Boolean function Representation :-

(1.) SOP (Sum of products) form:-

* Group of product terms summed together

Sum

Ex:- $AB + A\bar{B}C + BC$

product terms

↳ Also called Disjunctive normal form. (DNF)

(2) Product of Sums (POS) form:-

* group of sum terms multiplied/ ANDed together

Ex:- $(A+B).(B+C)$ multiplication

Sum Terms

↳ Conjunctive normal form (CNF)

Canonical form:-

Standard SOP (SSOP)

Each product term contains all the variables of the function

$F(A,B,C) = \bar{A}BC + AB\bar{C}$

$F(A,B,C) = AB + B\bar{C}\bar{A}$

SOP ✓

SSOP ✗

2. Standard POS (SPOS)

↳ Each sum term contains all the variables of the function

$F(A,B,C,D) = AB\bar{C}\bar{D} + \bar{A}\bar{B}CD + AC\bar{B}\bar{D}$

$= (A+B+\bar{C}+\bar{D})(\bar{A}+\bar{B}+C+D)(A+C+B+\bar{D})$

↳ SPOS ✓

MINTERMS & MAXTERMS :-

Minterm

* Each individual term in SOP is called a Minterm

Maxterm

* Each individual term in SPOS is called Maxterm

2-variable function, $f(A,B)$

Variable		Minterm		Maxterm	
A	B				
0	0	$\bar{A}\,\bar{B}$	(m_0)	$A + B$	(M_0)
0	1	$\bar{A}\,B$	(m_1)	$A + \bar{B}$	(M_1)
1	0	$A\,\bar{B}$	(m_2)	$\bar{A} + B$	(M_2)
1	1	$A\,B$	(m_3)	$\bar{A} + \bar{B}$	(M_3)

Minterm → 0 → take complement
1 → actual variable

Maxterm → 0 → actual variable
1 → take complement

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

Ex:- $f(A,B) = A\bar{B} + \bar{A}B$

SSOP form.

$= \Sigma m(1,3)$

$A\bar{B} + \bar{A}B$
(1 1) (0 1)

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

$= \Pi M(0,2)$.

SOP to SSOP :-

Steps

1. Identify the missing variables in product terms.
2. Multiply (variable + its complement)
3. Neglect the repeated terms.

Ex:- $f(A, B, C) = AB + AB\bar{C} + BC$

(C is missing; A missing.)

$= AB(C + \bar{C}) + AB\bar{C} + BC(A + \bar{A})$

$= ABC + AB\bar{C} + AB\bar{C} + ABC + \bar{A}BC$

$= ABC + AB\bar{C} + \bar{A}BC$

1 1 1 — m_7 ; 1 1 0 — m_6 ; 0 1 1 — m_3

SSOP

$= \Sigma m(3, 6, 7)$

POS to SPOS :-

Steps

1. Identify the missing variable
2. Add with that variable & its complement separately
3. Neglect repeated terms.

Ex :- $f(A,B,C) = A(\overbrace{A+C}^{\text{B is missing.}})$

↓

Single sum term, B, C are missing

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

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

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

$= \Pi M(\quad)$

$= M(0,1,2,3)$