CS 164, Fall 2019

Homework 3

Due: Thursday, November 20th, 2019, 11:59 pm online.

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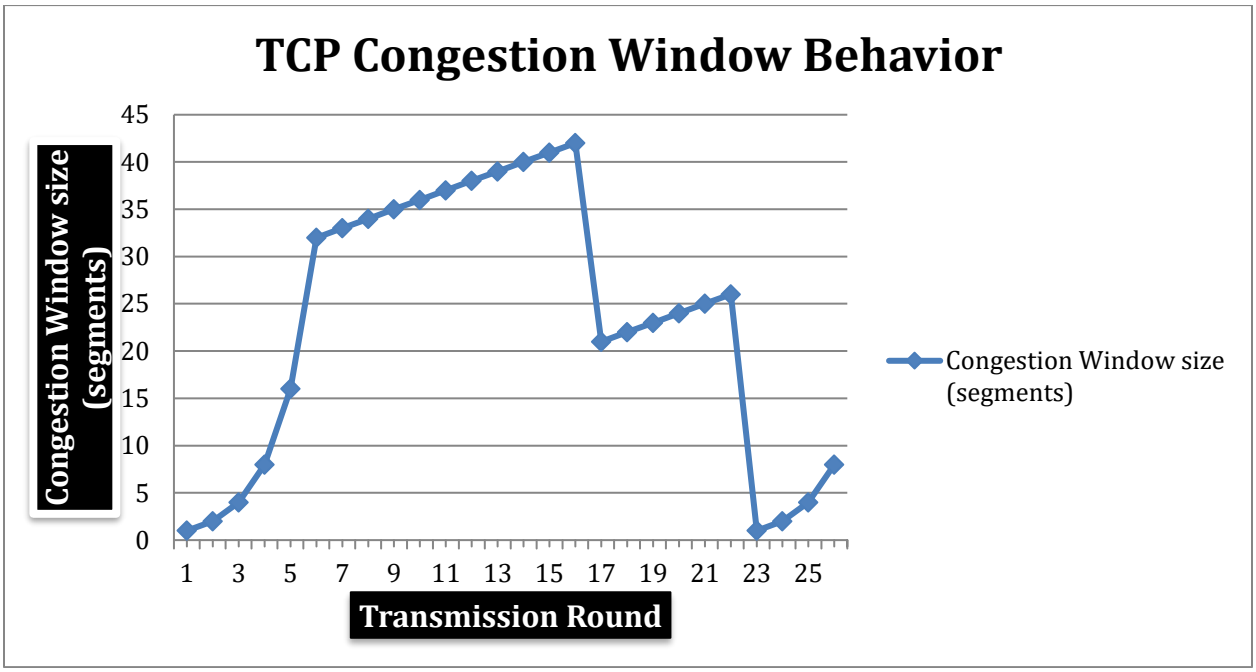
1. Consider the TCP Congestion Window Behavior in Figure below. Assuming TCP Reno is the protocol used. Answer the following questions; in all cases, you should provide a short discussion justifying your answer. (3 points for each answer)



a. Identify the intervals of time when TCP slow start is operating.
    a. **Slow start: [1,6], [23,26]**
        i. **The Congestion windows haven't reached its threshold, so the segment is double each time**
b. Identify the intervals of time when TCP congestion avoidance is operating.
    a. **Congestion avoidance: [6,16], [17,22]**
        i. **Since it reaches the threshold, the segment is increment by 1 each time**
c. After the 16th transmission, is segment loss detected by a timeout or by a triple duplicate ACK?
    a. **Triple duplicate**

i. **It doesn't just start from beginning, so it is in fast recovery**

d. After the 22nd transmission, is segment loss detected by a triple duplicate ACK or by a timeout?
   a. **Time out**
      i. **It restarted process from 1**
e. What is the initial value of **ssthresh** at the first transmission?
   a. **Sstresh = 32**
      i. **It is the transition from slow start to congestion avoidance**
f. What is the value of **ssthresh** at the 18th transmission?
   a. **21**
      i. **The cwnd before loss was 42, cut in half is 21**
g. What is the value of **ssthresh** at the 24th transmission ?
   a. **13**
      i. **The cwnd before loss was 26, divide in half is 13**
h. Assuming a packet loss is detected after the 26th transmission by the receipt of a triple duplicate ACK, what will be the values of the congestion window size and of **ssthresh?**
   a. **7**
      i. **Cwnd at is 8. After loss, sstresh = 8/2 = 4, new cwnd = sstresh + 3 = 7**

2. We are trying to design a pipelined reliable data transfer protocol to fully utilize a cross-country link between a source (US East Coast) and destination (US West Coast). The RTT is 25 milliseconds. The transmission rate R is 1 Gigabit/second. The packet size, L is 1250 bytes including header fields and data. What is the Window size, N, that is to be used by a Selective Repeat protocol to make the utilization of the sender and the link be 100%. (20 points)
   a. **R = 1000/8 = 125 Mbytes/sec. It takes 1250 bytes/125 bytes = 10 RTT to transfer a packet. The windows size should be half or less of sequence number because when reuse same sequence number with new packets, it won't duplicate sequence number with old packet which can cause the receiver to think it is a transmit instead of retransmit data.**

      The size of packet is 1250 bytes, we assume the sequence number between link is 1250. The windows size is best at N = 1250/2 = 625