EAST WEST UNIVERSITY
Department of Computer Science and Engineering
B.Sc. in Computer Science and Engineering Program
Final Examination, Spring 2021 Semester, Set - II

Course: CSE405 Computer Networks, Section-4
Instructor: Dr. Maheen Islam, Associate Professor CSE Department
Full Marks: 50
Time: 90 Minutes

---

1 XYZ University is about to open a new School with three new departments A, B and C. The IPv4 address prefix of the new School is 128.232.176.0/21 and it is expecting each department to have the following number of hosts: **10 Marks**

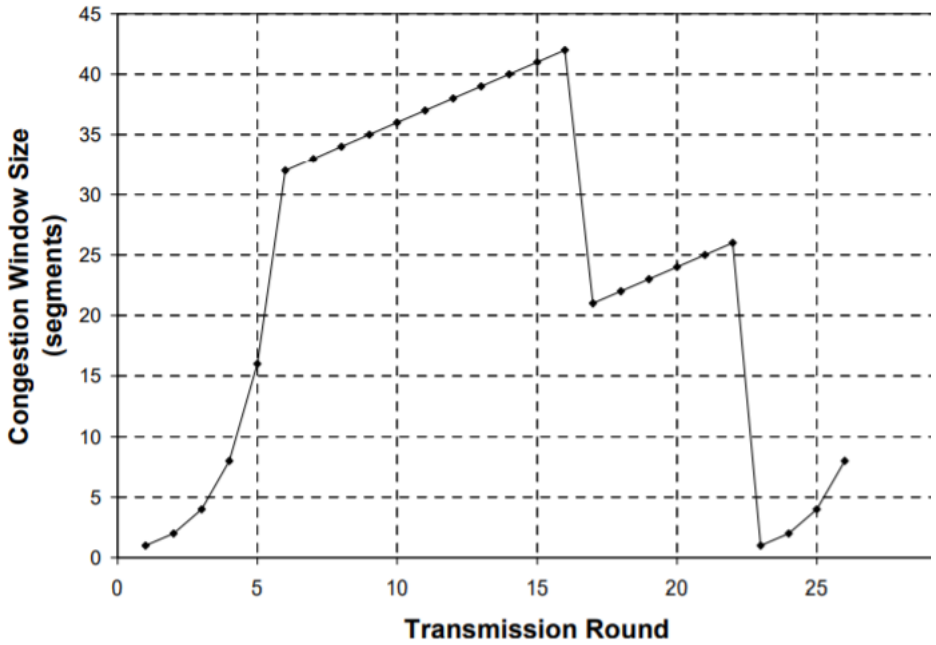
- Department A: between 60 and 100 hosts
- Department B: between 150 and 220 hosts
- Department C: between 20 and 30 hosts

a. The university wishes to allocate a subnet for each department. Give possible IPv4 subnet masks for each new department.

b. Later, the School opens a fourth department D with 30 hosts. Provide possible IPv4 subnet masks to accommodate all four departments.

c. Finally, the School opens a fifth department E of similar size to B. Provide possible IPv4 subnet masks to accommodate all five departments.

2 Consider the following plot of TCP window size as a function of time: **10 Marks**

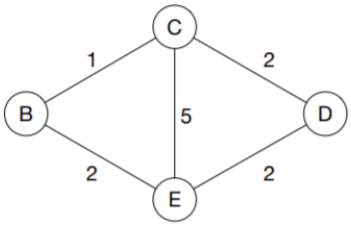


Assuming TCP Reno is the protocol experiencing the behavior shown above, answer the following questions.

a. Identify the intervals of time when TCP slow start is operating.
b. Identify the intervals of time when TCP congestion avoidance is operating (AIMD)
c. After the 16th transmission round, is segment loss detected by a triple duplicate ACK or by a timeout?
d. What is the initial value of ssthreshold at the first transmission round?
e. What is the value of ssthreshold at the 18th transmission round?
f. What is the value of ssthreshold at the 24th transmission round? (g) During what transmission round is the 70th segment sent?

g. Assuming a packet loss is detected after the 26th round by the receipt of a triple duplicate ACK, what will be the values of the congesion-window size and of ssthreshold?

3. Consider the network shown in the figure below with four nodes. Cost links are shown in the diagram. **10 Marks**



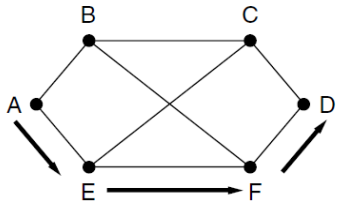
Give the distance-vector routing tables for node D in the following two consecutive steps.

a. Step 0: D knows the distances to its immediate neighbors and
b. Step 1: information from step 0 is exchanged as per the distance-vector algorithm.

4. Consider the host mine.ja.net, with a local DNS server dns1.ja.net. Note: dns1.ja.net is configured to use recursive DNS by default. **5 Marks**

a. Host mine.ja.net asks server dns1.ja.net to resolve the hostname yours.foobar.com. Assume there are no cached entries relevant to this request. Write down the steps taken to resolve yours.foobar.com and respond to mine.ja.net.
b. Describe the differences between this solution and one achieved using iterative DNS.

5. At high speeds or over long distances, many new packets may be transmitted after congestion has been signaled because of the delay before the signal takes effect. Consider the following network diagram, where a host connected to router *A is* sending traffic to a host connected to router *D 350* Mbps. Assume that the router D begins to run out of buffers and the end-to-end delay of a packet between these hosts is 42 msec. Now, discuss the consequence of sending the congestion notification signal through choke packet and hop-by-hop backpressure. Discuss which technique is more efficient and why? **5 Marks**



6. In a communication network, two hosts – H1 and H2 are communicating over a TCP connection. Assume, at time instant t1, Host H2 has already received from H1 all bytes up through byte 256. At time instant t2 and t3, H1 sends two segments to H2 back-to-back. The first and second segments contain 100 and 80 bytes of data, respectively. In the first segment, the sequence number is 257, the source port number is 205, and the destination port number is 80. H2 sends an acknowledgment whenever it receives a segment from H1. **10 Marks**

a. In the second segment sent from Host H1 to H2, what are the sequence number, source port number, and destination port number?
b. If the first segment arrives before the second segment, in the acknowledgment of the first arriving segment, what is the acknowledgment number, the source port number, and the destination port number?

c. If the second segment arrives before the first segment, in the acknowledgment of the first arriving segment, what is the acknowledgment number?
d. Suppose the two segments sent by H1 arrive in order at H2. The first acknowledgment is lost, and the second acknowledgment arrives after the first timeout interval.

Draw a timing diagram, showing these segments and all other segments and acknowledgments sent. (Assume there is no additional packet loss.) For each segment in your figure, provide the sequence number and the number of bytes of data; for each acknowledgment that you add, provide the acknowledgment number