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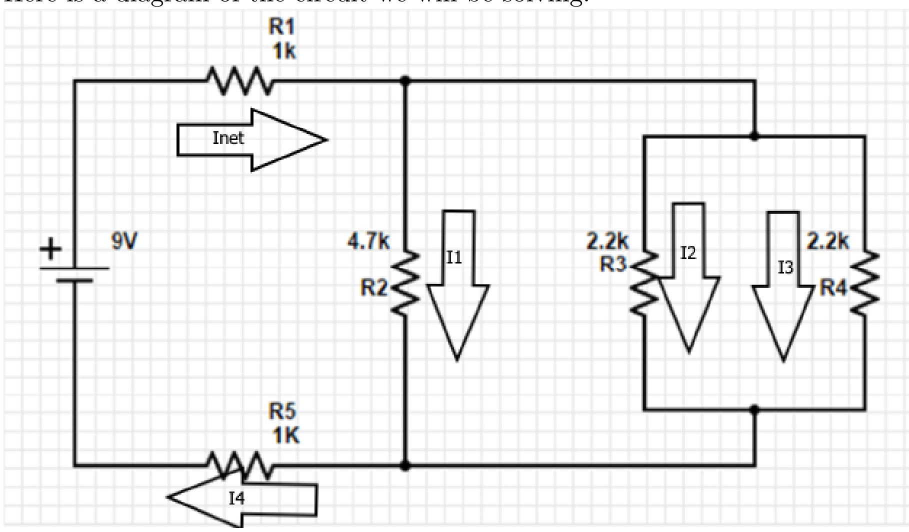
CECS 211 Section 01
Lab 4
2019-09-19–2019-09-24

Here is a diagram of the circuit we will be solving:



The given values for this circuit are as follows:

$$\begin{aligned} V_s &= 9\,\mathrm{V} \\ R_1 &= 1\,\mathrm{k\Omega} \\ R_2 &= 4.7\,\mathrm{k\Omega} \\ R_3 = R_4 &= 2.2\,\mathrm{k\Omega} \\ R_5 &= 1\,\mathrm{k\Omega} \end{aligned}$$

The equivalent resistance for this circuit can be calculated as follows:

$$\begin{aligned} R_{\text{net}} &= R_1 + ((R_3 \parallel R_4) \parallel R_2) + R_5 \\ &= 1\,\mathrm{k\Omega} + ((2.2\,\mathrm{k\Omega} \parallel 2.2\,\mathrm{k\Omega}) \parallel 4.7\,\mathrm{k\Omega}) + 1\,\mathrm{k\Omega} \\ &= 1\,\mathrm{k\Omega} + (1.1\,\mathrm{k\Omega} \parallel 4.7\,\mathrm{k\Omega}) + 1\,\mathrm{k\Omega} \\ &= 1\,\mathrm{k\Omega} + 0.891\,\mathrm{k\Omega} + 1\,\mathrm{k\Omega} \\ &= 2.891\,\mathrm{k\Omega} \end{aligned}$$

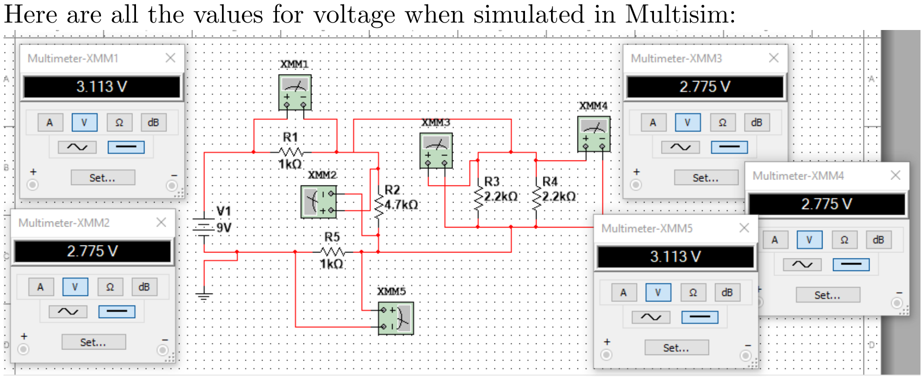
Using Ohm's Law ($V = IR$), we can find the total current for the circuit:

$$\begin{aligned} I_{\text{net}} &= \frac{V_s}{R_{\text{net}}} \\ &= \frac{9\,\mathrm{V}}{2.891\,\mathrm{k\Omega}} = 3.113\,\mathrm{mA} \end{aligned}$$

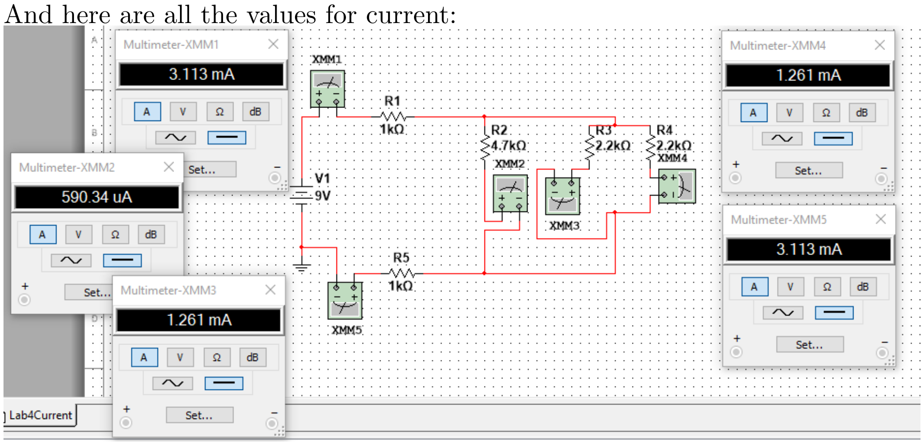
The amount of current going through each resistor and the amount of voltage dropped by each resistor can also be calculated using Ohm's Law.

I_{net}	$3.113\,\text{mA}$
V_{R_1}	$3.113\,\text{mA} \times 1\,\text{k}\Omega = 3.113\,\text{V}$
V_{R_2}	$V_s - (V_{R_1} + V_{R_5}) = 9\,\text{V} - (3.113\,\text{V} + 3.113\,\text{V}) = 2.774\,\text{V}$
V_{R_3}	$2.774\,\text{V}$
V_{R_4}	$2.774\,\text{V}$
V_{R_5}	$3.113\,\text{mA} \times 1\,\text{k}\Omega = 3.113\,\text{V}$
I_1	$2.774\,\text{V}/4.7\,\text{k}\Omega = 0.590\,\text{mA}$
I_2	$2.774\,\text{V}/2.2\,\text{k}\Omega = 1.261\,\text{mA}$
I_3	$2.774\,\text{V}/2.2\,\text{k}\Omega = 1.261\,\text{mA}$
I_4	$3.113\,\text{V}/1\,\text{k}\Omega = 3.113\,\text{mA}$

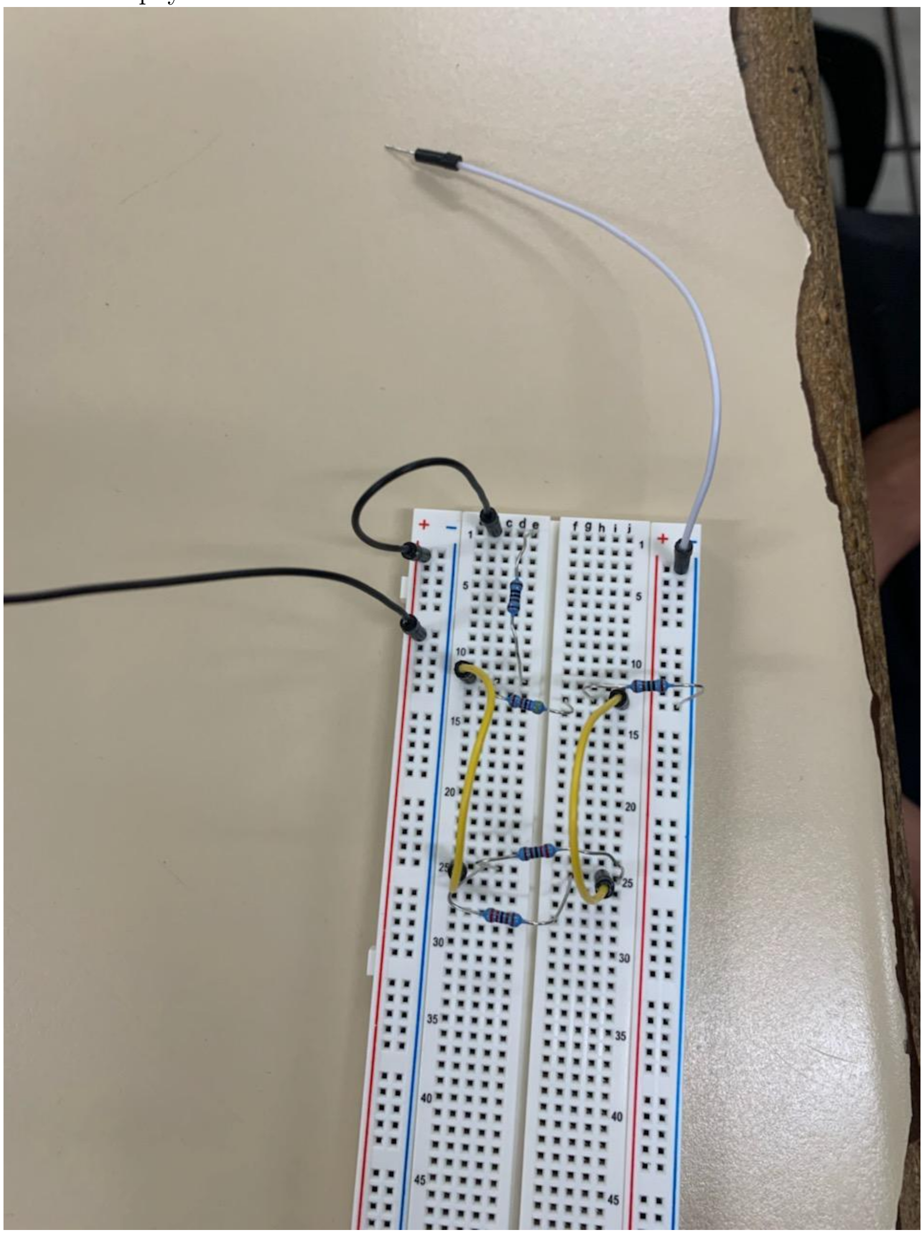
Here are all the values for voltage when simulated in Multisim:



And here are all the values for current:



Here is the physical breadboard build of this circuit:



And here are all the values I tested for using a physical digital multimeter:

R_1	$998\,\Omega$
R_2	$4.7\,\mathrm{k\Omega}$
R_3	$2.2\,\mathrm{k\Omega}$
R_4	$2.2\,\mathrm{k\Omega}$
R_5	$997\,\Omega$
I_T	$3.11\,\mathrm{mA}$
I_1	$0.60\,\mathrm{mA}$
I_2	$1.25\,\mathrm{mA}$
I_3	$1.25\,\mathrm{mA}$
I_4	$3.11\,\mathrm{mA}$
V_{R_1}	$3.11\,\mathrm{V}$
V_{R_2}	$2.77\,\mathrm{V}$
V_{R_3}	$2.77\,\mathrm{V}$
V_{R_4}	$2.77\,\mathrm{V}$
V_{R_5}	$3.11\,\mathrm{V}$