

# *Canonical Form of Boolean Expressions*

- An expanded form of Boolean expression.
- each term contains all Boolean variables in their true or complemented form
- For example :
$$f(A,B, C) = \overline{A}.\overline{B}.\overline{C} + \overline{A}.\overline{B}.C + A.B.C$$
- These Boolean function of three variables expressed in canonical form.
- This function after simplification reduces to:
$$f(A,B, C) = \overline{A}.\overline{B} + A.B.C$$

- Example:

convert  $\overline{A} + \overline{B}$  to standard minterms and draw truth table

Sol :

$$\begin{aligned}\overline{A} + \overline{B} &= \overline{A}(1) + (1)\overline{B} \\ &= \overline{A}(\overline{B} + B) + (\overline{A} + A)\overline{B} \\ &= \overline{A}\overline{B} + \overline{A}B + A\overline{B} + A\overline{B} \\ &= \overline{A}\overline{B} + \overline{A}B + A\overline{B}\end{aligned}$$

$$F(A, B) = \sum m(0, 1, 2)$$

A	B	F
0	0	1
0	1	1
1	0	1
1	1	0

A	B	C	F
0	0	0	
0	0	1	
0	1	0	
0	1	1	
1	0	0	
1	0	1	
1	1	0	
1	1	1	

- Example:

convert  $\overline{A} + \overline{B}C$  to standard minterms and draw truth table

Sol :

$$\begin{aligned}\overline{A} + \overline{B}C &= \overline{A}(1)(1) + (1)\overline{B}C \\ &= \overline{A}(\overline{B} + B)(C + \overline{C}) + (\overline{A} + A)\overline{B}C \\ &= \overline{A}\overline{B}C + \overline{A}B\overline{C} + \overline{A}BC + \overline{A}B\overline{C} + A\overline{B}C + A\overline{B}\overline{C} + AB\overline{C} + ABC\end{aligned}$$

$$F(A, B, C) = \sum m(0, 1, 2, 3, 5, 6, 7)$$

- Example :
- Calculate the maxterms forms for the given table

$$F(A B C) = (A + B + C) (A + \overline{B} + \overline{C}) (\overline{A} + \overline{B} + C) (\overline{A} + B + \overline{C})$$

$$= m_0 \quad m_3 \quad m_4 \quad m_6$$

$$F(A B C) = \prod m (0, 3, 4, 6)$$

A	B	C	F
0	0	0	0
0	0	1	1
0	1	0	1
0	1	1	0
1	0	0	0
1	0	1	1
1	1	0	0
1	1	1	1

### NOTE

- If a given Boolean function  $f(A,B,C)$  is given by

$$f(A, B, C) = \sum 0, 1, 4, 7,$$

- Then  $f(A, B, C) = \prod 2, 3, 5, 6$

A	B	C	F
0	0	0	1
0	0	1	1
0	1	0	0
0	1	1	0
1	0	0	1
1	0	1	0
1	1	0	0
1	1	1	1 <sup>3</sup>