UNIT-II

Combinational Logic System

Lecture 14

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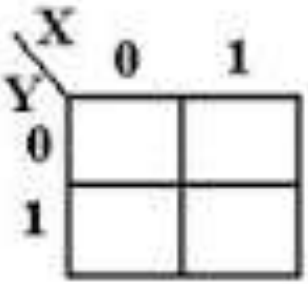
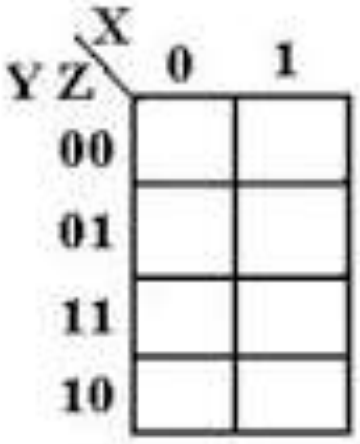
KMAP

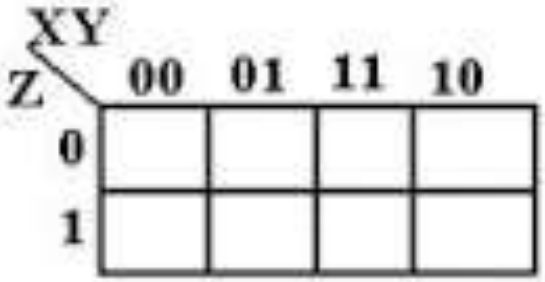
Karnaugh map is a tool for simplification of Boolean algebra
K-Map diagram is made up of squares
K-map is a graphical representation of SOP (Minterm)
K-Map extensively reduce the calculation and provides best minimized solution
K-map solve the expression with grouping of neighbor cells



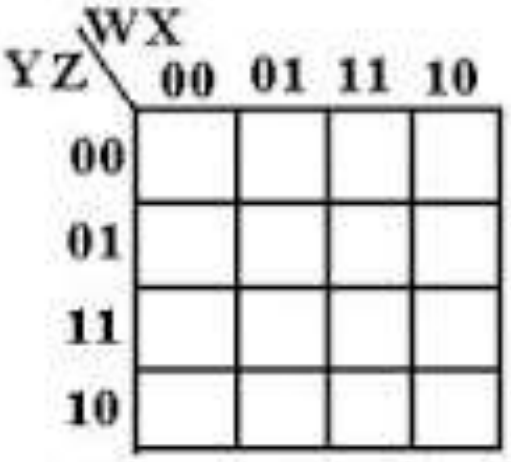
2 variable



3 variable



3 variable



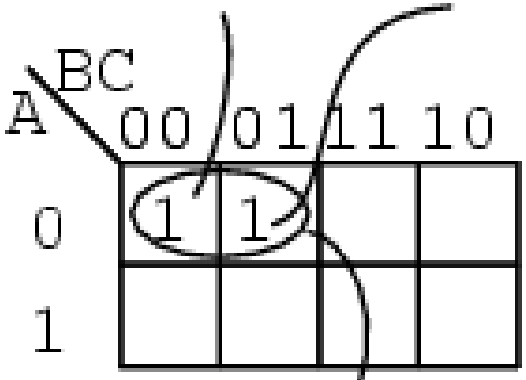
4 variable

Kmap Simplification Rule

1) Construct kmap and place 1's in the squares according to the truth table.
2) Groupings can contain only 1s
3) Groups can be formed only at right angles; diagonal groups are not allowed.
4) The number of 1's in a group must be a power of 2
5) The groups must **be made as large** as possible.
6) Groups can overlap and wrap around the sides of the Kmap.
7) Every group puts a term in the solution

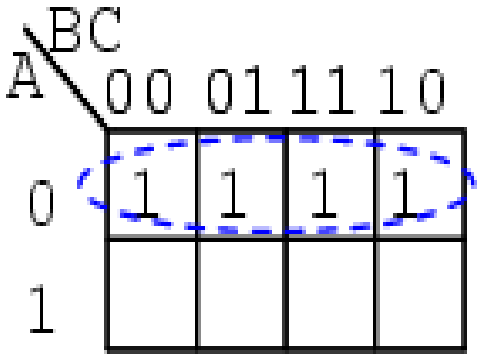
Optimized Solution
Minimum number of group
Each group covers maximum possible squares

Out= $\overline{A}\,B\,\overline{C} + \overline{A}\,B\,C$



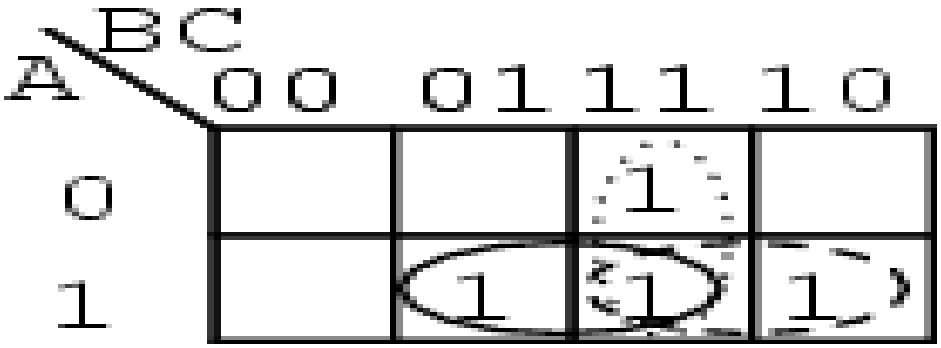
Out= $\overline{A}\,B$

Out= $\overline{A}\,\overline{B}\,\overline{C} + \overline{A}\,\overline{B}\,C + \overline{A}\,B\,C + \overline{A}\,B\,\overline{C}$

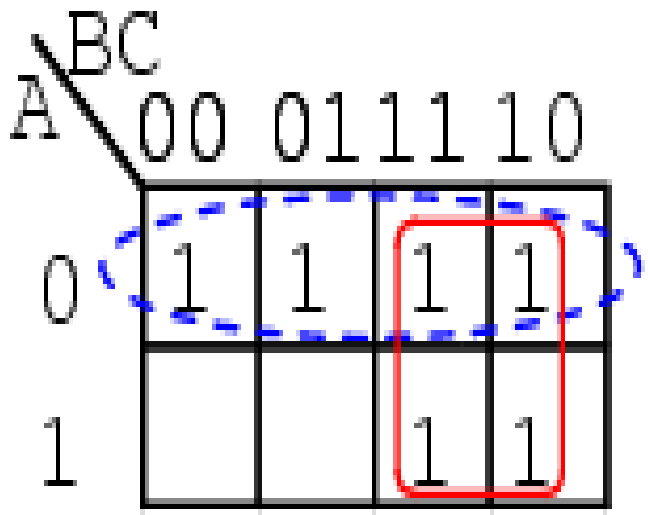


Out= $\overline{A}$

Output = AB + BC + AC

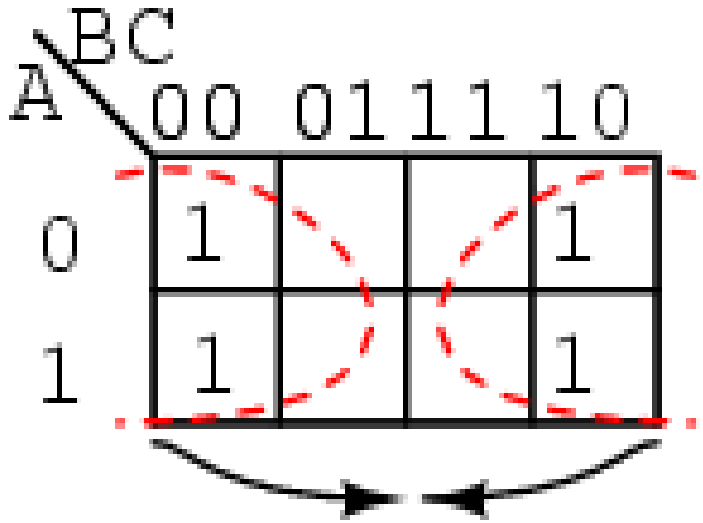


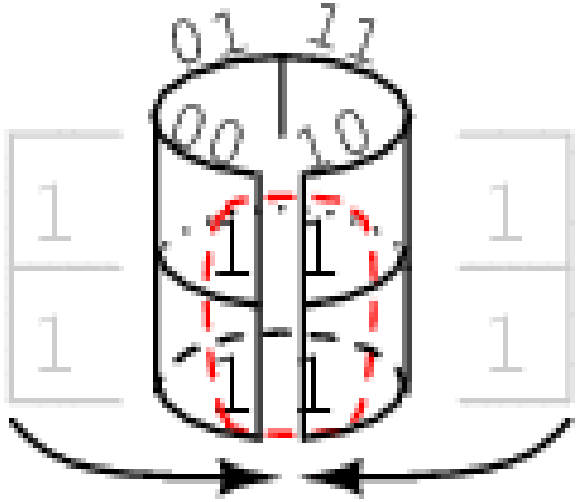
$$Out = \overline{A}\,\overline{B}\,\overline{C} + \overline{A}\,\overline{B}\,C + \overline{A}\,B\,C + \overline{A}\,B\,\overline{C} + A\,B\,C + A\,B\,\overline{C}$$



$$Out = \overline{A} + B$$

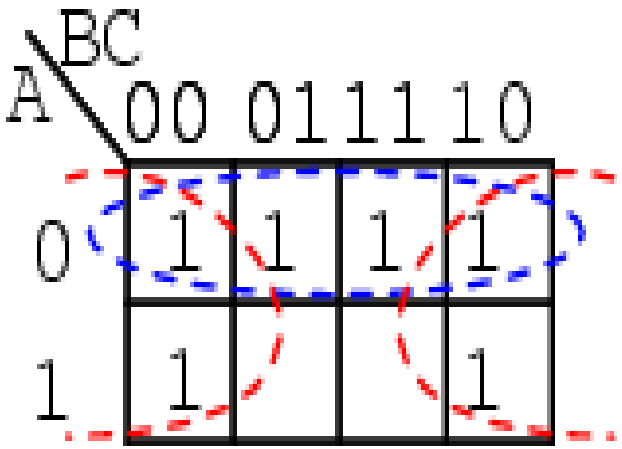
$$Out = \overline{A}\,\overline{B}\,\overline{C} + A\,\overline{B}\,\overline{C} + \overline{A}\,B\,\overline{C} + A\,B\,\overline{C}$$





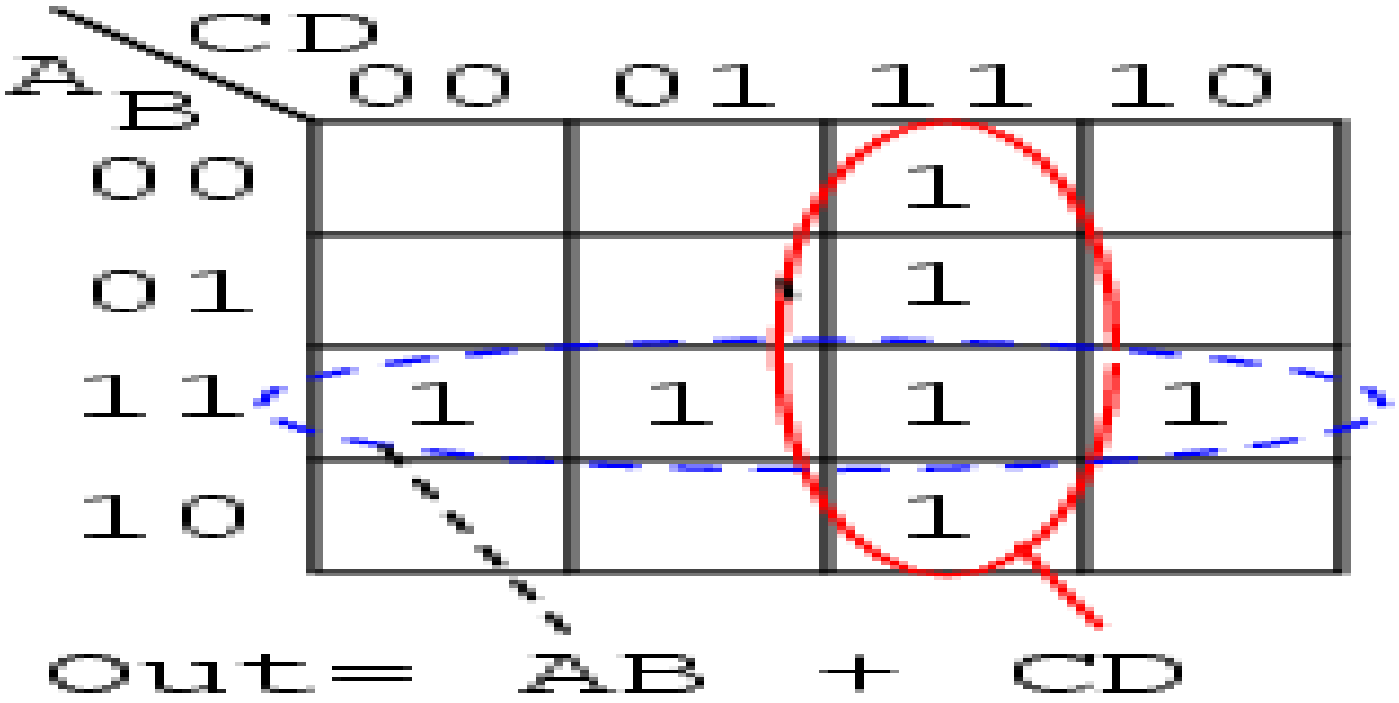
$$Out = \overline{C}$$

$$Out = \overline{A}\,\overline{B}\,\overline{C} + \overline{A}\,\overline{B}\,C + \overline{A}\,B\,C + \overline{A}\,B\,\overline{C} + A\,\overline{B}\,\overline{C} + A\,B\,\overline{C}$$

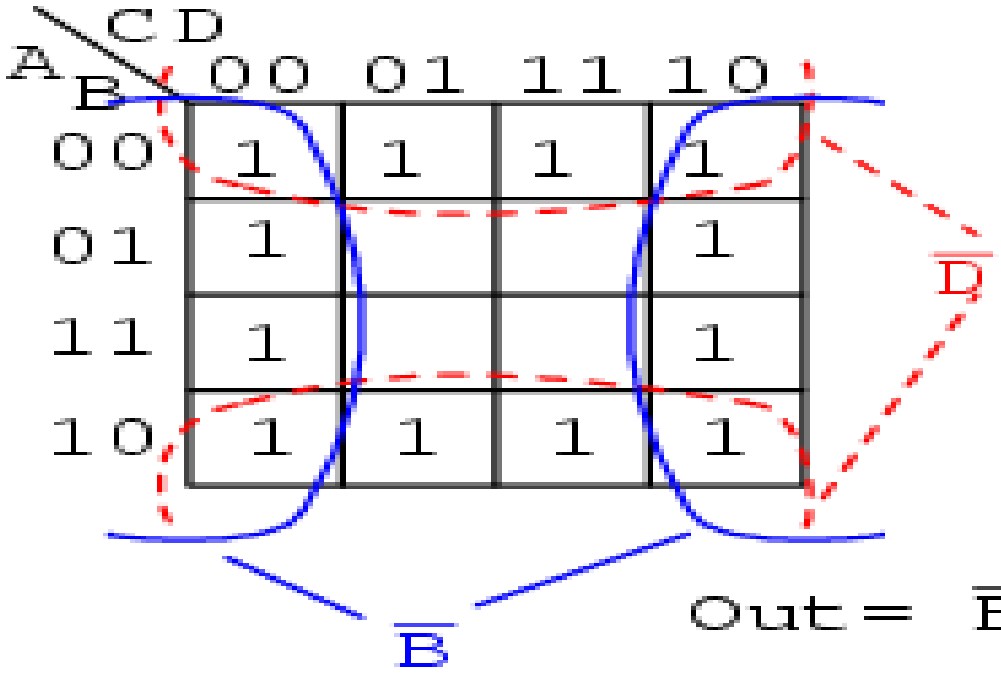


$$Out = \overline{A} + \overline{C}$$

$Out = \bar{A}\bar{B}CD + \bar{A}B\bar{C}D + ABCD + A\bar{B}CD + AB\bar{C}\bar{D} + AB\bar{C}D + ABC\bar{D}$

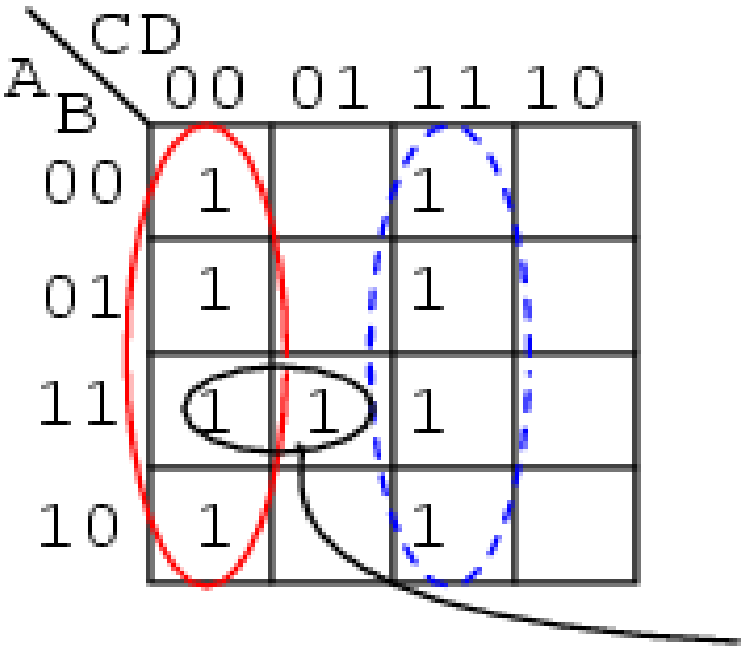


$$Out = \overline{A}\,\overline{B}\,\overline{C}\,\overline{D} + \overline{A}\,\overline{B}\,\overline{C}D + \overline{A}\,\overline{B}C\,D + \overline{A}\,\overline{B}C\,\overline{D} + B\,\overline{C}\,\overline{D} + BC\,\overline{D} + A\,\overline{B}\,\overline{C}\,\overline{D} + A\,\overline{B}D + A\,\overline{B}C\,\overline{D}$$

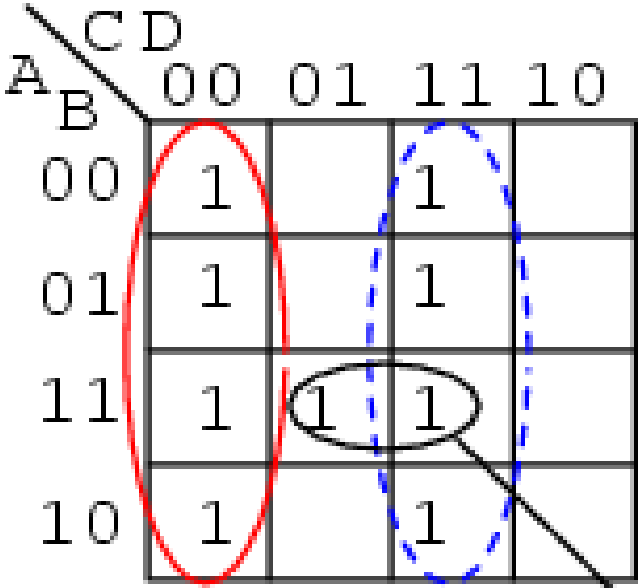


$$Out = \overline{B} + \overline{D}$$

$$Out = \bar{A}\bar{B}\bar{C}\bar{D} + \bar{A}\bar{B}CD + \bar{A}B\bar{C}\bar{D} + \bar{A}BCD + AB\bar{C}\bar{D} + AB\bar{C}D + ABCD + A\bar{B}\bar{C}\bar{D} + A\bar{B}CD$$

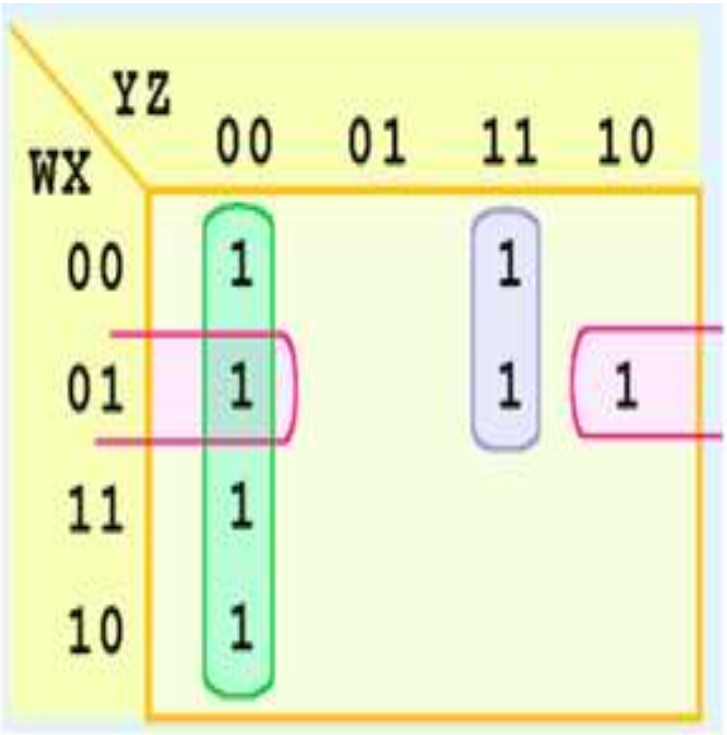


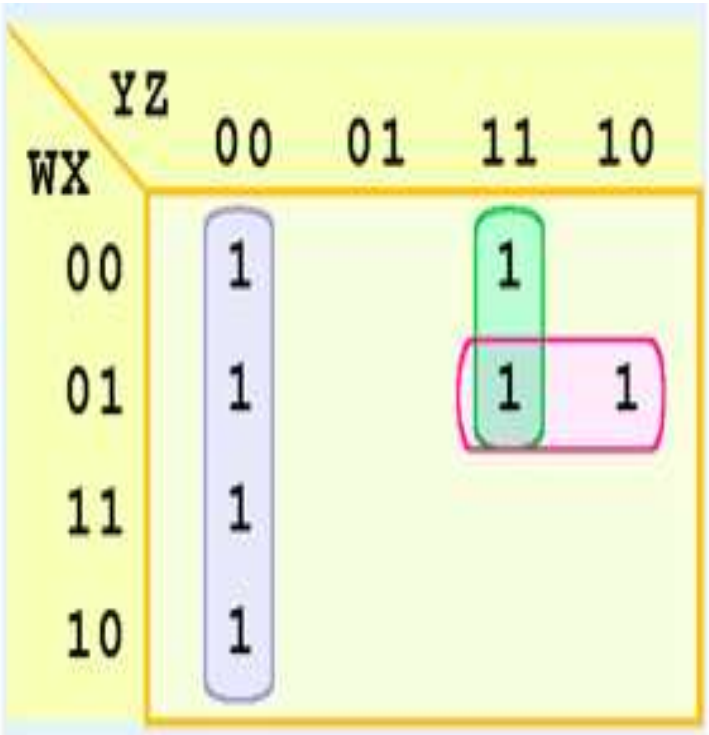
$$Out = \bar{C}\bar{D} + CD + A\bar{B}\bar{C}$$



$$Out = \bar{C}\bar{D} + CD + ABD$$

Practice Question





Quick Quiz (Poll 1)

- There are _____ cells in a 4-variable K-map.
  a) 12
  b) 16
  c) 18
  d) 8

Quick Quiz (Poll 2)

- These logic gates are widely used in _____ design and therefore are available in IC form.
  a) Sampling
  b) Digital
  c) Analog
  d) Systems