North South University

Department of Electrical & Computer Engineering

Lab Report

Experiment No:	5
Experiment Title:	Design of a 16-bit ALU
Course Code:	**CSE332L**
Course Name:	**Computer Organization & Architecture Lab**
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Date of Experiment:	08-12-2020
Date of Submission:	08-12-2020

Equipment: Logisim tool.

Block diagram:

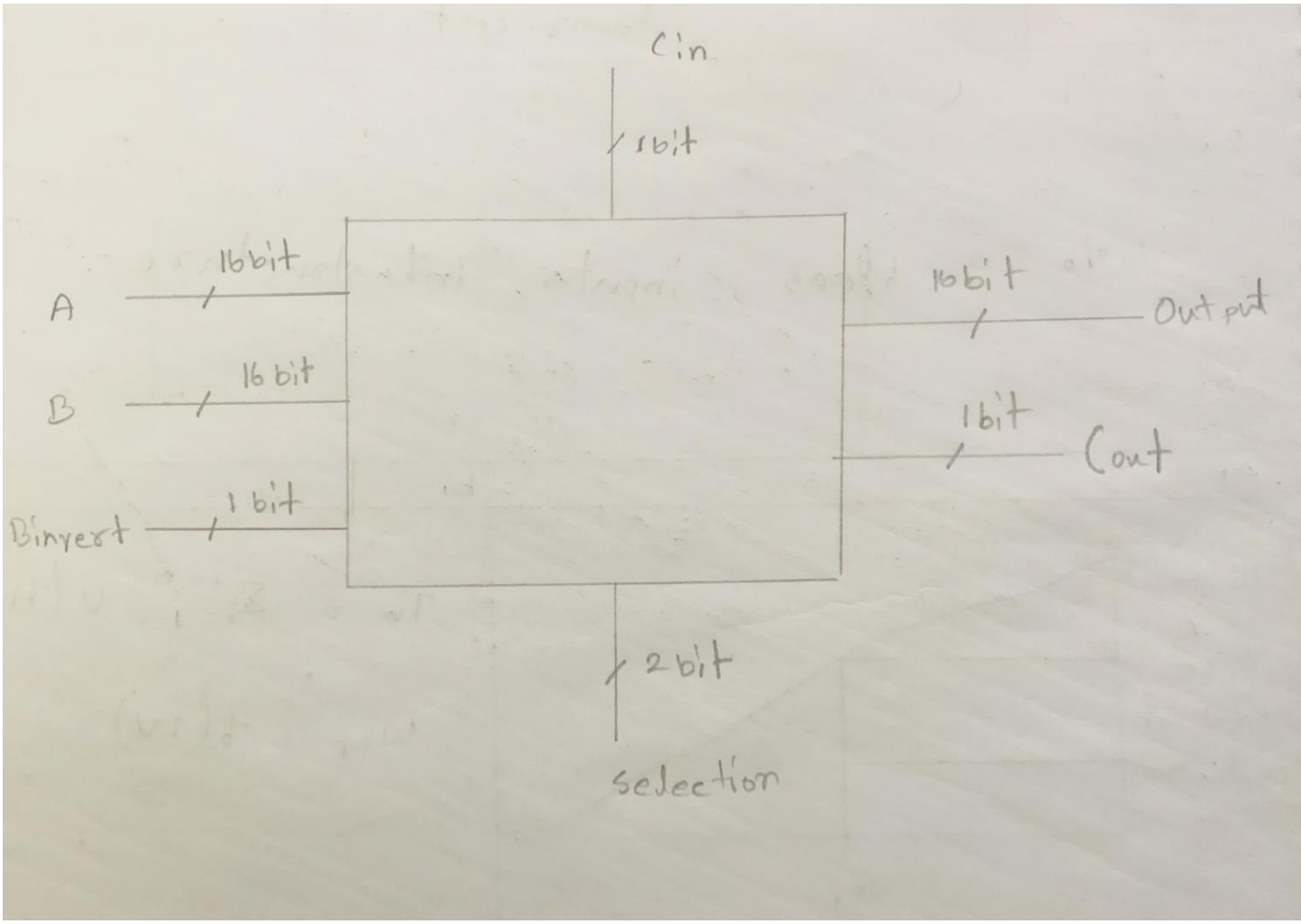

Figure: Block diagram of a 16-bit ALU.

Circuit diagram:

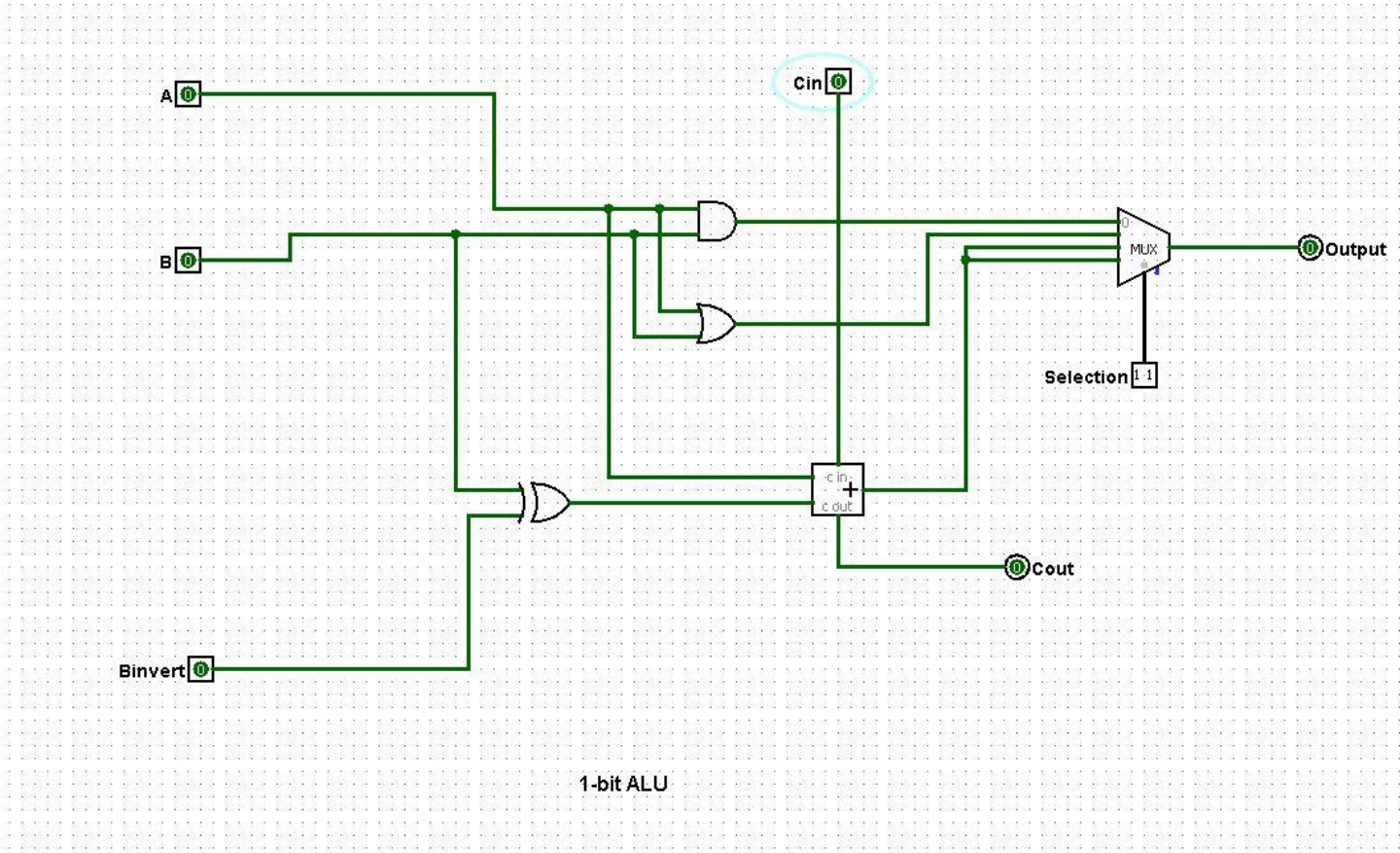

Figure: Circuit diagram of a 1-bit ALU.

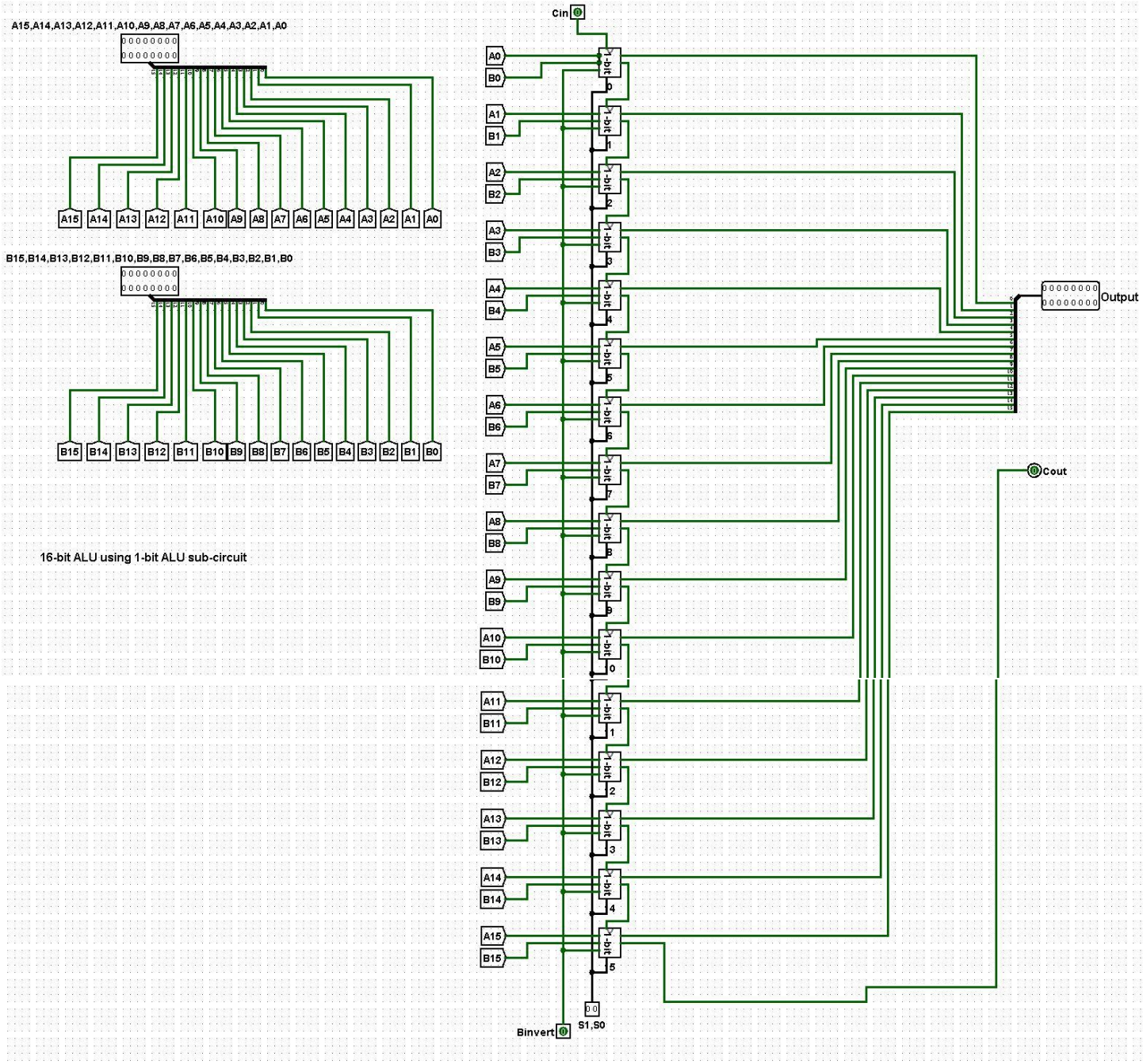

Figure: circuit diagram of a 16-bit ALU using 1-bit ALU sub-circuit.

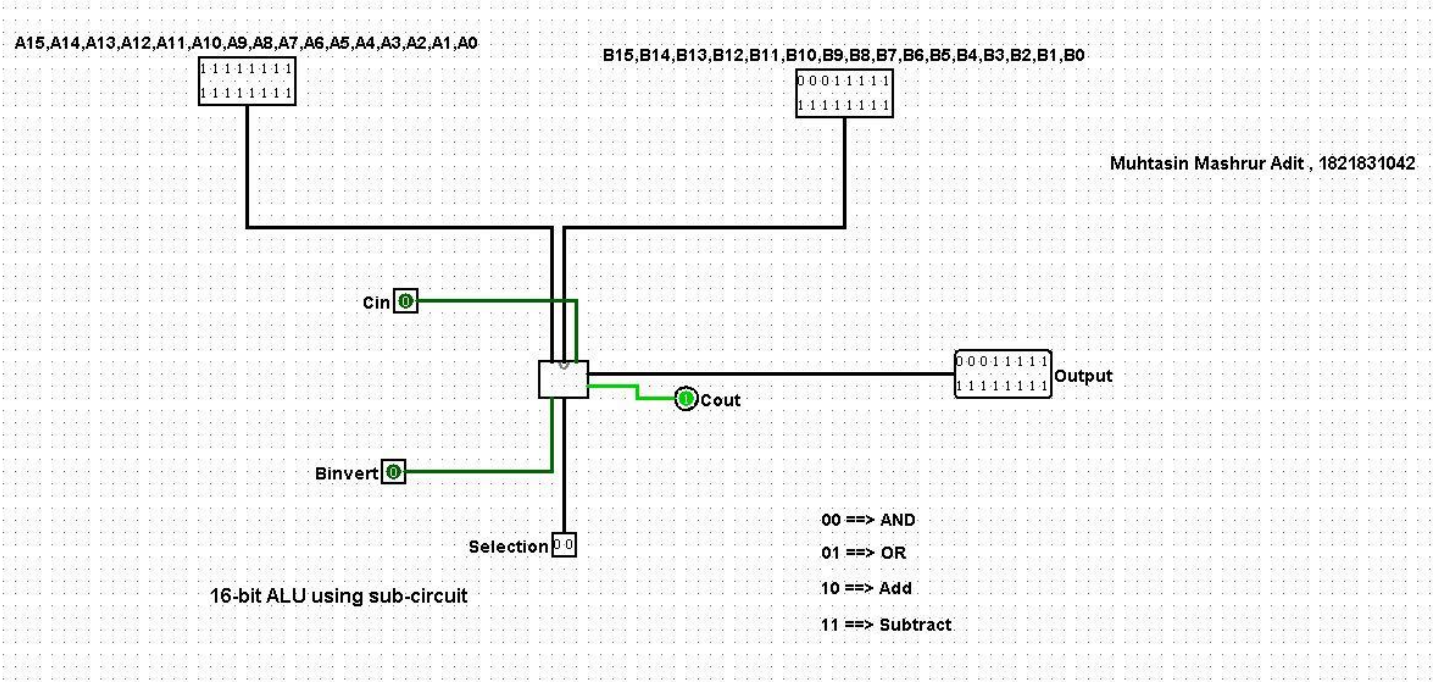

Figure: Circuit diagram of a 16-bit ALU using sub-circuit.

Discussion: Firstly, in Logisim I've to build a 1-bit ALU. In this circuit I build two arithmetic and two logic functions. Using a 2-bit selection bit multiplexer I separated the circuit for 4 operations. I took an AND gate, an OR gate, an adder circuit and a XOR gate. I took a 1-bit input leveled as Binvert with the B connected in the Xor gate to determine if I want to do addition or subtraction. For addition I will take the input of Binvert 0 and for subtraction I will take 1. Taking 1 as Binvert makes the B's value 1's complement and in the Adder circuit I take the value of Cin 1 to make B 2's complement. Thus, we get more accurate answer in subtraction than the built-in subtractor circuit. For selection bits, 00 is for AND operation, 01 is for OR operation, 10 is for Adder operation and 11 is for Subtraction operation.
Then I take the 1-bit ALU in the 16-bit ALU as sub-circuit. Then I take 16-bit input for A and B. I give the 1-bit connections to the 0-15 labeled sub-circuits respectively from A and B using splitter. The Cout of the previous sub-circuit is connected with the following sub-circuit. From the final sub-circuit, I will get an output labeled as Cout. The outputs of the sub-circuits are respectively connected with the output using a splitter. Then, in the final circuit I took the 16-bit ALU as sub-circuit and take the 16-bit connections for A and B. Manually using the selection bits, Binvert, Cin, we perform 4 different operations in the circuit.