CS 6380 Computer Networks **Fall Quarter, 1997**

Homework 3

Assigned: October 21 *Due: October 28*

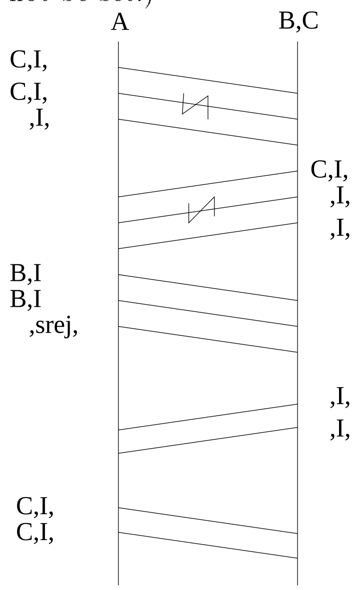
Reminder: Late homeworks will NOT be accepted!

1. Consider the use of Go-back-N ARQ with a three-bit sequence number and a sending window size of 4. Assume that node A is the sender and node B is the receiver. Show the sender and receiver window positions for the following sequence of events:
   (a) Before A sends any frames.
   (b) After A sends frames 0, 1, 2 and B acknowledges 0, 1 and the ACKs are received by A.
   (c) After A sends frames 3, 4, 5 and B acknowledges 4 and the ACK is received by A.

2. Show by example that a three-bit sequence number is needed for Selective Reject ARQ with a sending window size of 4.

3. Fill in the missing information in the following HDLC diagram, where each transmission is to be labeled using the notation from class: $\langle$secondary$\rangle$, $\langle$frame type$\rangle$, $[N(S)]$, $N(R)$, [P/F]

   The parts of the notation enclosed in square brackets will not necessarily be present on every transmission. (Recall that the $N(S)$ field is not present in supervisory frames, and the Poll/Final bit will sometimes not be set.)



4. Consider a physical configuration in which several physical links connect two stations. We would like to use a “multi-link HDLC” that makes efficient use of these links by sending each frame on the next available link. What enhancements to HDLC are needed?

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5. Give a token ring example that shows that the *single-user* and *single-token* free token replacement schemes can produce different token ring usage. You will need to specify the number of stations and the order in which packets are generated at the stations. Use a timing diagram similar to the one in class to illustrate the behavior of the system.

6. Tanenbaum, Chapter 4, problem 4.

7. A group of N stations shares a slotted-ALOHA channel. Each station generates a 1000-bit packet at an average rate of one every 100 seconds. What is the maximum useful value of N?