ECE265

ECE 265 Lab 1 Report

University of Illinois at Chicago – 9-7-2023

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Lab 1 of ECE265 involves implementing a logic function into two circuit diagrams, then using the diagrams to build a functional circuit that performs according to the function's respective truth table, testing all permutations [a,b].

Section I. Purpose

The purpose of this lab was to become familiar with the tools that can be used throughout the semester. This lab introduced several components of the course:

- Taking a given function and creating its matching truth table by evaluating the Boolean algebraic expressions.
- Using a Boolean expression to create an equivalent circuit using online CAD software (CircuitVerse).
- Drawing a matching circuit on paper, showing how the ICs can be connected to implement the desired functionality of the expression.
- Orientation, introduction to lab kit, becoming familiar with using jumpers, ICs, pin diagrams.

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Section II. Procedure

The procedure used was as follows:

1. First the Boolean algebraic expression **x = ((ab)(a+b')) xor a** was used to generate a truth table by plugging in the different permutations of [a,b] and evaluating the result.
2. Referring to the given expression, a new CircuitVerse project was created, and the circuit was implemented gate by gate. First an AND gate between a and b was created. Below this, an OR gate was implemented between input a and the inverse of input b (inverter gate). The outputs of the AND, OR gates were connected to a new AND gate. Finally the output of this AND gate was connected to a XOR gate, whose other channel was the input a.
3. The CircuitVerse inputs were toggled, to create a second truth table. If the truth tables matched, then this would mean the expression was implemented correctly.
4. After it was verified the CircuitVerse CAD circuit was correct, the lab sheet's breadboard diagram was used to create a sketch for how the IC's could be connected using jumper cables. Jumpers were represented by lines between pins; some lines were dotted and others were plain, to help convey that they were separated.
5. At arrival in lab, the lab kit was opened, all of the parts were unboxed.
6. The breadboard was used to assemble the circuit. The ICs were placed as to match the sketch of the circuit. Then the sketch was used to place jumpers between the pins as shown.
7. Some troubleshooting occurred, and a current limiting diode was added between the source and main hot line (top of breadboard). An additional troubleshooting LED was added. Resistors were added under the push-button switched and under the LED. Lab tutorial videos were referenced during the creation of the circuit.
8. The switches were toggled, and the result (shown by the LED) was noted. The circuit was verified to perform correctly.

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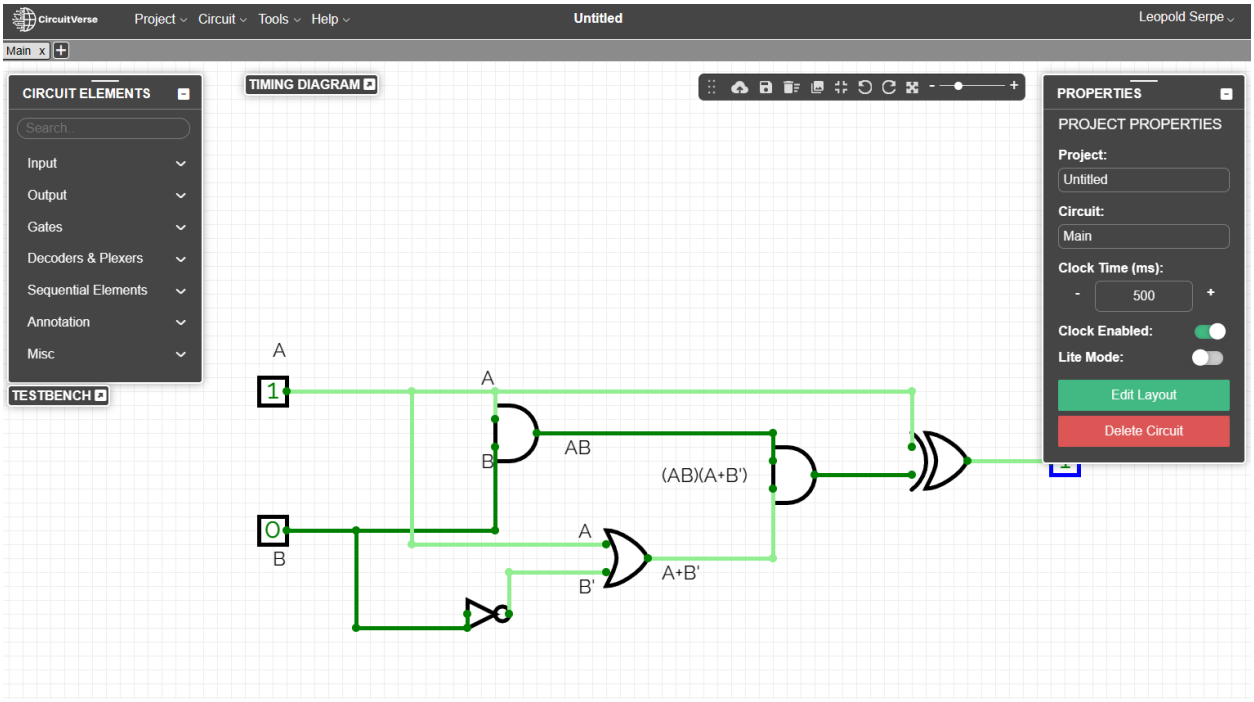
Section III. Simulated Circuit



Section IV. Simulation Results

A	B	AB	A+B’	((AB)(A+B’)) XOR A
0	0	0	1	0
0	1	0	0	0
1	0	0	1	1
1	1	1	1	0

Yellow – results obtained directly from CircuitVerse

Green – intermediates calculated directly from Boolean expression

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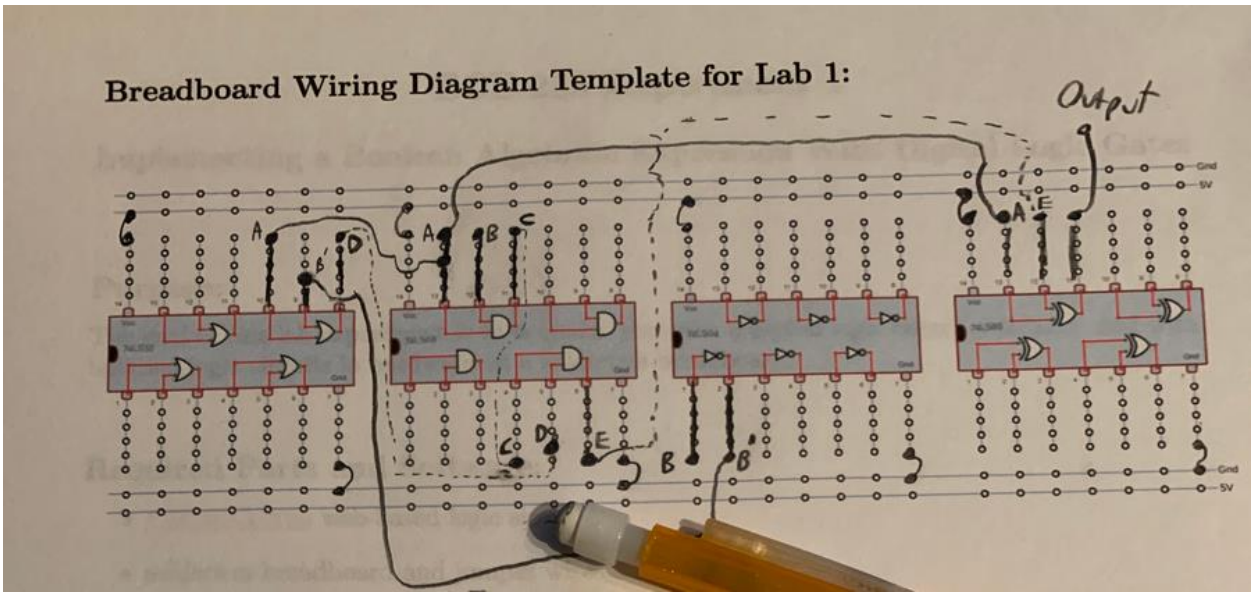
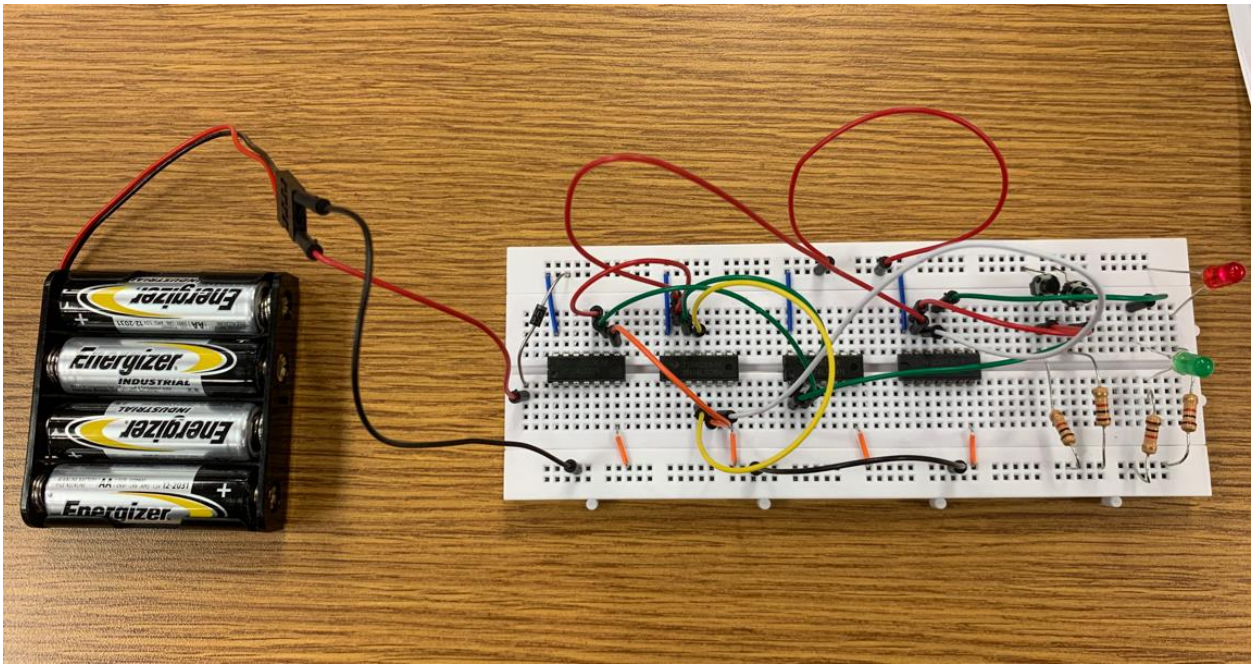
Section V. Hardware Circuit

Sketch:



Implementation:



*additional wires connect the split in the hot and ground lines of breadboard at top (red) and bottom (black).

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Section VI. Conclusion

From this lab I learned (1) to take a boolean expression and create a circuit using gates in CircuitVerse, (2) how to make a sketch using a CAD diagram, and (3) I also received experience implementing a circuit in a breadboard based from sketches and diagrams.

In particular, I feel that I learned that it is good practice to install the diode between the battery and the breadboard hot line, and I also learned to put a resistor downstream of the LED. These components were not included in my CAD drawing or sketch, and I had to learn this in the lab itself. Overall I was satisfied to have built a functioning circuit.