Group8
Victoria Talty
Yutong Li

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Lab #1: Introduction to Logic Gates

I. Introduction:

For Lab 1, we needed to construct a circuit that dealt with the "and" gate and the "or" gate. We were given a real world situation and told to adapt that situation into a circuit that followed the specific guidelines given. During lab, we learned how to place the gates on to the breadboard, and then use those gates in order to efficiently create a circuit that corresponded with the problem given. As a result, we used our pre-lab information in order to use the "and" and "or" gates properly.

II. Procedure:

Part 1: Working with the breadboard

1. Testing the eight LED pairs:

(i) On the monitor, the LED light for number 1 is on HIGH, aka red.
(ii) With GND, the LED light for number 1 is on LOW, aka green. After repeating for the other pairs, all of the LEDs are on HIGH(red) when connected to +5V and are on LOW(low) when connected to GND.
Observation:
The red LED refers to 1, and the green LED refers to 0. In the lecture, we learn that generally, 1 refers to on, and 0 refers to off. In the breadboard, given the choices of HIGH and LOW, we believe that 1 refers to HIGH and 0 refers to LOW.
The red LED (+5V) is connected to ground somewhere in the breadboard to complete the circuit. And the green LED (GND) is connected to +5V(some positive voltage) to complete the circuit.

2. Eight Logic Switches:

When the switch moves UP, the red light(HIGH) is on. When the switch moves DOWN, the green light(LOW) is on.
After testing the remaining S2-S8, all of them function correctly.

3. Clock:

(i) The light switches from green to red to green and then to red, and stays in both green and red for about a second. The red LED turns on 34 times in a 30 second interval.
(ii) The switch between red and green goes faster.
(iii) Both red and green stay on. The output looks like that they are always on, but it actually is switching on and off so fast that we can't see the switching.
(iv) The third and the fifth in addition to the fourth LED are turned on on red, while the green for the fourth remains on.
The frequency of the output is so high that it turns the LED beside the target LED on.

Part 2: Working with digital chips/ICs (integrated Circuits)

From the printed sign on the chips, we recognize that “or” gate has the number 7432 and “and” gate has the number 7408. After identifying the notch, we plug the chips into the breadboard firmly. Then we started to connected the top right pins of both chips with +5V, and connected the bottom left pins with ground.

Part 3: Building a Logic circuit

Studying the given condition, we know that there should be two gates in total for this lab, one “and”gate and one “or”gate.

For the “or” gate, the inputs are M and S, and the output is A.

For the “and” gate, the inputs are M and S, and the output is L.

We encounter several problems until we get the correct truth table.

1. The first alarm that we get doesn’t work, so we get a new alarm which works.
2. We put A as the output of the “or” gate, so when we run the circuit, the alarm doesn’t work correctly. Then we put the alarm as the output of the and gate, and it functions.
3. Calibration the motion detector is really hard. We spend a lot of time on calibrating the motion detector. In order for the system to function, we need to re-calibrate the motion detector constantly in order to get the correct truth table.

M	S	L	A
0	0	0	0
0	1	1	0
1	0	1	0
1	1	1	1

III. Correct solution to prelab

a)

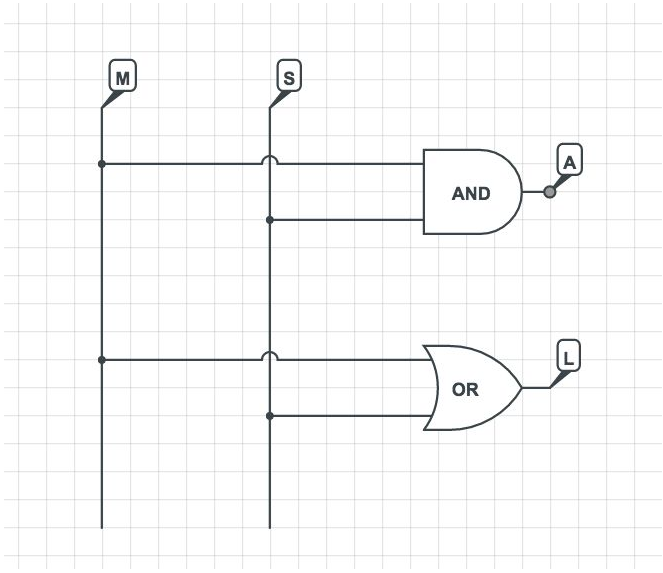
M	S
0	0
0	1
1	0
1	1

b)

M	S	L	A
0	0	0	0
0	1	1	0

1	0	1	0
1	1	1	1

c)



IV. Pre-lab comparison:

In my pre-lab, I didn't do the truth table correctly. The alarm is only going to go on when both the switch and the motion detector is on. And I also did the schematic interpretation wrong. For the "or" gate, the inputs should be motion detector and switch, but in my pre-lab, I chose motion detector and light to be my inputs. I didn't realize that light and alarm can only be outputs when I was doing my pre-lab. In the lab session, through discussion with my partner, I realized the problem that I have in the pre-lab and corrected them, and we built the correct circuit that fulfills the situation provided. (Yutong Li)

My pre-lab and our lab truth table turned out to be the same. As a result, the circuit in both ended up being the same. Although I was a a bit confused as to where the alarm output needed to be. Overall, I think my circuit in the pre-lab made sense and it corresponded with the lab circuit. (Victoria Talty)

V. Final question:

1. Suppose the alarm system is functioning in such a way that the alarm (A) is activated as soon as motion is detected. List the possible issues with this system and how could you determine if the system is acting incorrectly.
   Possible Issues:
   a. Alarm will always be activated due to uncontrollable motion
   b. For example, if we are talking about a home alarm system, if any motion can activate the alarm, for example, a piece of paper flies through, or animals' movement, this system would be very annoying.
   c. Battery is depleted at a quicker pace

    d. You can tell if the system is acting incorrectly if there is a motion and the alarm does not go off. Therefore it can be tested by hand movement or body movement. If the alarm doesn't go off, then it is acting incorrectly.

2. Suppose the alarm system is operating in such a way that the alarm (A) goes on continuously regardless of the state of the other inputs. List the possible issues with this system and how you could fix this issue.
    a. Since the alarm is supposed to tell/alarm about something, the kind of alarm in this question will be meaningless because no matter what you do, the alarm will go on.
    b. In order to solve this issue, we would create an additional input that corresponds with the Alarm output. Therefore affected whether or not the alarm in on or off.