CS2102 First Midterm Exam

10:10-12:00, Thursday, October 15, 2009

Department of Computer Science, National Tsing Hua University

(15%) Represent 149.375_{10} in

(a) Binary format 10010101.011

(b) Octal (Radix 8) format 225.3

(c) Hexadecimal (Radix 16) format 95.6

(d) Radix 32 format 4L.C

(e) BCD (Binary-Coded Decimal) Format

0001 0100 1001. 0011 0111 0101

2. (10%)

(a) What is noise margin?

(b) What are the advantages of digital signal processing over analog one?

3. (10%) We have shown that there are 16 distinct two-input-one-output combinational logic functions.

(a) How many five-input-one-output combinational logic functions are there?

(b) How about an N-input-one-output one? 2^{2^N}

4. (10%) What is a n-bit Gray Code (also called Mirror Code)? Define it precisely in either English or Chinese.

5. (10%) Give a Boolean function F(A, B, C, D) = AB'D + BC' + CD'

(a) Write F in Sum-Of-Minterms form $\Sigma m(2, 4, 5, 6, 9, 10, 11, 12, 13,$

(b) Write F in Product-Of-Maxterms form $\Pi M(0, 1, 3, 7, 8, 15)$

6. (20%) Simplify the function $F(W, X, Y, Z) = \Sigma_m(0, 7, 10, 13, 15)$ with don't care conditions $\Sigma_d(1, 2, 6, 8, 9)$ using K-map method

(a) Write down all **prime implicants**

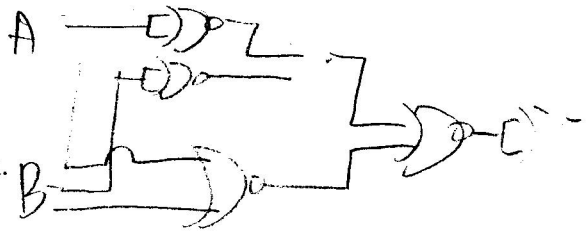
(b) Identify all **essential prime implicants.**

(c) Write down your final Boolean function

(d) What is the cost of your final function in terms of literal count (L)?

7. (15%) Design a combinational logic circuit with a four-bit input (A, B, C, D) and an one-bit output Z such that Z is 1 if the difference between number of 1s and number of 0s in the input is two or smaller, and 0 otherwise.

8. (10%) Construct a circuit that perform Z = XNOR(A, B) using only 2-input NOR gates.



9. (10%) Give the circuit below
   (a) What is the function S(X, Y, Z)? State it in English.
   (b) Express S in Sum-of-Minterms form.