Experiment No. 2
Basic gates using universal gates.
Name: Vinith Shetty
Roll Number: 55
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.
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.

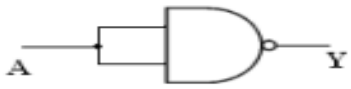
Components required -

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

Circuit Diagram -

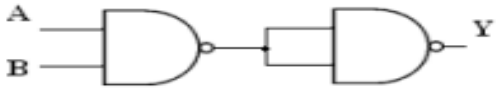
Implementation using NAND gate:

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



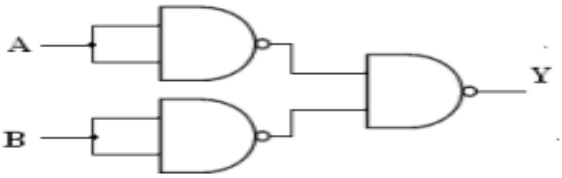
A	Y
0	1
1	0

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



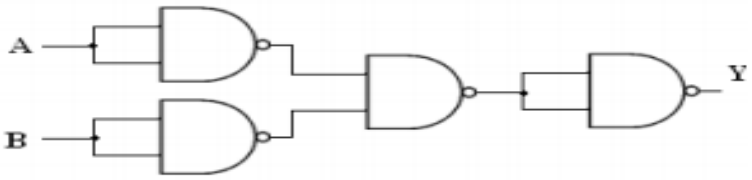
A	B	Y
0	0	0
0	1	0
1	0	0
1	1	1

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



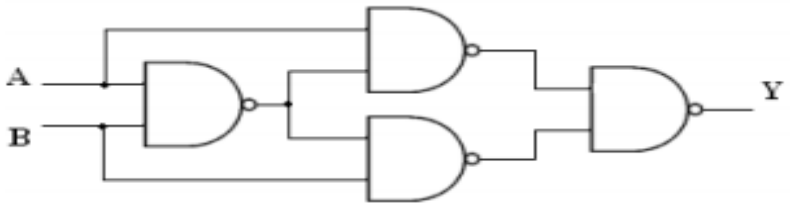
A	B	Y
0	0	0
0	1	1
1	0	1
1	1	1

(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: $Y = A \oplus B$



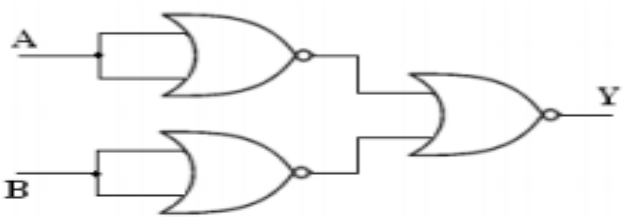
A	B	Y
0	0	0
0	1	1
1	0	1
1	1	0

Implementation using NOR gate:

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

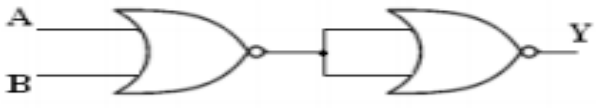
A	Y
0	1
1	0

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



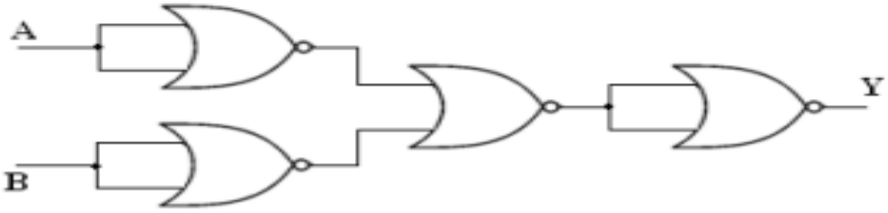
A	B	Y
0	0	0
0	1	0
1	0	0
1	1	1

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



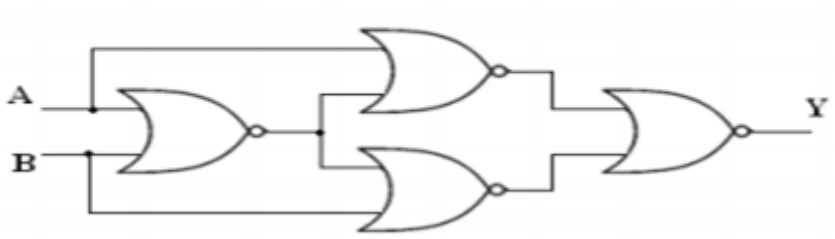
A	B	Y
0	0	0
0	1	1
1	0	1
1	1	1

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



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

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



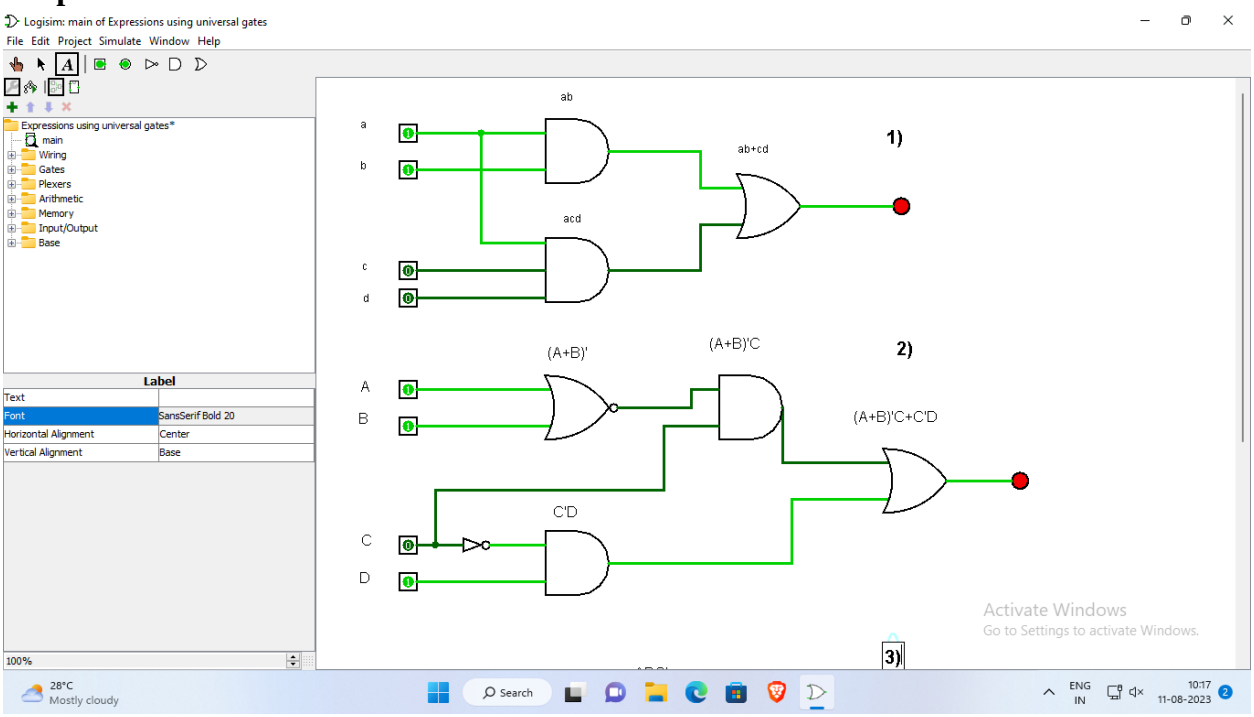
A	B	Y
0	0	1
0	1	0
1	0	0
1	1	1

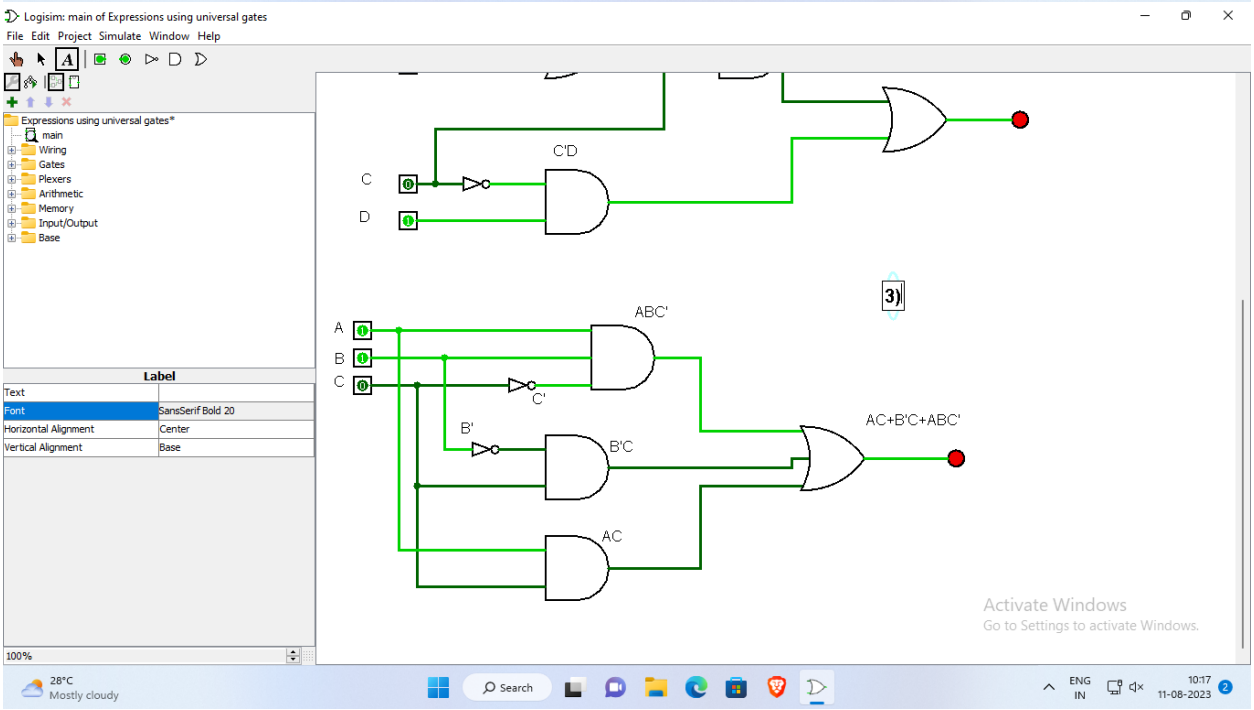
Procedure:

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:-


Logisim: main of Expressions using universal gates
File Edit Project Simulate Window Help
Expressions using universal gates*
main
Wiring
Gates
Plexers
Arithmetic
Memory
Input/Output
Base
Label
Text
Font
SansSerif Bold 20
Horizontal Alignment
Center
Vertical Alignment
Base
100%
ab
a
b
ab+cd
1)
acd
c
d
(A+B)'
(A+B)'C
2)
A
B
(A+B)'C+C'D
C'D
C
D
Activate Windows
Go to Settings to activate Windows.
3)
28°C
Mostly cloudy
Search
ENG
IN
10:17
11-08-2023


Logisim: main of Expressions using universal gates
File Edit Project Simulate Window Help
Expressions using universal gates*
main
Wiring
Gates
Plexers
Arithmetic
Memory
Input/Output
Base
Label
Text
Font
SansSerif Bold 20
Horizontal Alignment
Center
Vertical Alignment
Base
100%
C'D
C
D
3)
ABC'
A
B
C
C'
B'
B'C
AC+B'C+ABC'
AC
Activate Windows
Go to Settings to activate Windows.
28°C
Mostly cloudy
Search
ENG
IN
10:17
11-08-2023

Conclusion: –

Utilizing universal gates to implement basic logic functions (AND, OR, NOT) offers a versatile and efficient approach in digital circuit design. Universal gates like NAND (NOT-AND) and NOR (NOT-OR) gates can individually perform all basic logic functions. This characteristic makes them powerful building blocks for constructing complex logic circuits. By employing only one type of universal gate, one can create any desired logic function. The application of universal gates to perform basic logic functions significantly streamlines the design and implementation of digital circuits.