EGE -534 HW #2 Dr. Izadi

Name: ____

Problem 1 (20 Points)
A cyclic code is to be based on the Generator polynomial $X^7 + X^5 + X^4 + X + 1$.
a. Generate a codeword for the input data 10101.
b. Using logic gates, design an appropriate encoder and decoder the given generator.

Problem 2 (20 Points)
A 4G X 16 memory system is design using 1 G X 4 chips. Assume chip failure modes are single-bit cell (55%), single-row all-0's (20%), single-column all-0's (15%), and whole-chip all-0's (10%). Also, assume 0 and 1 values are equally likely. Compare and comment on relative performance (single-error-detection coverage) and overhead of the following approaches.
a. Bit per chip
b. Bit per multiple chips
c. Duplication
d. Single precision checksum (one sum for the entire memory).

Problem 3 (10 Points)
Design a totally self-checking checker with 8 inputs.

Problem 4 (20 Points)
Consider a random-access memory that has an 8-bit data.
a) Determine the H matrix such that the error code computed by your Single Error Correcting Hamming code specifies the bit position of the error.
b) Design a circuit for such an encoder using basic gates.
c) How you would modify the SEC code you have defined above in order to obtain an SEC/DED code.

Problem 5 (20 Points)
a. Using full adders and basic gates, design a 3N code encoder, where N is a 3-bit binary number.
b. Design a circuit to detect an error in the above 3N code.

Problem 6 (20 Points)
Consider a low-cost residue code based on module 7.
a. Show how do you obtain residue-7 check bits of $X_7\ X_6\ X_5\ X_4\ X_3\ X_2\ X_1\ X_0$ using recursive addition technique?
b. What is the theoretical base for this easy encoding process?

Problem 7 (15 Points)
Convert 0 to 14 to RNS using modules [3,5,7]. Within this range demonstrate if the code is single error detecting. Repeat the same for single error correcting.

Due: March 12, 2010