Homework 2

CS 210
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Solve the following problems. Show all work.

1 Demonstrate by means of truth tables the validity of the following equations:

a) DeMorgan's theorem for three variables: $(xyz)' = x' + y' + z'$.
b) The second distributive law: $x + yz = (x + y)(x + z)$.
c) The consensus theorem: $xy + x'z + yz = xy + x'z$.

2 Simplify the following Boolean expressions to a minimum number of literals.

a) $x'y' + xy + x'y$
b) $(x + y)(x + y')$
c) $x'y + xy' + xy + x'y'$
d) $x' + xy + xz' + xy'z'$
e) $xy' + y'z' + x'z'$ (use the consensus theorem, Problem 1c)

3 (Problem 2-3, Mano) Simplify the following Boolean expressions to a minimum number of literals.

a) $ABC + A'B + ABC'$
b) $x'yz + xz$
c) $(x + y)'(x' + y')$
d) $xy + x(wz + wz')$
e) $(BC' + A'D)(AB' + CD')$

4 (Problem 2-4, Mano) Reduce the following Boolean expressions to the indicated number of literals:

a) $A'C' + ABC + AC'$ to three literals.
b) $(x'y' + z)' + z + xy + wz$ to three literals.
c) $A'B(D' + C'D) + B(A + A'CD)$ to one literal.
d) $(A' + C)(A' + C')(A + B + C'D)$ to four literals.

5 Using DeMorgan's theorem, convert the following Boolean expressions to equivalent expressions that have only OR and complement operations. Show that the functions can be implemented with logic diagrams that have only OR gates and inverters.

a) $F = x'y' + x'z + y'z$
b) $F = (y + z')(x + y)(y' + z)$

6 Using DeMorgan's theorem, convert the two Boolean expressions listed in Problem 5 to equivalent expressions that have only AND and complement operations. Show that the functions can be implemented with only AND gates and inverters.