

CS 513/ECE 506 Computer Networks Written Homework 2
Spring Semester 2010
Due: Monday, March 8, 2010 (in-class)

1. (Problem 3.3 from text) The following data fragment occurs in the middle of a data stream for which the byte-stuffing algorithm described in the text is used: A B ESC C ESC FLAG FLAG D. What is the output after stuffing?
2. Suppose the following sequence of bits arrives over a link:

1101011111010111110010111110110

Show the resulting frame after any stuffed bits have been removed. Indicate any errors that might have been introduced into the frame.

3. (Problem 3.9 from text) Sixteen-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 1101001100110101. Assume that even parity is used in the Hamming code.
4. Suppose we want to transmit the message **11001001** and protect it from errors using the CRC polynomial $x^3 + 1$.
 - a) Use polynomial long division to determine the message that should be transmitted.
 - b) Suppose that the leftmost bit of the message is inverted due to noise on the transmission link. What is the result of the receiver's CRC calculation? How does the receiver know that an error has occurred?
5. (Problem 3.16 from text) Data link protocols always put the CRC in a trailer rather than in a header. Why?
6. Consider an ARQ protocol that uses only negative acknowledgments (NAKs) but no positive acknowledgments (ACKs). Describe what timeouts would need to be scheduled. Explain why an ACK-based protocol is usually preferred to a NAK-based protocol
7. (Problem 4.10 from text) 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 whose addresses are prime numbers suddenly become ready at once, how many bit slots are needed to resolve the contention? (**Note:** Assume 1 is NOT a prime number)
8. (Problem 4.17 from text) Sketch the Manchester encoding for the bit stream 0001110101.