1. **(KR, Chapter 3, Problem 1)** Suppose client A initiates a Telnet session with server S. At about the same time, client B also initiates a Telnet session with server S. Provide possible source and destination port numbers for:

    (a) the segments sent from A to S

    (b) the segments sent from B to S

    (c) the segments sent from S to A

    (d) the segments sent from S to B

    (e) if A and B are different hosts, is it possible that the source port number in the segments from A to S is the same as that from B to S?

    (f) How about if they are the same host?

2. **(KR, Chapter 3, Problem 3)** UDP and TCP use 1's complement for their checksums. Suppose you have the following three 8-bit bytes: 01010101, 01110000, 01001100. What is the 1's 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 summands.) Show all work. Why is it that UDP takes the 1's complement of the sum; that is, why not just use the sum? With the 1's complement scheme, how does the receiver detect errors? Is it possible that a one-bit error will go undetected? How about a two-bit error?

3. **(KR, Chapter 3, Problem 5)** In protocol rdt3.0, the ACK packets flowing from the receiver to the sender do not have sequence numbers (although they do have an ACK field that contains the sequence number of the packet they are acknowledging). Why is it that our ACK packets do not require sequence numbers?

4. **(KR, Chapter 3, Problem 6)** Draw the FSM for the receiver side of protocol rdt3.0.

5. **(KR, Chapter 3, Problem 7)** Give a trace of the operation of protocol rdt3.0 when data packets and acknowledgement packets are garbled. Your trace should be similar to that used in Figure 3.16.

6. **(KR, Chapter 3, Problem 10)** Consider the alternating-bit (also known as stop-and-wait) protocol. Draw a diagram that shows that if the network connection between the sender and receiver can reorder messages (that is, that two messages propagating in the medium between the sender and receiver can be reordered), then the alternating-bit protocol will not work correctly (make sure you clearly identify the sense in which it will not work correctly). Your diagram should have the sender on the left and the receiver on the right, with the time axis running down the page, showing data (D) and the acknowledgement (A) message exchange. Make sure you indicate the sequence number associated with any data or acknowledgement segment.