KARNAUGH MAPS

Karnaugh mapping is a method used to simplify a truth table using sum of products or product of sums along with simultaneous optimization of the output function. Karnaugh maps are the graphical equivalent of a truth table. In other words, Karnaugh maps are an easy way of designing and optimizing a circuit from a truth table.

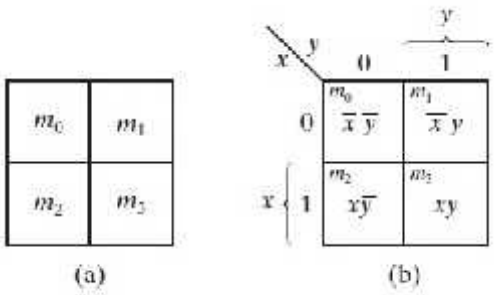
TWO-VARIABLE KARNAUGH MAP

The two-variable map is shown in Fig. 1 (a). There are four minterms for two variables; hence, the map consists of four squares, one for each minterm. The map is redrawn in (b) to show the relationship between the squares and the two variables x and y . The 0 and 1 marked in each row and column designate the values of variables. Variable x appears primed in row 0 and unprimed in row 1. Similarly, y appears primed in column 0 and unprimed in column 1.

*If we mark the squares whose minterms belong to a given function, the two-variable map becomes another useful way to represent any one of the **16** Boolean functions of two variables. As an example, the function xy is shown in Fig. 1 (a). Since xy is equal to* $\mathbf{m_3}$ *, a **1** is placed inside the square that belongs to m3. Similarly, the function **x + y** is represented in the map of Fig. 1 (b) by three squares marked with **1's**. These squares are found from the minterms of the function:*

$$m1 + m2 + m3 = \bar{x}y + x\bar{y} + xy = x + y$$

A	B	f =1
0	0	0
0	1	1
1	0	1
1	1	1



Two-variable K-map.

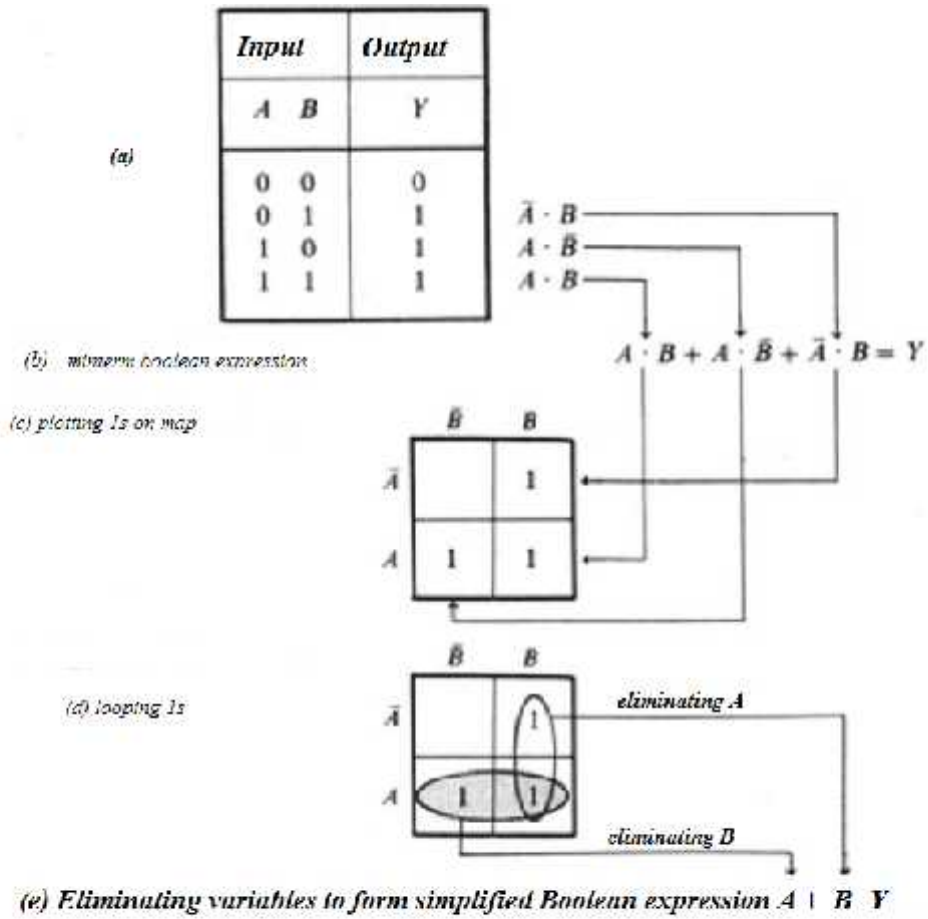


Fig 2

The 3-Variable Karnaugh Map

The 3-variable Karnaugh map is an array of eight cells. as shown in Fig.(3). In this case, A, B, and C are used for the variables although other letters could be used.

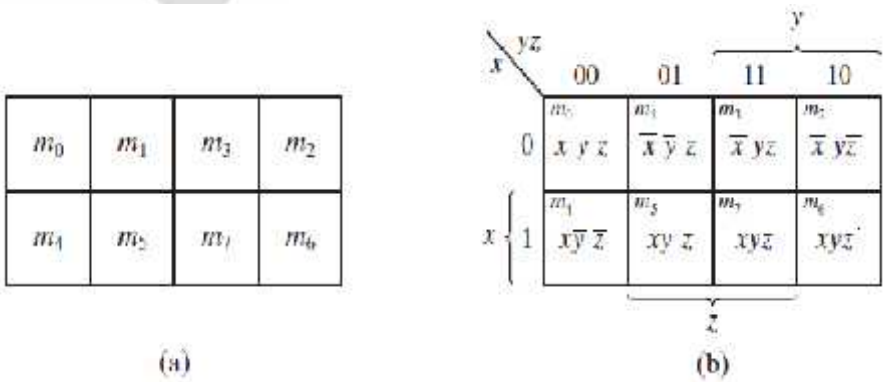
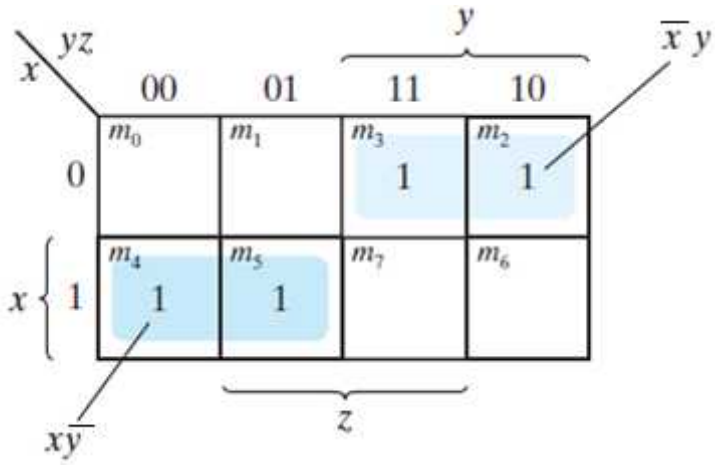


Fig3 three variable K-map

EX// Simplify the Boolean function

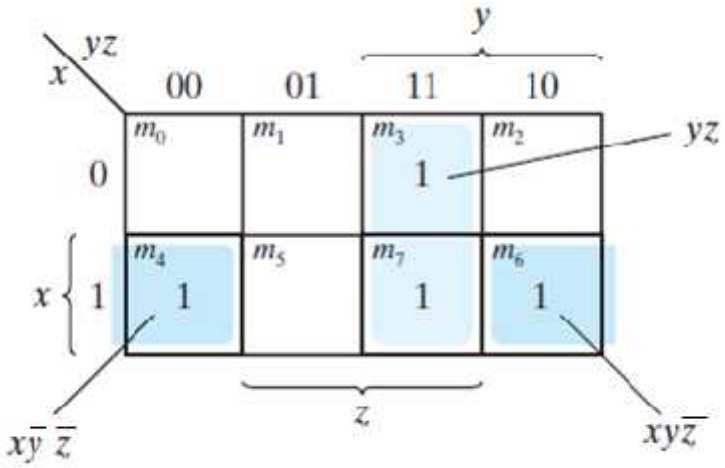
F (x, y, z) = ∑(2, 3, 4, 5)



Map for Example , F (x, y, z) = ∑(2, 3, 4, 5) = $\overline{x}\,y + x\,\overline{y}$

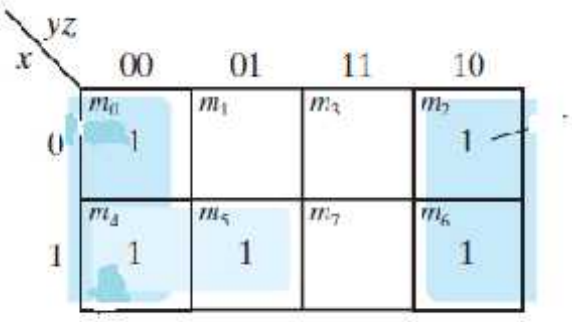
Ex// Simplify the Boolean function

F (x, y, z) = ∑(3, 4, 6, 7)



f= Y Z+X $\overline{Z}$

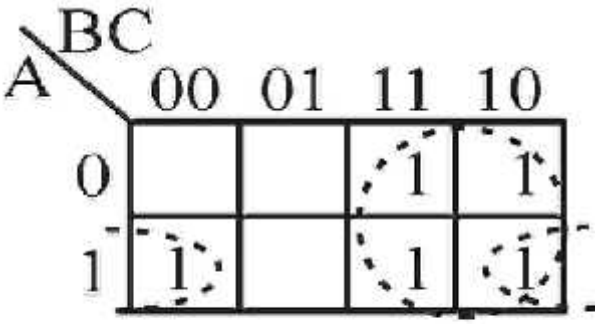
EX// Simplify the Boolean function



$$F=\overline{Z}+X\,\overline{Y}$$

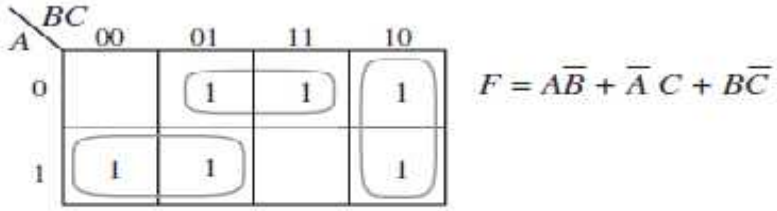
EX// Simplify by using K-map

A	B	C	Y
0	0	0	0
0	0	1	0
0	1	0	1
0	1	1	1
1	0	0	1
1	0	1	0
1	1	0	1
1	1	1	1

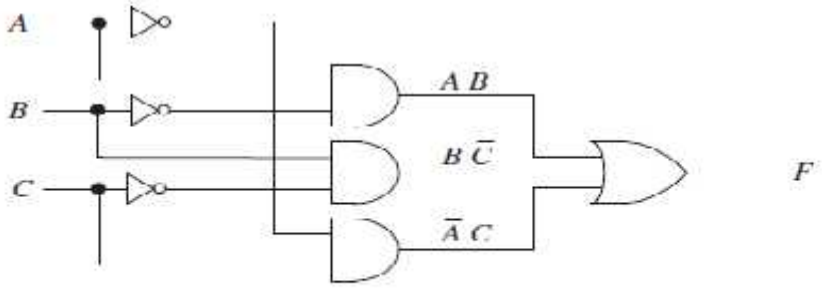


$$Y = AC' + B$$

EX// Simplify f =∑(1,2,3,4,5,6)



(a) K-map for F



(b) Logic Diagram for the output, F