KARNAUGH MAP (K-MAP) :-

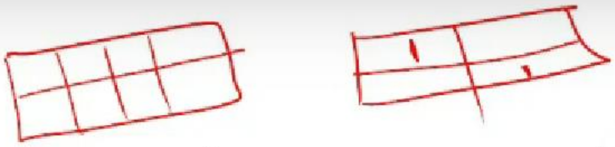
The complexity of the digital logic gates that implement a Boolean function is directly related to the complexity of the algebraic expression from which the function is implemented.

* The simplification of Boolean function by algebraic method is tedious because it lacks specific rules to predict each succeeding step in the manipulative process.
* The K-map method provides a straight forward procedure for simplifying or minimizing the

Boolean function.

* This method was first proposed by Veitech and modified by Karnaugh.
* This method is also called as Veitech diagram.
* This method provides a pictorial representation of all possible ways a function may be expressed in a standard form.

* Each square represents one minterm.
* Any two adjacent squares in the map differ by only one variable which is primed in one square and unprimed in the other.
* Minterms are not arranged in a binary sequence but in a sequence



$x'y' + x'y$

* Each square represents one minterm.

$\rightarrow x\ y \rightarrow x'y',\ x'y,\ xy',\ xy$

$00 \quad 01 \quad 10 \quad 11$

* Any two adjacent squares in the map differ by only one variable which is primed in one square and unprimed in the other.
* Minterms are not arranged in a binary sequence but in a sequence

in which only one bit changes from 0 to 1 or 1 to 0.

Two - Variable map :-

$x \backslash y$	0	1
0	m_0	m_1
1	m_2	m_3

m_0 — 00
m_1 — 01
m_2 — 10
m_3 — 11

Three - Variable map :-

$x \backslash yz$	00	01	11	10
0	m_0	m_1	m_3	m_2
1	m_4	m_5	m_7	m_6

10
000

00

$x'y'z'$
$x'y'z$

000
001

Four-variable map :-

wx \ yz	00	01	11	10
00	m_0	m_1	m_3	m_2
01	m_4	m_5	m_7	m_6
11	m_{12}	m_{13}	m_{15}	m_{14}
10	m_8	m_9	m_{11}	m_{10}

$m_0 \rightarrow m_1, m_4, m_2, m_8$

$m_4 \rightarrow m_0, m_5, m_6, m_{12}$

$m_{15} \rightarrow m_7, m_{13}, m_{14}, m_{11}$

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Problems :-

$f(x,y) = x'y' + x'y + xy'$

① Simplify $f(x,y) = \Sigma(0,1,2)$

x \ y	0	1
0	1	1
1	1	

$f(x,y) = y' + x'$

$\therefore f(x,y) = x' + y'$

$f(x,y) = x'y' + x'y + xy'$

$= x' \cdot (y' + y) + xy'$

$= x' \cdot 1 + xy'$

$= x' + xy'$

$= (x' + x) \cdot (x' + y')$

$= x' + y'$