



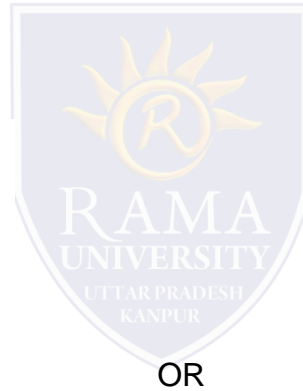
FACULTY OF ENGINEERING & TECHNOLOGY

LOGIC GATE

Three Variable K – map:

For three variables two adjacent variables are taken on either side (vertical line or horizontal line) of the K – map and the remaining one variable on the other side. Let A, B and C are the three variables.

		$A \cdot B$			
		00	01	11	10
C	0	m_0	m_2	m_6	m_4
	1	m_1	m_3	m_7	m_5

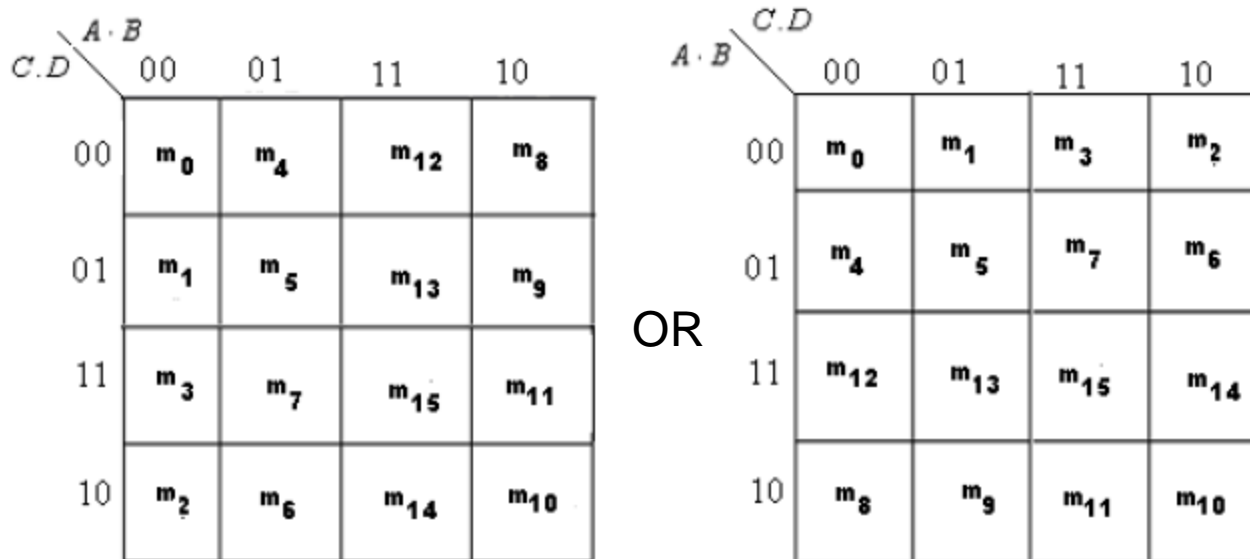


		C	
		0	1
$A \cdot B$	00	m_0	m_1
	01	m_2	m_3
	11	m_6	m_7
	10	m_4	m_5

NUMBER SYSTEM

Four Variable K – map:

For four variables two adjacent variables are taken on either side (vertical line or horizontal line) of the K – map and the two variables on the other side. Let A, B, C and D are the four variables.



NUMBER SYSTEM

Example 1: Draw the K – maps for the following Boolean function of three variables.

$$F_1(A, B, C) = \sum (m_1, m_3, m_5, m_6, m_7)$$

In the K – map of three variables 1s entry are made for the combinations m_1, m_3, m_5, m_6, m_7 and in the remaining combinations, 0s are entered.

		A · B			
		00	01	11	10
C	0	0	0	1	0
	1	1	1	1	1



Example 2: Draw the K – maps for the following Boolean function of four variables.

$$F_1(A, B, C, D) = \sum (m_2, m_3, m_4, m_6, m_7, m_{11}, m_{14}, m_{15})$$

		A · B			
		00	01	11	10
C · D	00	0	1	0	0
	01	0	0	0	0
	11	1	1	1	1
	10	1	1	1	0

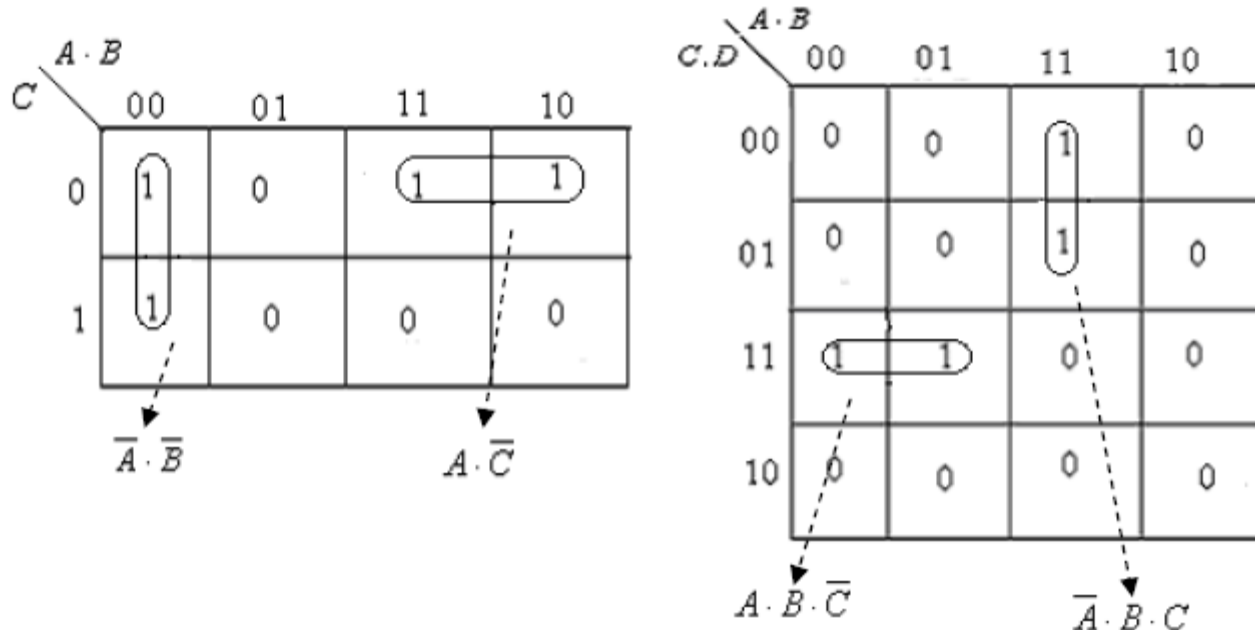
NUMBER SYSTEM

Encircling of Groups:

After constructing K – map, the pairs quads and octets of adjacent 1s in the K – map are made for getting the minimal Boolean expression. A pair eliminates one variable with its complement; a quad and an octet eliminate two variables and three variables respectively with their complements.

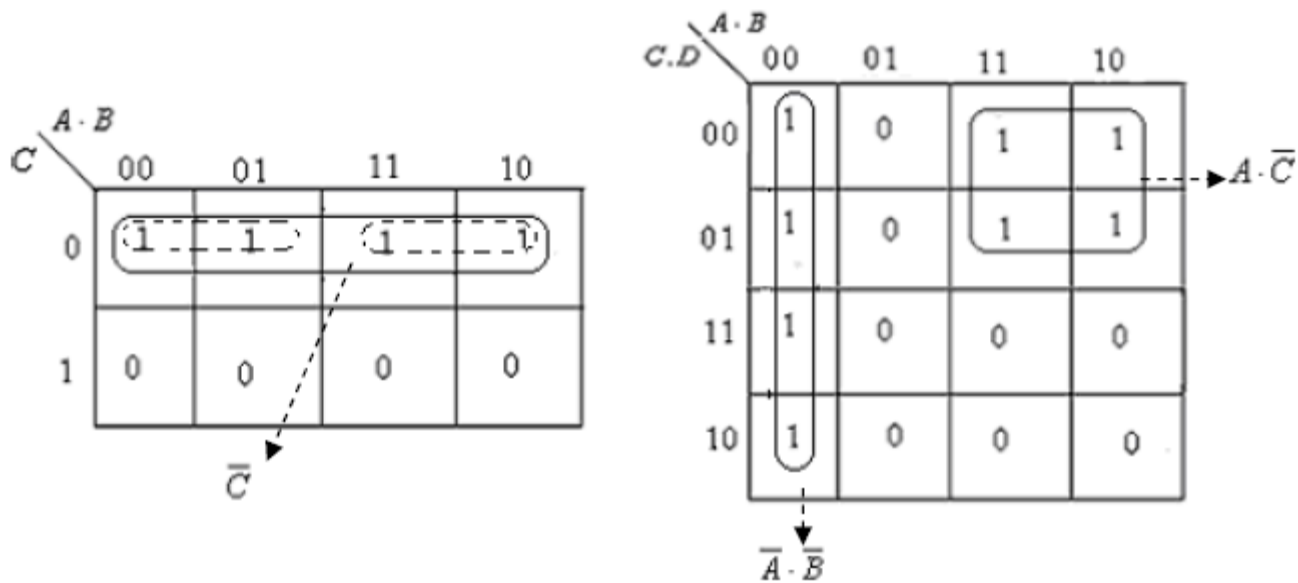
Pairs:

In the three-variable or four variable K – map having 1s and 0's entry, two adjacent 1s (vertically or horizontally) are encircled. The diagonally adjacent 1s are never encircled.



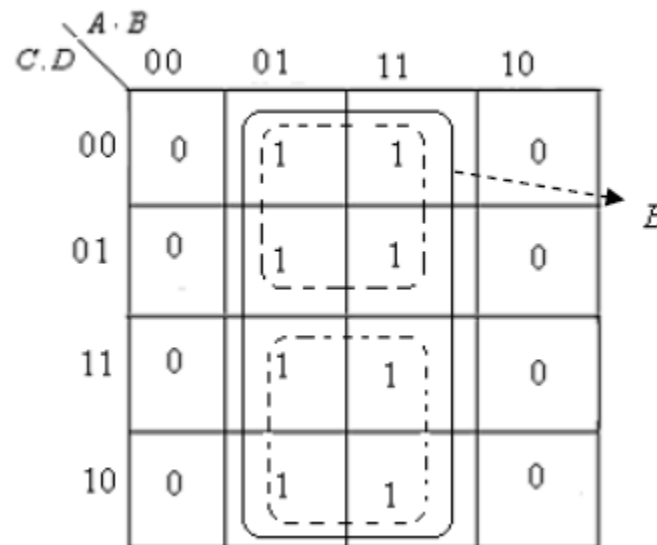
Quads:

In the K-map if four 1s are adjacent in a row or column or in the form of a square, then these 1s are encircled called as quads.



Octets:

The eight adjacent 1s are encircled in a K – map known as octet. Figure shows the encircled octet (solid line) in a K – map of 4 variables.



Overlapping groups: While making encircled groups in the K – map, it is always tried to have the groups of largest number of 1s first than others, i.e. octets are encircled first than quads and than pairs. It is important to use same 1 more than once. In other words same 1 may be used in more than one encircled groups. Such groups are called as the overlapped groups. Some overlapped groups are shown in figure

$C.D \backslash A.B$	00	01	11	10
00	0	0	0	0
01	0	1	1	0
11	1	1	1	1
10	1	1	1	1

$C.D \backslash A.B$	00	01	11	10
00	0	1	0	0
01	0	1	1	0
11	1	1	1	0
10	0	0	1	0

$C.D \backslash A.B$	00	01	11	10
00	0	1	0	0
01	0	1	0	0
11	1	1	1	0
10	0	1	0	0

$C.D \backslash A.B$	00	01	11	10
00	1	1	1	1
01	1	1	1	0
11	1	0	0	0
10	0	0	0	0

The terms for each encircled groups are written in the same manner as is done for normal pairs, quads and octets.

Rolling groups:

It is also allowed to roll the K – map so that grouping of largest number of 1s may be formed. To understand this consider a K – map as shown in figure 1. In this K – map while encircling, one can obtain two quads but using the rolling of K – map, an octet may be formed as shown in figure 2. Here the rolling is done in such a way that the left hand side encircled quad touches the right hand side encircled quad. This in fact looks like an octet. The rolling is shown by half encircling the two groups as shown in figure 2.

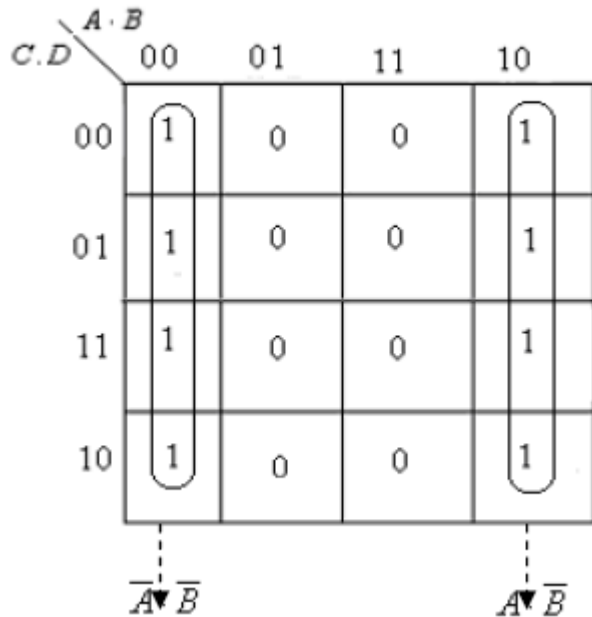


figure 1

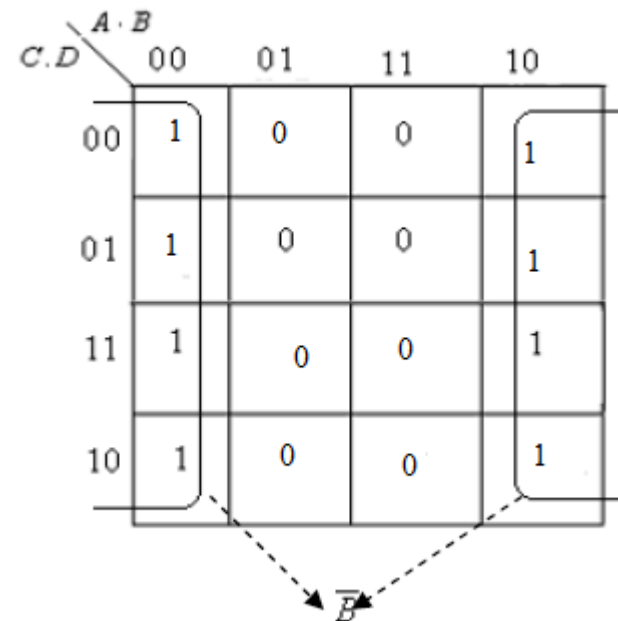
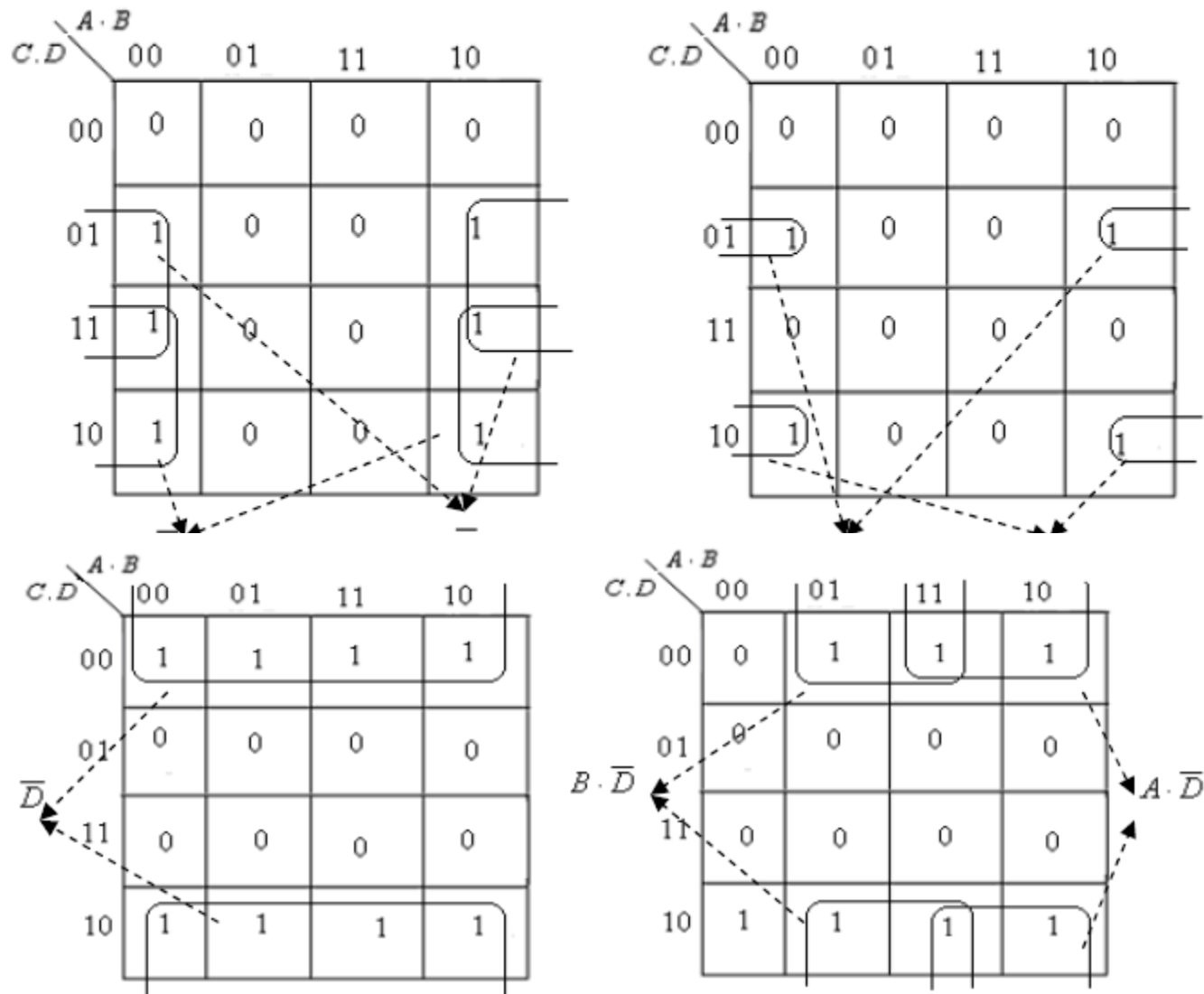


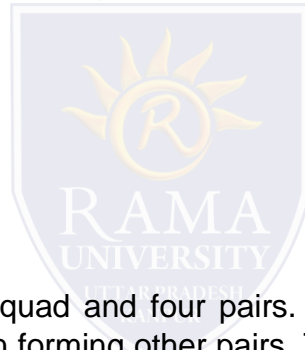
figure 2

The following rolling is possible as illustrated in figure



Redundant Groups:

While encircling the groups in the K – maps, there is a possibility that all the elements (1s) of some group/groups are overlapped by other groups. Such a group whose all 1s are overlapped by other groups is called a redundant group. The redundant groups may be illustrated by considering a K – map as shown in figure.



In this K – map the encircled groups are: one quad and four pairs. But quad is redundant since all its four 1s are used in forming other pairs. The quad is, therefore, eliminated. So the valid encircled groups will be as shown in figure.

