CECS 201
My Name
The Date

Homework #2

1. Demonstrate by a proof by perfect induction the validity of the Second (Dual) Distributive Law: *X+YZ=(X+Y)(X+Z)*

X	***Y***	***Z***					
0	0	0					
0	0	1					
0	1	0					
0	1	1					
1	0	0					
1	0	1					
1	1	0					
1	1	1					

2. Prove the identity of each of the following Boolean equations, using algebraic manipulation. Do not forget to write the name of the law you are applying.

(a) $\overline{X} \cdot \overline{Y} + \overline{X} \cdot Y + X \cdot Y = \overline{X} + Y$
(b) $Y + \overline{X} \cdot Z + X \cdot \overline{Y} = X + Y + Z$

3. Reduce the following Boolean expressions to the indicated number of variables.

(a) $\overline{X} \cdot \overline{Y} + X \cdot Y \cdot Z + \overline{X} \cdot Y$ to three variables
(b) $\overline{W}X(\overline{Z} + \overline{Y}Z) + X(W + \overline{W}YZ)$ to one variable

4. Using DeMorgan's theorem, express the function: $F = A \cdot B \cdot C + \overline{A} \cdot \overline{C} + \overline{A} \cdot \overline{B}$

(a) with only OR and complement operations.

(b) with only AND and complement operations.

5. Obtain the truth table of the following functions, and express each function in sum-of-minterms and products-of-maxterms forms:

(a) $(XY + Z)(Y + XZ)$
(b) $(\overline{A} + B)(\overline{B} + C)$

Truth Tables for a) and b)

X	***Y***	***Z***	***a***
0	0	0	
0	0	1	
0	1	0	
0	1	1	
1	0	0	
1	0	1	
1	1	0	
1	1	1	

A	***B***	***C***	***b***
0	0	0	
0	0	1	
0	1	0	
0	1	1	
1	0	0	
1	0	1	
1	1	0	
1	1	1	

(a) Sum of Minterms:
Product of Maxterms:

(b) Sum of Minterms:
Product of Maxterms:

6. For the Boolean function E and F, as given in the following truth table

X	*Y*	*Z*	*E*	*F*
0	0	0	1	0
0	0	1	1	0
0	1	0	1	1
0	1	1	0	1
1	0	0	0	0
1	0	1	1	0
1	1	0	0	1
1	1	1	0	1

(a) Express E and F in sum-of-minterms algebraic form

(b) Simplify E and F to expressions with a minimum number of variables.

7. Draw the logic diagram for the following Boolean expression. The diagram should correspond exactly to the equation. Assume that the complements of the inputs are not available. $A(B\cdot\overline{C}+\overline{B}\cdot C)+C(B\cdot D+\overline{B}\cdot\overline{D})$

8. Simplify the following expression, and implement it with NAND gates. Assume that both true and complement versions of the input variables are available.

$$F = W\cdot\overline{X} + W\cdot X\cdot Z + \overline{W}\cdot\overline{Y}\cdot\overline{Z} + \overline{W}\cdot X\cdot\overline{Y} + W\cdot X\cdot\overline{Z}$$

9. Draw the NAND logic diagram for the following expression, using a multiple-level NAND circuit.

$$F = W(X+Y+Z)+XYZ$$

10. Convert the AND/OR/NOT logic diagram shown here to a) a NAND logic diagram and b) a NOR logic diagram