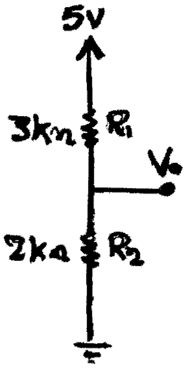
EE320 Homework #1

PROBLEM 1.7



Using Voltage divider

With exact Values:

$$V_o = \frac{R_2}{R_1 + R_2} \cdot V_i$$

$$= \frac{2000}{3000+2000} \times 5\text{V} = \underline{2\text{V}}$$

With 5% tolerance, One time with (R_1 + 5% and R_2 - 5%) for V_{min} and another time with (R_1 - 5% and R_2 + 5%) for V_{max}

$$V_{min} = \frac{2000(0.95)}{3000(1.05) + 2000(0.95)} = \underline{1.881\text{V}}$$

$$V_{max} = \frac{2000(1.05)}{3000(0.95) + 2000(1.05)} = \underline{2.121\text{V}}$$

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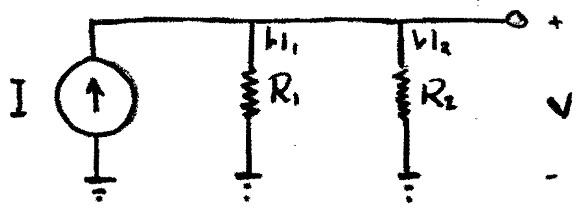
PROBLEM 1.10



$$V = I \cdot R_{eq}$$

$$R_{eq} = (R_1 // R_2)$$

$$= \frac{R_1 \times R_2}{R_1 + R_2}$$

$$V = I \cdot \frac{R_1 \times R_2}{R_1 + R_2}$$

Voltage accross two Resistor is the same so.

$$I_1 = V \cdot \left(\frac{1}{R_1}\right) = I \cdot \frac{R_1 \times R_2}{R_1 + R_2} \times \frac{1}{R_1} = I \frac{R_2}{R_1 + R_2}$$

$$I_2 = V \cdot \left(\frac{1}{R_2}\right) = I \cdot \frac{R_1 \times R_2}{R_1 + R_2} \times \frac{1}{R_2} = I \frac{R_1}{R_1 + R_2}$$

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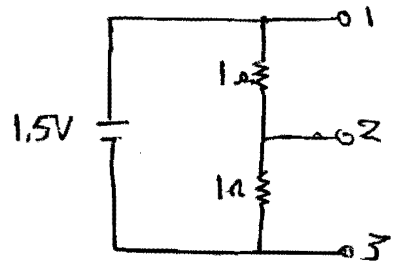
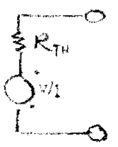
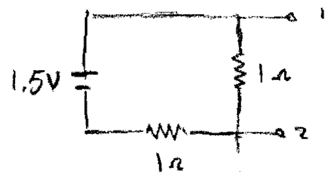
Problem 1.14



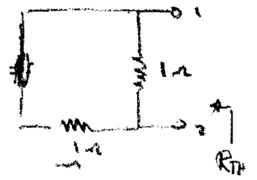
Thevenin Therom



ⓐ 1 AND 2

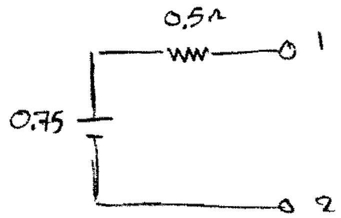


, To find R_{TH} , Short the Voltage Sorce

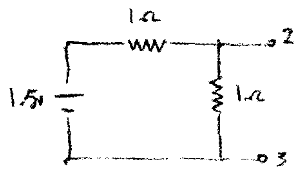


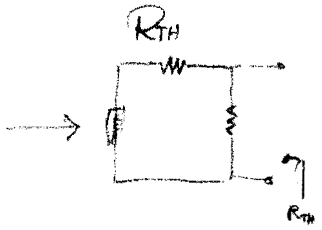
$R_{TH} = (1 // 1) = \frac{1 \cdot 1}{1+1} = 0.5\,\Omega$

$V_{1,2} = 1.5 \cdot R_{TH} = 0.75\,V$



ⓑ 2 AND 3

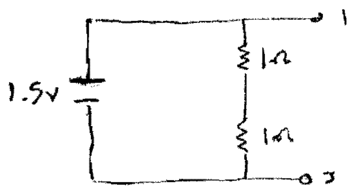


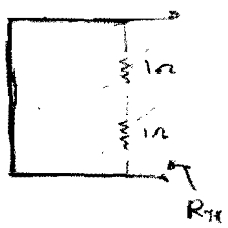


$R_{TH} = \frac{1 \cdot 1}{1+1} = 0.5\,\Omega$

$V_{TH} = 1.5 \cdot R_{TH} = 0.75\,V$

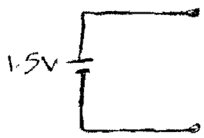
ⓒ 1 AND 3





$R_{TH} = 0\,\Omega$, When we Short Voltage Source, the Resistors get Shorted

$V_{TH} = 1.5\,v$



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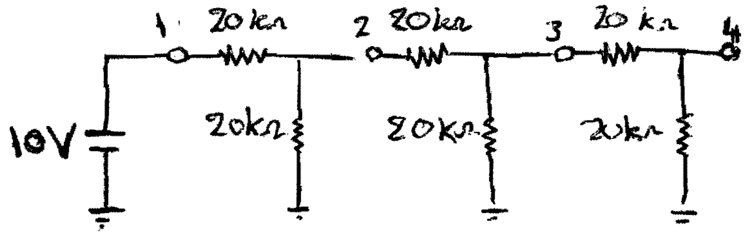
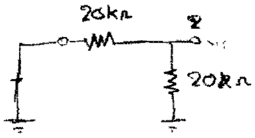
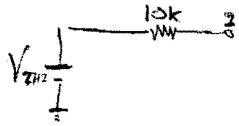
Problem 1.15



② and ground



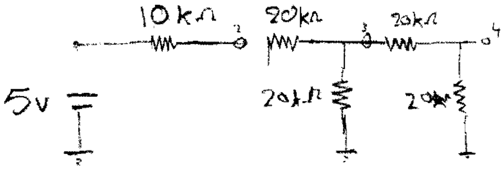
$R_{TH2} = (20k // 20k) = \frac{20k \times 20k}{20k + 20k} = 10k\Omega$

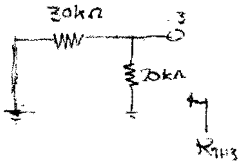


$V_{TH2} = 10 \cdot \frac{20k}{20k + 20k} = 5V$

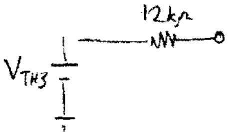
(Voltage divider)

③ and ground



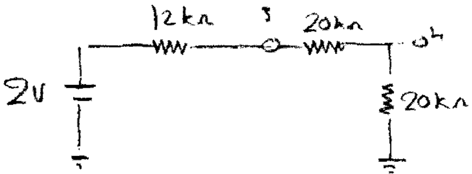


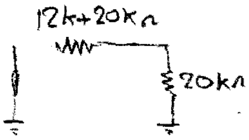
$R_{TH3} = (30k\Omega // 20k\Omega) = \frac{30k \times 20k}{30k + 20k} = 12k\Omega$



$V_{TH3} = 5 \cdot \frac{20k}{30k + 20k} = 2V$

④ AND Ground

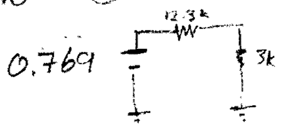




$R_{TH4} = (32k\Omega // 20k\Omega) = \frac{32k \times 20k}{32k + 20k} = 12.31k\Omega$

$V_{TH4} = 2 \cdot \frac{20k}{32k + 20k} = 0.769V$

Node ④ + 3kΩ



$I = 0.769 \times \frac{1}{12.3k + 3k} = 0.0503\,mA$

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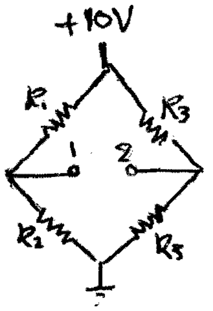
Problem 1.17

$I_5 = ?$

$V_5 = ?$



$R_1 = 1\ k\Omega$

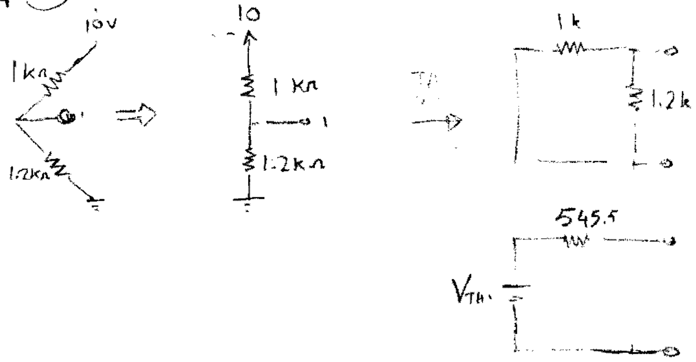
$R_2 = 1.2\ k\Omega$

$R_3 = 9.1\ k\Omega$

$R_4 = 11\ k\Omega$

$R_5 = 2\ k$

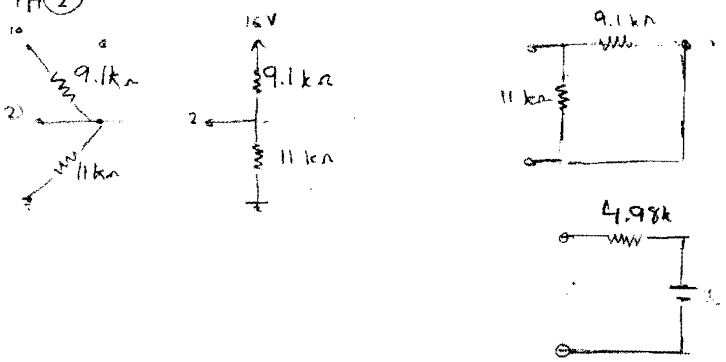
TH ①



$$R_{TH1} = \frac{1k \times 1.2k}{1k + 1.2k} = 545.5\ \Omega$$

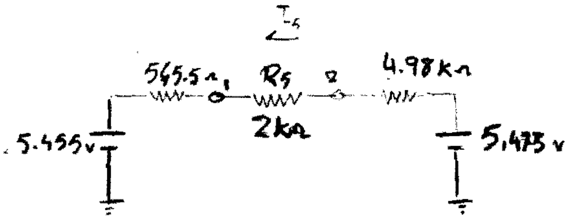
$$V_{TH1} = 10 \cdot \frac{1.2k}{1k + 1.2k} = 5.455\ V$$

TH ②



$$R_{TH2} = \frac{9.1k \cdot 11k}{9.1k + 11k} = 4.98\ k\Omega$$

$$V_{TH2} = 10 \cdot \frac{11k}{9.1k + 11k} = 5.473\ V$$



$$I_5 \quad \frac{5.473 - 5.455}{545.5 + 2k + 4.98k} = 2.404\ \mu A$$

$$V = I \cdot R_5 = 4.808\ mV$$