EECS 122: Homework 1

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Question 1:
Suppose nodes A and B are communicating via a connection over an unreliable link. Neither node wants to terminate the connection unless it is certain that the other node has no more packets to send. Show that this is impossible, i.e., there is no protocol that will work all of the time.
Hint: Over a reliable link, it is easy to agree on termination: When either node has no more packets to send it sends a message (NOMORE MSGS). Then a node can only terminate the connection if it has received a NOMORE MSGS message from the other node.

Question 2:
Consider a link layer protocol in which the sender receives a sequence of bits from the higher layer that it converts into variable length frames, and then transmits to the receiver. In order to indicate the end of a frame, the sender appends the end of data flag, 01111110 (which we will write as 01^60). A problem with this approach is that the *actual data* could contain the flag 01^60. To get around this, suppose that the sender uses a technique called *bit stuffing*: it scans the data from first to last bit and replaces every occurrence of 1^5 with 1^50. The receiver operates as follows: after observing 1^5 it deletes the next bit if it is a 0 and declares the data complete if the next bit is a 1.
Example: If 111111011111111110111110 is the original data stream then bit stuffing produces: $1111\bar{0}1011111\bar{0}1111\bar{0}101111\bar{0}0$ (the zeros with the bars are the stuffed bits) and the end of data sequence 01111110 is appended to the stuffed sequence. For this problem assume that the link is reliable.

(a) Suppose the received string is 01111110111111011001111100111111011111011000111111010111110. Remove the stuffed bits and show where the end of data flags are.

(b) Now change the bit stuffing rule to to stuff a 0 only after the appearance of 01^5 in the original data. Carefully describe how the receiver should destuff in this case.
Also, destuff 01101111101111110111110101111110.

Questions 3,4,5,6:
Kurose and Ross Chapter 1: Problems 5, 6 14 and 16.

Question 7:
Application of Little's Law: Customers arrive at a fast food restaurant at the rate of five per minute. All the customers get to place an order as soon as they arrive. The average time taken to receive an order once it is placed is only 5 minutes. Half the customers are take out customers and leave after receiving their order, and half eat their meal in the restaurant. It takes an average of 20 minutes for customers eating in the restaurant to finish their meal, pay and depart. What is the average number of customers in the restaurant?