



Vidyavardhini's College of Engineering and Technology

Department of Artificial Intelligence & Data Science

Experiment No. 2
Basic gates using universal gates.
Name: Nitish Jha
Roll Number: 18
Date of Performance:
Date of Submission:

Aim - To realize the gates using universal gates.

Objective -

- 1) To study the realization of basic gates using universal gates.



Vidyavardhini's College of Engineering and Technology

Department of Artificial Intelligence & Data Science

- 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.

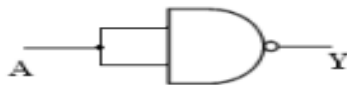
Components required -

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

Circuit Diagram -

Implementation using NAND gate:

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



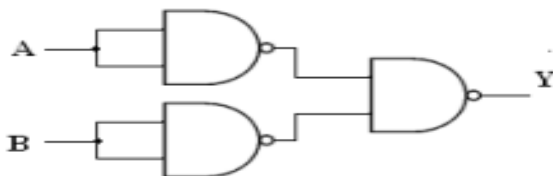
A	Y
0	1
1	0

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



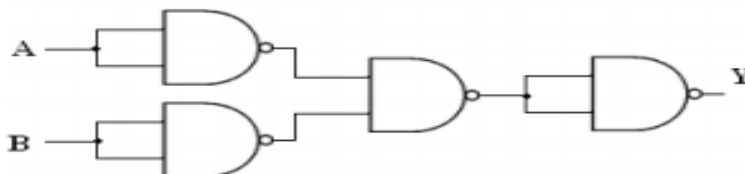
A	B	Y
0	0	0
0	1	0
1	0	0
1	1	1

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



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

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



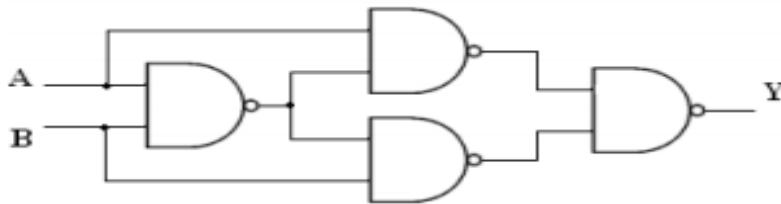
A	B	Y
0	0	1
0	1	0
1	0	0
1	1	0



Vidyavardhini's College of Engineering and Technology

Department of Artificial Intelligence & Data Science

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



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



Vidyavardhini's College of Engineering and Technology

Department of Artificial Intelligence & Data Science

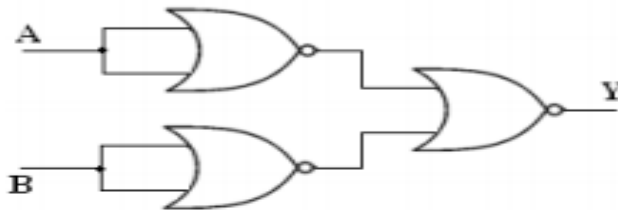
Implementation using NOR gate:

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



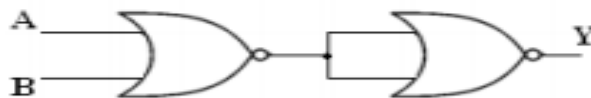
A	Y
0	1
1	0

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



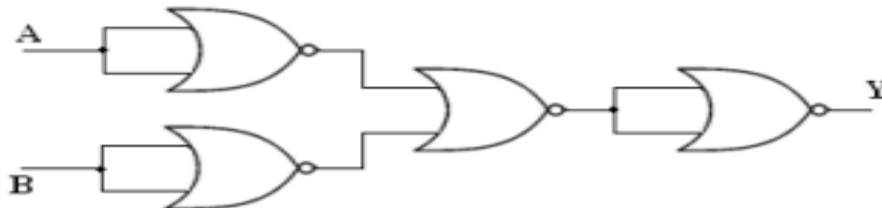
A	B	Y
0	0	0
0	1	0
1	0	0
1	1	1

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



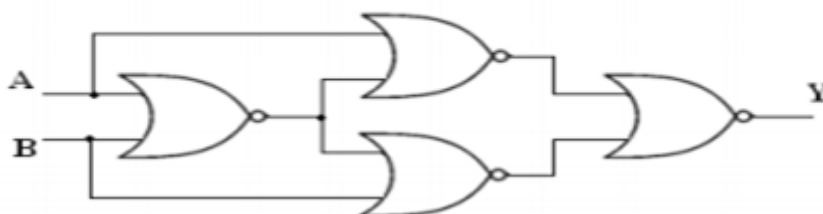
A	B	Y
0	0	0
0	1	1
1	0	1
1	1	1

(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:

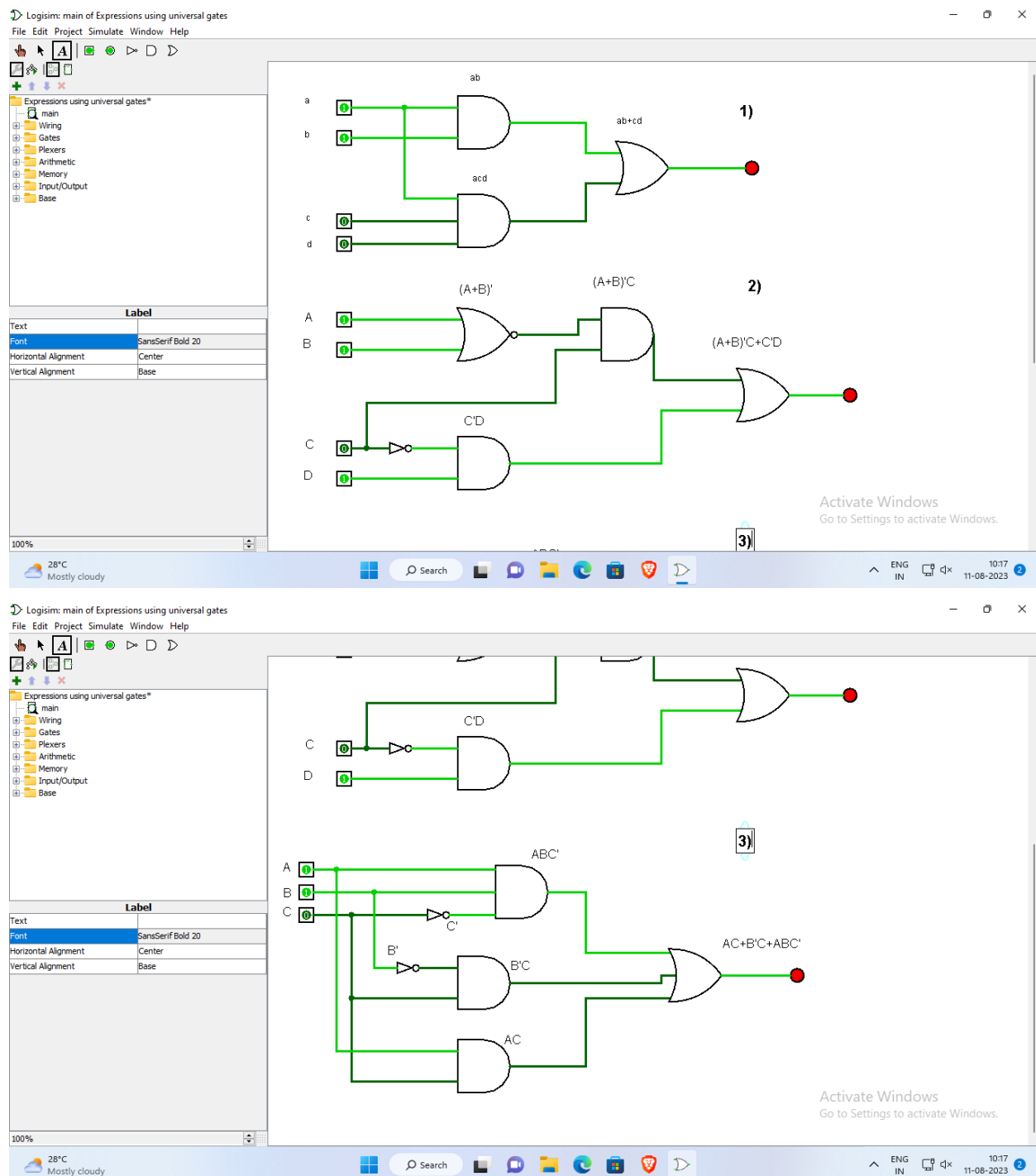
- Connections are made as per the circuit diagrams.
- By applying the inputs, the outputs are observed and the operations are verified with the help of truth table.



Vidyavardhini's College of Engineering and Technology

Department of Artificial Intelligence & Data Science

Output:-



Conclusion –

In conclusion, universal gates can be used to implement various logic gates, emphasizing their versatility. This approach reduces costs, component count, and simplifies circuit design. Gates



Vidyavardhini's College of Engineering and Technology

Department of Artificial Intelligence & Data Science

constructed using universal gates are logically equivalent to dedicated gates. The versatility of universal gates makes them valuable in various applications.