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 0160). A problem with this approach is that the actual data could contain the flag 0160. 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 15 with 150. The receiver operates as follows: after observing 15 it deletes the next bit if it is a 0 and declares the data complete if the next bit is a 1.

Example: If 11111011111111110111110 is the original data stream then bit stuffing produces: 111111010111110111110111110 (the zeros with the bars are the stuffed bits) and the end of data sequence 0111110 is appended to the stuffed sequence. For this problem assume that the link is reliable.

(a) Suppose the received string is 0111110111111010011111010111110. 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 015 in the original data. Carefully describe how the receiver should destuff in this case.
Also, destuff 011011111011111101111101011111110.

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?