Lab 1

Laboratory Report for CS 2420

Brent Johnson

Computer Science

Texas State University

Department of Computer Science

bj1107@txstate.edu

*Abstract*— This lab was intended as an introduction to measuring voltage, creating simple circuits, measuring said voltage at different spots along the circuit, and working with the LED lights and basic logic gate. It was an overall introduction to our ELVIS boards.

# Introduction

During this lab, I used the NI Elvis board to create some simple circuits (one in series and one in parallel). I also used the led lights and logic gate to create and measure some simple logic circuits. This is important to Digital Logic because we will presumably be working with the Elvis boards all semester with increasing complexity. It is important to get a solid understanding of the basics of our equipment before we can be expected to perform more complicated procedures. As a student with no history in electrical engineering, or even using a multimeter, this lab is an obvious starting point.

# Experimental Method

For this procedure, three random resistors were used in conjunction with the NI Elvis board, its equipped digital multimeter, and the corresponding computer software.

Before the experimentation began, I used Ohms Law (Voltage = Current \* Resistance) to predict output at the points I would be measuring. Ohm’s law accurately predicted the output (minus trivial natural loss of current) for all points in each circuit. I have included the predicted results and corresponding calculations in the diagrams and tables to follow.

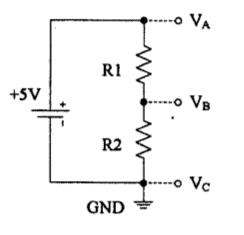
First, I created a simple circuit with two resistors in series. I measured the voltage with the multimeter at three different points in the circuit (before first resistor., after first resistor, and after final resistor). I then created a slightly more complex circuit using three resistors. I measured the voltage at three different spots for this circuit as well (before first resistor, after first resistor, and after the third resistor).

Next I created a circuit using the LED lights equipped on the Elvis board. I measured the voltage at several different points (DIO and LED for two LEDs).

Finally, I created a circuit using a basic logic gate (gate 7404) on the Elvis board. I connected DIO 0 to LED 7 and recorded the voltage and logic output at several different spots along that circuit.

# Results

For the first circuit (resistors in series), I measured the voltage at three different points.



V(b) = I\*R V = 5 Rt = R1 + R2 = 10

5 = I(10) >> I = ½

5 – (5)(1/2) = 2.5

Va should have 0 draw because it has not crossed a resistor.

Vc should have 0 volts because it has crossed all resistors.

The results were as follows:

|  |  |  |  |
| --- | --- | --- | --- |
| Probing Points | V(a) | V(b) | V(c) |
| Expected Voltage (V) | 5v | 2.5v | 0v |
| Measured Voltage (V) | 4.93v | 2.45v | 0.05v |

Next, I created a circuit with three resistors (the first in series and the last two in parallel). I recorded the voltage outputs as follows:



V = I\*R

R23 = (R2 \* R3)/(R2 +R3) = 2.5

R123 = 2.5 + 5 = 7.5

5 = I(7.5) I = 0.667

5 – (5)(0.667) = 1.66

Va should have 0 draw because it has not passed any resistors.

Vc should have 0 voltage because it has passed all resistors.

|  |  |  |  |
| --- | --- | --- | --- |
| Probing Points | V(a) | V(b) | V(c) |
| Expected Voltage (V) | 5v | 1.66v | 0v |
| Measured Voltage (V) | 4.97v | 1.52v | 0v |

Next I set up two simple circuits from DIO 0 to LED 0 and from DIO 1 to LED 1. I measured the voltage while the corresponding LED was on and off. The results were as follows:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| DIO 1 | DIO 0 | Voltage DIO 1 | Voltage DIO 0 | Voltage LED 1 | Voltage LED 0 |
| lo | lo | 0 | 0 | 0 | 0 |
| lo | hi | 4.52 | 0 | 4.52 | 0 |
| hi | lo | 0 | 4.51 | 0 | 4.51 |
| hi | hi | 4.52 | 4.51 | 4.52 | 4.51 |

Finally, I set up a simple circuit passing through the 7404. I connected DIO 0 to the input pin 1A and the output in 1Y to LED 7. I measured the voltage for the input and output pins.

The results were as follows:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| INPUT | | OUTPUT | | |
| Logic Input | Voltage at 1A | Voltage at 1Y | Logic Output | LED 7 (on/off) |
| 0 (lo) | 0 | 4.5 | 1 | on |
| 1 (hi) | 4.9 | 0 | 0 | off |

# Conclusion

In conclusion, this was a lab that accomplished its intentions. By created several different circuits (some using logic gates and some without), I became more acquainted with the Elvis board, its accompanying software, and creating and measuring circuits. I am no longer scared to use the digital multimeter. This is vital skill development because the laboratory assignments will only increase in complexity requiring more advanced skill.

# References

No references (other than lab assignment) were used in the creation of this lab report.