Lab 9: Multiplexers
EECE 2106.05

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Abstract

In Experiment 9 we designed circuits with multiplexers. We tested these circuits based on equations given in the pdf for this lab, and had to use Shannon's theorem to find an equation fit for the multiplexer part of this lab. One highlight was the multiplexer gates themselves, which is a new gate for this lab and was quite different from any other circuit used thus far and far reduces the amount of complexity in a circuit.

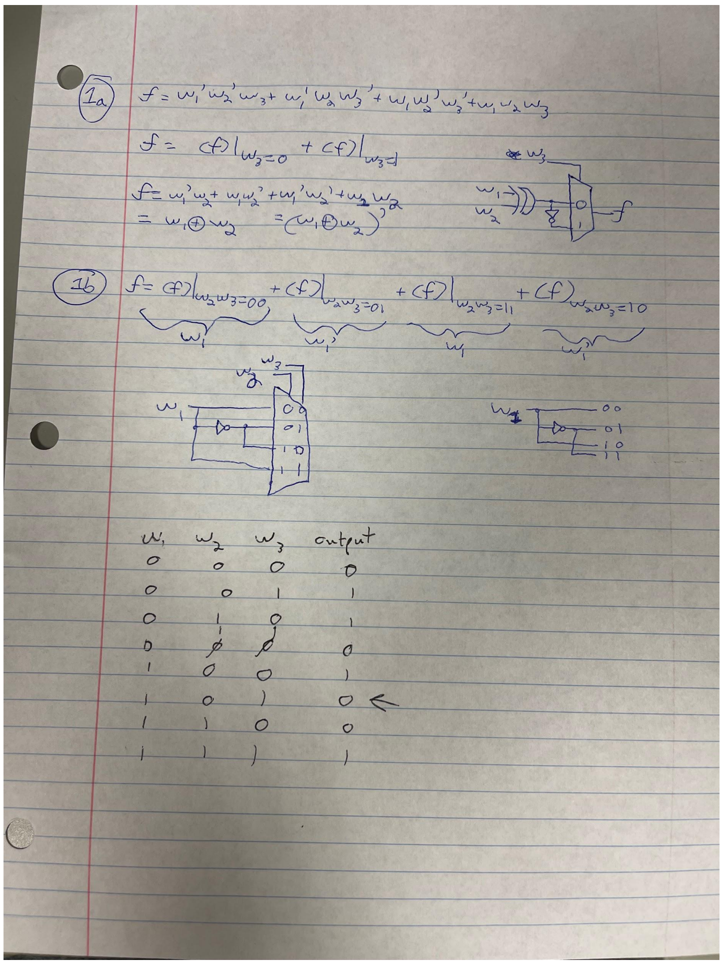
Components:

The components utilized to complete the experiment include:

- Gate 74151 (MULT gate)
- Gate 7404 (NOT gate)
- Gate 7486 (XOR gate)
- 4 resistors
- 4 LED lights
- Two Breadboards (we both tried construction)
  - Cable wires
- Power supply (w/ 5v battery)
  - Multimeter

Experiment:

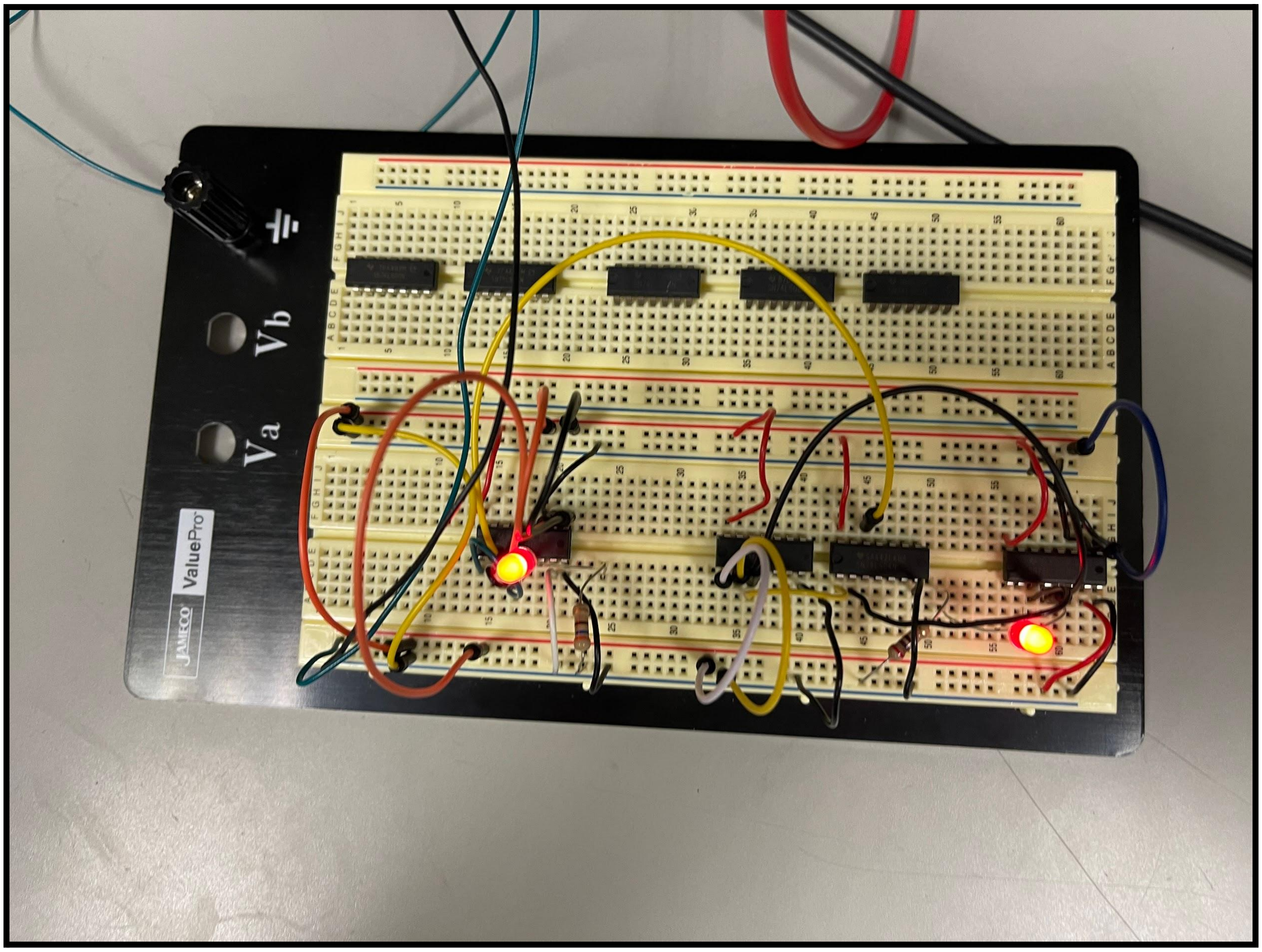
Here is the prelab for problem 1. We were told to construct a breadboard that used Shannon's theorem/multiplexer. Here is the equation, the circuit, and the truth table is at the bottom of this page.



Here is the completed breadboard for problem 1.

To clarify, the original equation was **f = w1’w2’w3 + w1’w2w3’ + w1w2’w3’ + w1w2w3**

Samuel Lee - Problem 1 Breadboard



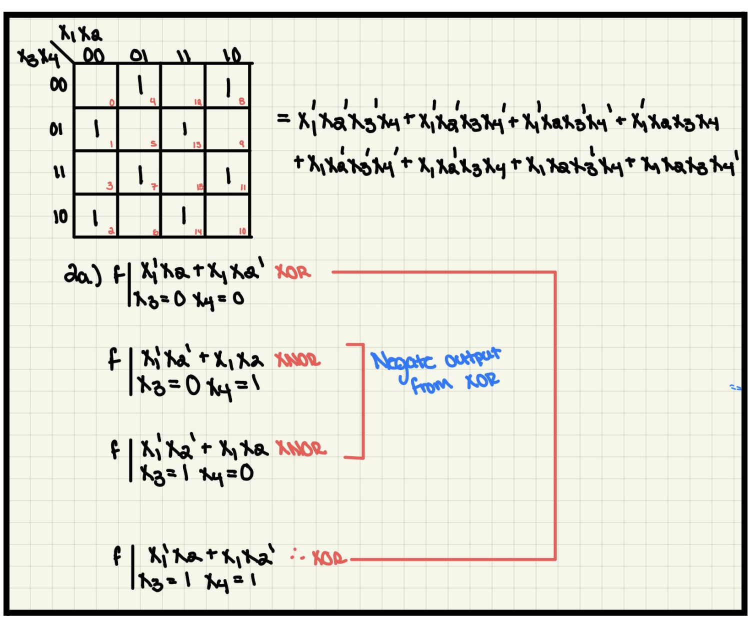
The right half of the breadboard is the circuits responsible for 1a while the left half is responsible for 1b.

The second half of the experiment involved creating a circuit utilizing a 4 variable XOR expression using a 8:1 multiplexer and a NOT gate. The truth table for the given expression is as given below.

4-Variable XOR Truth Table

	x_1	x_2	x_3	x_4	$x_1 \oplus x_2$ (x_5)	$x_3 \oplus x_4$ (x_6)	$x_5 \oplus x_6$
0	0	0	0	0	0	0	0
1	0	0	0	1	0	1	1
2	0	0	1	0	0	1	1
3	0	0	1	1	0	0	0
4	0	1	0	0	1	0	1
5	0	1	0	1	1	1	0
6	0	1	1	0	1	1	0
7	0	1	1	1	1	0	1
8	1	0	0	0	1	0	1
9	1	0	0	1	1	1	0
10	1	0	1	0	1	1	0
11	1	0	1	1	1	0	1
12	1	1	0	0	0	0	0
13	1	1	0	1	0	1	1
14	1	1	1	0	0	1	1
15	1	1	1	1	0	0	0

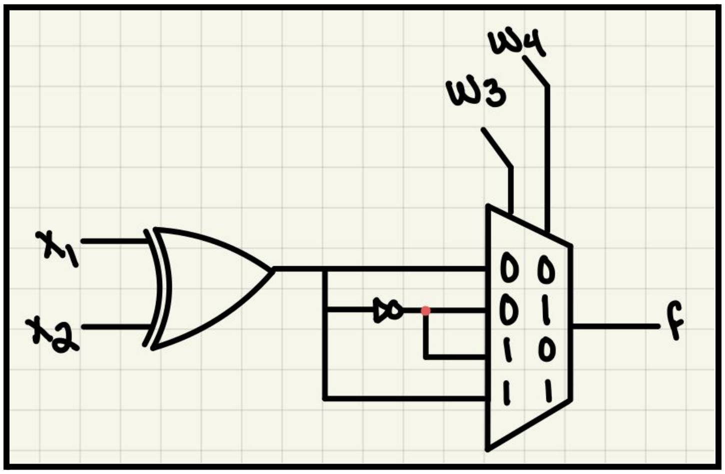
From the truth table above we were then able to come up with an equation using a k-map and then using Shannon's theorem to build a circuit utilizing a multiplexer based on two select lines being used.



4-variable XOR and 2a. Shanon's Theorem

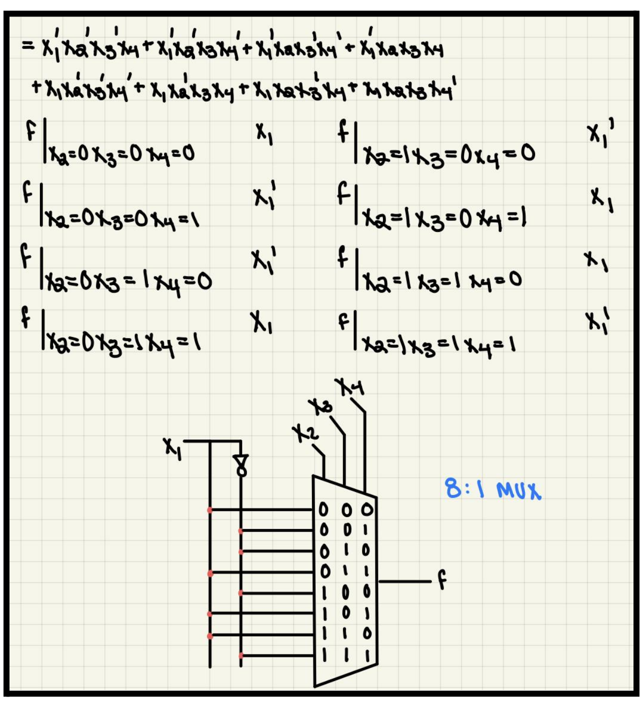
We then created a circuit diagram based off the Shannon's Theorem given in respect to the select line's truth values and got the following.

<u>2a. Multiplexer Diagram</u>



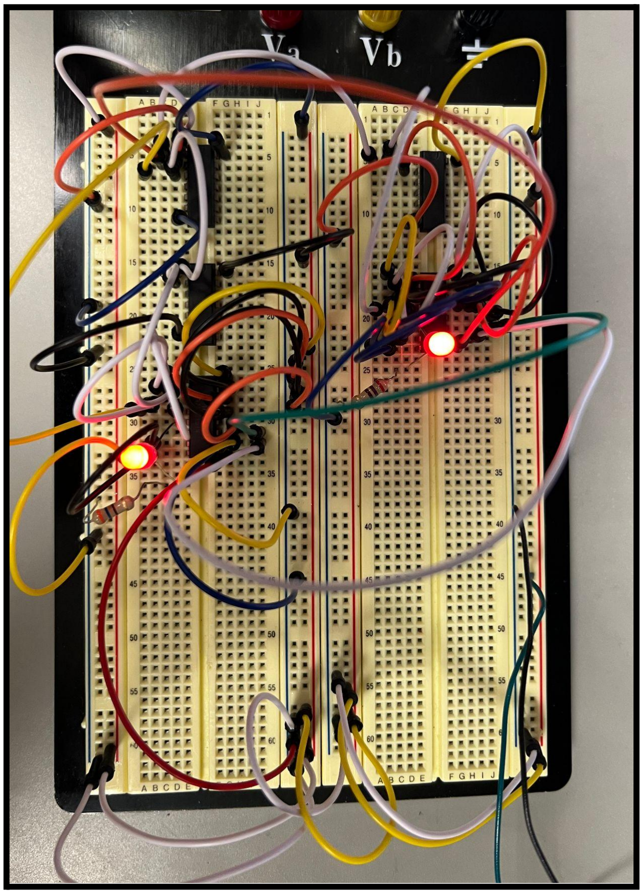
To implement this utilizing a 8:1 multiplexer, set the first select line to ground and w3/w4 to their select truth values.

Similarly to 2a, a similar process is taken with the exception of there being three select lines being used. This affects the Shannon's Theorem and circuit diagram to be as follows:



<u>2a. Shannon's Theorem & Circuit Diagram</u>

Problem 2 Breadboard



Conclusion:

Both teammates constructed a breadboard. Samuel Lee was responsible for problem 1 and half of this lab report, Carlos Alvizo was responsible for problem 2 and half of this lab report. Thankfully circuits seemed to be working, unlike last week. Multiplexer construction was successful. Multiplexer gate was interesting, had many different inputs/outputs to consider.