Lab 6

To Demonstrate the Working of Binary Subtractor

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

b) Boolean Expression (Simplified)

c) Logic Diagram

Q.NO1. Part(a) Truth table.

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

m_1
m_2

Part (b) Expression (Simplified)

$$D = m_1 + m_2$$

$$D = \bar{A}B + A\bar{B}$$

$$\boxed{D = A \oplus B}$$

The Equation of Difference
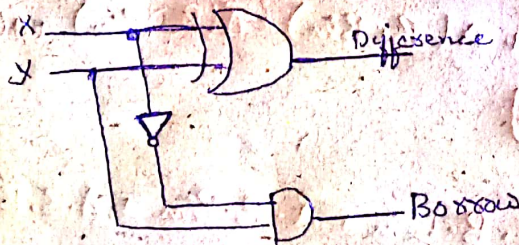
$$B = m_1$$

$$\boxed{B = \bar{A}B}$$

The Equation of Borrow.

Part (c) Logic diagram

X
Y → Difference

Borrow

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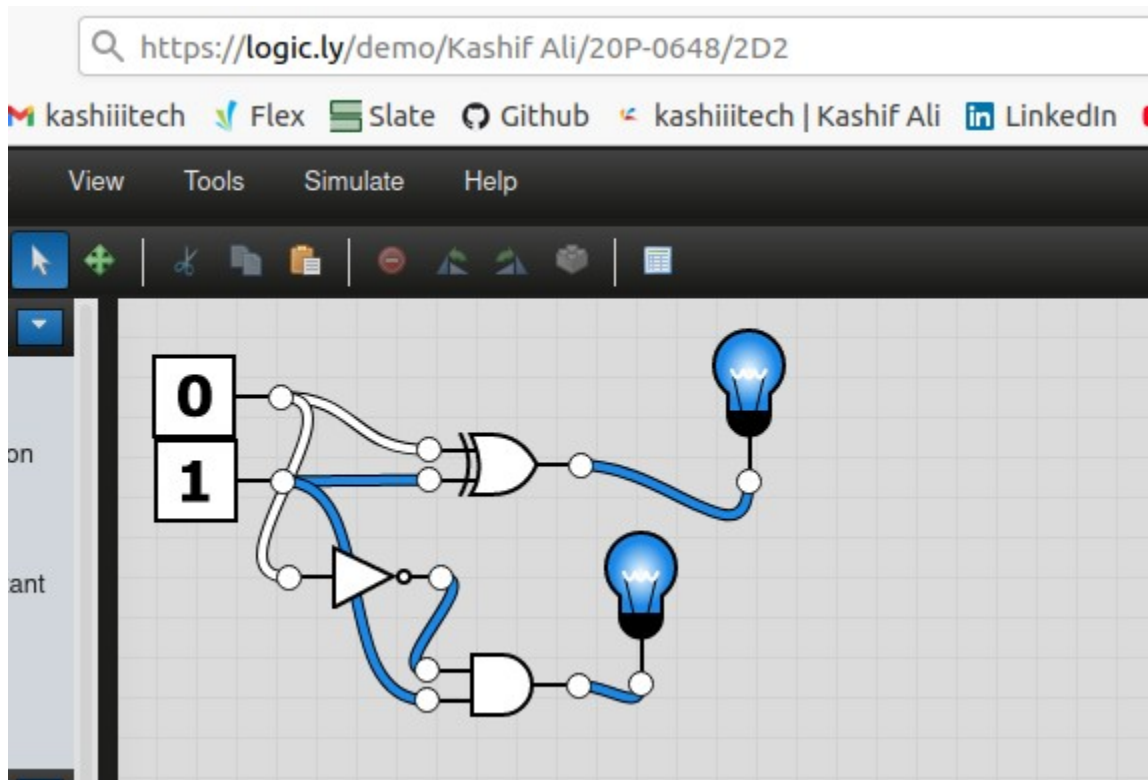
Full Subtractor

a) Truth Table

b) Boolean Expression (Simplified)

c) Logic Diagram

Full Subtracter

Part (a) Truth table

Inputs			Outputs	
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

Part (b) Expression (Simplified)

$$\text{Difference} = \overline{A}\cdot\overline{B}\cdot B_{in} + \overline{A}\cdot B\cdot\overline{B_{in}} + A\cdot\overline{B}\cdot\overline{B_{in}} + A\cdot B\cdot B_{in}$$

$$= \overline{A}(\overline{B}\cdot B_{in} + B\cdot\overline{B_{in}}) + A(\overline{B}\cdot\overline{B_{in}} + B\cdot B_{in})$$

$$= \overline{A}(B\oplus B_{in}) + A(B + B_{in}) = \overline{A}(B\oplus B_{in}) + A(\overline{B\oplus B_{in}})$$

$$\boxed{= A \oplus B \oplus B_{in}}$$

$$\text{Borrow} = \overline{A}\,\overline{B}\,B_{in} + \overline{A}\cdot B\cdot\overline{B_{in}} + \overline{A}\cdot B\cdot B_{in} + A\cdot B\cdot B_{in}$$

$$\text{Borrow} = \overline{A}\cdot\overline{B}\cdot B_{in} + \overline{A\cdot B\cdot B_{in}}\;\overline{A}\cdot B(\overline{B_{in}} + B) + A\cdot B\cdot B_{in}$$

$$\boxed{= B_{in}(\overline{A\oplus B}) + \overline{A}\,B}$$

Part (c) Logic Diagram.

A

B

Bin

Diff out

Borrow out

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

View   Tools   Simulate   Help
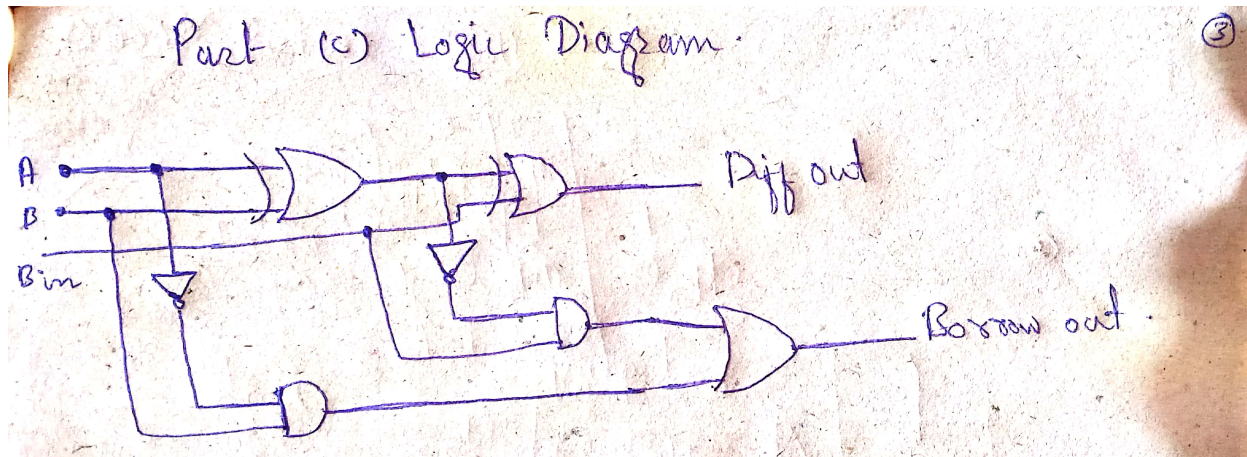
2. **A full subtractor can be implemented using 2-half subtractors. Demonstrate the logic diagram for the said circuit. Simulate your circuit for the verification of results.**

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

Q.No.3:- Part (a)

Logic diagram of full Subtractor using two half Subtractor
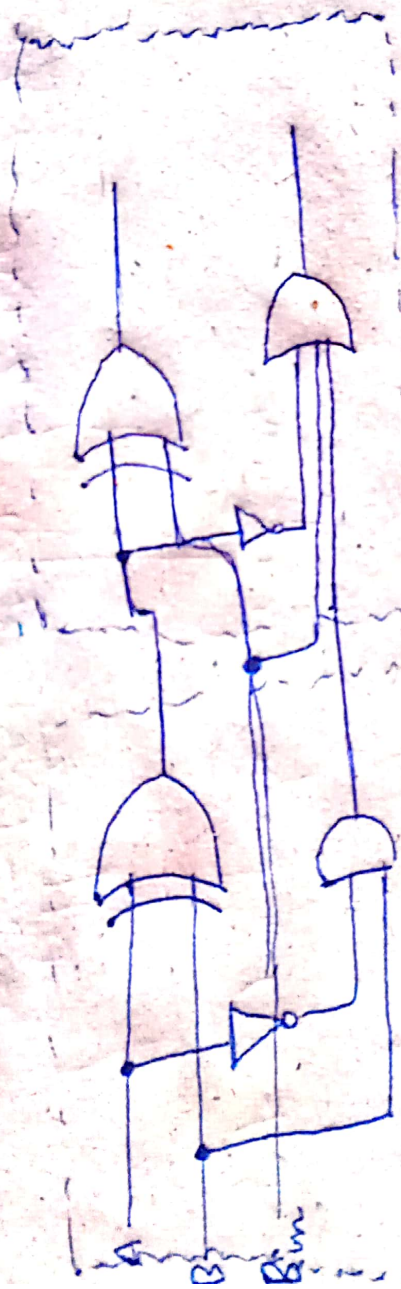
First half Subtractor

Second half Subtractor.

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