Introduction to Computer Science and Engineering
Meet the Lab

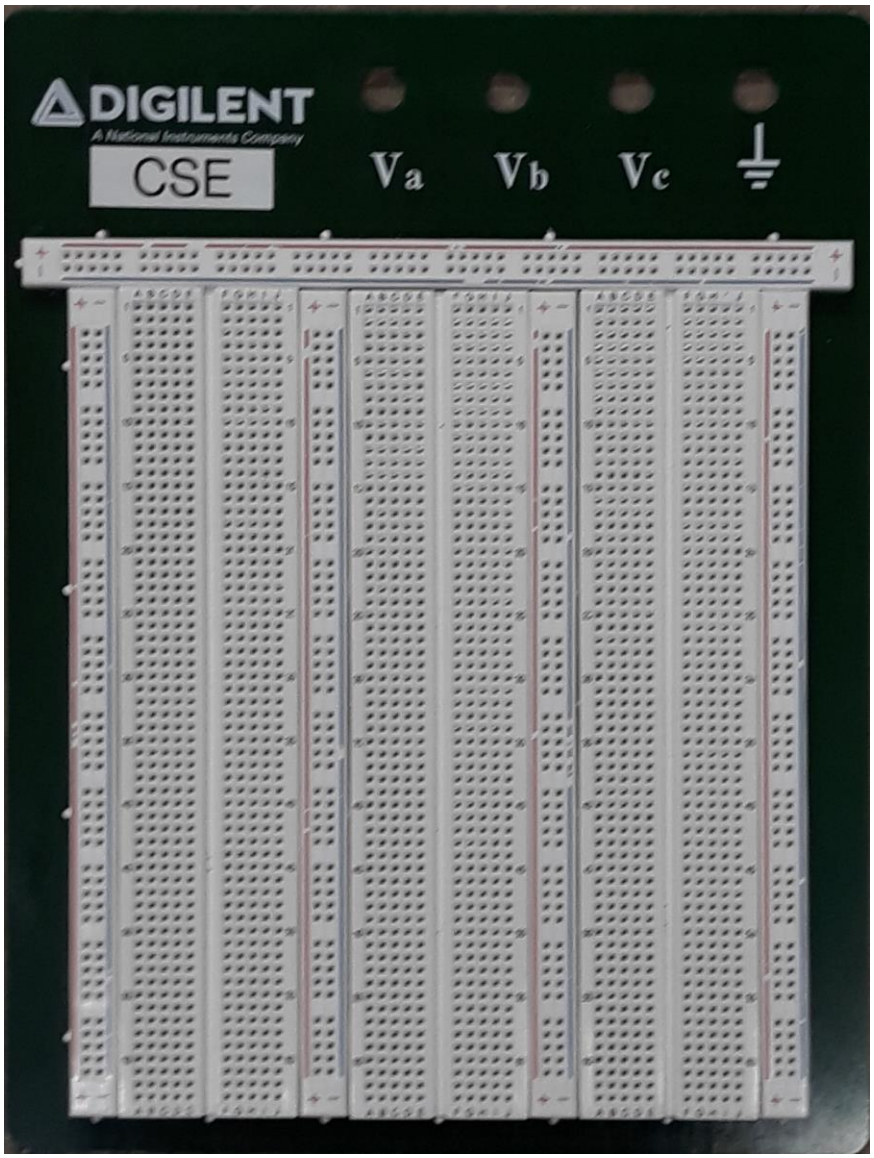
Introduction

The goal of this lab is to quickly introduce you to some of the equipment you will use during the course so that the upcoming two labs will be simpler.

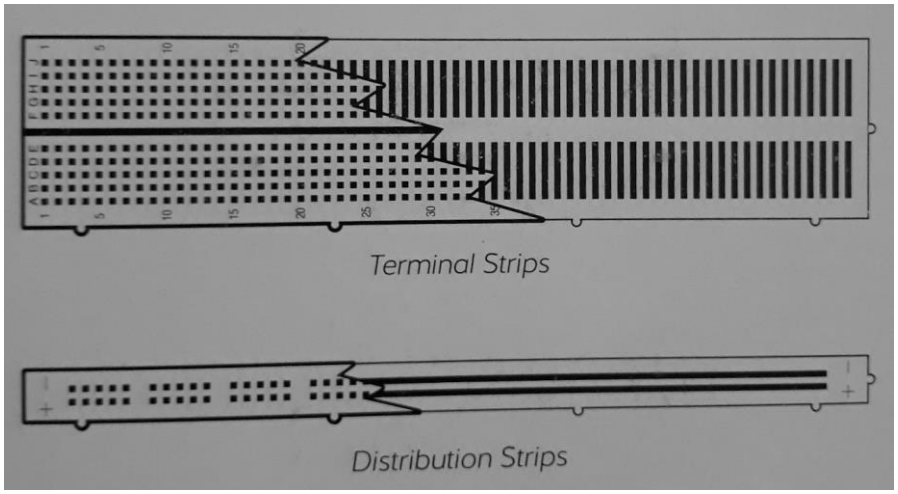
In the upcoming labs, we will use a selection of integrated circuits (aka ICs or chips), LEDs, switches, resistors, and wire leads to build digital logic circuits, like those used to build computers that run the programs that you will write.

Breadboard

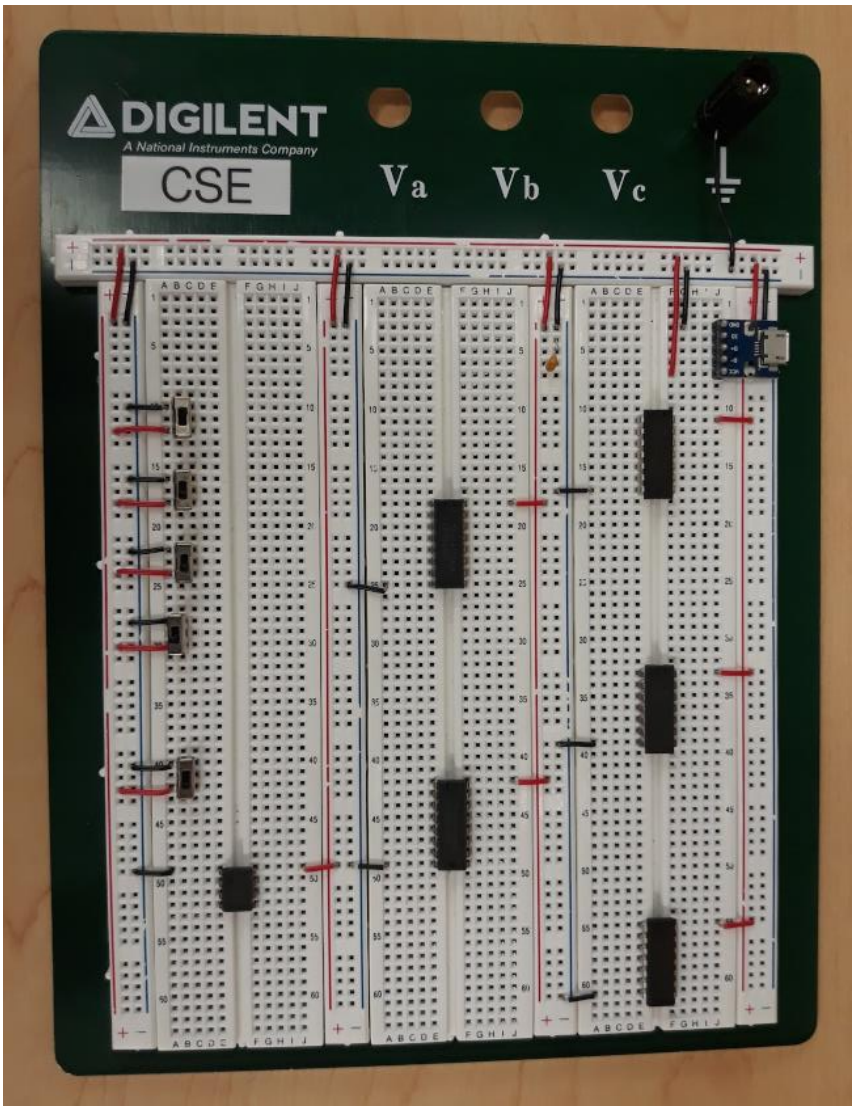
All of these circuit components will be inserted into a breadboard that looks like this:



The secret to using a breadboard is knowing what is under the grid of sockets. For the terminal strips, each row of 5 sockets are interconnected. The distribution strips, which carry 5V (red strip) or 0V (blue strip), are connected along the entire length of the strip. These interconnections are shown below:



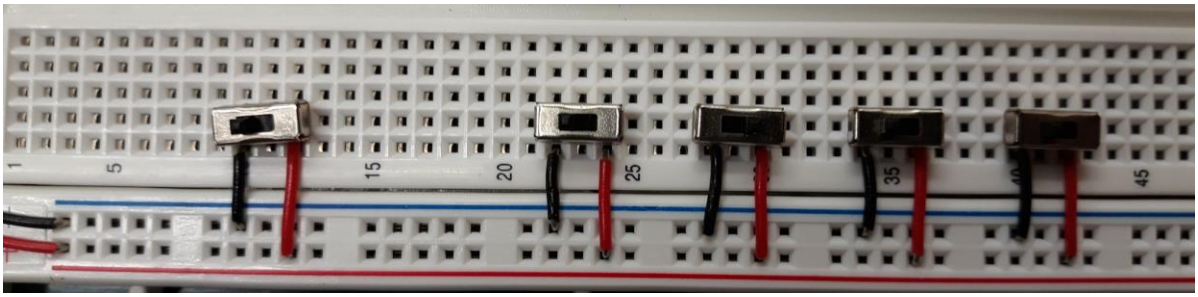
To make the lab easier, a USB adapter (upper left), 5 slide switches (bottom), 6 ICs (the black 8-, 14-, and 16-pin devices) and red and black wires have been populated in the board. Please do not remove or change these wires, switches, ICs, or the USB adapter.



Each of the red wires carries voltage from the USB port of you computer and is approximately 5V (compare to an AA battery which is about 1.5V). Each of the black wires is connected to ground (another way of saying 0V). So if you measure the voltage between the red and black wires at any point on the board, you will measure about 5V – 0V = 5V when the computer is powered on.

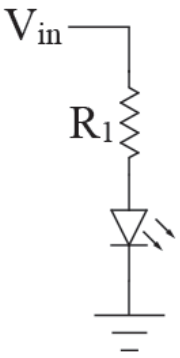
Slide Switches

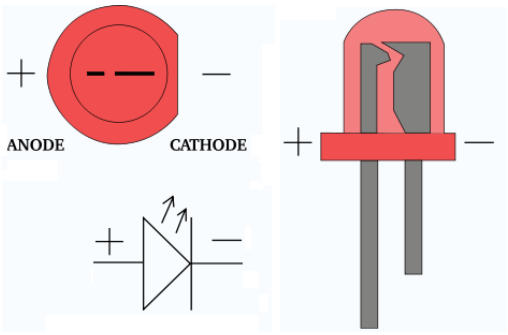
Moving the slide switch to the left selects 0V (aka low/'0') from the black wire and moving the slide switch to the right selects 5V (aka high/'1') from the red wire. You can move these switches to select whatever voltage to use. The terminal strip containing the center pin is the output that you can connect to an LED or ICs (in the next labs). The center pin is located between the red and black wire terminal strips of the 3-pin slide switch



Light Emitting Diodes (LEDs)

To visually see if the voltage is present, we can use an light-emitting diode (LED) to look at the voltages at different points in the circuit using the circuit below:





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In the figure above, the 3 parallel line symbol at the bottom means ground, so it connects to 0V (the black wires on the board). R1 is a 220 ohm resistor (red-red-brown color bands) that prevents damage to the LED. When connecting the LED, the shorter lead connects to ground and the longer lead connects to the resistor.

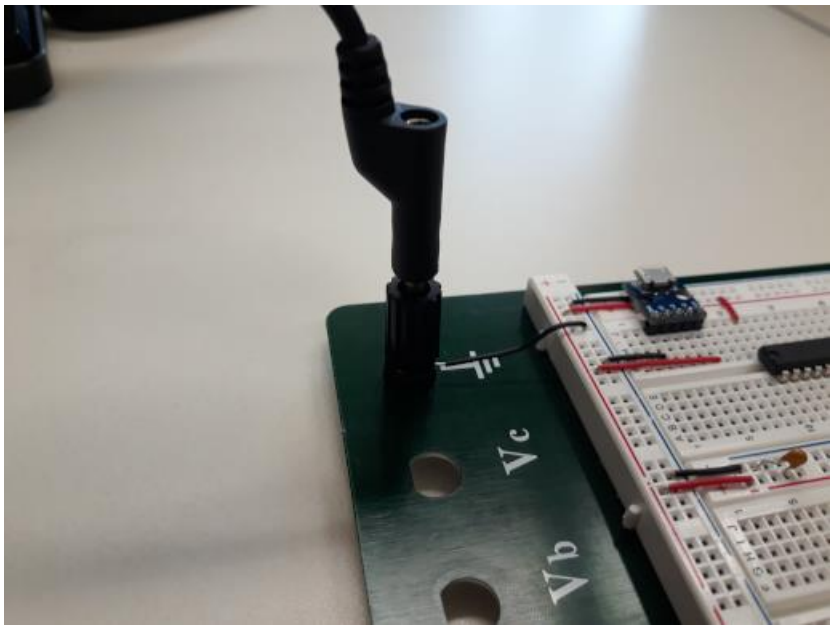
Multi-meter

Many times, you will need to measure the actual voltage between two points in the circuit. A picture of a multi-meter is shown below.

A multi-meter can measure voltages if you put it in the DC voltage mode by rotating the knob to the position marked as _V_ as shown below.

To measure a voltage, insert the red probe into the V banana jacks and the black banana plug into the COM banana jack at the bottom as shown here.

In this lab, the black banana jack cord that connects to the multimeter will always be connected to 0V (a black wire or a blue strip) on the breadboard) by plugging it into the banana jack on the breadboards as shown below.



The measure the voltage, touch the end of the red probes to the conductors (metal points) in the circuit to be measured. The black wire is already connected to 0V with the banana plug lead.

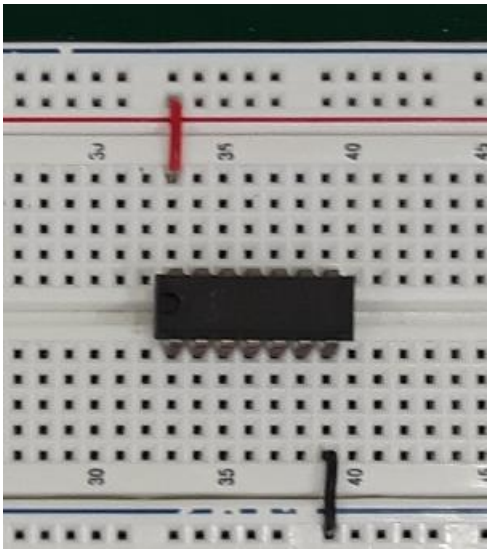
A Few Wiring Hints

1. Red wires should only be used when connecting 5V to a component.

2. Black wires should only be used when connecting 0V (ground) to a component.

3. To assist in debugging in the lab, please do not use red or black wires for any other purpose.

4. Not that the chips on the board straddle the divider between two 5 contact rows on the board as shown below. In this case, the red wire routes 5V to the chip and the black wire routes 0V to the chip. More on this in the next lab.



Meet the Lab Worksheet

Name Faris Soepangat

Course/Section CSE 1106-010

Please complete the following steps to complete the introduction lab:

1. What color wire carries 5V on the breadboard? Red

2. What color distribution strip carries 5V on the breadboard? Red

3. What color wire carries 0V on the breadboard? Black

4. What color distribution strip carries 0V on the breadboard? Blue

5. Using a type A to micro B USB cable, connect the breadboard to the USB port of the computer.

6. Using a multi-meter, measure the difference between the red and black wires on the board and record below. It should be around 5V, but it will not be exactly.

The voltage was 5.01 V

Note: This is the same voltage that is provided your flash drives and phone chargers when you plug them into a computer.

7. Take the blue LED and a 220 ohm resistor (red-red-brown) in series as shown in the LED Section above and connect them across the red (5V) and blue (0V) distribution strips at a point near the Digilent label so it is out of the way for the next steps. It should glow brightly.

8. Take the orange LED and a 220 ohm resistor (red-red-brown) in series as shown in the LED Section above and connect them between the center connection of one of the slide switches and the blue (0V) distribution strips.

9. Using a multi-meter, measure the difference between the center connection of the switch and the blue (0V) distribution strip and record below with the switch in the left and right position below:

With the switch in the left position (relative the the picture in the Breadboard Section),
the voltage was 0 V and the LED was off (on or off)

With the switch in the right position,
the voltage was 4.935 V and the LED was on (on or off)

10. Lab checkout steps:

a. Show your working circuit and program to the grader.

b. Create a file, lastname_netid_lab0.zip, that includes the following files:

- A JPEG/JPG or PNG image of your working circuit

- This completed lab worksheet with all data completed

c. Upload the zip file to Canvas.

d. After you have taken your picture and send the zip file, remove the LEDs and resistors you added and return everything to the box on the shelf. Do not remove the USB adapter, ICs, slide switches, or the pre-loaded red and black wires.

Thank you for attending the lab.

In the next lab, we will explore basic digital logic circuits and their relation to Boolean operators in the C programming language.

Drs. Losh and Eary

Lab 0 Rubric

Prerequisite:
-40: Did not complete syllabus quiz on time

Assignment:
-10: Wrong file name
-10: Wrong file type for image
-40: No completed worksheet
-40: No image of working circuit