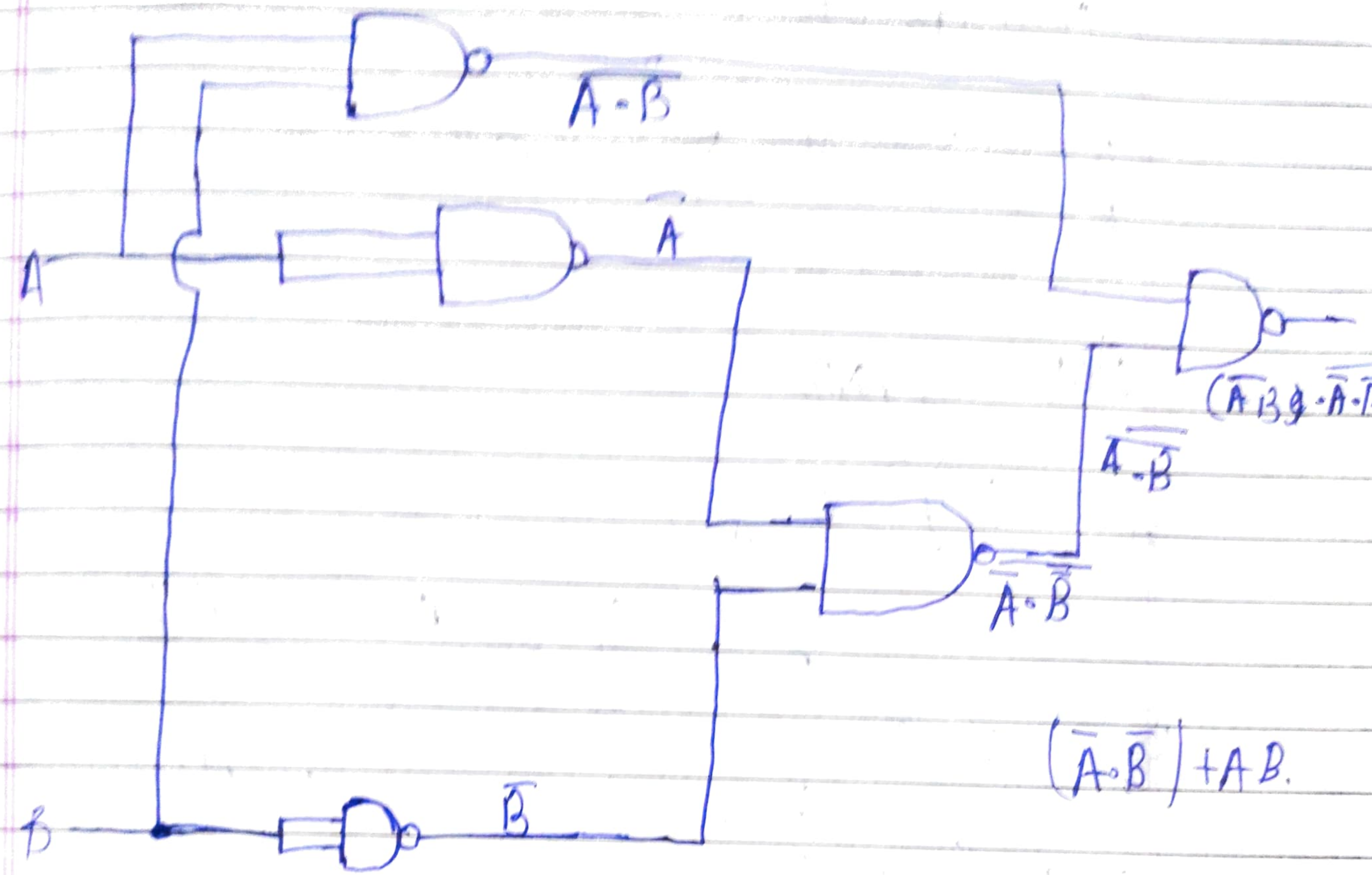
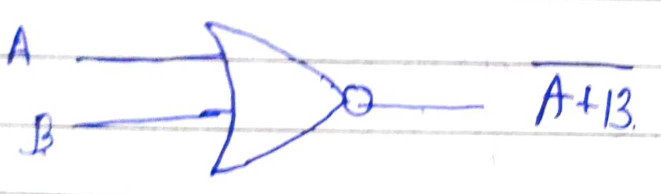
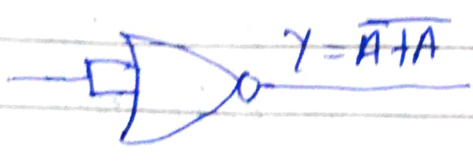
09 Mar 2022



$(\overline{A}\cdot\overline{B})+AB.$

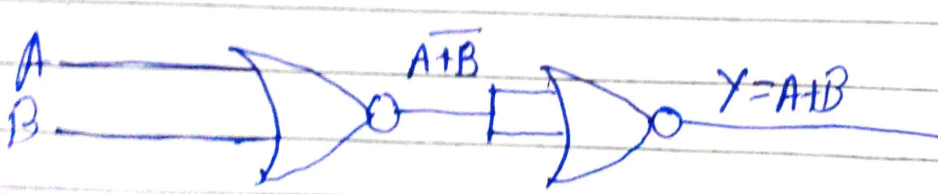


(i) NOR as NOT

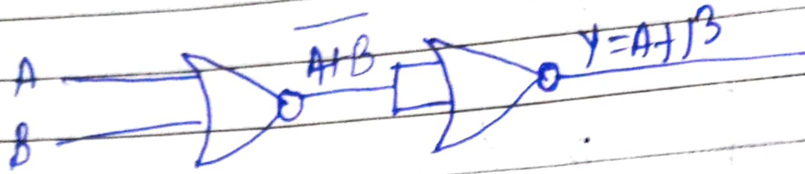


$=\overline{A}$

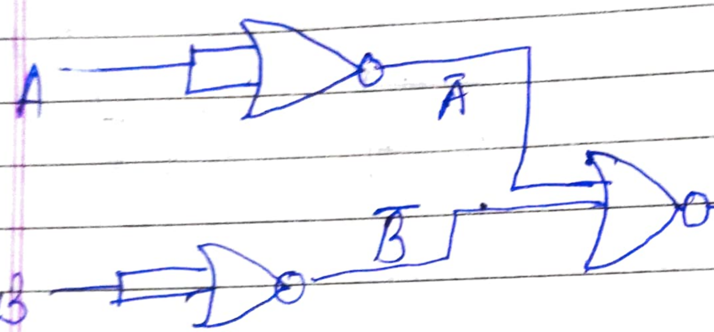
(ii) NOR as OR



NOR as OR



NOR as AND

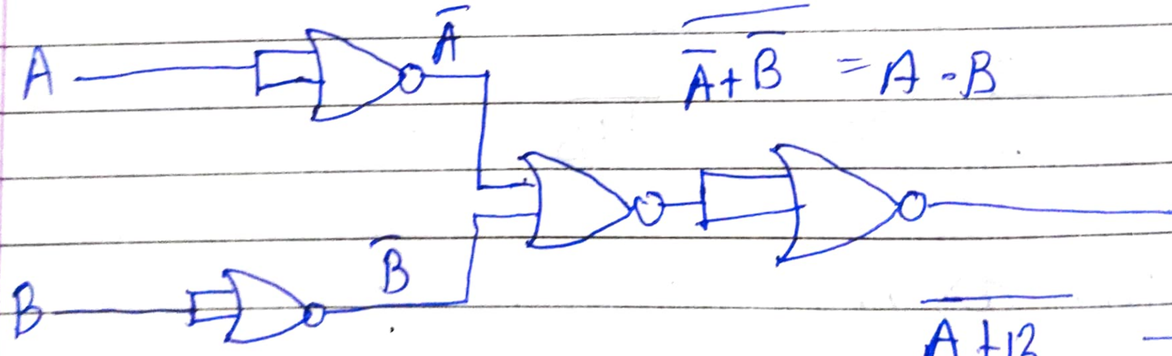


$\overline{\overline{A}+\overline{B}} = \overline{\overline{A}}\cdot\overline{\overline{B}}$

$Y = A.B$

NOR as NAND

$\overline{\overline{A}+\overline{B}} = A\cdot B$



$\overline{A+B} \longrightarrow$ NOR

$A\overline{B}+\overline{A}B$

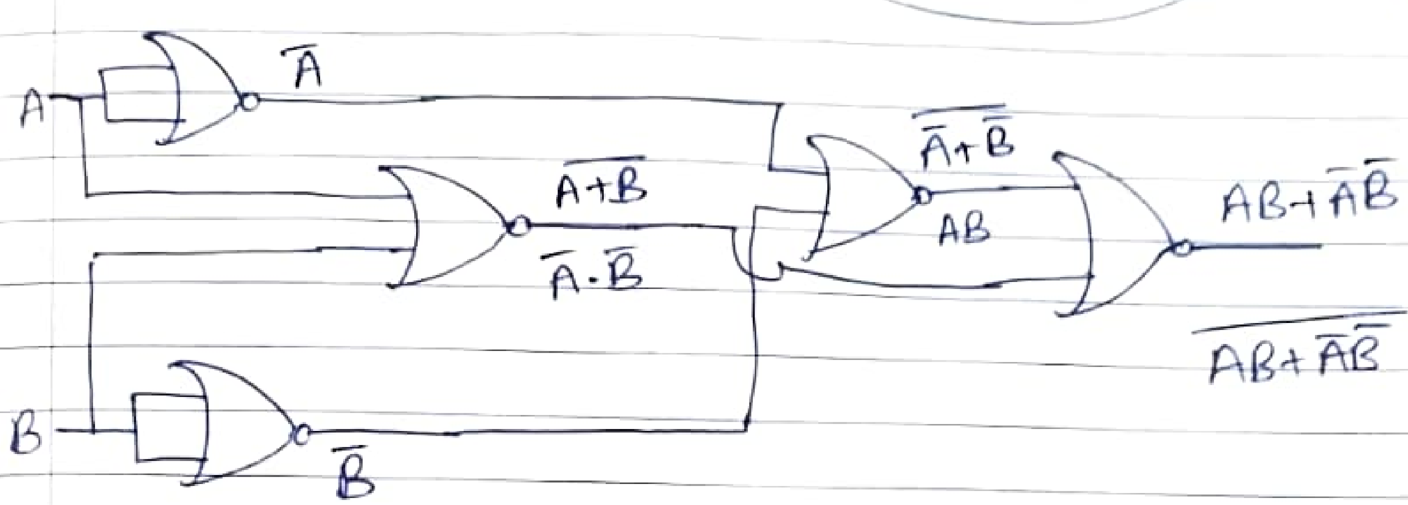
$A\overline{B}+\overline{A}B$

NOR OR EXOR

$\overline{A+B}$ NOR

$A\overline{B} + \overline{A}B$

* NOR as Ex-OR



* $A + B\cdot C$

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

$\underline{A\cdot A} + A\cdot C + B\cdot A + B\cdot C$

$\underline{A + AC + B A} + B\cdot C$

$A(1 + \underline{C+B}) + BC$

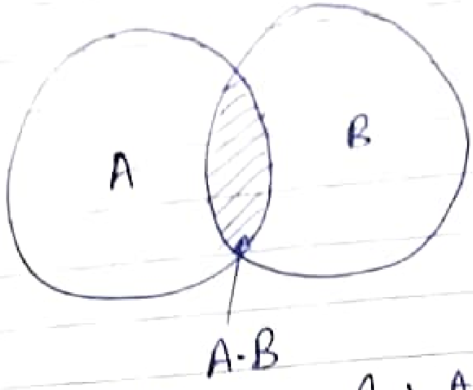
$A(1) + BC$

$A + B\cdot C$

* $A + AB = A(1+B)$

$= A(1)$

$= A$



$A + A \cdot B = A + AB = A$

* $A + \bar{A}B = \underline{A + B}$

$(A + \bar{A}) \cdot (A + B)$

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

* <u>Compute</u>

$\bar{A} + AB + ABC + ABCD$

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

$(\bar{A} + A) \cdot (\bar{A} + B)$

$1 \cdot (\bar{A} + B)$

$= \underline{\bar{A} + B}$

* If $\bar{A} + AB + ABC + ABCD + 1$

$= 1$

1 or with any expression will be $\boxed{1}$

* Importance of Simplification of Algebraic Equation.

$$Y = \bar{A} + AB + ABC + ABCD$$
$$= \bar{A} + B$$

Q $Y = AB + C\bar{D} + D + BC + (C + \bar{C}) + \bar{B}A$

$Y = A(B+\bar{B}) + D + BC + 1 + \bar{B}A$

$\boxed{Y = 1}$

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

$Y = \bar{A}\cdot\bar{B} + \bar{B}+\bar{C} + \bar{C} + B + B\bar{C} + \bar{D} + \overline{A+C}$

$Y = 1$

Q $Y = (A+(BC)')'(AB' + ABC)$

$Y = (A' \cdot ((BC)')')(AB' + BC)$

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

$\because A' = 0$ $= (A' \cdot BC)A \cdot (B' + C) = 0$

Q $xyz + x'y + xyz'$

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

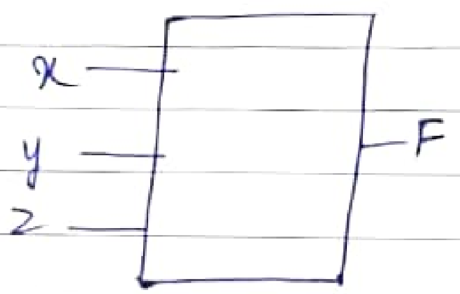
$= xy + x'y$

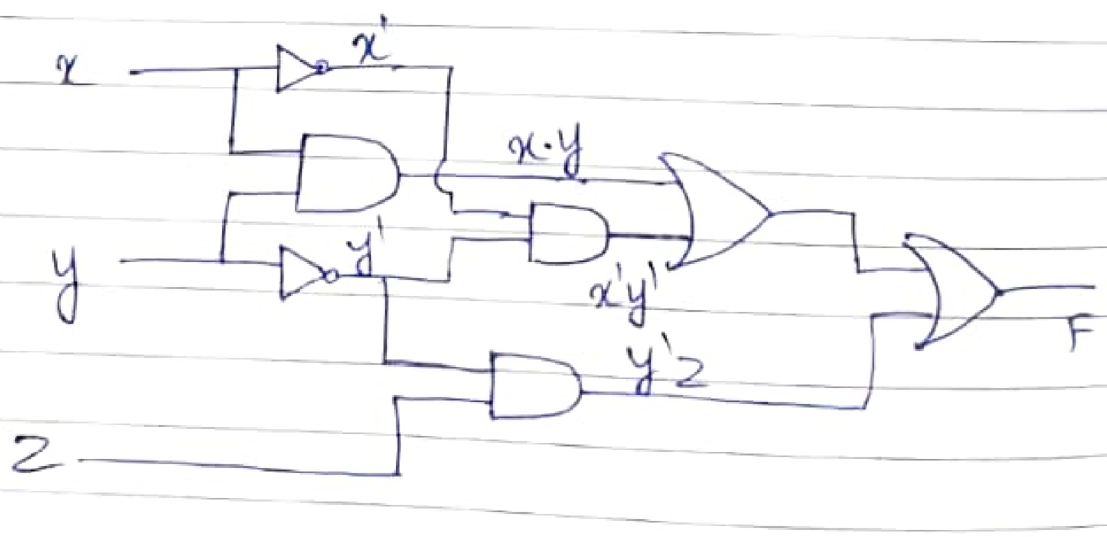
$= y(x+x')$

$= y(1) = \underline{y}$

Q Design a circuit.

$F = xy + x'y' + y'z$





2-input OR

2- input AND

NOT

Q. Design the same ckt using OR and not gate.

$$F = xy + x'y' + y'z$$

$$\overline{A \cdot B} = \bar{A} + \bar{B}$$

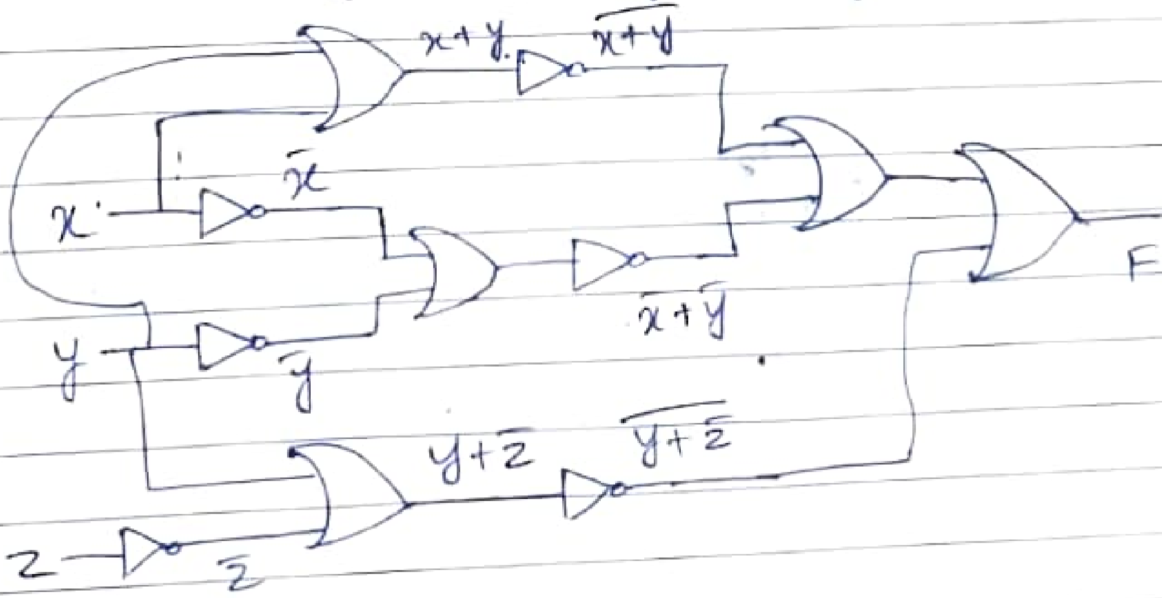
$$\overline{A + B} = \bar{A} \cdot \bar{B}$$

$$F = \overline{\overline{xy + x'y' + y'z}}$$

$$xy = \overline{\bar{x} + \bar{y}}$$

$$= \bar{\bar{x}} \cdot \bar{\bar{y}} = xy$$

$$F = (\overline{\bar{x} + \bar{y}}) + (\overline{x + y}) + (\overline{y + \bar{z}})$$



$$F = \overline{\overline{xy + x'y' + y'z}}$$

$$= \overline{(\overline{xy}) \cdot (\overline{x'y' + y'z})}$$

$$= \overline{(\bar{x} + \bar{y}) \cdot (\overline{x'y'} \cdot \overline{y'z})}$$

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

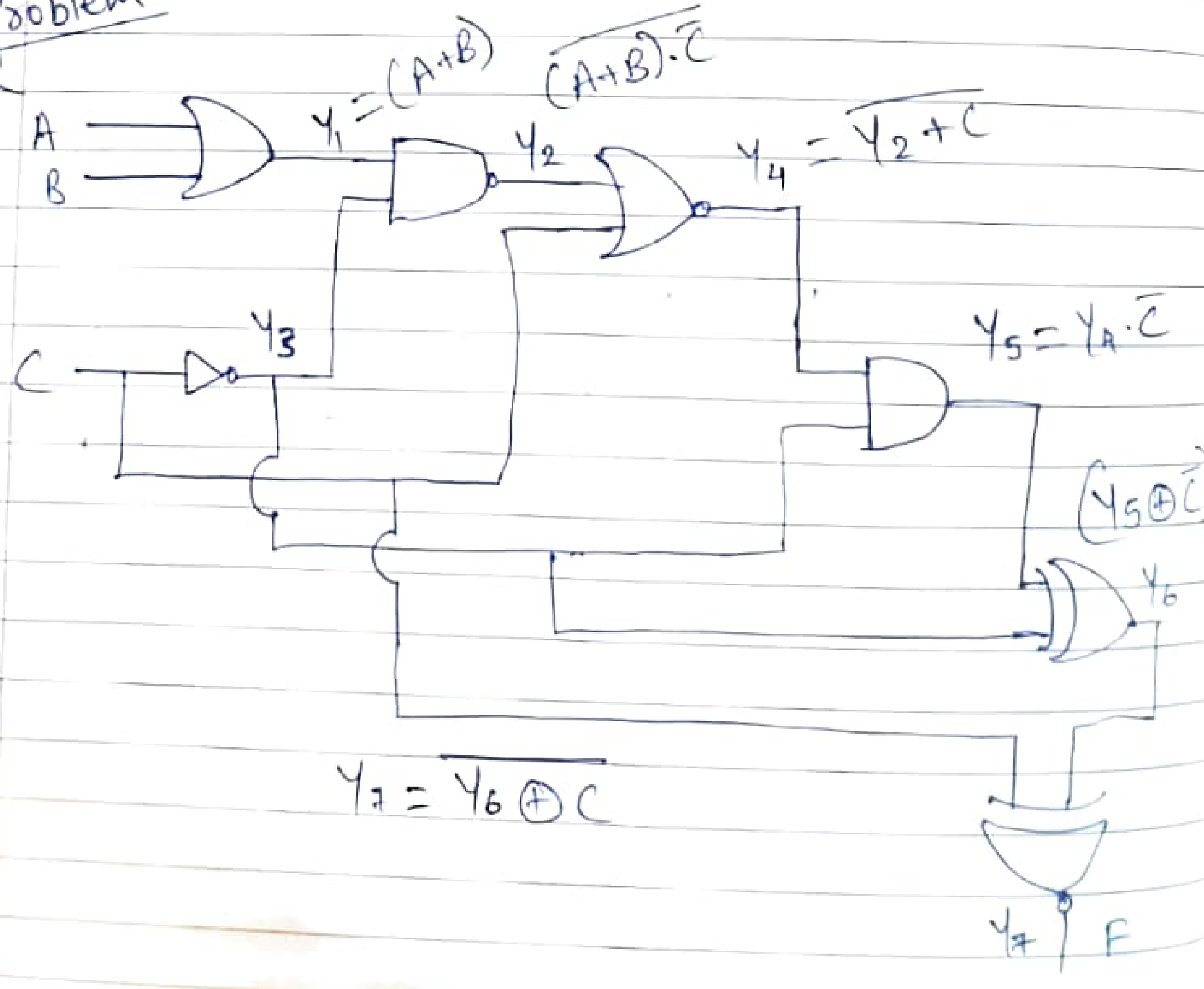
$$= \overline{(\bar{x} + \bar{y})} + \overline{(x + y)} + \overline{(y + \bar{z})}$$

$$\overline{A + B + C} = \bar{A} \cdot \bar{B} \cdot \bar{C}$$

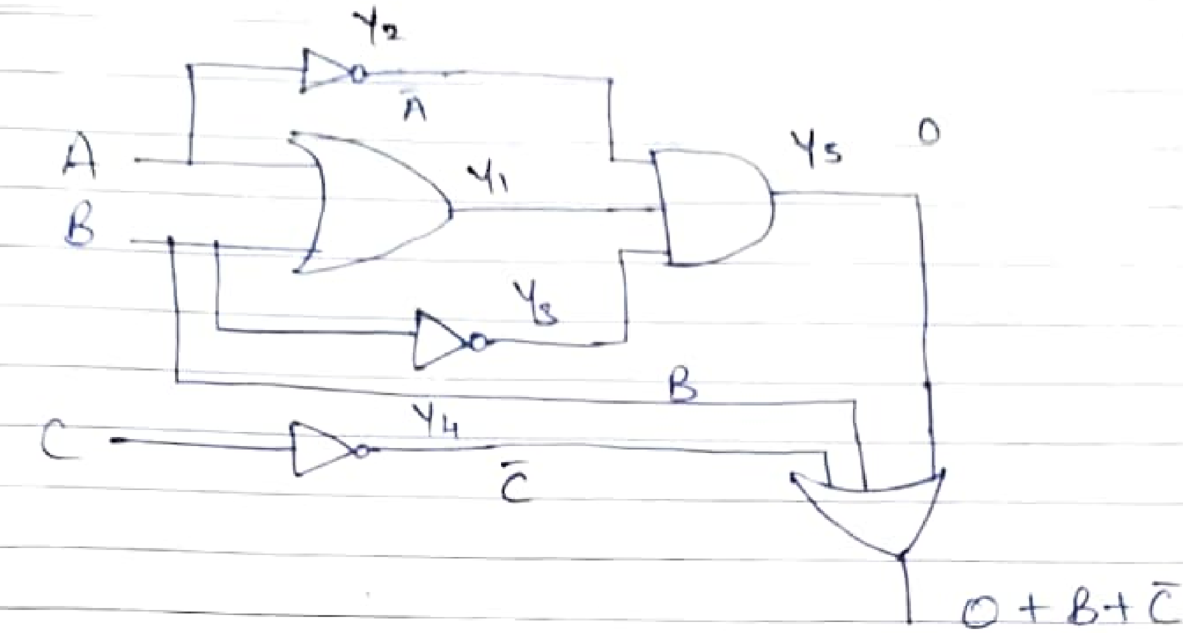
$$\overline{A \cdot B \cdot C} = \bar{A} + \bar{B} + \bar{C}$$

Ckt Problem

Q



Q



Q

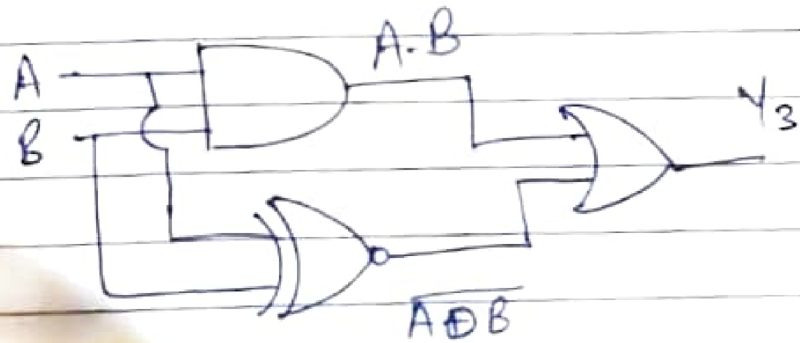
i/P		O/P		
A	B	Y_1	Y_2	Y_3
0	0	0	1	1
0	1	0	0	0
1	0	0	0	0
1	1	1	1	1

$$Y_1 = A \cdot B$$

$$Y_2 = \overline{A \oplus B}$$

$$Y_3 = (A \cdot B) + (\overline{A \oplus B})$$

$$= (A \cdot B) + A \text{ Ex-NOR } B$$



* SOP = Sum of Products

min terms

$$\begin{array}{ccc} m_0 & m_1 & m_2 \\ Y = ABC + & AC\bar{B} + & \bar{A}CB \end{array}$$

$m_0 + m_1 + m_2$ Standard SOP form

SOP form $\underline{\underline{\Sigma m_0}}$

(For ending)

$AB + B + BC + ABC$ Non Standard SOP form

* POS = Product of Sums

Max terms

$$\begin{array}{ccc} M_0 & M_1 & M_2 \\ Y = (A+B) \cdot & (B+C) \cdot & (A+C) \end{array}$$

Standard POS form.

$Y = \Pi M$

(For oring)

$A \cdot (A+B) \cdot (A+B+C)$ Non Standard POS form.

A	B	Y
0	0	1
0	1	0
1	0	1
1	1	0

K-Map

Q

A	B	Y
0	0	1
0	1	0
1	0	1
1	1	0

$\rightarrow \overset{m_0}{\bar{A}\cdot\bar{B}} + \overset{m_1}{A\cdot\bar{B}}$ (using SOP)

$\bar{B}\cdot(A+\bar{A})$

$Y = \bar{B}$

$A\cdot\bar{B}$

Using POS

A	B	Y
0	0	1
0	1	0
1	0	1
1	1	0

$(A+\bar{B})\cdot(\bar{A}+\bar{B})$

$= A\cdot\bar{A} + A\cdot\bar{B} + \bar{B}\cdot\bar{A} + \underbrace{\bar{B}\cdot\bar{B}}_{\bar{B}}$

$= 0 + \bar{B}(\bar{A} + A + 1)$

$= \bar{B}(1)$

$Y = \bar{B}$

Q

A	B	C	Y
0	0	0	0
0	0	1	1
0	1	0	0
0	1	1	1
1	0	0	1
1	0	1	1
1	1	0	0
1	1	1	1

Solve By SOP and POS Method.

By SOP

$\bar{A}\cdot\bar{B}\cdot C + \bar{A}\cdot B\cdot C +$
$A\cdot\bar{B}\cdot\bar{C} + A\cdot\bar{B}\cdot C$
$+ A\cdot B\cdot C$

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

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

$$Y = \bar{A}C + A\bar{B} + ABC.$$

$$Y = A\bar{B} + \bar{A}C + ABC.$$

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

$$Y = \bar{A}C + A\bar{B}\bar{C} + AC.$$

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

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

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

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

<u>Using POS</u>

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

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

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

Q

A	B	Y
0	0	0
0	1	1
1	0	1
1	1	0

SOP

$A\bar{B} + B\bar{A}$

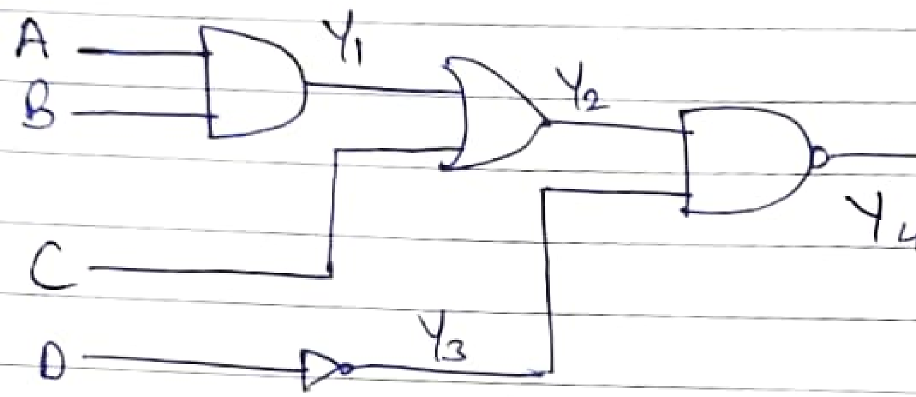
POS

$(A + B) \cdot (\bar{A} + \bar{B})$

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

* KMap = Karnaugh Map.

A \ B	0	1
0	✓	✓
1	✓	✓



A	B	Y_1
0	0	0
0	1	0
1	0	0
1	1	$\boxed{1}$

A B

<u>SOP</u>

$AB + 0$

$$\boxed{Y = AB}$$

A \ B	$\bar{B}$ 0	B 1
$\bar{A}$ 0	0	0
A 1	0	1

AB

* POS Product of Sum

A	B	Y
0	0	0 ✓
0	1	0 ✓
1	0	0 ✓
1	1	1

$$(A+B)\cdot(A+\bar{B})\cdot(\bar{A}+B)$$

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

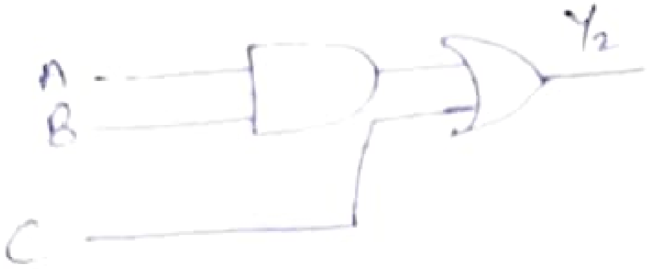
$$= (A+B)\cdot(\bar{B}\bar{A} + AB)$$

$$= AAB + \cancel{A\bar{B}\bar{A}} + \cancel{B\bar{B}\bar{A}} + BAB$$

$$= AB + AB$$

$$= AB$$

A \ B	0	1
0	0	0
1	0	1



A	B	C	Y_2
0	0	0	0
0	0	1	1
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	1
1	1	0	1
1	1	1	1

SOP

	A \ BC	$\bar B \bar C$ 00	$\bar B C$ 01	BC 11	$B\bar C$ 10
$\bar A$	0	0	1	1	0
A	1	0	1	1	1

$$\bar A \bar B \bar C + \bar A B C + A \bar B C + ABC + AB\bar C$$

= [illegible]

$$= \bar B C(\bar A + A) + BC(\bar A + A) + AB\bar C$$

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

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

$= C + \bar{C}AB$
$= (C + \bar{C}) \cdot (C + AB)$

$= C + AB \Rightarrow AB + C$

POS

A \ BC	00 $(B+C)$	01 $(B+\bar{C})$	11 $(\bar{B}+\bar{C})$	10 $(\bar{B}+C)$
A 0	0	1	1	0
$\bar{A}$ 1	0	1	1	1

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

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

$[B + C](A + \bar{B} + C)$

$AB + AC + \cancel{B\bar{B}}^{0} + \bar{B}C + CB + C \cdot C$

$= AB + C[A + \bar{B} + B + 1]$

$= AB + C$

23/3/23

A	B	C	Min. terms m_0 SOP		Max. terms M POS
0	0	0	$\bar{A}\bar{B}\bar{C}$	m_0	$A+B+C$
0	0	1	$\bar{A}\bar{B}C$	m_1	$A+B+\bar{C}$
0	1	0	$\bar{A}B\bar{C}$	m_2	$A+\bar{B}+C$
0	1	1	$\bar{A}BC$	m_3	$A+\bar{B}+\bar{C}$
1	0	0	$A\bar{B}\bar{C}$	m_4	$\bar{A}+B+C$
1	0	1	$A\bar{B}C$	m_5	$\bar{A}+B+\bar{C}$
1	1	0	$AB\bar{C}$	m_6	$\bar{A}+\bar{B}+C$
1	1	1	ABC	m_7	$\bar{A}+\bar{B}+\bar{C}$

POS	SOP	A \ BC	$B+C$ $\bar{B}\bar{C}$ 00	$B+\bar{C}$ $\bar{B}C$ 01	$\bar{B}+\bar{C}$ BC 11	$\bar{B}+C$ $B\bar{C}$ 10
A	$\bar{A}$	0	0 m_0	1 m_1	1 m_3	0 m_2
$\bar{A}$	A	1	0 m_4	1 m_5	1 m_7	1 m_6

Quad

Pair

Pair
Quad
Octa.

POS → C + AB

Pair → reduces by 1
Quad → reduces by 2
Octa → reduces the no. of variables by 3 in the expression

Q

POS	SOP	A \ BC	$\bar{B}\bar{C}$ 00	$B+\bar{C}$ 01	$\bar{B}+\bar{C}$ 11	$B\bar{C}$ 10
A	$\bar{A}$	0	1	0	0	1
$\bar{A}$	A	1	1	0	0	1

Q

POS	SOP	AB \ CD	$C+D$ $\bar{C}\bar{D}$ 00	$C+\bar{D}$ $\bar{C}D$ 01	$\bar{C}+\bar{D}$ CD 11	$\bar{C}+D$ $C\bar{D}$ 10
$A+B$	$\bar{A}\bar{B}$	00	1	0	0	1
$A+\bar{B}$	$\bar{A}B$	01	0	1	1	0
$\bar{A}+\bar{B}$	AB	11	0	1	1	0
$\bar{A}+B$	$A\bar{B}$	10	1	0	0	1

$$BD + \bar{B}\bar{D}$$

$$\overline{B \oplus D} = B \odot D$$

$$(B+\bar{D})\cdot(D+\bar{B})$$