CSE/EE 461
Assignment 4
Due Friday, October 31, 1997

Your solutions must contain the derivation of your answers.

1. In this problem we explore the options for using three bits for sequence numbers. There are two basic strategies, go-back-N where the sender has 7 buffers and the receiver has 1 buffer, or selective repeat where both the sender and receiver have 4 buffers each. Suppose all data frames have p bits with h bits of header included, the one way propagation delay is d, and the bandwidth of the physical channel is b. Assume that acknowledgement frames have just h bits.

   (a) What is the maximum utilization of go-back-N and selective repeat with three bits for sequence numbers as a function of p, h, d, and b? Assume the physical channel is errorless and that utilization is just the percentage of the time transmitting data bits.

   (b) For what values of d does go-back-N give better maximum utilization than selective repeat? Assume the physical layer is errorless.

   (c) Let $p = 1,000$ bits, $h = 100$ bits, and $d = .005$ seconds, and $b = 10^6$ bps. What is the maximum utilization of go-back-N and selective repeat, assuming an errorless channel? Which protocol has better utilization in this case?

   (d) Let x be the probability that a frame and its acknowledgement both arrive safely. We know from a previous homework problem that the expected number of attempts to send a frame with success probability x is $1/x$. What is the expected number of times a frame is sent in the go-back-N strategy? Note that any frame in the current window is resent any time the first frame in the window or its acknowledgement fail to be delivered.

   (e) Let $p = 1,000$ bits, $h = 100$ bits, and $d = .005$ seconds, and $b = 10^6$ bps. Suppose the probability that a frame and its acknowledgement both arrive safely is .9. In your judgement, which protocol is better in terms of utilization? What if the success probability as reduced to .7?