North South University
Department of Electrical & Computer Engineering

LAB REPORT

Course Name: **CSE332L- Computer Organization and Architecture Lab**

Experiment Number: 02

Experiment Name: Design of a 4-bit Arithmetic unit.

Experiment Date: 06-03-2021

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Section: 07

Group Number: Not form yet

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Remarks:	

TITLE: EXP: LAB 02 – DESIGN A 4 BIT ARITHMETIC UNIT

OBJECTIVE:

- To learn how to deal with an ALU(arithmetic logic unit). Using a 4-bit arithmetic unit.
- To test the ALU's operation in an experimental setting
- Logisim program was used to design a 4-bit arithmetic unit.
- To carry out a few micro-operations. (Add, Add with carry, Subtract, Subtract with borrow Increment, Decrement, Transfer).

LIST OF EQUIPMENT:

- Trainer board
- Breadboard
- Wires for connection
- IC 7404(six NOT gates),7483(4 bit adder), 74F153(Dual 4:1 mux).

THEORY:

You will build a 4-bit arithmetic unit, which is a component of an ALU, in this experiment. The arithmetic unit will add and subtract two 4-bit variables, A and B, as well as increment, decrement, and convert all of the inputs.

Add: Each bit of input A is applied to the corresponding bit of input B, and the sum, as well as any carry out, appears at the output of each complete adder.

- Add with carry:

  Each bit of input A and B is applied to the input carry,and the sum, as well as any carry out, appears at the output of each complete adder.

- Subtract:

  Each bit of input B is subtracted from the corresponding bit of input A, and the difference, along with any borrow out, occurs at the output of each complete adder.

- Subtract with borrow:

  With borrow, each bit of input B is subtracted from A. The performance displays the difference as well as the borrow out.

- Increament A:

  Each full adder's output contains the product of increasing each bit of A by one.

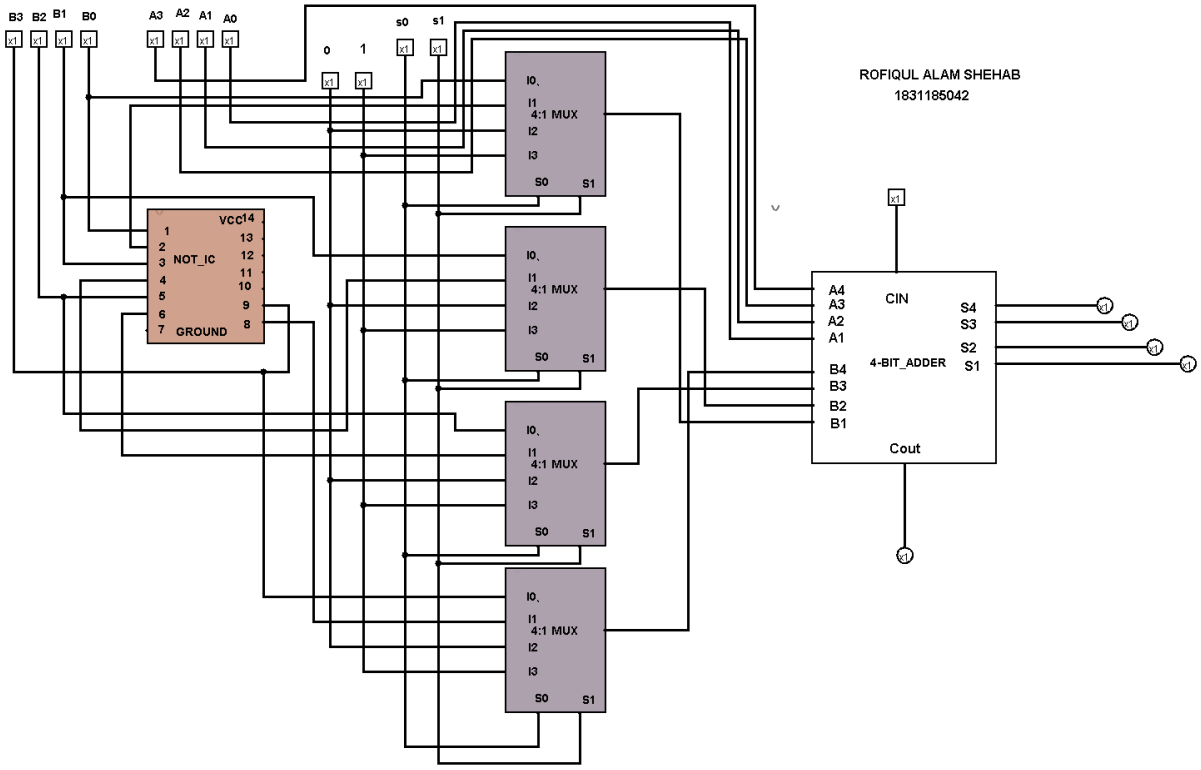
- Decreament A:

  Each bit of A is reduced by one, and the effect appears at the full adder's output.

- Transfer A:

  Each bit of A appears unaltered at the output of each complete adder.

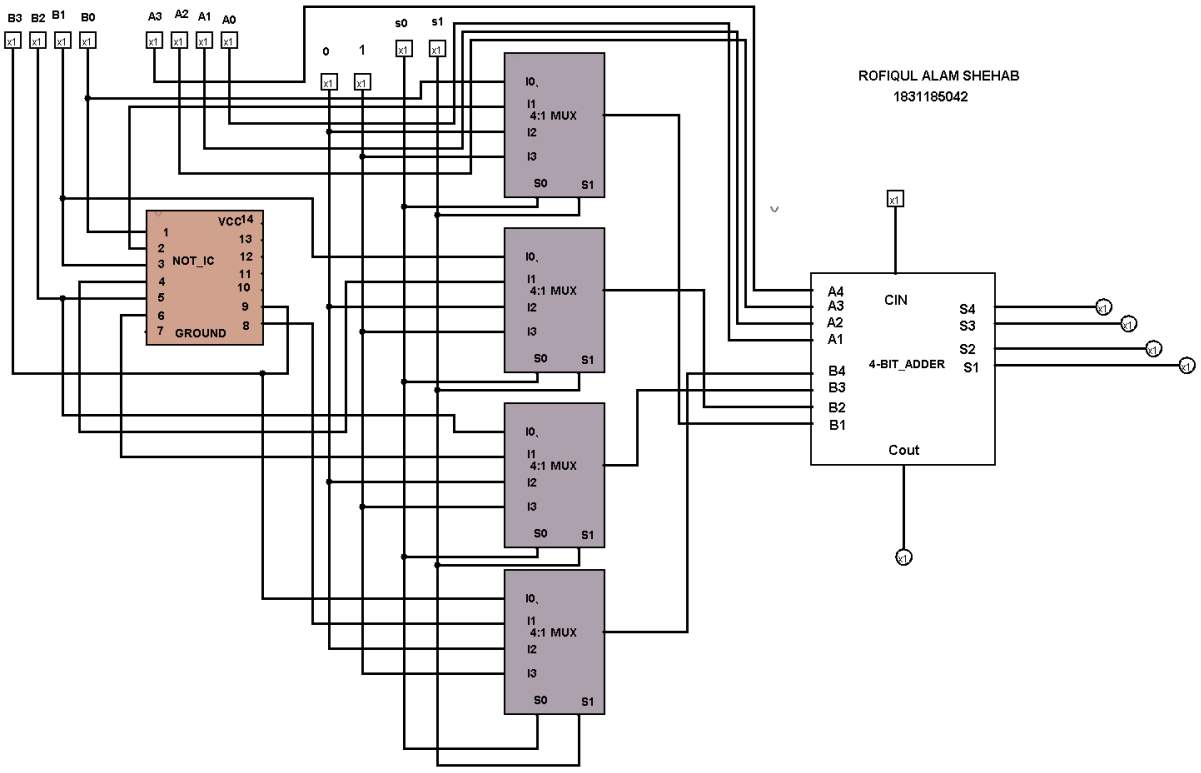
LOGIC CIRCUIT DIAGRAM:



DATA TABLE:

S1	S0	Cin	A3	A2	A1	A0	B3	B2	B1	B0	Cout	D3	D2	D1	D0	Micro operation
0	0	0	0	0	0	1	0	0	0	1	0	0	0	1	0	Add
0	0	1	0	0	1	1	0	1	0	0	0	1	0	0	0	Add with Carry
0	1	0	0	0	1	0	1	1	0	0	0	0	1	0	1	Subtract with Borrow
0	1	1	0	1	1	1	0	1	0	0	1	0	0	1	1	Subtract
1	0	0	1	0	1	1	0	1	0	0	0	1	0	1	1	Transfer A
1	0	1	0	1	0	0	0	0	0	0	0	0	1	0	1	Increment A
1	1	0	1	0	1	0	1	0	0	0	1	1	0	0	1	Decrement A
1	1	1	1	0	0	1	0	1	1	1	1	1	0	0	1	Transfer A

IC CIRCUIT DIAGRAM:



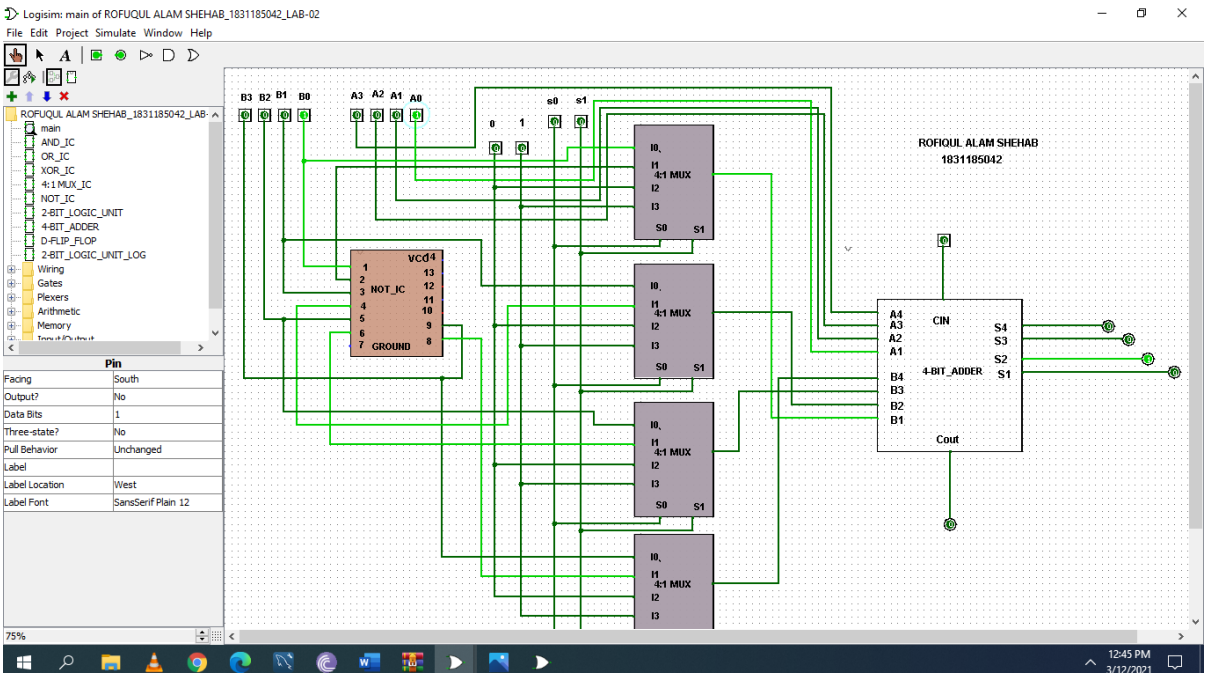


FIGURE: OUTPUT FOR ADD

DISCUSSION:

The main purpose of this experiment is how to design a 4-bit arithmetic unit which is one portion of the arithmetic logic unit. Here we have used different kinds of IC Such as NOT IC(7404),4:1 MULTIPLEXER IC. Therefore,Add, Add with carry,Subtract,Subtract with borrow,Subtract,Transfer,Increament,Decrement that are the micro-operations we have used in this experiment. After that, the most important thing that we have used selection bits for the multiplexer. It has work changing the output result.Inputs are passage from A,B and NOT to the multiplexer then it has now progressed to the 4-bit full adder, with the outputs shown in D3, D2,

D1, and D0. I also modified the selection bits of the multiplexers S1 and S2 during showing the performance of the micro-operations to display the output. The Cout, on the other hand, is for takeout. I've compiled a list of certain fundamentals.

I've used Logisim simulation to test binary operations.Here I have attached some operations which are from this experiment .

ADD: Each bit of input A and B is applied to the input carry,and the sum, as well as any carry out, appears at the output of each complete adder.

0010+0001=0011

2 + 1= 3

S0=0

S1=0

Cin=0

- **SUBTRACT WITH BORROW**:

With borrow, each bit of input B is subtracted from A. The performance displays the difference as well as the borrow out.

0010-1100=0101

S1=0

S0=1

Cin=0

Cout=0

- INCREAMENT :

Each full adder's output contains the product of increasing each bit of A by one.

Input of A = 0100

Input of B=0000

Output=0101

S0=0

S1=1

Cin=0

Cout=0

Similarly we can complete Adder with carry ,increament ,Decreament,Transfer using our knowledge what we have learn from this experiment. At the end, I can say that this experiment taught me how to design a 4-bit arithmetic unit using various types of integrated circuits and how to perform some micro-operations such as addition, subtraction, increment, decrement. I'm hoping that the experiment would assist me in creating some real circuit .