CIS 457 Data Communication: Homework 3

The following are selected from the end of Chapter 3 problem set beginning at page 284 of the textbook. The problem numbers are shown in the parentheses. Total points 35.

1. (3 points) (R8) Suppose that a Web server runs in Host C on port 80. Suppose this Web server uses persistent connections, and is currently receiving requests from two different Hosts, A and B. Are all the HTTP requests being sent through the same socket at Host C? If they are being passed through different sockets, do both of the sockets have port 80? Discuss and explain.

2. (R12) Visit the Go-Back-N interactive animation at the companion Web site.
   (a) (2 points) Have the source send five packets, and then pause the animation before any of the five packets reach the destination. Then kill the first packet and resume the animation. Describe what happens.
   (b) (2 points) Repeat the experiment, but now let the first packet reach the destination and kill the first acknowledgment. Describe again what happens.
   (c) (2 points) Finally, try sending six packets. What happens?

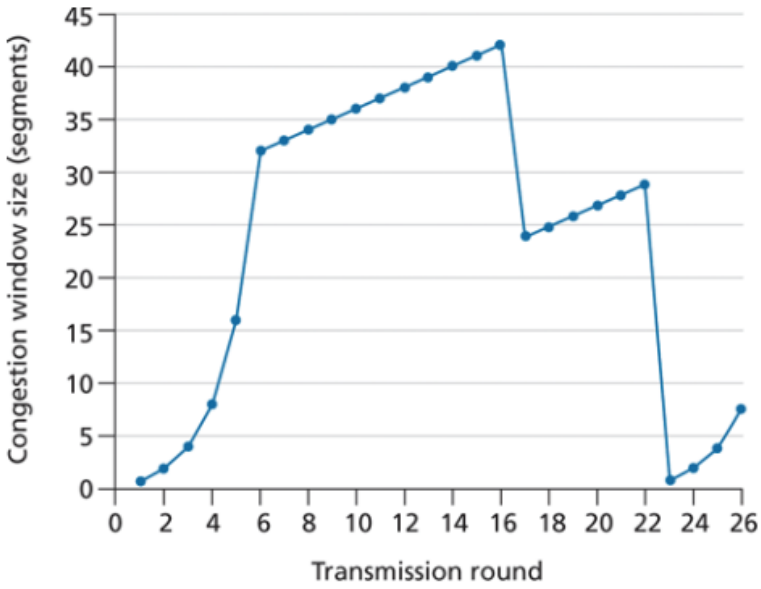
3. (P3) UDP and TCP use 1s complement for their checksums. Suppose you have the following three 8-bit bytes: `01010011`, `01100110`, `01110100`.
   (a) (2 points) What is the 1s complement of the sum of these 8-bit bytes? (Note that although UDP and TCP use 16-bit words in computing the checksum, for this problem you are being asked to consider 8-bit sums.) Show all work.
   (b) (2 points) Why is it that UDP takes the 1s complement of the sum; that is, why not just use the sum?
   (c) (2 points) With the 1s complement scheme, how does the receiver detect errors?
   (d) (2 points) Is it possible that a 1-bit error will go undetected? How about a 2-bit error?

4. (3 points) (P15) Consider the cross-country example shown in Figure 3.17.(Also read the calculations shown on page 213). Suppose that the size of a packet is 1,500 bytes, including both header fields and data. How big would the window size have to be for the channel utilization to be greater than 98 percent? Be sure to specify the unit of your answer (either "packets" or "bytes").

5. (P22) Consider the Go-Back-N protocol with a sender window size of 4 and a sequence number range of 0–1,024. Suppose that at time t, the next in-order packet that the receiver is expecting has a sequence number of K. Assume that the medium does not reorder messages. Considering all possible good and bad scenarios (packet lost, ACKs not received, etc.) answer the following questions:
   (a) (2 points) What are the possible sets of sequence numbers inside the sender's window at time t? Justify your answer.
   (b) (2 points) What are all possible values of the ACK field in all possible messages currently propagating back to the sender at time t? Justify your answer.

6. (11 points) (P40) Consider Figure 3.61 (from textbook). Assuming TCP Reno is the protocol experiencing the behavior shown above, answer the following questions. In all cases, you should **provide a short discussion** justifying your answer.

Figure 3.61 TCP window size as a function of time



(a) Identify the intervals of time when TCP slow start is operating.

(b) Identify the intervals of time when TCP congestion avoidance is operating.

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

(d) After the 22nd transmission round, is segment loss detected by a triple duplicate ACK or by a timeout?

(e) What is the initial value of ssthresh at the first transmission round?

(f) What is the value of ssthresh at the 18th transmission round?

(g) What is the value of ssthresh at the 24th transmission round?

(h) During what transmission round is the 70th segment sent?

(i) 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 congestion window size and of ssthresh?

(j) Suppose TCP Tahoe is used (instead of TCP Reno), and assume that triple duplicate ACKs are received at the 16th round. What are the ssthresh and the congestion window size at the 19th round?

(k) Again suppose TCP Tahoe is used, and there is a timeout event at 22nd round. How many packets have been sent out from 17th round till 22nd round, inclusive?