ELEN 50 Lab 2: Circuits w/ Series and Parallel Resistors
Pre Lab

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Part 1.

Step 2 - Calculate the theoretical values of the current and the two voltages specified in Step 2 of the lab procedure.

$$\begin{aligned} Vg &= (R_1 + R_2) * I_i \\ 20 &= (2.7 + 5.6) * I_i \\ I_i &= 2.4096\ mA \\ V_1 &= I_i * R_1 \\ V_1 &= 6.506\ V \\ V_2 &= I_i * R_2 \\ V_2 &= 13.494\ V \end{aligned}$$

Step 4 - Calculate the ideal ratio of V_1 to V_2 and the ratio of R_1 to R_2.

The ideal ratio is $V_1 : V_2 = 1 : 2.0741$ as is $R_1 : R_2 = 1 : 2.0741$

Step 6 - Calculate the currents and voltages specified in Step 6.

Voltage (V)	Current (mA)	Resistance ($k\Omega$)
$V_1 = 8.2845$	$I_1 = 3.0683$	$R_1 = 2.7$
$V_2 = 11.7155$	$I_2 = 2.0921$	$R_2 = 5.6$
$V_3 = 11.7155$	$I_3 = 0.9763$	$R_3 = 12$

Step 7 - Calculate the equivalent resistance of the parallel combination of R_3 and R_2.

$$Req = \frac{R_2 * R_3}{R_2 + R_3}$$

$$Req = \frac{5.6 * 12}{5.6 + 12}$$

$$Req = 3.8182\ k\Omega$$

$$R_1 + Req = R_{total} = 2.7 + 3.8182 = 6.5182\ k\Omega$$

Step 8 - Calculate the ratio of I_2 to I_3, and the ratio of R_2 to R_3.

The ratio is $I_2 : I_3 = 1 : 0.4667$ as is $R_2 : R_3 = 1 : 2.1429$

Step 10 - Calculate the currents and voltages specified in Step 10, as well as the equivalent resistance of the three parallel resistors.

Voltage (V)	Current (mA)	Resistance ($k\Omega$)
$V_1 = 14.9458$	$I_1 = 5.5355$	$R_1 = 2.7$
$V_2 = 5.0542$	$I_2 = 0.9025$	$R_2 = 5.6$
$V_3 = 5.0542$	$I_3 = 0.4212$	$R_3 = 12$
$V_4 = 5.0542$	$I_4 = 4.2118$	$R_4 = 1.2$
		$R_{234} = 0.913$

Part 2.

Calculate all currents and voltages specified in Step 2.

Calculate the theoretical value of the equivalent resistance of the circuit from Part 2. To do this,

- First calculate Req_{56}, the equivalent resistance of R_5 and R_6 connected in series.

  $R_{56} = 1.2 + 1.0 = 2.2\ k\Omega$

- Then calculate Req_{456}, the equivalent resistance of Req_{56} and R_4 connected in parallel.

  $R_{456} = \frac{2.2*5.6}{2.2+5.6} = 1.5795\ k\Omega$

- Continue this process until you have the total equivalent resistance for the circuit shown in Step 5 of the lab procedure.

$$R_{3456} = 1.5795 + 3.9 = 5.4795\ k\Omega$$
$$R_{23456} = \frac{5.4795 * 4.7}{5.4795 + 4.7} = 2.5230\ k\Omega$$
$$R_{123456} = 2.523 + 2.7 = 5.230\ k\Omega$$

Voltage (V)	Current (mA)	Resistance ($k\Omega$)
$V_1 = 10.3251$	$I_1 = 3.8241$	$R_1 = 2.7$
$V_2 = 9.6749$	$I_2 = 2.0585$	$R_2 = 4.7$
$V_3 = 6.8860$	$I_3 = 1.7656$	$R_3 = 3.9$
$V_4 = 2.7888$	$I_4 = 0.4980$	$R_4 = 5.6$
$V_5 = 1.5212$	$I_5 = 1.2676$	$R_5 = 1.2$
$V_6 = 1.2676$		$R_6 = 1.0$
$V_g = 20$		$R_{123456} = 5.230$