EXPERIMENT-1

Aim:

Verification and interpretation of truth table for AND, OR, NOT, NAND, NOR, Ex-OR, Ex-NOR gates.

Requirements:

Components: IC 7400, 7402, 7404, 7408, 7432, 7486

Apparatus: Prototyping board (breadboard), DC Power Supply, Connecting Wire

Theory:

AND, OR, and NOT gates are the basic building blocks of logic gates. XOR and XNOR are also considered universal gates. Logic gates are electronic circuits that are made up of various electronic devices and components. They have two possible states for inputs and outputs: HIGH or LOW, TRUE or FALSE, ON or OFF, or simply 1 and 0. A truth table lists all possible combinations of input variables and the corresponding outputs, showing how the logic circuit responds to different input combinations.

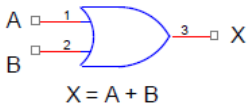
i. OR Gate

Description:

The output of the OR gate is set to logic 1, or "on," if any of the inputs are logic 1, or "on." The output is only set to logic 0, or "off," when all of the inputs are logic 0, or "off." This gate is also known as an "any or all" gate or an "inclusive OR" gate, because it allows for the possibility of multiple inputs to be present at the same time.

$$X = A + B$$

Logic symbol:



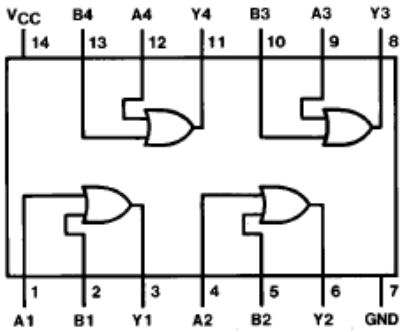
X = A + B

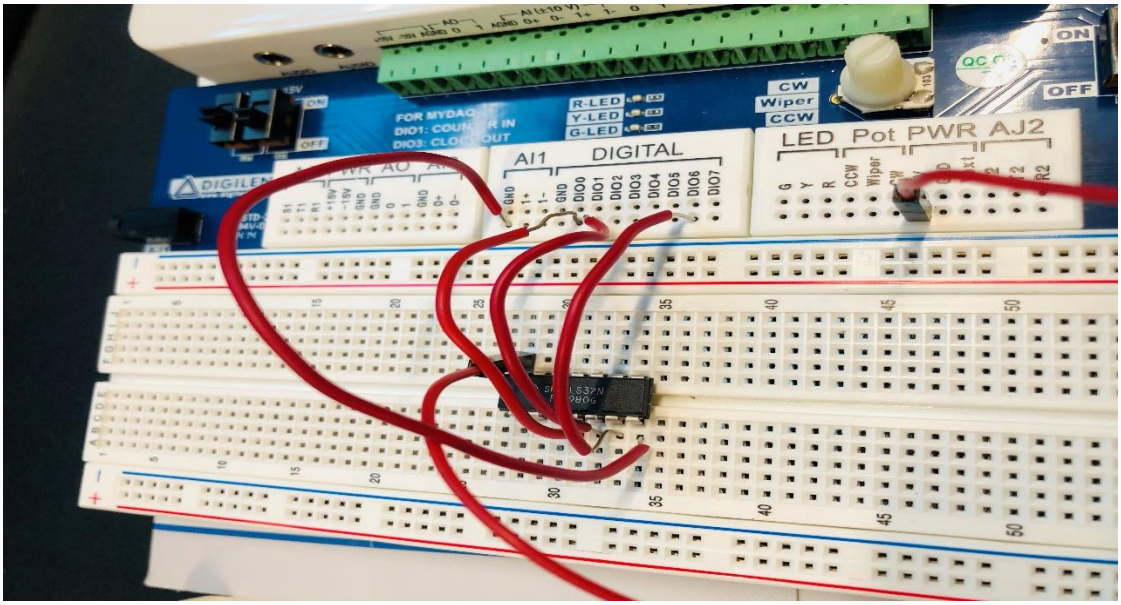
Truth table:

Input		Output
A	B	X
0	0	0
0	1	1
1	0	1
1	1	1

Circuit Diagram:

Pin diagram of IC**74LS32**:





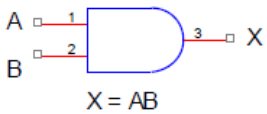
ii. AND Gate

Description:

An AND gate has multiple inputs but only one output. The output of the AND gate is set to logic 1, or "on," only when all of the inputs are logic 1, or "on." If any of the inputs are logic 0, or "off," the output will be set to logic 0, or "off." This gate is also known as an "all or nothing" gate because the output is only on when all inputs are also on.

$$X = A.B$$

Logic symbol:



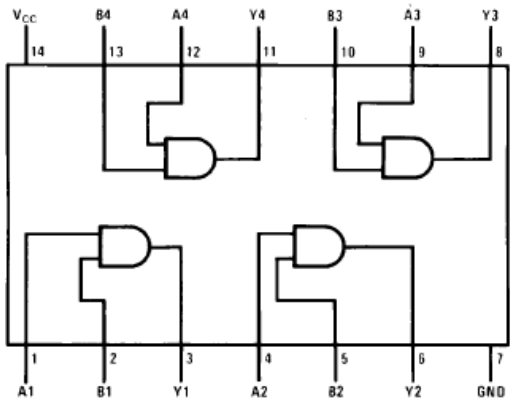
X = AB

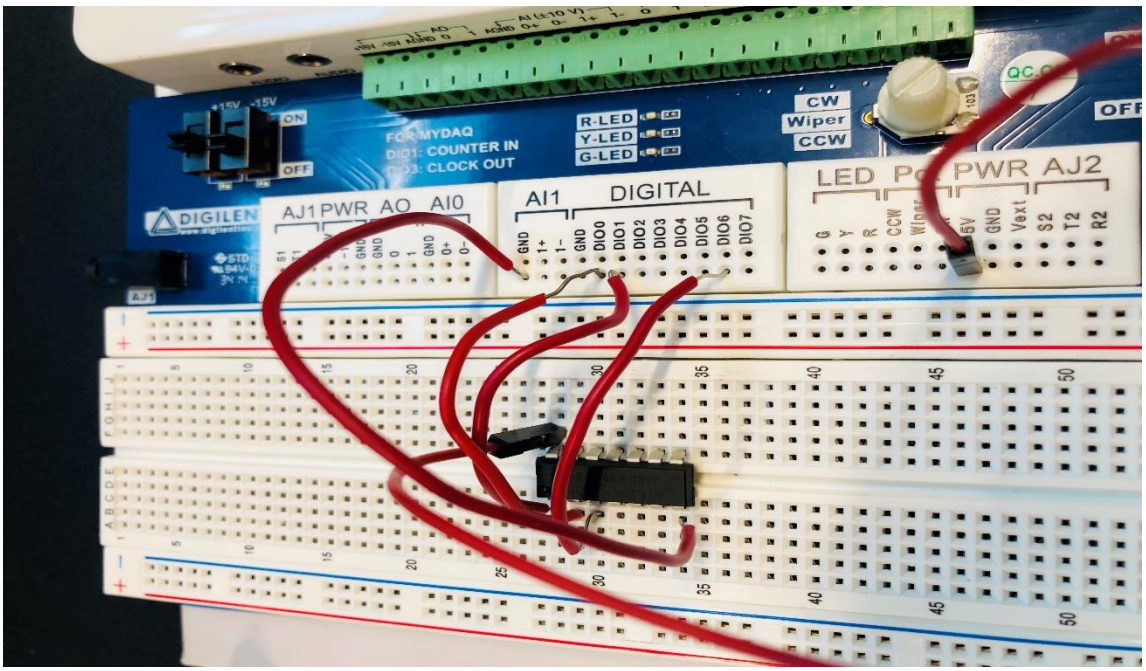
Truth table:

Input		Output
A	B	X
0	0	0
0	1	0
1	0	0
1	1	1

Circuit Diagram:

Pin diagram of IC**74LS08**:



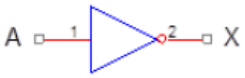


iii. NOT Gate

Description:

A NOT gate, also known as an inverter, has one input and one output. It's a device that inverts the input signal, meaning that the output is always the opposite of the input. If the input is logic 1, or "on," the output will be logic 0, or "off." If the input is logic 0, or "off," the output will be logic 1, or "on." In other words, a NOT gate changes a logic 1 input to a logic 0 output and vice versa.

Logic symbol:

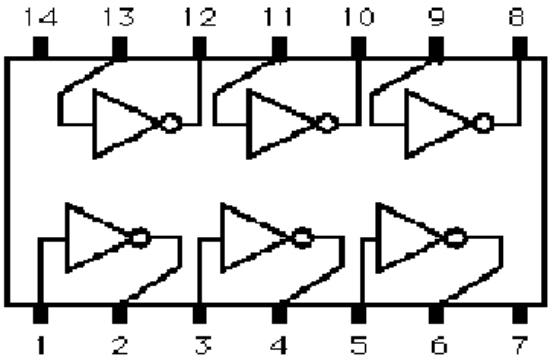


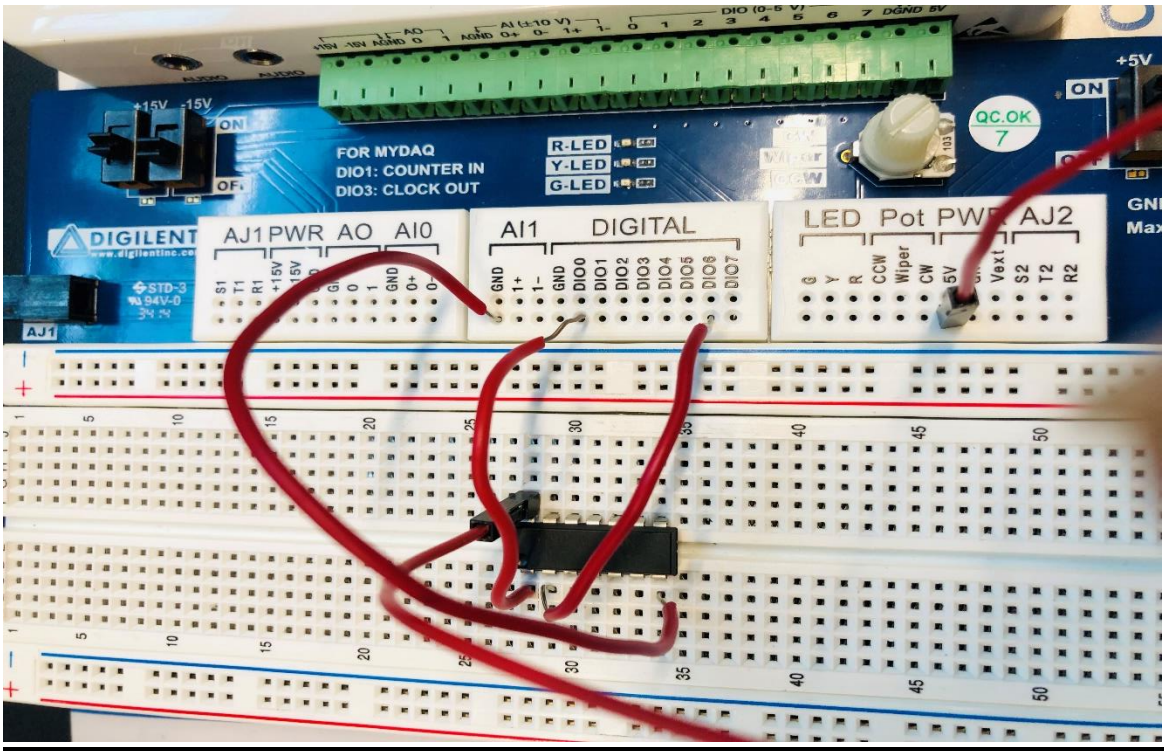
Truth table:

Input	Output
A	X
0	1
1	0

Circuit Diagram:

Pin diagram for IC**74LS04**:





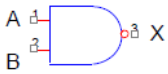
iv. NAND Gate

Description:

A NAND gate is a universal gate, meaning it can perform all basic logic functions. "NAND" stands for "NOT AND," which means that the output of an AND gate is inverted. In other words, a NAND gate is a combination of an AND gate and a NOT gate. The output is only logic 0, or "off," when all of its inputs are logic 1, or "on." For any other combination of inputs, the output is logic 1, or "on." A NAND gate is equivalent to an OR gate with an inverted output, also known as a "bubbled OR" gate.

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

Logic symbol:



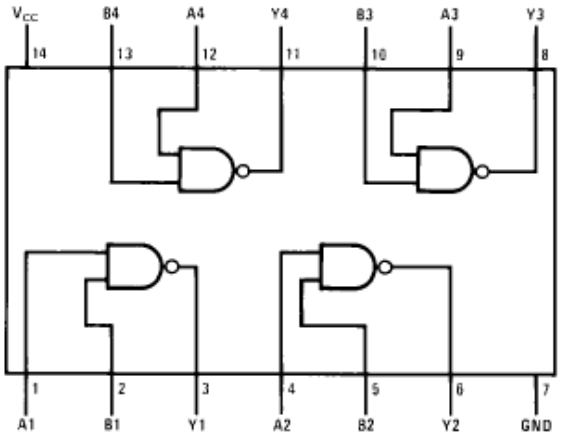
$X = \bar{A}B$

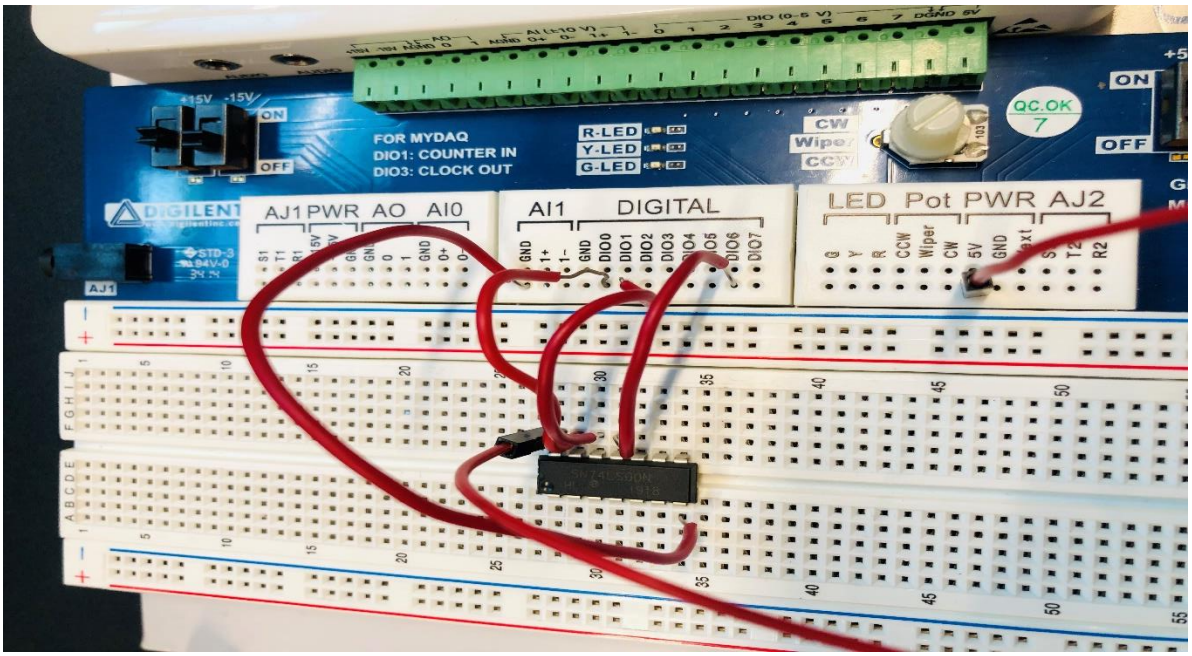
Truth table:

Input		Output
A	B	X
0	0	1
0	1	1
1	0	1
1	1	0

Circuit Diagram:

Pin diagram for IC**74LS00**:





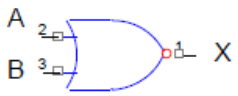
v. NOR Gate

Description:

A NOR gate is a universal gate, meaning it can perform all basic logic functions. "NOR" stands for "NOT OR," which means that the output of an OR gate is inverted. In other words, a NOR gate is a combination of an OR gate and a NOT gate. The output is only logic 1, or "on," when all of its inputs are logic 0, or "off." For any other combination of inputs, the output is logic 0, or "off." A NOR gate is equivalent to an AND gate with an inverted output, also known as a "bubbled AND" gate.

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

Logic symbol:



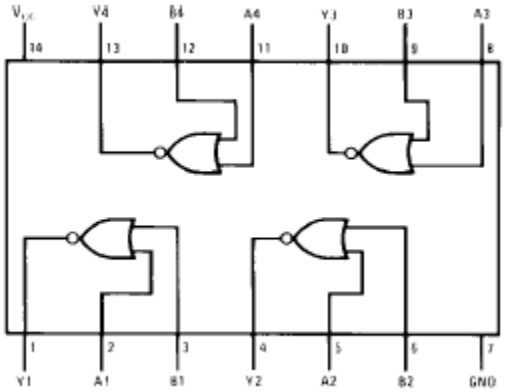
$X = \overline{A + B}$

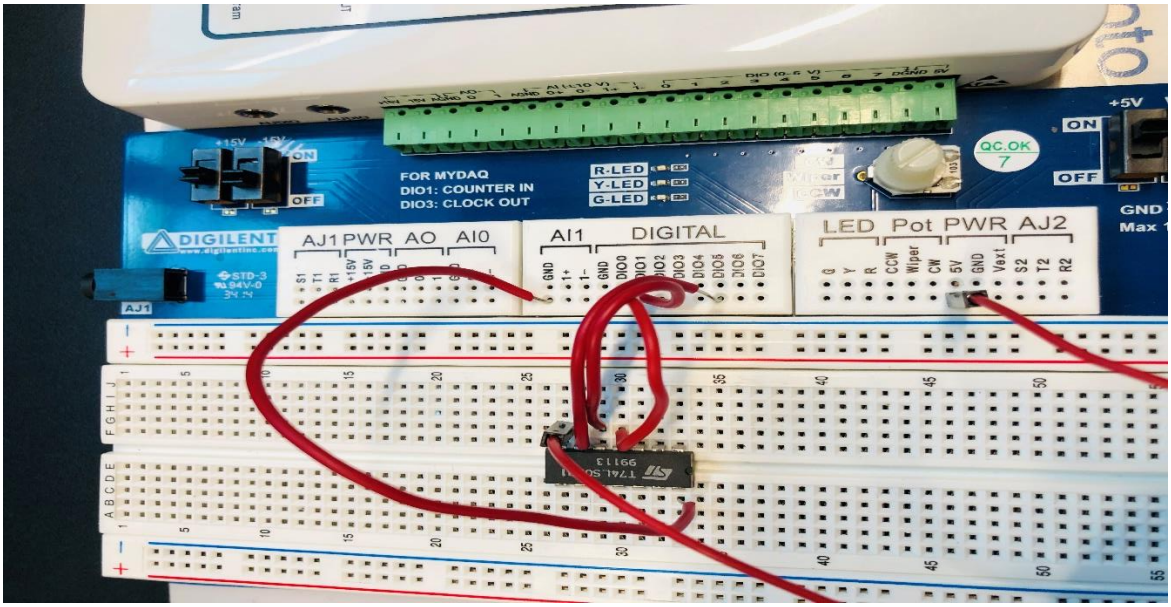
Truth table:

Input		Output
A	B	X
0	0	1
0	1	0
1	0	0
1	1	0

Circuit Diagram:

Pin diagram for IC**74LS02**:





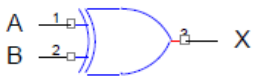
vi. EX-OR Gate

Description:

An XOR gate is a logic circuit with two inputs and one output. Its output is logic 1, or "on," when only one of the two inputs is logic 1, or "on." If both inputs are the same, either logic 0 or logic 1, the output is logic 0, or "off." This gate is called an "anti-coincidence" gate or an "inequality detector" because it produces an output of 1 only when the inputs are not equal. The output of an XOR gate is the modulo sum of its two inputs.

$$X = A \oplus B$$

Logic symbol:



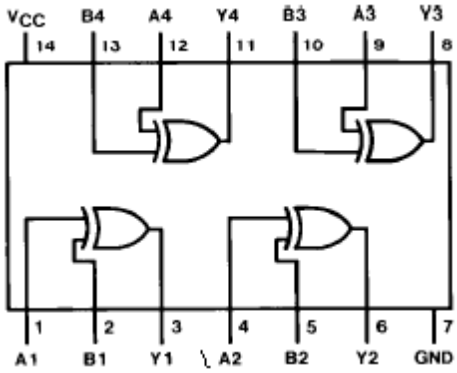
$$X = A \oplus B$$

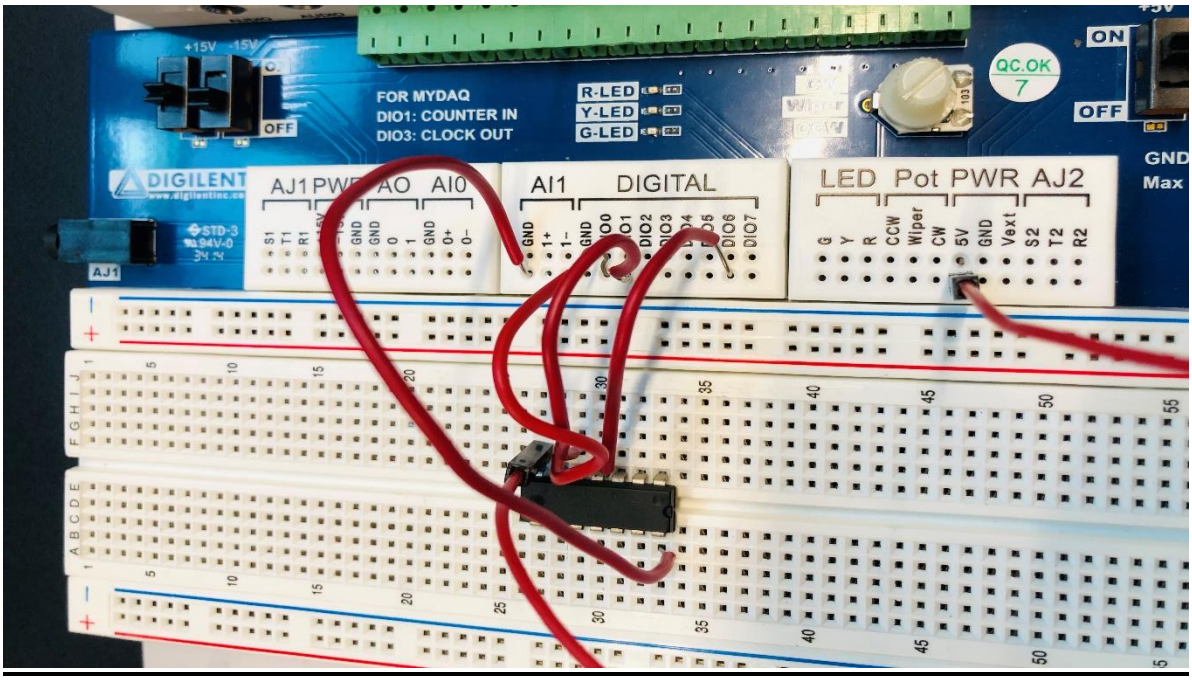
Truth table:

Input		Output
A	B	X
0	0	0
0	1	1
1	0	1
1	1	0

Circuit Diagram:

Pin diagram for IC**74LS86**:

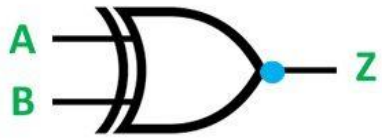




vii. EX-NOR Gate

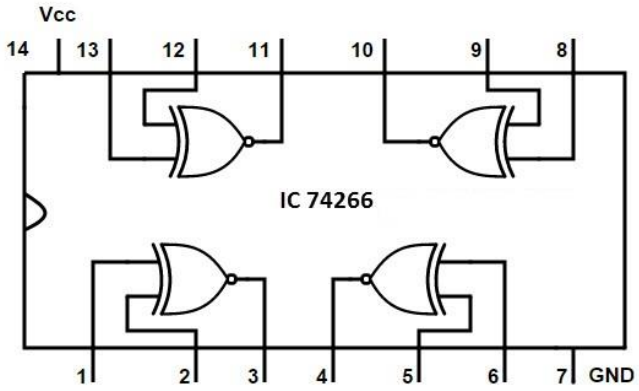
Description:

An XNOR gate is a logic circuit with two inputs and one output. Its output is logic 1, or "on," when both of the two inputs are the same, either logic 0 or logic 1. If one of the inputs is different, the output is logic 0, or "off." This gate is also known as an "equality detector" because it produces an output of 1 only when the inputs are equal. The output of an XNOR gate is the modulo sum of its two inputs with inverted.



A	B	Z=A⊙B
0	0	1
0	1	0
1	0	0
1	1	1

Circuit Diagram:



Observation Table:

LED ON: Logic 1

LED OFF: Logic 0

Input Variables: A, B

Output Variables: Y

Sr. No.	Input (A)	Input (B)	Output (NOT) Y = A'	Output (AND) Y=AB	Output (OR) Y=A+B	Output (NAND) Y= (AB)'	Output (NOR) Y= A+B	Output (EX-OR) Y=A⊕B	Output (EX-NOR) Y=(A⊕B)'
1	0	0	1	0	0	1	1	0	1
2	0	1	1	0	1	1	0	1	0
3	1	0	0	0	1	1	0	1	0
4	1	1	0	1	1	0	0	0	1

Results and Analysis:

1. NOT Gate: When logic 1 is applied to the NOT gate of 7404 IC, then output becomes zero. When input LED is ON, the output LED become OFF vice versa.
2. OR Gate: The output of an OR gate is a 1 if one or the other or both of the inputs are 1, but a 0 if both inputs are 0. When one or the other or Both of the input LEDS are ON, then output LED is ON otherwise Output LED is OFF
3. AND Gate: The output of an AND gate is only 1 if both its inputs are 1. For all other possible inputs, the output is 0. When both the LEDS are ON, then output LED is ON otherwise Output LED is OFF.
4. NOR Gate: The output of the NOR gate is a 1 if both inputs are 0 but a 0 if one or the other or both the inputs are 1.
5. NAND Gate: The output of the NAND gate is a 0 if both inputs are 1 but a 1 if one or the other or both the inputs are 0.
6. EX-OR gate: The output of the EXOR gate is a 1 if either but not both inputs are 1 and a 0 if the inputs are both 0 and both 1.
7. EX-NOR gate: The output of the EX-NOR gate is a 0 if either but not both inputs are 1 and a 1 if the inputs are both 0 and both 1.

Conclusion: Any Boolean expression can be realized using NOT, AND, OR, NAND, NOR, EXOR, EX-NOR gates.

Note: The whole documentation is to be converted to pdf/word format before uploading it on the moodle. Only the pdf/word format will be acceptable. The Submission has to be done on time. After the deadline no submission of the particular experiment will be acceptable.