

North South University
Department of Electrical & Computer Engineering

LAB REPORT

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

Experiment Number: 02

Experiment Name: **Design a 4 Bit Arithmetic Unit**

Experiment Date: 22 June, 2022

Report Submission Date: 28 June, 2022

Section: 02

Group Number:

Student Name: Md. Baker

Score

Student ID: **1911672642**

Remarks:

Exp: Lab 02 – Design a 4 Bit Arithmetic Unit

Objectives:

In this experiment I will construct a 4-bit arithmetic unit. I will use this 4-bit arithmetic unit to add two numbers of 4-bit variables. Let, the numbers are A and B. So, the main objective of this experiment is to construct this circuit. After that I will be able to,

- Add inputs
- Subtract inputs
- Increment any input
- Decrement any input
- Transfer any of the input

Equipment List:

- Trainer Board
- IC 7404
- IC 7483
- IC 74LS153
- Wires

Theory:

Arithmetic Logic Unit is a common operational unit with number of storages registers connected to it, using which it performs micro-operations. To perform a microoperation, the contents of specified registers are placed in the inputs of the common ALU. The ALU performs an operation and the result of the operation is then transferred to a destination register. The ALU is a combinational circuit so that the entire registers transfer operation from the source register through the ALU and the destination register can be performed during one clock pulse period.

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

Table: 4-bit Arithmetic Unit Micro-operation

Logic Circuit Diagram:

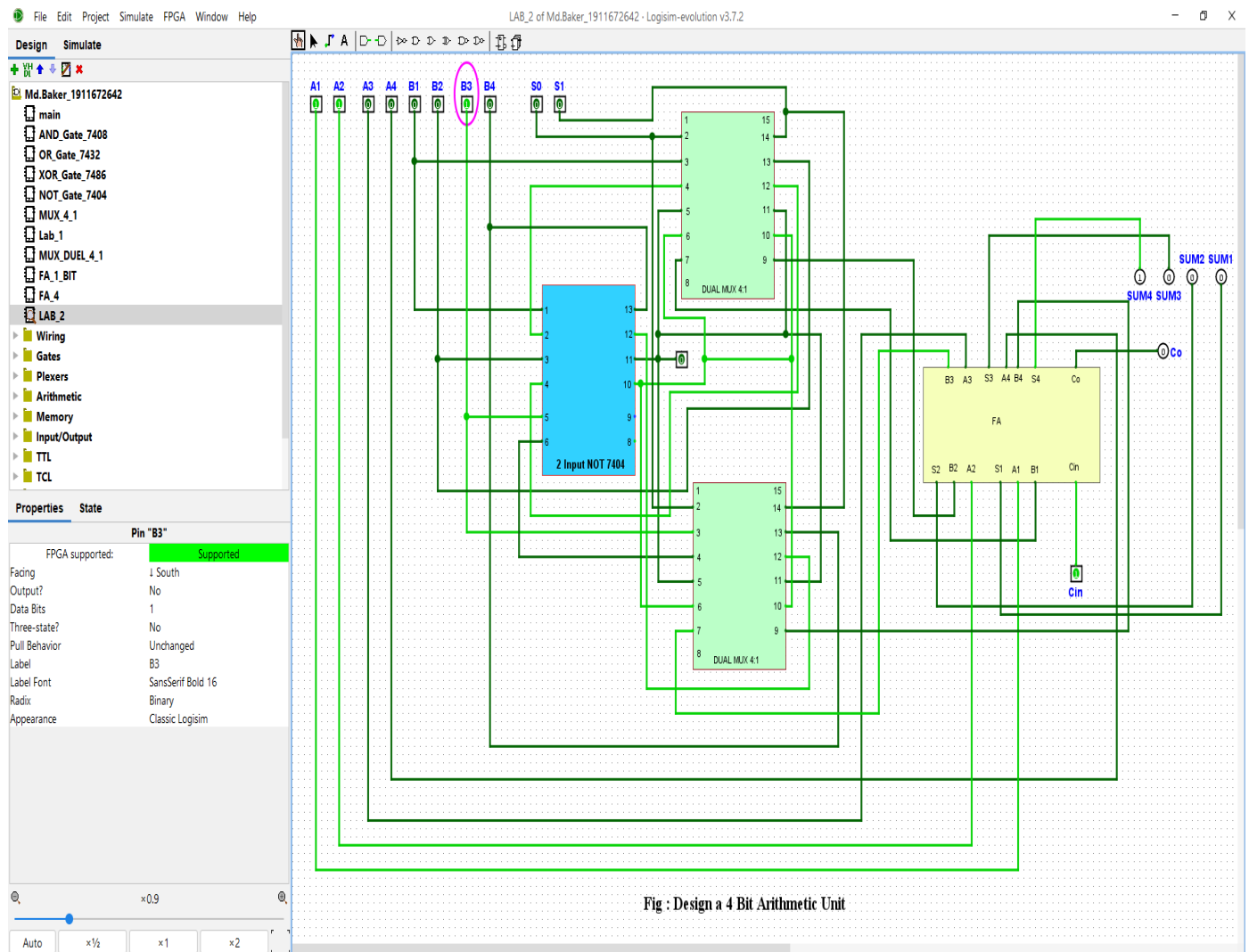


Fig: 4-bit Arithmetic Unit Circuit Diagram

Discussion:

In this experiment I have constructed a 4-bit arithmetic unit. Which is a part of arithmetic logic unit or ALU. I have used this arithmetic logic unit to add, subtract, increment, decrement and transfer two numbers. I have used 2 Dual multiplexers also I need 4 full adders because a full adder has one bit output & carry.

I built 2 Dual 4:1 MUX and also 4 Full Adder into one IC using simulation.

I have two selector pin S_1 , S_0 . I can control the operation using these selectors of the MUX. Let, two number A and B. I have another pin C_{in} which is for input carry.

If the selector is $S_1 = 0$, $S_0 = 0$ our circuit will ADD A and B. If $S_1 = 0$, $S_0 = 1$ it will show the difference or subtract two number. We simply need 2's complement, means complement then plus 1, when we need to do subtract. If $S_1 = 1$, $S_0 = 0$ and $C_{in} = 0$ it will transfer the value of A in the output if $C_{in} = 1$, the value of A will increase. If $S_1 = 1$, $S_0 = 1$ and $C_{in} = 0$ It will also transfer the value of A but if $C_{in} = 1$ it will decrease the value of input A.

After all of that I included data into 4-bit Arithmetic Unit Micro-operation table and verify them.