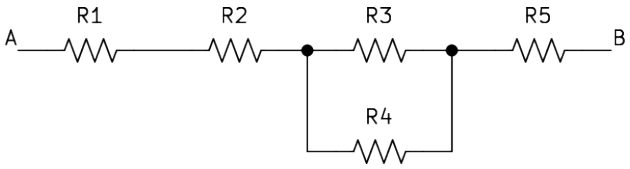
Homework 1 — Due May 27th

Problems:

1. For all subquestions for this problem, consider the given resistor network below.



   (a) Determine the total equalivalent resistance, R_{eq} for the resistor network below between nodes A and B. Show your work and simplify as much as possible.

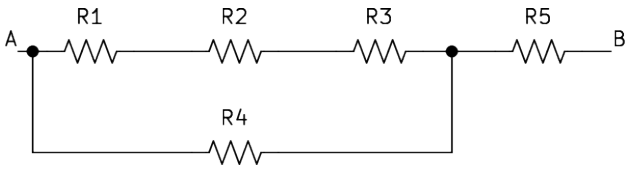
   (b) Assuming that $R_1 = R_3 = R_5 = 5\,\text{k}\Omega$ and $R_2 = R_4 = 3\,\text{k}\Omega$, what is the value for R_{eq}?

   (c) A DC voltage source is connected to nodes A and B such that the voltage at A is $V_A = 5\,\text{V}$ and B is grounded ($V_B = 0\,\text{V}$). How much current is being drawn from the voltage source?

   (d) Create a table that has a row for each resistor and two columns: "Voltage" (resistor voltage drop) and "Current" (resistor current). For each resistor, calculate both the voltage drop across the resistor and the current passing through the resistor and fill in the table.

   (e) Create the circuit in LTspice and simulate it. Use a similar simulation configuration as done in Experiment 1 but use a DC voltage source instead of a sine wave voltage source. Use this simulation to verify your table from the previous question. To show you completed this, take a screenshot of the LTspice window showing both the schematic and the plot window showing at least one trace of voltage measurement and one trace of current measurement each.

2. Determine the total equivalent resistance for the resistor network below between points A and B. Simplify as much as possible.



3. Two resistors, R_1 and R_2 are in **series**. With $R_1 = 5\,\text{k}\Omega$, what limit must be placed on the value of R_2 such that the equivalent series resistance, R_{eq} is within $\pm 1\%$ of the value of R_1? That is, for what range of R_2 is $R_{eq} \approx R_1$.

4. Two resistors, R_1 and R_2 are in **parallel**. With $R_1 = 5\,\text{k}\Omega$, what limit must be placed on the value of R_2 such that the equivalent parallel resistance, R_{eq} is within $\pm 1\%$ of the value of R_1? That is, for what range of R_2 is $R_{eq} \approx R_1$.

5. A resistor, R_{load}, is placed across a NiMH battery with $V_{bat} = 1.2\,\text{V}$. Assuming an internal resistance of $25\,\text{m}\Omega$ [ref: datasheet], what value must R_{load} be if the voltage drop across R_{load} is $V_{load} = 1.1\,\text{V}$?