EGE 534 HW #2 Dr. Izadi

First Name:_____ Last Name: _____

Problem 1 (20 Points)
A 8G X 32 memory system is design using 1 G X 8 chips. Assume chip failure modes are single-bit cell (45%), single-row all-0's (30%), 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 2 (30 Points)
Consider a random-access memory that has a 6-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. Show a block diagram of your data bus, memory, and various stages of parity generation and error correction mechanism.
c. Design the detailed design of parity generation, syndrome generation and error correction circuitry using basic gates.
d. How you would modify the SEC code you have defined above in order to obtain an SEC/DED code.

Problem 3 (20 Points)
A cyclic code is to be based on the Generator polynomial $X^6 + X^5 + X^2 + 1$.

a. Generate a codeword for the input data 10111.
b. Using logic gates, design an appropriate encoder and decoder the given generator.

Problem 4 (20 Points)

a. Using full adders and basic gates, design a 5N code encoder, where N is a 4-bit binary number.
b. Based on the code distance, determine if the code has error detecting and/or error correcting capability.

Problem 5 (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 6 (20 Points)
Convert 0 to 14 to RNS using modules [3,4,5,7].

a. For the given range, does the code has the capacity for error detection? If yes, how many bits?
b. For this given range, does the code has the capacity for error correction? If yes, how many bits?

Problem 7 (15 Points)
Design a totally self-checking checker with 8 inputs. After showing the internal circuitry of one module, you may use block form to implement the design of an 8 input unit.

Due: Friday 2/26/ 2016