Homework **Solution** 2 for CSCI 255, ENGR 274, ECE 212

Problem 1:

Construct the truth tables corresponding to each of the following three Boolean functions:

F(a, b, c) = a b' + c (a' + b)

a	b	c	((a	·	b')	+	(c	·	(a'	+	b)))
0	0	0	0	0	1	0	0	0	1	1	0
0	0	1	0	0	1	1	1	1	1	1	0
0	1	0	0	0	0	0	0	0	1	1	1
0	1	1	0	0	0	1	1	1	1	1	1
1	0	0	1	1	1	1	0	0	0	0	0
1	0	1	1	1	1	1	1	0	0	0	0
1	1	0	1	0	0	0	0	0	0	1	1
1	1	1	1	0	0	1	1	1	0	1	1

F(a, b, c) = a (b + a') c

a	b	c	((a	·	(b	+	a'))	·	c)
0	0	0	0	0	0	1	1	0	0
0	0	1	0	0	0	1	1	0	1
0	1	0	0	0	1	1	1	0	0
0	1	1	0	0	1	1	1	0	1
1	0	0	1	0	0	0	0	0	0
1	0	1	1	0	0	0	0	0	1
1	1	0	1	1	1	1	0	0	0
1	1	1	1	1	1	1	0	1	1

F(a, b, c) = a ⊕ b' c

a	b	c	((a	⊕	(b'	·	c))
0	0	0	0	0	1	0	0
0	0	1	0	1	1	1	1
0	1	0	0	0	0	0	0
0	1	1	0	0	0	0	1
1	0	0	1	1	1	0	0
1	0	1	1	0	1	1	1
1	1	0	1	1	0	0	0
1	1	1	1	1	0	0	1

Problem 2:

Write Boolean functions corresponding to the following two Boolean functions:

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

x	*Y*	*z*	*F*
0	0	0	1
0	0	1	0
0	1	0	0
0	1	1	1
1	0	0	1
1	0	1	1
1	1	0	0
1	1	1	0

F(x, y, z) = x' y z' + x' y z + x y' z' + x y z
F(x, y, z) = x' y' z' + x' y z + x y' z' + x y' z

Problem 3:

Express the five Boolean functions described in problems 1 and 2 in sum of products notation (disjunctive normal form).

Problem 1 functions
F(a, b, c) = a' b' c + a' b c + a' b' c' + a b c
F(a, b, c) = a b c
F(a, b, c) = a' b' c + a b' c' + a' b c' + a' b c

Problem 2 functions of solution are already in disjunctive normal form

If you prefer Σ notation

F(a, b, c) = Σ(1,3,4,5,7)
F(a, b, c) = Σ(7)
F(a, b, c) = Σ(1,4,6,7)
F(x, y, z) = Σ(2,3,4,7)
F(x, y, z) = Σ(0,3,4,5)

Problem 4:

Draw the logic circuits corresponding to each of the following two Boolean functions:

F(a, b, c) = a b' + c (a' + b)
F(a, b, c) = (a + b + c) (b ⊕ c)

Answer omitted -- Too hard to draw.

Problem 5:

Use algebraic manipulation to simply the following three Boolean expressions:

w' x' + w' x y + w x + w x' y' + x' y

(a + b) (a + b') b

a b + a b' c + c

w' x' + w' x y + w x + w x' y' + x' y

= (w' x' + w' x y) + w x + (w x' y' + x' y)

= w' (x' + x y) + w x + x' (w y' + y)

= w' (x' + y) + w x + x' (w + y)

= w' x' + w' y + w x + w x' + x' y

= w' x' + w' y + (w x + w x') + x' y

= w' x' + w' y + w + x' y

= (w + w' x' + w' y) + x' y

= (w + x' + y) + x' y

= w + x' + (y + x' y)

= w + x' + y

(a + b) (a + b') b

= (a + b) ((a + b') b)

= (a + b) (a b + b' b)

= (a + b) (a b + 0)

= (a + b) a b

= a a b + b a b

= a b + a b

= a b

a b + a b' c + c

= a b + (c + a b' c)

= a b + c