Example report

Report for Fall 2011 EE 361L Experiment #1

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Abstract: The abstract of this should describe the laboratory assignment, key findings, significance, and major conclusions and results. It should be brief and not more than 150 words.

1 Introduction

From this assignment, we learned about some of the parameters of inputs and outputs of *Transistor Transistor Logic* (TTL) circuits. We followed the laboratory handout [1] and instructions from our T.A. Ashok. The assignment consisted of a series of circuit set-ups and measurements of voltages and current.

Our lab team divided the work so that I was responsible for setting up the circuits on my protoboard, Cathy operated the instruments and took the measurements, and Frank carefully recorded the data and any problems we encountered. Fortunately, we did not encounter any technical problems. We all received copies of Frank's notes and used them for our reports.

The rest of the report is organized as follows. Section 2 is an explanation of our experimental set-ups and measurements. It also has the data we collected. Section 3 addresses a number of questions that were in the laboratory handout [1]. Our conclusions are left in Section 4.

2 Experiments and Measurements

We used the following equipment and supplies

- Protoboard
- Wire
- TTL Voltage Inverter Integrated Circuits:
    - 7404
    - 74LS04
    - 74S04
    - 74H04

The following are the measurements that we made. First, we set up each of the '04 circuits as shown in Figure 1. The two set ups in the figure is to measure the output voltage VOH and current IOH when the output is supposed to be "High". Note that these are the maximum values for the output. Table 1 has the measured values.

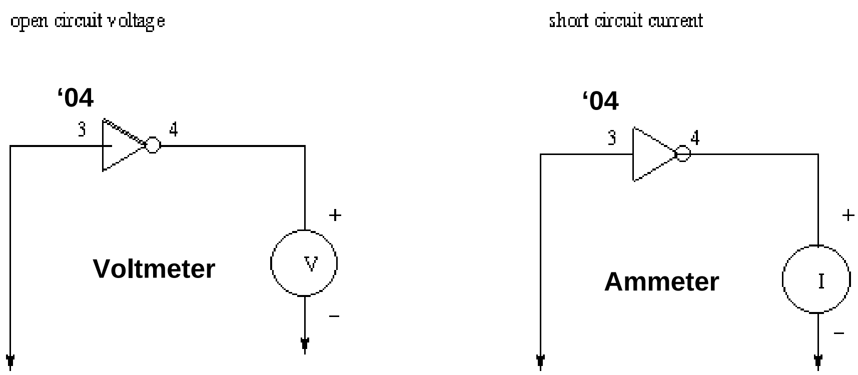

Figure 1. Set up to measure VOH and IOH.

Table 1. Measured VOH and IOH values.

Devices	VOH	IOH
7404		
74LS04		
74S04		
74H04		

Next, we set up each of the '04 circuits as shown in Figure 2 to measure the output voltage VOL when it is supposed to be "Low". Table 2 has the measured values.

Then we set up each of the '04 circuits as shown in Figure 3 to measure the source capabilities of the outputs. The R-Box is a resistance box that is adjustable to different resistances. We set the resistance value such that the output voltage is just above 2.4 volts, which the minimum for a logic "1" output voltage. Then we recorded the output voltage VOH* and the resistance ROH*. The ratio of the voltage over the resistance is the maximum current the device can source IOH* while producing a valid logic "1" at the output. These values are in Table 3.

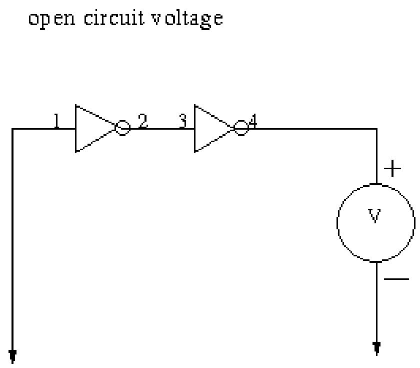

Figure 2. Set up to measure VOL.

Table 2. Measured VOL values.

Devices	VOL
7404	
74LS04	
74S04	
74H04	

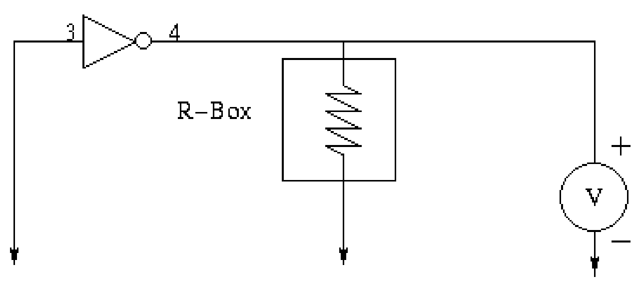

Figure 3. Set up to measure VOH* and ROH*.

Table 3. Values of ROH*, VOH*, and IOH*.

Devices	ROH*	VOH*	IOH*
7404			
74LS04			
74S04			
74H04			

We measured the output current when the output is logic "1" using the set up in Figure 4. The R-Box was adjusted so that the output voltage VOL* is just below 0.8 volts. We recorded this voltage and the resistance ROL* of the R-Box. Note that the voltage across the R-Box is (5 volts – VOL*). To calculate the current at the output IOL* we computed (5 volts – VOL*)/ROL*. The values of VOL*, ROL*, and IOL* are in Table 4.

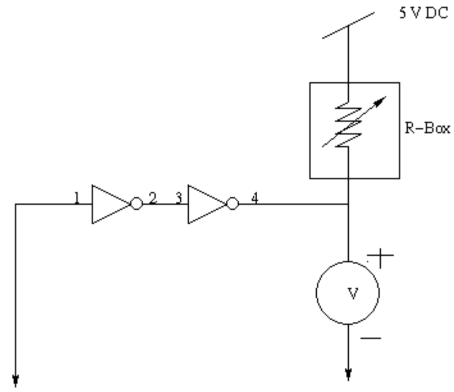

Figure 4. Set up to measure ROL* and VOL*.

Table 4. Values of ROL*, VOL*, and IOL*.

Devices	ROL*	VOL*	IOL*
7404			
74LS04			
74S04			
74H04			

The final set of measurements was for the set up shown in Figure 5. In this case, the R-Box was adjusted until the input voltage VIL was just below 0.8 volts, which is logic “0”. Both the resistance RIL at the R-Box and the input voltage VIL were recorded. The input current IIL can be computed by dividing VIL over RIL. Note that IIL is the maximum input current for logic “0”. The values for VIL, RIL, and IIL are in Table 5.

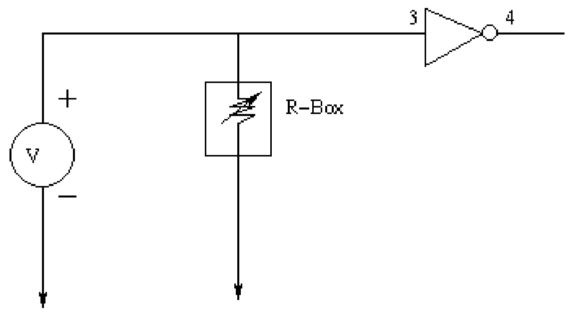

Figure 5. Set up to measure VIL and RIL.

Table 5. Values of VIL, RIL, and IIL.

Devices	VIL	RIL	IIL
7404			
74LS04			
74S04			
74H04			

3 Fanout

The laboratory handout [1] posed five tasks about the measured data. In this section, we address them.

Task 1. Calculate the DC fanout for both logic levels using your lab results.

In the lab, Ashok explained how to calculate the fanout given the data in Tables X, Y, and Z. To calculate the measured fanout for logic level "0", we used the formula .... To calculate the fanout for logic level "1", we used the formula ....

Table 6 has the calculated fanout values. "FL Measured" is the fanout for logic level "0", and "FH Measured" is the fanout for logic level "1". Fanouts for logic levels "0" and "1" from the TTL data books [2] are also presented in the table under "FL Databook" and "FH Databook", respectively.

Table 6. Fanouts

Devices	FL Measured	FH Measured	FL Databook	FH Databook
7404				
74LS04				
74S04				
74H04				

Task 2. Note: When you do the calculation for logic "1" case the inverter input is acting as a sink and no procedure is given for that parameter. Look up the parameter in the TTL databook. Why can't you measure the input sink in the lab?

Your answer, blah blah blah.

Task 3. Compare the lab results to the TTL calculated results using the TTL databook. Explain why you think the DC results differ from the calculated ones?

Your answer, blah blah blah.

Task 4. Why is the fanout calculated using logic "1" usually meaningless in the use of TTL logic family circuits?

Your answer, blah blah blah.

Task 5. Explain why fanout is so important in logic design?

Your answer, blah blah blah.

4 Conclusions

Our team successfully measured the voltages, resistances, and currents for each of the circuit set ups, and completed the tasks for the lab assignment. We learned about fanout and were able to apply our knowledge of circuits from EE 213. It was surprising that the measured fanout was quite different than the values from the TTL databooks.

References

1. "EE 361L, Experiment #1," Laboratory handout for EE 361, University of Hawaii, Fall 2003, < http://www-ee.eng.hawaii.edu/~sasaki/EE361/Fall03/Lab/exp1.html >.
2. TI data sheets for the '04 TTL voltage inverters, Dec. 1983, revised Feb. 2002, <http://focus.ti.com/lit/ds/sdls029b/sdls029b.pdf>.