CS309 Spring 2010 Midterm Exam 1

Name_____

Show all work

- 1. Answer the following questions:
- (a) $1101.001_2 = (?)_{10}$
- (b) $2^{x} = 128M$. What is x?
- (c) What is Maxterm 4 of the Boolean Expression f(A,B,C,D)?
- (d) $A41_{hex} = (?)_2$

(e) $22.625_{10} = (?)_2$

- 2. Use a 2's Complement Number System with 4 magnitude bits to do the following. Show all steps, show all bits including sign bits. All problems are written as decimal integers. Show your answers using the 2's Complement Number System.
- (a) 3 + (-4) = ?

(b)
$$(-14) + (-3) = ?$$

- 3. State the following theorems:
- (a) DeMorgan's Theorem for 3 variables
- (b) Absorption Theorem

- 4. For $f(w,x,y) = \Sigma m(0-2,5,7)$:
- (a) Write the truth table for f

- (b) Write f in Canonical SOP form
- (c) Write f in Canonical POS form
- (d) Use a K-Map to minimize f in SOP form

5. Use a K-Map to minimize g(w,x,y,z) in SOP form, where g(w,x,y,z) = w'z' + wx'y + wxyz + x'y'z'

6. Implement the function $f(w,x,y) = \Sigma m(0-2,5,7)$ (see Problem 4) as a minimized 2-level circuit that uses only NAND gates. (Assume that all variables are available in both complemented and uncomplemented forms and that there are no restriction on the number of inputs to the NAND gates).

7. Implement the function x' + y' + z' using only 2-input NAND gates.

8. Write a minimized SOP expression for the Complement of f(w,x,y,z) = w'x + w'y + wy' 9. Implement the function g(w,x,y,z) = w'z' + wx'y + wxyz + x'y'z' (see problem 5) as a minimized 2-level circuit using AND and OR gates. (Assume that all variables are available in both complemented and uncomplemented forms and that there are no restriction on the number of inputs to the AND and OR gates).

10. Implement $f(A,B,C) = \Sigma m(0,1,2,6)$ as a 2-level AND-OR-INVERT circuit.