30/10/21 Saturday

m_j M_j n 2^n

Minterm :- $x'y'z'$; $x'y'z$; $x'yz'$; $x'yz$
$xy'z'$; $xy'z$; xyz' ; xyz

Consists of all the variables either in un primed form or primed form but not both and the variables are combined using only AND operation. It is denoted by m_j where j denotes the decimal equivalent of the binary number of the minterm designated.

Maxterm : $x+y+z$; $x+y+z'$; $x+y'+z$; $x+y'+z'$
$x'+y+z$; $x'+y+z'$; $x'+y'+z$; $x'+y'+z'$

AND $\Leftrightarrow$ OR

M_j

(X) Boolean function can be expressed as a sum of minterms (Sum of product Canonical form)

Product of maxterms (Product of Sum Canonical form)

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(1) Obtain the sum of product canonical form for the following Boolean functions

(i) $F(x,y) = x + x'y$

(ii) $F = xy + xz + yz$

H.W (iii) $F = xy + x'y + z$

Sol:- (i)

x	y	x'	$x'y$	$F = x+x'y$	Minterms
0	0	1	0	0	$x'y'$
✓ 0	1	1	1	1	$x'y$
✓ 1	0	0	0	1	xy'
✓ 1	1	0	0	1	xy

$\therefore$ The sum of product canonical form of F is $x'y + xy' + xy$ or $m_1 + m_2 + m_3$ or $\sum(1,2,3)$

Aliter

$F = x + x'y$

$= x \cdot 1 + x'y$ [By Identity Law]

$= x \cdot (y + y') + x'y$ [By Complement Law]

$= x \cdot y + x \cdot y' + x' \cdot y$ [By distributive property]

Therefore, the sum of product canonical form of F is $xy + xy' + x'y$

(ii) $F = xy + xz + yz$

x	y	z	xy	xz	yz	$xy+xz+yz$	Minterms
0	0	0	0	0	0	0	$x'y'z'$
0	0	1	0	0	0	0	$x'y'z$
0	1	0	0	0	0	0	$x'yz'$
0	1	1	0	0	1	1	$x'yz$
1	0	0	0	0	0	0	$xy'z'$
1	0	1	0	1	0	1	$xy'z$
1	1	0	1	0	0	1	xyz'
1	1	1	1	1	1	1	xyz

$\therefore$ The sum of minterms of F is $x'yz + xy'z + xyz' + xyz$ or $m_3 + m_5 + m_6 + m_7$ or $\sum(3,5,6,7)$

Aliter $F = xy + xz + yz$

$= xy \cdot 1 + xz \cdot 1 + yz \cdot 1$ [By identity law]

$= xy \cdot (z + z') + xz(y + y') + yz(x + x')$ [By Complement Law]

$= xyz + xyz' + xyz + xy'z + xyz + x'yz$ [By distributive law]

$= xyz + xyz' + xy'z + x'yz$

$\therefore$ The sum of minterms of F is $x'yz + xy'z + xyz' + xyz$

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(2) Obtain product of sum canonical form for the following Boolean functions.

(i) $F(x,y) = x + x'y$

(ii) $F(x,y,z) = (x+y)\cdot(x+z)\cdot(y'+z)$

(iii) $F(x,y,z) = xy + yz + xz$

Sol: (i)

x	y	x'	$x'y$	$x+x'y$	Maxterms
0	0	1	0	0	$x+y$
0	1	1	1	1	$x+y'$
1	0	0	0	1	$x'+y$
1	1	0	0	1	$x'+y'$

Therefore, the Product of maxterms is $(x+y)$ or M_0 (+).

Ality
$$F = x + x'y \quad 1 + (2\cdot 3)$$
$$= (x+x')\cdot(x+y) \quad \text{[By distributive property]}$$
$$= 1\cdot(x+y) \quad \text{[By Complement Law]}$$
$$= (x+y) \quad \text{[By Identity Law]}$$

$\therefore$ The product of Maxterms is $x+y$

(ii) $F = (x+y)\cdot(x+z)\cdot(y'+z)$

$$= ((x+y)+0)\cdot((x+z)+0)\cdot((y'+z)+0)$$

[By Identity law]

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

[By Complement Law]

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

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