The 741 Operational Amplifier

In this lab, you will design and build several operational amplifier circuits on the breadboard.

Use $-V_{cc} = -15\text{V}$ and $+V_{cc} = +15\text{V}$ for all circuits.

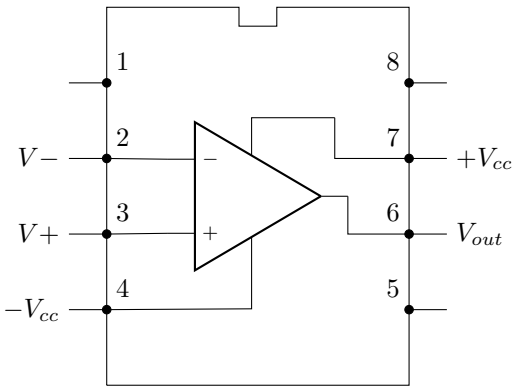

Figure 1: For this lab you don't need to connect pins 1, 5 or 8

Prelab

1. Given the circuit shown in Figure 2, assume that $V_{in} = 5\text{V}$. Calculate V_{out}.

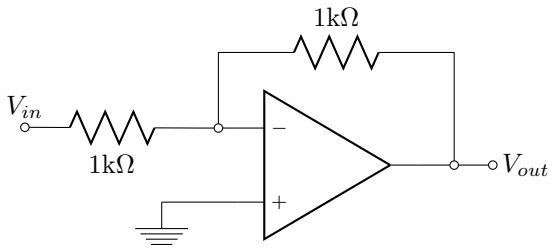

Figure 2:

2. For the circuit in Figure 3 (non-inverting op-amp), assume $V_{in} = 5\text{V}$. Calculate V_{out}.

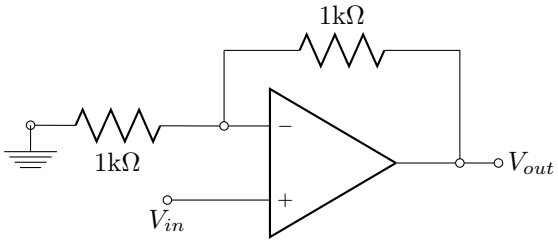

Figure 3:

3. For the above problems (1 and 2), what is the highest and lowest input voltages you could apply to each circuit before the op-amp would "rail" (saturate)?
4. Design an op-amp circuit with a total gain of 3.25.
5. Design an op-amp circuit with a total gain of -3.25.

Lab

1. Build the circuit shown in Figure 2 (inverting op-amp) on the protoboard. **After your wiring has been checked by a lab assistant**, apply a 5V input voltage. Measure and record V_{out}. Is this the value you expected to see? How close was your answer to your calculated result (do a percent difference).
2. Build the circuit shown in Figure 3. Apply a 5V input voltage. Measure and record V_{out}. Is this the value you expected to get? How close is it to your expected value (percent difference)?
3. Build the op-amp circuit you designed in the prelab with a total gain of 3.25. Apply a 5V input signal and record Vout. Record your result for V_{out}.
4. Build the op-amp circuit you designed in the prelab with a total gain of -3.25. Apply a 5V input signal and record V_{out}. Record your result for V_{out}.
5. Design and build a cascaded op-amp circuit with a total gain of $+1/8$ (Refer to your class notes for assistance, if necessary). Calculate V_{out} for this circuit if you were to apply a 5V input. Apply a 5V input signal and record V_{out}. How close is your result to what you ideally would get?

Questions

1. How could you design a circuit to provide a gain of 1/8 to an input signal without using an op-amp?
2. In problems 3 and 4, were your outputs 3.25 (or -3.25) times the magnitude or your inputs? Explain why or why not.