

EXPT NO.6 :

STUDY OF HALF SUBTRACTOR AND FULL SUBTRACTOR

Objective :

To study the half subtractor and full subtractor.

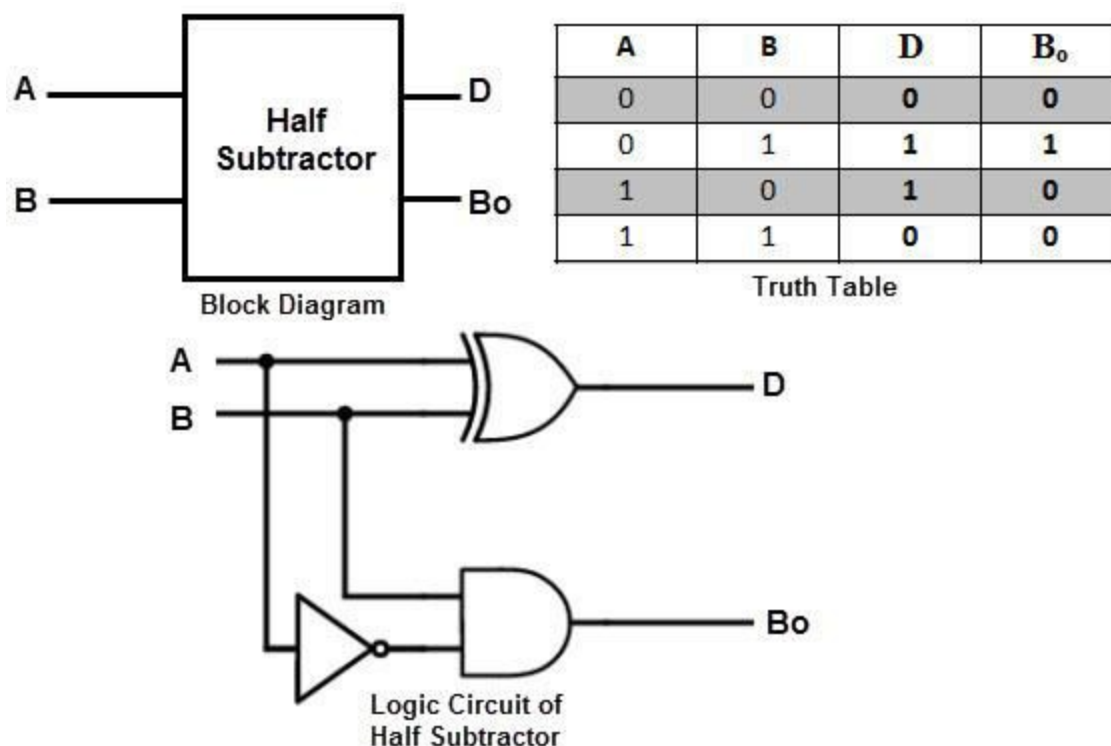
Equipments :

Logic Circuit Simulator Pro.

Theory :

Half Subtractor :

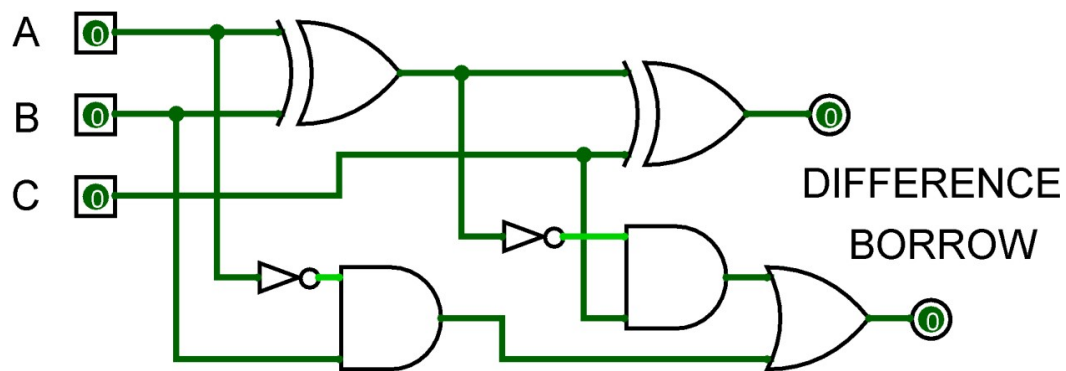
The half subtractor is constructed using X-OR and AND. The half subtractor has two inputs and outputs. The outputs are borrow and difference. The difference can be applied using X-OR gate, borrow out can be implemented using AND gate and an inverter.



Here D = Difference and Bo = Borrow
 Difference (D) = $\bar{A}B + A\bar{B}$, Borrow (B) = $A.B$

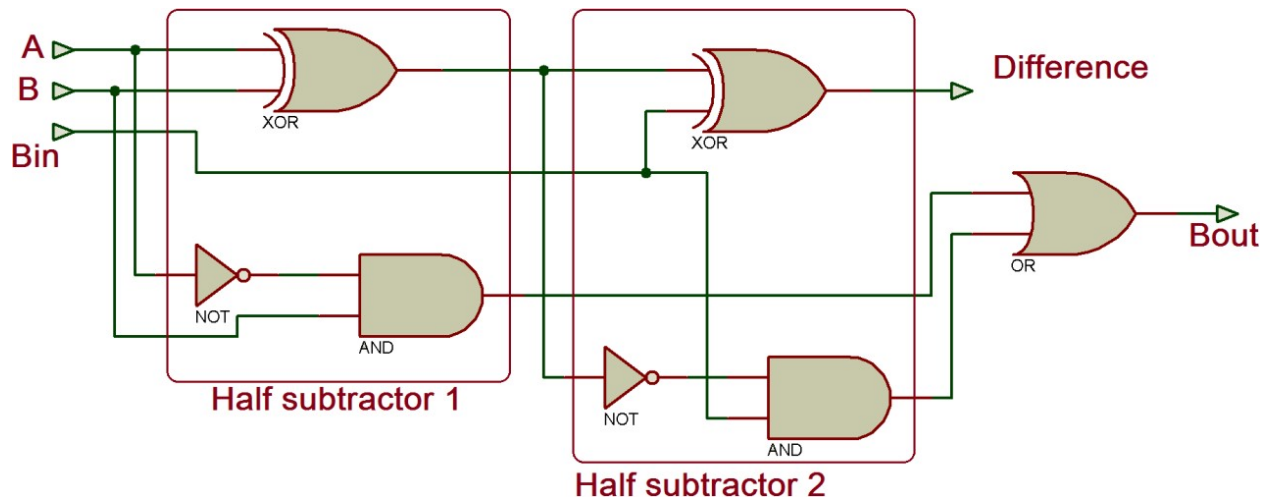
Full Subtractor :

The full subtractor is a combination of X-OR, AND, OR, NOT gates. In a full subtractor the logic circuit has three inputs and two outputs. The two half subtractors put together gives a full subtractor.

**TRUTH TABLE:**

Full Subtractor-Truth Table				
Input			Output	
A	B	C	Difference	Borrow
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
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Full Adder using two Half Subtractor :

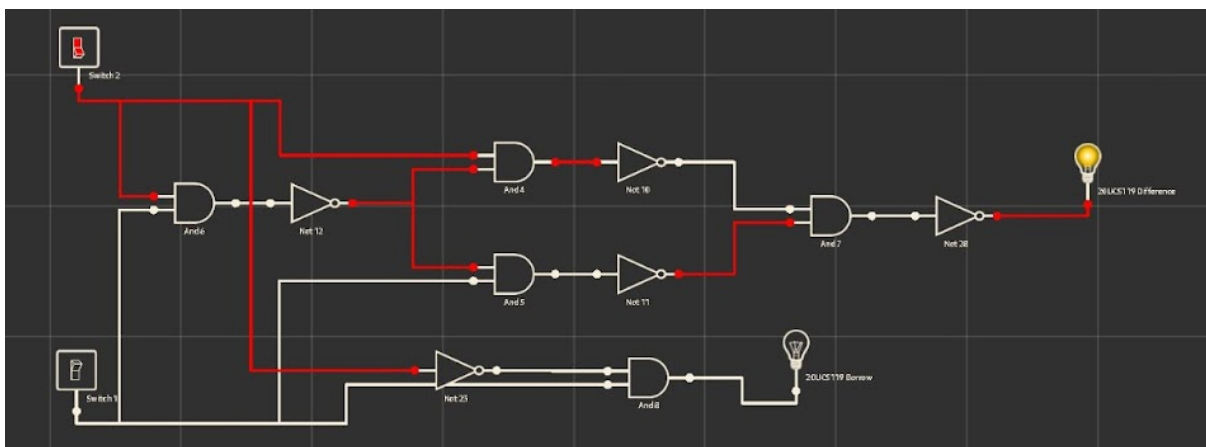


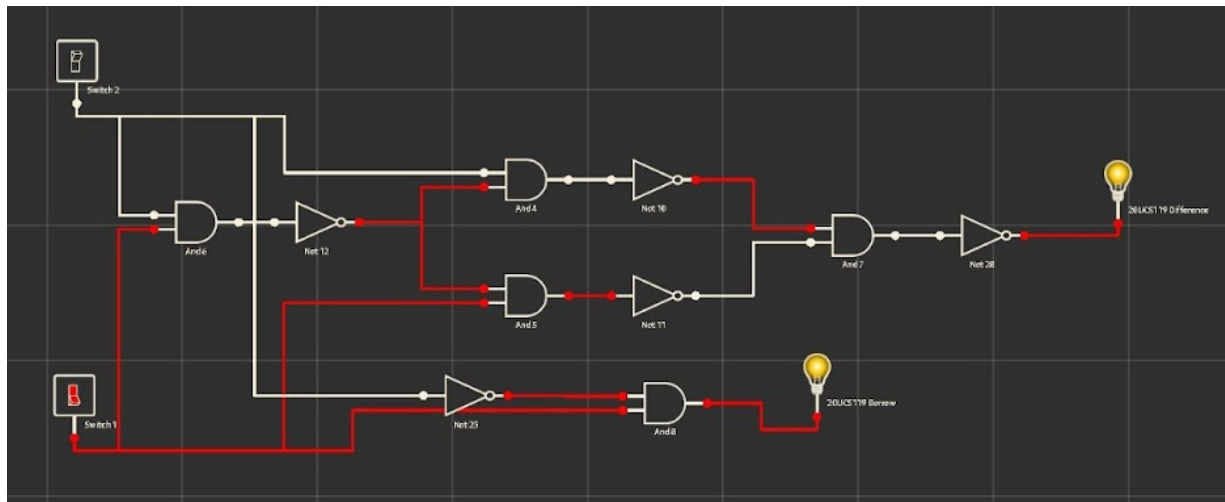
The difference in case of full adder is: $A \oplus B \oplus B_{in}$ And the carry can be $AB + BB_{in} + AB_{in}$ or $(A \oplus B)B_{in} + AB$

Procedure :

1. Half Subtractor :

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





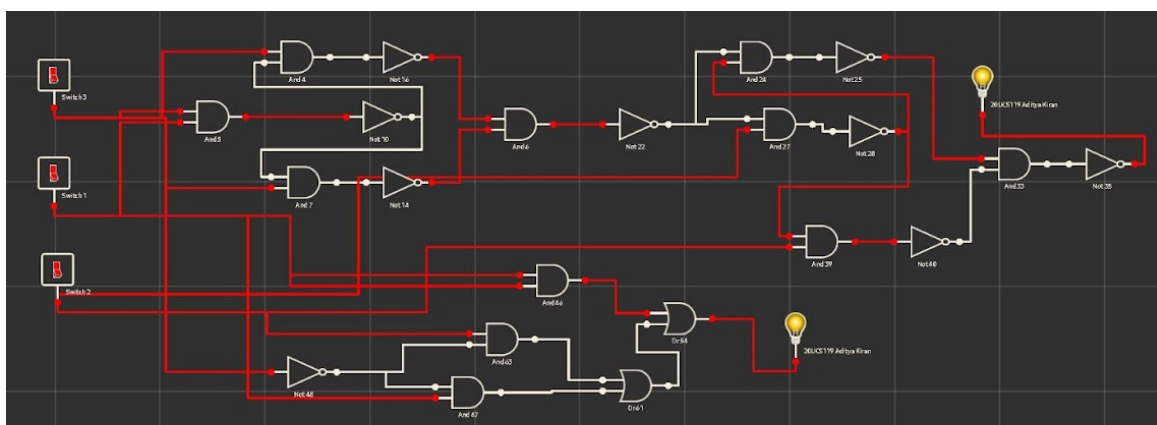
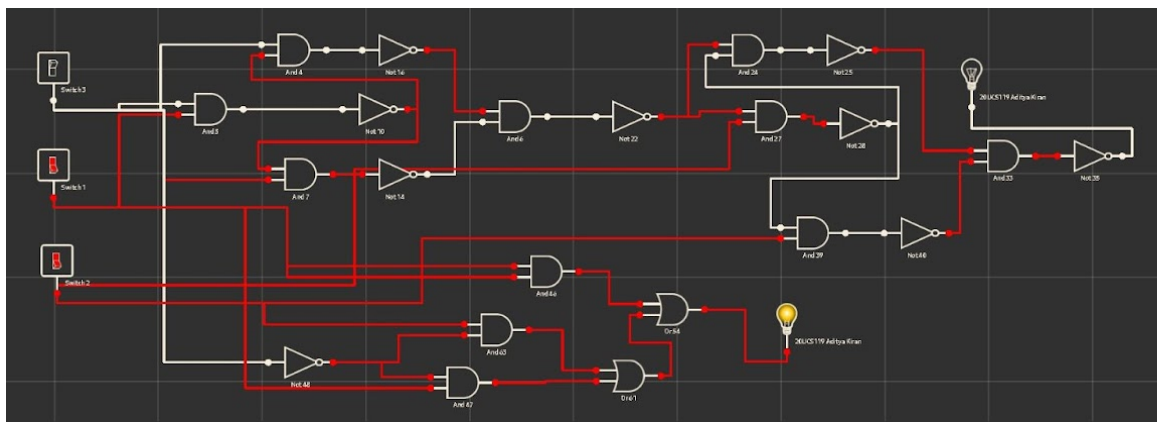
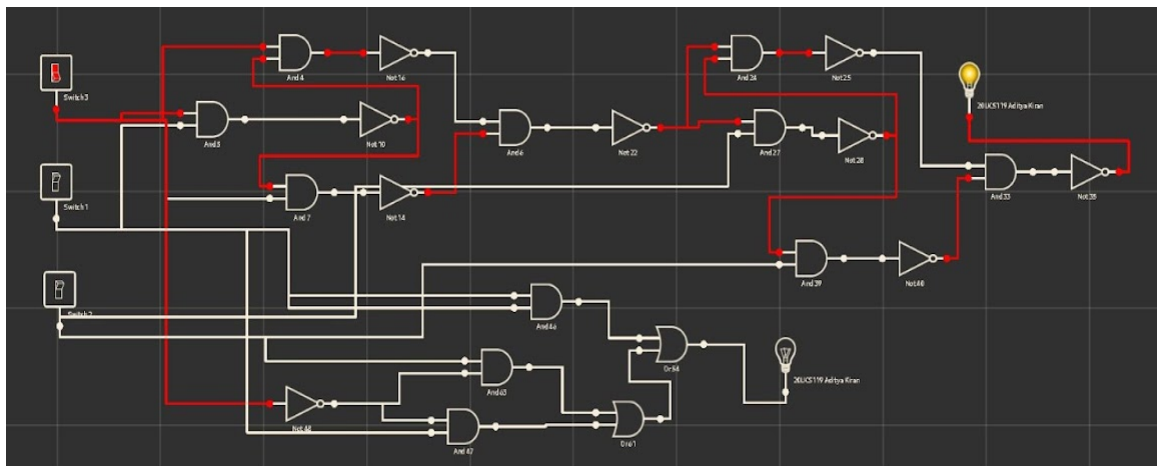
TRUTH TABLE:

Inputs		Outputs	
A	B	Diff	Borrow
0	0	0	0
0	1	1	1
1	0	1	0
1	1	0	0

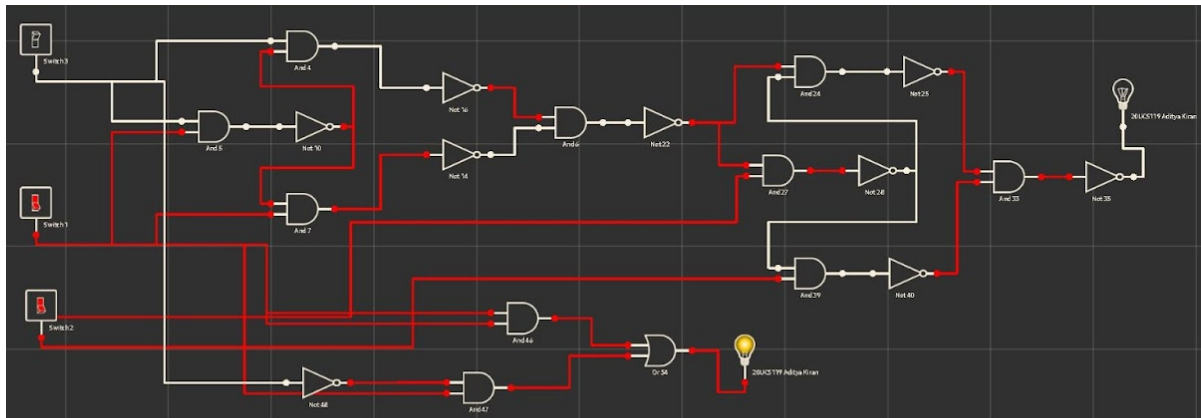
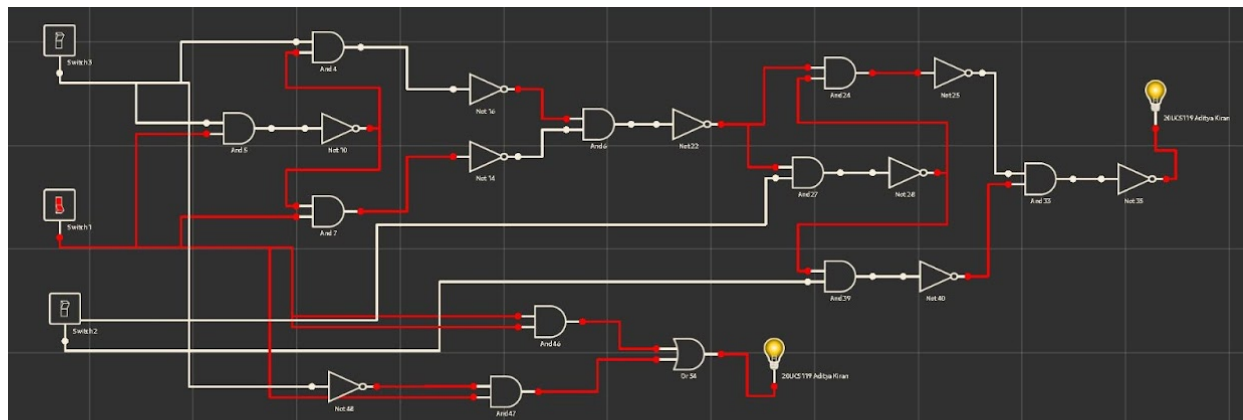
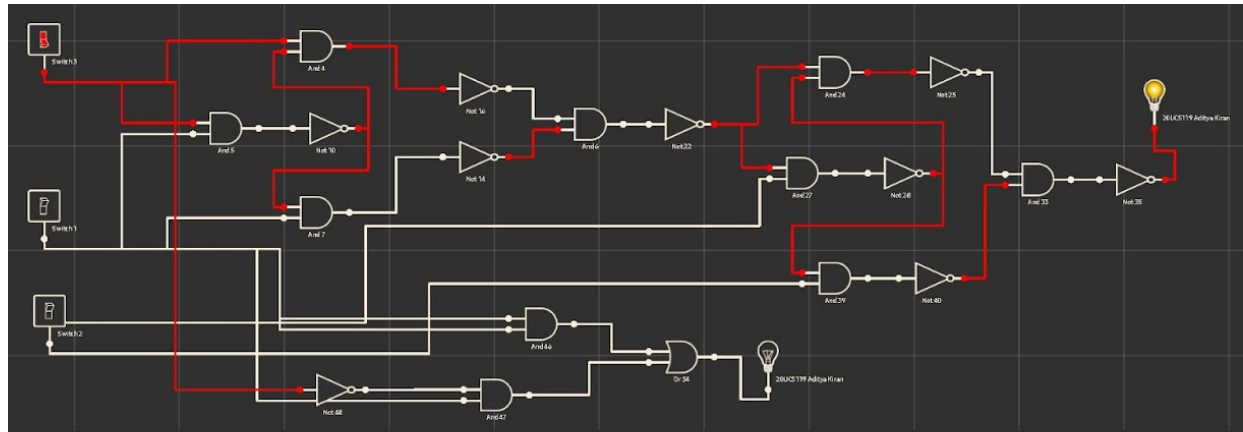
FULL Subtractor :

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

CASE 1: When $B\text{-out} = \bar{A}B + BB_{in} + \bar{A}B_{in}$



CASE 2: When C-out = $(A \oplus B)B_{in} + \bar{A}B$:



TRUTH TABLE:

A	B	Bin	Difference(D)	Borrow(Bout) $AB + BB_{in} + AB_{in}$	Borrow(Bout) $(A \oplus B)B_{in} + AB$
0	0	0	0	0	0
0	0	1	1	1	1
0	1	0	1	1	1
0	1	1	0	1	1
1	0	0	1	0	0
1	0	1	0	0	0
1	1	0	0	0	0
1	1	1	1	1	1

Conclusion : Hence the functionality of half subtractor and full subtractor are verified.