Lab 6 - 4/4/22

Full Adder

EGT 245 - Digital Electronics

Johnny Rivera & Mason Milburn

Northern Kentucky University
Spring 2022

Introduction

The purposes of this experiment are as follows: allow students to build a physical circuit using multiple different components, build familiarity with lab equipment and the mentioned components, and utilize the learned formulae to compute theoretical circuit values, then test those values against real-world models.

Required Equipment & Components

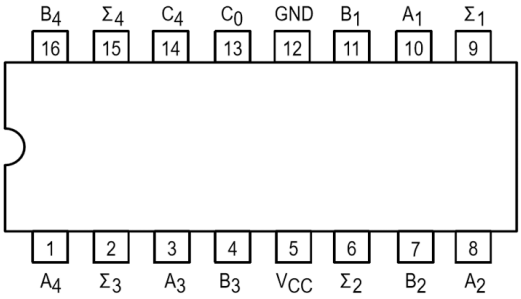
- 74LS83A (4-bit Binary Adder)
- Breadboard with Jumper Wires
- SPST Switch (x4)
- LED (x4)
- 5V Power Supply

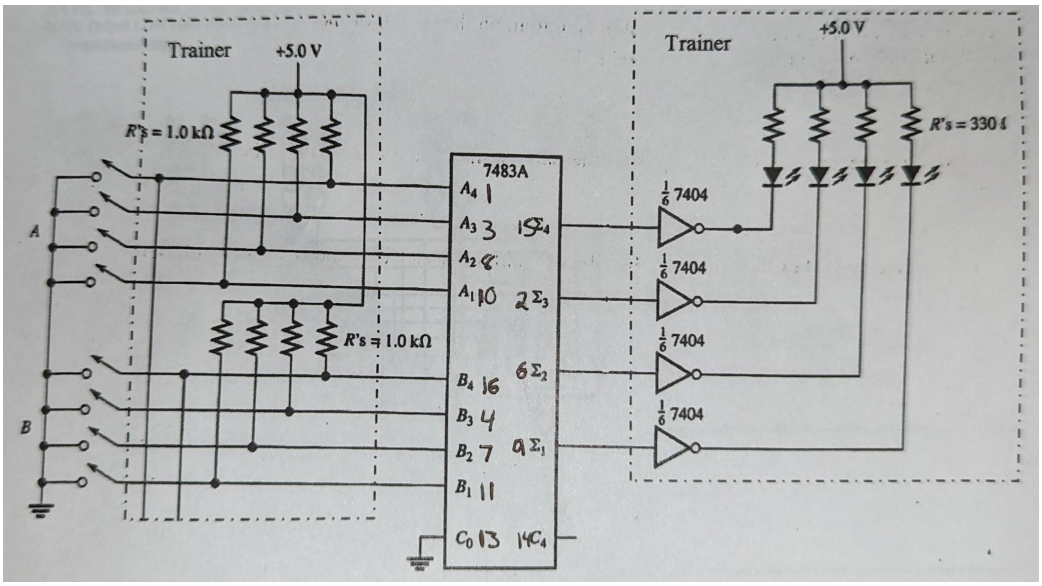
Theory

The utilized IC contains four 1-bit full-adders. Switches 1-4 are connected to the A adder inputs. Switches 5-8 are connected to the B adder inputs. As there won't be any further addition, the carry output is not connected. The output of the full adder is connected to LEDs 1-4, displaying the sum. For the demonstration, switch-set A will be set to 0011, and switch-set B will be set to 0001. The LEDs will display the final sum. The switches will be toggled based on the sequences found in the "experimental results" truth table. The order of each switch-set is LSB -> MSB.

Component Layout

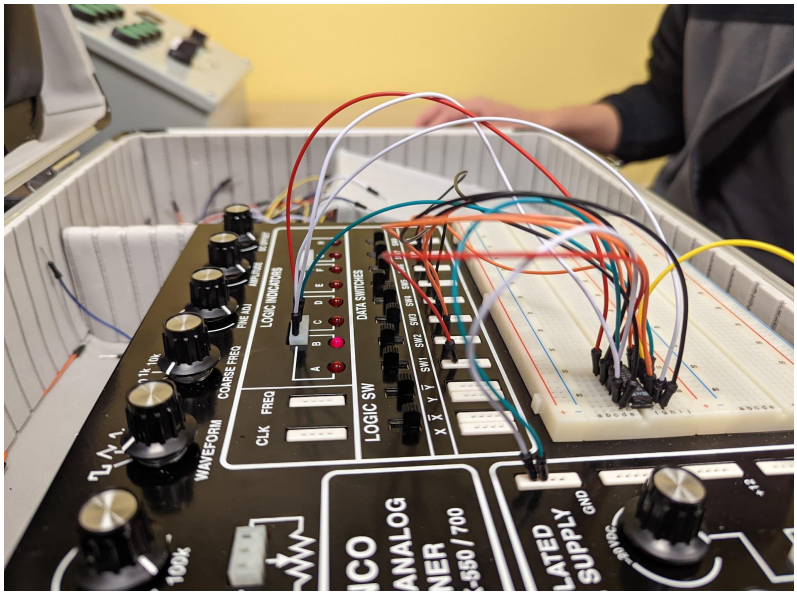
74LS83A





Experimental Results

S1-4	S5-8	Output (LED)
0011	0001	0100



Conclusion

Through the use of integrated circuit (IC) chips that in our case had 4 full adders incorporated inside we were able to demonstrate how they function. Using the logic we learned in class prior to this lab we were able to fully utilize the IC chip. These 4 full adders used XOR(⊕) gates, AND(*) gates, and OR(+) gates to simplify our logic expression where the sum of the first bit on each number was $Sum = A \oplus B \oplus C$. The full adders uses carry input for a carry bit as well when the sum of the two bits are both high and when is a need for a carry-in into the next bit operation, the Carry-out logic expression is $Cout = A * B + B * Cin + A * Cin$. These chips allowed us to gain better insight into how 4-bit numbers are added by using switches to specify high/low levels and LEDs to display the output. Overall, we believe that this lab allowed us to better understand full adders and the logic thinking behind designing them.