# Lab 6

## To Demonstrate the Working of Binary Subtractor

***Note: You may draw all the logic diagrams with hand and paste the pictures here or on logicly software with your name, roll number & section mentioned in your workspace. Make sure that all of your connections are clearly visible and distinguishable.***

**Tasks**

1. **Construct a logic circuit for half and full subtractor with the help of truth table/Boolean expression. Also write the Boolean expression for output(s).**

Half Subtractor

a) Truth Table

| A | B | Difference | Borrow |
|---|---|---|---|
| 0 | 0 | 0 | 0 |
| 0 | 1 | 1 | 1 |
| 1 | 0 | 1 | 0 |
| 1 | 1 | 0 | 0 |

b) Boolean Expression (Simplified)

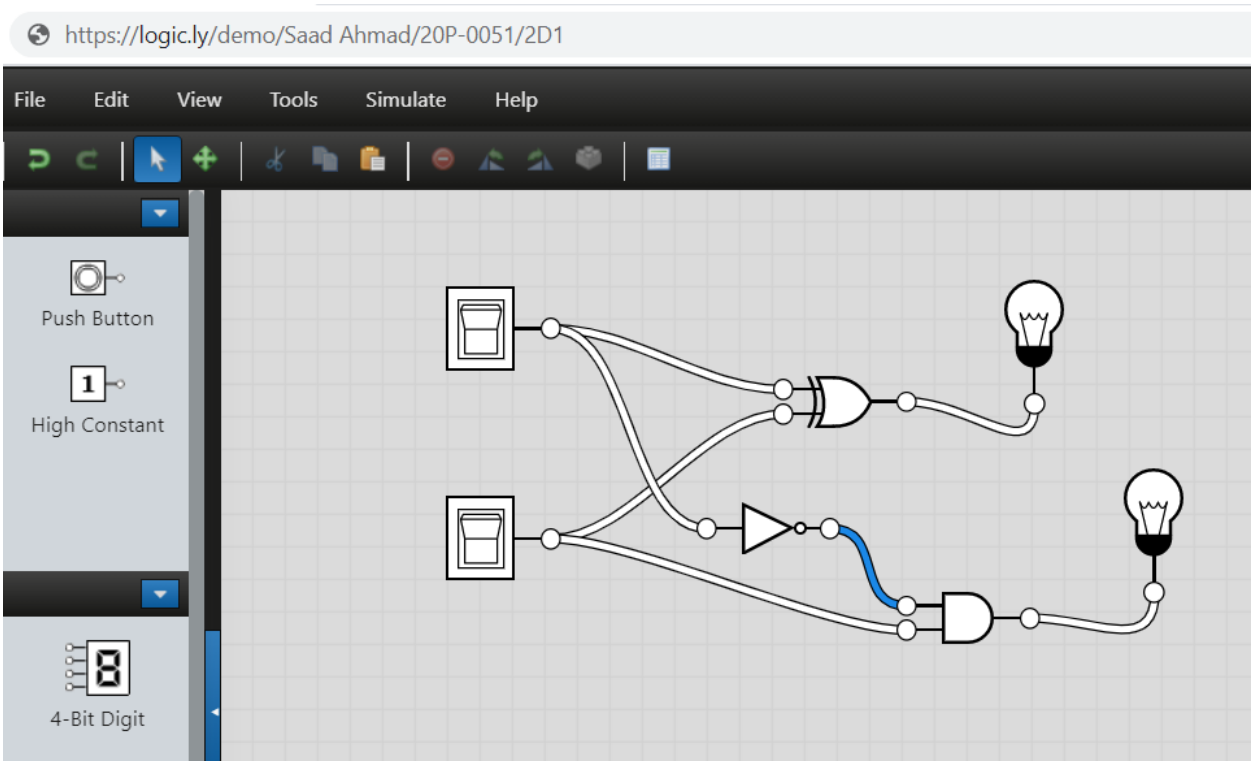
Difference:

$$D = A \text{ X-OR } B = A \oplus B$$

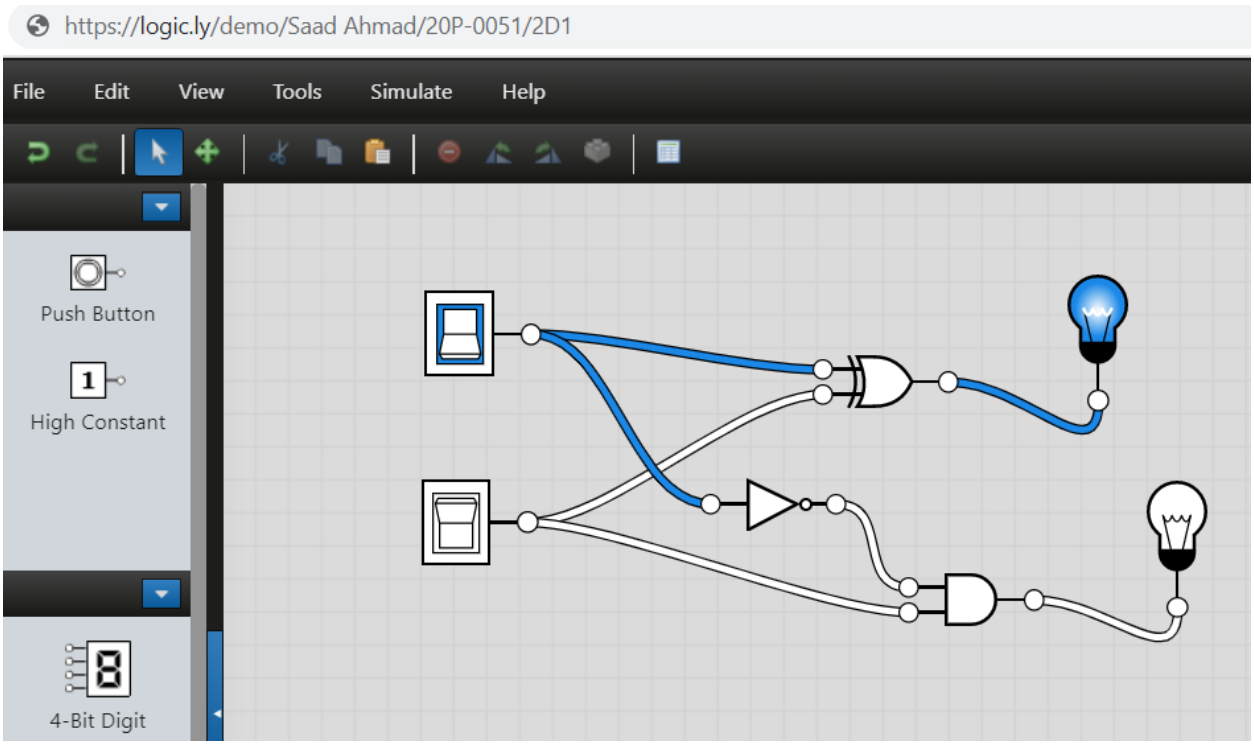
Borrow:

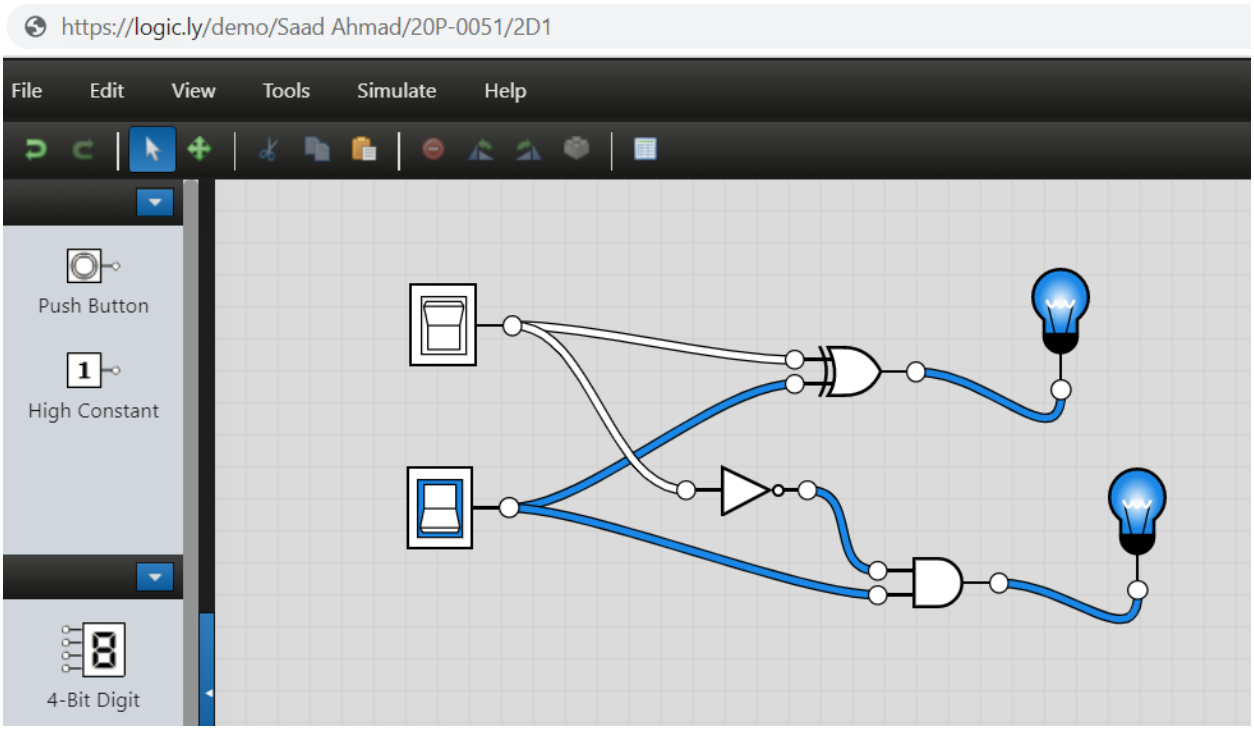
$$B = \text{NOT } A \text{ AND } B = A'.B$$

c) Logic Diagram




d) Software Simulation (Show here your results for each combination that gives a high output)






## Full Subtractor

a) Truth Table

| A | B | Borrow in | Difference | Borrow out |
|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 |
| 1 | 0 | 0 | 1 | 0 |
| 0 | 1 | 0 | 1 | 1 |
| 1 | 1 | 0 | 0 | 0 |
| 0 | 0 | 1 | 1 | 1 |
| 1 | 0 | 1 | 0 | 0 |
| 0 | 1 | 1 | 0 | 1 |
| 1 | 1 | 1 | 1 | 1 |

b) Boolean Expression (Simplified)

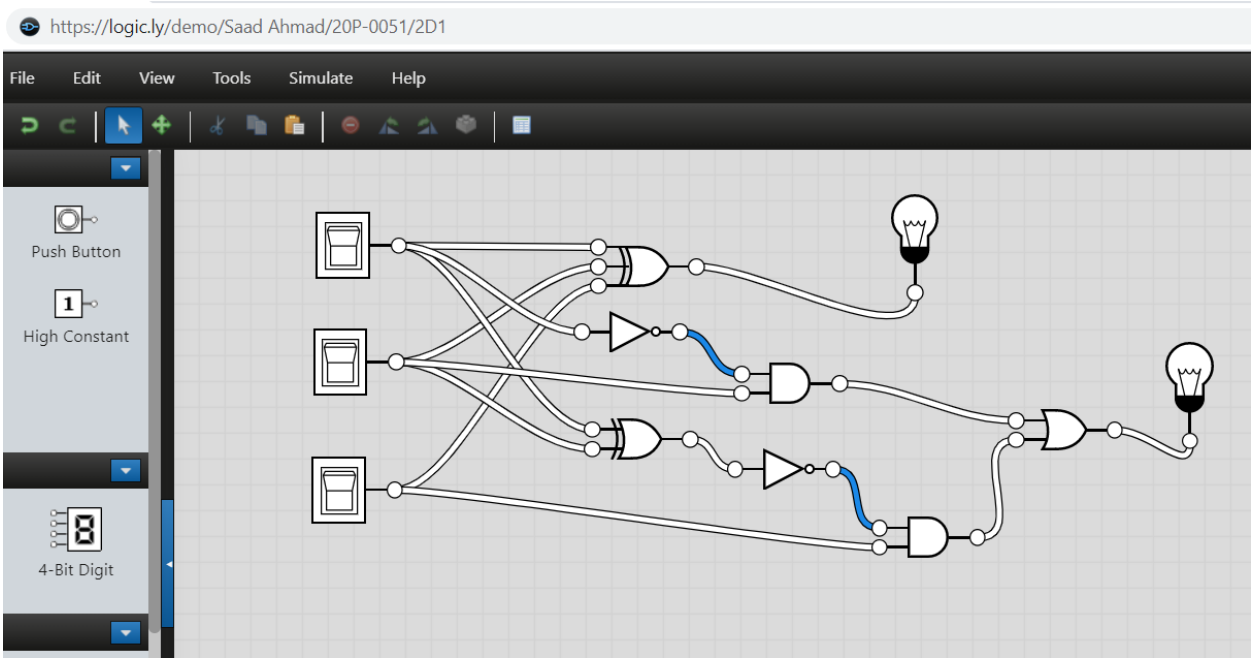
Difference:

D = (A X-OR B) XOR $B_{IN}$ = (A $\oplus$ B) $\oplus$ $B_{IN}$

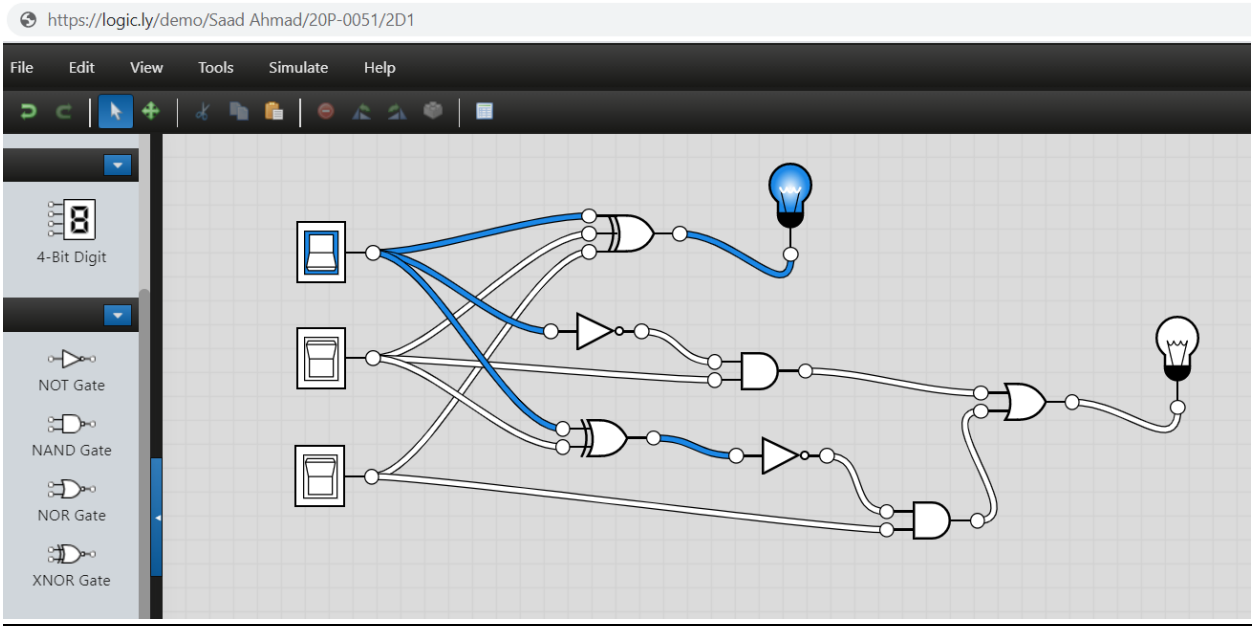
Borrow:

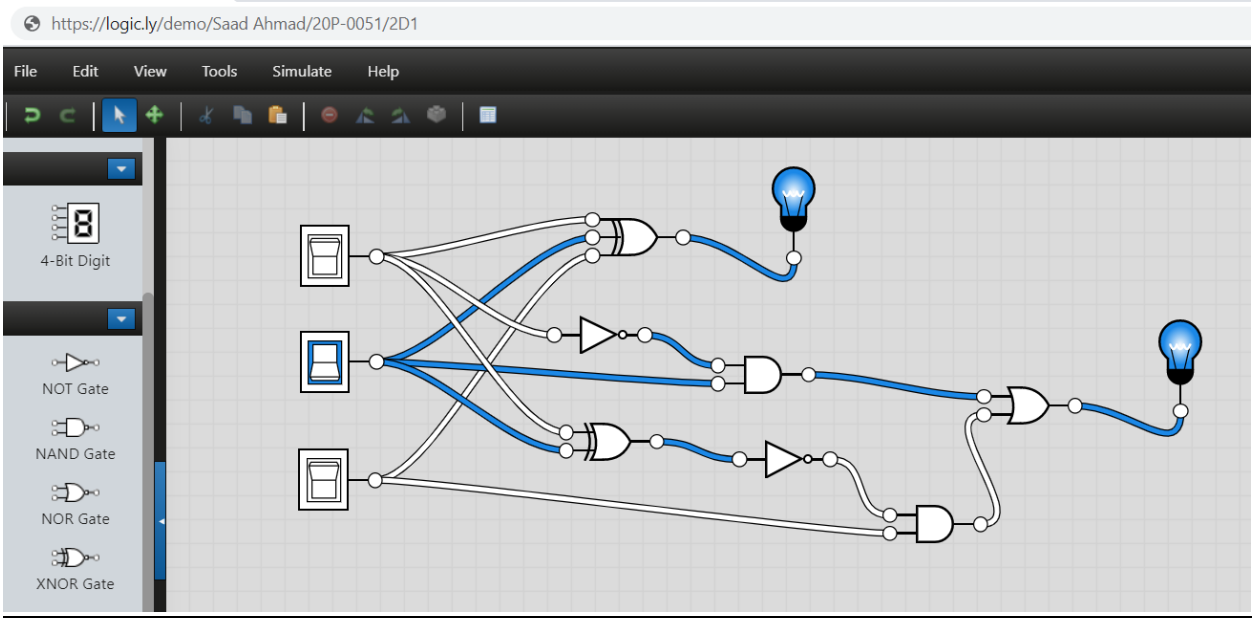
$B_{OUT}$ = (NOT A AND B) OR {NOT (A X-OR B)} $B_{IN}$=A'.B +{(A $\oplus$ B)}'$B_{IN}$

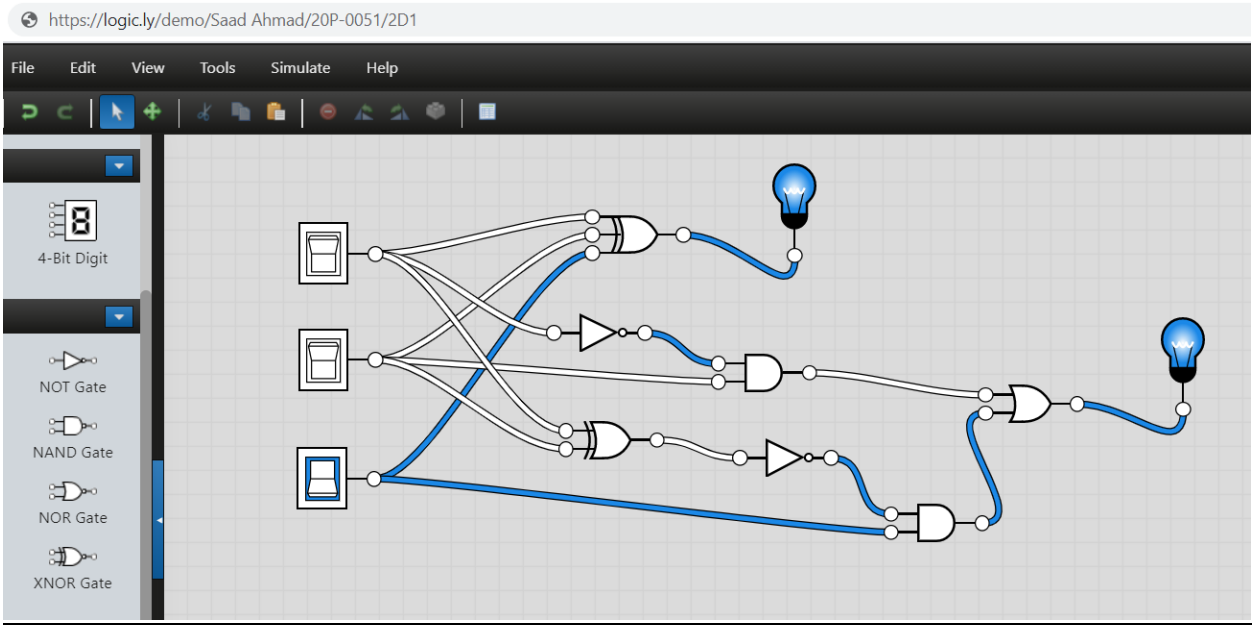
c) Logic Diagram

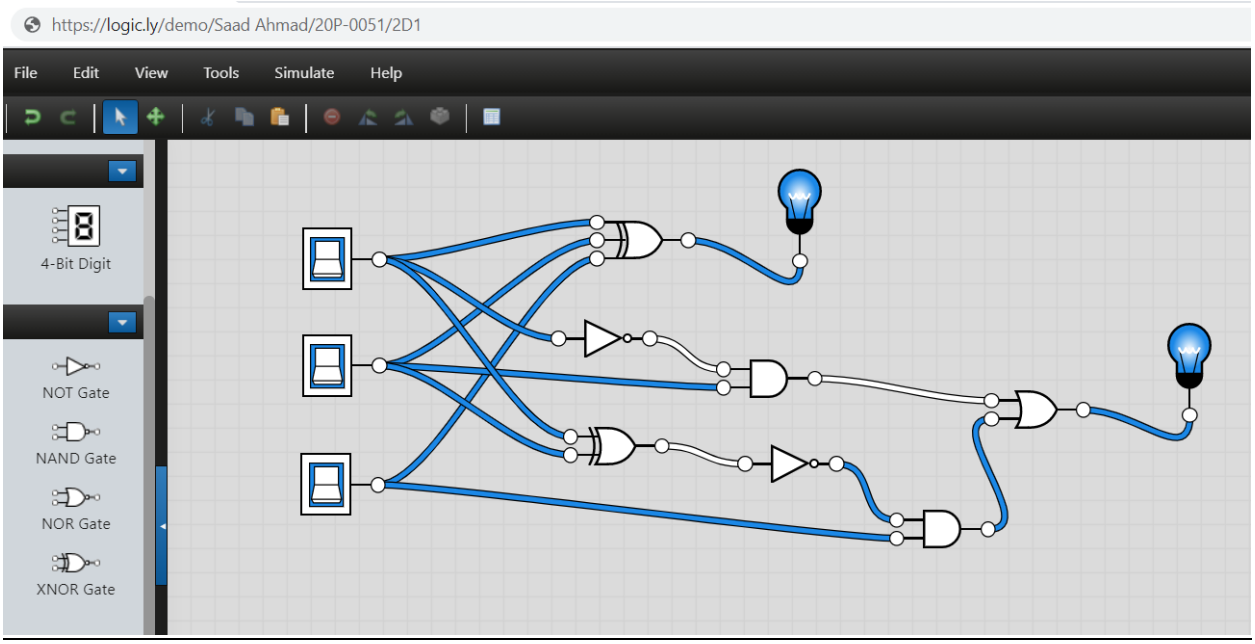


d) Software Simulation (Show here your results for each combination that gives a high output)




https://logic.ly/demo/Saad Ahmad/20P-0051/2D1
File
Edit
View
Tools
Simulate
Help
4-Bit Digit
NOT Gate
NAND Gate
NOR Gate
XNOR Gate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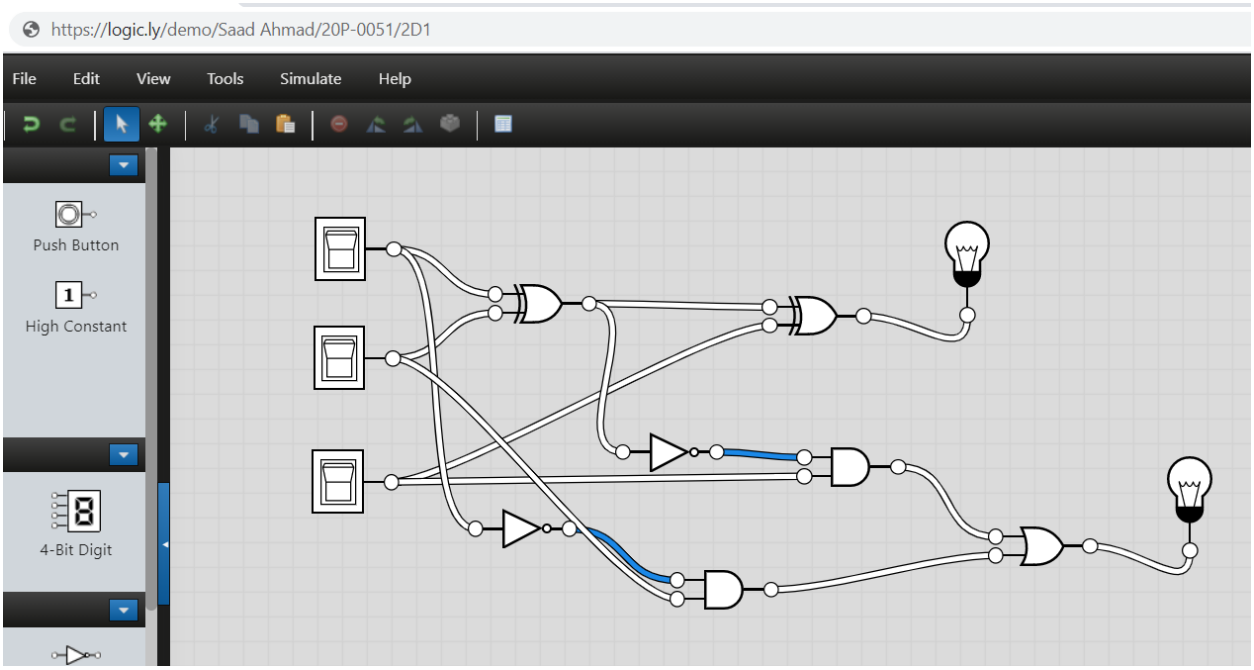
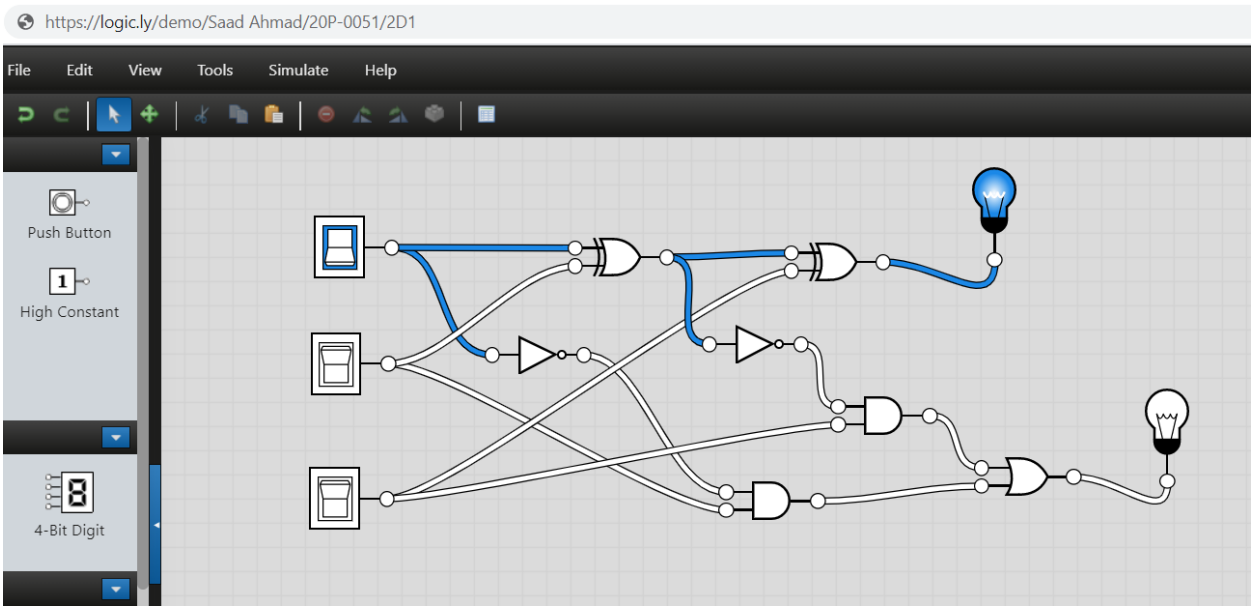
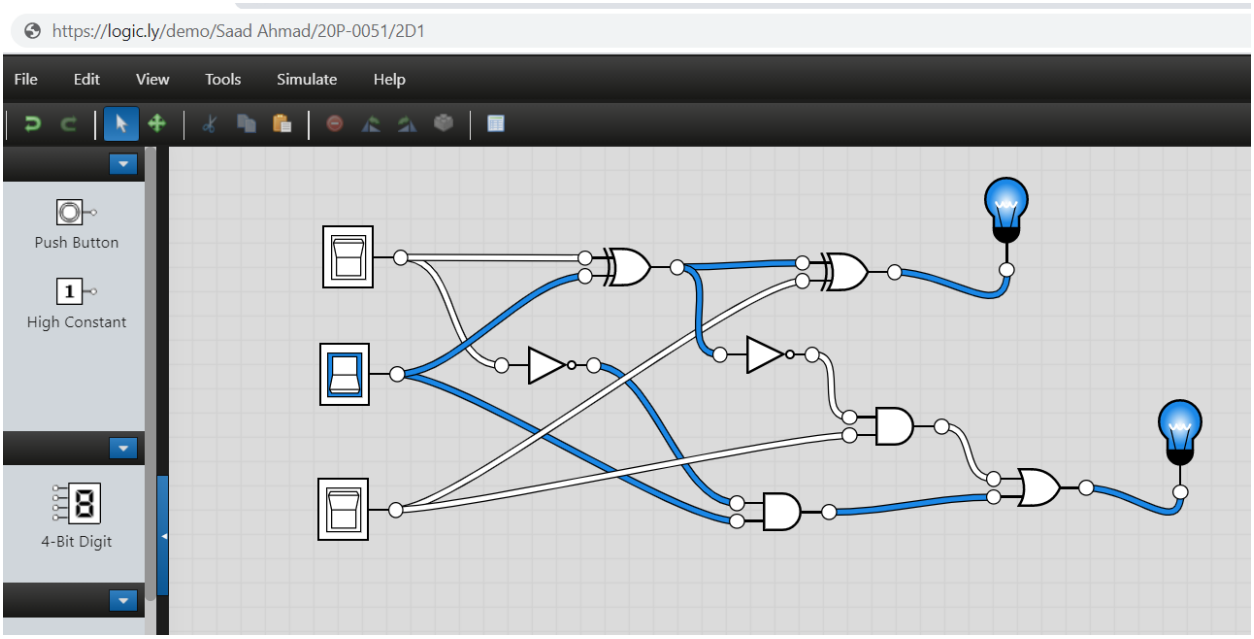
2. **A full subtractor can be implemented using 2-half subtractors. Demonstrate the logic diagram for the said circuit. Simulate your circuit for the verification of results.**

a) Logic Diagram of Full Subtractor using 2-Half Subtractor



b) Software Simulation (Show here your results for each combination that gives a high output)



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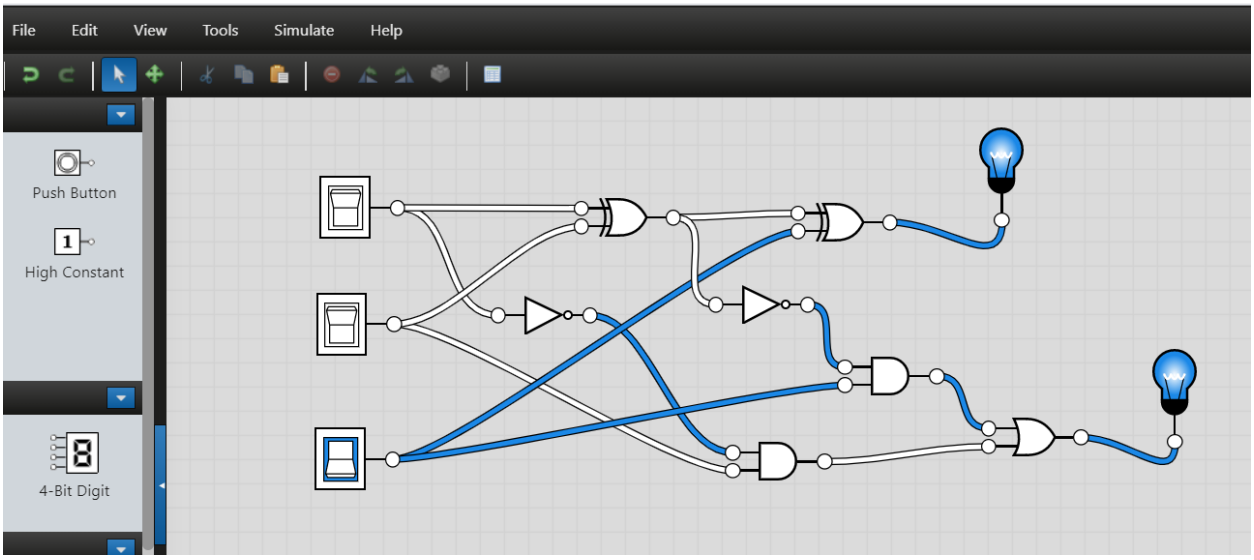


https://logic.ly/demo/Saad Ahmad/20P-0051/2D1