ESE 505 - SPRING 2015 - HOMEWORK #1
DUE by 4:30 PM on Wednesday 21-Jan-2015

For our initial lab exercises, we need to understand the basic operation of operational amplifiers. Since many students in the class already know how they work, we won't cover this in lecture. But if you don't know how op-amps work, then you should do some preparation before coming to lab.

To get the basic idea, you should start by watching this 5-minute tutorial video, which uses the LM324 quad op-amp IC chip that we will use in the lab: https://www.youtube.com/watch?v=TQB1VlLBgJE.

Here is another short (about 15-minute) video that gives a bit more detail: https://www.youtube.com/watch?v=K03Rom3Cs28.

If you are more patient and would like a more traditional lecture, you can watch this MIT lecture, which is what I would say if I did give a lecture in our class: https://www.youtube.com/watch?v=2SwT6JnfCq8. There is also a nice recitation (about 20 minutes) from MIT: http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-01sc-introduction-to-electrical-engineering-and-computer-science-i-spring-2011/unit-3-circuits/op-amps/#?w=535

Prefer to learn by reading, or at least skimming, some written notes? Here is a nice reference work from Georgia Tech: http://users.ece.gatech.edu/mleach/ece3050/sp04/OpAmps01.pdf.

Ready to test yourself? Try Dr. Cimbala's 15-question online quiz about op-amps: http://www.mne.psu.edu/cgi-me345/Quizzes/Op_amp/quiz_gen.pl

What to submit? For the circuit shown at right, make a graph showing Vout on the y-axis and Vin on the x-axis, with Vin ranging from 0V to 5V. Assume the following details:

- The op-amp is an LM324N, with a 5-volt single-side supply (power is 0 to 5 volts).
- R2=100kΩ and R1=47kΩ.
- The "ground" symbol shown (⏚) is a virtual ground, where the voltage is fixed at 2.5V (midway between the supply voltages to the op-amp).