DIGITAL SYSTEMS

LAB-5

4-bit Adder and Subtractor

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Aim: To design a simple half adder and a controlled 4-bit-adder/subtractor.

Summary of the experiment:
Implementing adder+subtractor circuit using 74LS83 IC

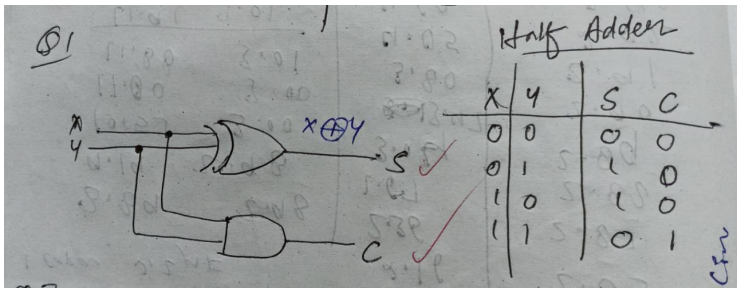
Components used: IC (74LS83), switches, LED, breadboard, power supply, 1k ohm resistor

Truth Table:

X	Y	S	C
0	0	0	0
0	1	1	0
1	0	1	0
1	1	0	1

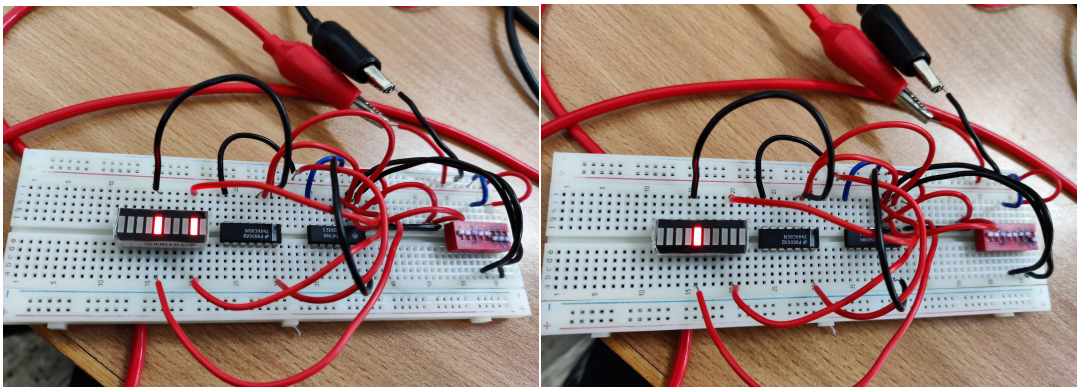
Design:
We got two question in which
first one is :
Design and implement a half adder circuit using a minimum number of 2 input gates.

- We made circuit diagram of half adder ,there are 1 XOR and 1 AND gate in it.
- Make the connections on breadboard , supplied inputs X,Y through switch.



Hardware:

Half-Adder



The second question is :
Familiarize 74LS83 IC and **implement a controlled 4-bit adder/subtractor** circuit which is controlled by **signal CTRL** using 74LS83 and **minimum number of 2-input gates.**

In this we have to design a 4-bit adder/subtractor with minimum number of 2-input gates,which is controlled by signal CTRL .
Design:

- In this firstly we made circuit diagram of 4-bit adder/subtractor.
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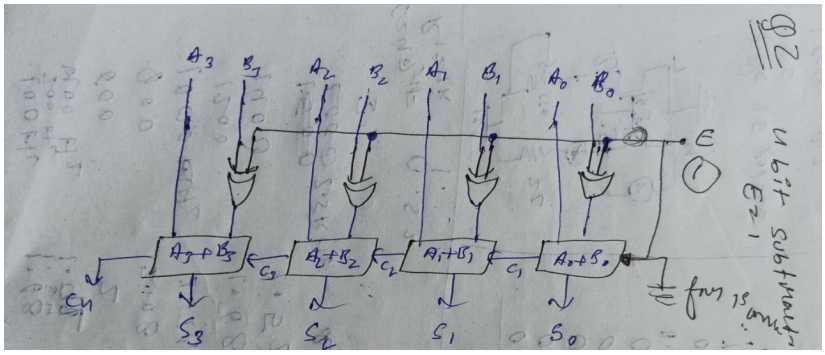
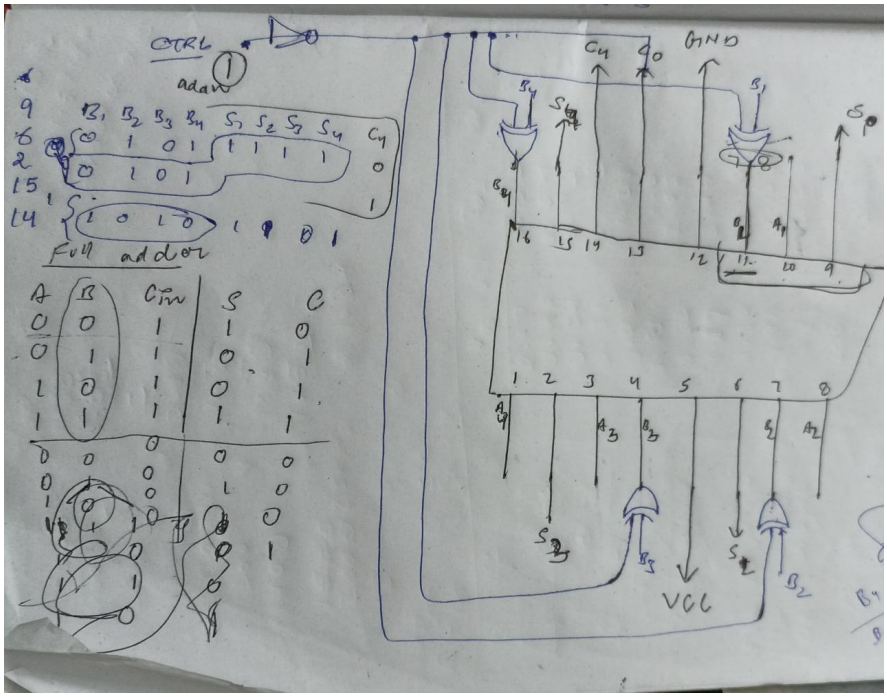
- 

- 

- In it there are 4 full adder used for which we required 4 XOR gates.
- And since it was controlled by CTRL we required one NOT gate as to reverse the output.(i.e according to below equation for it to work as adder CTRL should be 0 but in our question addition was done with CTRL=1 and vice-versa)
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CTRL	OPERATION
1	Addition
0	Subtraction (either 1's or 2's complement method)

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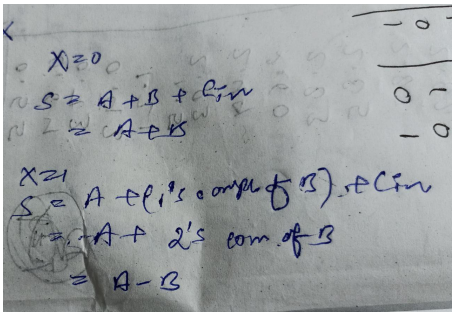
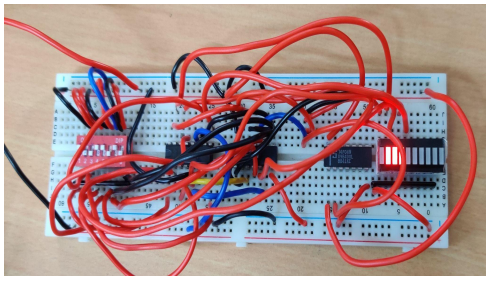


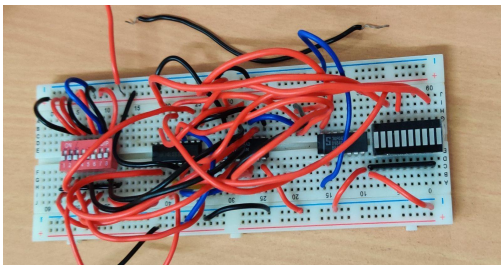
- For 1’s and 2’s complement we have to connect we have to connect
- Co/pin 13 of IC to GND for **1’s complement** to make it 0
- Co/pin 13 of IC to VCC for **2’s complement** to make it 1
- Since it is 4-bit adder /subtractor we have to provide 8 inputs and we will get 5 outputs.
- Input and outputs we managed through switch and LED .

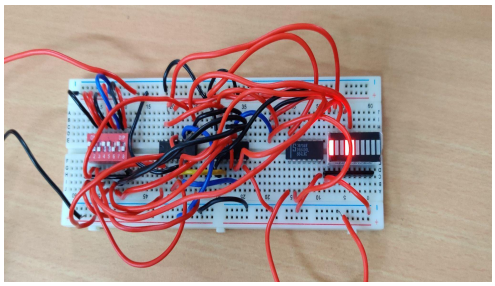
Truth table:

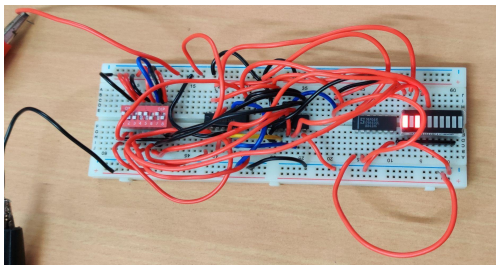
A	B	Cin	S	C
0	**0**	**1**	**1**	**0**
0	**1**	**1**	**0**	**1**
1	**0**	**1**	**0**	**1**
1	**1**	**1**	**1**	**1**
0	**0**	**0**	**0**	**0**
0	**1**	**0**	**1**	**0**
1	**0**	**0**	**1**	**0**
1	**1**	**0**	**0**	**1**

4-bit Adder/Subtractor hardware









Discussions:
It is there in design section

Conclusion/results:
In this experiment we learnt how to make full adder and subtractor with 2-bit
And also 4-bit adder/subtractor, and learnt how to control signal in 4-bit adder/subtractor with CTRL signal, by giving 1/0 to it.
We learnt how to work with a 16 pin IC, as it is quite different with 8/14 pin.