EECS 122: Homework 2

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Question 1:
Find the CRC of the message 11100011 using the generating polynomial 110011.

Question 2:
Suppose that one byte in a buffer covered by the internet checksum algorithm needs to be decremented (e.g. a header hop count field). Give an algorithm to compute the revised checksum without rescanning the entire buffer. Your algorithm should consider whether the byte in question is low order or high order.

Question 3:
Problem 21 p154 in the textbook (Peterson and Davie).

Question 4:
a) Consider the single-bit even parity check : what is the minimum Hamming distance of this code ? Prove it. How many bit errors can you detect while using it ? How many can you correct ?

b) Consider the 3-repetition code (obtained by repeating each bit 3 times before transmission: 010 becomes 000111000). Answer the same questions as above.

c) We assume that bit errors are independent, and occur with probability $p = 10^{-7}$. What is the probability of transmitting a packet of length 50 without errors ? Using the 3-repetition code, what is the probability of transmitting the same packet with 0 or 1 error ?

Do the same with $p = 10^{-2}$. When would you use the code ? Comment.

Question 5:
Assume that a SONET receiver synchronizes whenever a 1 bit appears; other wise the receiver samples the signal in the middle of what it believes is the bit's time slot.
(a) What relative accuracy of the sender's and receiver's clock is required in order to receive 48 zero-bytes in a row?
(b) Consider a forwarding station A on a SONET STS-1 line, receiving frames from the downstream station end B and retransmitting them upstream. What relative accuracy of A's and B'a clocks is required to keep A from accumulating more than one extra frame per minute?