University of Rochester
Department of Electrical & Computer Engineering

ECE111 Lab #2 The Reality of Node Voltages and Circuit Reduction

Sept. 25 or 26, 2014

Unless prior arrangements are made with the instructor, all laboratories are to be conducted during regularly scheduled lab. Write-ups must be prepared with word-processing software and should be organized as follows: 1) statement of laboratory objectives; 2) concise description of lab procedures with diagrams of all circuits; 3) detailed description of the results; 4) discussion and conclusions; 5) on a separate sheet - stapled to the top of the report - prepare an Executive Summary as described. Report grades will be based upon conciseness, grammar, and spelling, as well as completeness and correctness of quantitative results. Poorly written reports will be returned for revision.

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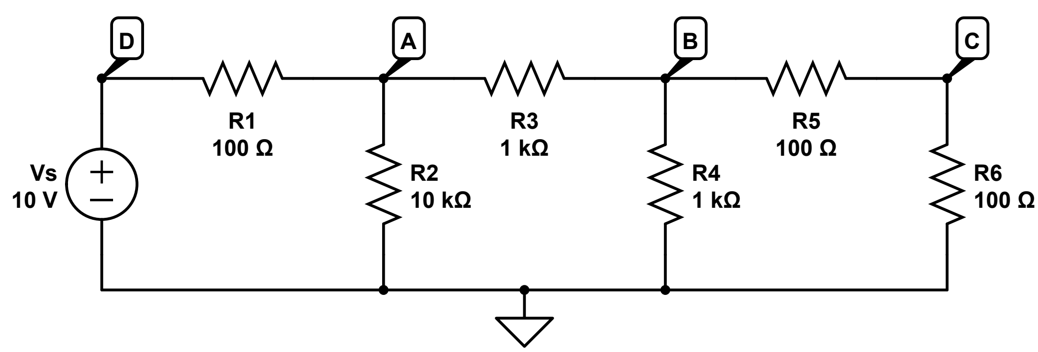
0. Laboratory preparation

Please prepare for this lab assignment by a careful reading of the text and a review of your lecture notes on Node Voltage Analysis, and analyze the circuit below to get V_A, V_B, V_C, and V_D.

In this lab, you will investigate two of the most powerful circuit analysis techniques, and see that the quantities you calculate using them are real, easily measurable quantities.

I. Node Voltage Analysis

In the lab, assemble the circuit below, using the power supply to be V_S, assuming it has no internal resistance. Now use a multimeter to measure V_A, V_B, V_C, and V_D directly.



Quantity	Predicted Value	Measured Value
V_A		
V_B		
V_C		
V_D		

Table 1: Predicted and measured voltages with V_S=10V.

Do the measured values agree with the predicted values to within 5%?

Now, turn the input voltage down to 5V. Predict what the new voltages will be and then measure them:

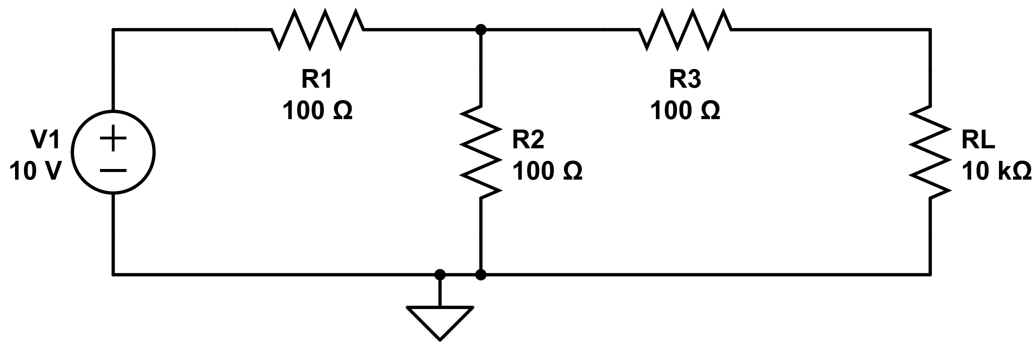
Quantity	Predicted Value	Measured Value
V_A		
V_B		
V_C		
V_D		

Table 2: Predicted and measured voltages with V_S=5V.

Do the measured values agree with the predicted values to within 5%?

II. Circuit Reduction

Given the circuit below:



Build this circuit in the lab, on a breadboard and using the lab power supply as though it were the ideal voltage source of the diagram.

1. Measure the Open Circuit Voltage, V_{OC}, obtained when you remove the Load Resistor R_L and put nothing in its place.

2. Measure the Short Circuit Current, I_{SC}, obtained when you remove the Load Resistor R_L and put an ammeter in its place. (To make your multimeter into an ammeter, move the red lead to the second from the left connector, make sure you predict the current will be less than 20 mA, move the mode selector switch to mA, then put the leads on the two points where R_L was connected. Current entering the red lead will, I believe, be read as positive.)

3. Return the Load Resistor R_L to the circuit and measure the voltage across it (be sure to reconfigure the multimeter appropriately.)

Reduce the circuit to a single Practical Voltage Source with a load resistor R_L on the right had side.

(Space for your work)

Build this circuit on the breadboard, again using the power supply as the ideal voltage source.

4. Measure the Open Circuit Voltage, V_{OC}, obtained when you remove the Load Resistor R_L and put nothing in its place.

5. Measure the Short Circuit Current, I_{SC}, obtained when you remove the Load Resistor R_L and put an ammeter in its place. (To make your multimeter into an ammeter, move the red lead to the second from the left connector, make sure you predict the current will be less than 20 mA, move the mode selector switch to mA, then put the leads on the two points where R_L was connected. Current entering the red lead will, I believe, be read as positive.)

6. Return the Load Resistor R_L to the circuit and measure the voltage across it (be sure to reconfigure the multimeter appropriately.)

Are the results for 4, 5, and 6 consistent with the results in parts 1, 2, and 3?