Networks Homework 6 (Due Friday 9/25/2020)

1. True or False.

   (a) In TCP, if segments 1-5 are sent and 1, 2, 4, and 5 arrive, with 3 being lost, there is a way for the receiver to indicate to the sender in just one segment that they got 1, 2, 4, and 5.

   (b) In TCP, the next sequence number after 4294967295 is 0.

   (c) One way to end a TCP connection is by sending a FIN segment, and another way is to use an RST.

   (d) Each side of a TCP connection stores incoming data and doesn't always immediately send it up to the application layer.

   (e) The TCP header is 20 bytes if no options are used.

   (f) Not all the bits of the TCP header are currently used.

   (g) If you start a TCP connection with a web server, it's possible for the destination port to be 80 and the source port to be 74888.

2. Congestion collapse involves a network that is busy and dropping packets and it is accelerated to the point of network collapse by which facet of TCP?

   (a) resending unACKed data (b) sliding window (c) slow start (d) high MSS

3. For a TCP connection, the receive window (flow control sliding window) has size 1,400,000 bytes, and the congestion window has size 750,000 bytes. There are no outstanding unACKed segments. What is the maximum number of bytes allowed to be sent?

4. Suppose the TCP Window Scaling option is used with a Window Scaling value 5, corresponding to a scaling factor of $2^5 = 32$. If the window size in the TCP header is 20000, what is the true window size?

5. In TCP slow start, suppose a receiver starts their congestion window (send limit) in slow start at 5 segments instead of the 1 given in the class/notes examples. Suppose they send 5 segments and receive ACKs back for all of them. How many segments can they send now?

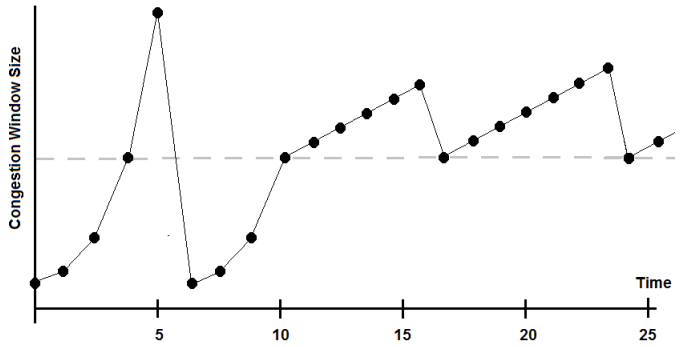
6. The graph below shows a trace of the congestion window size over time. Use it to answer the following questions.

   (a) During what time periods is TCP slow start active?

   (b) During what time periods is congestion avoidance in effect?

   (c) There are three times that a packet was lost. What times are they?

   (d) Of those three times, which ones correspond to losses detected by duplicate ACKs, and which ones correspond to losses detected by timeouts?



7. Alice and Bob are in the middle of a TCP connection. Alice has already sent bytes 0 to 4399 and Bob has send bytes 0 to 54999. The following sequence of transfers takes place. Assume each segment arrives right after it is sent. Give a table like the one from class or the notes that shows the sequence and ACK numbers corresponding to each of these segments.

(a) 1. Alice sends bytes 4400 to 4699.
(b) 2. Alice sends bytes 4700 to 4999.
(c) 3. Bob sends an ACK with no data.
(d) 4. Alice sends bytes 5000 to 5299.
(e) 5. Bob sends bytes 55000 to 59999.
(f) 6. Alice sends an ACK with no data.