ECE 300
Spring Semester, 2006
HW Set #2: version 2

Due: January 26, 2005 **Name**________________________
wlg Print (last, first)

Use engineering paper. Work only on one side of the paper. Use this sheet as your cover sheet, placed on top of your work and stapled in the top left-hand corner. Number the problems at the top of the page, in the center of the sheet. **Do neat work. Underline your answers. Show how you got your equations**. **Be sure to show how you got your answers.** Each problem counts 10 points.

(1) You are given the circuit of Figure 1. The four nodes of the circuit are identified. Using KCL, write the respective equation at each node. This will give you 4 equations. Add the equations you get at nodes 1, 2, and 3. This should give the equation you get at node 4. What this shows is that only 3 of the equations are linearly independent. In general, if a circuit has n nodes, only n-1 of the nodes can be used in applying KCL and getting independent equations. **Rule: If a circuit has n nodes, only n-1 nodes can be used to write independent KCL equations.**

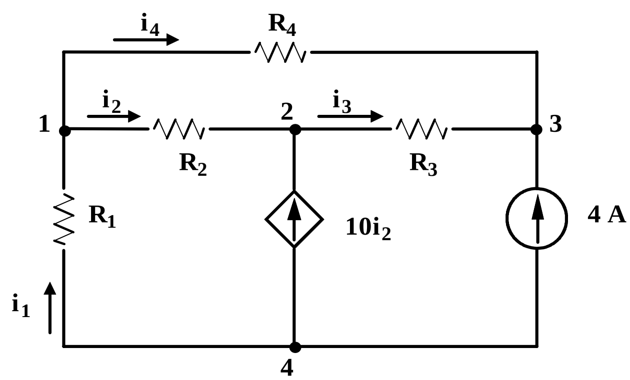

Figure 1: Circuit for problem 1.

(2) You are given the circuit of Figure 2. Find I_1, I_2 and I_3. Ans: I_1 = 5 mA, I_2 = 20 mA, I_3 = -15 mA

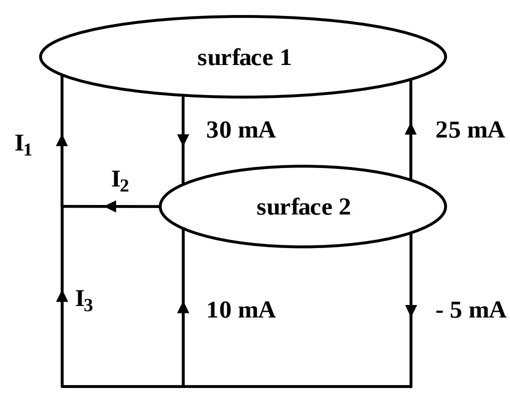

Figure 2: Circuit for problem 2.

(3) You are given the circuit of Figure 3. The loops are identified as loop 1, loop 2, and loop 3. Write KVL around each loop. Add loop 1 and loop 2 together and show that you get the equation for loop 3. This shows that only two of the equations are independent. **Rule: The number of independent KVL equations that may be written for a circuit is equal to the number of mesh (the number of "windows") in the circuit.**

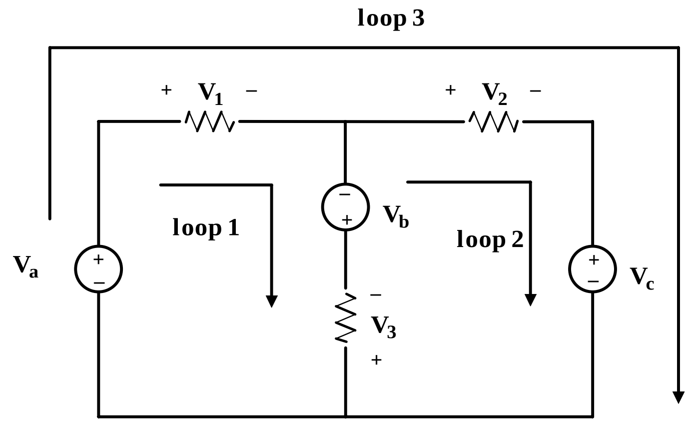

Figure 3: Circuit for problem 3.

(4) You are given the circuit of Figure 4. (a) Find V_{ad} Ans –16 V; (b) Find V_{eb} Ans – 36 V

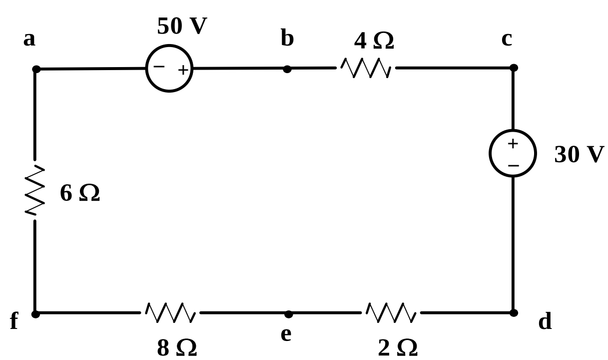

Figure 4: Circuit for problem 4.

(5) You are given the circuit of Figure 5. Find i_1, i_2 and i_3. Ans: $i_1 = 0.654$ A, $i_2 = 0.462$ A, $i_3 = 0.192$

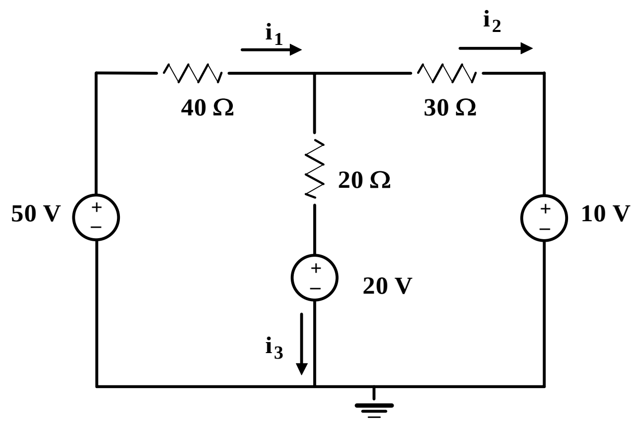

Figure 5: Circuit for problem 5.

(6) For the circuit in Problem 5, show that the power absorbed by the 40 Ω, 30 Ω and 20 Ω resistors is equal to the power supplied by the 50 V, 20 V and 10 V sources.

(7) You are given the circuit of Figure 7. Compute (determine) the values of the currents i_1, i_2, i_3, i_4. Ans: $i_1 = 2$ A, $i_2 = 0.167$ A, $i_3 = 1.83$ A, $i_4 = -1.17$ A.

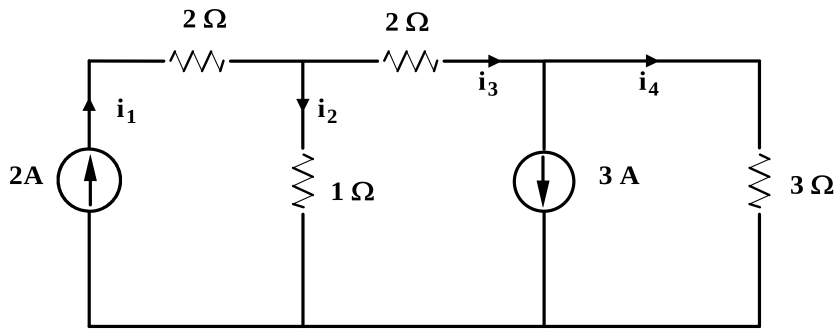

Figure 7: Circuit for problem 7.

(8) A certain circuit having two independent voltage sources and three linear resistors produces the following equations in matrix form.

$$\begin{bmatrix} 25 & -15 \\ -15 & 45 \end{bmatrix} \begin{bmatrix} i_1 \\ i_2 \end{bmatrix} = \begin{bmatrix} 50 \\ 30 \end{bmatrix}$$

(a) Draw a circuit using 3 linear resistors and 2 constant independent voltage sources that will produce these equations. Show the locations and values of R_1, R_2, R_3, V_1 and V_2. Ans: On your own.

(b) Solve for i_1 and i_2. Ans: $i_1 = 3$ A, $i_2 = 1.67$ A

(9) You are given the circuit of Figure 9. Use current division, directly, to find I_{30}. Ans: $I_{30} = 4$ A

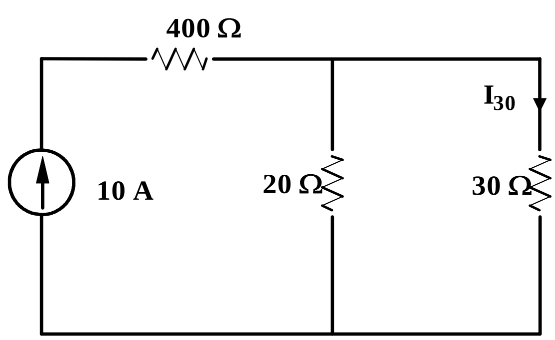

Figure 9: Circuit for problem 9.

(10) (a) Find R_{ab} for the circuit of Figure 10a. Ans: 10 Ω

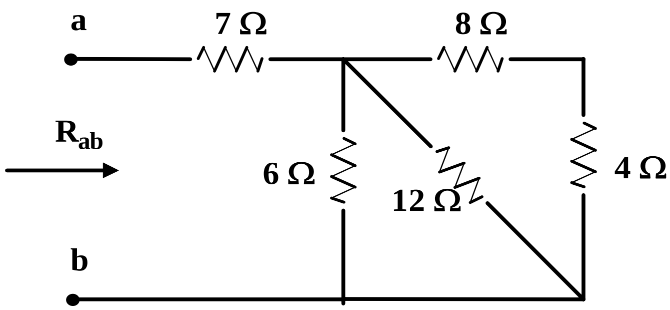

Figure 10a: Circuit for problem 10a.

(b) Find R_{ab} seen looking into terminals a-b for the circuit of Figure 10b. Ans: 20 Ω

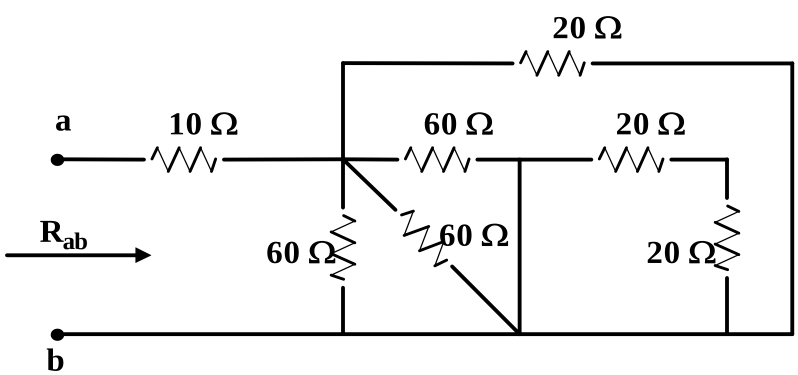

Figure 10b: Circuit for problem 10b

(11) Obtain the equivalent resistance R_{ab} in the circuit of Figure 11. Ans: On your own.

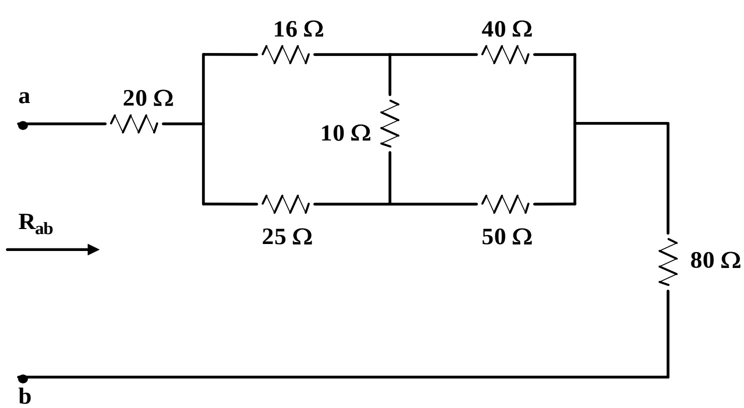

Figure 11: Circuit for problem 11. 132.