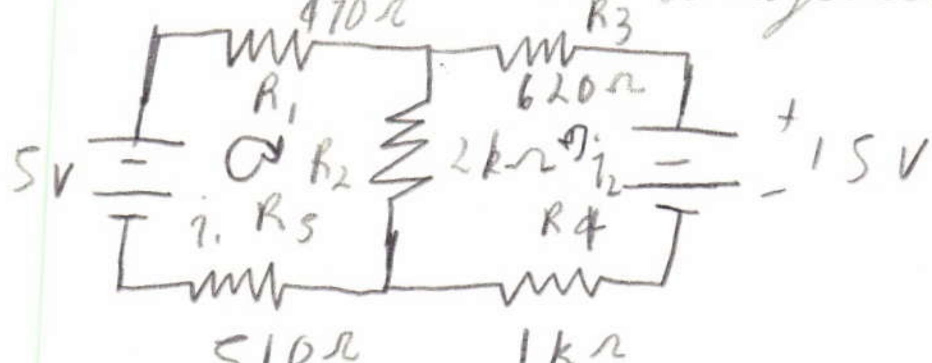
prelab #5 CPE 1140 Bruce Liu

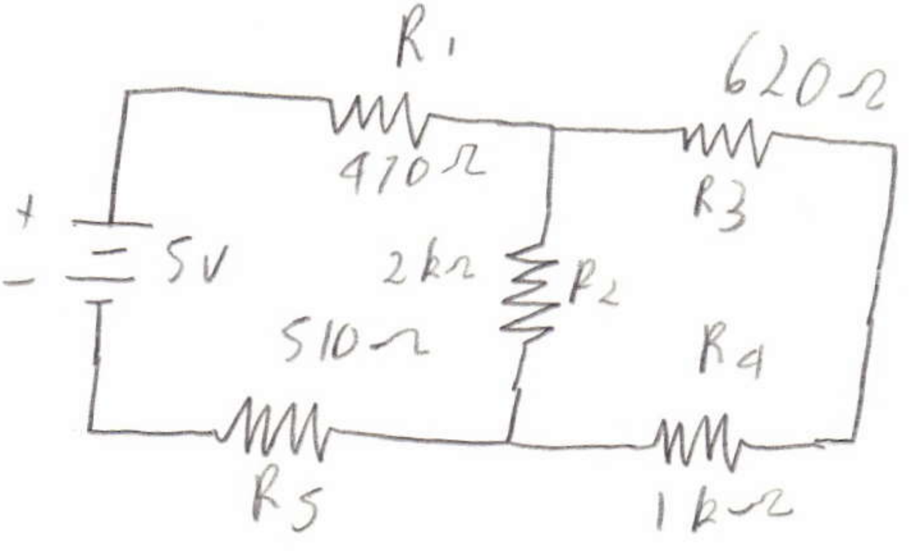
objective: analysis of a two Souce circuit via superposition. theroy claims that the effects on the circuit are the sum of the sources indepentant effects on the circuit

circuit to be analyized:



theory says to compute one Source at a time to short voltage sources and break current Sources other than that of the one of analasis.

first super position circuit 5 V kept 15 volt shorted



seeking intial current converting to thevin equivalent

$$R_3 + R_4 = 1620\ \Omega$$

$$R_{3+4} \parallel R_2 = \frac{1620 \times 2 \times 10^3}{1620 + 2000}$$

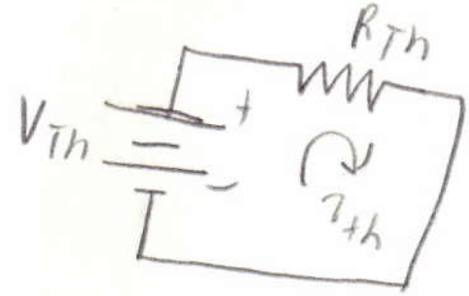
$$R_{3+4} \parallel R_2 = \frac{3240 \times 10^3}{3620}$$

$$R_{3+4\parallel 2} = 895.027\ \Omega$$

$$R_1 + R_{3+4\parallel 2} + R_5 = 470 + 895.027 + 510$$

$$R_{Th_{circuit_1}} = 1875.027\ \Omega$$

$V_{Th} = i\, R_{Th}$



$\frac{V_{Th}}{R_{Th}} = i_{Th}$

$$\frac{5}{1875.027} = 2.666 \text{ mA}$$

inital current is 2.666 mA
Current divider at R_2 and $R_3 + R_4$
current at R_5 is known since exit current is equal to entry current from lab 4.

current divider formula default

$$i_{target} = \frac{R_{other}}{\Sigma R} i_{source}$$

current $i_{R_2 \text{ circuit}, 1}$

$$i_{R_2 \text{ circuit}, 1} = \frac{620+1000}{1000+620+2000} 2.666 \times 10^{-3}$$

$$i_{R_2 \text{ circuit}, 1} = \frac{1620}{3620} 2.666 \times 10^{-3}$$

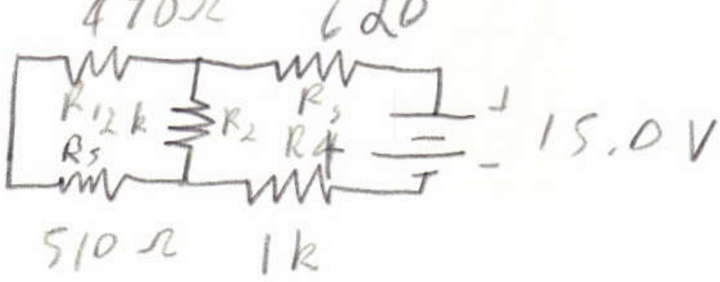
$$i_{R_2 \text{ circuit}, 1} = 1.193 \text{ mA}$$

Current $i_{R_{3+4}}$ circuit 1

$$i_{R_{3+4}\,circuit\,1} = \frac{2000}{1000+2000+620}\,2.666\times10^{-3}$$

$$i_{R_{3}+4}\,\text{circuit 1} = 1.472\ mA$$

Superposition circuit 2



Thevinin to find i_{th} or inital current and exit current.

$$R_1 + R_5 = 470 + 510 = 980\ \Omega = R_{4+5}$$

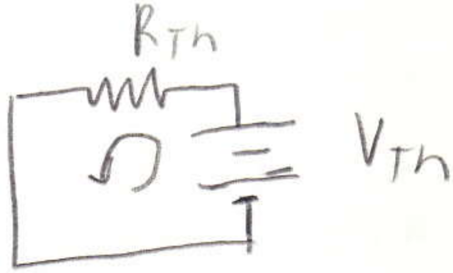
$$R_{4+5} \parallel R_2 = \frac{980 \times 2000}{980 + 2000}$$

$$R_{4+5\parallel 2} = 657.718\ \Omega$$

$$R_{Th} = R_{4+5\parallel 2} + R_3 + R_4 =$$

$$R_{th} = 657.718 + 620 + 1000 = 2277.718\ \Omega$$

Therin superposition circuit $_2$



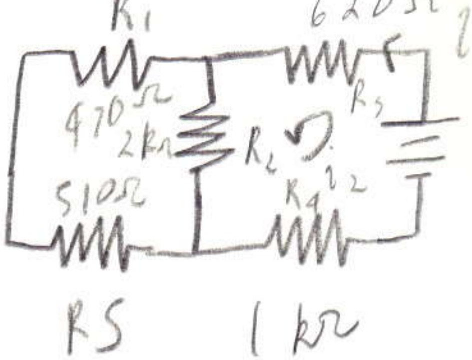
$$i_{Th} = \frac{V_{Th}}{R_{Th}}$$

$$i_{Th\ circuit\ 2} = \frac{15}{2277.718}$$

$$i_{Th\ circuit\ 2} = 6.585\ mA$$

This is expected due to the higher voltage pushing more amps.

Current divider Superposition circuit 2.



i_T in circuit 2 = 6.585 mA

$$i_T = \frac{R_{other}}{\Sigma R} i_{source}$$

$\Sigma R = R_1 + R_5 + R_2$

$\Sigma R = 470 + 510 + 2000$

$\Sigma R = 2980$

$R_{other_{R_2}} = 980\,\Omega = R_1 + R_5$

$R_{other_{R_1+R_5}} = 2000\,\Omega$

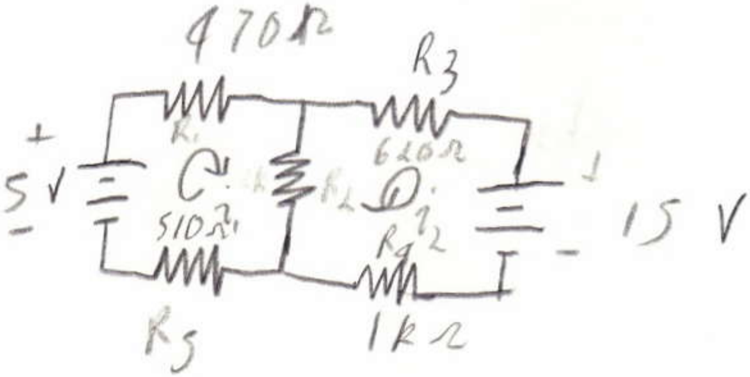
$$i_{R_2} = \frac{980}{2980} 6.585 \, ma$$

$$i_{R_2} = 2.165 \, mA$$

$$i_{R_1+R_5} = \frac{2000}{2980} 6.585 \, mA$$

$$i_{R_1+R_5} = 4.419 \, mA$$

Sum of currents original circuit.



calculated currents

	5V contrabution	15 V contrabution
i_{R_1}	2.666 mA	4.419 mA
i_{R_2}	1.193 mA	2.165 mA
i_{R_3}	1.472 mA	6.585 mA
i_{R_4}	1.472 mA	6.585 mA
i_{R_5}	2.666 mA	4.419 mA

analysis of direction

i_{R_2} is sumed

i_{other} are opposing

Σ currents

$i_{R_1} = (2.666 - 4.419)\,mA$

$i_{R_1} = -1.753\ mA$

$i_{R_2} = (1.193 + 2.165)\,mA$

$i_{R_2} = 3.358\ mA$

$$i_{R_3} = (-1.472 + 6.585)\ mA$$

$$i_{R_3} = 5.891\ mA$$

$$i_{R4} = (-1.472 + 6.585)\ mA$$

$$i_{R_4} = 5.113\ mA$$

$$i_{R_5} = (-4.419 + 2.666)\ mA$$

$$i_{R_5} = 1.753\ mA$$

<u>net currents</u>

i_{R_1}	-1.753 mA
i_{R_2}	3.358 mA
i_{R_3}	5.113 mA
i_{R4}	5.113 mA
i_{R5}	-1.753 mA