Practical exercise 4

Aim :- To verify the De-morgans Theorems by forming the circuit on the bread-board .

Theory :- The famous Mathematician De-morgans derived the two most important theorems of an Boolean Algebra .

In the Equation form they are :-

1] $\overline{A.B} = \overline{A} + \overline{B}$

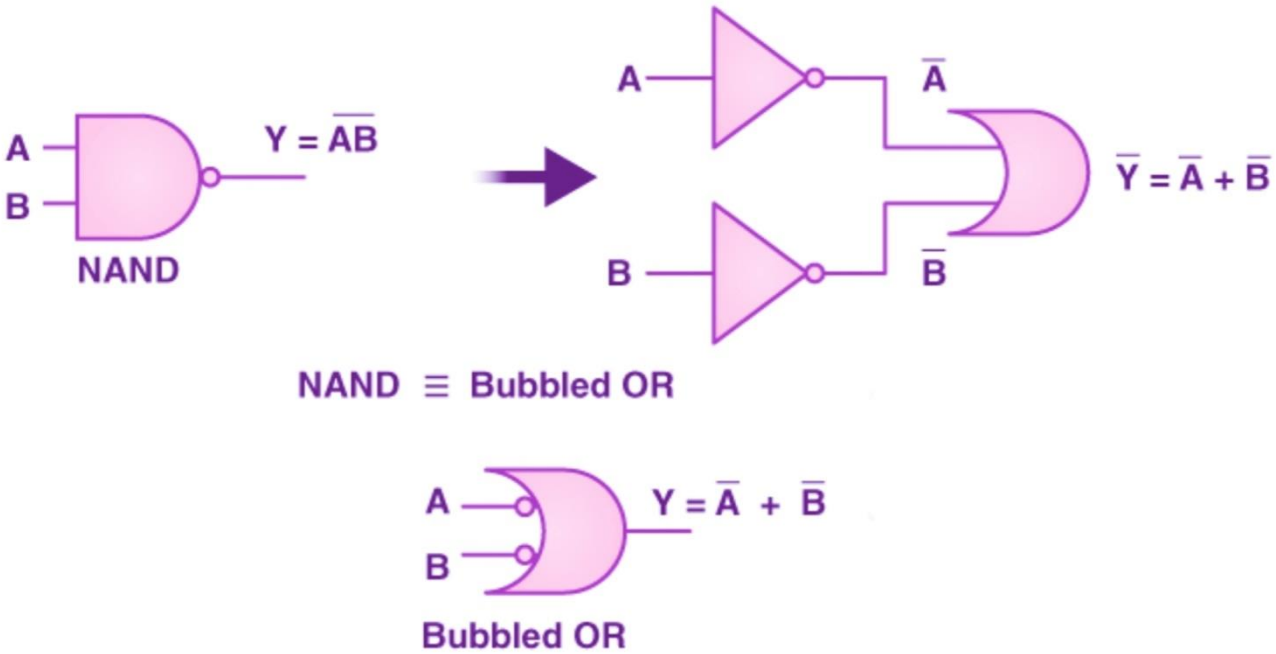
2] $\overline{A+B} = \overline{A} \cdot \overline{B}$

Now lets see the De-morgan Theorem in the detail :-

1] De-morgans first Theorem :-

Theorem :- Complement of product of all the terms is equal to the sum of the complement of the each term .

$$\overline{A.B} = \overline{A} + \overline{B}$$



- The LHS Side of the Theorem represents the NAND Gate that has the input A and B .
- RHS Side of the theorem represents the inverted OR gate with its inputs .

Lets Prove the theorem :-

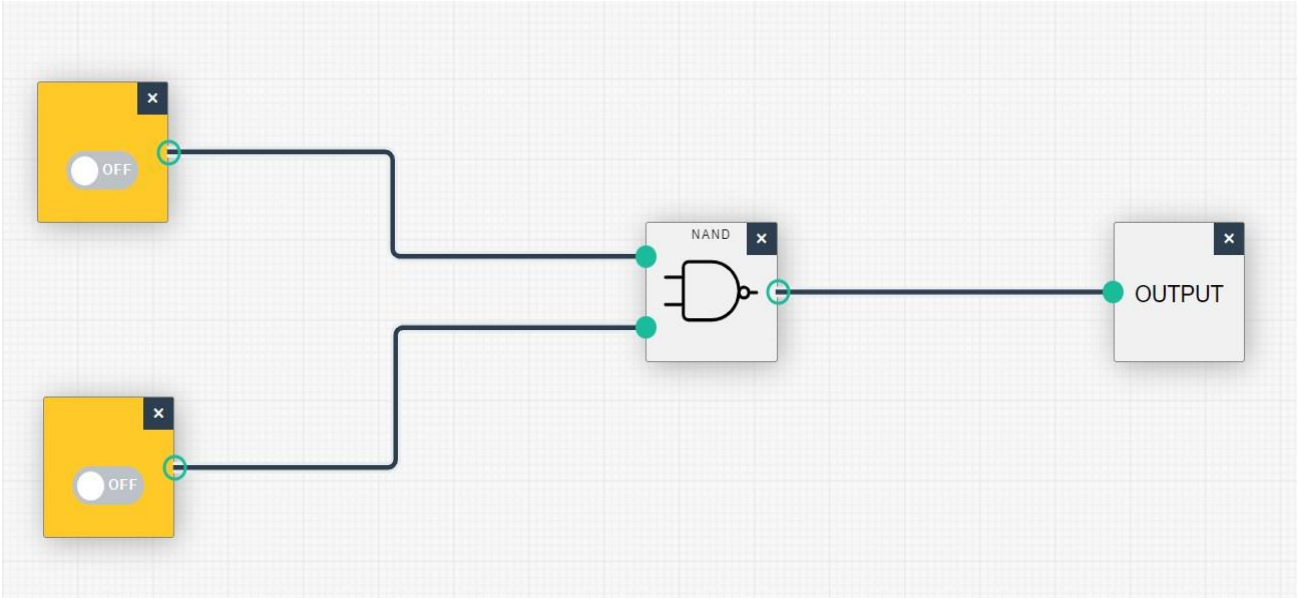
LHS

A	B	A.B	$\overline{A.B}$
0	0	0	1
0	1	0	1
1	0	0	1
1	1	1	0

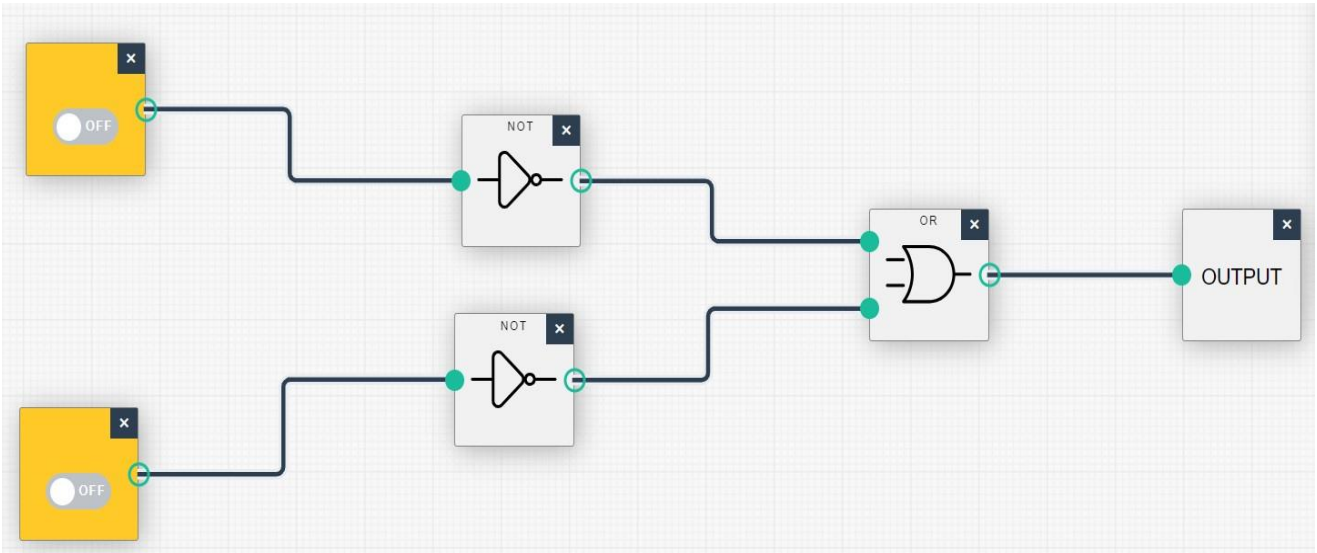
RHS

$\overline{A}$	$\overline{B}$	$\overline{A} + \overline{B}$
1	1	1
1	0	1
0	1	1
0	0	0

Hence proved the De-morgans 1st Theorem :-



$$\overline{A.B} = \overline{A} + \overline{B}$$



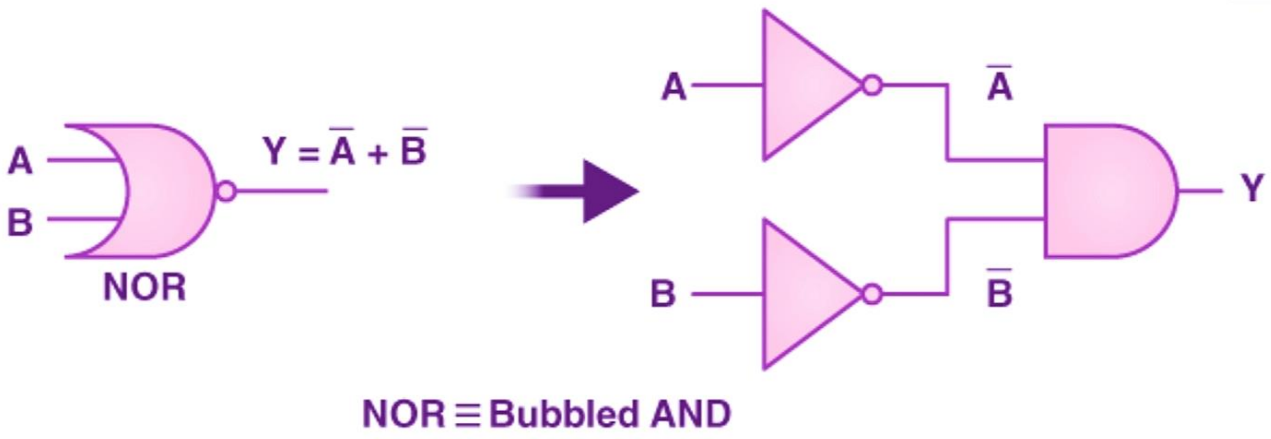
The top logic gate arranged of $\overline{A.B}$ can be implemented by using the standard NAND gate with the inputs A and B . The logic gate arranged at the lower side first inverts the two inputs producing the $\overline{A}$ and $\overline{B}$ then it became the inputs for the OR gate hence the output from the OR gate becames $\overline{A} + \overline{B}$.

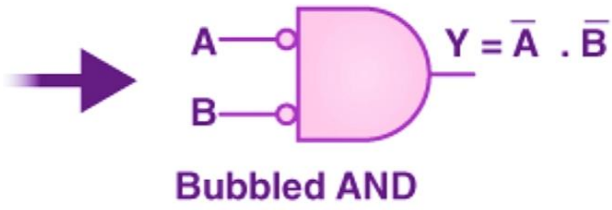
Then we can see here that standard OR gate function with the inverter on each of its inputs is equivalent to the NAND gate function .

2] De-morgans second Theorem :-

Theorem :- The Complement of sum of all term is equal to the product of the complement of each term .

$$\overline{A+B} = \overline{A} \cdot \overline{B}$$





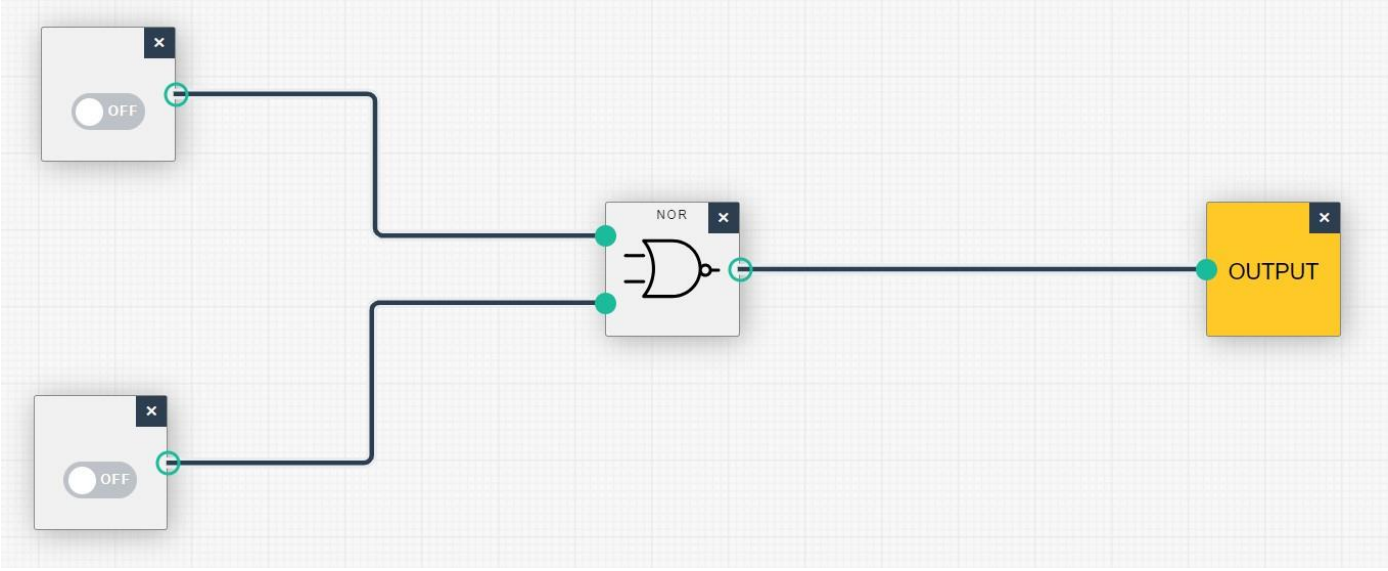
- The left hand side of the theorem represents the NOR gate that has the inputs A and B .
- On the Right hand side Represents the AND gate with the inverted inputs .

LHS

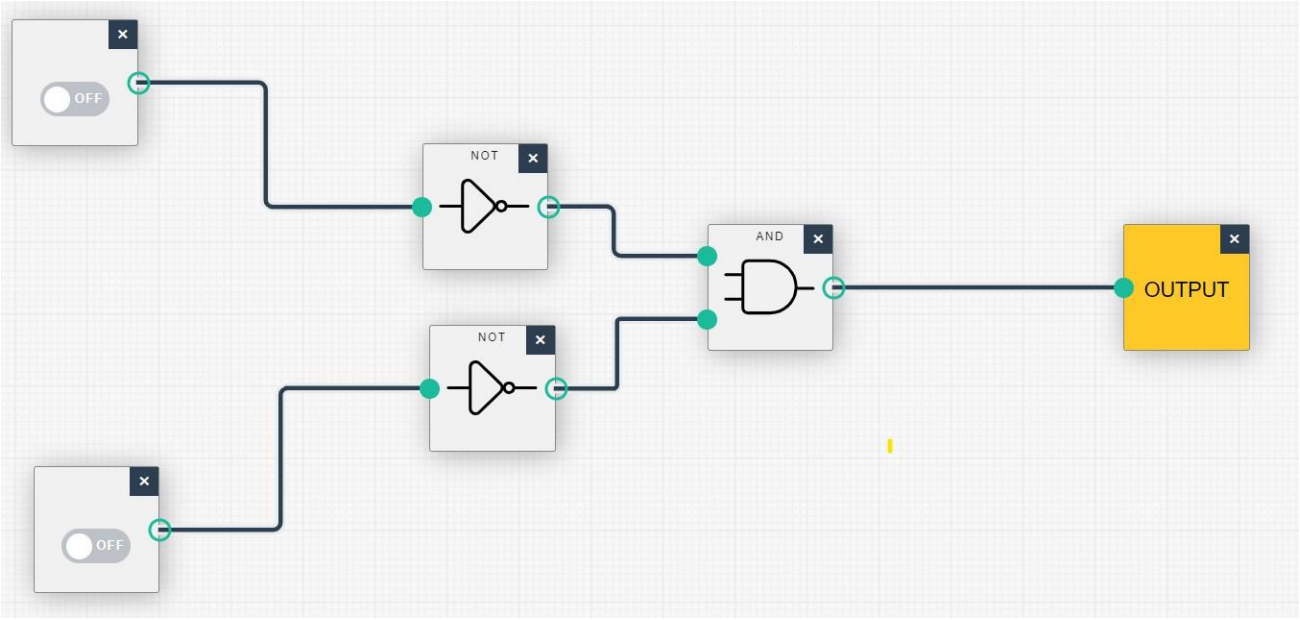
A	B	A+B	$\overline{A+B}$
0	0	0	1
0	1	1	0
1	0	1	0
1	1	1	0

RHS

$\overline{A}$	$\overline{B}$	$\overline{A.B}$
1	1	1
1	0	0
0	1	0
0	0	0



$$\overline{A+B} = \overline{A} \cdot \overline{B}$$



The top logic gate arrangement of $\overline{A+B}$ can be implemented by inputs A and B . The lower logic gate arrangement first inverts the two inputs and then provide $\overline{A}$ and $\overline{B}$ then they became the inputs for AND gate hence outputs became $\overline{A}.\overline{B}$.

Conclusion :- Hence we have successfully verified the De-morgans Theorem .