TECHNO INDIA

KOLKATA

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LOGIC Gate

A logic gate is a device that acts as a building block for digital circuits. They perform basic logical functions that are fundamental to digital circuits. Most electronic devices we use today will have some form of logic gates in them. For example, logic gates can be used in technologies such as smart phones tablets or within memory device.

In a circuit, logic gates will make decisions based on a combination of digital signals coming from its inputs. Most logic gates have two inputs and one output. Logic gates are based on Boolean algebra. At any given moment, every terminal is in one of the two binary conditions, *false* or *true*. False represents 0, and true represents 1. Depending on the type of logic gate being used and the combination of inputs, the binary output will differ. A logic gate can be thought of like a light switch, wherein one position the output is off -- 0, and in another, it is on -- 1. Logic gates are commonly used in integrated circuits (IC).

LOGIC GATES		
Basic Logic Gate	**Universal Logic Gate**	**Exclusive Logic Gate**
AND Gate	**NOR Gate**	**XOR Gate**
OR Gate	**NAND Gate**	**XNOR Gate**
NOT Gate		

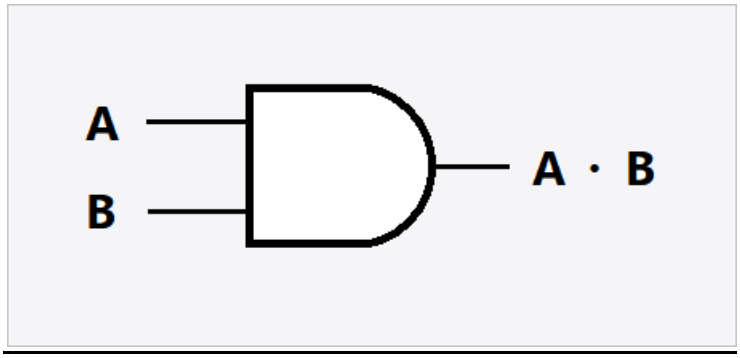
AND Gate

The **AND gate** is a basic digital logic gate that implements logical conjunction (∧) from mathematical logic – AND gate behaves according to the truth table above. A HIGH output (1) results only if all the inputs to the AND gate are HIGH (1). If not all inputs to the AND gate are HIGH, LOW output results. The function can be extended to any number of inputs.

Truth Table:

INPUT A	INPUT B	OUTPUT
0	0	0
0	1	0
1	0	0
1	1	1

Logic Diagram of AND Gate :



OR Gate :

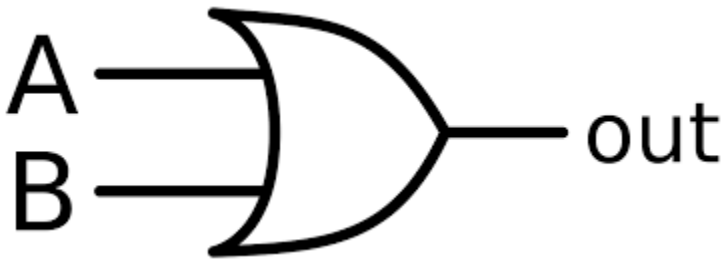
The OR gate is a mostly used digital logic circuit. The output state of the OR gate will always be low when both of the inputs states is low. Simply, if any input value in the OR gate is set to 1, and then it will always return high-level output (1).

The logic or Boolean expression for the OR gate is the logical addition of inputs denoted by plus sign (+) as A+B=Y

Truth Table:

INPUT A	INPUT B	OUTPUT
0	0	0
0	1	1
1	0	1
1	1	1

Logic Diagram of OR Gate :



NOT Gate :

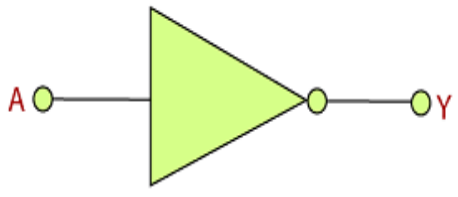
The NOT gate is the most basic logic gate of all other logic gates. NOT gate is also known as an **inverter** or an **inverting Buffer**. NOT gate only has one input and one output. When the input signal is "Low", the output signal is "High" and when the input signal is "High", the output is "Low". The Boolean expression for the NOT gate is as follows: A'=Y

When A is not true, then Y is true

Truth Table:

INPUT A	OUTPUT Y
1	0
0	1

Logic Diagram of NOT Gate :



NOT Gate

NAND Gate:

The NAND gate is a special type of logic gate in the digital logic circuit. The NAND gate is the universal gate. It means all the basic gates such as AND, OR, and NOT gate can be constructed using a NAND gate. The NAND gate is the combination of the NOT-AND gate. The output state of the NAND gate will be low only when all the inputs are high. Simply, this gate returns the complement result of the AND gate.

The logic or Boolean expression for the NAND gate is the complement of logical multiplication of inputs denoted by a full stop or a single dot as

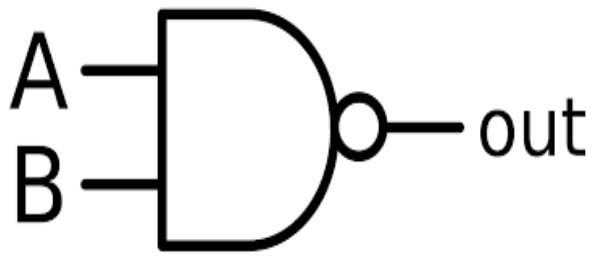
$(A.B)'=Y$

The value of Y will be true when any one of the input is set to 0.

Truth Table:

Input		Output
A	B	Y
0	0	1
0	1	1
1	0	1
1	1	0

Logic Diagram of NAND Gate:



NOR Gate:

The NOR gate is also a universal gate. So, we can also form all the basic gates using the NOR gate. The NOR gate is the combination of the NOT-OR gate. The output state of the NOR gate will be high only when all of the inputs are low. Simply, this gate returns the complement result of the OR gate.

The logical or Boolean expression for the NOR gate is the complement of logical multiplication of inputs denoted by the plus sign as

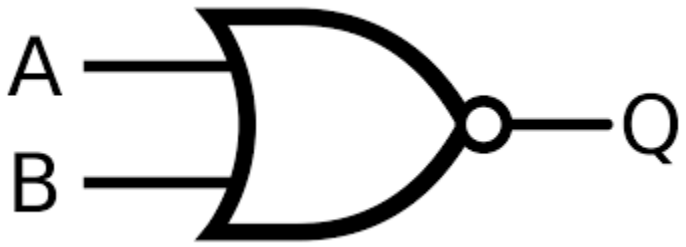
(A+B)'=Y

The value of Y will be true when all of its inputs are set to 0.

Truth Table:

Input		Output
A	B	Y
0	0	1
0	1	0
1	0	0
1	1	0

Logic Diagram of NOR Gate:



XOR Gate :

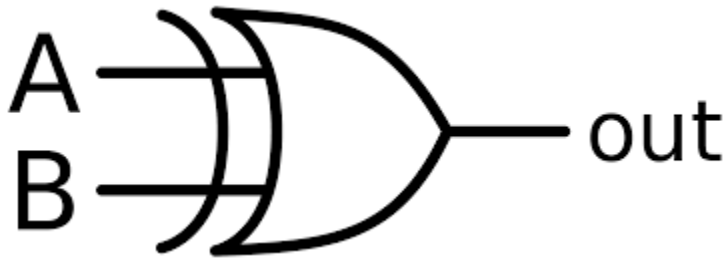
The XOR gate stands for the Exclusive-OR gate. This gate is a special type of gate used in different types of computational circuits. Apart from the AND, OR, NOT, NAND, and NOR gate, there are two special gates, i.e., Ex-OR and Ex-NOR. These gates are not basic gates in their own and are constructed by combining with other logic gates. Their Boolean output function is significant enough to be considered as a complete logic gate. The XOR and XNOR gates are the hybrids gates.

The 2-input OR gate is also known as the Inclusive-OR gate because when both inputs A and B are set to 1, the output comes out 1(high). In the Ex-OR function, the logic output "1" is obtained only when either A="1" or B="1" but not both together at the same time. Simply, the output of the XOR gate is high(1) only when both the inputs are different from each other.

Truth Table:

INPUT A	INPUT B	OUTPUT
0	0	0
0	1	1
1	0	1
1	1	0

Logic Diagram of XOR Gate



XNOR Gate:

The XNOR gate is the complement of the XOR gate. It is a hybrid gate. Simply, it is the combination of the XOR gate and NOT gate. The output level of the XNOR gate is high only when both of its inputs are the same, either 0 or 1. The symbol of the XNOR gate is the same as XOR, only complement sign is added. Sometimes, the XNOR gate is also called the **Equivalence gate**.

Truth Table:

INPUT A	INPUT B	OUTPUT
0	0	1
0	1	0
1	0	0
1	1	1

Logic Diagram of XNOR Gate: