Department of Computer Science
National Chiao Tung University
**Digital System Design**
First Midterm Exam 10/20/2011

1. (10%) The state of a 12-bit memory word is 100101000111. What is its content if it represents (a) a 3-digit BCD, (b) a 3-digit *excess*-3 code.

2. (10%) Convert decimal +45, +23 to binary using the *signed 2's complement* representation and enough bits to accommodate the numbers. Then perform the binary equivalent of (+23)+(−45), and (−23)+(−45). What is the minimum number of bits which is needed for correct results of these computations?

3. (6%) Find the complement of $g(x,y,z) = x+(y'z)$.

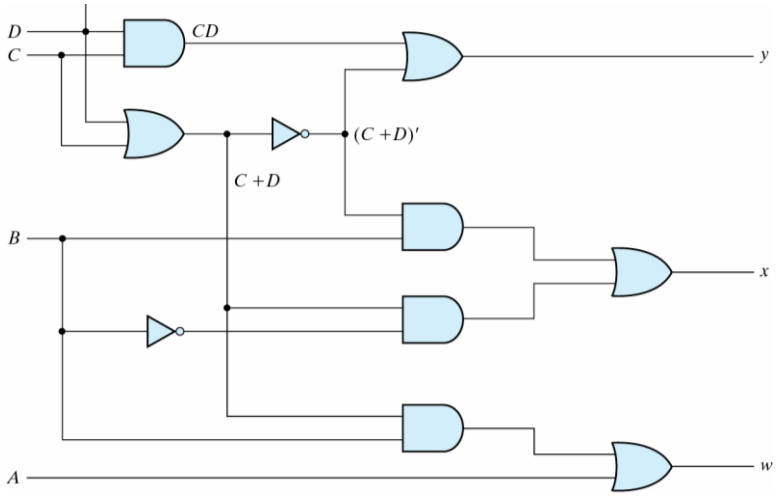
4. (10%) Show that $x+(y'z) = (x+y')(x+z)$ by using (i) algebraic manipulation and (ii) truth table.

5. (10%) Simplify the function $f(x,y,z) = (x+y)(x+z)(y'+z)$ and in *sum-of-product* (SOP) form.

6. (10%) Obtain the optimal *product-of-sum* (POS) implementation of $F(w,x,y,z) = \sum(1,2,3,4,9)$ with *don't care* conditions $d(w,x,y,z) = \sum(10,11,12,13,14,15)$.

7. (6%) Draw the logic diagram of $F(A,B,C,D)=A(BC+D)+BCD'$.

8. (18%) Obtain the truth table for $w$ of the following circuit and derive the optimal (a) SOP implementations of $x$ and (b) POS implementation of $y$.




9. (10%) Find all *prime implicants* for $F(A,B,C,D) = \sum(0,2,3,5,7,8,10,11,13,15)$ and determine which are *essential.*

10. (10%) Implement $F = A'B'C' + B'C + AD$ with NOR and inverter gates.