Lecture 5 - KMAP

Aka → Karnaugh Map or Veitech Diagram.

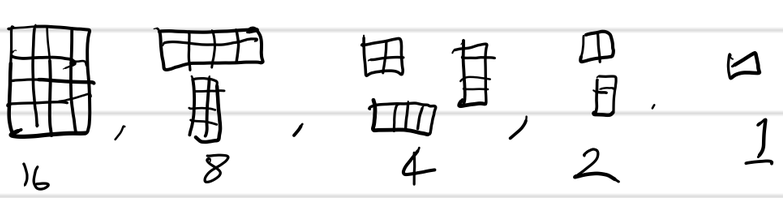
→ We use this to simplify Boolean functions.

Steps: 1. Identify number of variables and draw the map.

2. Put 1 in designated cells.

3. Make groups of adjacent 1's. For this we have the following Rules,

a. At first try to make largest group. [16, 8, 4, 2, 1]

b. group shape should be, 

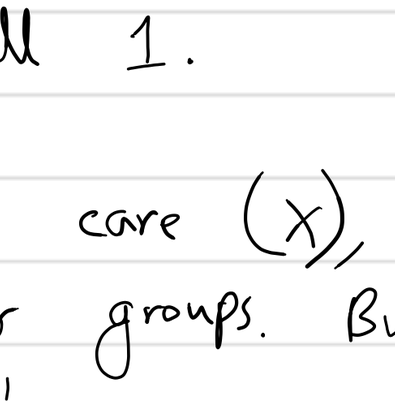
c. You can cover a '1' multiple times, only if it is need for a bigger group to cover any uncovered 1's.

d. We have to include all 1.

e. In case of don't care (X), we can use them to create larger groups. But we will not create groups of 'X'.

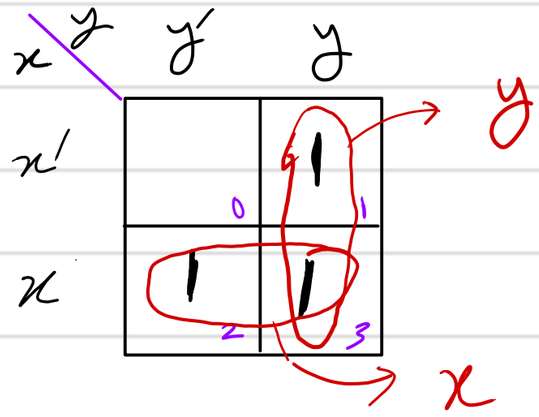
4. From the group, we will derive the minimized function by finding common literals.

2 variable K-MAP: $F(x,y) = \Sigma(1,2,3)$



for 2 variables, we have 4 minterms. Therefore 4 square.

Now we group them

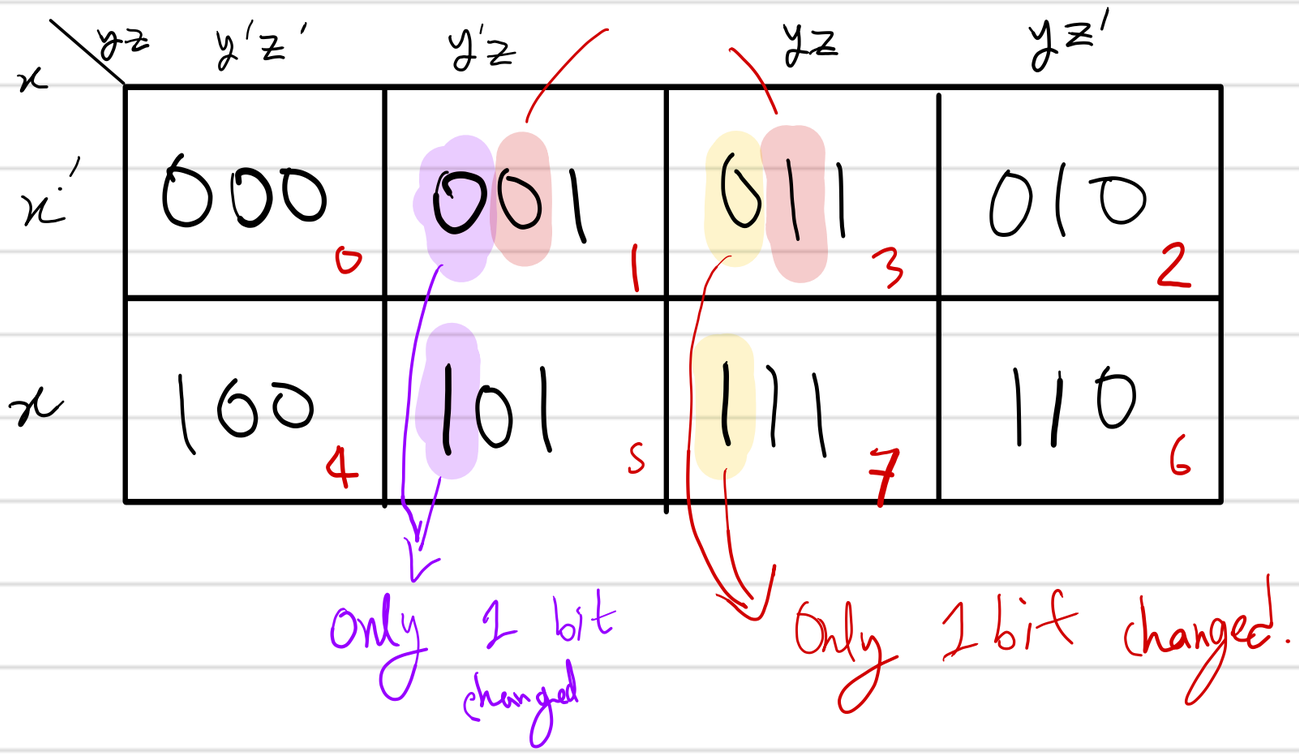


$= x + y$

3 variable K-MAP:

$F(x, y, z) = \ldots\ldots$

3 variable = 8 cell.

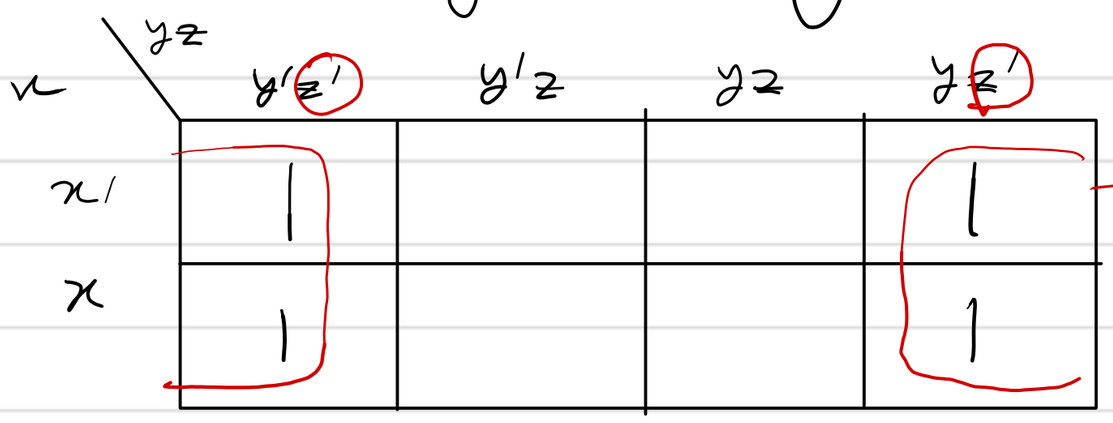


Note that we are using 0,1,3,2 and 4,5,7,6

We do this to keep the change of bit to one only in every adjacent cells.

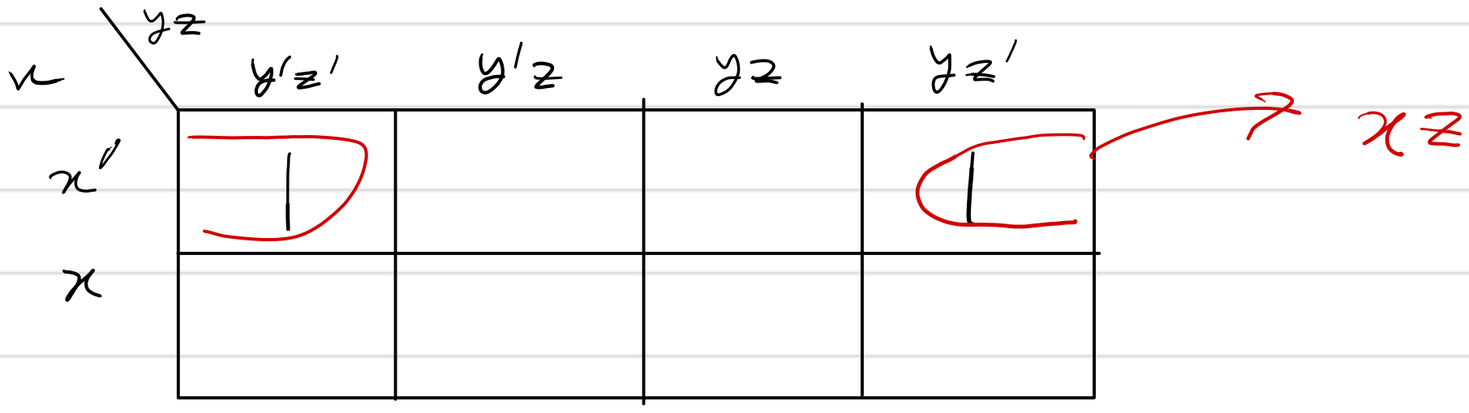
Concept of mirroring in groups:

We can create groups by the following way,



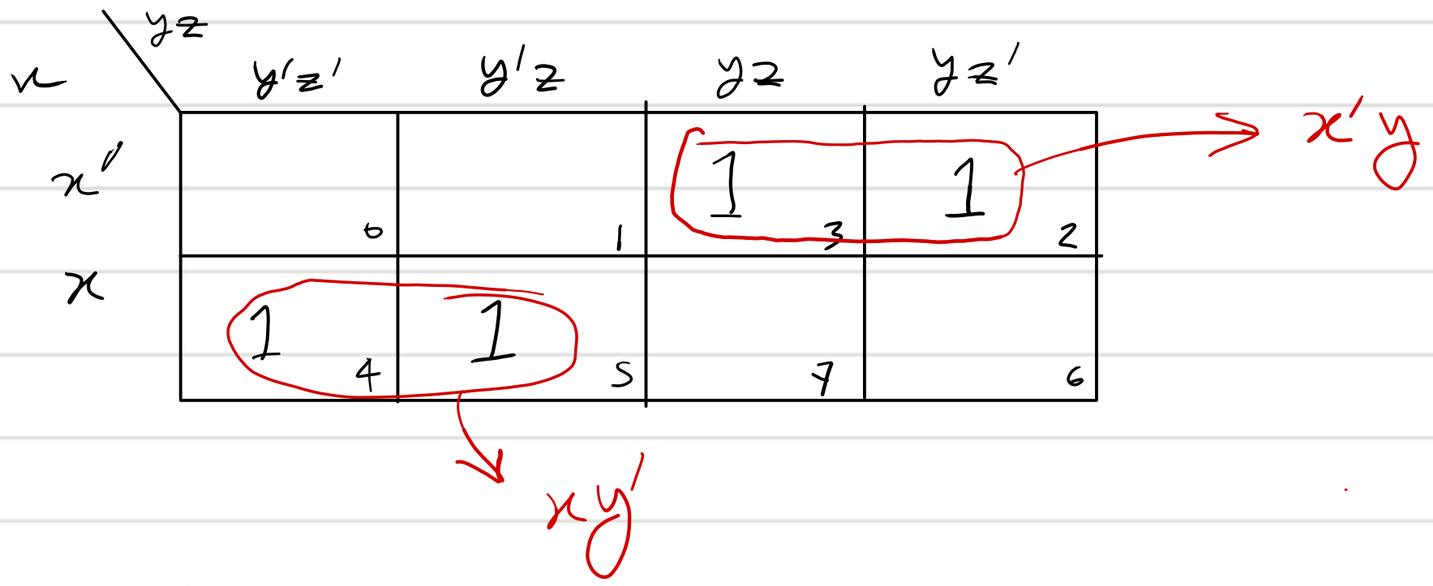
This is a valid group of 4 where common terms are z'.

Or



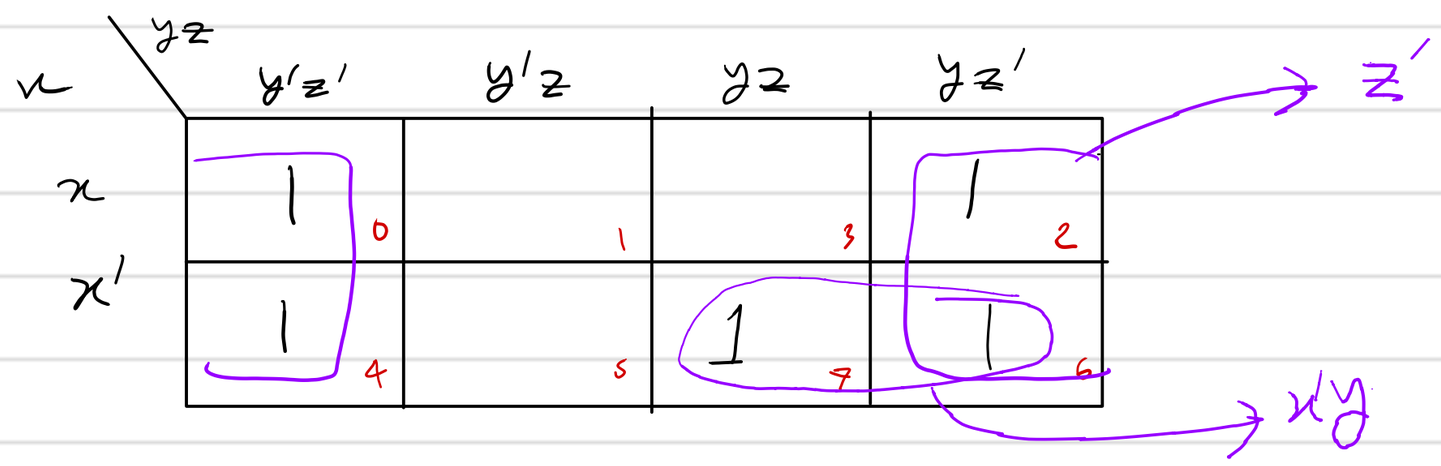
xz

Example: Simplify $F = \Sigma(2,3,4,5)$



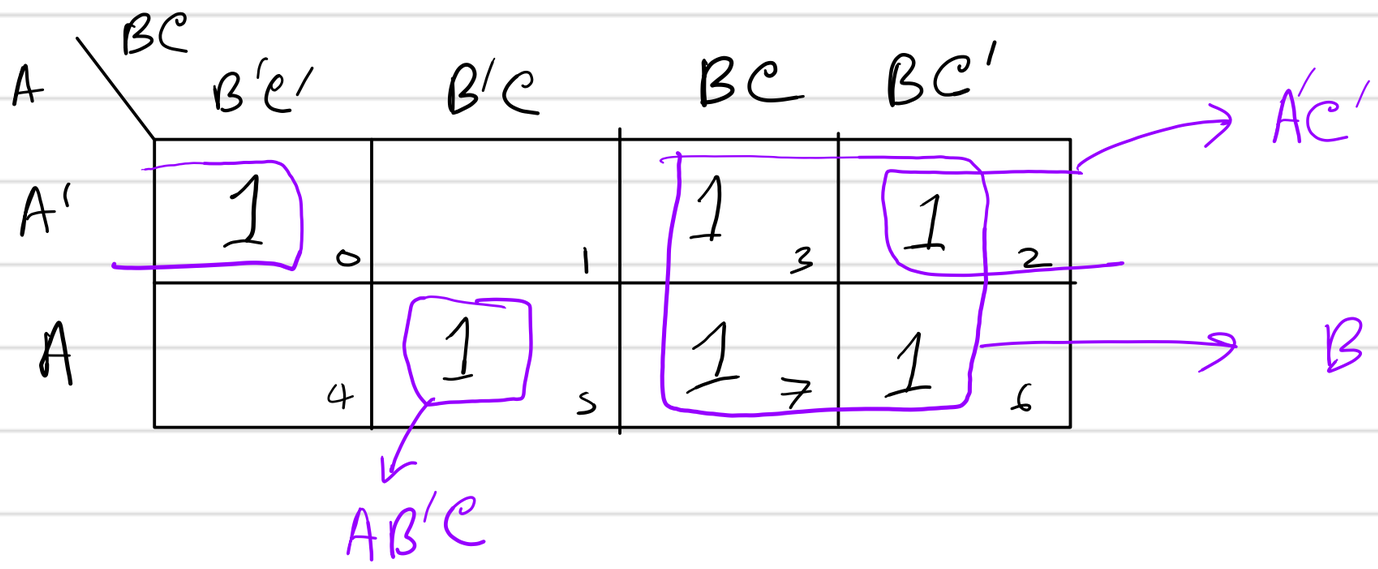
$\therefore F = \Sigma(2,3,45) = x'y + xy'$

Simplify $F = \Sigma(0,2,4,6,7)$



$\therefore F = x'y + z'$

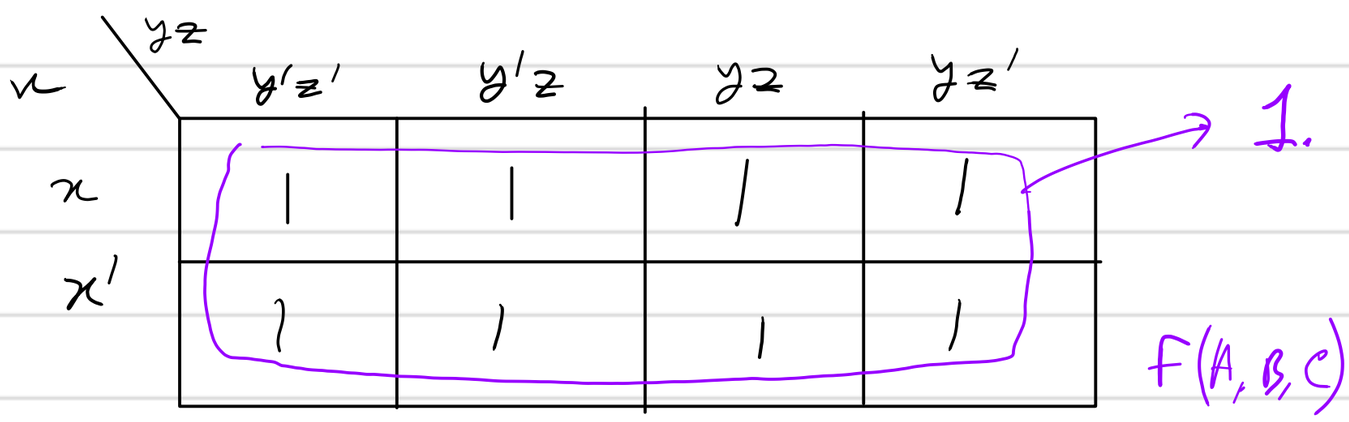
Simplify: $F(A,B,C) = \Sigma(0,2,3,5,6,7)$



Simplify:

$F(A,B,C) = AB'C + A'C' + B$

$F(A,B,C) = \Sigma(0,1,2,3,4,5,6,7)$



$f(A,B,C) = 1$

Note, There is nothing common. So, it will be 1.

4 variable K-MAP:

if $f(a,b,c,d) = \Sigma(\ldots\ldots)$

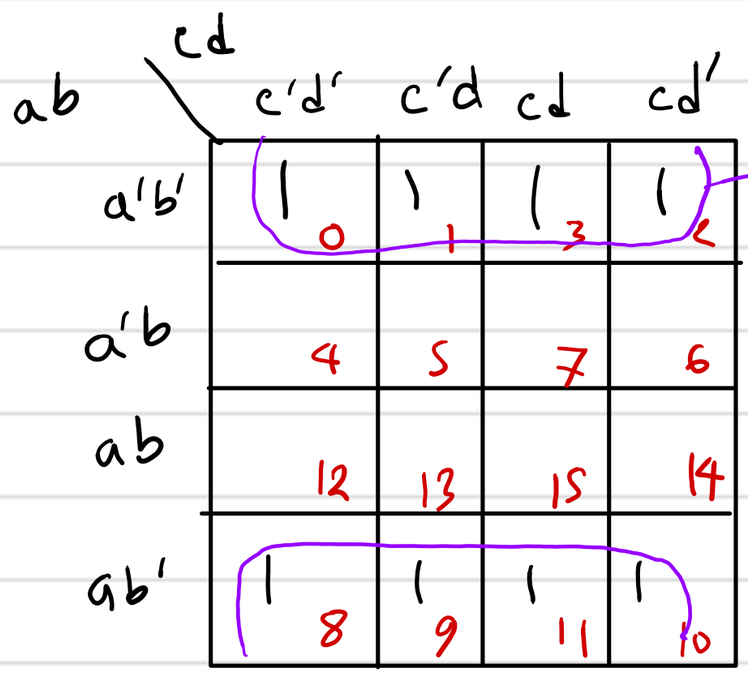
ab \ cd	c'd'	c'd	cd	cd'
a'b'	0	1	3	2
a'b	4	5	7	6
ab	12	13	15	14
ab'	8	9	11	10

* Note how we write minterm number in each cell.

* While making groups, the concept of mirroring will work in bottom to top.

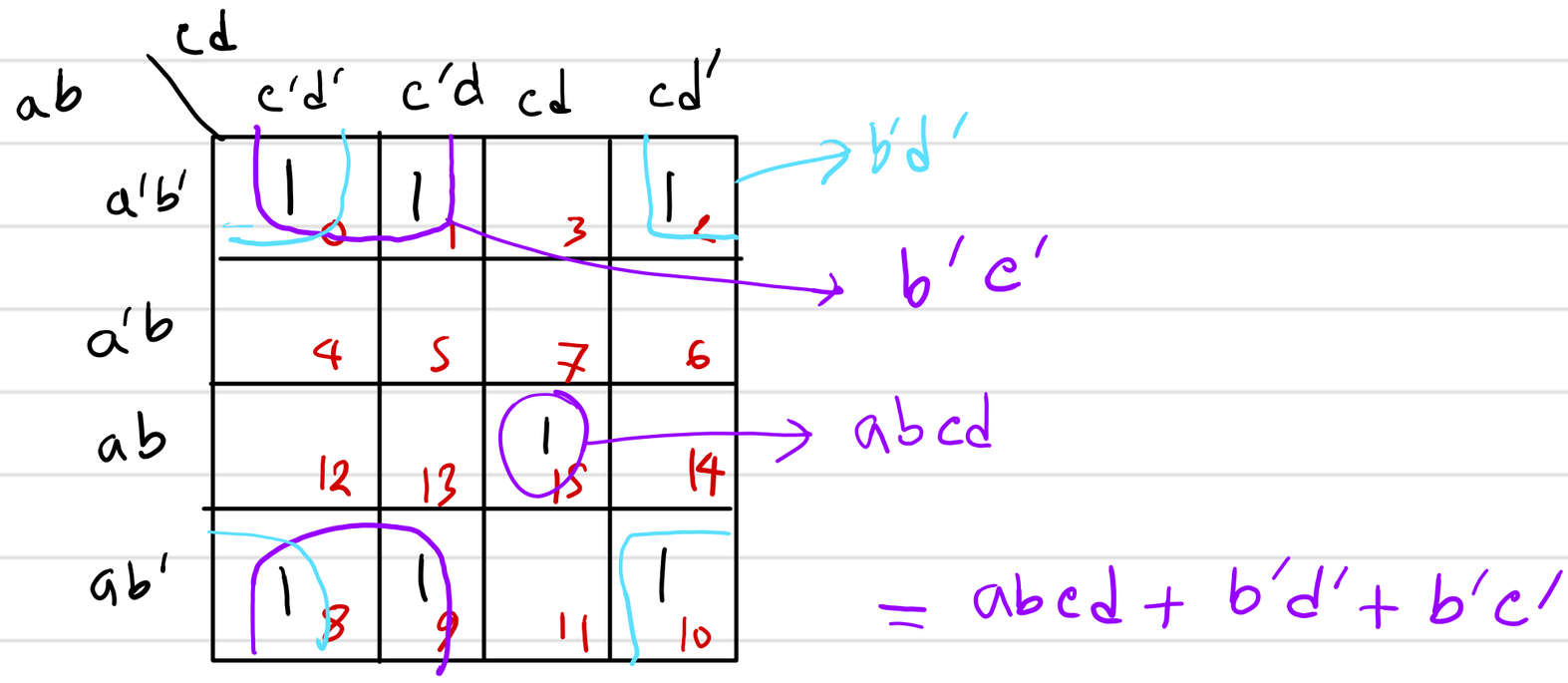
Examples;

$f(a,b,c,d) = \Sigma(0,1,2,3,8,9,10,11)$



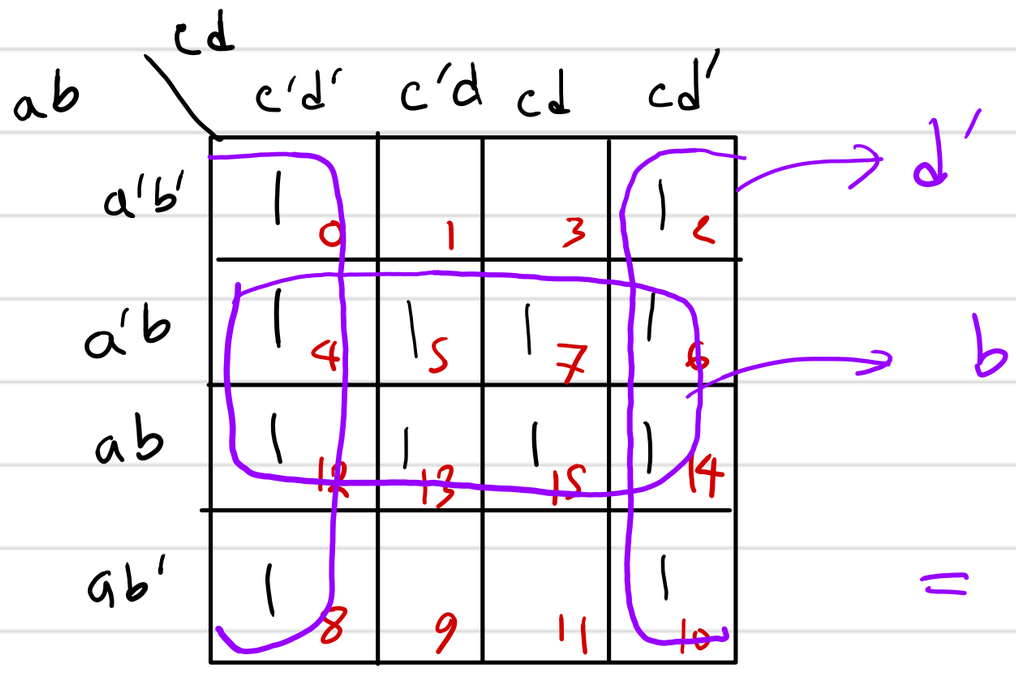
Ans = b'

$f(a,b,c,d) = \Sigma(0,1,2,8,9,10,15)$



$= abcd + b'd' + b'c'$

$f(a,b,c,d) = \Sigma(0,2,4,5,6,7,8,10,12,13,14,15)$



$= b + d'$

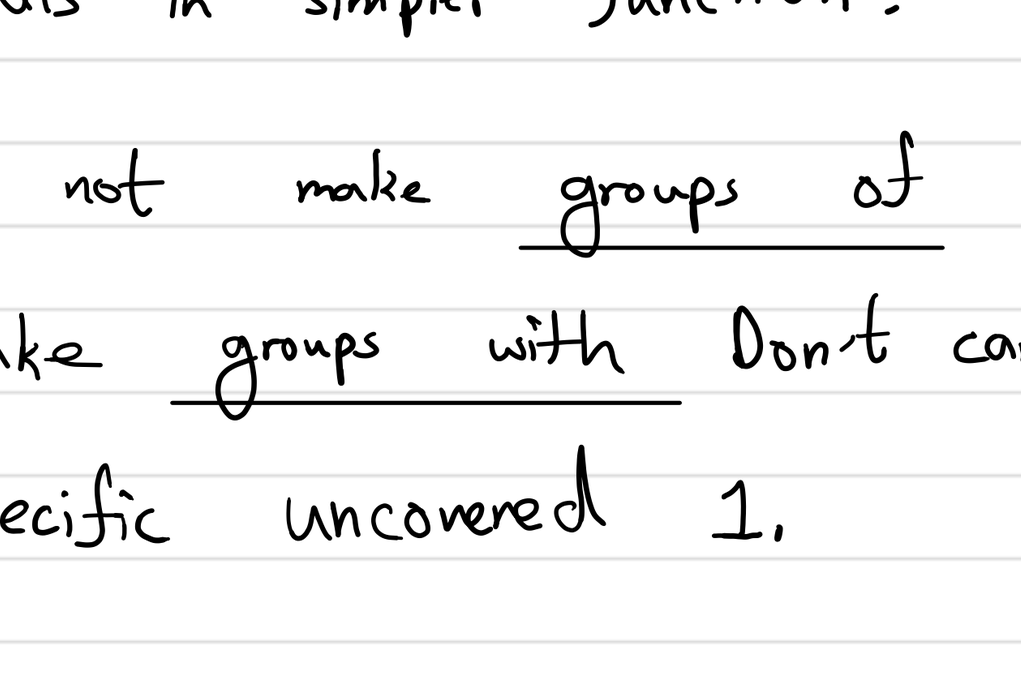
Don't care:

* ϕ is represent as 'X'.
* ϕ means output can be either 0 or 1. We don't care about that particular term.
* Don't care allows us to create larger group which results in simpler function.
* Do not make <u>groups of</u> Dont care only.

  Make <u>groups with</u> Don't care only to create a specific uncovered 1.

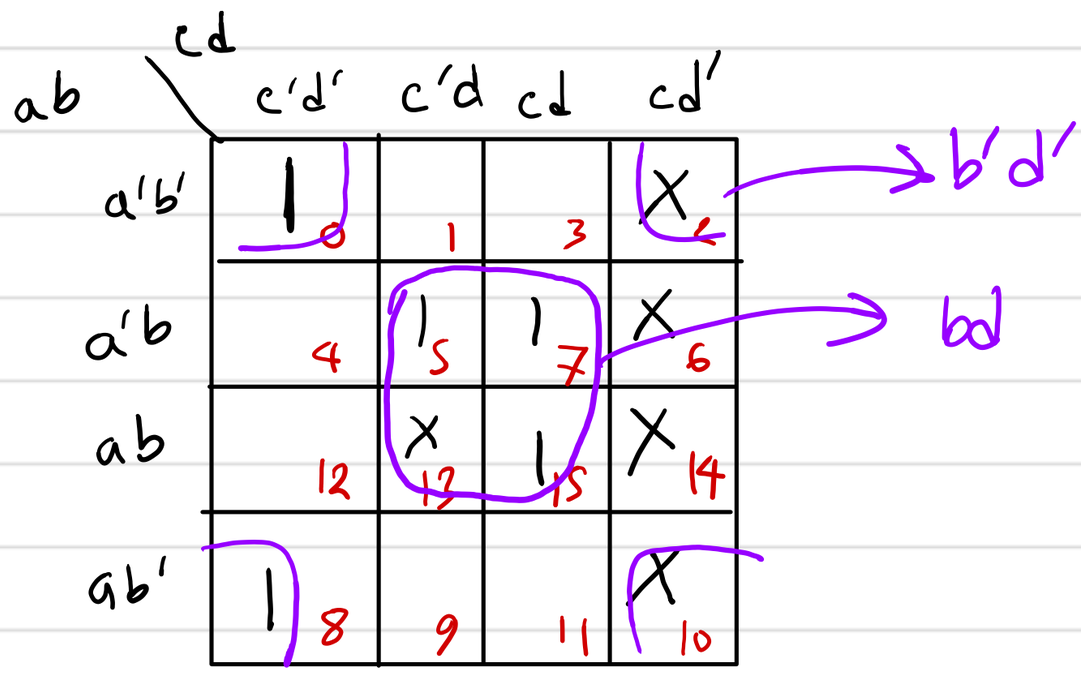
<u>Example:</u>

$f(a,b,c,d) = \Sigma(0,1,2,8,10,11,13) + d(3,4,9,15)$



$= b' + ad$

$f(a,b,c,d) = \Sigma($



$= bd + b'd'$