Experiment No. 2
Basic gates using universal gates.
Name: **Aman Mehtar**
Roll Number: **32**
Date of Performance: **31 / 07 / 24**
Date of Submission:

Aim - To realize the gates using universal gates.

Objective -

1) To study the realization of basic gates using universal gates.
2) Understanding how to construct any combinational logic function using NAND or NOR gates only.

Theory -

AND, OR, NOT are called basic gates as their logical operation cannot be simplified further. NAND and NOR are called universal gates as using only NAND or only NOR, any logic function can be implemented.

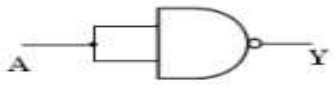
Components required -

1. IC's 7400(NAND) 7402(NOR)
2. Bread Board.
3. Connecting wires.

Circuit Diagram -

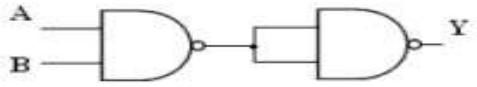
Implementation using NAND gate:

(a) NOT gate: $Y = A'$



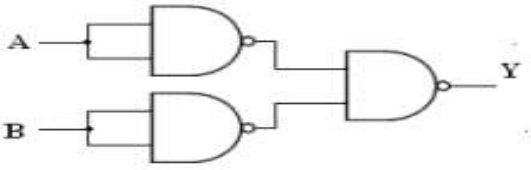
A	Y
0	1
1	0

(b) AND gate: $Y = A \cdot B$



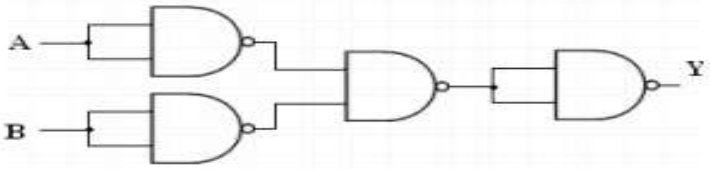
A	B	Y
0	0	0
0	1	0
1	0	0
1	1	1

(c) OR gate: $Y = A + B$



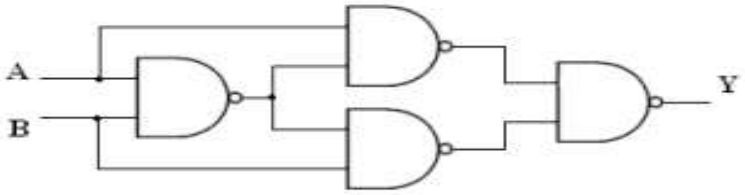
A	B	Y
0	0	0
0	1	1
1	0	1
1	1	1

(d) NOR gate: $Y = (A + B)'$



A	B	Y
0	0	1
0	1	0
1	0	0
1	1	0

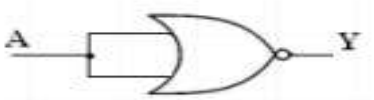
(e) Ex-OR gate: $Y = A \oplus B$



A	B	Y
0	0	0
0	1	1
1	0	1
1	1	0

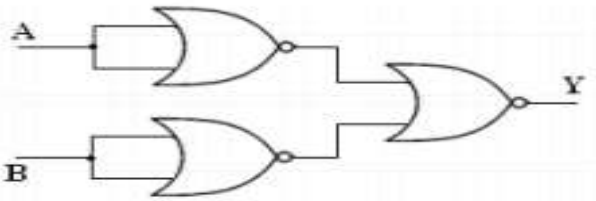
Implementation using NOR gate:

(a) NOT gate: $Y = A'$



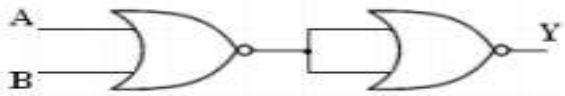
A	Y
0	1
1	0

(b) AND gate: $Y = A \cdot B$



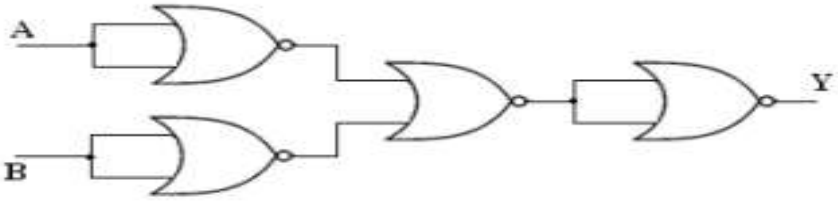
A	B	Y
0	0	0
0	1	0
1	0	0
1	1	1

(c) OR gate: $Y = A + B$



A	B	Y
0	0	0
0	1	1
1	0	1
1	1	1

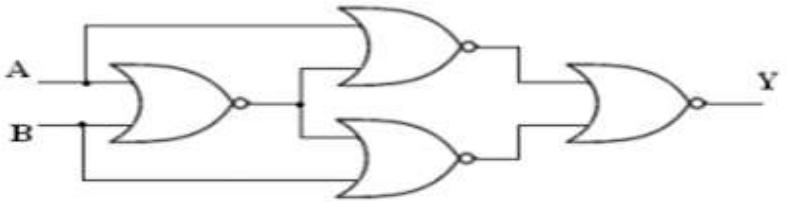
(d) NAND gate: $Y = (AB)'$



A	B	Y
0	0	1
0	1	1
1	0	1
1	1	0

(e) Ex-NOR gate: $Y = A \odot B = (A \oplus B)'$

A	B	Y
0	0	1
0	1	0
1	0	0
1	1	1

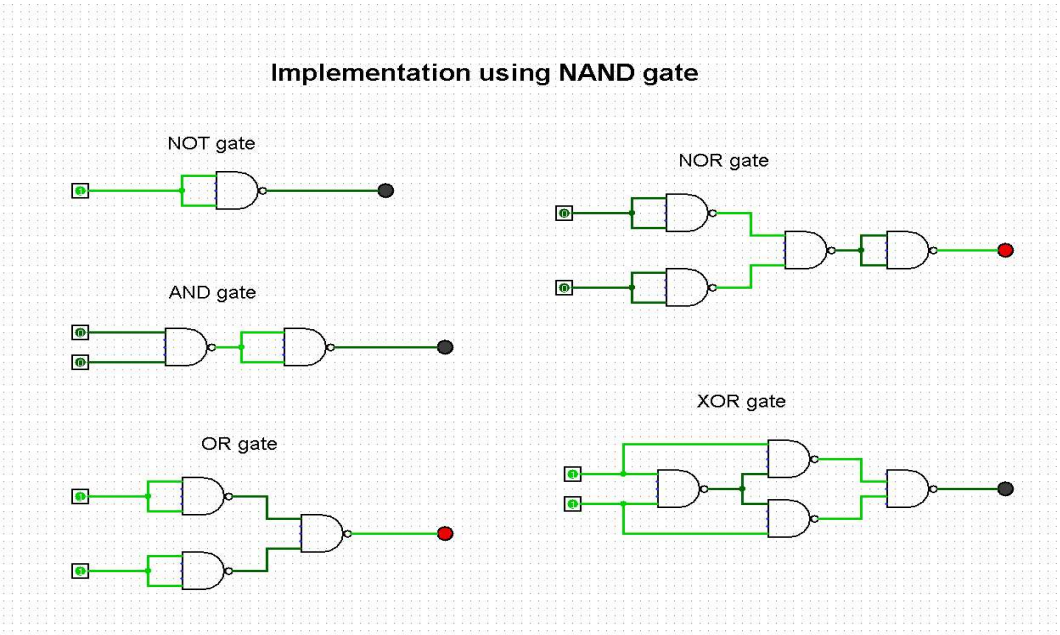


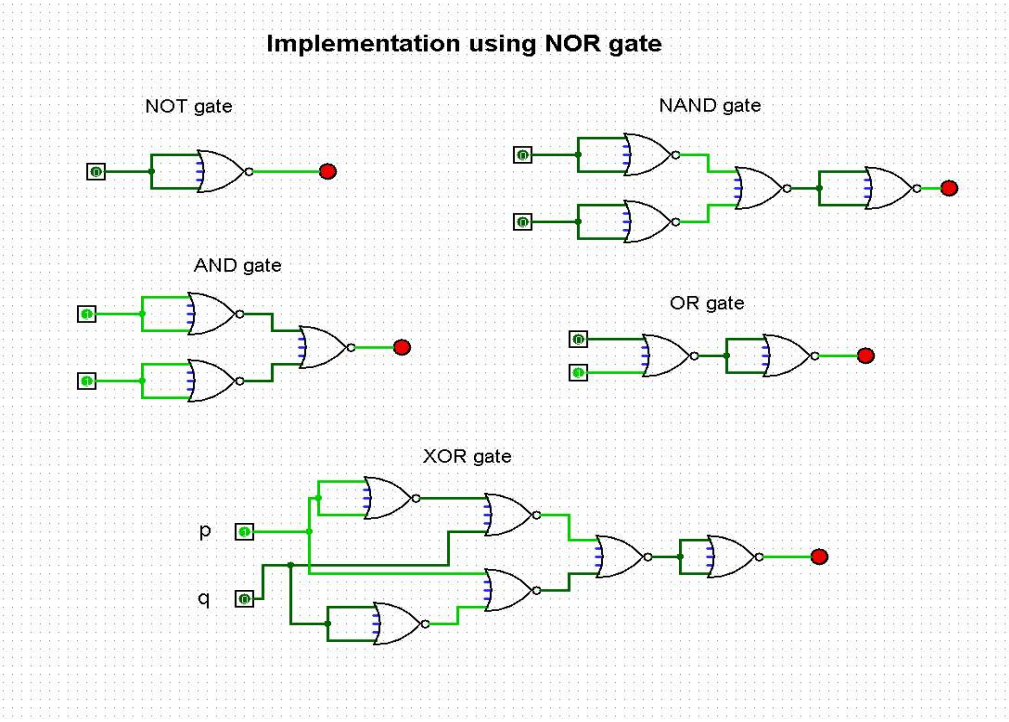
Procedure:

a) Connections are made as per the circuit diagrams.

b) By applying the inputs, the outputs are observed and the operations are verified with the help of truth table.

Output:





Conclusion:

In this experiment, we successfully demonstrated the realization of basic logic gates—AND, OR, and NOT—using only universal gates, specifically NAND and NOR gates, through the Logisim software. By constructing and analyzing circuits within the software environment, we confirmed that universal gates are indeed capable of implementing any combinational logic function. This practical exercise highlighted the versatility of NAND and NOR gates in digital circuit design, proving their ability to replicate fundamental logic operations and construct complex logic systems. The outputs observed in the simulations matched the expected results from the truth tables, validating the effective application of universal gates in achieving various logic functions.