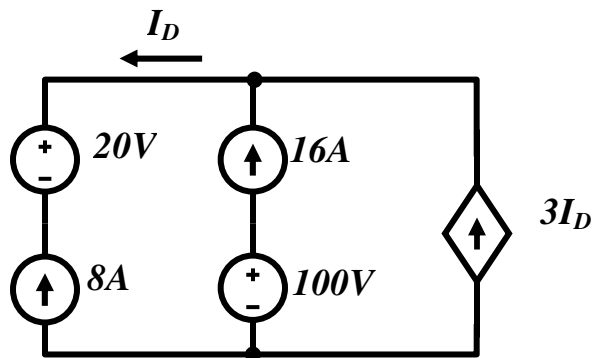


Department of Electrical & Computer Engineering
University of California, Santa Barbara

Homework #2

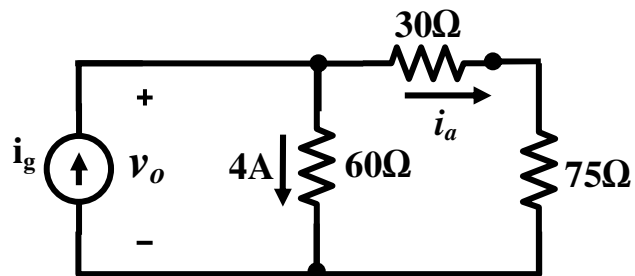
Due Date: April 22, 2008 (by 5:00 pm)

1. a) Is the interconnection in the figure below valid? Explain.
- b) Can you find the total energy developed in the circuit? Explain.



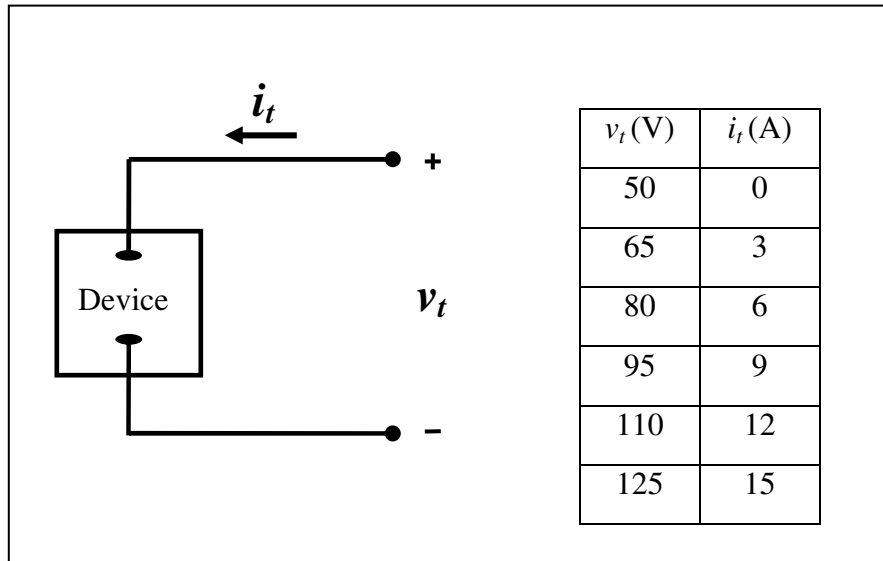
2. Given the circuit below,

- a) Find the currents i_a and i_g
- b) Find the voltage v_o
- c) Verify that power developed equals to the power dissipated.



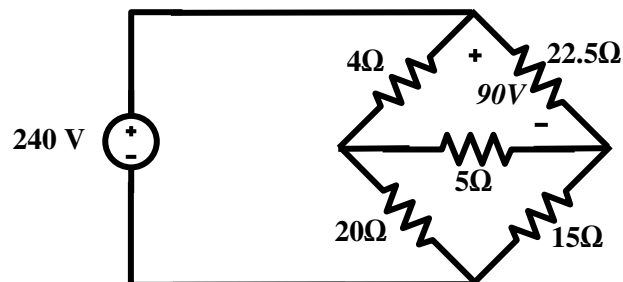
3. The voltage and current were measured at the terminals of the device shown in the figure below and the results are tabulated in the table.

- Construct a circuit model for this device using an ideal current source and a resistor.
- Use the model to predict the value of i_t when a 20Ω resistor is connected across the terminals of the device.

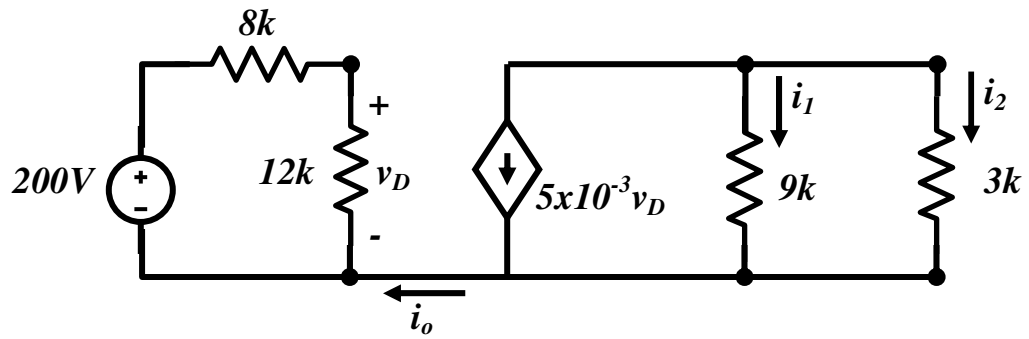


4. For the circuit shown below, find

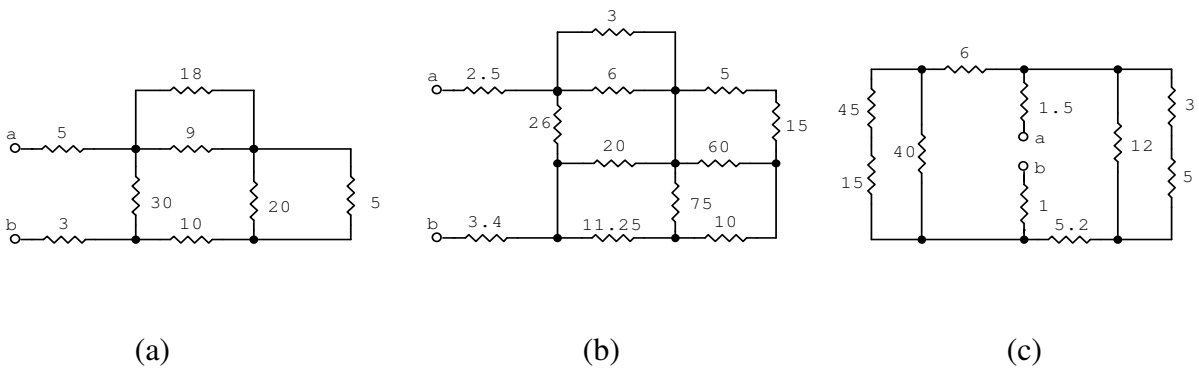
- the power dissipated in each resistor and
- the power supplied by the 240V ideal voltage source



4. Find (a) i_o , (b) i_1 , (c) i_2 , in the circuit below.

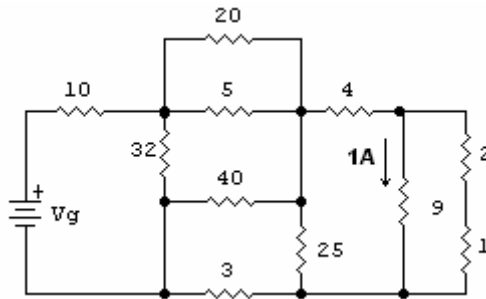


5. Find the equivalent resistance R_{ab} for each of the following circuits (all resistances in ohms):



6. The current in the 9Ω resistor in the circuit below is 1A, as shown. (all resistances in ohms)

a) Find v_g b) Find the power dissipated in the 20Ω resistor.

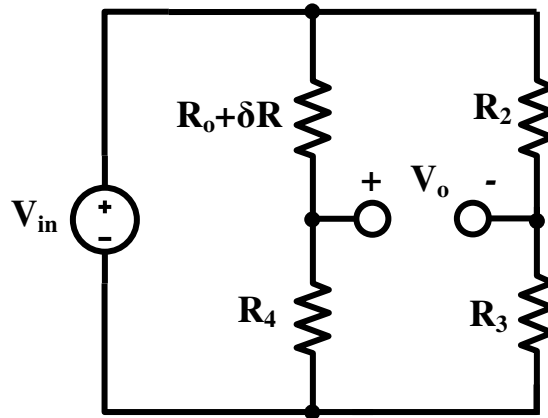


7. a) For the circuit shown below, the bridge is balanced when $\delta R=0$. Show that if $\delta R \ll R_o$, the bridge output voltage is approximately:

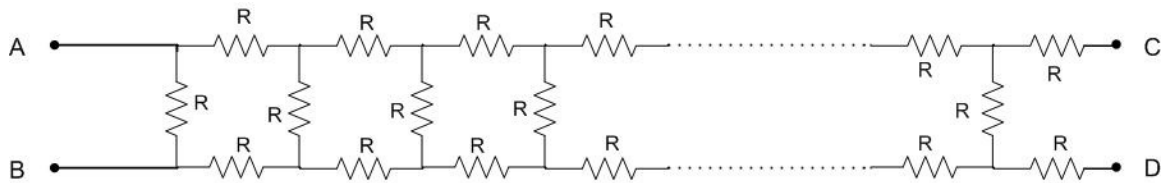
$$V_o \approx \frac{-\delta R \cdot R_4}{(R_o + R_4)^2} V_{in}$$

b) Given $R_2 = 1k\Omega$, $R_3 = 500\Omega$, $R_4 = 5k\Omega$, and $V_{in} = 6V$, what is the approximate bridge output voltage if δR is 3% of R_o ?

c) Find the actual value of V_o in part (b).



8. The following circuit represents a ladder of resistances each with a value R . The number of steps in that ladder is not known. Find the value of resistance Z to be connected between terminals C and D such that the effective resistance between terminals A & B remains the same irrespective of number of steps in the ladder.



9. Consider the cube shown below that is made of 12 identical resistors, each along the edges of the cube. If R is the resistance of each of these resistors, find R_{12} , the equivalent resistance of the cube edge. (**Hint:** you can either do it by brute force, by applying KCL and KVL methods or identify the symmetry in the structure and solve it more elegantly).

