Experiment 02

Experiment no 02 : Implementation of combinational circuits (Verify the truth table of various logic gates(basic and universal gates)

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Class	D10-A
Subject	Microprocessor Lab
LO Mapped	LO1: Analyze and design combinational circuits

Aim: Experiment no 02 : Implementation of combinational circuits (Verify the truth table of various logic gates(basic and universal gates)

Introduction:

Logic gates are the basic building blocks of any digital system. It is an electronic circuit having one or more than one input and only one output. The relationship between the input and the output is based on a certain logic.

Theory:

Basic gates: These gates are the basic building blocks in the digital IC's (integrated circuits). The basic logic gates are used to perform fundamental logic functions. Examples of basic gates are:

1. **AND gate**: The AND gate is a basic digital logic gate that implements logical conjunction.

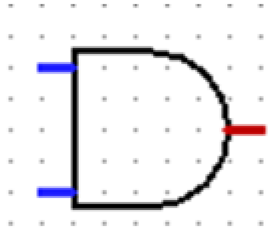
Statement:

Input 1 = A

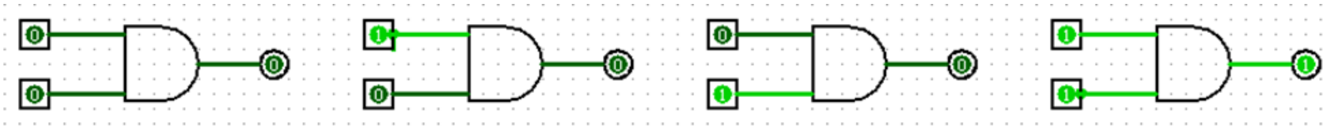
Input 2 = B

Output = A . B

Symbol:



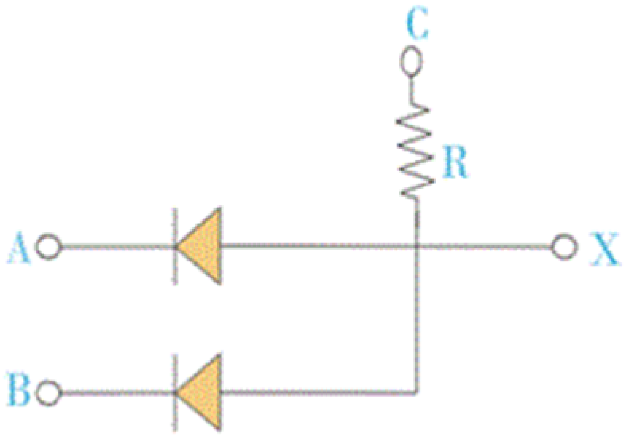
Working of AND gate: A HIGH output results only if all the inputs to the AND gate are HIGH. If none or not all inputs to the AND gate are HIGH, LOW output results. The function can be extended to any number of inputs.



Truth Table:

A	B	C = A . B
0	0	0
0	1	0
1	0	0
1	1	1

Circuit Diagram:



2. **OR gate**: The OR gate is a digital logic gate that implements logical disjunction.

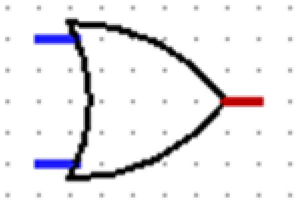
Statement:

Input 1 = A

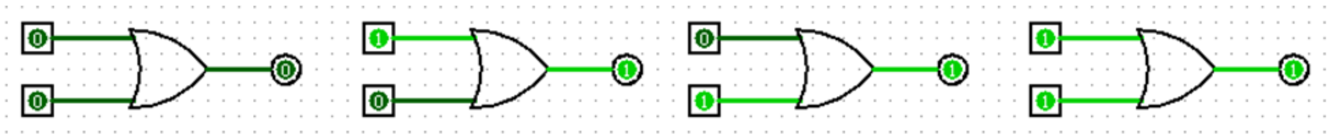
Input 2 = B

Output = A + B

Symbol:



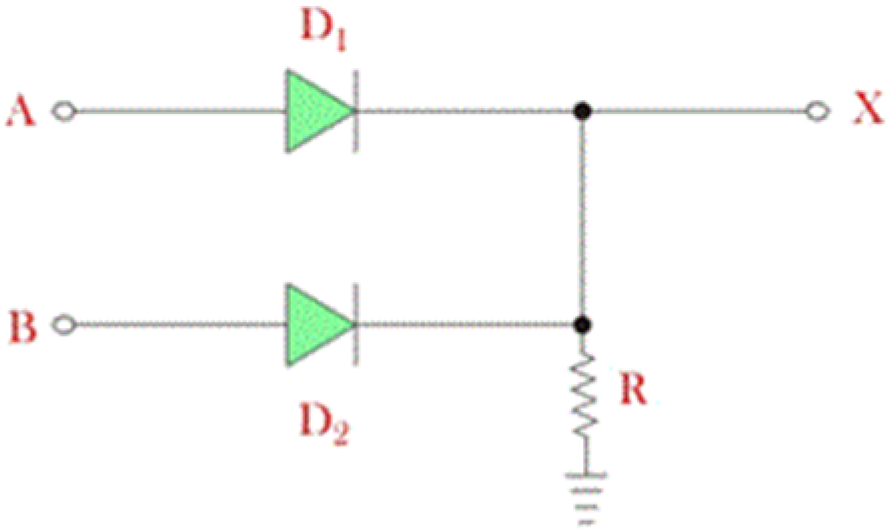
Working of OR gate: A HIGH output results if one or both the inputs to the gate are HIGH. If neither input is high, a LOW output results. In another sense, the function of OR effectively finds the maximum between two binary digits, just as the complementary AND function finds the minimum.



Truth Table:

A	B	C = A + B
0	0	0
0	1	1
1	0	1
1	1	1

Circuit Diagram:



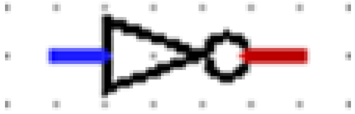
3. **NOT gate**: In digital logic, an inverter or NOT gate is a logic gate which implements logical negation.

Statement:

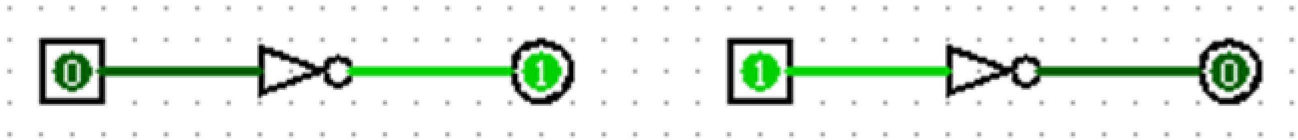
Input = A

Output = A’

Symbol:



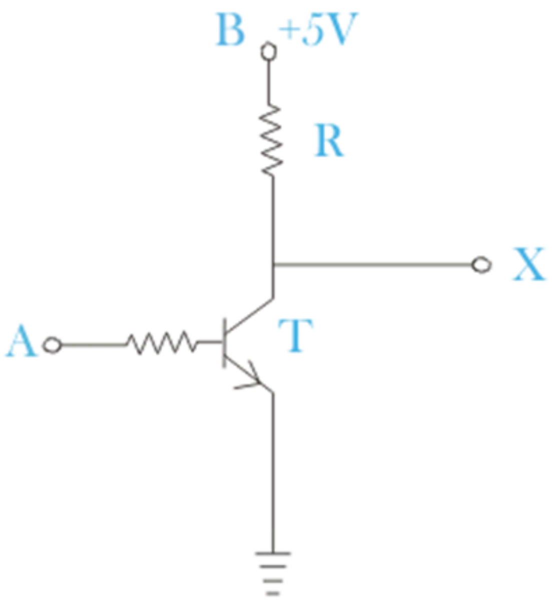
Working of NOT gate: A HIGH output results if the input is LOW and LOW output results if the input is HIGH.



Truth Table:

A	C = A’
0	1
1	0

Circuit Diagram:



Universal gates: A universal logic gate is a logic gate that can be used to construct all other logic gates. A universal gate is a gate which can implement any Boolean function without need to use any other gate type.

1. **NAND gate**: In digital electronics, a NAND gate (NOT-AND) is a logic gate which produces an output which is false only if all its inputs are true. Thus its output is a complement to that of an AND gate.

Proof of NAND as universal gate : NAND gate is actually a combination of two logic gates: AND gate followed by NOT gate. So it's the output of AND gate.This gate has minimum two inputs,output is always one.By using only NAND gate , we can realize all logic functions: AND , OR , X-OR,X-NOR,NOR.So this gate is also called universal gate.

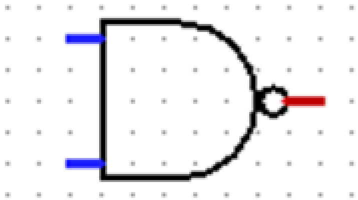
Statement:

Input 1 = A

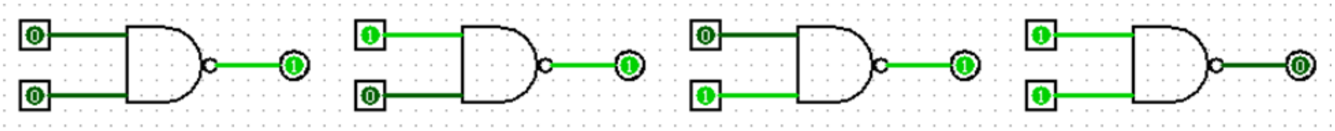
Input 2 = B

Output = (A . B)’

Symbol:



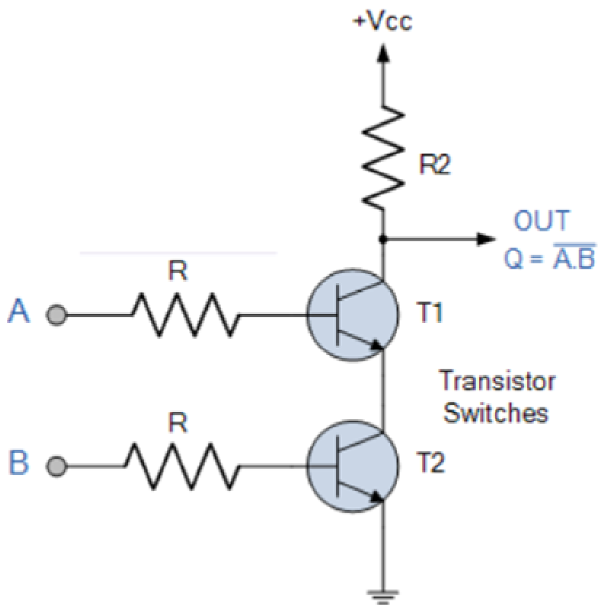
Working of NAND gate: A LOW output results only if all the inputs to the gate are HIGH. If any input is LOW, a HIGH output results.



Truth Table:

A	B	C = (A . B)’
0	0	1
0	1	1
1	0	1
1	1	0

Circuit Diagram:



2. **NOR gate**: The NOR gate is a digital logic gate that implements logical NOR. NOR is the result of the negation of the OR operator. It can also in some senses be seen as the inverse of an AND gate.

Proof of NOR as universal gate : NOR gate is actually a combination of two logic gates: OR gate followed by NOT gate.So it's output is complement of the output of an OR gate.This gate can have minimum two inputs,output is always one.By using only NOR gates,we can realize all logic functions: AND,OR,NOT,X-OR,X-NOR,NAND.So this gate is also known as universal gate.

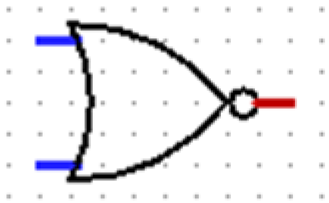
Statement:

Input 1 = A

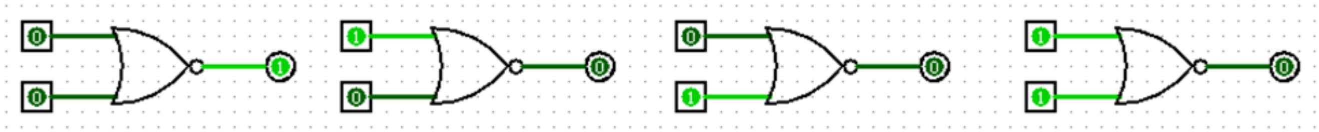
Input 2 = B

Output = (A + B)'

Symbol:



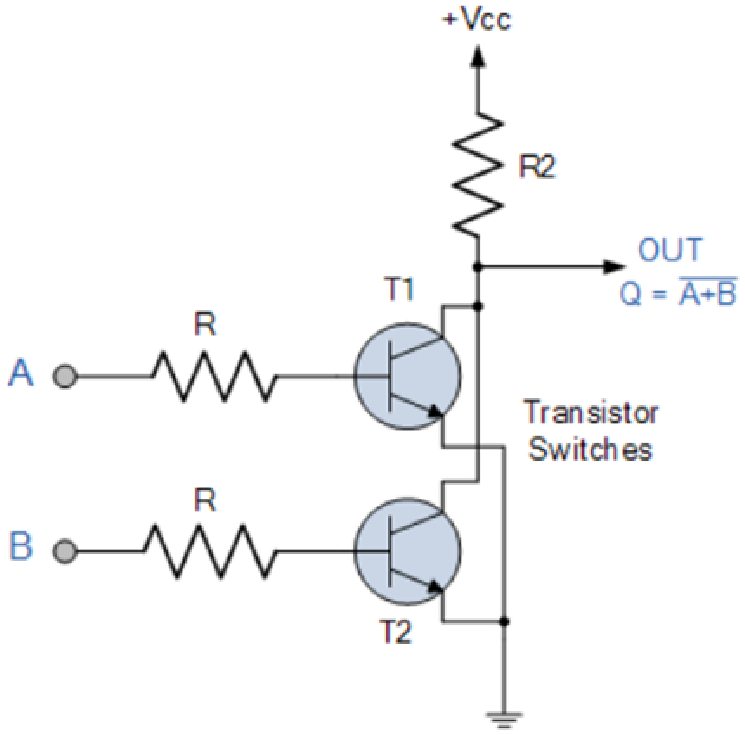
Working of NOR gate: A HIGH output results if both the inputs to the gate are LOW. If one or both input is HIGH, a LOW output results.



Truth Table:

A	B	C = (A + B)’
0	0	1
0	1	0
1	0	0
1	1	0

Circuit Diagram:



Conclusion: We have studied and verified the truth tables of various logic gates.