EGR 220: Engineering Circuit Theory
Lab 2: Exploring Equivalent Resistance

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See LabOverview Document, posted on webpage

Theme
The theme for lab this week is to explore the concept of equivalent resistance. The concept of equivalence overlaps with understanding voltage and current, so you can use this lab to explore many ideas.

Possible experiments with resistors
Design three circuits, each using at least three resistors (*at least* three, but you can use 1 or 2 more if you want to), for which the equivalent resistance is a value you select, the same for each circuit.
- Circuit 1: Use three resistors in series
- Circuit 2: Use three resistors in parallel
- Circuit 3: Use three resistors in a combination of parallel and series (and not all three in series or all three in parallel)

Possible experiments to understand the internal resistance of the laboratory Agilent multimeter
This experiment can help you understand how the laboratory equipment becomes part of our circuits. The experiments are to measure the effect of the multimeter on the measurements you make. Note that this is an experiment that allows you to investigate the concepts in the final homework problems from chapter 2 in homework set #2.

Multimeter in series configuration in your circuit
- Build the circuit below using a 1MΩ resistor for R shown.
- Take measurements and determine the internal resistance of the multimeter.
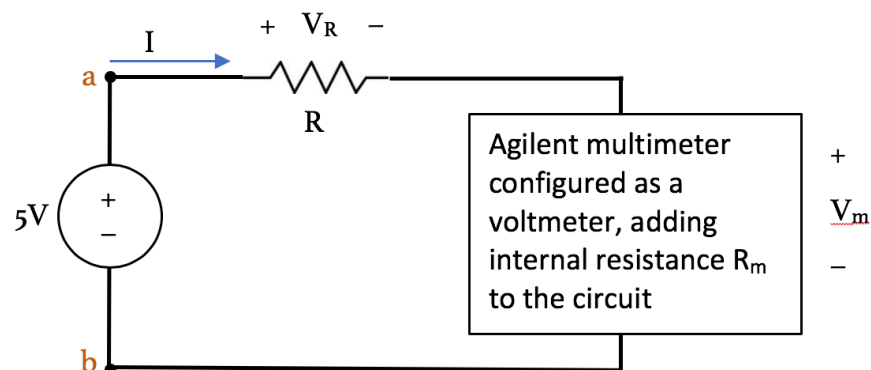- Repeat these steps using a 10MΩ resistor for R.

Fig 1: Voltmeter R_m in series with R

Multimeter in parallel configuration in your circuit

- Use two 10kΩ resistors for the two resistors, R, shown in the circuit below.
- Take measurements to help determine the internal resistance of the multimeter.
- Repeat these steps using two 10MΩ resistors for the two resistors, R, shown.
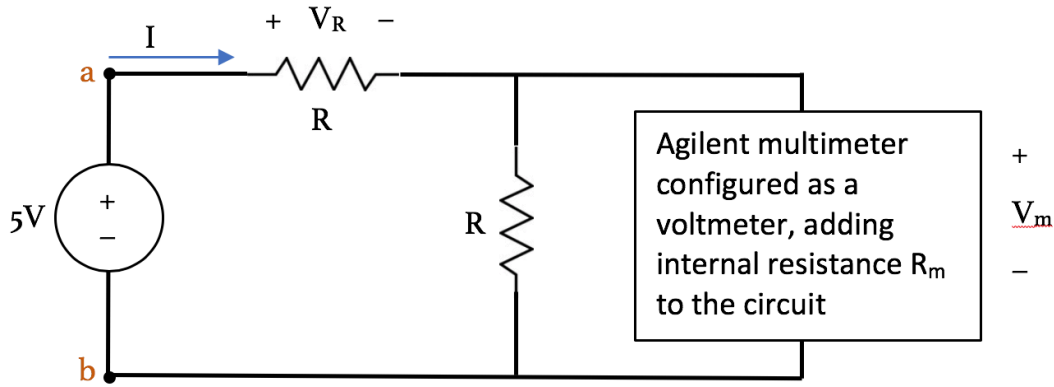

Fig 2: Voltmeter R_m in parallel with load resistor, R

Questions to consider

- When might you need to consider the internal resistance of the voltmeter and when might it be okay to assume that the voltmeter's internal resistance is infinite?
- If an ideal voltmeter has infinite internal resistance, what would be the ideal internal resistance for an ammeter?