CSEE 3827: Homework 1 — Due: 2/7/11

Complete the following problems. Be sure to show your work for partial credit.

1. Given the following two binary numbers: 11111100 and 01110000
   (a) Which of the two is larger in unsigned binary?
   (b) Which is larger in two's complement?
   (c) Which is larger in signed magnitude?

2. Given a very tiny computer that has a word size of 6 bits, what are the smallest negative and largest positive integers this computer can represent in...
   (a) One's complement?
   (b) Two's complement?

3. Construct a truth table for the following:
   (a) $xyz + x\overline{y}\overline{z} + \overline{x}\overline{y}\overline{z}$
   (b) $(x+y)(x+z)(\overline{x}+z)$

4. If $F(w,x,y,z) = xy\overline{z}(\overline{\overline{y}z + x}) + (\overline{w}yz + \overline{x})$, what is $\overline{F}$?

5. Using algebraic manipulation, prove that the following two statement of DeMorgan's Law are valid: $\overline{xy} = \overline{x} + \overline{y}$ and $\overline{x+y} = \overline{x} \cdot \overline{y}$.

6. Using the basic identities of Boolean algebra, show that: $xy + \overline{x}z + yz = xy + \overline{x}z$.

7. Given the truth table below, write F in sum-of-products form and product-of-sums form.

x	y	z	F
0	0	0	0
0	0	1	1
0	1	0	1
0	1	1	0
1	0	0	0
1	0	1	1
1	1	0	1
1	1	1	0

8. Construct an XOR operator using...
   (a) ... only AND, OR and NOT gates
   (b) ... only NAND gates

9. Create the K-maps and then simplify the following two functions.
   (a) $F = \overline{x} \cdot \overline{y} \cdot \overline{z} + \overline{x} \cdot y \cdot \overline{z} + x \cdot \overline{y} \cdot \overline{z} + x \cdot y \cdot \overline{z}$
   (b) $F = \overline{y} \cdot \overline{z} + \overline{y} \cdot z + x \cdot y \cdot \overline{z}$

10. Given the following K-map, show algebraically how the four terms reduce to one. (Assume the horizontal axis corresponds to ab and the vertical to c.)

	00	01	11	10
0	0	1	1	0
1	0	1	1	0