Name:

1 Introduction

The breadboard is laid out as a grid of holes spaced 0.1 inches apart. Each group of five holes is electrically connected (see Fig. 1). Some breadboards also have power and ground buses which allow you to distribute power across the entire board. In Fig. 1, all of the holes in the blue row on the top of the board are electrically connected. All holes on the red row are electrically connected also.

2 Baby’s First Voltage Divider

We’re going to start off by working on the voltage divider shown in Fig. 3a. In the space below, compute the voltage across R2.

Now build the circuit on your breadboard. Use your 5V USB power supply to apply 5V across the two resistors. Measure the voltage across R2 with a digital multimeter and write the voltage in the box below.

3 LED

Next we will bias a white LED with a resistor. The datasheet for our LED is linked below. Page 2 of the datasheet has a bunch of information about the LED, including specifications for forward current (20mA) and forward voltage (2.9-3.6V).
In the box below, calculate the resistance that we need to use to bias the LED to 20 mA using a 5V source.

Neil is a bonehead, and he didn’t order the resistor value that you specified above. The only resistors we have are 47Ω and 100Ω. Which one of these should we use, and how much current will be going through the LED if we use the one you picked?

Will your choice of bias resistor result in a brighter or dimmer LED than the ideal value you computed first?

Now, build the LED bias circuit on your breadboard and measure the voltage across the LED. Write your measurement in the box.

4 Filter

Next we are going to build an RC lowpass filter. The breadboard diagram of the butterworth filter is in Fig. 3b. After you’ve built the circuit, use the 1 kHz oscillator on the oscilloscope as the input voltage \( v_s(t) \).

What is the peak-to-peak voltage of the 1 kHz square wave generated by the scope?

What is the peak-to-peak voltage of the filtered signal \( v_C(t) \)?

![RC lowpass filter circuit diagram](image1)

![RC lowpass filter breadboard diagram](image2)

Figure 3: Building a butterworth filter.