K-MAP WITH DON'T CARE CONDITIONS

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- Real circuits don't always need to have an output defined for every possible input.
- The "**Don**'t **Care**" **conditions** allow us to replace the empty cell of a **K-Map** to form a grouping of the variables.
- In a K-map, a don't care condition is identified by an *X* in the cell of the minterm (s) for the don't care inputs, as shown below.
- In performing the simplification, **we** can consider a "**Don**'t **Care**" cell as either 1 or 0 or ignore the *X*'s when creating our groups.

WX \ YZ	00	01	11	10
00	✕	1	1	✕
01		✕	1	
11	✕		1	
10			1	

Don't Care Conditions

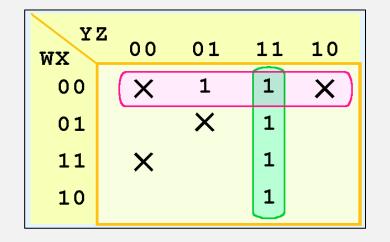Don't care conditions are part of function specification.

$$f = \sum m(.....) + \sum d(.....)$$

$$f = \prod M(....) \prod D(....)$$

They can be used for both sum-of-product and product-of-sum forms of functions.

DON'T CARE CONDITIONS

- Consider this example. In one grouping in the K-map below, we have the function:

$$F(W, X, Y, Z) = W'X' + YZ$$

$$F(W, X, Y, Z) = W'Z + YZ$$

- A different grouping gives us the function:

- However, the values for which they differ, are the inputs for which we have don't care conditions.

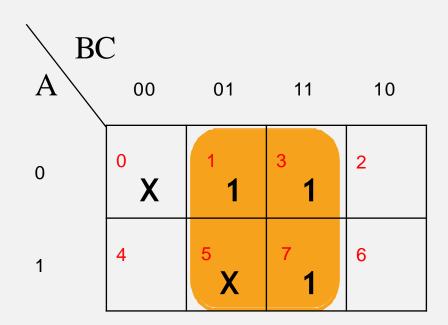- Two possible solutions , both are acceptable.

WX \ YZ	00	01	11	10
00	X	1	1	X
01		X	1	
11	X		1	
10			1	

WX \ YZ	00	01	11	10
00	X	1	1	X
01		X	1	
11	X		1	
10			1	

$$F(A, B, C) = \sum m(1, 3, 7) + \sum d(0, 5)$$

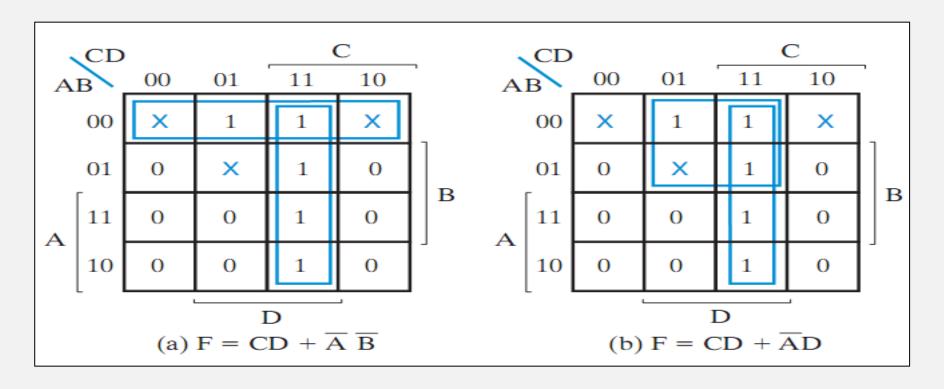Circle the x's that help get bigger groups of 1's (or 0's if POS).

Don't circle the x's that don't help.

Reduced form :F =C
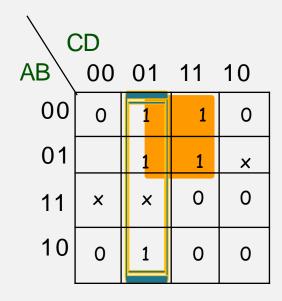
Solved example of Don't Care Conditions

$$F(A, B, C, D) = \sum m(1, 3, 7, 11, 15) + \sum d(0, 2, 5)$$

(a) $F = CD + \overline{A}\ \overline{B}$

(b) $F = CD + \overline{A}D$

Two possible solutions , both are acceptable.

Solved example of Don't Care Conditions

$$F(A, B, C, D) = \sum m(1, 3, 5, 7, 9) + \sum d(6, 12, 13)$$

AB\CD	00	01	11	10
00	0	1	1	0
01		1	1	×
11	×	×	0	0
10	0	1	0	0

Reduced Form F=A'D+C'D

Another Solved example of Don't Care Conditions Using Maxterm

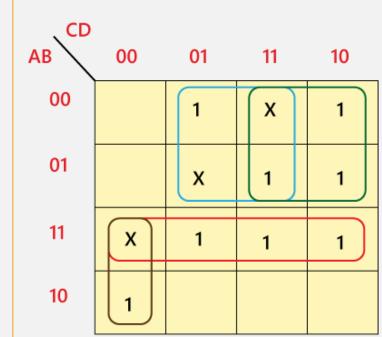$$f(A,B,C,D) = \prod m(1,6,10,11,12,13,15) + \prod d(4,5,7,8,14)$$

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

F=(A+C+D') (B') (A'+C')

MINIMIZE THE FOLLOWING FUNCTION IN SOP MINIMAL FORM

- F(A, B, C, D) = m(1, 2, 6, 7, 8, 13, 14, 15) + d(3, 5, 12)
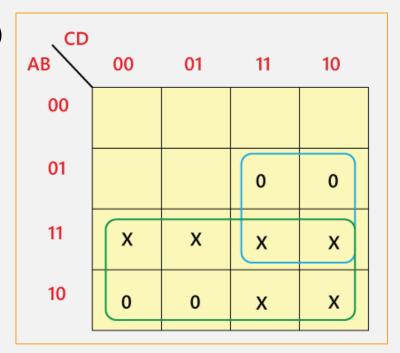
f = AC'D' + A'D + A'C + AB

MINIMIZE THE FOLLOWING FUNCTION IN POS MINIMAL FORM

F(A,B,C,D) = M(6,7,8,9) + d(10,11,12,13,14,15)

So, the minimized POS form of the function is:

F = A'(B' + C')

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

SOME PROBLEMS

1. F (A, B, C, D) = π M (0, 2, 3, 6, 7) + π d (8, 10, 11, 15)

2. F (A, B, C, D) = Σ m (1, 2, 3, 5, 6, 11, 12) + Σ d (7, 8, 10, 14)

3. F(W, X, Y, Z)= Σm(2,3,7,11,12,13,14,15) + Σ d(0,4,6,8,10)

4. F (A, B, C, D) = πM (1,3,5,7) + π d (9,10,11)