Minterm and Maxterm

Minterm - SOP $[\Sigma m]$ eg. $AB + A\bar{B} + \bar{A}B$

* A Product term containing all the "k" Variables of the function in either Complemented or uncomplemented form is called a minterm

Maxterm - POS $[\pi M]$ eg. $(A+B)(A+\bar{B})(\bar{A}+B)$

* A Sum term containing all the "k" Variables of the function in either Complemented or uncomplemented form is called a maxterm

Minterm and Maxterm for three Binary Numbers

A B C	Term	Designation	Term	Designation
0 0 0	$\bar{A}\bar{B}\bar{C}$	m_0	$A+B+C$	M_0
0 0 1	$\bar{A}\bar{B}C$	m_1	$A+B+\bar{C}$	M_1
0 1 0	$\bar{A}B\bar{C}$	m_2	$A+\bar{B}+C$	M_2
0 1 1	$\bar{A}BC$	m_3	$A+\bar{B}+\bar{C}$	M_3
1 0 0	$A\bar{B}\bar{C}$	m_4	$\bar{A}+B+C$	M_4
1 0 1	$A\bar{B}C$	m_5	$\bar{A}+B+\bar{C}$	M_5
1 1 0	$AB\bar{C}$	m_6	$\bar{A}+\bar{B}+C$	M_6
1 1 1	ABC	m_7	$\bar{A}+\bar{B}+\bar{C}$	M_7

SOP & POS

SOP

↳ To write Standard SOP expression for a given truth table

Steps

- Consider combinations only $Y=1$
- Product term for each combination
- "OR" all Product term combinations to get SOP

2 I/P Ex-NOR

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

$Y=1$

Step 1 : $Y=1$

Step 2 : $Y_1 = \bar{A}B$, $Y_2 = A\bar{B}$ — Boolean expression in the Product term

Step 3 : $Y = Y_1 + Y_2$

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

- This is the required expression in the Standard SOP form. It can also be represented as

$$Y = \bar{A}B + A\bar{B} = m_1 + m_2$$

(m_1 → minterm corresponds $m_1 - 01$; m_2 → minterm corresponds $m_2 - 10$)

Can also be written as $Y = \Sigma m(1,2)$

3 I/P's

A	B	C	Y	
0	0	0	0	
0	0	1	1	→ $\bar{A}\bar{B}C$ (m_1)
0	1	0	0	
0	1	1	0	
1	0	0	1	→ $A\bar{B}\bar{C}$ (m_4)
1	0	1	0	
1	1	0	0	
1	1	1	1	→ ABC (m_7)

Step1 : $Y=1$

Step2 : $Y = \bar{A}\bar{B}C + A\bar{B}\bar{C} + ABC$

Step3 : $Y = m_1 + m_4 + m_7$

$= \Sigma m(0,4,7)$

Pos

* To write a Standard Pos expression for a given truth table

Steps

* only combinations Producing a low O/P, $Y=0$
* Maxterms only for Such combinations
* AND these maxterms

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

Step 1 : $Y=0$

Step 2 : $A+B+C$ (M_0)

$A+\bar{B}+\bar{C}$ (M_3)

$\bar{A}+B+\bar{C}$ (M_5)

$\bar{A}+\bar{B}+C$ (M_6)

Step 2 : ANDing

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

∴ Thus is the required logic expression in the Standard POS form. Can also be written as

$$Y = M_0 \cdot M_3 \cdot M_5 \cdot M_6$$

(or)

$$Y = \pi (0, 3, 5, 6)$$