National University of Computer & Emerging Sciences, Karachi

Spring-2018 CS-Department

MidTerm 2

2nd April 2018, 9:00 am – 10:00 am

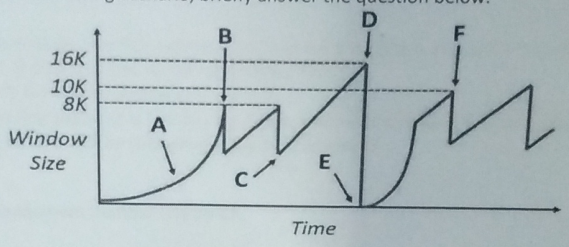
Course Code: CS-307	Course Name: Computer Networks
Instructor Names: Sufian Hameed, Faraz Idris Khan and Shoaib Raza	
Student Roll No:	Section No:

Instructions:

- Return the question paper.
- Be precise and to the point while answering the questions. Unnecessary details or wrong details will result in negative marking.
- All the answers must be solved according to the sequence given in the question paper.

Time: 60 minutes. **Max Marks**: 45 points

Question 1: Considering the following scenario, briefly answer the question below. **[12 points]**



a) Explain the event at B which occurs that causes the sender to decrease its window.
Triple Duplicate Ack

b) Does the event at B necessitate that the network discarded a packet? Explain.
No

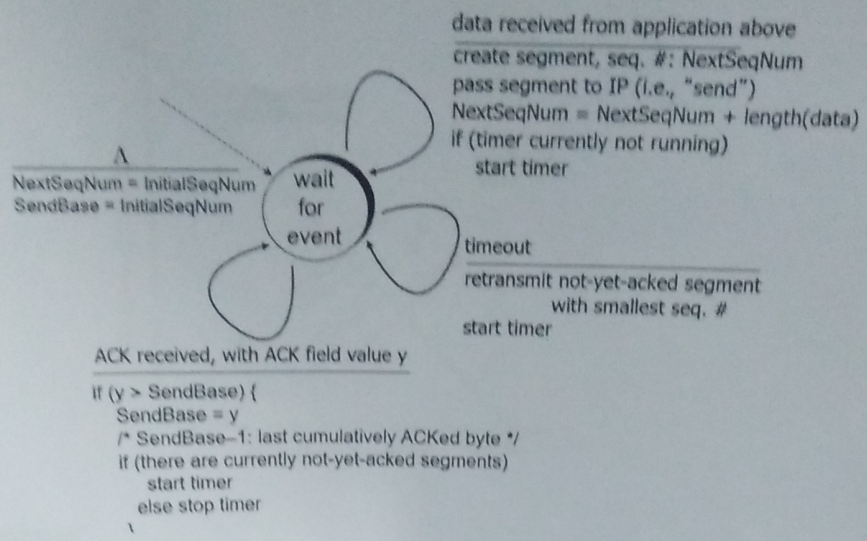
c) Explain the event at D which occurs that causes the sender to decrease its window.
Timeout

d) Does the event at D necessitate that the network discarded a packet? Explain
No

e) For a lightly-loaded network, is the event at D MORE likely or LESS likely to occur when the sender has multiple TCP segments outstanding?
LESS

f) Consider the curved slope labeled by point A. Why does the TCP window behave in such a manner, rather than have a linear slope? (Put another way, why would it be bad if region A had a linear slope?)
This "slow-start" period quickly discovers the maximum acceptable throughput that the path supports – otherwise, AI (additive increase) could take too long (each a full RTT).

Question 2: Given the template FSM (Finite State Machine) of a TCP sender with three different events (data received, timeout and ACK received) in the figure below please provide the details on the corresponding actions in the FSM. **[8 points]**



Question 3: Suppose Host A sends two TCP segments back to back to Host B over a TCP connection. The first segment has sequence number 61; the second has sequence number 72. **[4 points]**

a) How much data is in the first segment?
b) Suppose that the first segment is lost but the second segment arrives at B. In the acknowledgment that Host B sends to Host A, what will be the acknowledgment number?

Answer: a) 11 bytes
b) The acknowledgement number will be 61.

Question 4: TCP connection has currently estimated RTT of 30 ms with a deviation of 3 ms. What is the value of the retransmission timer after the next acknowledgement coming in after 28 ms? **[6 points]**

Solution:

EstimatedRTT = (1-α) * EstimatedRTT + α * SampleRTT
= 0.875x30 ms + 0.125x28 ms = 29.75 ms

DevRTT = (1-β) * DevRTT + β*|SampleRTT-EstimatedRTT|
= 0.75 x 3 ms + 0.25 x |28 ms – 29.75 ms| = 2.6875 ms

RTO = EstimatedRTT + 4*DevRTT
= 29.75 ms + 4x2.6875 ms = 40.5 ms

Question 5: Briefly explain at what point the TCP congestion control algorithm switches from the slow-start to the congestion avoidance phase? Is it possible that the algorithm is also switching back from the congestion avoidance to slow-start. Briefly explain your answer. **[5 points]**

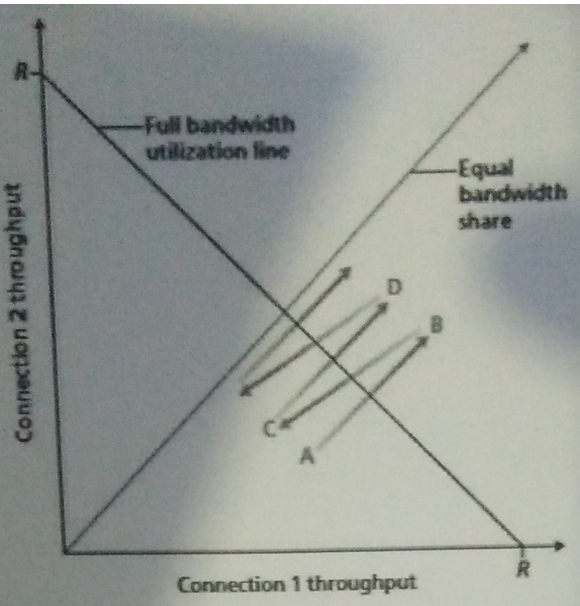
Solution: This transition happens when the slow-start threshold (sshtresh) is reached. Yes, in the case of packet loss or time out.

Question 6: Does UDP require a mechanism to estimate the RTT between sender and receiver? Briefly explain your answer? **[5 points]**

Solution: No, UDP does not perform retransmissions and, thus, does not require an RTT-based timeout timer.

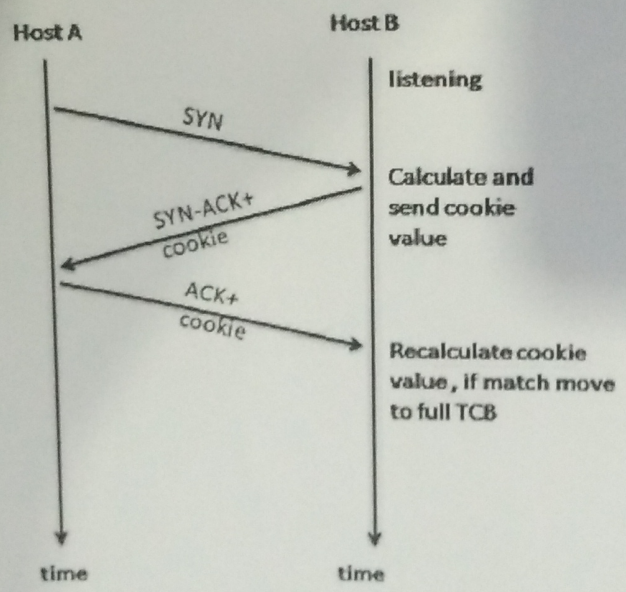
Question 7: Explain how the fairness is ensured if two TCP connections share the bandwidth between each other. **[5 points]**

By Using AIMD Control law



[BONUS QUESTION]

Illustrate via a time sequence diagram how SYN cookies can be used as a defense mechanism against SYN Flooding attack. **[5 points]**



BEST OF LUCK!

Cookie = Hash(SrcIP, dst IP, srcPort, dst port, secret)