Department of Computer Science
National Chiao Tung University
Digital System Design
First Midterm Exam 11/1/2012

1. (10%) Convert decimal +47, +26 to binary using the *signed 2's complement* representation and enough bits to accommodate the numbers. Then perform the binary equivalent of (+26)+(−47), and (−26)+(−47). What is the minimum number of bits which is needed for correct results of these computations?

2. (10%) Represent the *unsigned* decimal numbers 53 and 69 in BCD, and then show the steps necessary to form their sum.

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

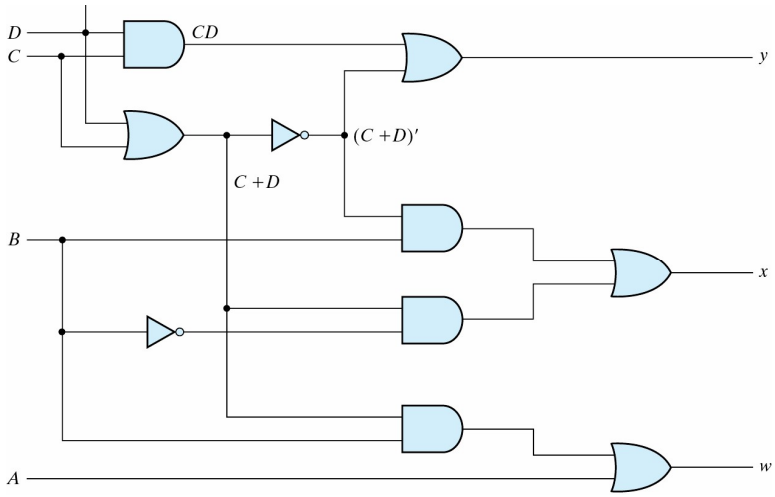
4. (10%) Show that $(y+x)\ (y+z') = y+(xz')$ by using (i) truth table and (ii) algebraic manipulation (without using distributive laws).

5. (8%) Express the complement of function $F(A,B,C,D)=A'(B'C+D')+B'CD$ in *product-of-maxterm* form.

6. (10%) Obtain the optimal *sum-of- product* (SOP) implementation of $F(w,x,y,z) = \sum(3,4,6,10,12,14)$ with *don't care* conditions $d(w,x,y,z) = \sum(1,8,9,13)$.

7. (10%) Find all *prime implicants* for $F(A,B,C,D) = \sum(0,2,4,5,7,8,10,13)$ and determine which are *essential.*

8. (18%) For the following circuit, obtain multiple-level NAND gate circuit for w, the optimal POS implementation of x, and the truth table of y.



9. (8%) Obtain the two-level NAND implementation of $f(x,y,z) = y+(xy+z')(y'+z)$.

10. (10%) Implement $F = AB' + B'C + AC'D$ with OR and inverter gates.