Sr. No: 71

Name: Soham Manoj

Date: 18/01/2022

Experiment No. 2

Aim: Verify the truth table of various logic gates (basic and universal gates)

LO No & Statement: LO2: Analyze and design combinational circuits

Hardware/Software Requirements: Logisim Software

Theory:

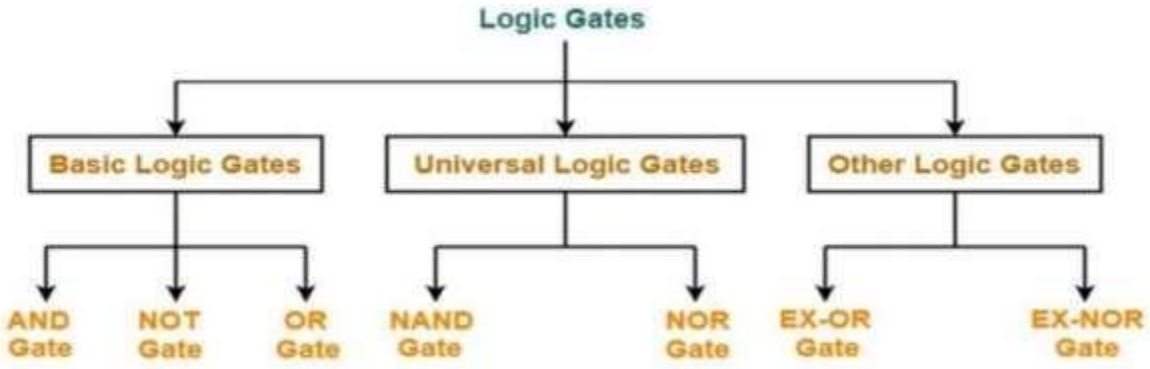


Figure 1: Types Of Logic Gates

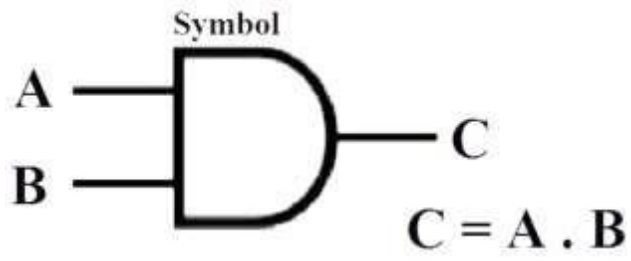
Basic Gates:

1) **AND Gate:**

The Logic AND Gate is a type of digital logic circuit whose output goes HIGH to a logic level 1 only when all of its inputs are HIGH

The logic or Boolean expression given for a digital logic AND gate is that for Logical Multiplication which is denoted by a single dot or full stop symbol, (.) giving us the Boolean expression of: A.B = Q.

Symbolic Representation:



Truth Table

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

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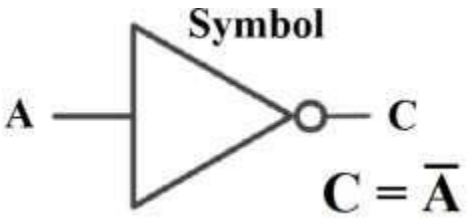
2) NOT Gate:

The Logic NOT Gate is the most basic of all the logical gates and is often referred to as an Inverting Buffer or simply an Inverter. Inverting NOT gates are single input device which have an output level that is normally at logic level "1" and goes "LOW" to a logic level "0" when its single input is at logic level "1", in other words it "inverts" (complements) its input signal. The output from a NOT gate only returns "HIGH" again when its input is at logic level "0" giving us the Boolean expression of: A = Q.

Symbolic Representation:



Truth Table

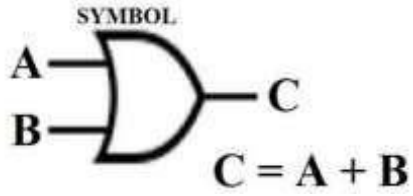
INPUT	OUTPUT
A	NOT A
0	1
1	0

3) OR Gate:

The Logic OR Gate is a type of digital logic circuit whose output goes HIGH to a logic level 1 only when one or more of its inputs are HIGH.

The logic or Boolean expression given for a digital logic OR gate is that for Logical Addition which is denoted by a plus sign, (+) giving us the Boolean expression of: A+B = Q.

Symbolic Representation:



Truth Table

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

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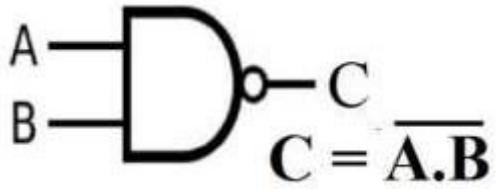
Universal Gates:

1) **NAND Gate:**

The Logic NAND Gate is a combination of a digital logic AND gate and a NOT gate connected together in series. The NAND (Not – AND) gate has an output that is normally at logic level "1" and only goes "LOW" to logic level "0" when ALL of its inputs are at logic level "1". The Logic NAND Gate is the reverse or "Complementary" form of the AND gate we have seen previously.

The Boolean expression for a logic NAND gate is denoted by a single dot or full stop symbol, (.) with a line or Overline, (¯) over the expression to signify the NOT or logical negation of the NAND gate giving us the Boolean expression of: $\overline{A.B} = Q$.

Symbolic Representation:



Truth Table

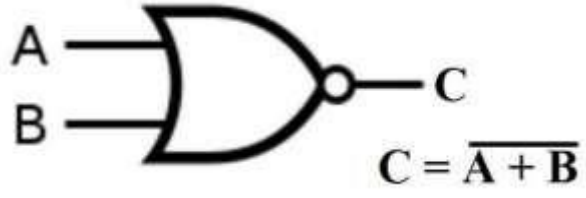
INPUT		OUTPUT
A	B	A NAND B
0	0	1
0	1	1
1	0	1
1	1	0

2) **NOR Gate:**

The Logic NOR Gate is a combination of the digital logic OR gate and an inverter or NOT gate connected together in series. The inclusive NOR (Not-OR) gate has an output that is normally at logic level "1" and only goes "LOW" to logic level "0" when ANY of its inputs are at logic level "1". The Logic NOR Gate is the reverse or "Complementary" form of the inclusive OR gate we have seen previously.

The Boolean expression for a logic NOR gate is denoted by a plus sign, (+) with a line or Overline, (¯) over the expression to signify the NOT or logical negation of the NOR gate giving us the Boolean expression of: $\overline{A+B} = Q$.

Symbolic Representation:



Truth Table

INPUT		OUTPUT
A	B	A NOR B
0	0	1
0	1	0
1	0	0
1	1	0

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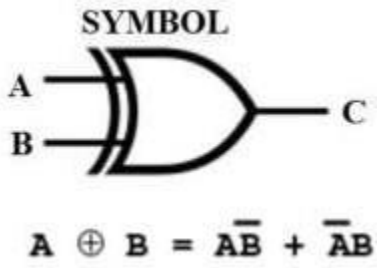
Other Logic Gates:

1) **EX-OR (XOR) Gate:**

The 'Exclusive-OR' gate is a circuit which will give a high output if either, but not both, of its two inputs are high. An encircled plus sign (⊕)is used to show the EXOR operation.

Symbolic Representation:



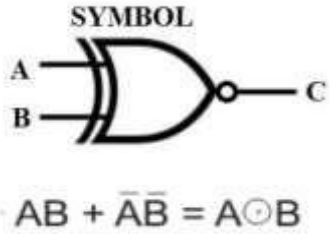
Truth Table

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

2) **EX-NOR (XNOR) Gate:**

The 'Exclusive-NOR' gate circuit does the opposite to the EOR gate. It will give a low output if either, but not both, of its two inputs are high. The symbol is an EXOR gate with a small circle on the output. The small circle represents inversion.

Symbolic Representation:



Truth Table

Input		Output
A	B	A XNOR B
0	0	1
0	1	0
1	0	0
1	1	1

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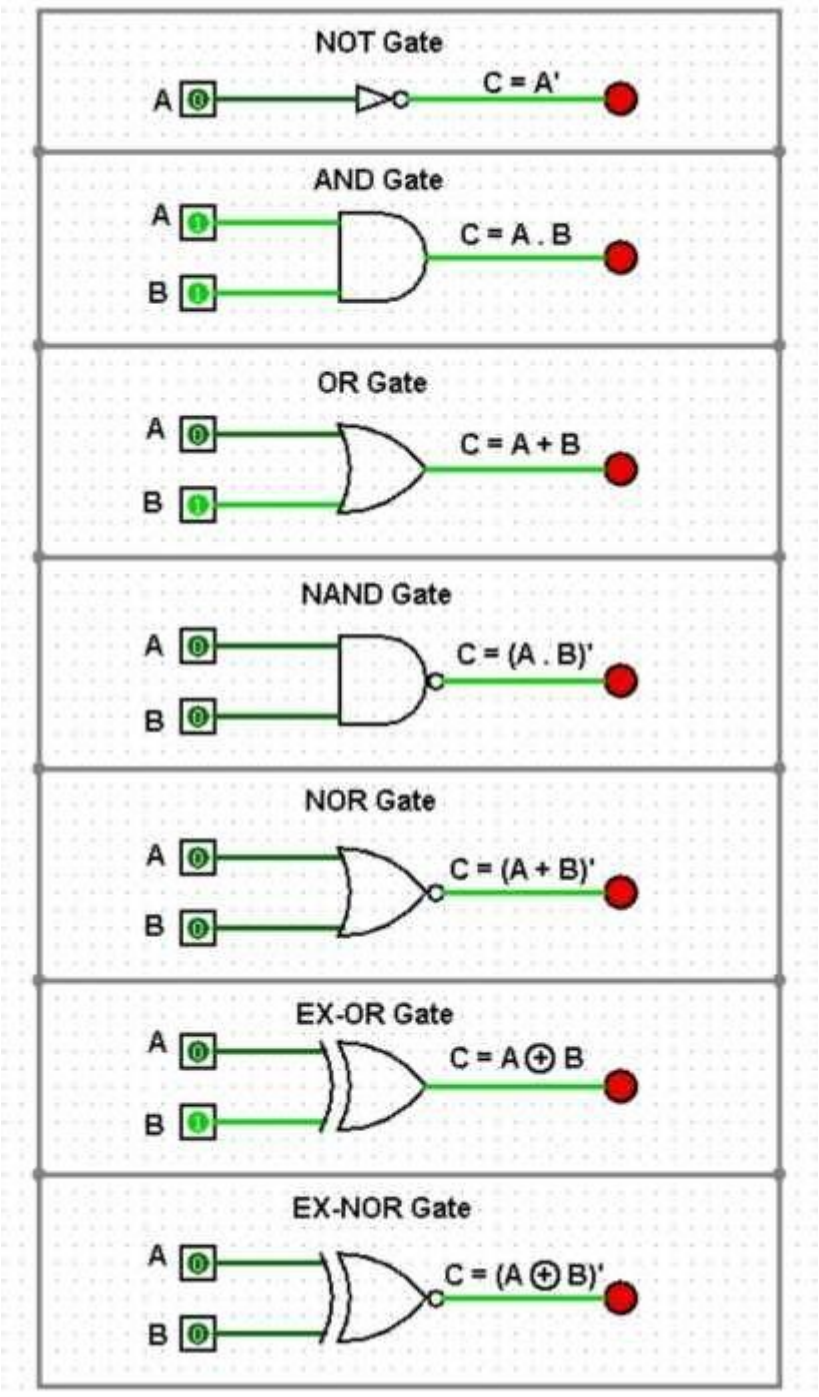
Diagram Using Logisim Software



Conclusion:

Through this experiment we learned all the concepts Basic Gates and Universal Gates with their Symbols, Boolean Expressions, Truth table. We also verified this all logic gates with the help of respective software with desire outputs.