Computer Science 281
Lab 2: Breadboard Basics

In this lab, you will be introduced to a very simple physical equivalent of Logisim. A "breadboard" allows you to construct simple logical circuits and test them.

1. Plug the machine in and turn it on. Peruse the board. There are a number of things we will not be using. Most importantly, the only power supply we need is +5 volts. NEVER hook a wire to any of the other voltages. Make sure all appropriate switches are set to TTL or +5.

2. Find the onboard Logic Probe. You must connect a wire from the socket marked `Vcc` to +5. The Logic Probe is a wire connected to a socket marked `INPUT`. Touch the wire to the +5 volts peg and the Ground peg and see what happens. **What does the MEM-PULSE switch do?**

3. Notice that the breadboard has many little red wires plugged in. Use the logic probe to find out where +5 and Ground are available. Notice the groove down the middle of each board. You need to figure out how the little holes on either side of the groove are wired. Devise a series of experiments to do this. **Summarize your conclusions.**

4. Explore the Logic Monitor (LEDs — light emitting diodes) and find out how it works. You'll frequently be using these to monitor output of your circuits.

5. Explore the Function Generator and find out how it works. Only use output from one of the sockets labelled TTL. (This is important.) **Summarize your conclusions.**

6. Attach a wire from the Function Generator to the speaker and play around.

7. Attach wires from the Logic Switches to the LEDs and see how they work. Now attach them to the *appropriate* sockets of the 7 Segment Display (lower right corner) and create the following bit patterns: 0000, 0001, 0010, 0011, 0100, 0101, 0110, 0111, 1000, 1001. **What happens when your input is greater than 1001**?

8. Now attach a wire from one of the NC sockets of the Pushbuttons to the Logic Probe and experiment, monitoring the output. Now attach it to one of the NO sockets and play around. **What happens?** What do NC and NO stand for? To get a +5 signal, you must attach a "pull-up" resistor from the socket you are using to +5 volts. Get a 1K Ohm resistor and do this, if not already attached (they probably are), and repeat this experiment.

   The other parts on the board we will not use.

9. We will experiment with two chips today - the 7404, which contains six 1-input NOT gates, and the 7408, which contains four 2-input AND gates. Look at the spec sheet for these two chips. Now get one of each from the supply drawers, insert them both into the breadboard, attach +5 and gnd (ground) and experiment with the chips to convince yourself that the gates function the way they should. **What happens if you don't connect the +5 and ground?**

10. Now wire the following circuit, using the gates on the 7404 and 7408. Wire the inputs to switches and the final output to an LED. **Draw the truth table for this simple circuit as a result of experimenting. Also draw a truth table with columns** $a, b, a \cdot a, b \cdot b, \overline{a \cdot a}, \overline{b \cdot b}, (\overline{a \cdot a}) \cdot (\overline{b \cdot b})$, **and** q **(which is** $\overline{(\overline{a \cdot a}) \cdot (\overline{b \cdot b})}$**). What is this circuit equivalent to?**