Experiment No. 3
To realise half adder and full adder.
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Date of Performance:
Date of Submission:

Aim - To realise half adder and full adder.

Objective -

1) The objective of this experiment is to understand the function of Half-adder, Full-adder, Half-subtractor and Full-subtractor.
2) Understand how to implement Adder and Subtractor using logic gates.

Components required -

1. IC - 7486(X-OR), 7432(OR), 7408(AND), 7404 (NOT)
2. Bread Board
3. Connecting wires.

Theory -

Half adder is a combinational logic circuit with two inputs and two outputs. The half adder circuit is designed to add two single bit binary numbers A and B. It is the basic building block for addition of two single bit numbers. This circuit has two outputs CARRY and SUM.

Sum =A $\oplus$ B

Carry = A B

Full adder is a combinational logic circuit with three inputs and two outputs. Full adder is developed to overcome the drawback of HALF ADDER circuit. It can add two one bit numbers A and B. The full adder has three inputs A, B, and CARRY in,the circuit has two outputs CARRY out and SUM.

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

Carry = AB + Cin (A$\oplus$B)

Subtracting a single-bit binary value B from another A (i.e. A -B) produces a difference bit D and a borrow out bit B-out. This operation is called half subtraction and the circuit to realise it is called a half subtractor. The Boolean functions describing the half- Subtractor are

Sum =A $\oplus$B

Carry = A' B

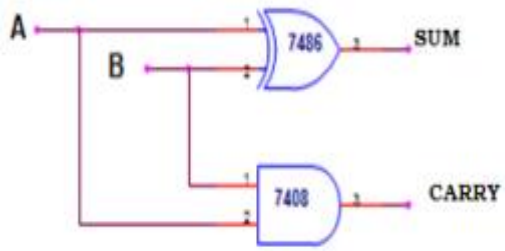
Subtracting two single-bit binary values, B, Cin from a single-bit value A produces a difference bit D and a borrow out Br bit. This is called full subtraction. The Boolean functions describing the full-subtractor are

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

Borrow = A'B + A'(Cin) + B(Cin)

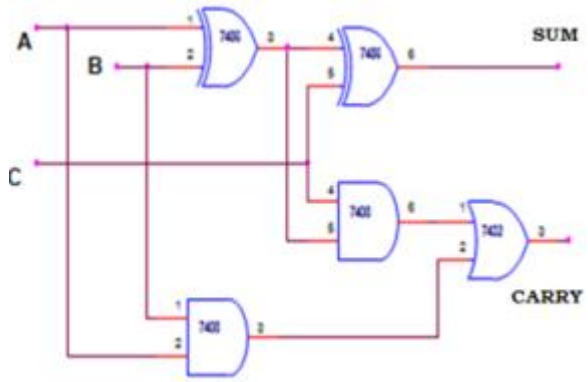
Circuit Diagram and Truth Table -

Half-adder



A	B	SUM	CARRY
0	0	0	0
0	1	1	0
1	0	1	0
1	1	0	1

Full-adder

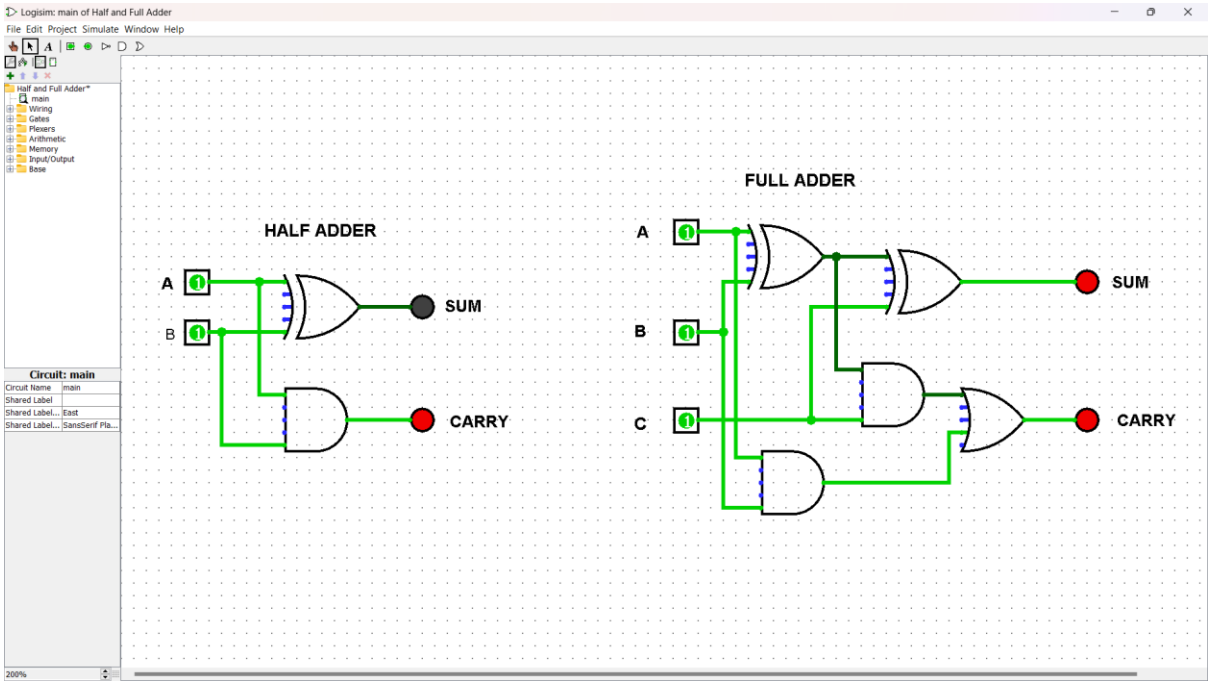


A	B	C	SUM	CARRY
0	0	0	0	0
0	0	1	1	0
0	1	0	1	0
0	1	1	0	1
1	0	0	1	0
1	0	1	0	1
1	1	0	0	1
1	1	1	1	1

Procedure -

1. Verify the gates.
2. Make the connections as per the circuit diagram.
3. Switch on VCC and apply various combinations of input according to the truth table.
4. Note down the output readings for half/full adder and half/full subtractor, Sum/difference and the carry/borrow bit for different combinations of inputs to verify their truth tables.

Screenshot:



Conclusion -

In conclusion, Experiment 3 provided us with a practical understanding of fundamental digital logic components, including half adders, full adders, half subtractors, and full subtractors. Through rigorous experimentation, we confirmed that these circuits accurately perform binary addition and subtraction operations in accordance with their respective truth tables. This hands-on experience enabled us to witness how logic gates, such as XOR, AND, OR, and NOT, could be used to construct these crucial building blocks of digital systems. The knowledge gained in this experiment forms the foundation for more complex digital systems and paves the way for further exploration of advanced topics in digital logic and computer architecture.