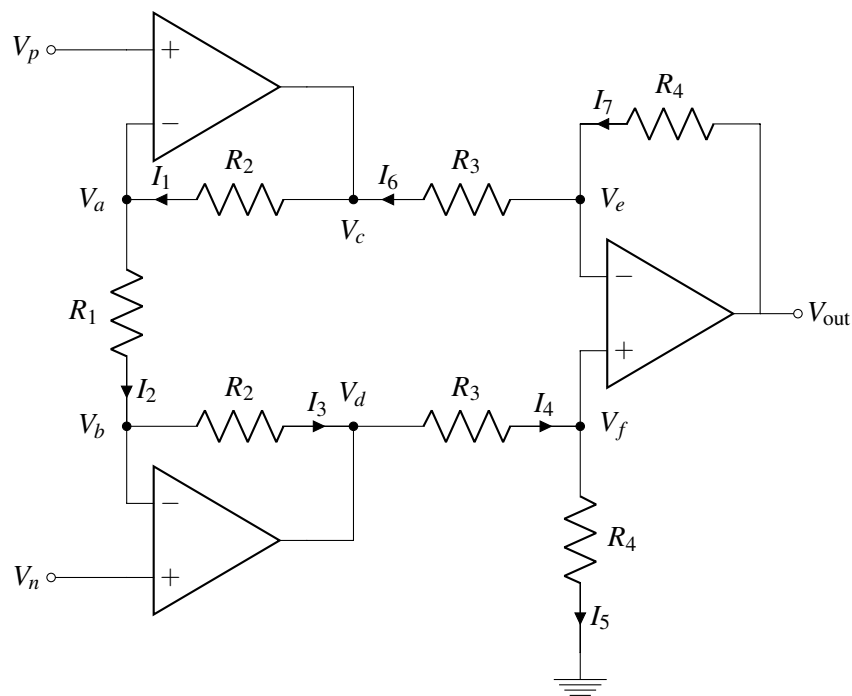


**This homework is due on Wednesday, August 29, 2018, at 11:59PM**  
**Self-grades are due on Monday, September 03, 2018, at 11:59PM**

### Mechanical:

## 1. Op-Amp Review

Consider the circuit below:

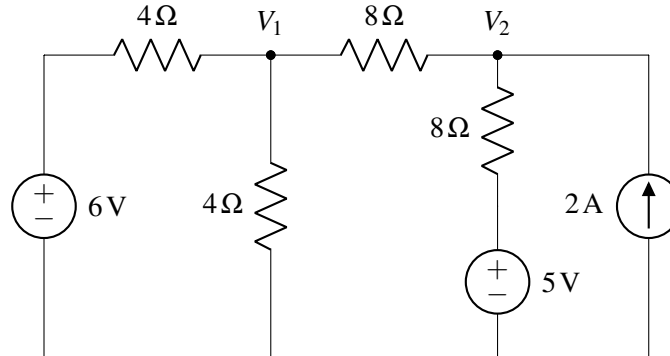


- Write the KCL equations at each node (you can skip the nodes  $V_c$  and  $V_d$ ). Use Ohm's law and the golden rules of op-amps to express  $I_1$  through  $I_7$  in terms of voltages and resistances.
- In part (a), we used a general circuit analysis procedure to develop a full set of equations that we could then solve (as we could for any circuit).  
However, with this specific circuit, we can make some observations to reduce the amount of necessary calculations. Notice that there exists a symmetry between the two op-amps at the first stage of this circuit. What is the relationship between  $I_1$  and  $I_3$ ? How do  $I_1$  and  $I_3$  influence  $I_2$ ?
- Compute  $I_2$ .
- Compute  $V_c$  and  $V_d$ .

- (e) Compute  $V_f$ .
- (f) Compute  $V_{out}$ .

## 2. More practice

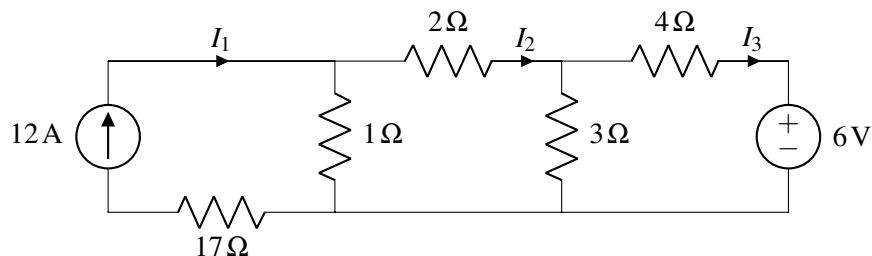
Consider the circuit shown below:



Compute  $V_1$  and  $V_2$ .

## 3. OPTIONAL: Even more practice

Consider the circuit shown below:



Determine the amount of power supplied by the voltage source. Do not use superposition.

## 4. Write Your Own Question And Provide a Thorough Solution.

Writing your own problems is a very important way to really learn material. The famous “Bloom’s Taxonomy” that lists the levels of learning is: Remember, Understand, Apply, Analyze, Evaluate, and Create. Using what you know to create is the top level. We rarely ask you any homework questions about the lowest level of straight-up remembering, expecting you to be able to do that yourself (e.g. making flashcards). But we don’t want the same to be true about the highest level. As a practical matter, having some practice at trying to create problems helps you study for exams much better than simply counting on solving existing practice problems. This is because thinking about how to create an interesting problem forces you to really look at the material from the perspective of those who are going to create the exams. Besides, this is fun. If you want to make a boring problem, go ahead. That is your prerogative. But it is more fun to really engage with the material, discover something interesting, and then come up with a problem that walks others down a journey that lets them share your discovery. You don’t have to achieve this every week. But unless you try every week, it probably won’t ever happen.