

Date: _____ MY CHOICE
Page No: _____

* Self dual, Neutral and orthogonal functions L-19

• SSOP to SPOS

$$\bar{A}B + A\bar{B} = (A+B) \cdot (\bar{A}+\bar{B})$$

$$f(A, B) = \Sigma_m(1, 2)$$

↓ in SPOS

$$f(A, B) = \Pi_M(0, 3)$$

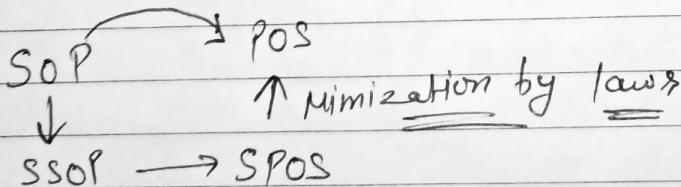
• SPOS to SSOP

$$f(A, B) = \Pi_M(0, 3)$$

↓ in SSOP

$$f(A, B) = \Sigma_m(1, 2)$$

$$(A+B) \cdot (\bar{A}+\bar{B}) \Rightarrow \bar{A}B + A\bar{B}$$



Q $f(A, B, C) = \bar{A}B + \bar{B}C$

SSOP $\rightarrow \Sigma_m(\cancel{2, 3}, \cancel{6, 7}) \Sigma_m(2, 3, 1, 5)$

$$\underline{\underline{SSOP}} \rightarrow (\underline{2}, \underline{3}, \underline{6}, \underline{7}) \quad (2, 3, 1, 5)$$

$$\underline{\underline{SPOS}} \rightarrow (\underline{0}, \underline{1}, \underline{4}, \underline{5}) \quad (0, 4, 6, 7)$$

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

$$\underline{\underline{POS}} \rightarrow (B+C) \cdot (\bar{A}+\bar{B})$$

$$* \quad \underline{\underline{POS}} \rightarrow \underline{\underline{SOP}}$$

$$f(A, B, C) = (A+\bar{B}) \cdot (B+\bar{C})$$

$$= \Pi M(2, 3, 1, 5)$$

$$\underline{\underline{SOP}} = \Sigma m(0, 4, 6, 7)$$

$$\Downarrow \underline{\underline{SSOP}}$$

$$\underline{\underline{\bar{A}\bar{B}\bar{C}}} + \underline{\underline{A\bar{B}\bar{C}}} + \underline{\underline{AB\bar{C}}} + \underline{\underline{ABC}}$$

$$\underline{\underline{\bar{B}\bar{C}}} + \underline{\underline{AB}} \rightarrow \underline{\underline{SOP}}$$

* Functions

\rightarrow Neutral
 No. of minterm = No. of maxterm
 \rightarrow not neutral
 No equal

A	B	f ₁	f ₂	f ₃	f ₄	f ₅	f ₆
0	0	1	1	1	0	0	0
0	1	1	0	0	1	1	0
1	0	0	1	0	1	0	1
1	1	0	1	1	0	1	1

$$4C_2 = 6$$

Q If we have 'n' var then total no. of neutral function possible?

$$n \rightarrow 2^n \Rightarrow \text{minterms}$$

$$\frac{2^n}{2} = 2^{n-1} \Rightarrow 2^n C_2^{n-1}$$

Q XOR on 2 variable is neutral?

XOR \rightarrow odd no. of literal true
 so, yes it is neutral

$$\text{XOR} \rightarrow 2^{n-1}$$

Q XNOR on 2 variable is neutral?
yes, statement is correct

Q XNOR on n variable is neutral?
yes

Q NOT \rightarrow Neutral \checkmark

OR $\rightarrow 2^n - 1$ X

AND $\rightarrow 1$ X

NAND $\rightarrow 2^n - 1$ X

NOR $\rightarrow 1$ X

XOR $\rightarrow 2^{n-1}$ \checkmark

XNOR $\rightarrow 2^{n-1}$ \checkmark

NOT, XOR, XNOR \Rightarrow Neutral

* Functions

\rightarrow Self dual
function & its dual are same

\rightarrow not self dual
not same

• $f(A, B) = \bar{A}B + \bar{A}\bar{B}$

$\bar{A}B(\bar{A} + B) \cdot (A + \bar{B})$

$\rightarrow \bar{A}\bar{B} + AB$

not same / not self dual

• $f(A, B) = \bar{A}B + AB$
 $\downarrow B$

$(\bar{A} + B) \cdot (A + B)$
 $\downarrow B$ Same / Self dual

• $f(A, B) = A\bar{B} + AB$
 $\downarrow A$

$(A + \bar{B}) \cdot (A + B)$
 $\downarrow A$ Same / Self dual

* 2 Condition for self dual

→ Neutral

→ no mutually exclusive term

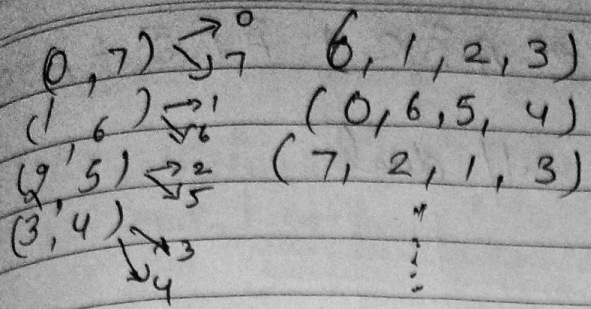
$A\bar{B}$, $\bar{A}B$ $\bar{A}BC$ $A\bar{B}\bar{C}$

both are mutual exclusive term because we cannot take "Common"

• 3 variable

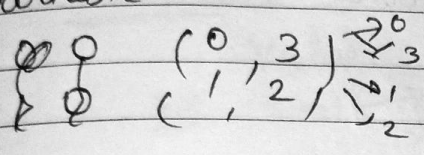
(0, 7)	$\bar{A}\bar{B}\bar{C}$	ABC
(1, 6)	$\bar{A}\bar{B}C$	$AB\bar{C}$
(2, 5)	$\bar{A}B\bar{C}$	$A\bar{B}\bar{C}$
(3, 4)	$\bar{A}BC$	$A\bar{B}C$
	└──────────┘	

mutual exclusive terms



$2 \times 2 \times 2 \times 2 = 2^4 = 16 \Rightarrow$ Self dual function on 3 variables

• 2 variable



$2 \times 2 = 4 = 2^2$

• 4 variables

- (0, 15)
- (1, 14)
- (2, 13)
- (3, 12)
- (4, 11)
- (5, 10)
- (6, 9)
- (7, 8)

2^8

No. of self dual functions on 'n' variables

minterms $\Rightarrow 2^n$

Pairs $\Rightarrow 2^{n-1}$

$f^n = 2^{2^{n-1}}$

Ans

$$f(A, B, C) = \bar{A}BC + A\bar{B}C + \bar{A}\bar{B}\bar{C} + ABC$$

(0, 7) ✓ not self dual

(1, 6) ✗

(2, 5) ✓

(3, 4) ✓

$$f(A, B, C) = \bar{A}\bar{B}\bar{C} + \bar{A}BC + A\bar{B}C + ABC$$

(0, 7) ✓ self dual

(1, 6) ✓

(2, 5) ✓

(3, 4) ✓

* function

→ orthogonal
dual = Complement

→ non orthogonal
dual ≠ Complement

Q XOR fn is orthogonal?

$$A \oplus B = A\bar{B} + \bar{A}B \rightarrow (A + \bar{B}) \cdot (\bar{A} + B)$$

↓

$$AB + \bar{A}\bar{B}$$

↕ orthogonal

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