form is called as a MAX TERM.

* A max term gives the value '0' for exactly one combinetn of variables.

* The product of all max term of 'f' for which 'f' assumes '0' is called cannonical product of sums or conjunctive normal forms.

Lecture 02

## Redundant literal Rule

1) $A + \bar{A}B = A + B$

2) $A(\bar{A} + B) = AB$ dual form

## Absorption Law

1) $A + A \cdot B = A$

2) $A(A + B) = A$

## Consensus Theorem

1) $AB + \bar{A}C + BC = AB + \bar{A}C$

2) $(A+B)(\bar{A}+C)(B+C)$
$= (A+B)(\bar{A}+C)$

## Transposition Theorem

$AB + \bar{A}C = (A+C)(\bar{A}+B)$

## Consensus Theorem

① L.H.S $AB + \bar{A}C + BC$

$= AB + \bar{A}C + BC(A+\bar{A})$

$= AB + \bar{A}C + ABC + \bar{A}BC$

$= AB(1+C) + \bar{A}C(1+C)$

$= AB + \bar{A}C = $ R.H.S

② LHS $(A+B)(\bar{A}+C)(B+C)$

$= (A\cdot\bar{A} + AC + B\cdot\bar{A} + BC)(B+C)$

$= (0 + AC + B\cdot\bar{A} + BC)(B+C)$

$= ABC + B\cdot B\bar{A} + B\cdot C\cdot B + ACC + B\bar{A}C + BC\cdot C$

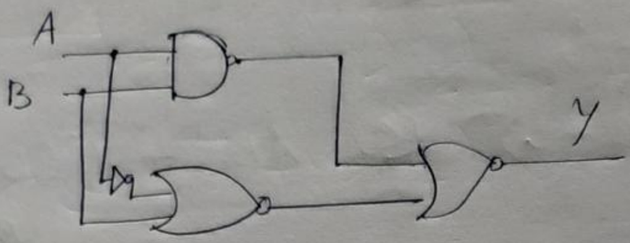
$= ABC + \bar{A}B + BC + AC + \bar{A}BC + BC$

$= BC(A+1) + \bar{A}B(1+C) + BC + AC$

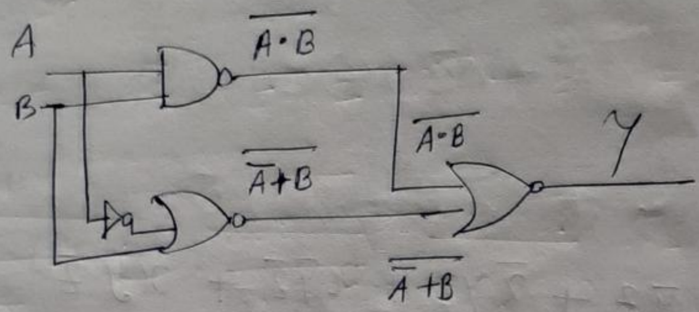
$= BC + BC + \bar{A}B + AC$

# Boolean Algebra & Expression - Part IX

Q [NET-DEC-2018]

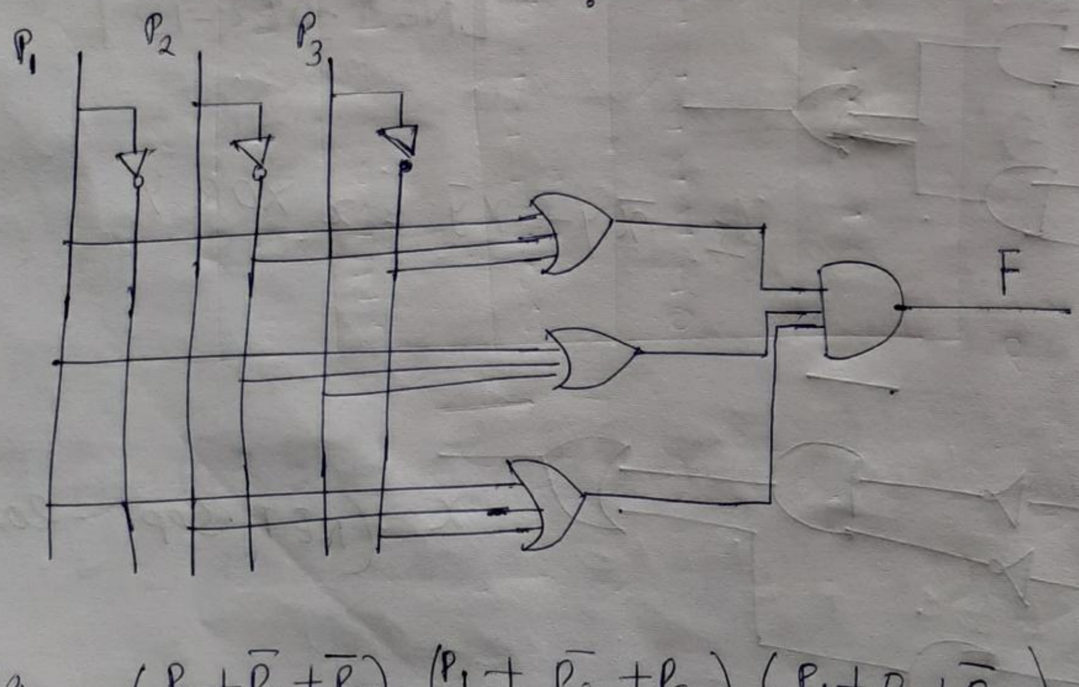



Soln:-




$= \overline{\overline{A\cdot B} + \overline{\bar{A}+B}} = \overline{\overline{A\cdot B}}\cdot\overline{\overline{\bar{A}+B}} = A\cdot B\,(\bar{A}+B) = AB$ #

Q What is the O/P ? [NET-NOV-2017]




Soln $(P_1+\bar{P}_2+\bar{P}_3)(P_1+\bar{P}_2+P_3)(P_1+P_2+\bar{P}_3)$

$= \Sigma m(3, 2, 1) \simeq \Sigma m(0, 4, 5, 6, 7)$

$= \bar{P}_1\bar{P}_2\bar{P}_3 + P_1\bar{P}_2\bar{P}_3 + P_1\bar{P}_2P_3 + P_1P_2\bar{P}_3$

$+ P_1P_2P_3$

$= P_1\bar{P}_2(P_3+\bar{P}_3) + P_1P_2(\bar{P}_3+P_3) + \bar{P}_1\bar{P}_2\bar{P}_3$

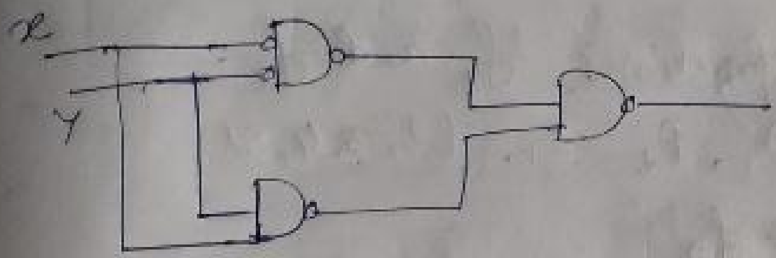
$= P_1\bar{P}_2 + P_1P_2 + \bar{P}_1\bar{P}_2\bar{P}_3 = \bar{P}_2(P_1 + \bar{P}_1\bar{P}_3) + P_1P_2$

$= \bar{P}_2(P_1+\bar{P}_3) + P_1P_2 = P_1\bar{P}_2 + \bar{P}_2\bar{P}_3 + P_1P_2 = P_1(P_2+\bar{P}_2) + \bar{P}_2\bar{P}_3$

$= P_1 + \bar{P}_2\bar{P}_3$ #

Q What is the $\overline{O/P}$ of the following circuit

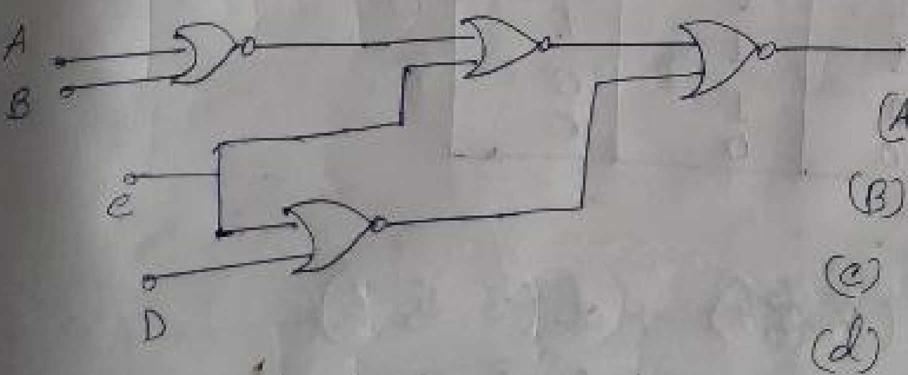
[NET-AUG-20




Soln $\overline{\overline{\bar{x}\cdot\bar{y}}\cdot\overline{x\cdot y}} = \overline{\overline{\bar{x}\cdot\bar{y}}} + \overline{\overline{x\cdot y}}$

$= \bar{x}\cdot\bar{y} + xy = x \odot y$ #

Q What is the $\overline{O/P}$? [NET - June - 2010]




Options

(A) $\bar{A}\bar{C} + \bar{B}\bar{C} + CD$

(B) $A\bar{C} + B\bar{C} + \bar{C}D$

(C) $ABC + \bar{C}\bar{D}$

(d) $\bar{A}\bar{B} + \bar{B}\bar{C} + \bar{C}\bar{D}$

Soln

$\overline{\overline{\bar{a}\cdot\bar{b}+c} + \overline{(c+d)}}$

$= \overline{\overline{\bar{a}\cdot\bar{b}+c}}\cdot\overline{\overline{c+d}} = (\bar{a}\cdot\bar{b}+c)(c+d)$

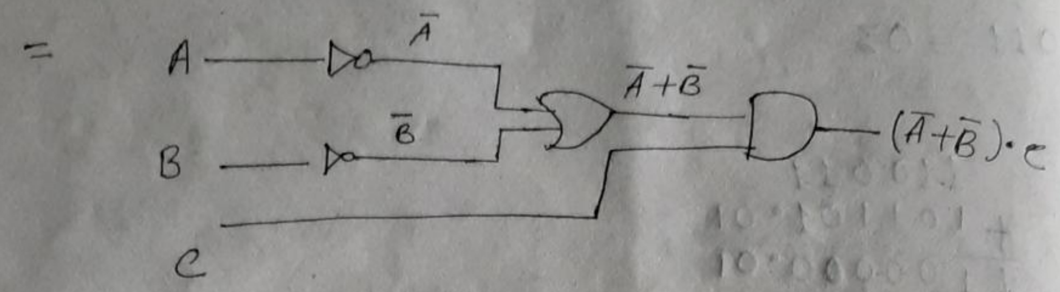
$= \bar{a}\bar{b}c + \bar{a}\bar{b}d + c + cd = \bar{a}\bar{b}d + c$

But it is not matching with any of the options

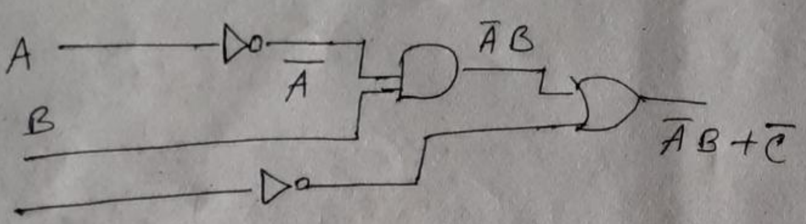
even after drawing K-Map.

Q $y = (\bar{A} + \bar{B})C$

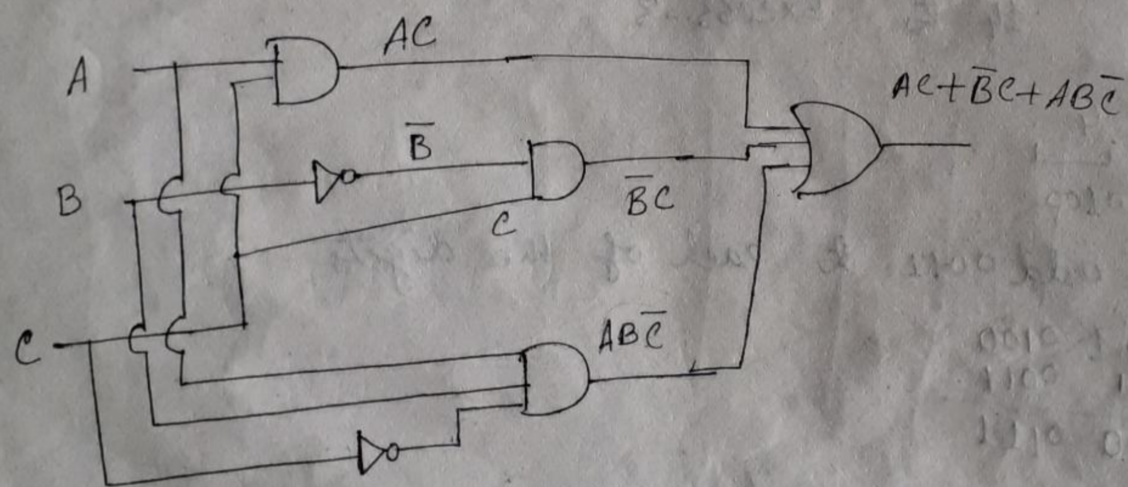
=



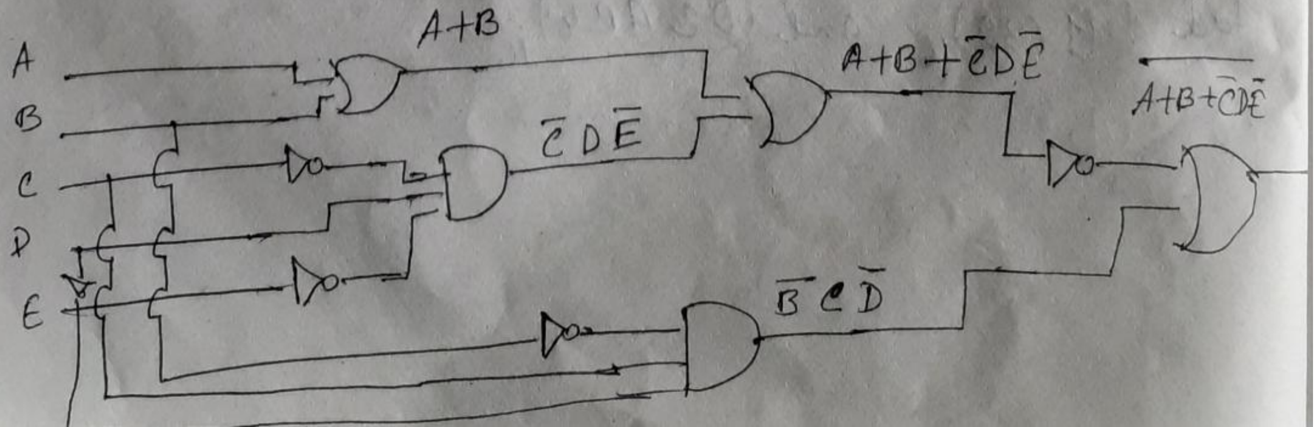

Q $Y = \bar{A}B + \bar{C}$




Q $Y = AC + \bar{B}C + AB\bar{C}$




Q $Y = \overline{(A+B+\bar{C}D\bar{E})} + \bar{B}C\bar{D}$



# Boolean Algebra ..

## ① Idempotent Law

$a \cdot a = a$

$a + a = a$

## ② Associative Law

$a \cdot (b \cdot c) = (a \cdot b) \cdot c$

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

## ③ Commutative Law

$a \cdot b = b \cdot a$

$a + b = b + a$

## ④ Distributive Law

$a \cdot (b + c) = a \cdot b + a \cdot c$

$a + (b \cdot c) = (a + b) \cdot (a + c)$

## ⑤ De. Morgan's Law

$\overline{a + b} = \bar{a} \cdot \bar{b}$

$\overline{a \cdot b} = \bar{a} + \bar{b}$

## ⑥ Identity Law

$a + 0 = a$

$a \cdot 0 = 0$

$a + 1 = 1$

$a \cdot 1 = a$

## ⑦ Complement Law

① $\bar{0} = 1$ ③ $a \cdot \bar{a} = 0$

② $\bar{1} = 0$ ④ $a + \bar{a} = 1$

## ⑧ Involution Law

$\bar{\bar{a}} = a$

# Proof of De-Morgan Theorem

(1) $\overline{A \cdot B} = \overline{A} + \overline{B}$

From complementary Law

$A + \overline{A} = 1$ , $A \cdot \overline{A} = 0$

$(x+y) + (\overline{x+y}) = 1$

$(x+y) + \overline{x} \cdot \overline{y}$

$(x+y+\overline{x})(x+y+\overline{y})$

$= (1+y)(1+x)$

$= 1 \cdot 1 = 1$

$(x+y) \cdot (\overline{x+y}) = 0$

$(x+y) \cdot (\overline{x} \cdot \overline{y})$

$(x \cdot \overline{x} \cdot \overline{y}) + (y \cdot \overline{x} \cdot \overline{y})$

$= (0 \cdot \overline{y}) + (0 \cdot \overline{x})$

$= 0 + 0$

$= 0$

Q $\overline{x}\,\overline{y} + xy + \overline{\overline{x}y}$ [Simplify the expression]

$= \overline{x}\,\overline{y} + y(x+\overline{x})$

$= \overline{x}\,\overline{y} + y \cdot 1$ [Complement Law]

$= \overline{x}\,\overline{y} + y$ [Identity Law]

$= (\overline{x}+y)(\overline{y}+y)$ [Distributive Law]

$= (\overline{x}+y) \cdot 1$ [Complement Law]

$= (\overline{x}+y)$ [Identity Law]