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ECE 218

Assignment #2

2.2) j) $a'bc + abc' + abc + a'bc'$

Take common terms.

$a'bc + abc' + abc + a'bc' = a'b(c+c') + ab(c+c')$

$= a'b(1) + ab(1)$

$= b(a'+a)$

$= b.$

∴ Simplified Boolean expression is $\boxed{b}$.

2.9) c) $z + z'(v'w + xy)$

Let $F = z + z'(v'w + xy)$

∴ $F' = [z + z'(v'w + xy)]'$

$= (z') \cdot [z'(v'w + xy)]'$ [DeMorgan's Theorem]

$= (z') \cdot [z + (v'w + xy)']$

$= (z') \cdot [z + (v'w)' \cdot (xy)']$

$= (z') \cdot [z + (v+w) \cdot (x'+y')]$

$= z' \cdot z + z'(v+w') \cdot (x'+y')$

∴ $\boxed{F' = z'(v+w')(x'+y')}$

2.17) c) $(c'+d)(b+c')$

Truth table of $F = (c'+d)(b+c')$

b	c	d	c'	c'+d	b+c'	F
0	0	0	1	1	1	1
0	0	1	1	1	1	1
0	1	0	0	0	0	0
0	1	1	0	1	0	0
1	0	0	1	1	1	1
1	0	1	1	1	1	1
1	1	0	0	0	1	0
1	1	1	0	1	1	1

Sum of minterms:

$F = (c'+d)(b+c')$

$= c'(b+c') + d(b+c')$

$= bc' + bd + c'd + c'$

$F = bc' + bd + c'(d+1)$

$= bc' + bd + c'$

$= bc'(d+d') + bd(c+c') + c(b+b')(d+d')$

$= bc'd + bc'd' + bdc + bdc' + (bc' + b'c')(d+d')$

$= bc'd + bc'd' + bcd + bc'd + bc'd + b'c'd + b'c'd'$

$= bc'd + bc'd' + bcd + b'c'd' + b'c'd'$

$= b'c'd' + b'c'd + bc'd' + bc'd + bcd$

$= m_0 + m_1 + m_4 + m_5 + m_7$

$\boxed{F = \Sigma(0, 1, 4, 5, 7)}$

Product of maxterm.

$F = (c'+d)(b+c')$

$= (c'+d+bb')(b+c'+dd')$

$= (c'+d+b)(c'+d+b')(b+c'+d)(b+c'+d')$

$= (b+c'+d)(b+c'+d')(b'+c'+d)$

$F = M_1 M_2 M_6$

$\boxed{F = \Pi(2,3,6)}$

2.21) a) $F(x,y,z) = \Sigma(1,3,5)$

$F'(x,y,z) = \Sigma(0,2,4,6,7)$

$= m_0 + m_2 + m_4 + m_6 + m_7$

$= x'y'z' + x'yz' + xy'z' + xyz' + xyz$

$F(x,y,z) = [F'(x,y,z)]'$

$= (x'y'z' + x'yz' + xy'z' + xyz' + xyz)'$

$= (x'y'z')' \cdot (x'yz')' \cdot (xy'z')' \cdot (xyz')' \cdot (xyz)'$

$= (x+y+z) \cdot (x+y'+z) \cdot (x'+y+z) \cdot (x'+y'+z) \cdot (x'+y'+z')$

$= M_0 M_2 M_4 M_6 M_7$

$\boxed{F(x,y,z) = \Pi(0,2,4,6,7)}$

b) $F(A,B,C,D) = \Pi(3,5,8,11)$

$= M_3 M_5 M_8 M_{11}$

$= (A+B+C'+D')(A+B'+C+D')(A'+B+C+D)(A'+B+C'+D')$

$F' = [(A+B+C'+D')(A+B'+C+D')(A'+B+C+D)(A'+B+C'+D')]'$

$F' = (A+B+C+D')' + (A+B+C'+D)' + (A'+B+C+D)' + (A'+B+C'+D')'$

$= A'B'CD + A'BC'D + AB'C'D' + AB'CD$

$= m_3 + m_5 + m_8 + m_{11}$

$F'(A,B,C,D) = \Sigma(3,5,8,11)$

$F(A,B,C,D) = [F'(A,B,C,D)]'$

$\boxed{F(A,B,C,D) = \Sigma(0,1,2,4,6,7,9,10,12,13,14,15)}$

2.27)

f_1	f_2	a	b	c
1	1	0	0	0
0	1	0	0	1
1	0	0	1	0
1	1	0	1	1
1	0	1	0	0
0	1	1	0	1
1	0	1	1	1

$f_1 = \Sigma m(0,2,3,4,7)$

$= a'b'c' + a'bc' + a'bc + ab'c' + abc$

$= [a'b' + a'b + ab']c' + [a'+a]bc$

$= [a'[b'+b] + ab']c' + bc$

$= [(a' + ab']c' + bc$

$= [(a'+a)(a'+b')]c' + bc$

$\boxed{f_1(a,b,c) = a'c' + b'c' + bc}$

$f_2 = \Sigma m(0,1,3,5)$

$= a'b'c' + a'b'c + a'bc + ab'c$

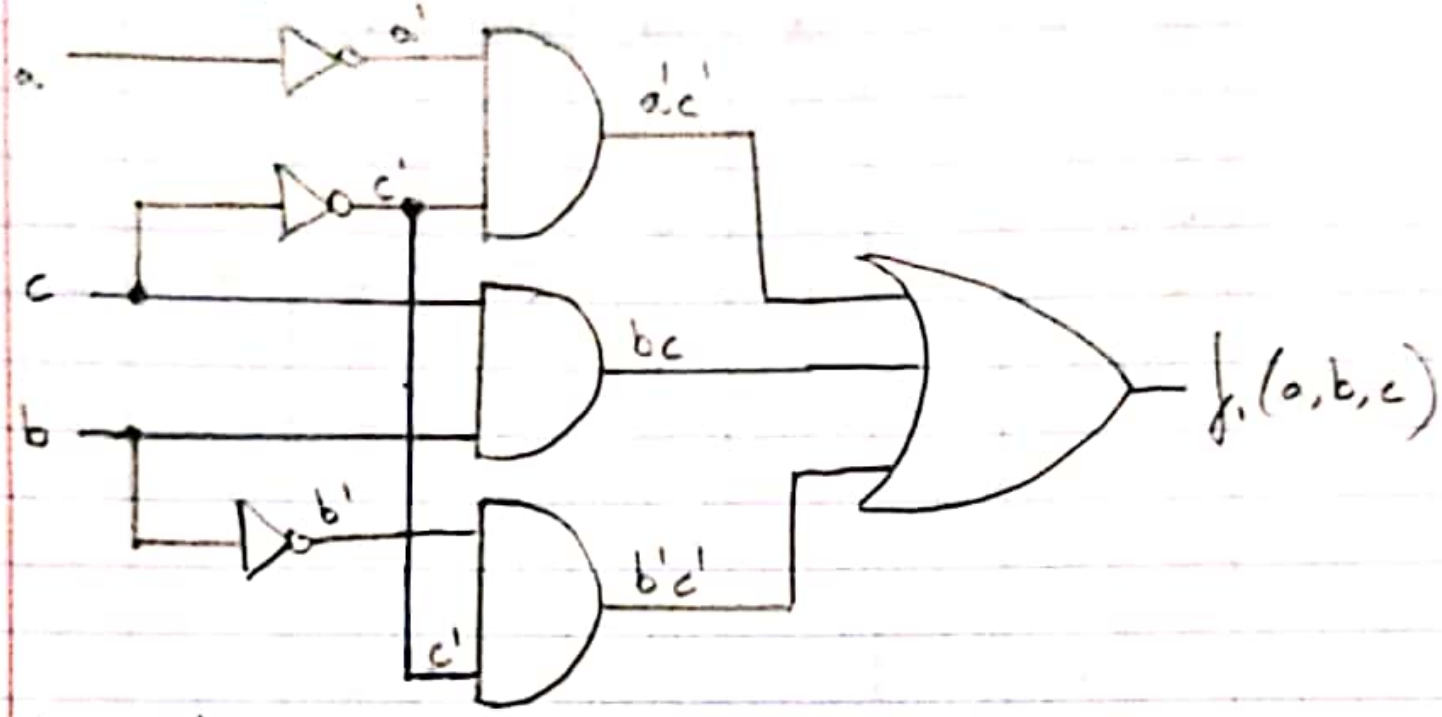
$= a'b'c' + (a'b'c + a'b'c + a'bc) + a'bc + ab'c$

$= (a'b'c' + a'b'c) + (a'bc + a'b'c) + (ab'c + a'b'c)$

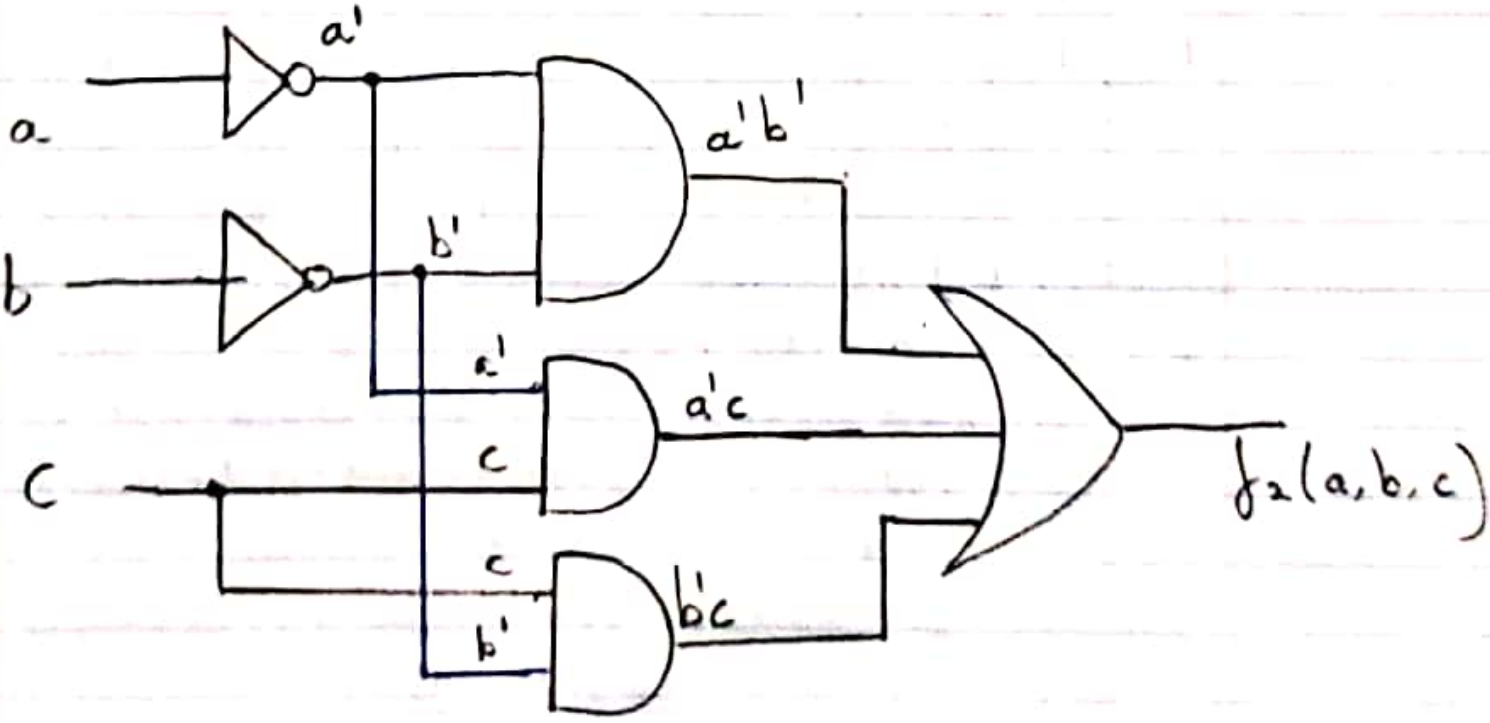
$= a'b'(c'+c) + a'c(b+b') + b'c(a+a')$

$\boxed{f_2(a,b,c) = a'b' + a'c + b'c}$

Logic diagram for f_1



Logic diagram for f_2



EXTRA

2.7) d) $bd' + acd' + ab'c + a'c'$

a	b	c	d	bd'	acd'	ab'c	a'c'	F
0	0	0	0	0	0	0	1	1
0	0	0	1	0	0	0	1	1
0	0	1	0	0	0	0	0	0
0	0	1	1	0	0	0	0	0
0	1	0	0	1	0	0	1	1
0	1	0	1	0	0	0	1	1
0	1	1	0	1	0	0	0	1
0	1	1	1	0	0	0	0	0
1	0	0	0	0	0	0	0	0
1	0	0	1	0	0	0	0	0
1	0	1	0	0	1	1	0	1
1	0	1	1	0	0	1	0	1
1	1	0	0	1	0	0	0	1
1	1	0	1	0	0	0	0	0
1	1	1	0	1	1	0	0	1
1	1	1	1	0	0	0	0	0

$F = bd' + acd' + ab'c + a'c'$ (Sum of minterms)

$= bd'(a+a')(c+c') + acd'(b+b') + ab'c(d+d') + a'c'(b+b')(d+d')$

$= \{(abcd' + a'bd')(c+c') + abcd' + ab'cd' + ab'cd' + ab'cd + ab'cd + a'b'cd + a'b'cd' \rightarrow$
$\rightarrow + a'bcd + a'b'cd + ab'c'd'\}$

$= a'b'c'd' + a'b'c'd + a'bcd' + a'bc'd + a'bcd' + ab'cd' + ab'cd + ab'd' + abcd'$

$F = \Sigma(0, 1, 4, 5, 6, 10, 11, 12, 14)$

$F = bd' + acd' + ab'c + a'c'$ (Product of maxterms)

$F = \Pi(2, 3, 7, 8, 9, 13, 15)$