CSc 361: Computer Communication and Networks
(Spring 2016, Feb. 5, 2016)

Midterm Exam 1

Name: Student ID:

Closed book exam. A calculator without any communication function is allowed. Please read all questions [marks] on all the **three** pages first. **Duration: 50 minutes**

1. Please check if the following statements are correct or not. Just answer yes or no.

   (a) Connection-oriented services must be reliable services. [0.5] No

   (b) Connection-less services cannot be reliable services. [0.5] No

   (c) In socket programming with UDP socket, the server program must call accept() to receive data from the client. [0.5] No

   (d) Assume that you are required to design a connection-oriented, reliable transport protocol that only needs to support half-duplex communication, i.e., the protocol only needs to deal with the following case: once the connection is established, DATA is always from one end host A to the other end host B, and ACK is always from B to A. Then this protocol only needs two-way handshake for connection establishment. [0.5] Yes

2. Assume that an end host received a TCP segment having the TCP header shown in Figure 1.

   Answer the following questions:

   (a) What is the size of the TCP header in terms of bytes? [1]

6 × 4 = 24 bytes

5416	25
4162801	
268124	
6 | 0	0
0x8C4F	0
timestamp: 0xFF736681	
stand on guard for thee	

Figure 1: The content in the received TCP header

(b) After the host received this segment, will the host immediately send the next TCP segment to its peer (i.e., the other end host)? If yes, what is the sequence number in the next TCP segment? If not, why? [1]

No, because the size of receive window is 0. TCP flow control does not allow the host to send segments to its peer.

3. The following question is on how TCP sets *TimeOutInterval*. Suppose that four sequentially measured *SampleRTT* values are 106 ms, 120 ms, 130 ms, 100 ms.

(a) Compute the *EstimatedRTT* after each of these *SampleRTT* values is obtained, using a value $\alpha = 0.25$ and assuming that the value of *EstimatedRTT* was 100ms just before the first of these four samples was obtained. [2]

$EstimatedRTT_1 = (1-0.25)*100 + 0.25*106 = 101.5$ ms

$EstimatedRTT_2 = (1-0.25)*101.5 + 0.25*120 = 106.125$ ms

$EstimatedRTT_3 = (1-0.25)*106.125 + 0.25*130 = 112.0938$ ms

$EstimatedRTT_4 = (1-0.25)*112.0938 + 0.25*100 = 109.07$ ms

(b) Compute the *DevRTT* after each of these *SampleRTT* values is obtained, using a value $\beta = 0.5$ and assuming that the value of *EstimatedRTT* was 5 ms just before the first of these four samples was obtained. [2]

$DevRTT_1 = (1-0.5)*5 + 0.5*|106-101.5| = 4.75$ ms

$DevRTT_2 = (1-0.5)*4.75 + 0.5*|120-106.125| = 9.3125$ ms

$DevRTT_3 = (1-0.5)*9.3125 + 0.5*|130-112.0938| = 13.609$ ms

$DevRTT_4 = (1-0.5)*13.609 + 0.5*|100-109.07| = 11.3398$ ms

(c) Computer the TCP *TimeOutInterval* after each of these samples is obtained. [2]

$TimeoutInterval_1 = 101.5 + 4*4.75 = 120.6$ ms

$TimeoutInterval_2 = 106.125 + 4*9.3125 = 143.375$ ms

$TimeoutInterval_3 = 112.0938 + 4*13.609 = 166.53$ ms

$TimeoutInterval_4 = 109.07 + 4*11.3398 = 154.43$ ms

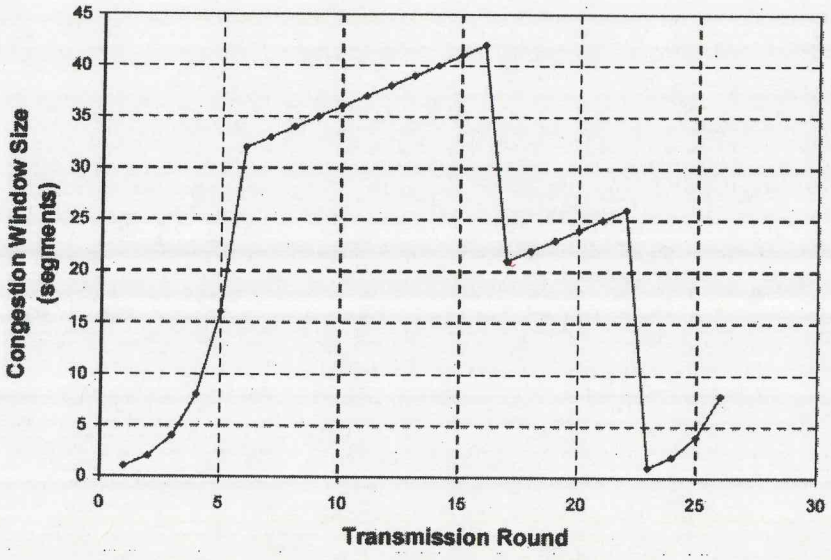

Figure 2: TCP window size as a function of time

4. Assume that TCP Reno is used. Consider the plot of TCP congestion window size as a function of time in Figure 2:

   (a) Identify the intervals of time (in terms of transmission round) when TCP slow start is operating. [1]

   1-6 and 23-26.

   (b) Identify the intervals of time (in terms of transmission round) when TCP congestion avoidance is operating.[1]

   6-16 and 17-22

   (c) After the 16-th transmission round, is segment loss detected by a triple duplicate ACK or by a timeout? [1]

   triple duplicate ACK

   (d) What is the initial value of *ssthreshold* at the first transmission round? [1]

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   (e) What is the value of *ssthreshold* at the 18-th transmission round?[1]

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