CS 4514 Computer Networks Written Homework 2
C Term 2006
Due: Tuesday, February 7, 2006 (in-class)

1. Eighteen-bit messages are transmitted using a Hamming code. How many check bits are needed to ensure that the receiver can detect and correct single-bit errors? Show the pattern transmitted for the message 101101100011010110

2. The following character encoding is used in a data link protocol:

   A: 10011011; B: 10010011; FLAG: 01111110; ESC: 11001100

   Show the bit sequence transmitted (in binary) for the four-character frame: A B ESC FLAG when each of the following framing methods are used:

   a) Character count b) Flag bytes with byte stuffing
   c) Starting and ending flag bytes, with bit stuffing

3. An 8-bit byte with binary value 10101011 is to be encoded using an even-parity Hamming code. What is the binary value after encoding?

4. A bit stream 11001001 is transmitted using the standard CRC method described in the text. The generator polynomial is $x^3 + 1$. Show the actual bit string transmitted. Suppose the third bit from the left is inverted during transmission. Show that this error is detected at the receiver's end.

5. Sketch the Manchester encoding for the bit stream 1100011001

6. (Problem 3.27 from text) Consider the operation of protocol 6 over a 1-Mbps error-free line. The maximum frame size is 1000 bits. New packets are generated 1 second apart. The timeout interval is 10msec. If the special acknowledgement timer were eliminated, unnecessary timeouts would occur. How many times would the average message be transmitted?

7. (Problem 3.29 from text) Frames of 1000 bits are sent over a 1-Mbps channel using a geostationary satellite whose propagation time from the earth is 270msec. Acknowledgements are always piggybacked onto data frames. The headers are very short. Three-bit sequence numbers are used. What is the maximum achievable channel utilization for
   a) Stop-and-wait
   b) Protocol 5
   c) Protocol 6

8. Sixteen stations, numbered 1 through 16, are contending for the use of a shared channel by using the adaptive tree walk protocol. If all the stations 2, 4, 5, 7, 8 and 11 suddenly become ready to transmit at once, how many bit slots are needed to resolve the contention?