

## 1. Half Adder

**Half Adder:** is a combinational circuit that performs the addition of two bits, this circuit needs two binary inputs and two binary outputs.

Inputs		Outputs	
X	Y	C	S
0	0	0	0
0	1	0	1
1	0	0	1
1	1	1	0

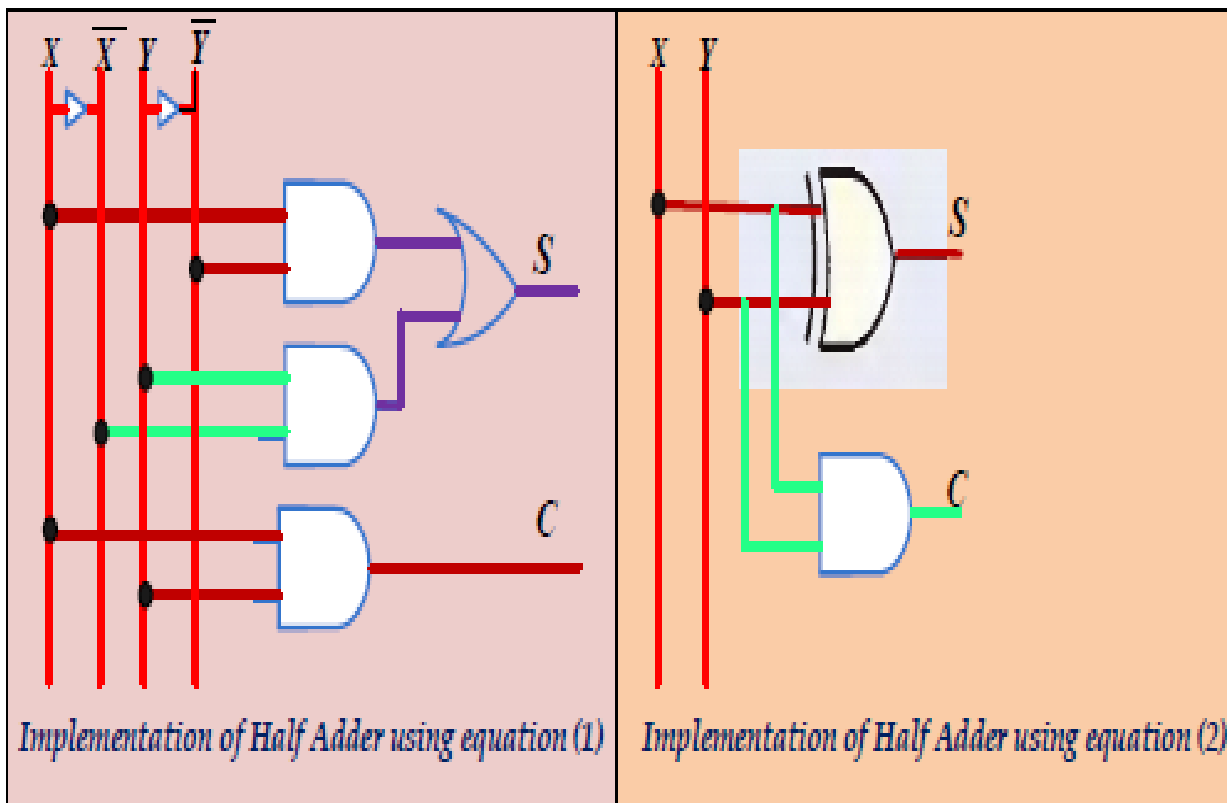
**Truth table**

The simplified Boolean function from the truth table:

$$\begin{cases} S = \overline{X}Y + X\overline{Y} \\ C = XY \end{cases} \quad 1 \quad \text{(Using sum of product form)}$$

Where  $S$  is the sum and  $C$  is the carry.

$$\begin{cases} S = X \oplus Y \\ C = XY \end{cases} \quad 2 \quad \text{(Using XOR and AND Gates)}$$



Implementation of Half Adder using equation (1)

Implementation of Half Adder using equation (2)