ELEC 101, Spring 2005
Prof. Rich Kozick

Homework 6

Date Assigned: Monday, February 21, 2005
Date Due: Thursday, February 24 (pre–lab activities in item 2) and Monday, February 28, 2005 (items 3–6)

1. **Reading:** Please continue to study Chapter 2 in the Bobrow text, Section 2.5 (Thevenin equivalent circuit) and Section 2.6 (superposition). Later this week, we will begin discussing capacitors. The relevant reading is in Sections 3.1, 3.2, and 3.3. The concept of a *time constant* is very important.

2. Before lab on Thursday, February 24, please do the pre–lab activities that are printed in red on the Lab 5 assignment that is posted on the web page.

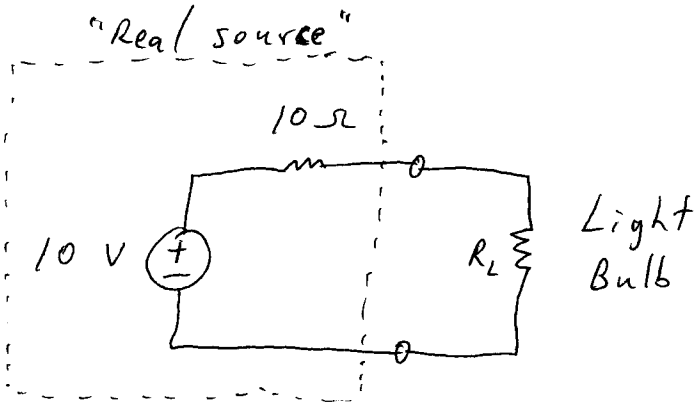
   Also, please note the date changes that are indicated in red at the bottom of the revised Lab 5 assignment. All students are asked to demonstrate their R–2R ladder D/A converter by March 3, and I will collect your lab notebooks on March 3 to grade labs 1–5.

3. Suppose you have a real (non–ideal) voltage source with 10 ohm internal resistance, as shown below. The source is used to light a bulb, as shown.

   (a) What value of resistance should the bulb have in order for it to shine as brightly as possible?

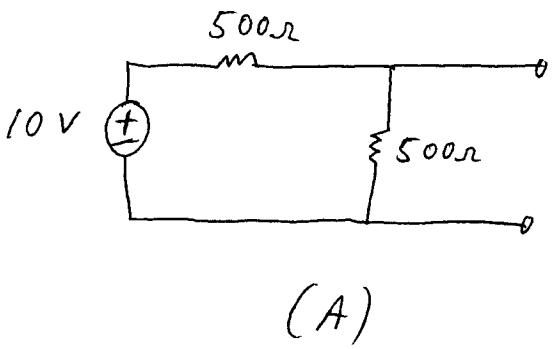
   (b) How much power is dissipated by the bulb when its resistance has the value you specified in part (a)?

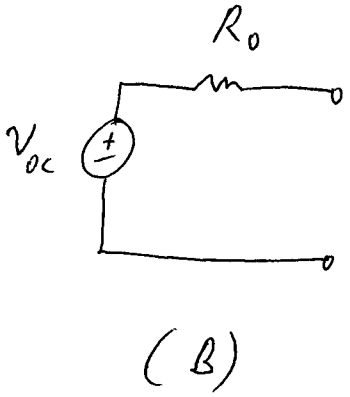
   (c) How much power is dissipated by the bulb when it has resistance 1 ohm? What about 100 ohm?



4. Assume that you have a 20 volt source available and that this 20 volt source is very good, that is, it has a negligible internal resistance. Such a source is usually referred to as a "stiff" source. Design a circuit that gives 10 volts open circuit with no more than 100 ohms internal resistance. That is, your circuit should have a Thevenin model with v_{oc} = 10 volts and R_0 <= 100 ohms.

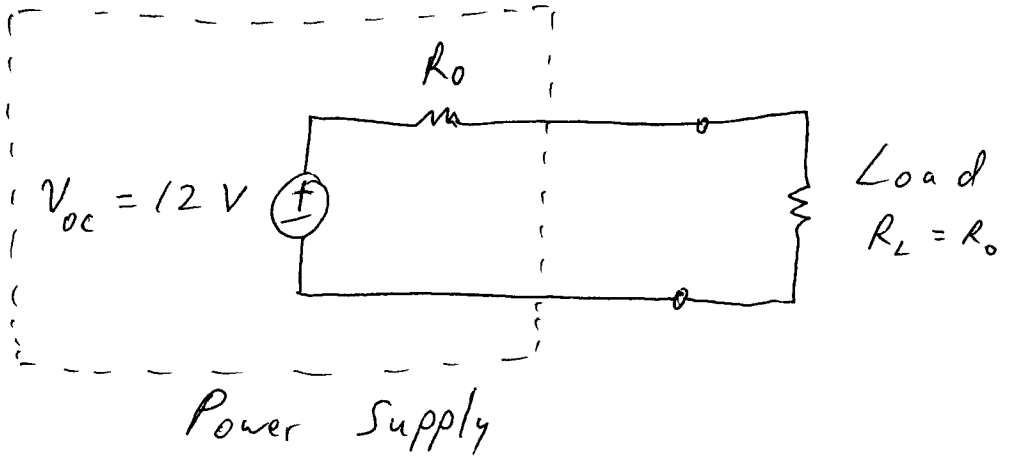
5. The voltage divider shown in circuit (A) below has been used to convert an *ideal* 10 volt source into a 5 volt source. Please find the Thevenin model for circuit (A). That is, find v_{oc} and R_0 in circuit (B) so that both circuits have the same voltage and current behavior at their terminals.





6. Suppose that a voltage source (also called a power supply) is to be designed such that it provides 12 volts when its terminals are open–circuited (nothing connected between them). In addition, the voltage source must be able to provide at least 70 watts of power to a load. What is the *maximum* value of R_0 in the Thevenin model for this source?

   (The load resistance R_L can be assumed to be matched to R_0 for maximum power transfer.)



Thank you.