CSE-40534 HW #2 Dr. Izadi

Name: ____

Problem One (15 Points)
Design a self-dual full-addrer.

Problem Two (15 Points)
Convert 0 to 15 to RNS using modules [3,5,7]. Within this range would you say a single fault is detectable or not. Justify your answer.

Problem Three (20 Points)

a. Using full adders and basic gates, design a 3N code encoder, where N is a 4-bit binary number.
b. Design a circuit to detect an error in the above 3N code.

Problem Four (20 Points)

a. In class we discussed that residue-3 code can be calculated using successive module-3 additions. Based on this technique, 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? What is the theoretical base for this easy encoding process. Hint: use the weights of bit groups.
b. Design a totally self-checking checker with 7 inputs.

Problem Five (20 Points)
Consider a random-access memory that has a word format X_4 X_3 X_2 X_1 X_0 of size 5 bits. We can use Hamming code to correct any single bit in this memory.

a) What is the H (or P) matrix?
b) Given the four syndromes s_i computed by your SEC Hamming code for single-bit errors affecting data bit x_i, $0 \le i \le 4$. Also give the error-free syndrome s^*.
c) Explain how you would modify the SEC code you have defined above in order to obtain an SEC/DED code.

Problem Six (20 Points)
Using the combinatorial model, determine the reliability of a simplex, TMR, and 5MR systems as a function of reliability of a simplex system, R(t) . You may assume a fault-free voter. Using MathLab, plot the reliability of the three systems versus R(t) and comment on their relative reliabilities.

Problem Seven (25 Points)
Using Markov model, determine the discrete solution for the reliability of a 3MR system with λ failure rate and μ repair rate. You may assume that the system initially is fault free. Using MathLab plot R(t) from 0 to 5 hours using

a. $\Delta t = 0.01$, $\lambda = .0001$ and $\mu. = .01$
b. $\Delta t = 0.01$, $\lambda = .001$ and $\mu. = .01$
c. $\Delta t = 0.01$, $\lambda = .0001$ and $\mu. = .001$

Due October 13, 2004