Minterms and Maxterms →

			Minterms		Maxterms	
x	y	z	Term	Designation	Term	Designation
0	0	0	$x'y'z'$	m_0	$(x+y+z)$	M_0
0	0	1	$x'y'z$	m_1	$x+y+z'$	M_1
0	1	0	$x'yz'$	m_2	$x+y'+z$	M_2
0	1	1	$x'yz$	m_3	$x+y'+z'$	M_3
1	0	0	$xy'z'$	m_4	$x'+y+z$	M_4
1	0	1	$xy'z$	m_5	$x'+y+z'$	M_5
1	1	0	xyz'	m_6	$x'+y'+z$	M_6
1	1	1	xyz	m_7	$x'+y'+z'$	M_7

Minterm – standard product
Maxterm – Standard sum.

Any Boolean function can be expressed as a sum of minterms [Sum of product (SOP)] – "Sum" meant the ORing of terms

And also can be expressed as ~~Sum of maxterm or Sum~~ product of sum (POS) or product of maxterms – "product" meant the ANDing of terms.

Ex- SOP – $f_1 = x'y'z + xy'z' + xyz = m_1 + m_4 + m_7$

POS – $f_2 = (x+y+z)(x+y'+z)(x+y'+z')(x'+y+z')(x'+y'+z)$
$= M_0 \cdot M_2 \cdot M_3 \cdot M_5 \cdot M_6$

Ex- Express the Boolean function $F = A + B'C$ in a sum of minterms.

Solⁿ- $F = A + B'C$

The fonⁿ has three variables A, B and C. The first term A is missing two variable. Therefore

$A = A(B+B') = AB + AB'$

This is still missing one variable:

$A = AB(C+C') + AB'(C+C') = ABC + ABC' + AB'C + AB'C'$

The second term $B'C$ is missing one variable:

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

Combining all terms, we have

$F = A + B'C$

$= ABC + ABC' + AB'C + AB'C' + AB'C + A'B'C$

But $AB'C$ appears twice, so according to theorem, $x + x = x$

$\therefore F = ABC + ABC' + AB'C + AB'C' + A'B'C$

$= m_7 + m_6 + m_5 + m_4 + m_1$

$= m_1 + m_4 + m_5 + m_6 + m_7$ Ans.

Product of Sum (POS)

Q. Express the Boolean function $F = xy + x'z$ in a product of maxterm form or POS form.

Soln $F = xy + x'z = (xy + x')(xy + z)$

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

$= (x' + y)(x + z)(y + z)$ $(\because x + x' = 1)$

Here each maxterm is missing one variable, therefore

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

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

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

Combining all the terms and removing those that appear more than once, we finally obtain:

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

$= M_4 \cdot M_5 \cdot M_0 M_2$

$= M_0 \cdot M_2 M_4 \cdot M_5$