21. **HALF ADDER**

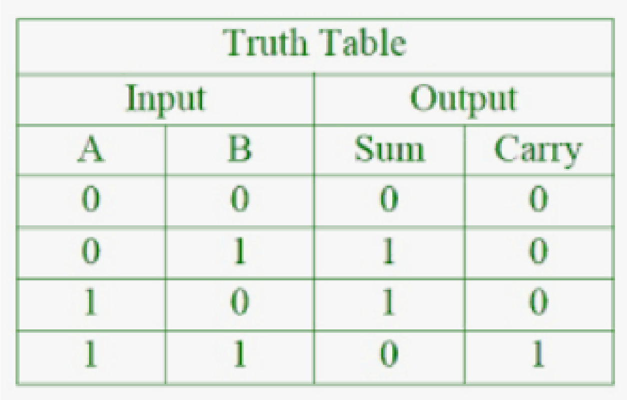
EXP.NO: 21

AIM: To design and implement the two bit half adder using Logisim simulator.

PROCEDURE:

1) Pick and place the necessary gates.
2) Insert 2 inputs into the canvas.
3) Connect the inputs to the XOR gate and AND gate.
4) Insert 2 outputs into the canvas.
5) Make the connections using the connecting wires.
6) Verify the truth table.

TRUTH TABLE:

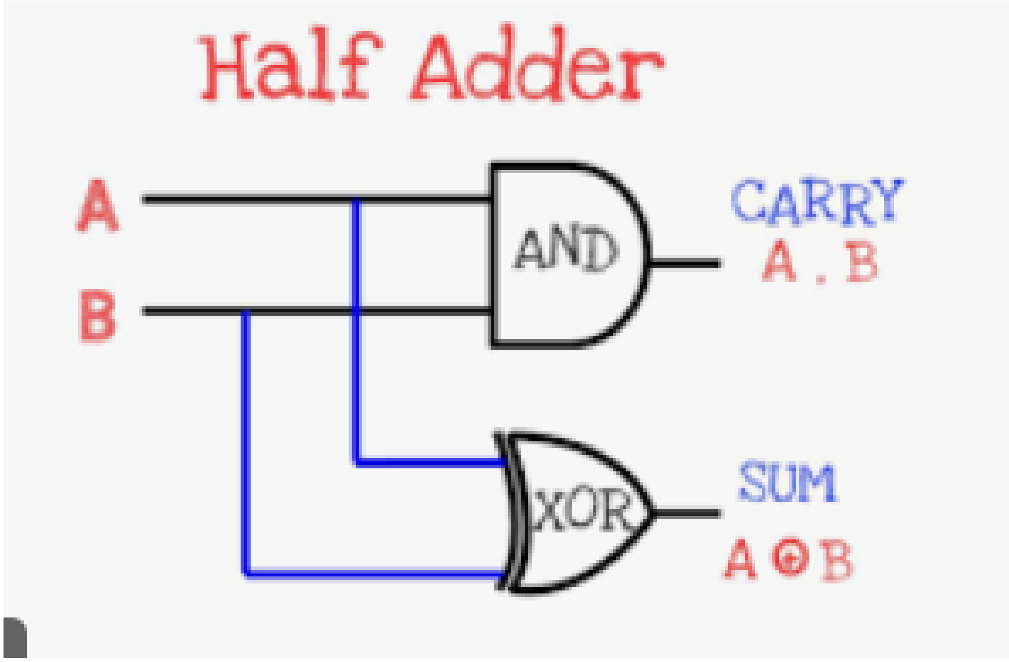


Truth Table

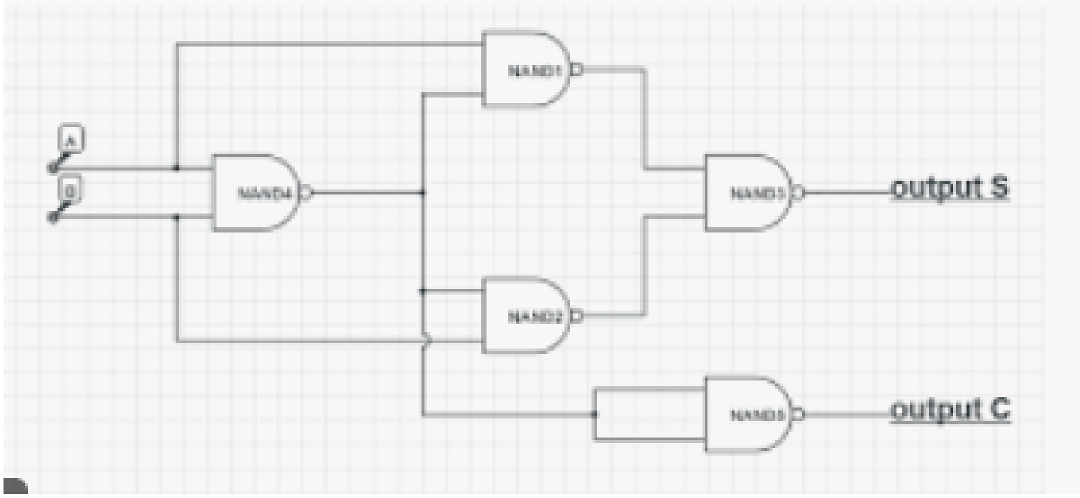
Input		Output	
A	B	Sum	Carry
0	0	0	0
0	1	1	0
1	0	1	0
1	1	0	1

S = A XOR B C = A AND B

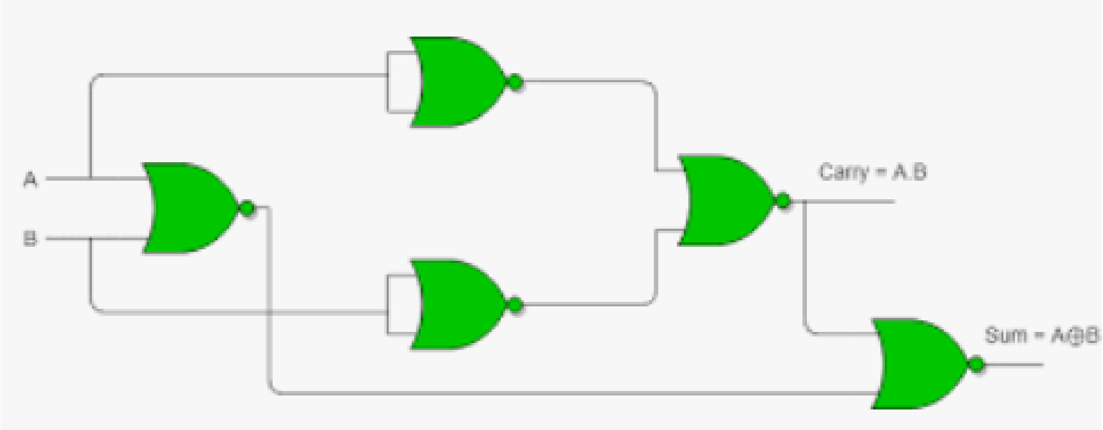
Logical Diagram:



Half Adder using NAND Gates:



Half Adder using NOR Gates:



OUTPUT

RESULT: Thus 2-bit half adder has been designed and implemented successfully using logisim simulator.

22. **TWO BIT HALF SUBTRACTOR**

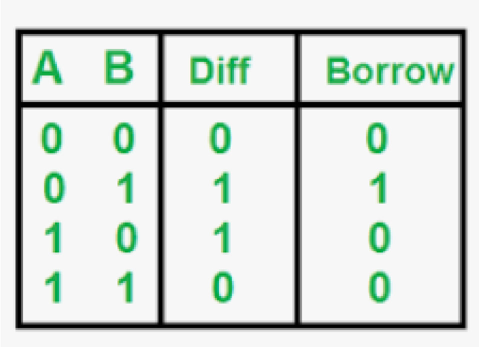
EXP.NO: 22

AIM: To design and implement the two bit half subtractor using Logisim simulator.

PROCEDURE:

1) Pick and place the necessary gates.
2) Insert 2 inputs into the canvas.
3) Connect the inputs to the OR gate, AND gate and NOT gate.
4) Insert 2 outputs into the canvas.
5) Make the connections using the connecting wires.
6) Verify the truth table.

TRUTH TABLE:

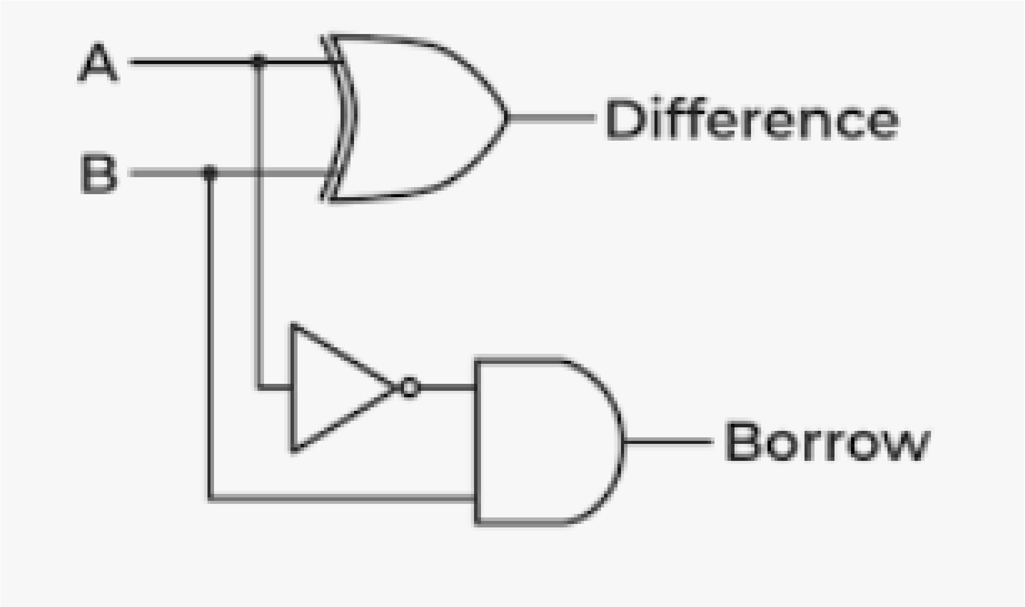


A	B	Diff	Borrow
0	0	0	0
0	1	1	1
1	0	1	0
1	1	0	0

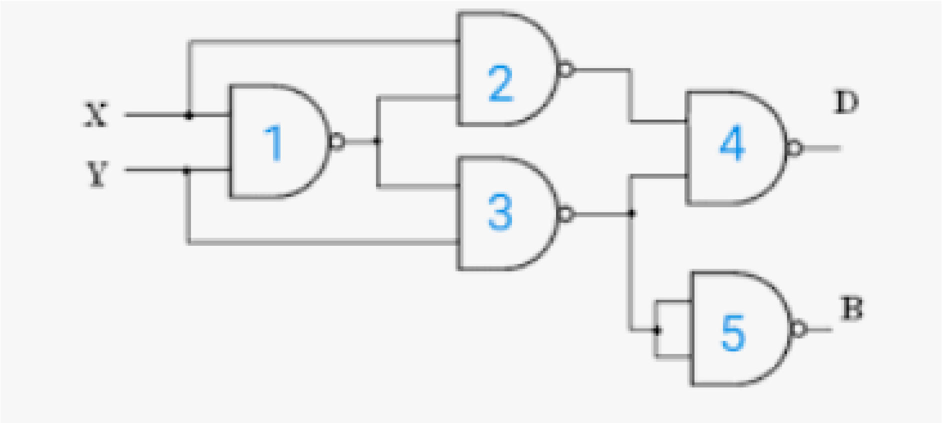
Diff=A'B+AB'

Borrow = A'B

Logical Diagram:

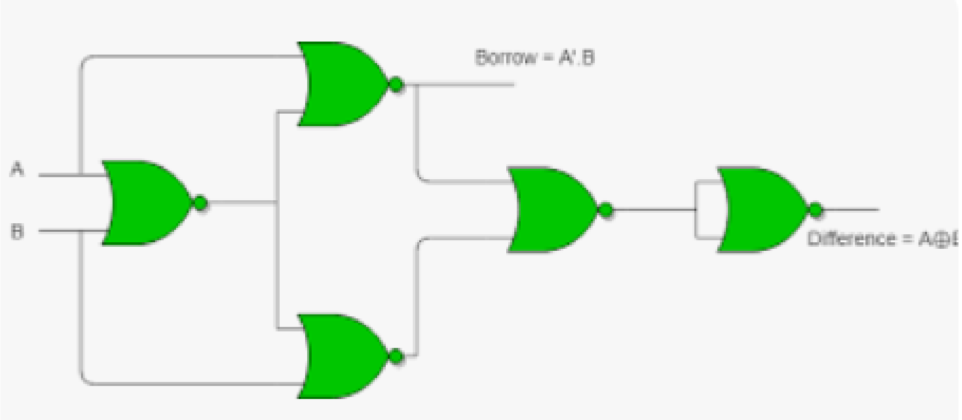


Half Subtractor using NAND Gates:



Half-Subtractor using NAND gates

Half Subtractor using NOR Gates:



OUTPUT

RESULT: Thus 2-bit half subtractor has been designed and implemented successfully using logisim simulator.

23. **FULL ADDER**

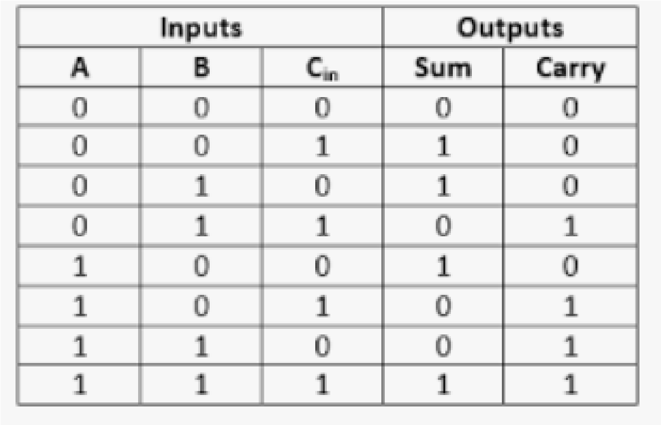
EXP.NO: 23

AIM: To design and implement the full adder using Logisim simulator.

PROCEDURE:

1) Pick and place the necessary gates.
2) Insert 3 inputs into the canvas.
3) Connect the inputs to the XOR gate, AND gate and OR gate.
4) Insert 2 outputs into the canvas.
5) Make the connections using the connecting wires.
6) Verify the truth table.

TRUTH TABLE:

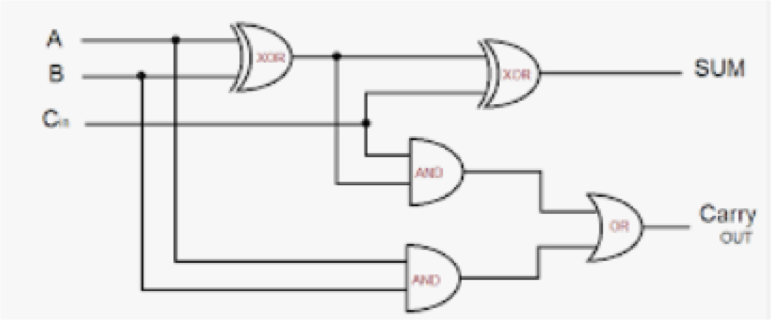


Inputs			Outputs	
A	B	C_{in}	Sum	Carry
0	0	0	0	0
0	0	1	1	0
0	1	0	1	0
0	1	1	0	1
1	0	0	1	0
1	0	1	0	1
1	1	0	0	1
1	1	1	1	1

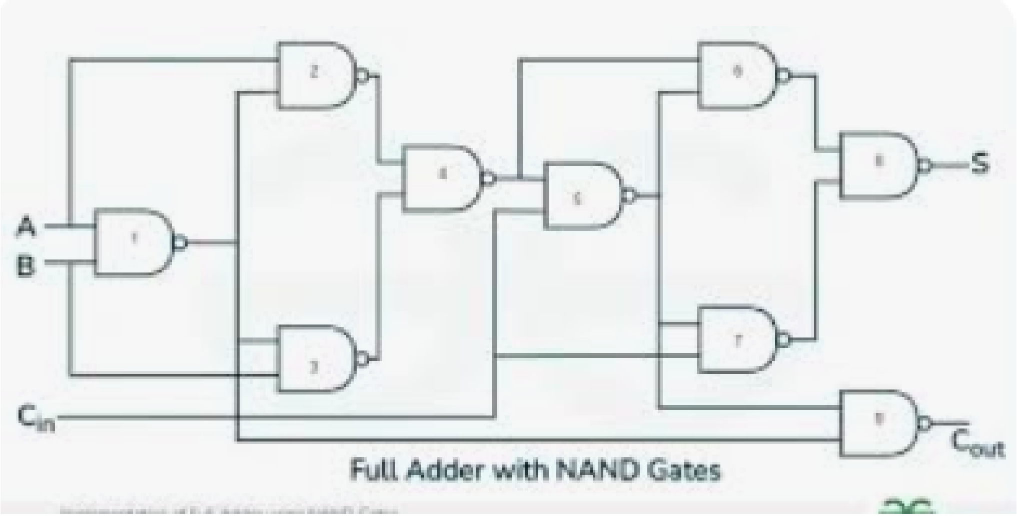
$Sum=(A\oplus B) \oplus Cin$

$Carry=A.B+ (A \oplus B)$

Logical Diagram:

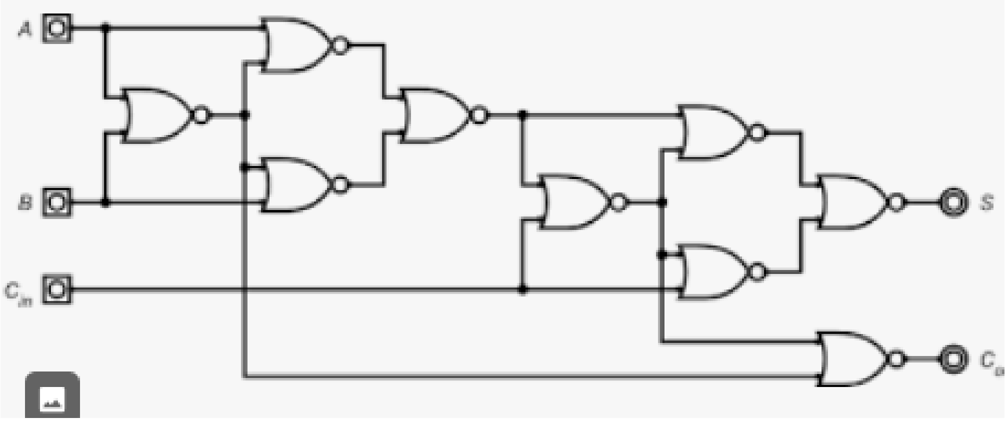


Full adder using NAND Gates:



Full Adder with NAND Gates

Full adder using NOR Gates:



OUTPUT

RESULT: Thus full adder has been designed and implemented successfully using logisim simulator.

24. **FULL SUBTRACTOR**

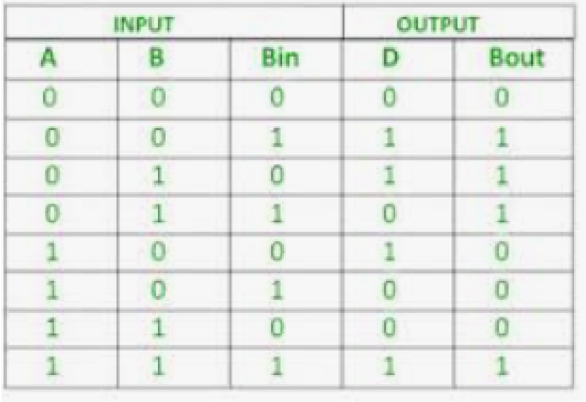
EXP.NO: 24

AIM: To design and implement the full subtractor using Logisim simulator.

PROCEDURE:

1) Pick and place the necessary gates.
2) Insert 3 inputs into the canvas.
3) Connect the inputs to the XOR gate, AND gate and OR gate.
4) Insert 2 outputs into the canvas.
5) Make the connections using the connecting wires.
6) Verify the truth table.

TRUTH TABLE:

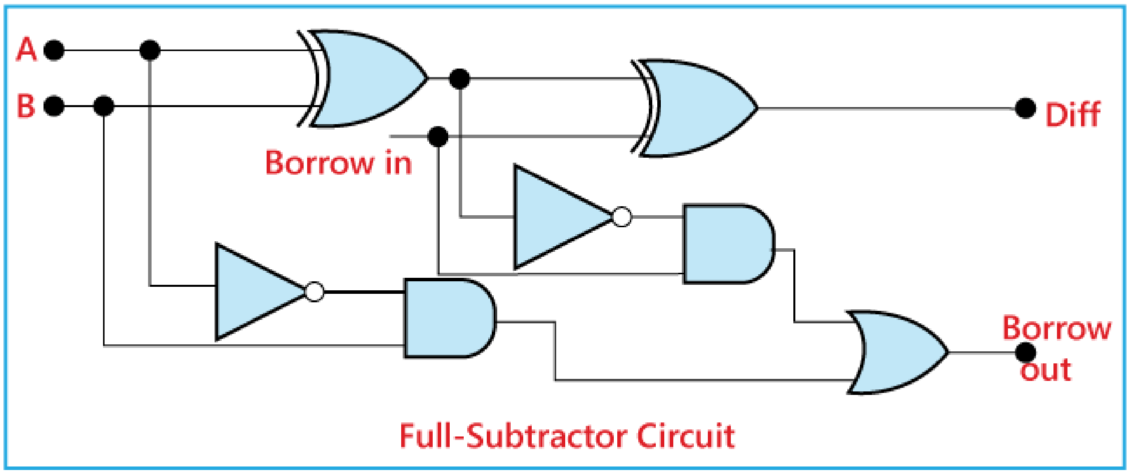


INPUT			OUTPUT	
A	B	Bin	D	Bout
0	0	0	0	0
0	0	1	1	1
0	1	0	1	1
0	1	1	0	1
1	0	0	1	0
1	0	1	0	0
1	1	0	0	0
1	1	1	1	1

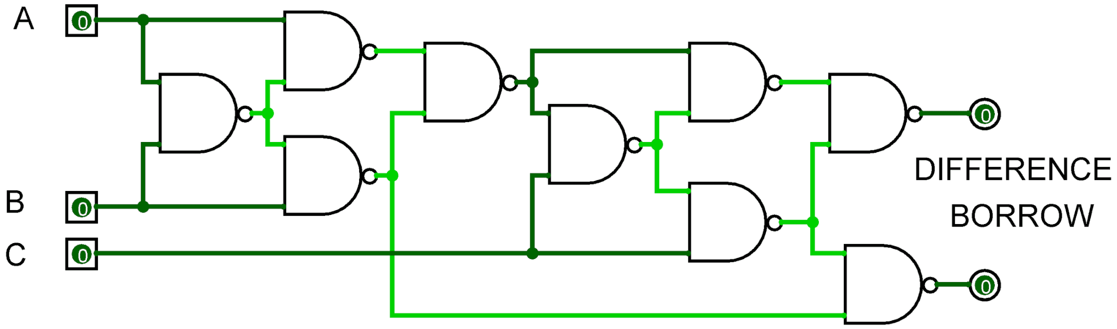
Diff=(A ⊕ B) ⊕ 'Borrowin'

Borrow=A'.B + (A ⊕ B)'

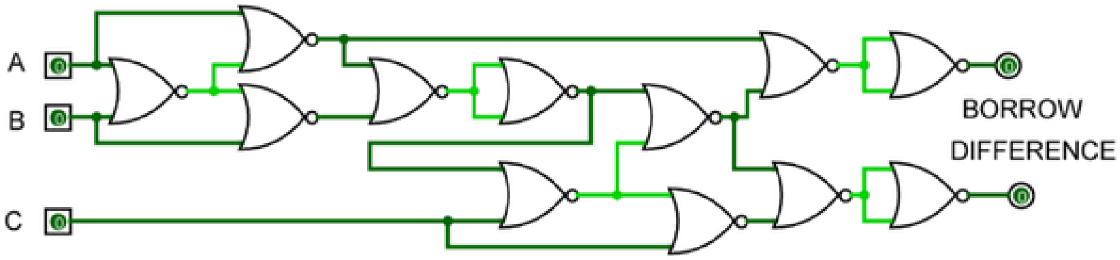
Logic Diagram:



Full Subtractor using NAND Gates:



Full Subtractor using NOR Gates:



OUTPUT

RESULT: Thus full subtractor has been designed and implemented successfully using logisim simulator.