# Assignment 6

The standard POS form :- A standard POS expression is one in which all the variables in the Domain appear in each sum term in the expression.

Example :- $(A+\bar{B}+C+\bar{D})(\bar{A}+B+C+\bar{D})(\bar{A}+B+\bar{C}+\bar{D})$

converting the following expression into standard POS form :-

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

Now,

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

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

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

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

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

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

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

Developing truth table for standard SOP expression :-

let, $X = \bar{A}\bar{B}C + A\bar{B}\bar{C} + ABC$

| Inputs | | | Outputs | | |
|---|---|---|---|---|---|
| A | B | C | X | Y | Z |
| 0 | 0 | 0 | 0 | 0 | 1 |
| 0 | 0 | 1 | 1 | 1 | 0 |
| 0 | 1 | 0 | 0 | 0 | 1 |
| 0 | 1 | 1 | 0 | 0 | 1 |
| 1 | 0 | 0 | 1 | 1 | 0 |
| 1 | 0 | 1 | 0 | 0 | 0 |
| 1 | 1 | 0 | 0 | 0 | 1 |
| 1 | 1 | 1 | 1 | 1 | 1 |

Converting POS expression to truth table format :-

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

Determining Standard Expression from a truth table ⇒

Standard SOP expression :

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

Standard POS expression :-

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

3 variable Karnaugh Map:-

| AB \ C | 0 | 1 |
|---|---|---|
| 00 | 0 | 1 |
| 01 | 0 | 0 |
| 11 | 0 | 1 |
| 10 | 1 | 0 |

Map the following SOP expression in the Karnaugh map.

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

Map the following SOP expression on a K map:

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

001 010 110 111

| AB \ C | 0 | 1 |
|---|---|---|
| 00 | 0 | 1 |
| 01 | 1 | 0 |
| 11 | 1 | 1 |
| 10 | 0 | 0 |

Map the following SOP expression on a K-map:

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

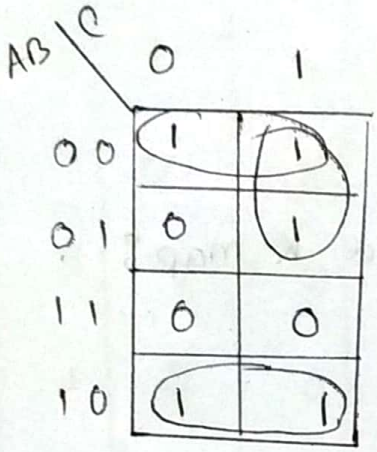
000 100 110
001 101
010
011

| AB \ C | 0 | 1 |
|---|---|---|
| 00 | 1 | 1 |
| 01 | 1 | 1 |
| 11 | 1 | 0 |
| 10 | 1 | 1 |

# K map simplification of SOP expression:

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

101 011 001 000 100




Simplified SOP expression

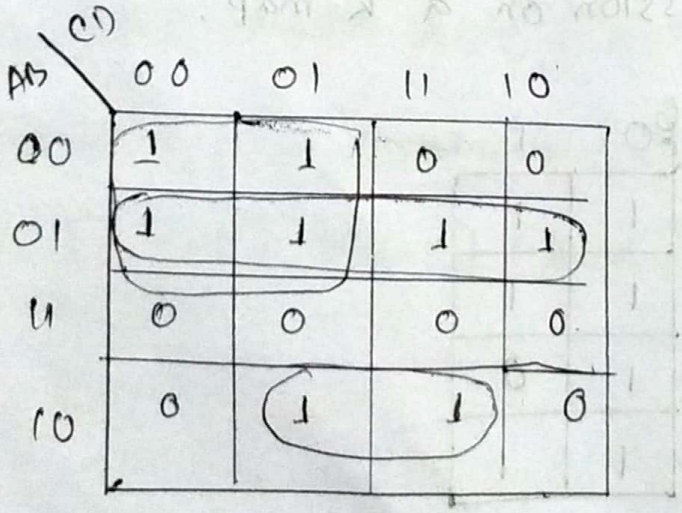
$\bar{B} + \bar{A}C$

* 1's in adjacent cells can be grouped. Each group can have 2, 4, 8, 16, ... ones.

* Use K-map to minimize the following expression:

$\bar{A}\bar{B}\bar{C}\bar{D} + \bar{A}\bar{B}\bar{C}D + \bar{A}B\bar{C}\bar{D} + \bar{A}B\bar{C}D + \bar{A}BCD + \bar{A}BC\bar{D}$

0000 0001 0100 0101 0111 0110

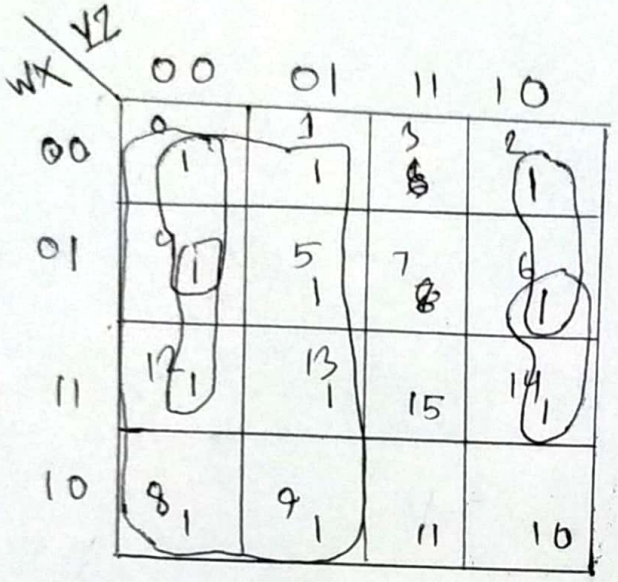



Simplified SOP expression

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

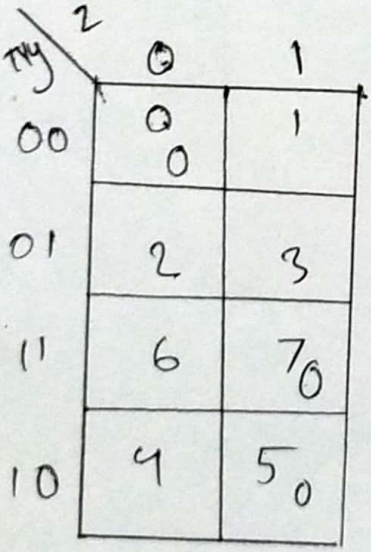
Simplify the function expressed in sum of minterms form, $F(W,X,Y,Z) = \Sigma(0,1,2,4,5,6,8,9,12,13,14)$

no. of minterms = 11 (minterms means standard product)




$\therefore F = \bar{Y} + \bar{W}\bar{Z} + X\bar{Z}$

Simplify the function expressed in product of maxterm form: $F(x,y,z) = \Pi(0,2,5,7)$




$\bar{F} = \bar{x}\bar{z} + xz$

$F = \overline{\bar{x}\bar{z} + xz}$

$= (\bar{\bar{x}} + \bar{\bar{z}})(\bar{x} + \bar{z})$

$= (x+z)(\bar{x}+\bar{z})$