

Fundamental products $\Rightarrow$ In logic gate circuit there are one or more input signals one output signal that is 0 or 1.

To convert the truth table into equivalent logic circuit we use two methods.

- (i) Sum of product method.
- (ii) Karnaugh map (K-map)

Sum of product methods $\Rightarrow$

Boolean expression are formed by two forms

(a) Sum of product (SOP) (minterms).

(b) Product of sum (POS) (maxterms).

Minterms (m) $\Rightarrow$ minterms are the product of input variables such that total value of the product = 1.

Ex $Y = \underline{ABC} + \underline{A\bar{B}\bar{C}} + \underline{\bar{A}BC}$ (minterms)

Maxterms (M) $\Rightarrow$ maxterms are the sum of input variables such that total value of the sum = 0

Ex $Y = (\underline{A+B}) \cdot (\underline{A+\bar{B}})$ (Maxterm)

Q.1 $\Rightarrow$ Write minterms and maxterms for the following Truth table.

Truth table		sop <u>Ans.</u>	spos
A	B	Minterms m_i	Maxterms M_i
0	0	$\bar{A}\bar{B} \rightarrow m_0$	$A+B \rightarrow M_0$
0	1	$\bar{A}B \rightarrow m_1$	$A+\bar{B} \rightarrow M_1$
1	0	$A\bar{B} \rightarrow m_2$	$\bar{A}+B \rightarrow M_2$
1	1	$AB \rightarrow m_3$	$\bar{A}+\bar{B} \rightarrow M_3$

Q.2 $\Rightarrow$ Express the Boolean function F in Sum of Product (SOP) form.

	A	B	C	F
m_0	0	0	0	0
m_1	0	0	1	0
m_2	0	1	0	1
m_3	0	1	1	0
m_4	1	0	0	1
m_5	1	0	1	1
m_6	1	1	0	1
m_7	1	1	1	1

Ans: In the given truth table there are 3 variables
So there are $2^3 = 8$ possible combinations.

The output of the combination is F

we will express F in sum of product (SOP) or in minterms.

The output can be written in sum of product or in minterms when output is high (1)

The output is high in m_2, m_4, m_5, m_6, m_7
Now

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

or

$$F(A, B, C) = m_2 + m_4 + m_5 + m_6 + m_7$$

$$= \sum m(2, 4, 5, 6, 7)$$

Minterms represented by m and Maxterms represented by M .

Minterms for two variable function:

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

$$= \sum m(1, 3)$$

	A	B
m_0	0	0
m_1	0	1
m_2	1	0
m_3	1	1

maxterms for two variable function:

$$F(A, B) = \overset{0}{A} \overset{0}{B} \cdot \overset{1}{\bar{A}} \overset{0}{B}$$

$m_0 \quad m_2$

$$F(A, B) = \prod M[0, 2]$$