

# ECE 478/578: Fundamentals of Computer Networks

## Homework Assignment # 2

**Due Thursday February 2nd, In class**

January 26, 2012

**Problems 2.4, 2.13, 2.18**, from textbook.

**Problem 4:** Suppose that flag “0101” is used to indicate the end of a frame and the bit stuffing rule is to insert a 0 after each appearance of 010 in the original data; thus, 010101 would be modified to 01001001. In addition, if the frame ends in 01, a 0 would be stuffed after the first 0 in the actual terminating string. Show how the string 110011010010101011101 would be modified by this rule. Describe the de-stuffing rule required at the receiver. How would the string 11010001001001100101 be de-stuffed?

**Problem 6:** (Only for grad students) Assume that a packet consists of IID random binary bits with equal probability of 0 and 1. Assume that the terminating flag for framing this packet is of the type  $01^j0$  for some  $j$  ( $j = 6$  corresponds to the standard flag 01111110 we have seen in the class). An insertion of a zero occurs after any string of the form  $01^{j-1}$  within the packet. Show that the expected overhead  $E[V]$  (i.e., number of bits used for framing) is given by:

$$E[V] = (E[K] - j + 3)2^{-j} + j + 2,$$

where  $E[K]$  is the expected length of the packet before framing. Approximate this overhead by

$$E[V] \leq (E[K])2^{-j} + j + 2,$$

and find the optimal value of  $j$  that minimizes  $E[V]$  for a given expected packet length  $E[K]$ .