Assignment

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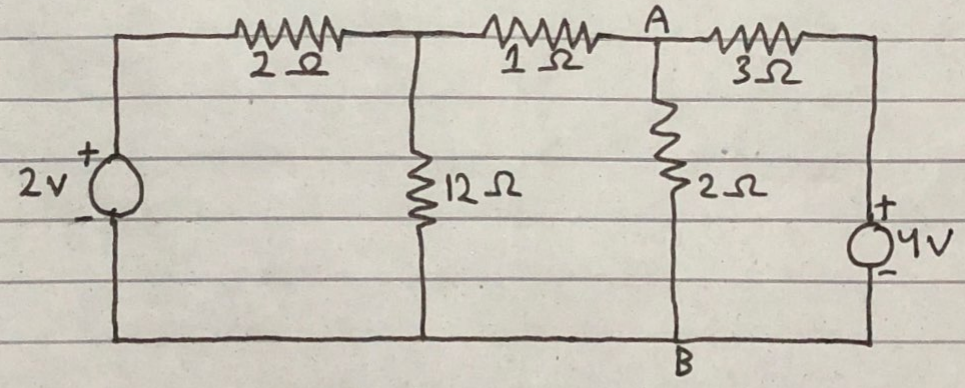
Course title : Linear circuit Anaylsis
Instructor : Engr. waleed jan
Student ID: 16216
Summer final term 2020

Q1: Using superposition principle, determine the current through 2 Ω resistor connected between terminal A and B in the circuit shown below:



Solution: Required VAB=?

using superposition theorem
Suppose to use 2v source and short ckt

VAB=?
using nodel Anaylsis

V1

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$$\frac{V_1-2}{2}+\frac{V_1}{12}+\frac{V_1-V_2}{1}=0$$

$$6V_1-12+V_1+12V_1-12V_2=0$$

$$19V_1-12V_2=12 \rightarrow (1)$$

V_2

$$\frac{V_2-V_1}{1}+\frac{V_2}{2}+\frac{V_2}{3}=0$$

$$6V_2-6V_1+3V_2+2V_2=0$$

$$-6V_1+11V_2=0$$

$$V_2=\frac{6V_1}{11} \rightarrow (2) \text{ put in } (1)$$

$$19V_1-12(6V_1)=12$$

$$V_1=0.9635V$$

$$V_2=0.525549V.$$

$$\boxed{V_{AB}=V_2-0=0.5225V}$$

Now

2v is short ckt

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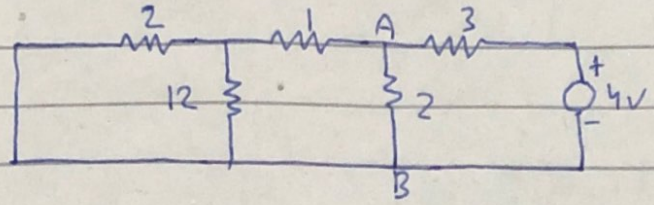
and 4V act as Source



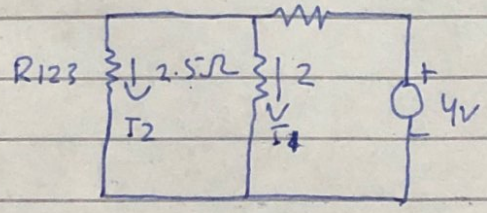
after parallel and sources simplifcator

$= 2 \parallel 12$

R12

$R_{123} = 2 \parallel 12 + 1$

$R_{123} = 1.5 + 1 = 2.5\,\Omega$



$V_{AB} = I_1 (2) \rightarrow (A)$

$$I = \frac{4}{2.5 \parallel 2 + 3} = \frac{4}{4.111} = 0.9724\,A$$

using cuncad division method

$$I_1 = \left(\frac{2.5}{2 + 2.5}\right) I = 0.5405\,\Omega$$

$V_{AB} = I_1 (2) = (0.5405)(2) = 1.081V$

So

Not voltage

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$$V_{AB} = V'_{AB} + V''_{AB} = 0.5225 + 1.681\,V$$

$$V_{AB} = 1.6035\,V$$

$$\boxed{V_{AB} = 1.6035\,V}$$

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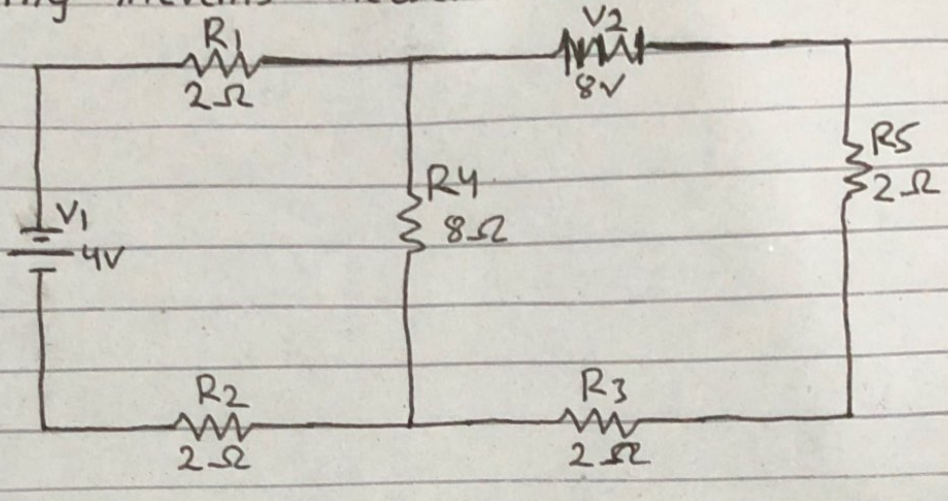
Q2: Find the current in 8Ω resistor using Thevein's theorem:



Sol:

$V_{total} = 4$ $R_{total} = 8v$

$$I = \frac{V}{R} \quad (\because V = IR)$$

$$I = \frac{4}{8} = 0.5^{-}A$$

$V_1 = 1v$

$V_2 = 1v$

$V_3 = 1v$

$V_4 = 1v$

$$\frac{1}{R} = \frac{1}{1} + \frac{1}{4}$$

$$\frac{4+1}{4} = \frac{5^{-}}{4} = \frac{4}{5^{-}}$$

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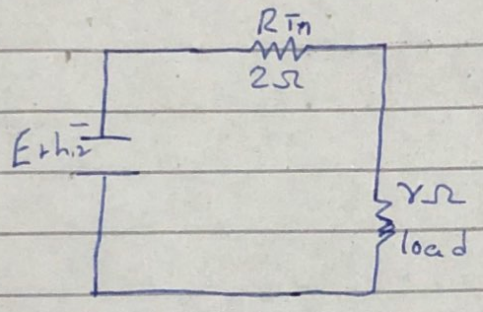
$V_{Th} = 6V$

$R_{Th} = 2\,\Omega$

$$\frac{1}{R} = \frac{1}{4} + \frac{1}{4}$$

$$\frac{1}{R} = \frac{1+1}{4} = \frac{2}{4} = \frac{1}{R} = \frac{1}{2}$$



$V = IR$

$$I_{In} = \frac{V}{R} = \frac{6}{10} = 0.6A$$

$\boxed{I = 0.6A}$

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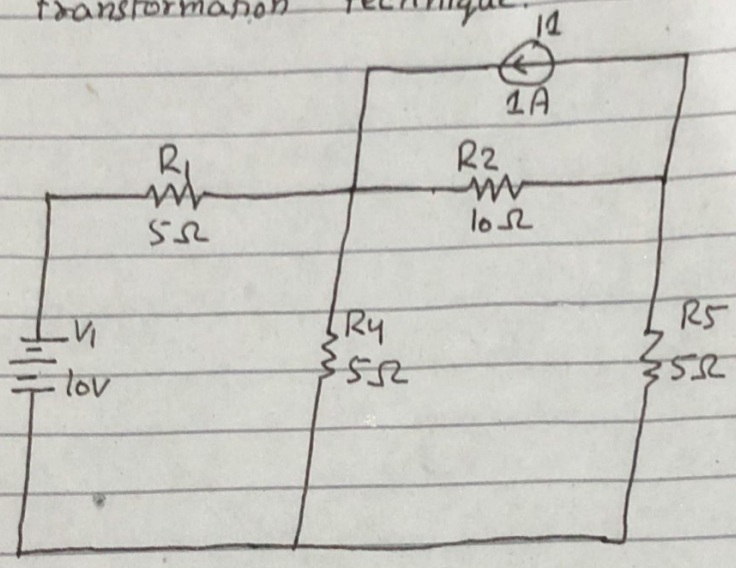
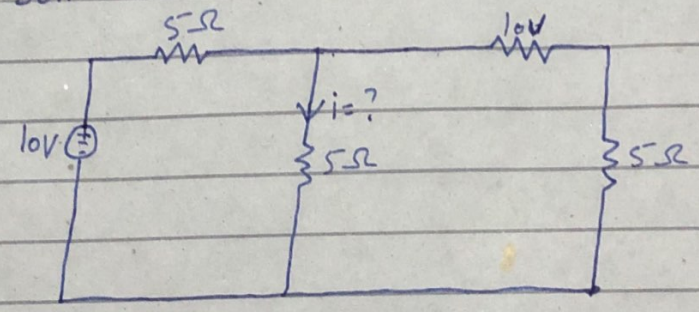
Q3: Find the current through the central 5Ω resistor using source transformation technique:



Ans: Sol:



Note that the +ve terminal of the 10V source is placed to the left because the current source arrow was playing to the left.

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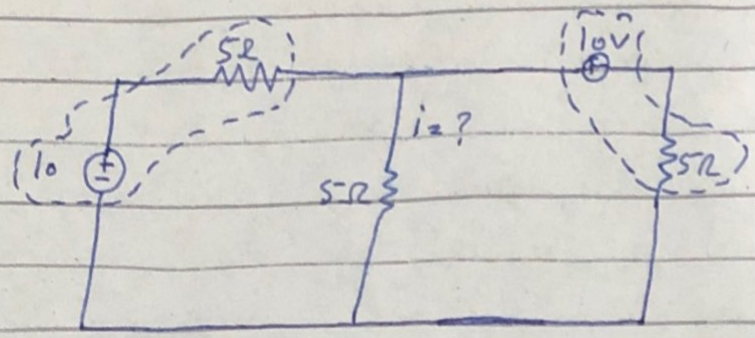

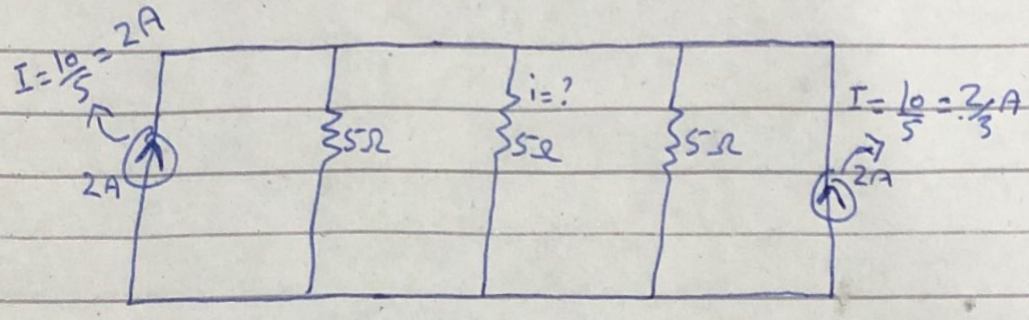

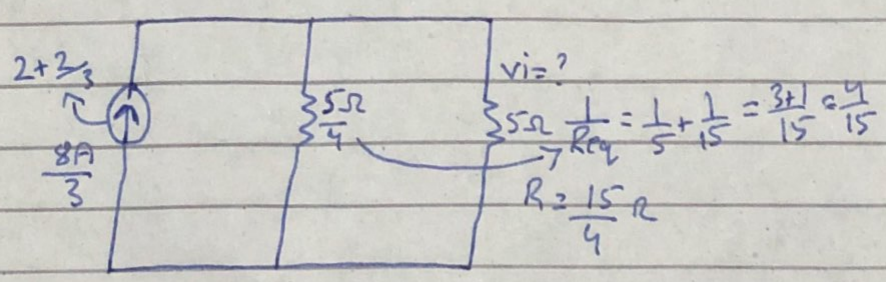

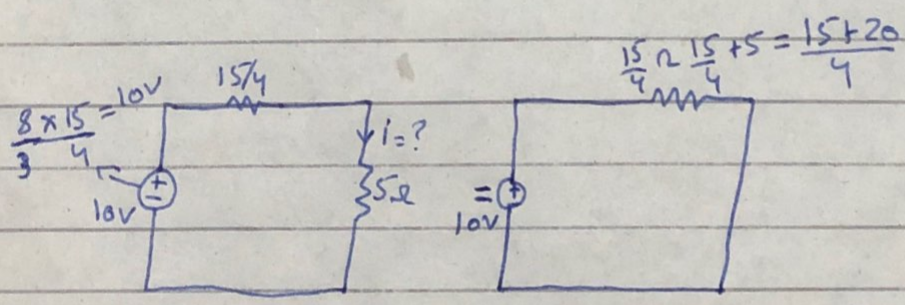

$$i = \frac{10}{\frac{35}{4}} = \frac{10 \times 4}{35} = \boxed{\frac{8A}{7}} = 1.143\ A$$

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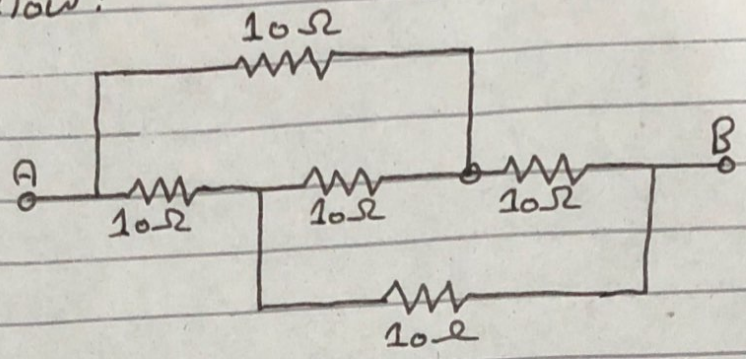
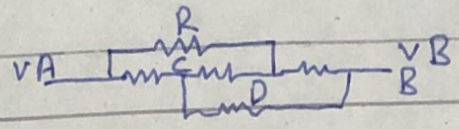
Q4:(a) Calculate the resistance between terminal A and B for the circuit shown below:

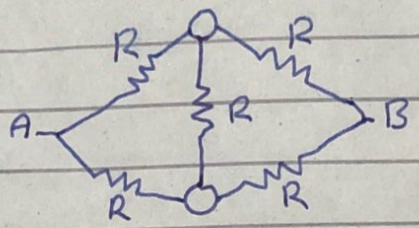




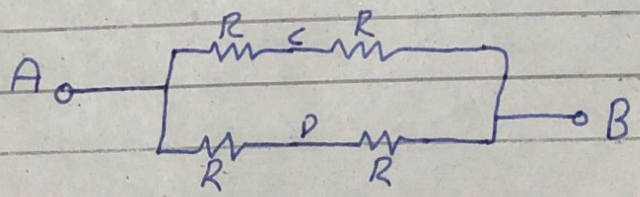
Sol:

A = VA

B = VB



all have some values



$$R_{eq} = \frac{2R \times 2R}{2R + 2R}$$

$$R_{eq} = \frac{2(10) \times (2(10))}{2(10) + 2(10)}$$

$$\boxed{R_{eq} = R}$$

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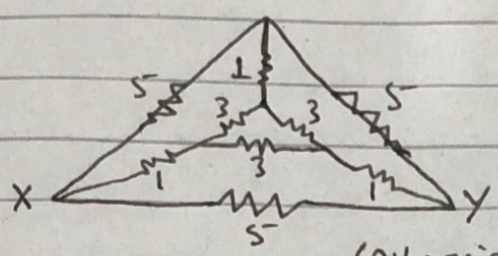
Q4: (b) Determine the resistance between terminal x and y for the circuit shown in the figure below:



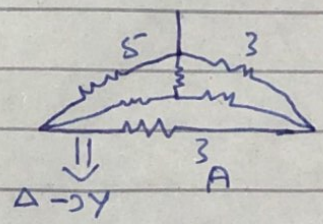
(All resistances in ohm)

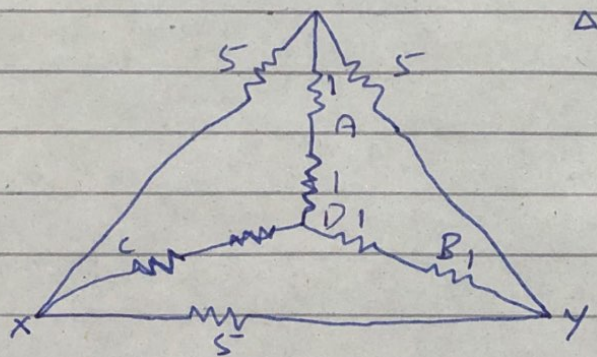
Solution:

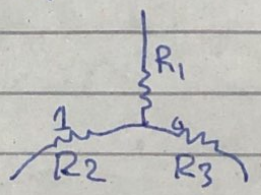
$$R_1 = \frac{3\times3}{3+3+3} = \frac{9}{9} = 1$$

$R_2 = 1$

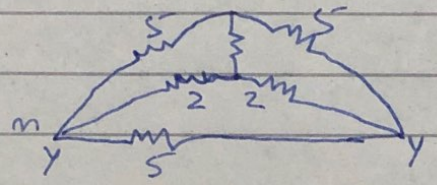
$R_3 = 1$







Put in CRK (A)



-> (B)

$$R_y = 2+2+\frac{2\times2}{2}$$

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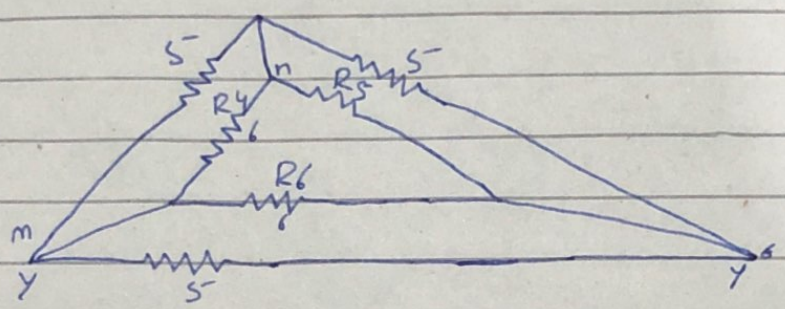
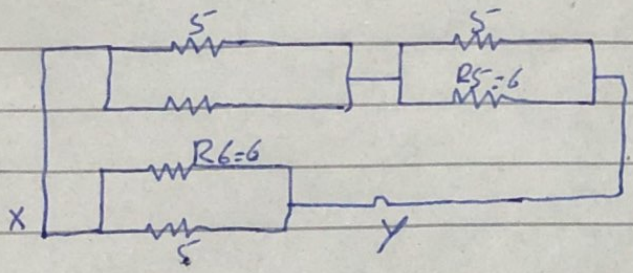
$R_4 = 4+2 = 6\ \Omega$

$R_5 = 4+2 = 6\ \Omega$

$R_6 = 6\ \Omega$



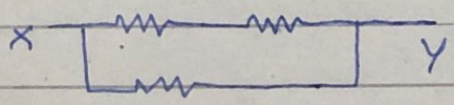


So

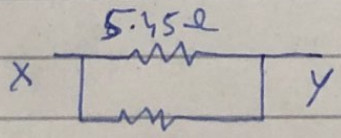
$R_{eq} = 5 \parallel R_i = 6 \quad 5 \parallel 6 = \frac{5 \times 6}{5+6} = \frac{30}{11}$

$R_{eq} = \frac{30}{11} = 2.727\ \Omega$

$2.727 + 2.727$



2.727



$\therefore$ $2.725\ \Omega$

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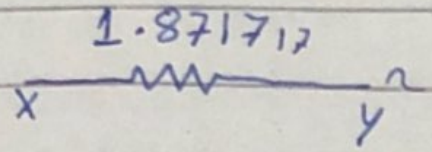

$$= \frac{5.45 \times 2.725}{5.45 + 2.725}$$

$$Z_{eq} = Z_{xy} = 1.817117\ \Omega$$