**Lab 1: Combinational Analysis**

**Primary Objectives**

1. Analyze and design a combinational system

2. Implement the system using the Logisim software

3. Test to verify the functionality of said system

*Objective 1 Design*

There are two inputs and one output in this project: MotionDetected, LightDetected, and LampOn. These values will be represented by the symbols *M*, *L*, and *A*, respectively. The system is supposed to turn the lamp on when there is motion detected and there is no light detected. This can be represented by the following code segment:

*while (true) {  
 boolean motion = isMotionDetected();  
 boolean light = isLightDetected();  
 boolean lamp = isMotionDetected() && ~isLightDetected();  
 showLight(lamp);  
}*

If this system is functional, the truth table should look like this:

|  |  |  |
| --- | --- | --- |
| M | L | A |
| 0 | 0 | 0 |
| 0 | 1 | 0 |
| 1 | 0 | 1 |
| 1 | 1 | 0 |

Table 1 Design

*Objective 2 Implementation*

Figure 1 shows one way the system could be implemented via Logisim. Note here that the lamp would be turned on when there is motion detected, but not when light is detected. To simplify things, the wire leading out of the AND gate and into the output is labeled as M~L. Therefore, a Boolean expression for the device is A = M~L. A green line with arrows

Description automatically generated

Figure 1 Implementation

*Objective 3 Testing*

Table 1 shows the actual truth table provided by the Logisim software’s combinational analysis feature. This truth table matches the predicted truth table (Table 1) perfectly. Based on this, the circuit functions as intended.

Table Combinational Analysis Truth Table

A close-up of a white box

Description automatically generated

**Conclusion**

The lab went smoothly with no issues. The initial table made from the problem description matches the table generated after the circuit was designed and implemented in Logisim. Therefore, the circuit was designed properly and the lab was a success.