I

Home work 2.

(1) Demonstrate by means of truth tables the validity of the following identities. The distributive Law: $x + yz = (x+y)\cdot(x+z)$

X	Y	Z	YZ	X+YZ	X+Y	X+Z	(X+Y)·(X+Z)
0	0	0	0	0	0	0	0
0	0	1	0	0	0	1	0
0	1	0	0	0	1	0	0
0	1	1	1	1	1	1	1
1	0	0	0	1	1	1	1
1	0	1	0	1	1	1	1
1	1	0	0	1	1	1	1
1	1	1	1	1	1	1	1

equal

(2) Simplify following Boolean expressions to a minimum number of literals

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

$\underbrace{aa'b'}_{0} + ac + \underbrace{ba'b'}_{0} + bc + c'a'b' + \underbrace{c'c}_{0}$

$\cancel{a'b'(a+b+c') + c(a+b+c')}$

$0 + ac + 0 + bc + c'a'b' + 0$

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

b) $a'bc + abc' + abc + a'bc'$

$a'b(\underbrace{c+c'}_{1}) + ab(\underbrace{c'+c}_{1})$

$a'b + ab$

$b(\underbrace{a'+a}_{1})$

b

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

$\underbrace{a'a}_{0} + a'b' + a'c' + c'a + c'b' + \underbrace{c'c'}_{1}$

$\cancel{a'(b'+c') + c'(a+b')}$

$c'(\underbrace{a'+a}_{1}) + c'\cdot b' + a'b'$

$c' + c'b' + a'b'$

$c'(\underbrace{1+b'}_{1}) + a'b'$

$c' + a'b'$

d) $ABC'D + A'BD + ABCD$

$BD(AC'\cancel{D} + A'\cancel{D} + AC\cancel{D})$

$\cancel{BD(AC' + (A' + AC))}$

$\cancel{BD(AC' + (A'+A)\cdot(A'+C))}$

$\cancel{BD(AC' + A'C)}$

$ABD(\underbrace{C'+C}_{1}) + A'BD$

$ABD + A'BD$

$BD(\underbrace{A+A'}_{1})$

BD

e) $AB' + A'B'D + A'CD'$

$B'(A + A' \cdot D) + A'CD'$

$B'(\underbrace{(A+A')}_{1} \cdot (A+D)) + A'CD'$

$B' \cdot (A+D) + A'CD'$

$B'A + B'D + A'CD'$

3. Find complement of the following expression.

a) $(A'+B) \cdot C'$

$((A'+B) \cdot C')'$

$(A'+B)' + C$

$A \cdot B' + C$

b) $(AB'+C) \cdot D' + E$

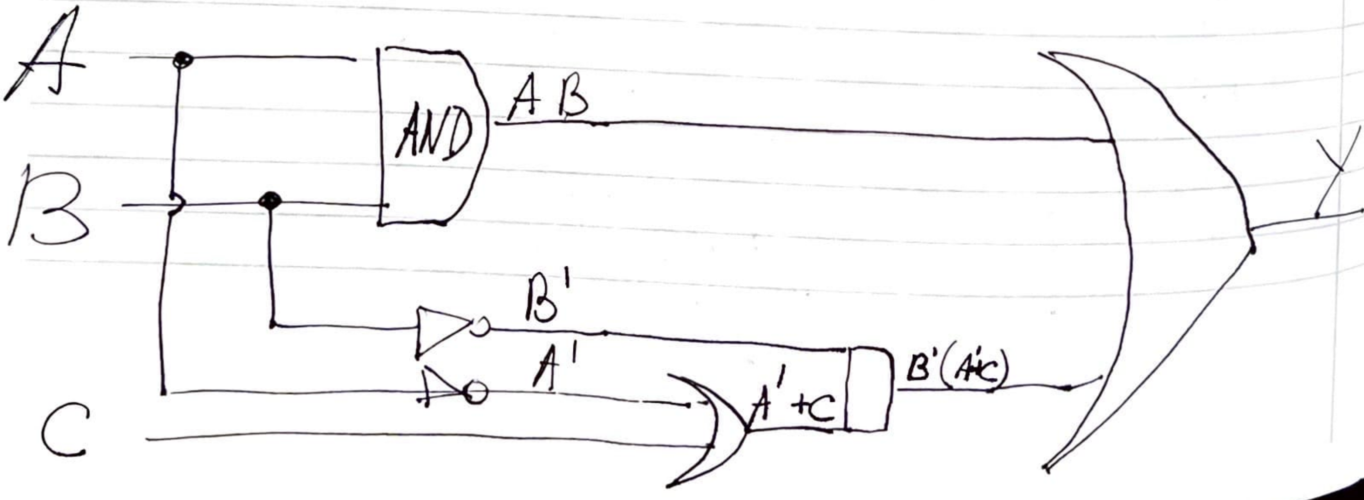
$((AB'+C) \cdot D' + E)'$

$(AB'+C)' + D \cdot E'$

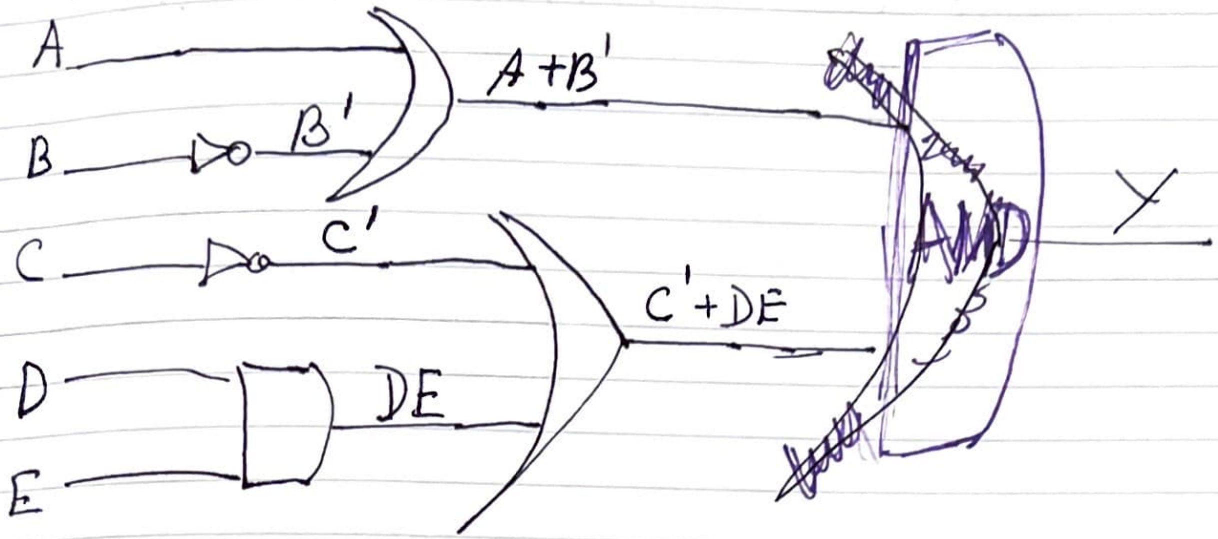
$A' + B \cdot C' + D \cdot E'$

4. Draw the logic diagram for the following boolean expressions.

a) $Y = AB + B'(A'+C)$



b) $Y = (A + B')(C' + DE)$



5. Obtain the truth table of the function $F = (A+C)(B'+C)$ and express function in sum of minterms and product of max.

A	B	C	B'	(A+C)	(B'+C)	(A+C)(B'+C)	
0	0	0	1	0	1	0	M_0
0	0	1	1	1	1	1	← m_1
0	1	0	0	0	0	0	M_2
0	1	1	0	1	1	1	← m_3
1	0	0	1	1	1	1	← m_4
1	0	1	1	1	1	1	← m_5
1	1	0	0	1	0	0	M_6
1	1	1	0	1	1	1	← m_7

$\Sigma Min = m_1 + m_3 + m_4 + m_5 + m_7 = A'B'C +$

$+ A'BC + AB'C' + AB'C + ABC$ SOP

POS $\Pi Max = M_0 \cdot M_2 \cdot M_6 = (A+B+C) \cdot (A+B'+C) \cdot (A'+B'+C)$

6. Express the following function in Sum of minterms and product of maxterms : $F = (a, b, c, d) = (c'+d)(b'+c'$

$= c'b' + \underbrace{c'c'}_{c'} + db' + dc'$

$c'b' + c' + db' + dc'$

$c'(\underbrace{b'+1}_{1}) + db' + dc'$

$c' + dc' + db'$

$c'(1+d) + db'$

$c' + db'$

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

SOP $\sum$ Minterm $= a'b'c'd' + a'b'c'd + a'b'cd + a'bc'd' + a'bc'd' +$
$+ ab'c'd' + ab'c'd + ab'cd + abc'd' + abc'd$

POS $\prod$ Maxterm $= (a+b+c'+d)(a+b'+c'+d) + (a+b'+c'+d')$
$+ (a'+b+c'+d) + (a'+b'+d'+c) + (a'+b'+c'+d')$

7. Convert following to other canonical form: a) $F_{(X,Y,Z)} = \sum(0,2,3,6) =$

$= \prod(1,4,5,7)$

b) $F(A,B,C,D) = \prod(1,3,4,6,7,8,12,15) =$

$= \sum(0,2,5,9,10,11,13,14)$

8. Conver following function into SOP and POS. You need to simplify first.

$$F = (BC+D)(C+AD') =$$

$$= B\underbrace{CC}_{C} + BCAD' + DC + A\underbrace{DD'}_{0} =$$

$$\cancel{C + BCAD' + DC + 0}$$

$$\cancel{BCAD'}$$

$$= BC(1+AD') + DC$$

$$BC + DC \rightarrow SOP$$

$$C \cdot (B+D) \rightarrow POS$$

9. Use Boolean Algebra to prove that the following Boolean equalities are true

a) $(a+b)'bc = 0$

$a' \cdot \underbrace{b'b}_{0}c = 0$

$a' \cdot 0 \cdot c = 0$

$0 = 0$

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

$(a'+b)\cdot(a+b')$

$\underbrace{a'a}_{0} + a'b' + ba + \underbrace{bb'}_{0}$

$a'b' + ab = a'b' + ab$