P3. UDP and TCP use 1s complement for their checksums. Suppose you have the following three 8-bit bytes: 01010011, 01010100, 01110100. 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. Why is it that UDP takes the 1s complement of the sum; that is, why not just use the sum? With the 1s complement scheme, how does the receiver detect errors? Is it possible that a 1-bit error will go undetected? How about a 2-bit error?

P4. a. Suppose you have the following 2 bytes: 01011100 and 01010110. What is the 1s complement of the sum of these 2 bytes?

P14. Consider the cross-country example shown in Figure 3.17. How big would the window size have to be for the channel utilization to be greater than 95 percent? Suppose that the size of a packet is 1,500 bytes, including both header fields and data.





P19. Consider the GBN protocol with a sender window size of 3 and a sequence number range of 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. Answer the following questions: a. What are the possible sets of sequence numbers inside the sender’s window at time t? Justify your answer. b. 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.

P53. In this problem, we consider the delay introduced by the TCP slow-start phase. Consider a client and a Web server directly connected by one link of rate R. Suppose the client wants to retrieve an object whose size is exactly equal to 15 S, where S is the maximum segment size (MSS). Denote the round-trip time between client and server as RTT (assumed to be constant). Ignoring protocol headers, determine the time to retrieve the object (including TCP connection establishment) when

a. 4 S/R > S/R + RTT > 2S/R

b. S/R + RTT > 4 S/R

c. S/R > RTT .

Kurose, James F.; Keith W. Ross (2011-03-10). Computer Networking: A Top-Down Approach (5th Edition) (Kindle Locations 6351-6357). Pearson HE, Inc.. Kindle Edition.