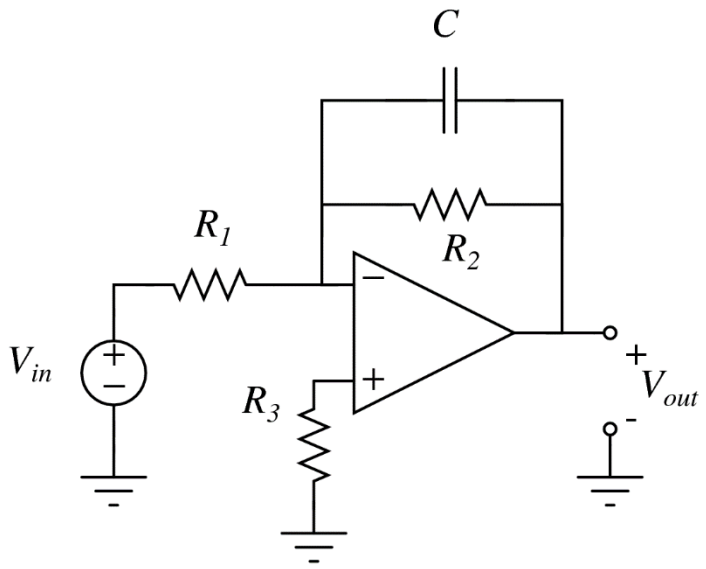
University of North Carolina-Charlotte
Department of Electrical and Computer Engineering
ECGR 3157 Electrical Engineering Design II Fall 2013

Problem Set 2
Due: Thursday September 26, 2013

Please show all work throughout. You will lose credit if you do not.

Problem 1: Basic op-amp circuit analysis

You are given the following circuit:

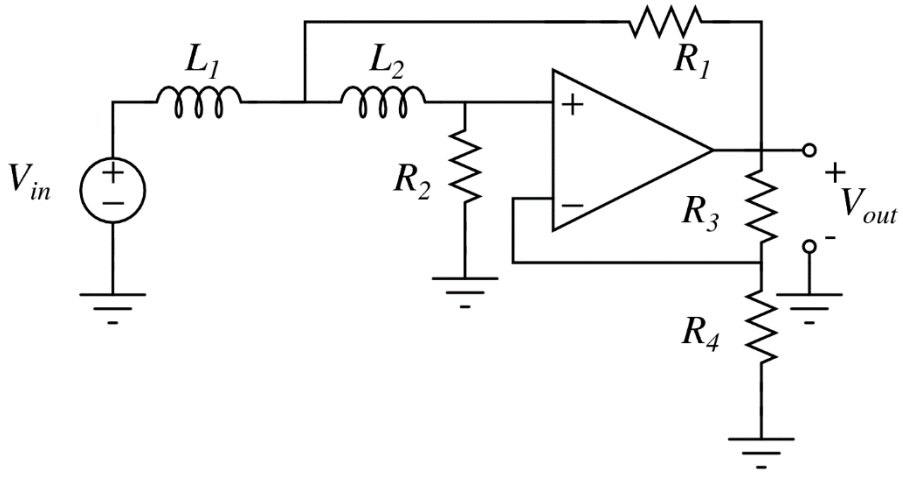


Please answer the following questions about this circuit, assuming that the source v_{in} is sinusoidal.

a) At low frequency, does a capacitor appear as a short or as an open? Explain using both equations and words. Using this knowledge, sketch an equivalent low-frequency circuit model.
b) What is the gain of the circuit that you drew in part a? You must show your work in order to receive credit.
c) At high frequency, does a capacitor appear as a short or as an open? Explain using both equations and words. Using this knowledge, sketch an equivalent high-frequency circuit model.
d) What is the gain of the circuit that you drew in part c? You must show your work in order to receive credit.
e) What is the gain of the complete circuit at any given frequency ω? Show that this result is consistent with your intuitive results from parts b and d by taking the limit of this expression as $\omega \to 0$ and as $\omega \to +\infty$.

Problem 2: Basic Op-Amp Circuit Analysis

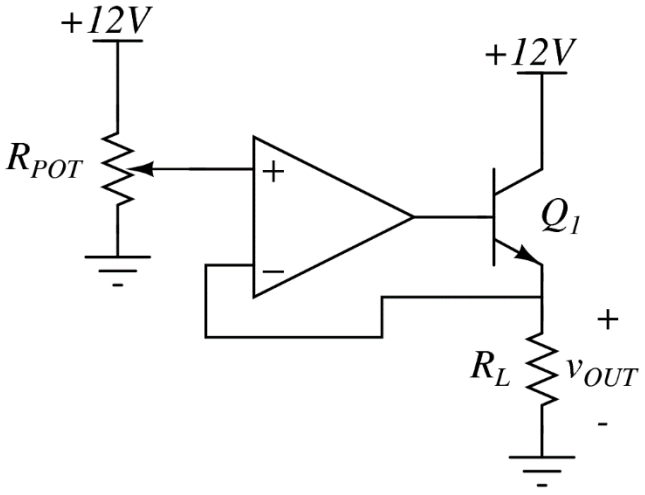
Please answer the following questions about this circuit, assuming that the source v_{in} is sinusoidal.



a) What is the gain from V_{in} to V_{out}?
b) Is this a low-pass or high-pass filter? Explain carefully using your transfer function from part a.
c) Does this circuit provide gain or attenuation at DC? Explain carefully using your transfer function from part a.

Problem 3: Basic Op-Amp Circuit Analysis

You are given the following circuit:



If the potentiometer is set to 50%, what is the value of the output voltage? You must show your work.