LAB 5 - REPORT

Designing & Implementation Of Adders & Subtractors

Aim: *Implementing the circuit for a given question using the ICs and constructing adders & subtractors*

1. Design and implement a half subtractor circuit using a minimum number of two (2) input NAND gates.

2. Familiarize 74LS83 IC and implement a controlled 3-bit adder/subtractor circuit which is controlled by signal CTRL using 74LS83 and a minimum number of 2-input gates.

Summary of the Experiment: *Solving the given circuit problem using the appropriate minimum number of NAND gates and also implementing the controlled 3-bit adder/subtractor by using 74LS83 IC by considering the given conditions such as the minimum number of 2-input gates*

Components Used:: *IC 7400,IC 7486,*

IC 74LS83,2Kohm resistor array -2, DIP

switches, LED displays, breadboard, multi-meter, and power supply.

Circuit Diagrams & Snapshots :

9/02/23

Lab - 5

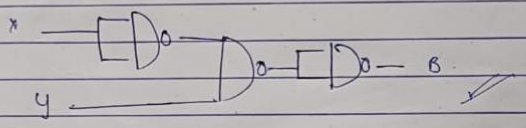
2-bit subtractor is

1)

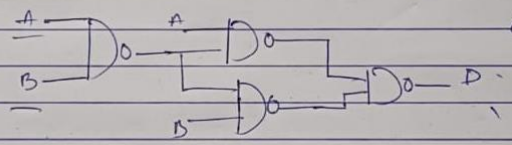
x	y	D	B
0	0	0	0
0	1	1	1
1	0	1	0
1	1	0	0

$D = x \oplus y$

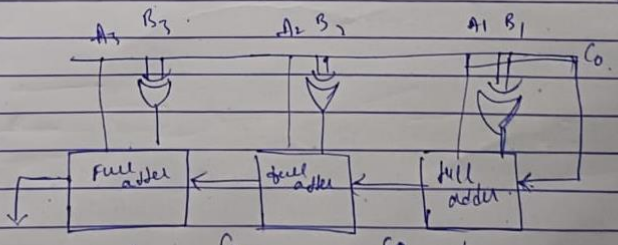
$B = \bar{x}y$



Half - subtractor



2)



5 101
-4 100
1 001

1100

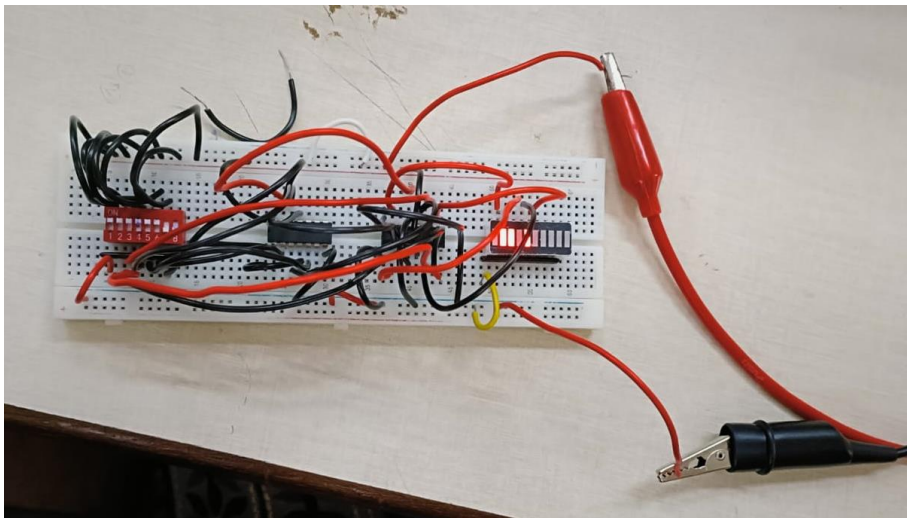
A2 A1 A0
1 0 0
1 0 1
1 0 0 1

MSB ← 1001 → LSB

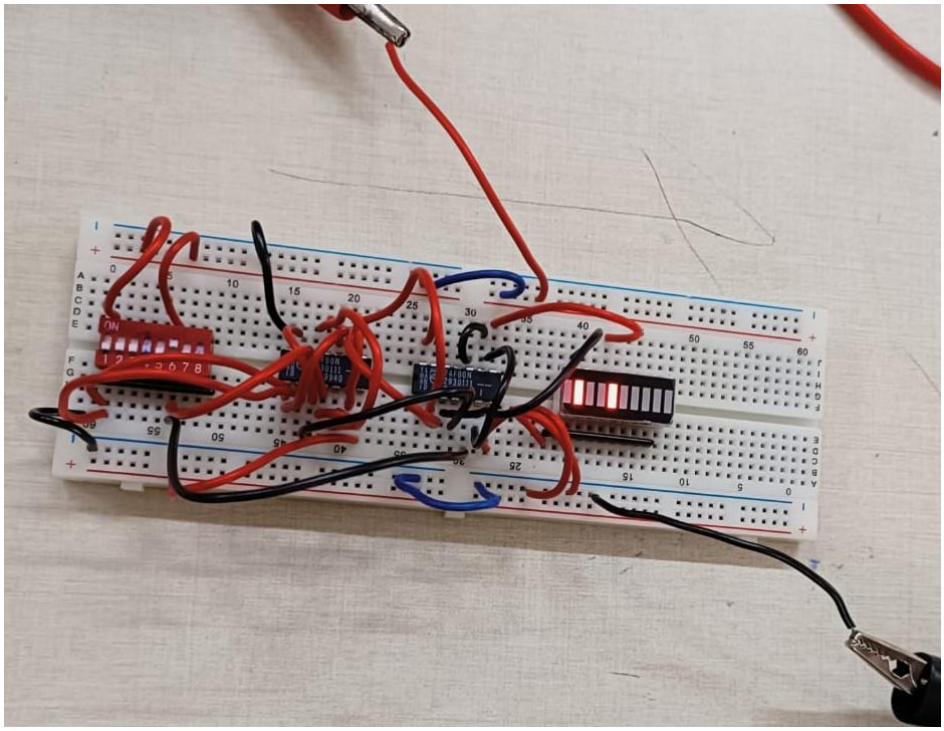
7 + 7
1 1 1
1 1 1
1 1 1 0

14 ⇒ 1110
MSB → LSB

Half Subtractor



3-Bit Adder/Subtractor



Results and Discussions :

- *X and Y are inputs, and D and B are the difference and borrow.*

- *D=XY' + X'Y B=X'Y*
- *Here 3 NAND gates are required to get B as output and 4 to get D as output.*
- *So we require a minimum of 7 NAND gates to design half subtractor.*
- *To implement a 3-bit adder/subtractor we need 74LS83 IC, and 3 XOR gates i.e., one 7486 IC.*
- *If CTRL=0 then the circuit acts as an adder and for 1 it acts as a subtractor. We use XOR gates to get the 2's complement.*
- *We use (A1 B1) (A2 B2) and (A3 B3) of 74LS83 IC.*

Conclusion:

- *Half subtractor is implemented using a minimum of 7 NAND gates.*

- *A 3-bit adder/subtractor is implemented using 74LS83 IC which is controlled by signal CTRL using 74LS83 and 3 XOR gates of.*

- *For CTRL=0 adder is implemented and for 1 subtractor is implemented.*