CMSC 130: Laboratory Exercise #3: BOOLEAN ALGEBRA, LOGIC FUNCTIONS and GATES

A. Construct the truth table for the following boolean functions.

1. F1(a,b,c,d) = ad’ + b'd’ + b'a’c

| a | b | c | d | ad’ | b'd’ | b'a’c | F1 |
|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | | | | |
| 0 | 0 | 0 | 1 | | | | |
| 0 | 0 | 1 | 0 | | | | |
| 0 | 0 | 1 | 1 | | | | |
| 0 | 1 | 0 | 0 | | | | |
| 0 | 1 | 0 | 1 | | | | |
| 0 | 1 | 1 | 0 | | | | |
| 0 | 1 | 1 | 1 | | | | |
| 1 | 0 | 0 | 0 | | | | |
| 1 | 0 | 0 | 1 | | | | |
| 1 | 0 | 1 | 0 | | | | |
| 1 | 0 | 1 | 1 | | | | |
| 1 | 1 | 0 | 0 | | | | |
| 1 | 1 | 0 | 1 | | | | |
| 1 | 1 | 1 | 0 | | | | |
| 1 | 1 | 1 | 1 | | | | |

2. F2(a,b,c)= Σ(1,5,6,7)

| a | b | c | F2 |
|---|---|---|---|
| 0 | 0 | 0 | |
| 0 | 0 | 1 | |
| 0 | 1 | 0 | |
| 0 | 1 | 1 | |
| 1 | 0 | 0 | |
| 1 | 0 | 1 | |
| 1 | 1 | 0 | |
| 1 | 1 | 1 | |

3. F3(w,x,y,z) = ∏(0,3,10,11,15)

| w | x | y | z | F3 |
|---|---|---|---|---|
| 0 | 0 | 0 | 0 | |
| 0 | 0 | 0 | 1 | |
| 0 | 0 | 1 | 0 | |
| 0 | 0 | 1 | 1 | |
| 0 | 1 | 0 | 0 | |
| 0 | 1 | 0 | 1 | |
| 0 | 1 | 1 | 0 | |
| 0 | 1 | 1 | 1 | |
| 1 | 0 | 0 | 0 | |
| 1 | 0 | 0 | 1 | |
| 1 | 0 | 1 | 0 | |
| 1 | 0 | 1 | 1 | |
| 1 | 1 | 0 | 0 | |
| 1 | 1 | 0 | 1 | |
| 1 | 1 | 1 | 0 | |
| 1 | 1 | 1 | 1 | |

B. Express the ff. functions in :

1. F1(a,b,c,d) = (ab + d)(b’ + c’) -> product of maxterms
2. F2(a,b,c,d) = a’ + b’cd -> sum of minterms

F1 = ∏ ( )

F2 = Σ ( )

C. Prove the following identities by using algebraic manipulation. Indicate the theorem used in each step.

1. (a O b)’ ⊕ c = ab’c’ + a’bc’ + a’b’c + abc

| | |
|---|---|
| = | ( ) |
| = | ( ) |
| = | ( ) |
| = | ( ) |
| = | ( ) |
| = | ( ) |
| = | ( ) |
| = | ( ) |

2. F(x,y,z) = Σ(0,1,2,3,7) = x’ + yz

| | |
|---|---|
| = | ( ) |
| = | ( ) |
| = | ( ) |
| = | ( ) |
| = | ( ) |
| = | ( ) |
| = | ( ) |
| = | ( ) |