ECE 223 – Assignment #2

2-2 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 2-1(c)].

2-3 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) $(BC' + A'D)(AB' + CD')$

2-6 Find the complement of the following expressions:
(a) $xy' + x'y$
(b) $(AB' + C)D' + E$
(c) $AB(C'D + CD') + A'B'(C' + D)(C + D')$
(d) $(x + y' + z)(x' + z')(x + y)$

2-7 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) $F = (y + z')(x + y)(y' + z)$

2-9 Obtain the truth table of the following functions and express each function in sum of minterms and product of maxterms:
(a) $(xy + z)(y + xz)$
(b) $(A' + B)(B' + C)$
(c) $y'z + wxy' + wxz' + w'x'z$

2-11 Given the following Boolean function:

$$F = xy'z + x'y'z + w'xy + wx'y + wxy$$

(a) Obtain the truth table of the function.
(b) Draw the logic diagram using the original Boolean expression.
(c) Simplify the function to a minimum number of literals using Boolean algebra.
(d) Obtain the truth table of the function from the simplified expression and show that it is the same as the one in part (a).

2-13 Express the complement of the following functions in sum of minterms:

(a) $F(A, B, C, D) = \Sigma(0, 2, 6, 11, 13, 14)$

(b) $F(x, y, z) = \Pi(0, 3, 6, 7)$

2-14 Convert the following to the other canonical form:

(a) $F(x, y, z) = \Sigma(1, 3, 7)$

(b) $F(A, B, C, D) = \Pi(0, 1, 2, 3, 4, 6, 12)$

2-19 By substituting the Boolean expression equivalent of the binary operations as defined in Table 2-8, show the following:

(a) The inhibition operation is neither commutative nor associative.

(b) The exclusive-OR operation is commutative and associative.