PE 7

Nodal Analysis

(Updated 9/10/2008)

A Practical Exercise Name:_____ Section: _____

I. Purpose.

1. Review the concept of voltage subscripts and the measurement of voltages as designated by their subscripts.
2. Review the concept of circuit ground and connecting a different point of the same circuit to the circuit ground.
3. Introduce the use of two voltage sources in a DC series/parallel circuit.
4. Introduce to the application of nodal analysis in determining multiple unknown node voltages and branch currents in a DC series/parallel circuit.

II. Equipment.

Agilent 34401A Digital Multimeter (DMM)
Agilent E3620A Dual DC Power Supply
Quad Board and Test Leads
1000 Ohm resistor
1000 Ohm resistor
1500 Ohm resistor
2000 Ohm resistor
560 Ohm resistor

III. Preparation.

Review procedures for measuring resistance, voltage, and current.

IV. Lab Procedure.

You must **read** and complete each step.

Step One: Construct a DC series/parallel circuit.

☐ On a QUAD board, construct the DC series/parallel circuit in Figure 1.

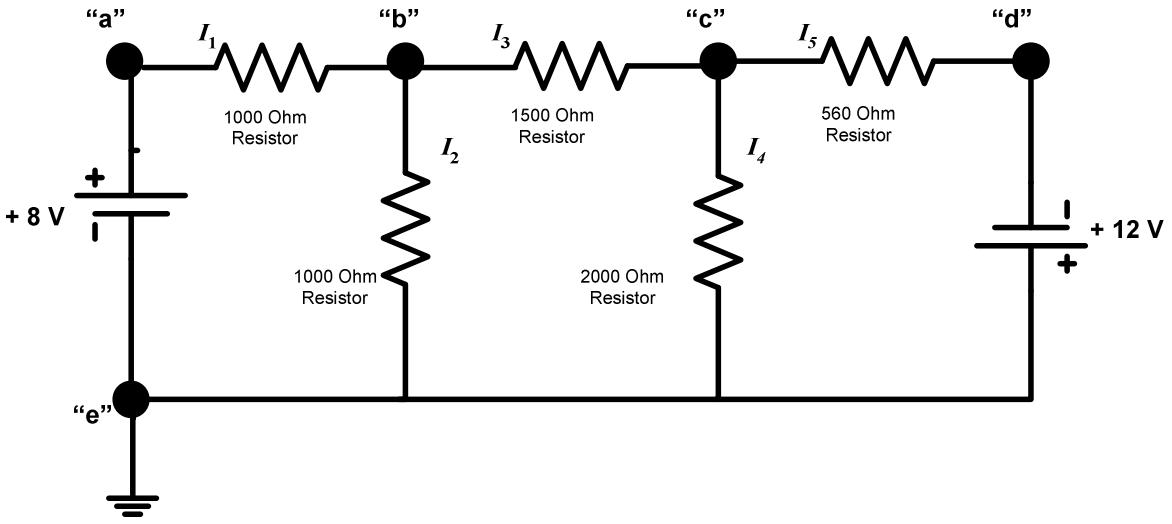

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Figure 1

Step Two: Nodal Analysis.

☐ Assume a direction for each current I_1 through I_5, and draw the current arrows on Figure 1.
☐ Using the assumed current directions, write the KCL equations at nodes *b* and *c*.

Node *b*: _____ Node *c*: _____

☐ Using Ohm's Law and the measured values of your resistors, write the expressions for the branch currents below in terms of the single-subscript nodal voltages and resistors.

$I_1 =$ _____ $I_2 =$ _____

$I_3 =$ _____ $I_4 =$ _____

$I_5 =$ _____

☐ Use Nodal Analysis to analyze this DC series/parallel network, calculating the nodal voltages and branch currents indicated in the following table. Use the space provided below to perform your calculations.

	Calculated value		Calculated value		Calculated value
V_a		V_d		I_3	
V_b		I_1		I_4	
V_c		I_2		I_5	

☐ Use your calculated values to verify Krichoff's current law at node *b*.

$$\Sigma\, I_{\text{entering node } b} = \Sigma\, I_{\text{leaving node } b}$$

$$\Sigma \_\_\_\_\_ = \Sigma \_\_\_\_\_$$

Step Three: Measure single-subscript node voltages and branch currents.

☐ Use the DMM to measure the indicated branch currents and node voltages.

	Measured value		Measured value		Measured value
V_a		V_d		I_3	
V_b		I_1		I_4	
V_c		I_2		I_5	

Step Four: Analyzing your results.

☐ In Figure 2, indicate the direction of the DC currents in all branches and the polarity of the DC voltage across each resistor.

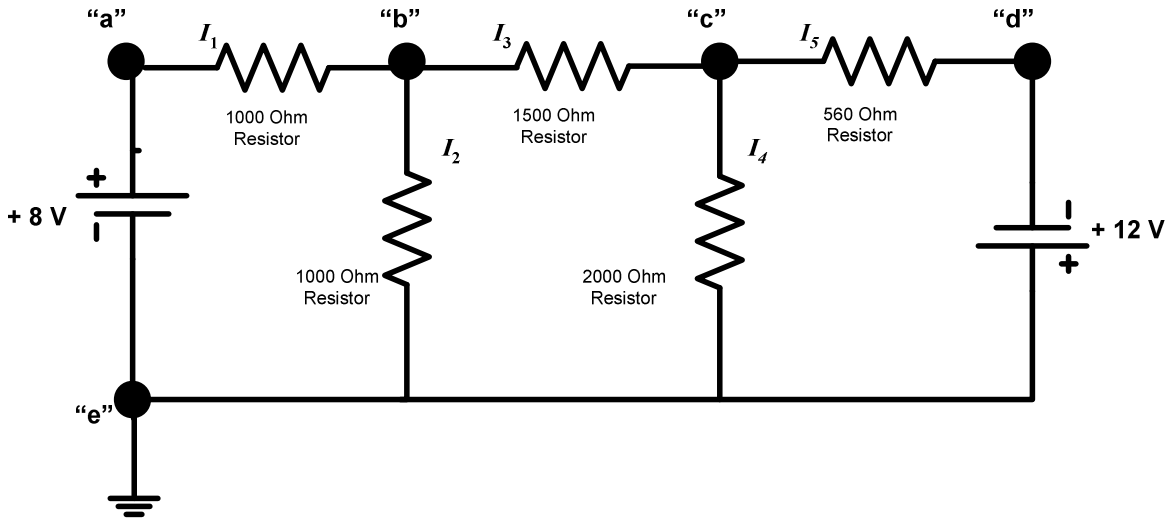

Figure 2

Do the current directions you assumed in step 2 match the current directions you determined in step 3?

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