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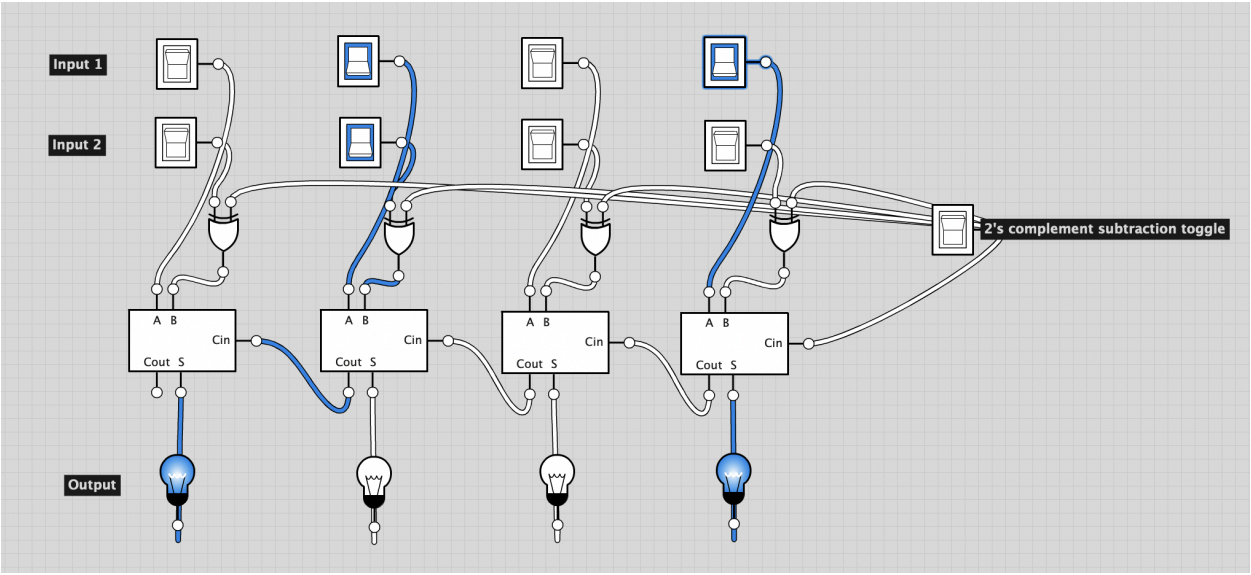
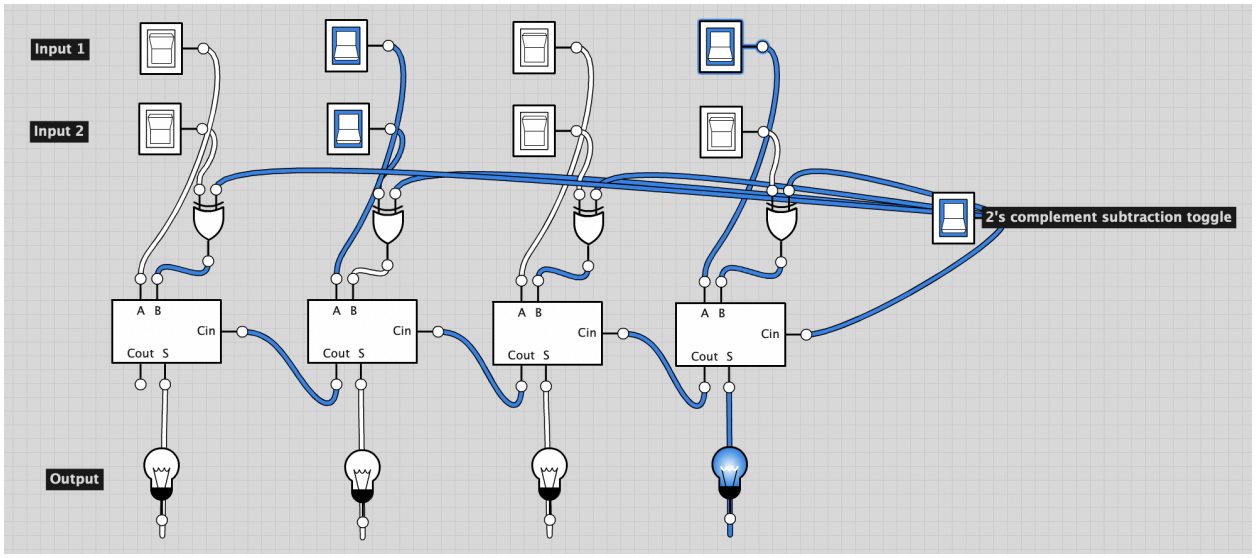
This report covers the making and testing of a 4-bit binary adder/subtractor circuit using logic gates. The circuit is designed to handle binary addition and also 2's complement subtraction. The circuit includes a switch that when toggled will switch the circuit to perform 2's complement subtraction, when the switch is off, the circuit will perform normal binary addition. In this circuit, two 4-bit binary numbers are used as inputs, and the result is displayed as a 4-bit binary number. This report will demonstrate how the circuit functions in both normal binary and 2's complement modes, and will also include results of tests run on the circuit.

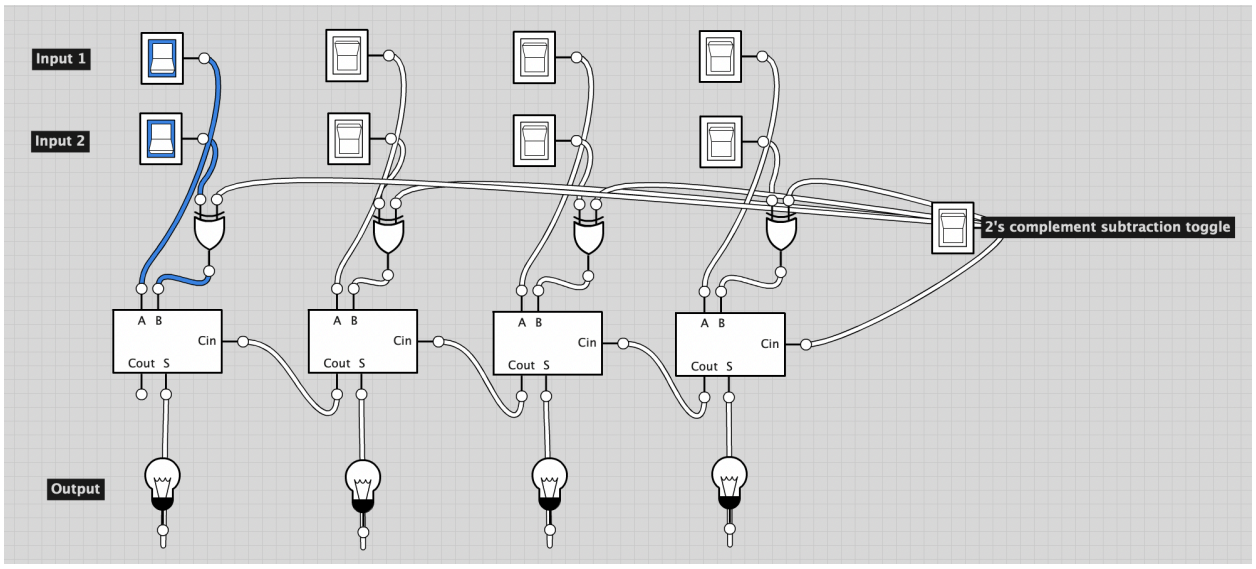
The image below shows an example of a basic 4-bit binary addition problem. The switch is set to off and the problem is 0101 + 0100 which should equal 1001 in binary or 9 in decimal.



As seen in the test, the circuit correctly performed the basic binary addition problem. The next image shows an example of a basic 2's complement subtraction problem. The toggle switch is set to on and the problem is 0101 - 0100 which should equal 0001 in 2's complement or 1 in decimal.



As seen in the image above, the circuit also correctly handles the 2's complement subtraction problem. In this last example the toggle switch is set to off, and the problem is 1000 + 1000 which should equal 10000 in binary, or 16 in decimal.



As seen in the image above, the circuit displays the incorrect result for this test. This is because this particular problem results in overflow, meaning that the result of the problem 1000 + 1000 is unable to fit into the scope of 4-bits. This test is to show that overflow is an important factor to consider when doing binary arithmetic on a small circuit like 4-bits.

Overall, designing this circuit was greatly helpful at helping me to understand basic binary arithmetic. Throughout a series of tests, the circuit was able to perform basic addition and subtraction correctly. However, when it came to dealing with larger numbers, the circuit often resulted in overflow conditions. For anyone looking to recreate this experiment, I would pay close attention to the overflow aspect and ensure that the circuit accounts for this when performing operations on larger numbers.