EXPT NO.5 :
TO STUDY HALF ADDER AND FULL ADDER

Objective :

To study the half adder, full adder, half subtractor and full subtractor.

Equipments :

Logic Circuit Simulator Pro.
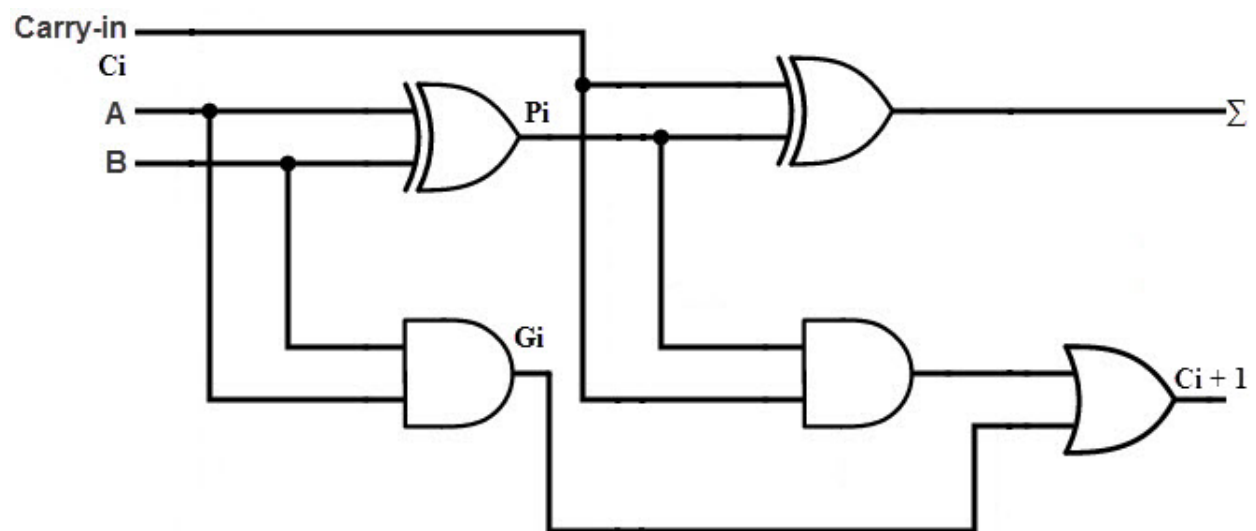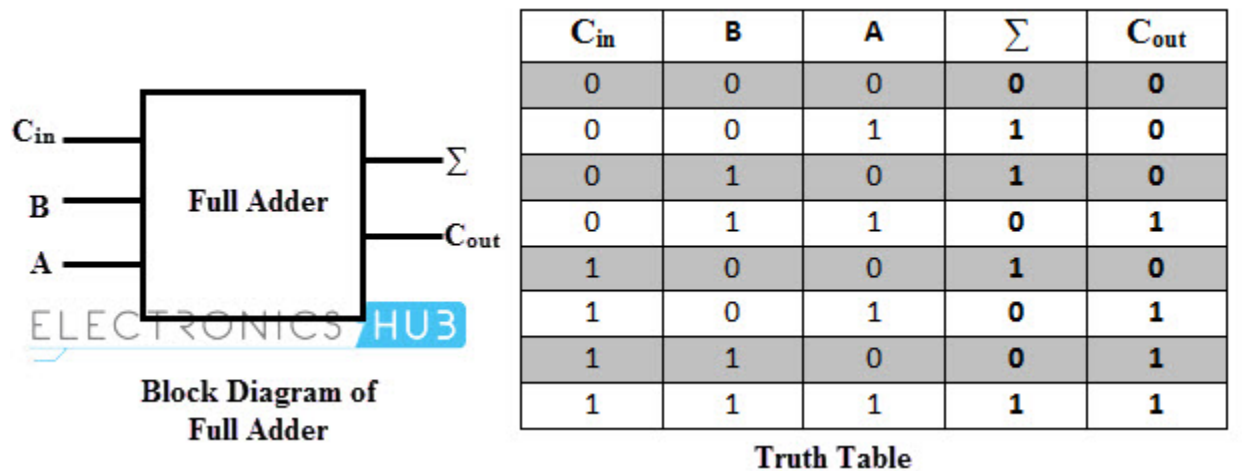
Theory :

Half Adder :

A half adder has two inputs for the two bits to be added and two outputs one from the sum 's' and other from the carry 'c' into the higher adder position. Above circuit is called as a carry signal from the addition of less significant bits sum from the X-OR gate and the carry out from the AND gate.
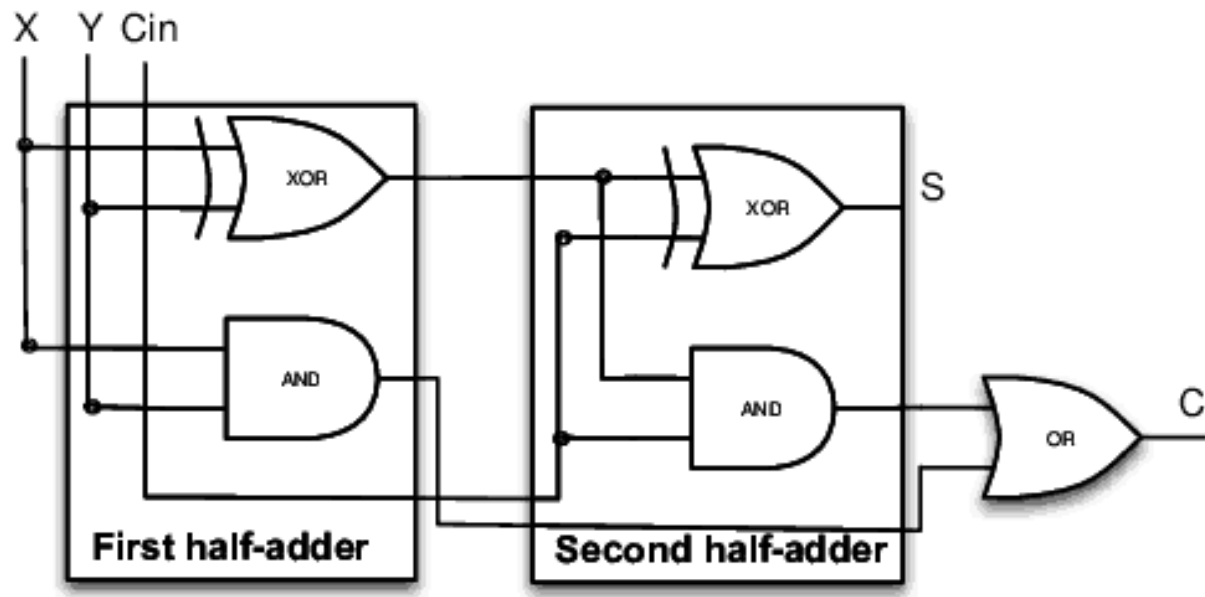

A	B	Sum (Σ)	Carry Out (Co)
0	0	0	0
0	1	1	0
1	0	1	0
1	1	0	1

Block Diagram

Truth Table

Logic Diagram
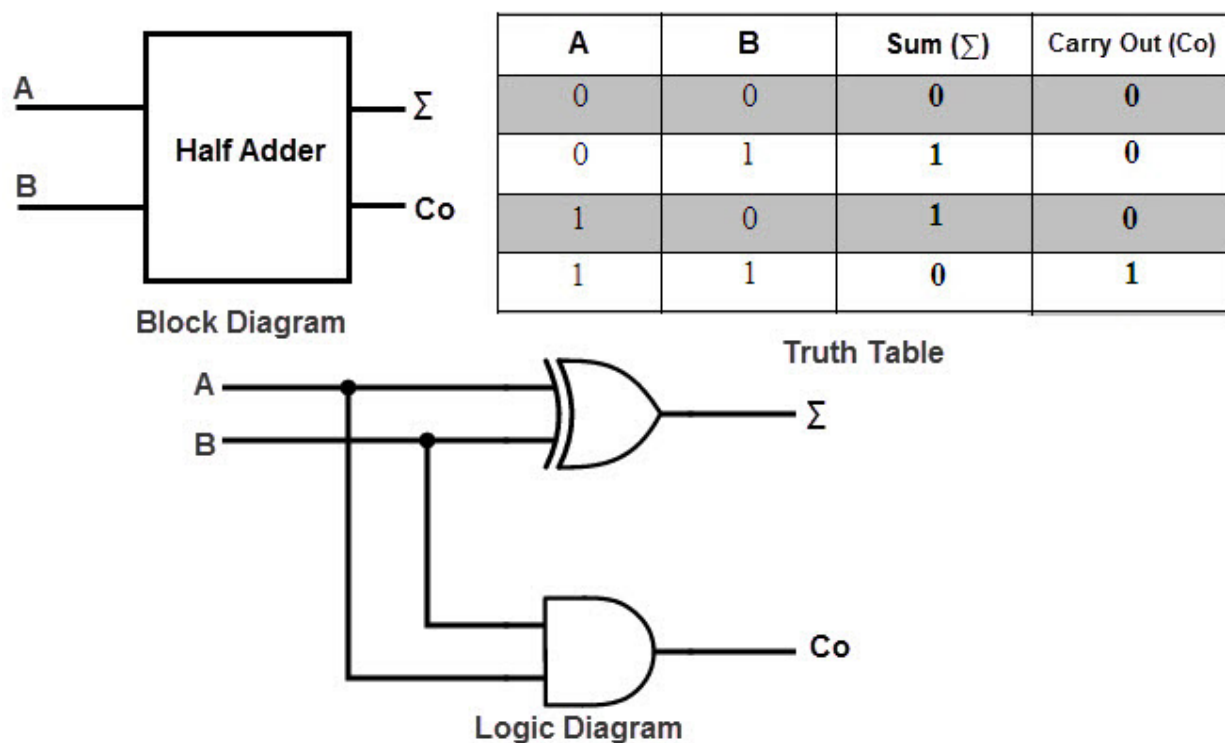
$$\text{Sum (s)} = \overline{A}B + A\overline{B}, \text{ Carry (c)} = A.B$$

Full Adder :

A full adder is a combined circuit that forms the arithmetic sum of input; it consists of three inputs and two outputs. A full ladder is used to add two three bits at a time but a half Adder cannot do so. In full adder sum output will be taken from X-OR gate, carry output will be taken from OR gate.

C_{in}	B	A	Σ	C_{out}
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

Block Diagram of Full Adder

Truth Table

Full Adder using two Half Adder :

The sum in case of full adder is: **A ⊕ B ⊕ C**
And, the carry can be **"AB+BC+AC "or "(A⊕ B)C +AB"**

Procedure :

1. Half Adder :

- Connect A and B input of half adder to switches from the input switches section.
- Connect the sum output of half adder to L1 and carry output of half adder to L2 in the output section.
- Switch on the power supply of the kit and provide proper inputs to half adder using switches as per truth table shown above.
- Observe the output of half adder and verify the functionality of half adder as per the truth table.
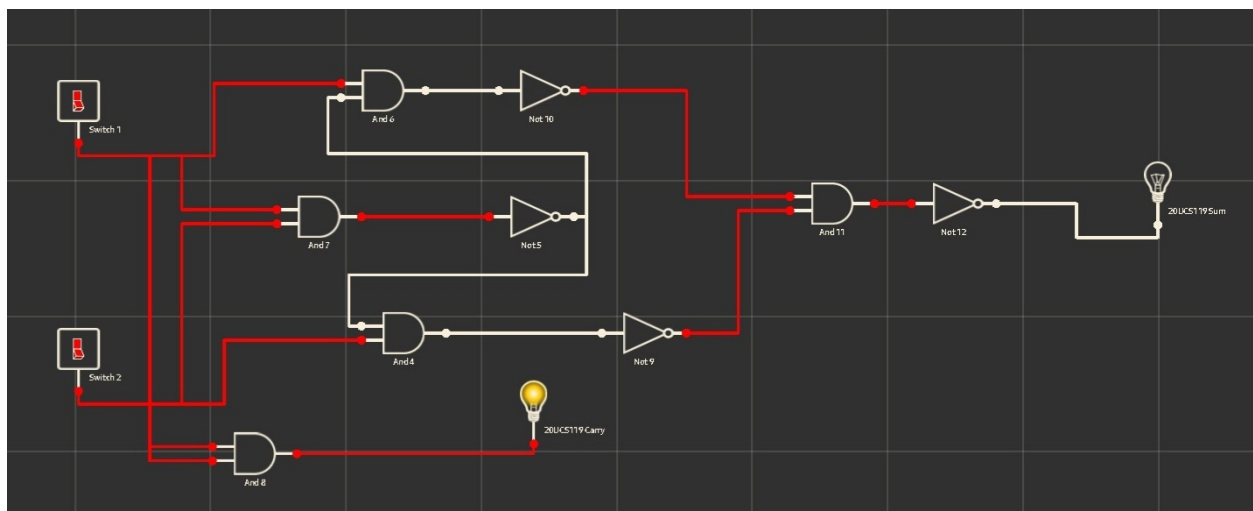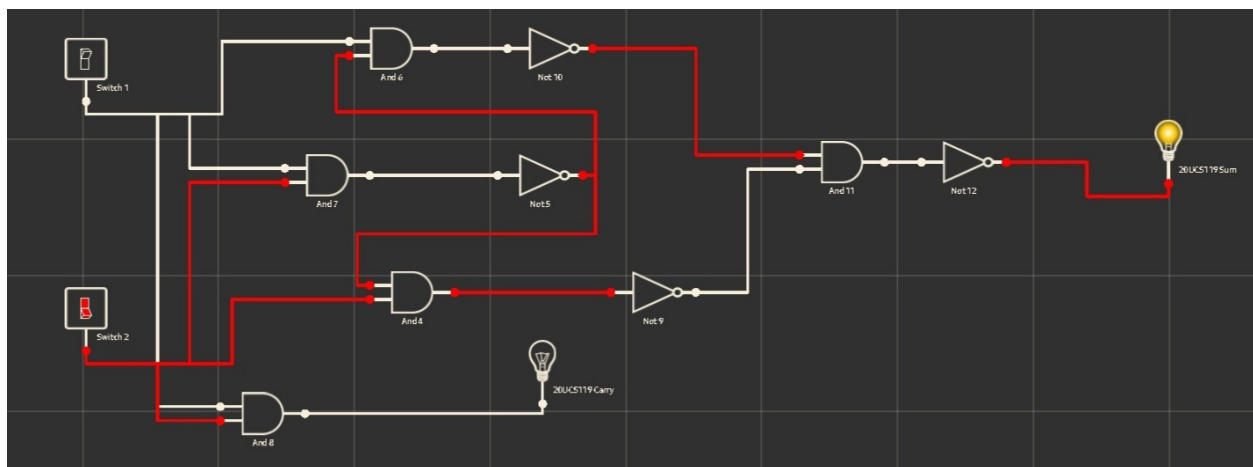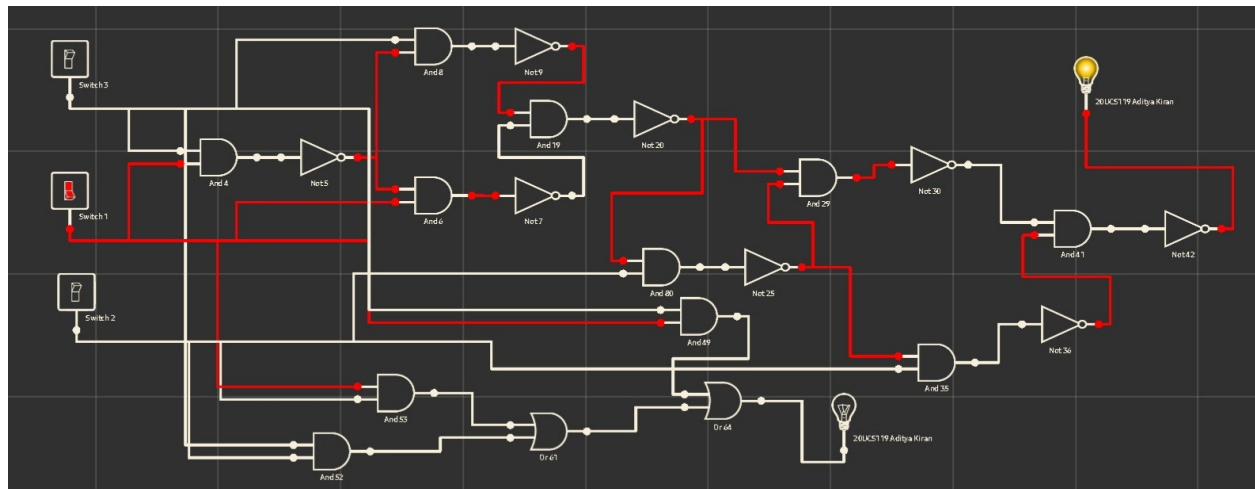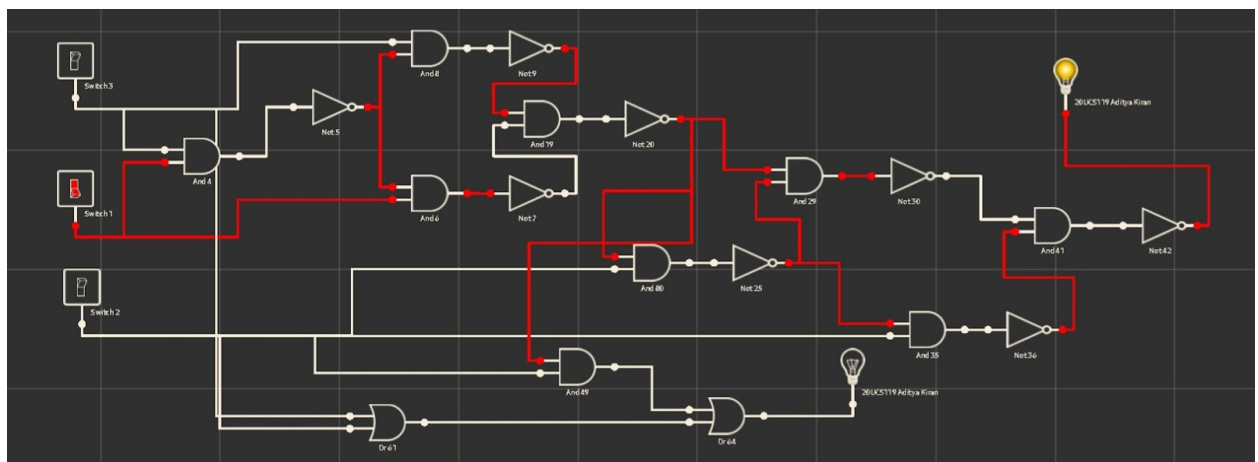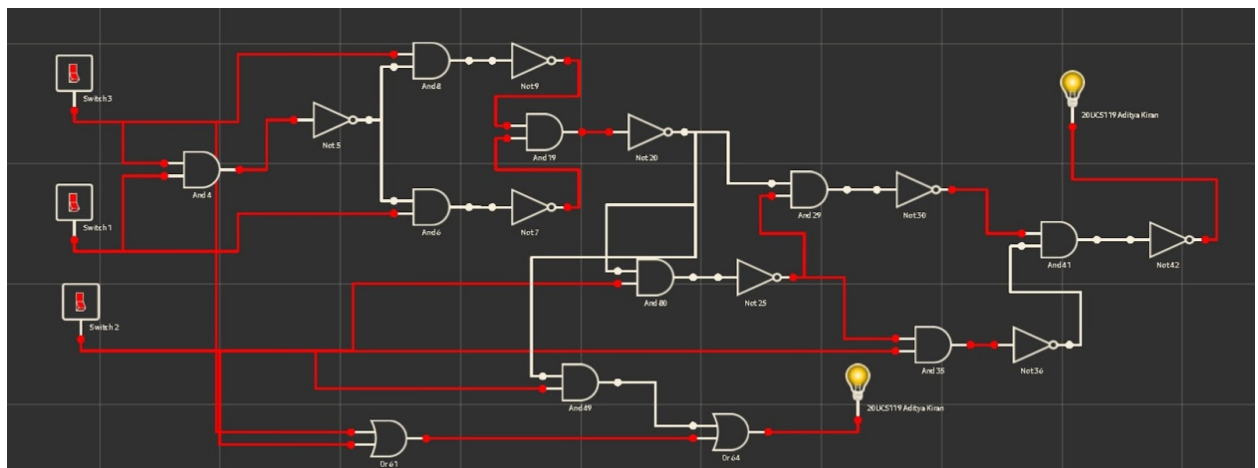
2. FULL ADDER :

- Connect A, B and C input of full adder to switches from the input switches section.
- Connect the sum output of full adder to L1 and carry output of half adder to L2 in the output section.
- Switch on power supply of the kit and provide proper inputs to full adder using switches as per truth table shown above.
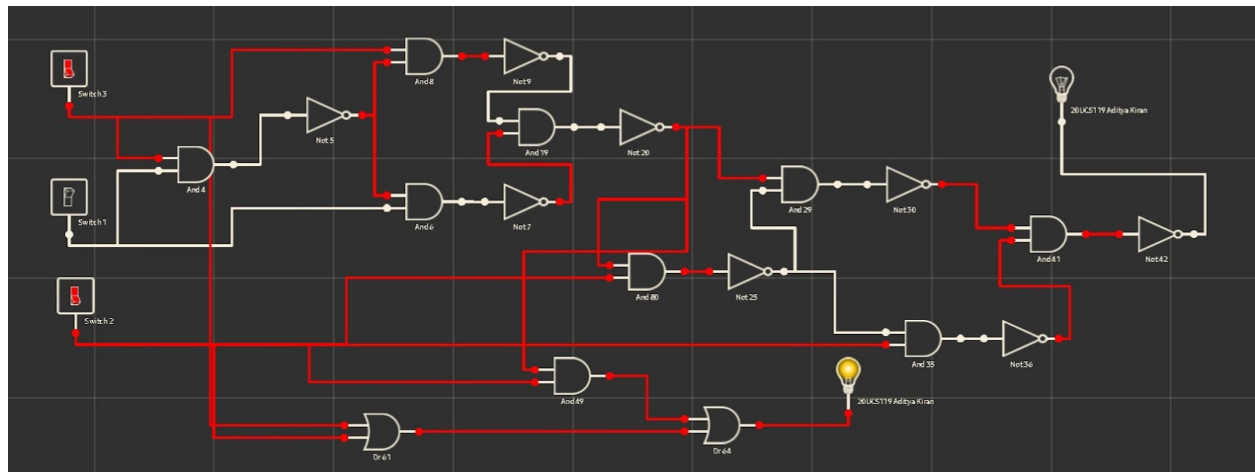- Observe the output of full adder and verify the functionality of half adder as per truth table.

CASE 1: When C-out = AB+BC+AC:
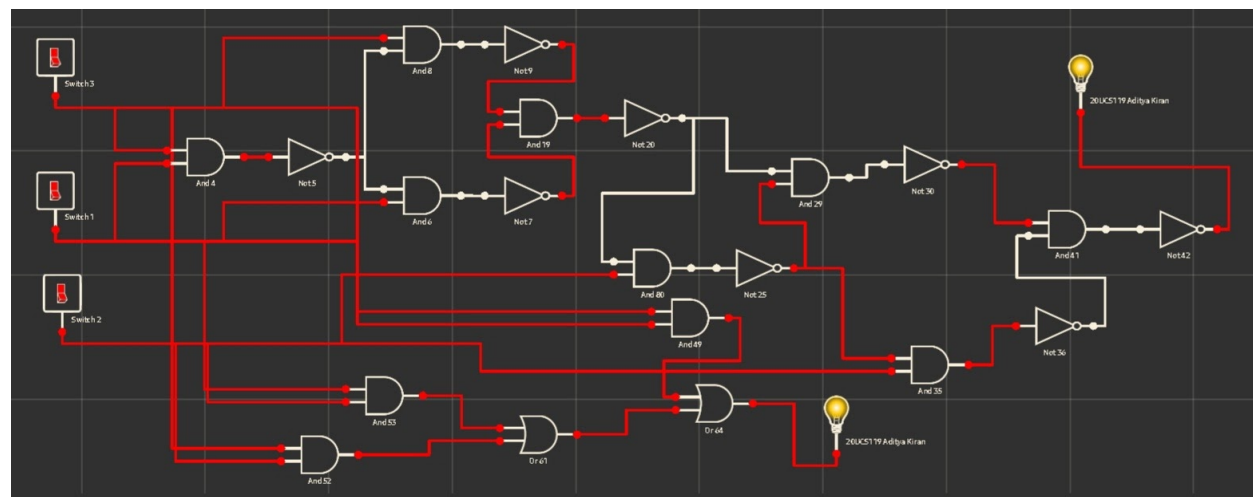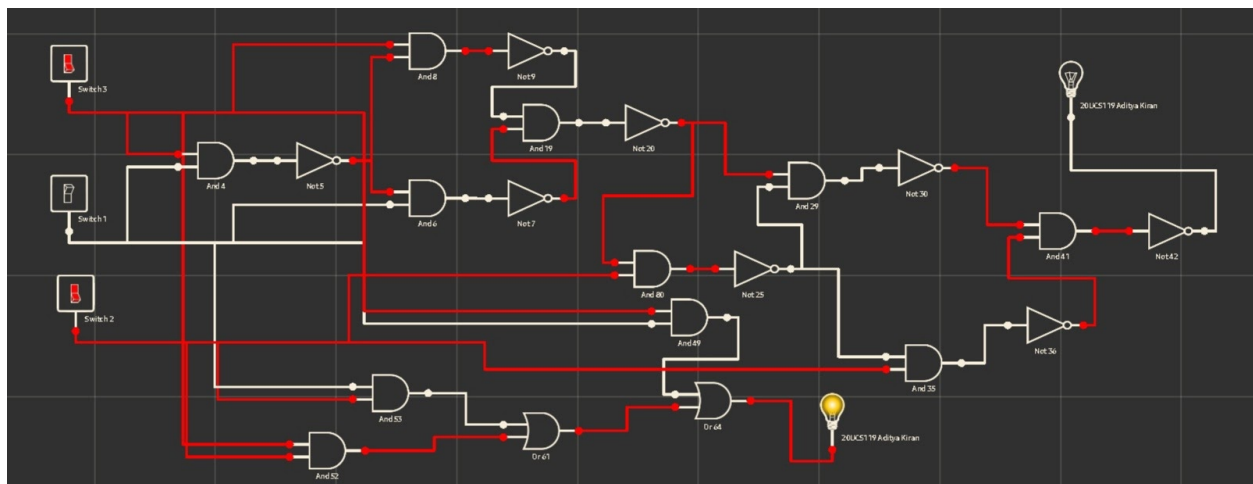
CASE 2: When C-out = (A ⊕ B)C + AB:

Truth Table :

HALF ADDER:

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

FULL ADDER:

A	B	Cin	CARRY	SUM
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

Conclusion :

Hence the functionality of half adder and full adder are verified.