North South University

Department of Electrical & Computer Engineering

Lab Report

Experiment No:	3
Experiment Title:	Design of a 2-bit Arithmetic unit
Course Code:	**CSE332L**
Course Name:	**Computer Organization & Architecture Lab**
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Date of Experiment:	24/3/2021
Date of Submission:	24/3/2021

★ Objectives:

- Constructing a 2-bit arithmetic unit
- Understanding use of full-adders and 4:1 multiplexers to implement 2-bit arithmetic unit.

★ Equipment:

- Trainer board
- IC 7404
- IC 7483
- IC 74f153
- Wires for connection

★ Block diagram:

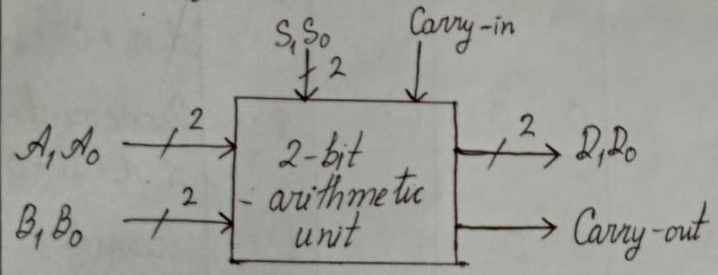


Figure 1: Block diagram for 2-bit arithmetic unit

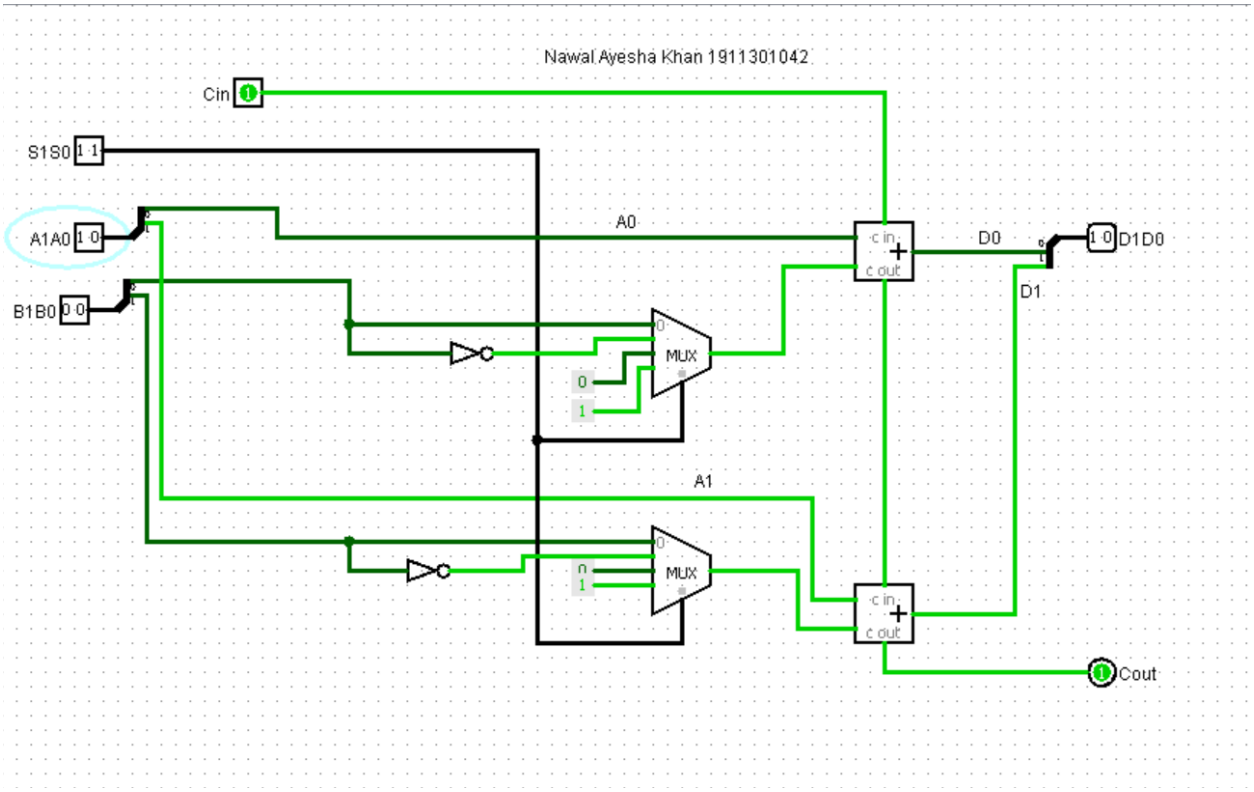
★ Function table:

S_1 S_0	C_{in}	A_1 A_0	B_1 B_0	D_1 D_0	C_{out}	Micro-operation
0 0	0	0 0	0 1	0 1	0	Add $A_1A_0 + B_1B_0 + 0$
0 0	1	1 0	0 1	0 0	1	Add with carry $A_1A_0 + B_1B_0 + 1$
0 1	0	0 1	0 0	0 0	1	Subtract with borrow $A_1A_0 + \bar{B}_1\bar{B}_0 + 0$
0 1	1	1 1	0 1	1 0	1	Subtract $A_1A_0 + \bar{B}_1\bar{B}_0 + 1$
1 0	0	1 1	0 1	1 1	0	Transfer A $A_1A_0 + 00 + 0$
1 0	1	1 0	1 0	1 1	0	Increment A $A_1A_0 + 00 + 1$
1 1	0	1 1	0 0	1 0	1	Decrement A $A_1A_0 + 11 + 0$
1 1	1	1 0	0 0	1 0	1	Transfer A $A_1A_0 + 11 + 1$

Table 1: Function table for experimental values and micro-operations for 2-bit arithmetic unit

Circuit diagram:

Figure 2: Circuit diagram of 2-bit arithmetic unit



★ Discussion: In this experiment, we learned about the theory behind the 2-bit arithmetic unit using 4:1 multiplexers and full-adders. We tested the inputs and validated them according to the function table. Multiplexers are used to choose between inputs, and the outputs are added to full adder with the needed carry-in. Inputs of multiplexer are chosen based on inputs of selection lines, which will determine the micro-operations needed to implement the needed arithmetic operations. The ICs are placed on a trainer board, and we test the circuit using input switches and output LEDs. Multiple input combinations are applied and outputs are observed and verified according to the table. As outputs match the theoretical ones in the table, the 2-bit arithmetic unit works as designed, and experiment was successful.