

Lab 2

First Stage

Intelligent Medical Systems Department



Logic Design

Lab 2: Basic Logic Gates (AND & OR Gates)

By

Asst. Lect. Ali Saleem Haleem

Basic Logic Gates (AND & OR Gates)

1. The AND Gate

The AND gate can have two or more inputs with one output and performs what is known as logical multiplication.

Figure below shows the AND gate logic symbol with **two**, **three**, and **four** input variables and the output variables indicated

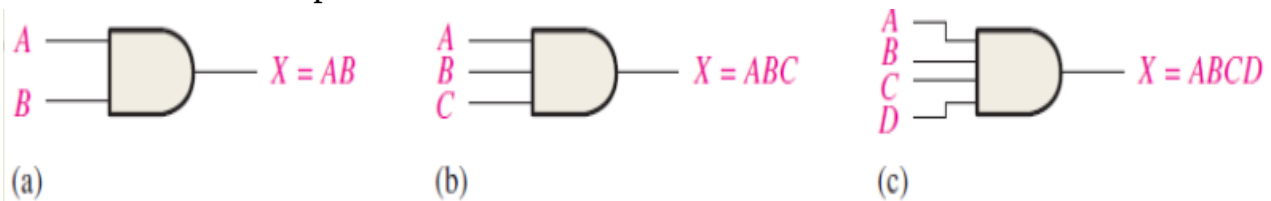
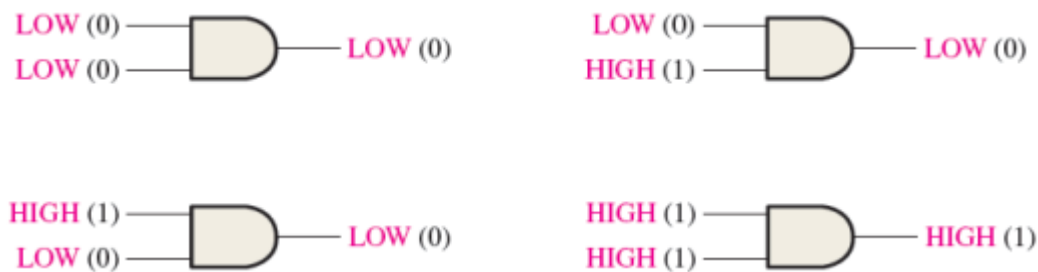


Figure below illustrates a **2-input AND** gate with all four possibilities of input combinations and the resulting output for each.



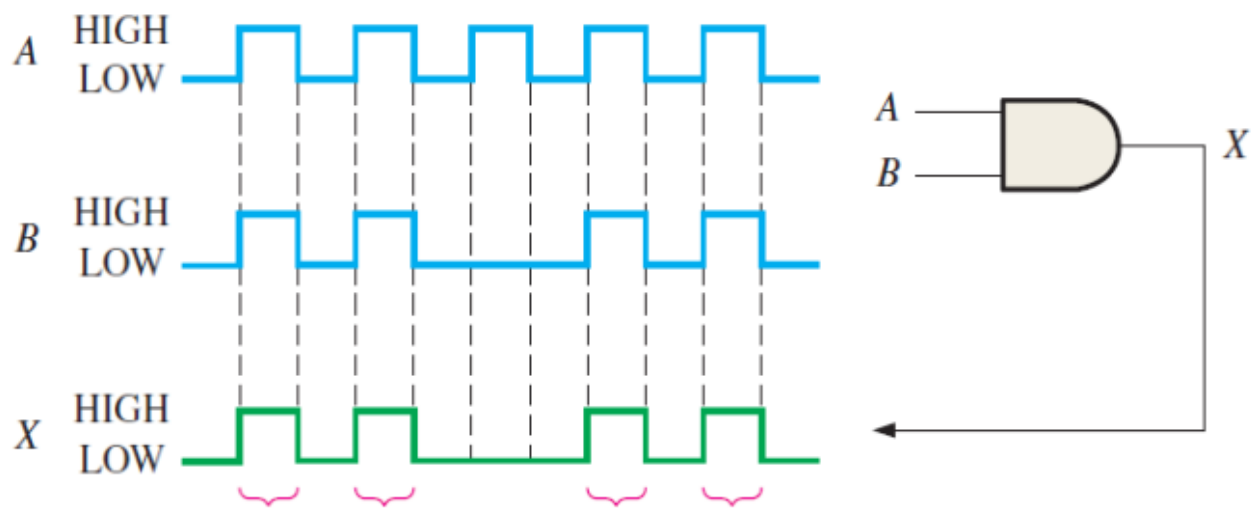
❖ Operation and Truth table for a 2-input AND gate

For two input variables: $N = 2^2 = 4$ combinations

Boolean Expression: $Q = A \cdot B$

The 2-input Logic AND Gate

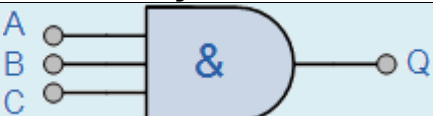
Symbol	Truth Table		
2-input AND Gate Boolean Expression $Q = A \cdot B$	A	B	Q
	0	0	0
	0	1	0
	1	0	0
	1	1	1
Read as A AND B gives Q			



*A and B are both HIGH during these four time intervals;
therefore, X is HIGH.*

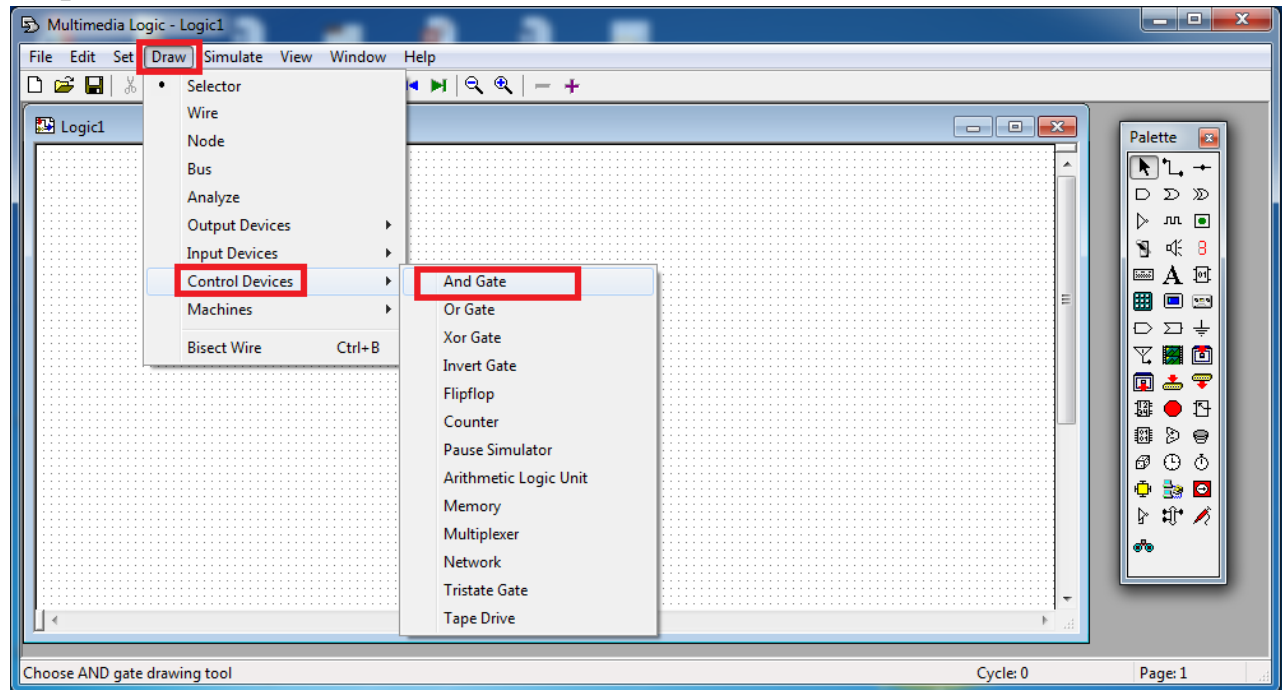
For three input variables: $N = 2^3 = 8$ combinations

The 3-input Logic AND Gate

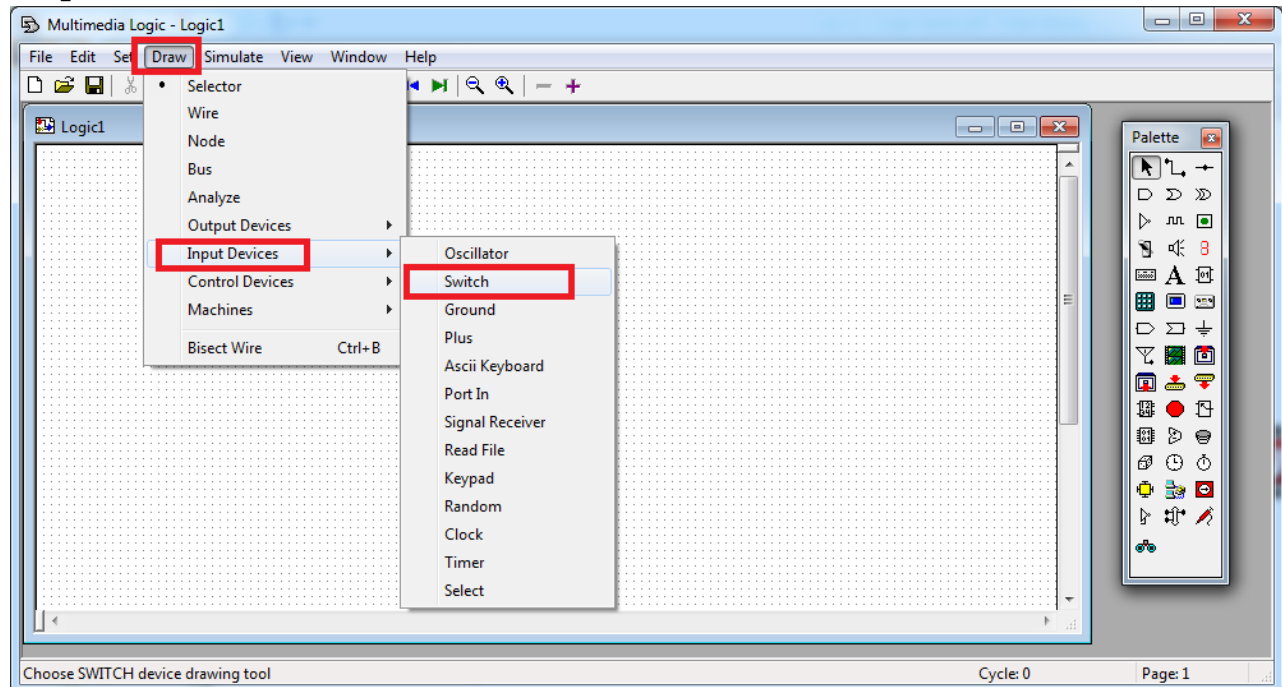
Symbol	Truth Table			
 3-input AND Gate	A	B	C	Q
	0	0	0	0
	0	0	1	0
	0	1	0	0
	0	1	1	0
	1	0	0	0
	1	0	1	0
	1	1	0	0
	1	1	1	1
Boolean Expression $Q = A.B.C$		Read as A AND B AND C gives Q		

1.2 Practical Application of AND gate

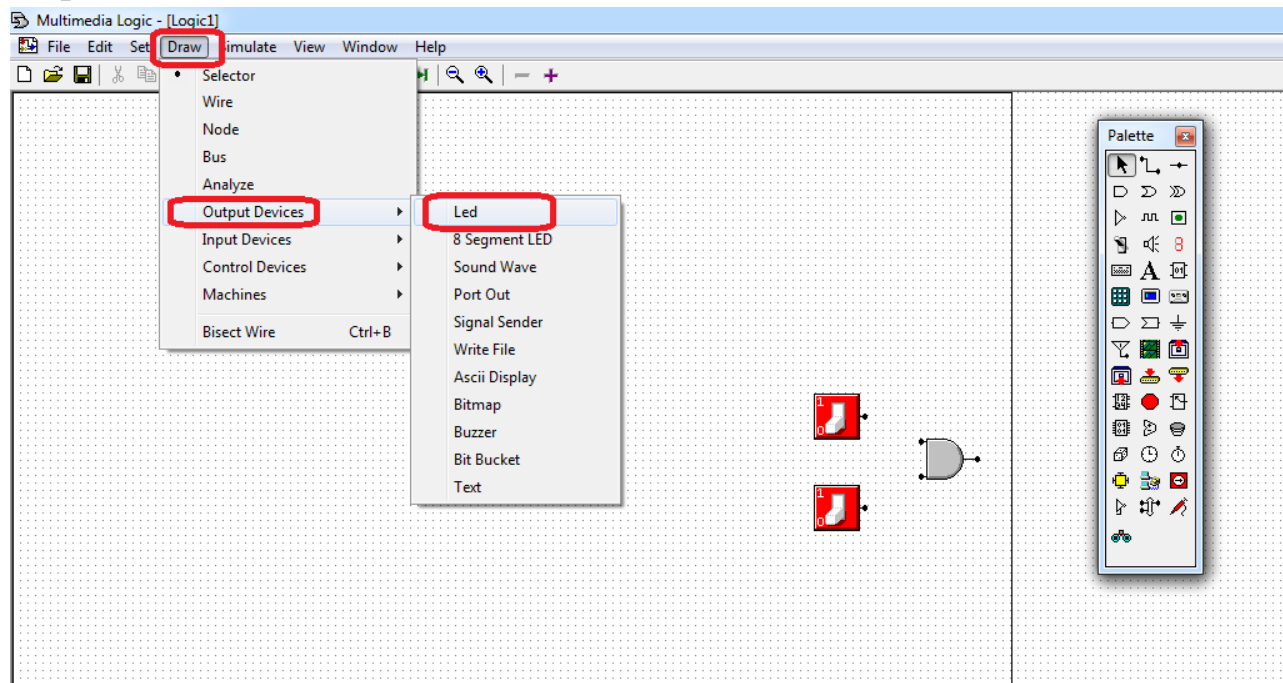
Step 1



Step 2

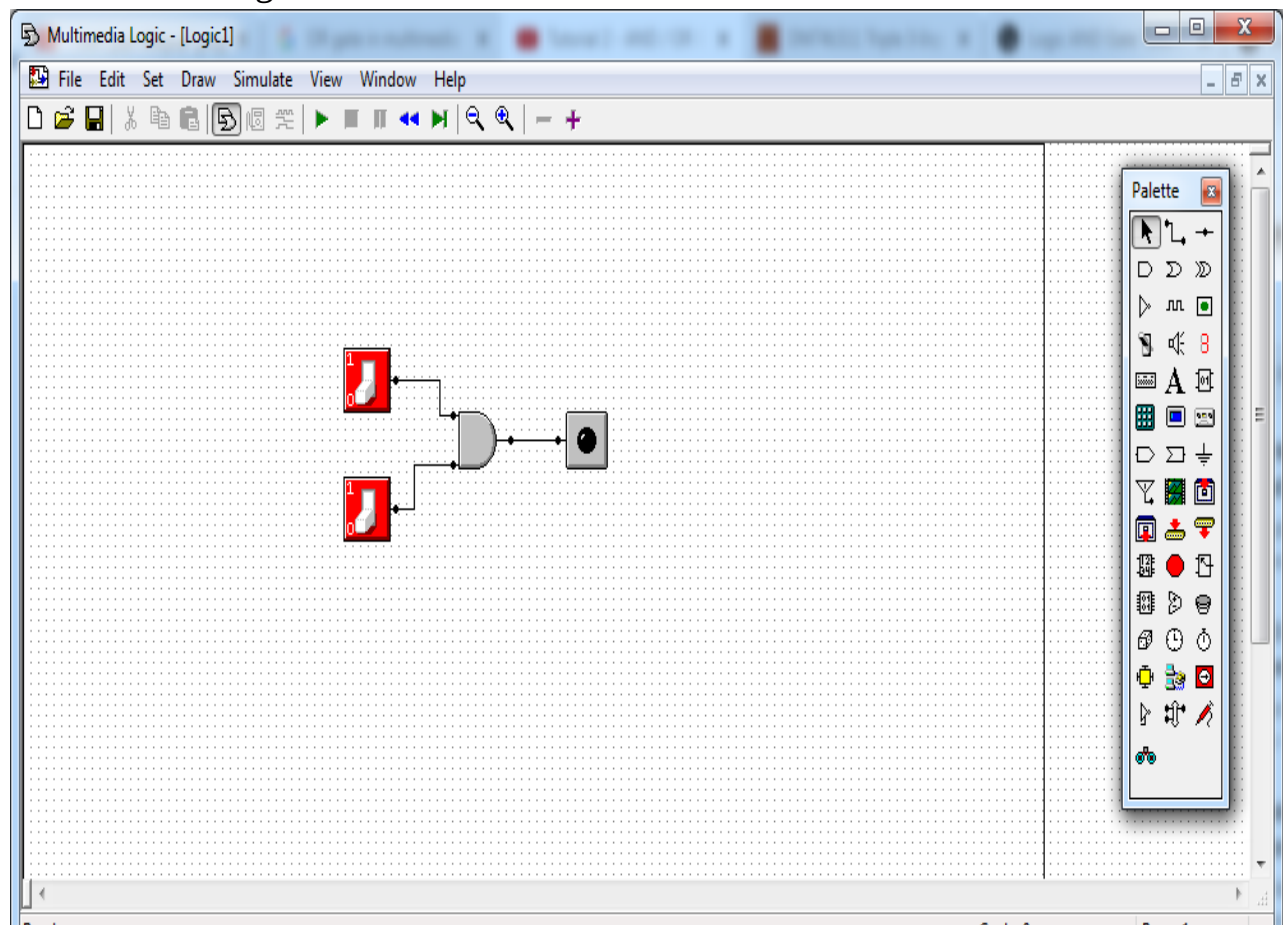


Step 3



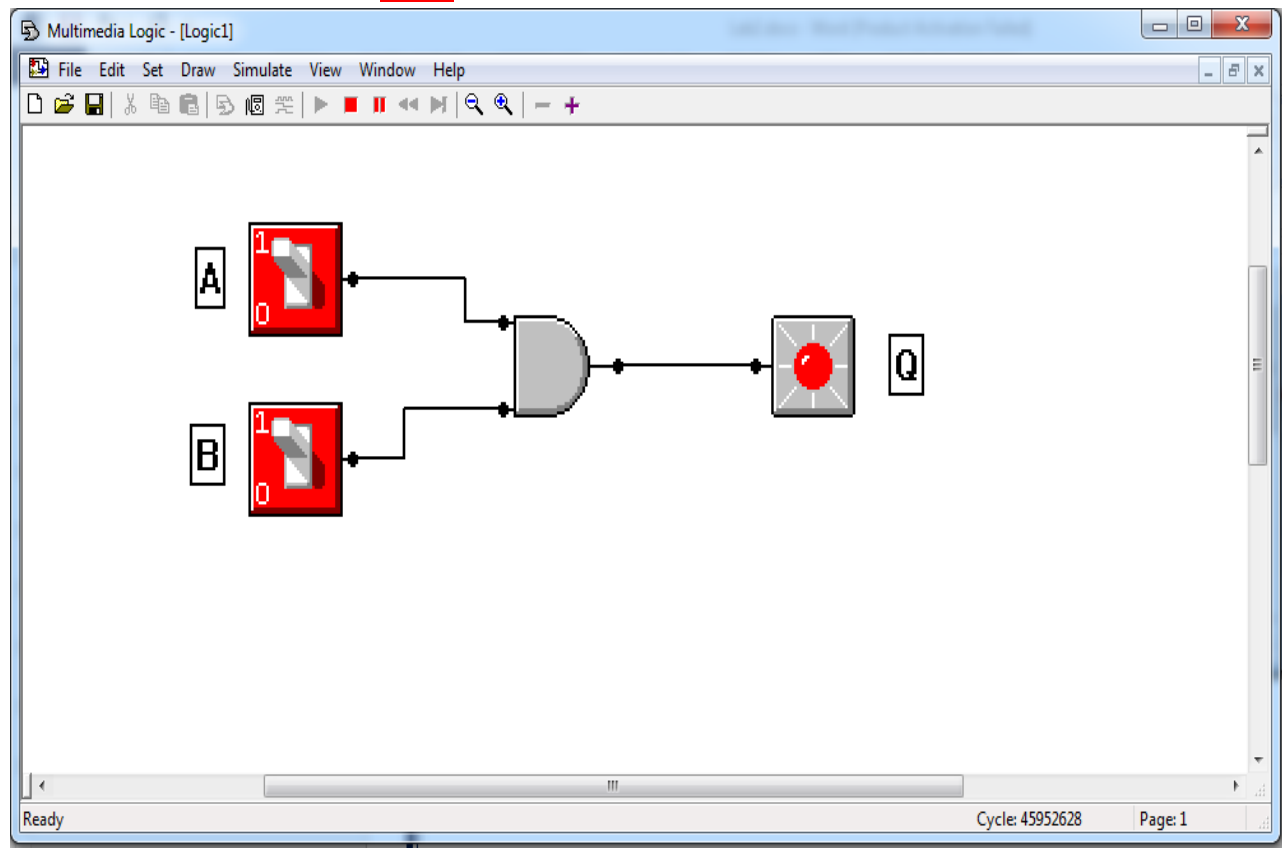
Step 4

Wire connected gate and switches



Step 5

Run simulate when set **both** switches to 1 , the Led is on otherwise off



2. The OR Gate

The OR gate can have two or more inputs with one output and performs what is known as logical addition.

Figure below shows the OR gate logic symbol with **two**, **three**, and **four** input variables and the output variables labeled.

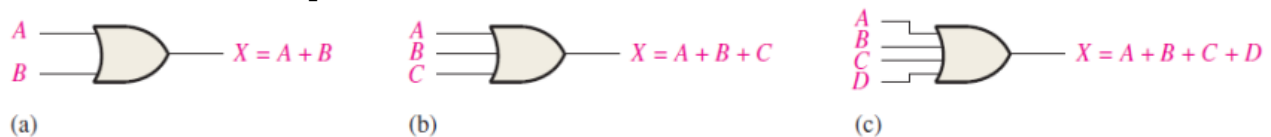


Figure below illustrates a **2-input OR** gate for all four possibilities of input combinations.

LOW (0) ———>  LOW (0)

LOW (0) ———>  HIGH (1)

HIGH (1) ———>  HIGH (1)

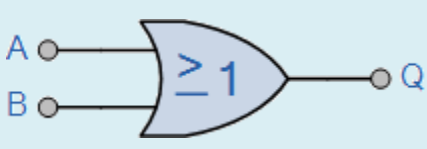
HIGH (1) ———>  HIGH (1)

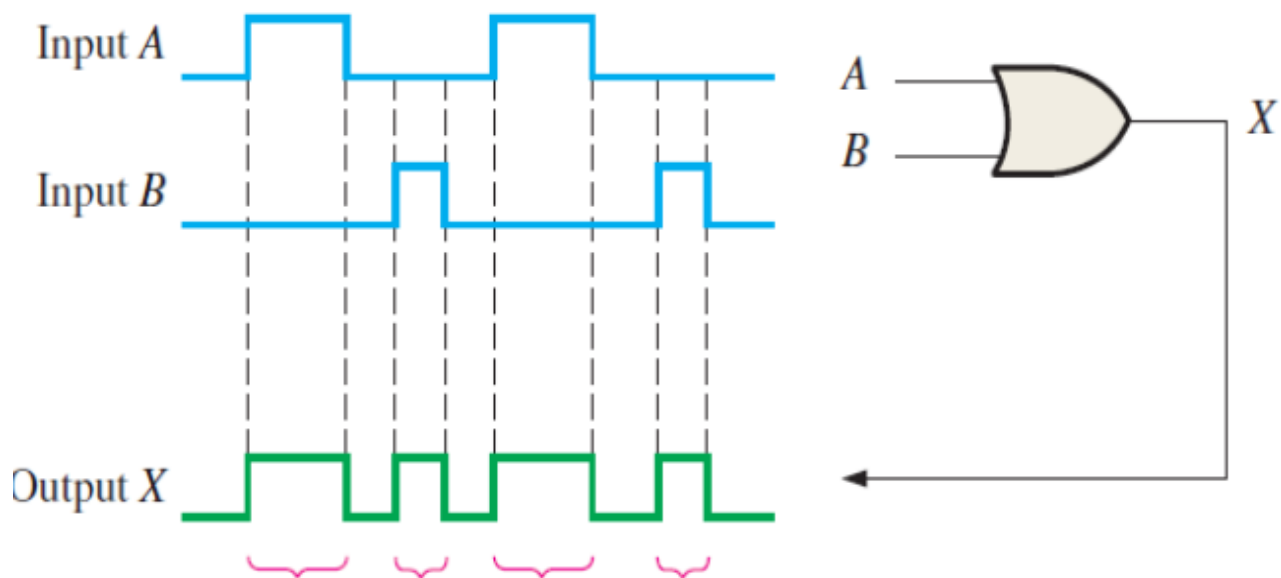
❖ Operation and Truth table for a 2-input AND gate

For two input variables: $N = 2^2 = 4$ combinations

Boolean Expression : $Q = A \cdot B$

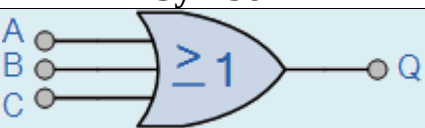
The 2-input Logic OR Gate

 2-input OR Gate	B	A	Q
	0	0	0
	0	1	1
	1	0	1
	1	1	1
Boolean Expression $Q = A + B$		Read as A OR B gives Q	



When either input or both inputs are HIGH, the output is HIGH.

The 3-input Logic OR Gate

Symbol	Truth Table			
 3-input OR Gate	C	B	A	Q
	0	0	0	0
	0	0	1	1
	0	1	0	1
	0	1	1	1
	1	0	0	1
	1	0	1	1
	1	1	0	1
	1	1	1	1
Boolean Expression $Q = A+B+C$		Read as A OR B OR C gives Q		

2.1 Practical Application of OR Gate

