K-Maps

Karnaugh-Maps

"K-Maps is a graphical method, to simplify a boolean function of 'n' variables, which consists of 2^n cells for 'n' variables. The adjecent cells are differed only in single bit position."

↓

Gray code

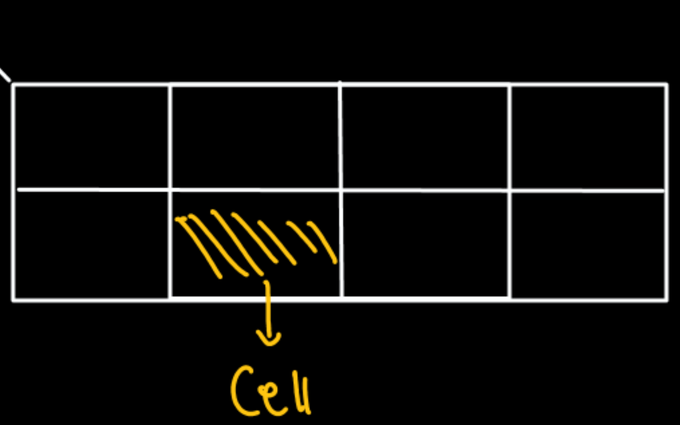
→ K map can be applied to any number of variables. but it becomes complicated for more than 5 variables.

Grouping of Variables in K-Maps :

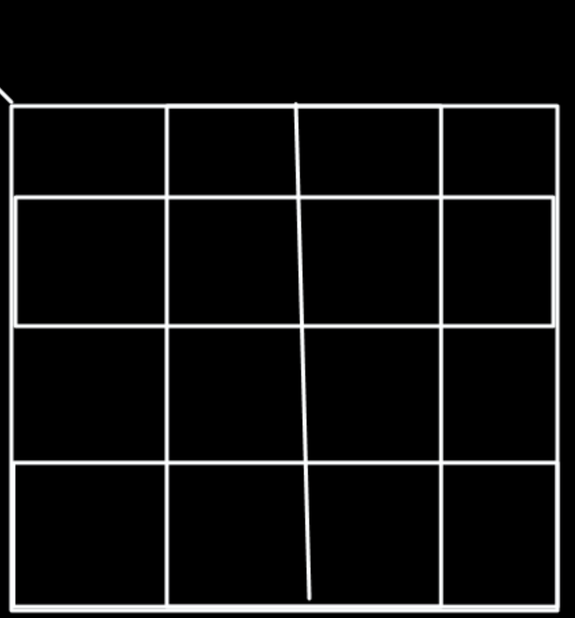
→ for 'n' variables there are 2^n Combinations

→ Each box Consists 1 Variable Combination from 2^n Combination
↓
Cell

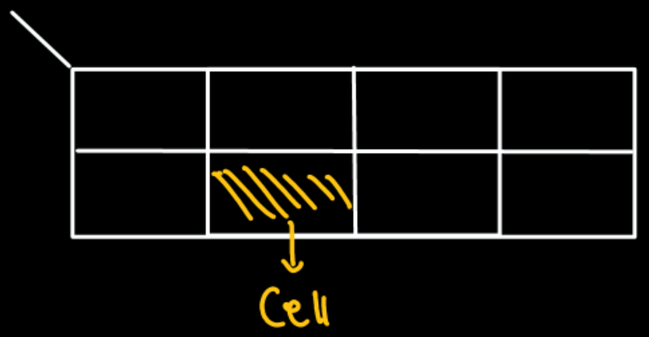
Ex: 3 variables = 2^3 = 8 Combination
↓
8 cells



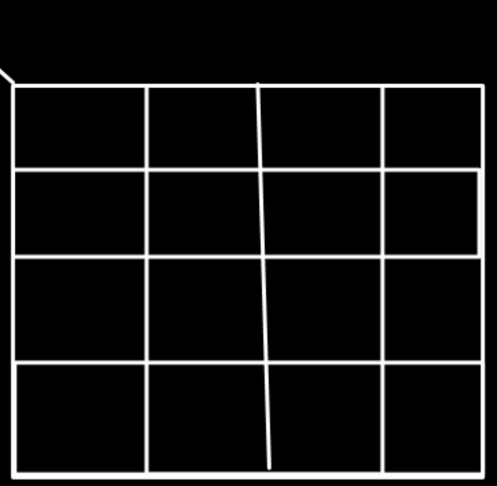
Ex: 4 Variables = 2^4 = 16 Combinations ⇒ 16 cells



Ex: 3 variables = 2^3 = 8 combination → 8 cells



Ex: 4 variables = 2^4 = 16 combinations ⇒ 16 cells



→ The square that consists 1's, should be taken in simplifying the least once.

1 is nothing but the minterm.

→ The square that contains '1' can be considered as many times as the grouping is possible with it.

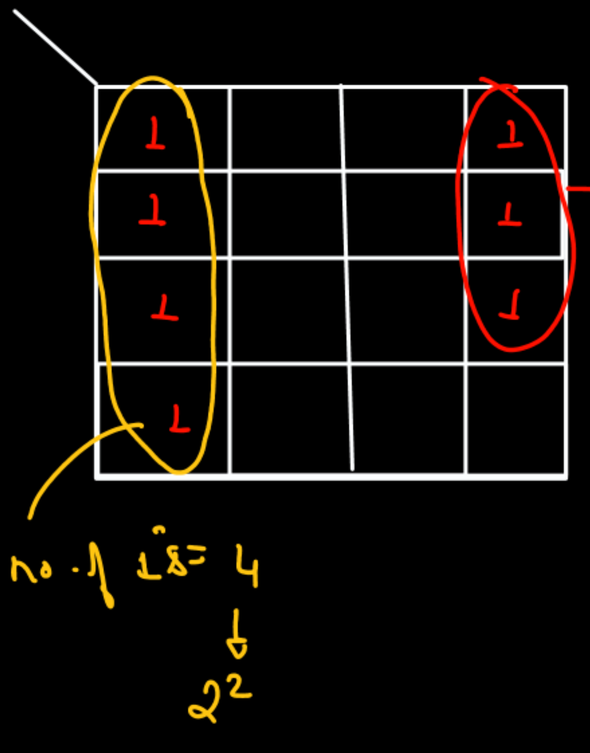
→ The group should not include any 'zeroes' for minterms

* → The group should be as large as possible.

* The group should be Vertical or Horizontal, but NOT diagonal.

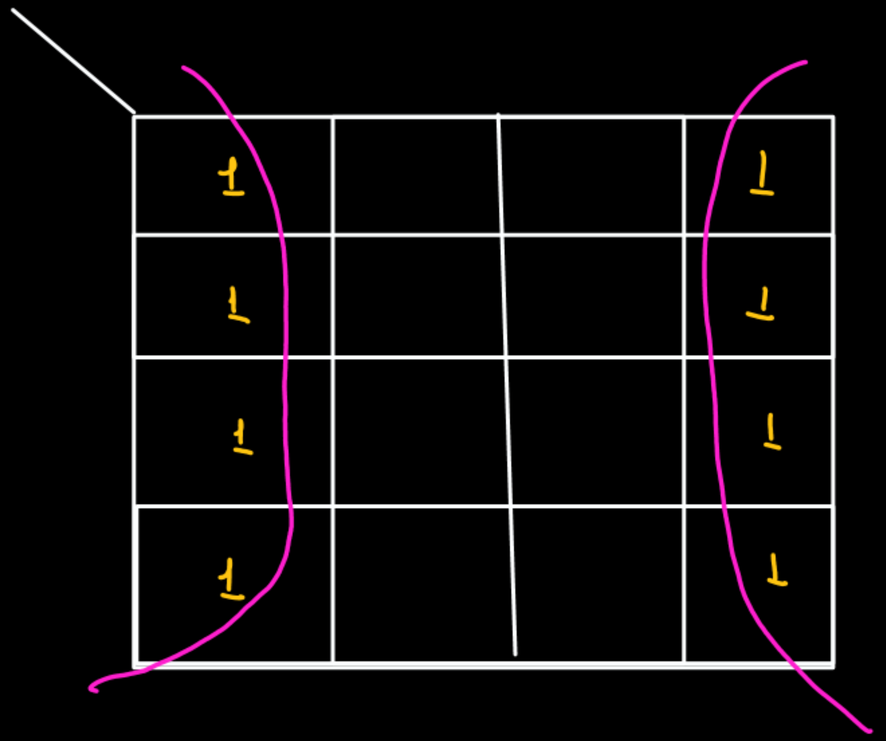
* The number of 1's in the group must be in power of 2.

1, 2, 4, 8, 16
2^0, 2^1, 2^2, 2^3, 2^4 ...

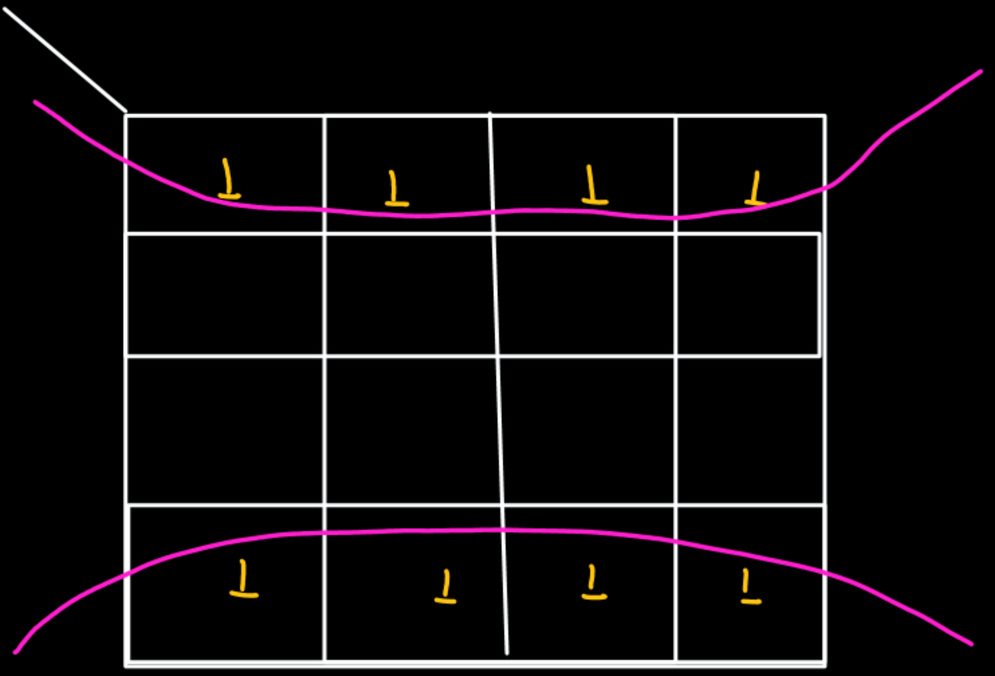


* The boolean function must be in Canonical SOP or POS form.

Grouping → If we group 2^k cells, then 'k' variables are eliminated. ← Each

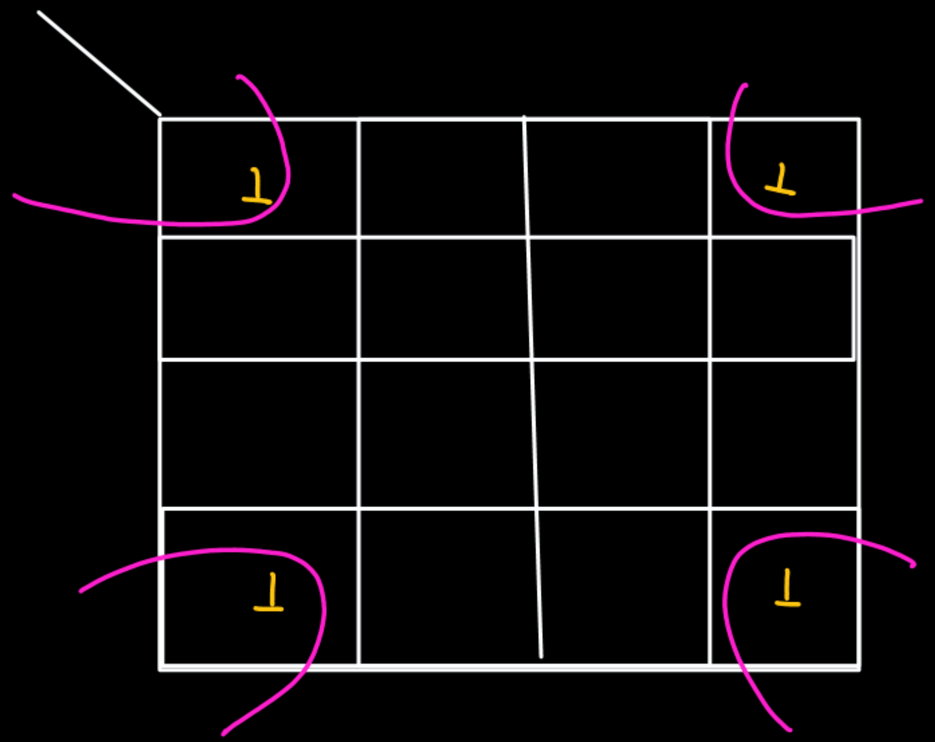


Cells of first & last Column
can be grouped together



The cells of 1st & last row
Can be grouped together

* All the four corners can be grouped together



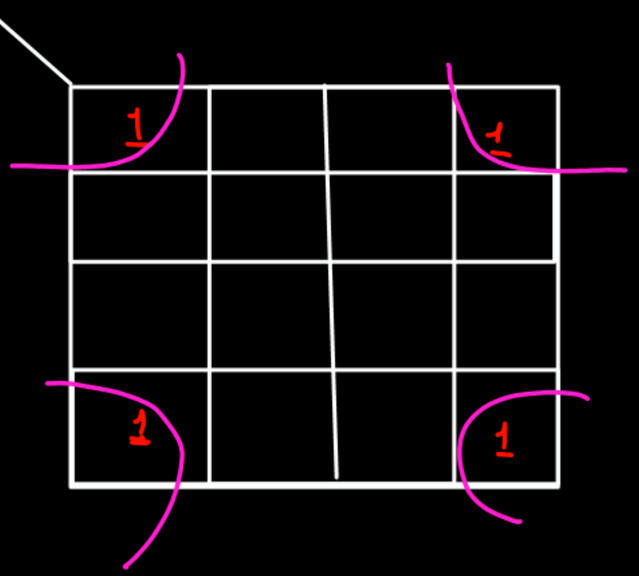
* Adjecent cells can be grouped together

group of 4 terms : eleminates 2 variables

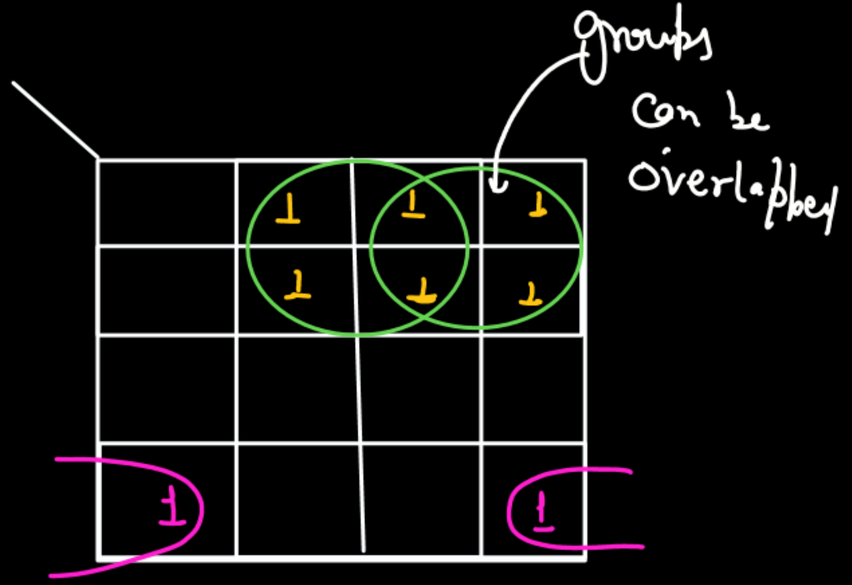
group of 8 terms : Eleminates 3 variables

group of 2^n terms : Eleminate 'n' variables

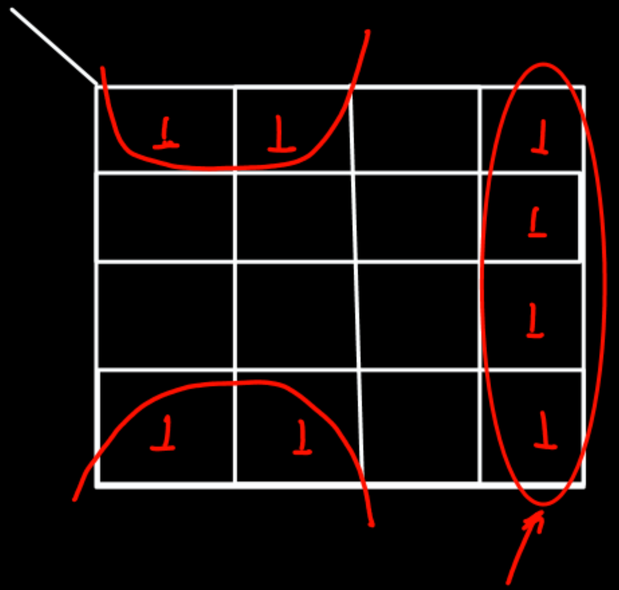
Examples:



Wrap Ground



Pair of two terms



Group of 8 terms

Called as 'Octate'

Cube of 4 terms

↓

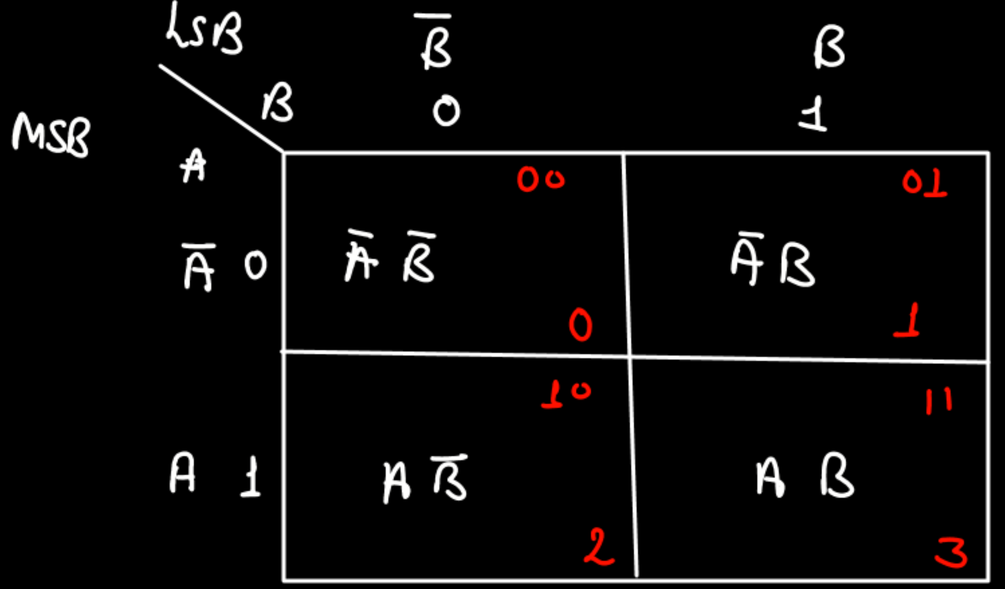
Quad

Designing K-Maps: 2 Variables K-Map

→ The possible minterms of 2 variables (A, B) are

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

A	B	Possible o/p	location on Kmap
0	0	$\bar{A}\bar{B}$	0
0	1	$\bar{A}B$	1
1	0	$A\bar{B}$	2
1	1	AB	3



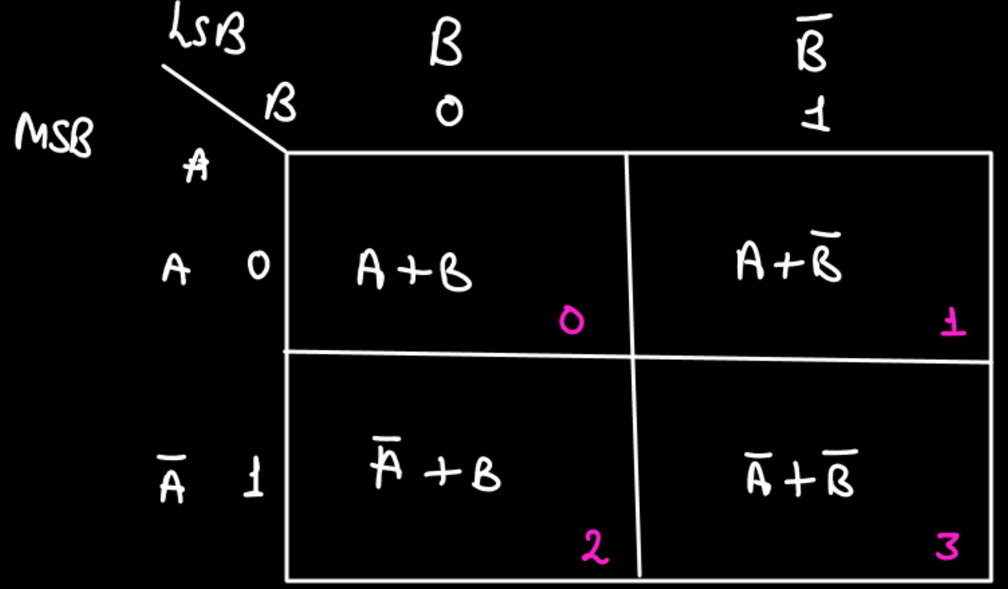
Minterms

2 variable K-Maps for maxterms:

→ Add the bits so that we can get zero

2 var = $2^2 = 4$ comb

A	B	Possible o/p	location on Kmap
0	0	$A+B$	0
0	1	$A+\bar{B}$	1
1	0	$\bar{A}+B$	2
1	1	$\bar{A}+\bar{B}$	3



Maxterms