Lecture 7

Miscellaneous on Karnaugh-Map

Revised by WJ Han

Youpyo Hong, Dongguk University
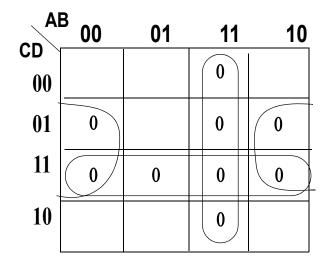
Product of Sums (POS) Simplification

With minor modification, we can get a simple POS expression.

SOP form can be changed to POS form using a complement.

$$\overline{F} = A{\cdot}B + C{\cdot}D$$

$$\overline{(\overline{F})} = \overline{AB + CD} = \overline{(AB) + (CD)} = (\overline{A} + \overline{B}) \cdot (\overline{C} + \overline{D}) = POS$$

Thus, to obtain POS, take $\overline{F}$ in SOP and complement it.

CD \ AB	00	01	11	10
00			0	
01	0		0	0
11	0	0	0	0
10			0	

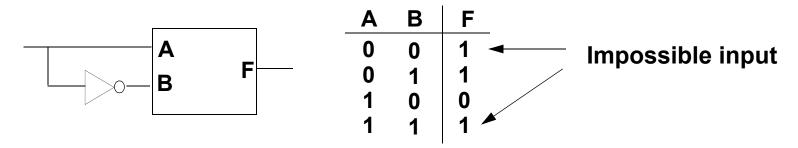| CD \ AB	00	01	11	10
00			0	
01	0		0	0
11	0	0	0	0
10			0	

$$\overline{F} = AB + CD + \overline{B}D$$

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

Youpyo Hong, Dongguk University

Don't Care Condition

- **A function is either 1 or 0 for each input combination.**

- **Sometimes, we do not care for some input combinations because they are not important or they cannot occur.**

A	B	F
0	0	1
0	1	1
1	0	0
1	1	1

Impossible input

- **We call such inputs "don't cares", (= don't care input conditions.)**

A	B	F
0	0	-
0	1	1
1	0	0
1	1	-

don't cares

A	B	F
0	0	X
0	1	1
1	0	0
1	1	X

Don't Care Minterm Flexibility

- **Don't care minterm can be treated as 0 or 1.**

AB

CD	00	01	11	10
00	0	1	0	0
01	0	–	0	0
11	0	0	1	0
10	0	0	1	–

$\overline{A} \cdot B \cdot \overline{C} \cdot \overline{D}$

Don't care as 1
$\overline{A} \cdot B \cdot \overline{C}$ **(Better)**

Utilization of Don't Care Minterm

- **Treat each don't care minterm as 0 or 1 to make covers biggest.**

	AB			
CD	**00**	**01**	**11**	**10**
00	–	1	1	–
01	0	–	1	0
11	0	0	1	0
10	0	0	1	0

Practice

AB CD	00	01	11	10
00	0	0	–	0
01	1	1	–	0
11	1	1	–	–
10	–	0	–	–

K-Map for 5 Variables

A = 0

BC DE	00	01	11	10
00	0	0	**0**	1
01	0	1	0	1
11	0	1	0	0
10	0	0	0	0

A = 1

BC DE	00	01	11	10
00	0	0	**0**	**0**
01	0	1	0	0
11	0	1	0	0
10	0	0	0	0

$$F = \overline{B} \cdot C \cdot E + \overline{A} \cdot B \cdot \overline{C} \cdot \overline{D}$$

Youpyo Hong, Dongguk University