



Digital Design : 2021-22

Lecture 9 : Five Variable K-Map

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Five Variable K-Map

The structure of such a K-Map for SOP expression is given below:

ST \ QR	00	01	11	10
00	0	1	3	2
01	4	5	7	6
11	12	13	15	14
10	8	9	11	10

P=0

ST \ QR	00	01	11	10
00	16	17	19	18
01	20	21	23	22
11	28	29	31	30
10	24	25	27	26

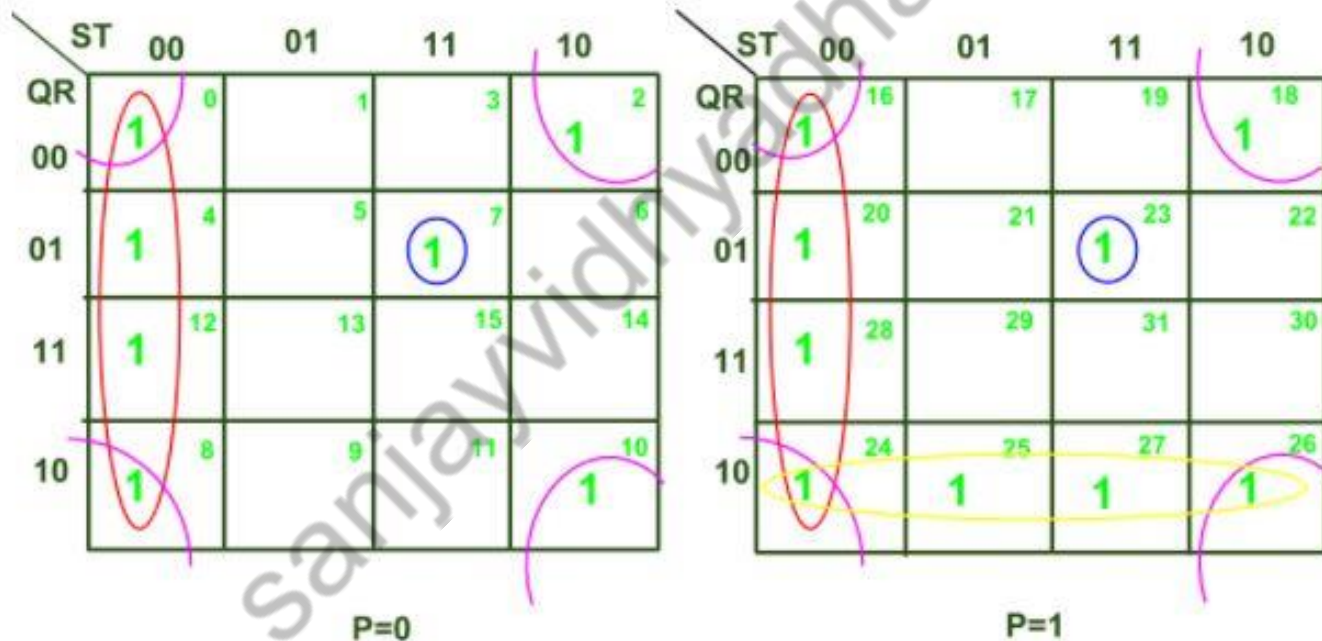
P=1

Five Variable K-Map

I. Solving SOP function –

For clear understanding, let us solve the example of SOP function minimization of 5 Variable K-Map using the following expression :

$$\sum m(0, 2, 4, 7, 8, 10, 12, 16, 18, 20, 23, 24, 25, 26, 27, 28)$$



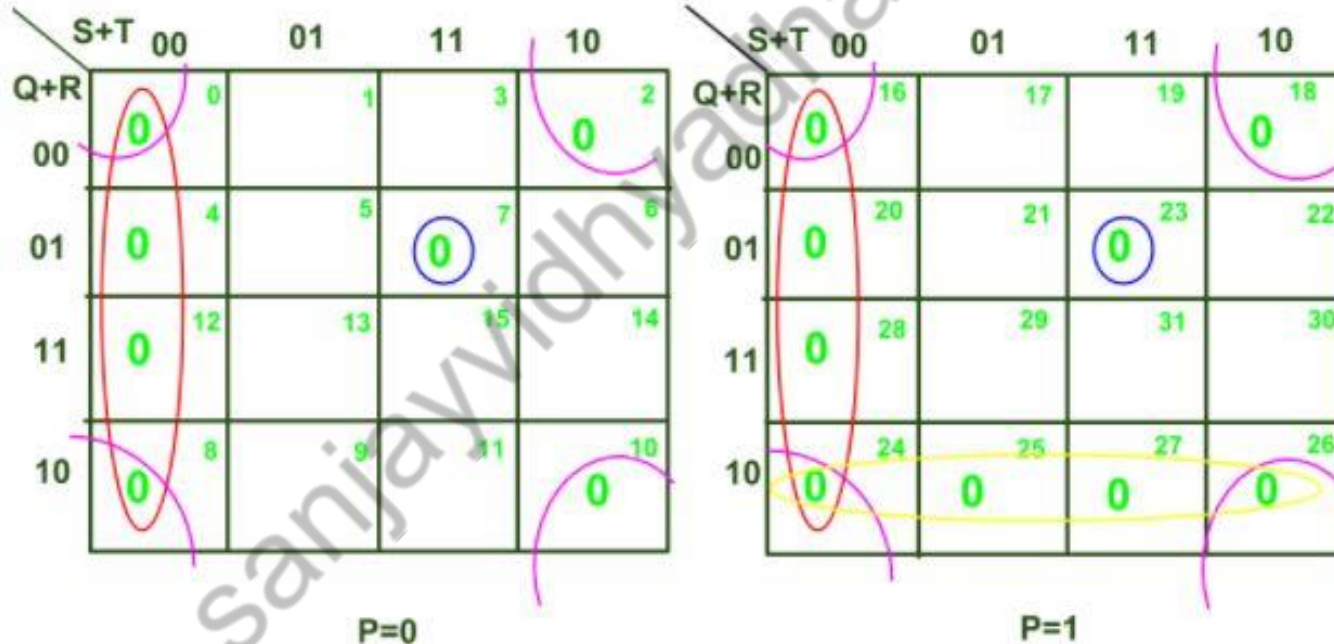
$$f(PQRST) = S'T' + Q'RST + PQR' + R'T'$$

Five Variable K-Map

II. Solving POS function –

Now, let us solve the example of POS function minimization of 5 Variable K-Map using the following expression :

$$\prod M(0, 2, 4, 7, 8, 10, 12, 16, 18, 20, 23, 24, 25, 26, 27, 28)$$



$$f(PQRST) = (S+T) \cdot (R+T) \cdot (Q+R'+S'+T') \cdot (P'+Q'+R)$$

Five Variable K-Map

Five Variable K-map

A \ B \ CDE	000	001	011	010	110	111	101	100
00								
01								
11								
10								

5-variable Karnaugh map (Gray code)

Five Variable K-Map

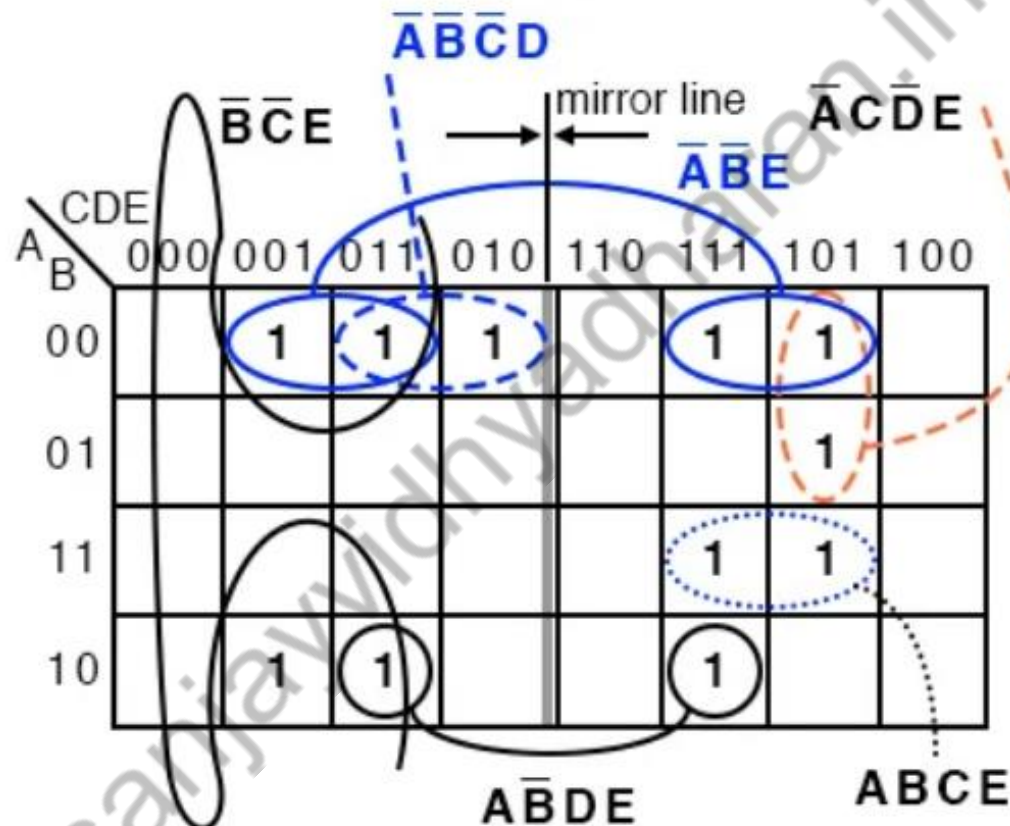
$$F(A, B, C, D, E) = \sum(0, 2, 4, 6, 9, 11, 13, 15, 17, 21, 25, 27, 29, 31)$$

		CDE							
		000	001	011	010	110	111	101	100
A	AB								
	00	1			1	1			1
	01		1	1			1	1	
	11		1	1			1	1	
	10		1					1	

The K-map is annotated with groupings for variables A, B, C, D, and E.
 Variable A is grouped vertically on the left.
 Variable B is grouped vertically on the right.
 Variable C is grouped horizontally at the top.
 Variable D is grouped horizontally at the bottom.
 Variable E is grouped horizontally at the bottom, with two separate groups.

$$BE + AD'E + A'B'E'$$

Five Variable K-Map



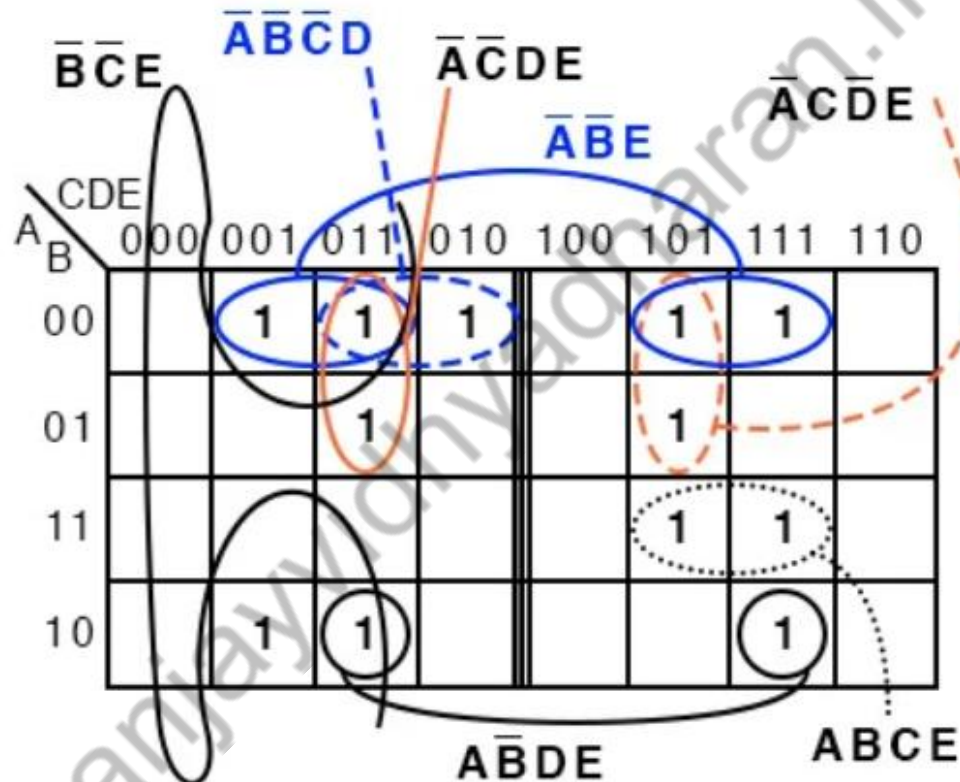
Five Variable K-Map

Overlay Version of the K-map

CDE A \ B		000	001	011	010	100	101	111	110
B	00								
	01								
	11								
	10								

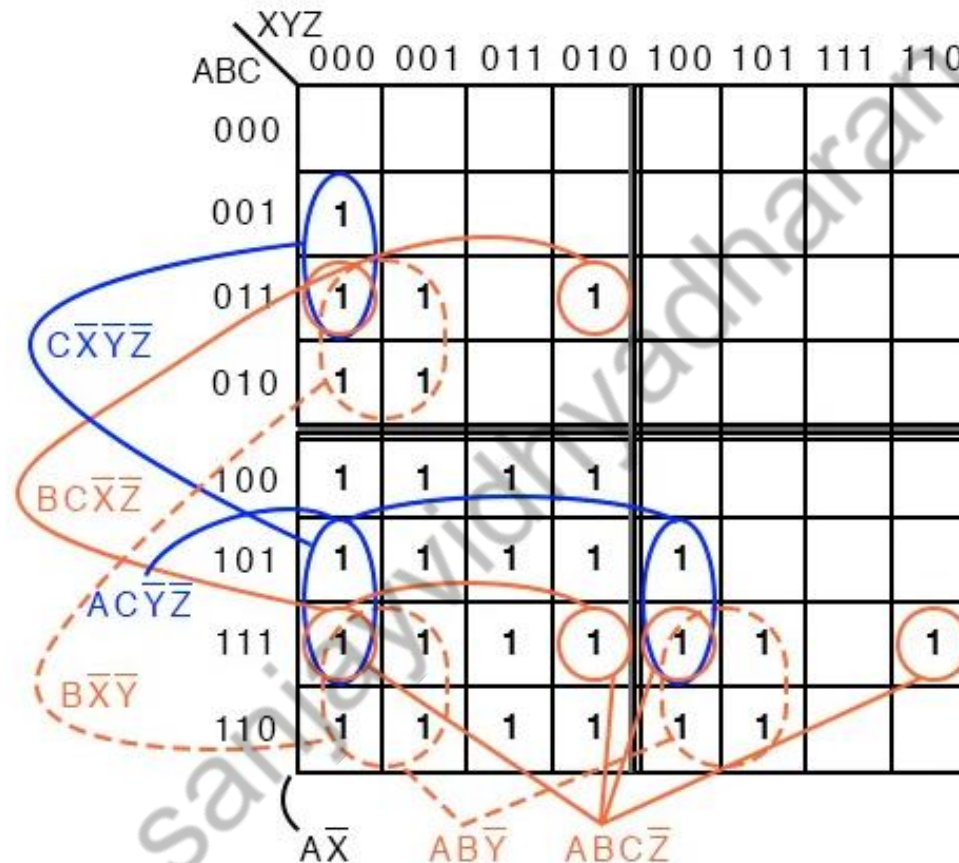
5-variable Karnaugh map (overlay)

Five Variable K-Map



5-variable Karnaugh map (overlay)

Six Variable K-Map



$$\text{Out} = A\bar{X} + AB\bar{Y} + B\bar{X}Z + ABC\bar{Z} + AC\bar{Y}Z + BC\bar{X}Z + C\bar{X}YZ$$

6 - variable Karnaugh map (overlay)

Thank you