Problem Set #2

1.) What is the resistance of a kilometer-long piece of 14-gage copper wire? (d_{wire} = 0.06408 inches).

2.) Determine the possible range of resistance values for:

(a) R_1 red-brown-yellow-gold

(b) R_2 black-violet-orange-gold

(c) Series combination of R_1 and R_2

(d) Parallel combination of R_1 and R_2

3.) When using a potentiometer as a "trim pot", it is usually placed in series with another fixed-value resistor. Why is it not placed in parallel?

4.) Does it matter in which direction you assume current flows when applying Kirchhoff's Laws to a circuit? Why?

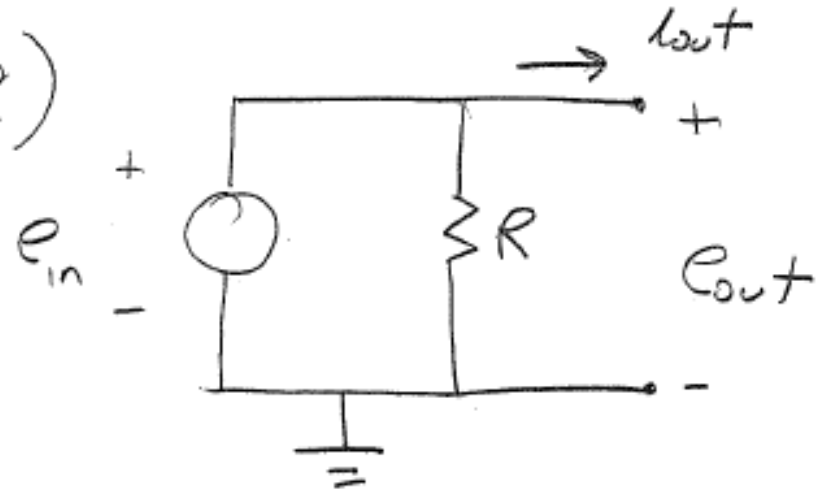
5.) You quickly need a 50 Ω resistor but have a supply of only 100 Ω resistors. What can you do?

6.) Using Ohm's Laws, KVL, and KCL derive an expression for the equivalent resistance of three parallel resistors R_1, R_2, and R_3.

7.) Derive current-division formulas for three resistors in parallel.

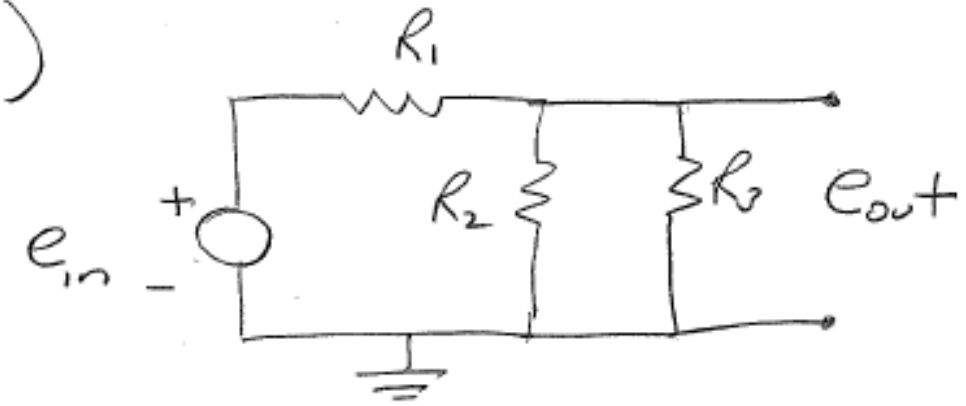
8.) Given two resistors R_1 and R_2, where $R_1 \gg R_2$, prove that the parallel combination is $\approx R_2$.

9.)



Assuming $i_{out} = 0$, plot e_{out} vs. R as R varies from 1Ω to $1K\Omega$ in 1Ω increments.

10.)



$R_1 = 1K\Omega$
$R_2 = 2K\Omega$
$R_3 = 3K\Omega$
$e_{in} = 5V$

(a) Find i_{R_1}
(b) Find i_{R_3}
(c) Find e_{R_2}

11.) Consider the circuit shown.

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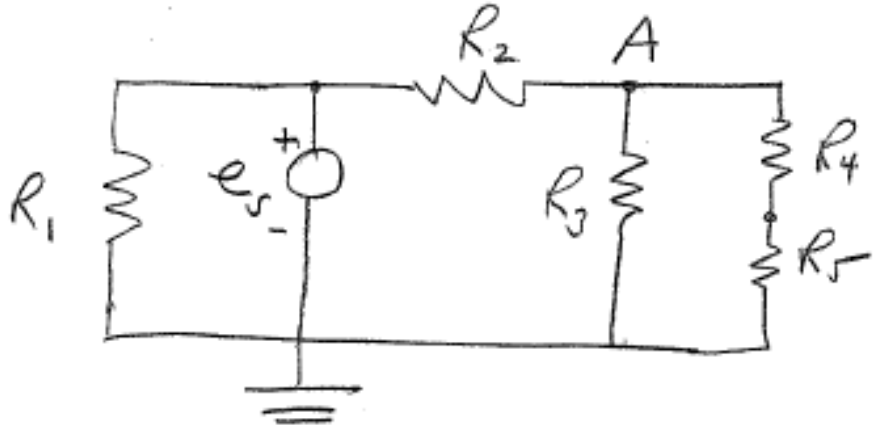

$R_1 = 1\ K\Omega$
$R_2 = 2\ K\Omega$
$R_3 = 3\ K\Omega$
$R_4 = 4\ K\Omega$
$R_5 = 1\ K\Omega$
$e_s = 10\ V$

Determine:

(a) total equivalent resistance seen by e_s.

(b) voltage at node A

(c) current through R_3

12.) Find the equivalent resistance of the circuit below as seen by the voltage source.

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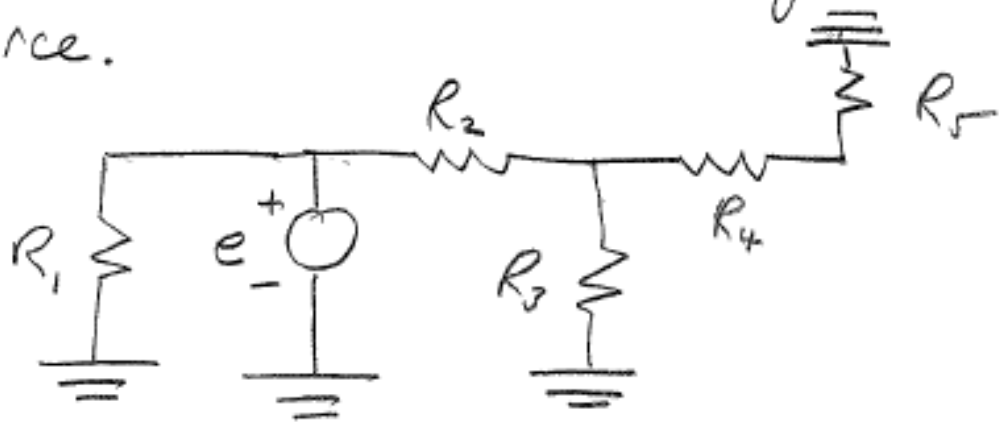

$R_1 = 1\ K\Omega$

$R_2 = 2\ K\Omega$

$R_3 = 3\ K\Omega$

$R_4 = 4\ K\Omega$

$R_5 = 5\ K\Omega$