start window 20 while considering following events:

- Triple Duplicate Ack received **after** data of round 6 is sent.
- Triple Duplicate Ack received **after** data of round 9 is sent
- Timeout happened **after** data of round 10 is sent.



Q3. (10pt.) Please indicate whether the following statements are TRUE or FALSE.

- The receiver using the go-back-N protocol requires a buffer to work properly. TRUE / FALSE
- Any acknowledgement mechanism increases the latency of the protocol. TRUE / FALSE
- Increasing Maximum Transmission Unit (MTU) will always increase the throughput of the link. TRUE / FALSE
- Using physical shortest path for all connections may not be the best solution for entire network. TRUE / FALSE
- Using SDN it is possible to separate different flows even if their destination is the same. TRUE / FALSE

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Q4. (25pt.) A local network employs a protocol similar to Link State Routing Protocol with the following packet format defined to disseminate link information throughout the network by flooding.

Sender Node	Number of adjacent nodes (n)	Adjacent node 1	Distance to adj. node_1	Adjacent node 2	Distance to adj. node_2	. . .	Adjacent node n	Distance to adj. node n

List of packets arrived to the **node U** is given below for the network, which consists of six (7) nodes such as *X, Y, Z, V, T, W, U}*. Calculate the shortest paths from the **node U** to all other nodes by using Dijkstra algorithm and show the steps of the algorithm.

Z	2	X	8	Y	12

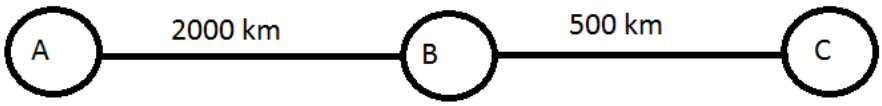
X	4	Z	8	Y	6	V	3	W	6
T	3	Y	7	V	4	U	2		

V	5	Y	8	X	3	W	4	U	3	T	4

W	3	X	6	V	4	U	4

Y	4	Z	12	X	6	V	8	T	7

Q5. (20pt.) In the figure below, frames are generated at node A and sent to node C through node B.



Based on the properties below:

- The data rate between A and B is 100 Kbps.
- The propagation delay on both links is 10 μsec/km.
- The lines are full duplex.
- All data frames are 1000 bits long; ACK frames are separate frames of negligible length.
- Between A and B, the go-back-n protocol is used.
- Between B and C, the stop-and-wait protocol is used.
- There is no error, and the processing delay at the nodes is negligible,
- The buffer space at B is limited with the requirements of the protocols.

a) What should be the **minimum window size** of the go-back-n protocol employed between A and B for the **best efficiency** (considering the transmission between A and B)?

b) Based on the window size calculated in (a) determine the ***minimum transmission rate*** required between nodes B and C so that the frames at node B are not lost.

Show all your work!