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Desk Copy

ECE 301
Fall Semester, 2005
Test #1

wlg Version A

Name wlg
Print (last, first)

Work the exam on your own engineering paper. Work on one side of your paper only. Attach your work to the back of this exam sheet and staple in the top left hand corner. You may omit one problem: either problem 1, or 2. Indicate at the top of the exam cover sheet which problem you omit. Each problem counts 25%.

(1) Find the voltage for V_o for the circuit given in Figure 1. Use any method.

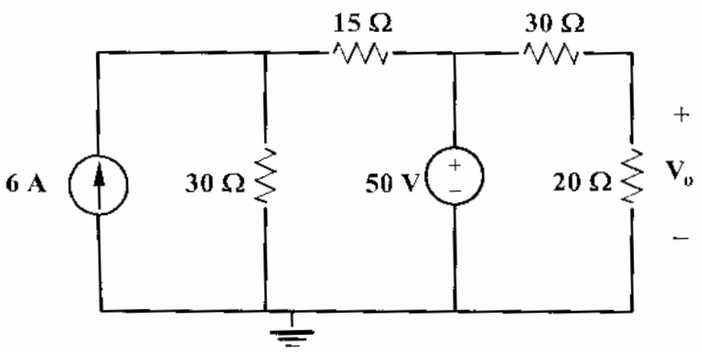

Figure 1: Circuit for problem 1.

(2) You are given the circuit of Figure 2.
(a) Find the voltage V_{ab}. Use any method.
(b) Find the power dissipated in the 10 Ω resistor.

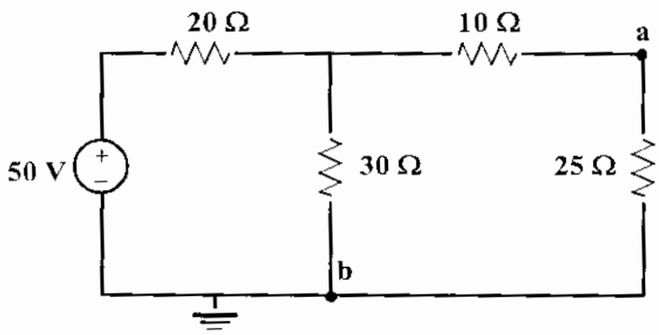

Figure 2: Circuit for problem 2.

(3) You are given the circuit of Figure 3. Use mesh analysis to find I_1 and I_2.

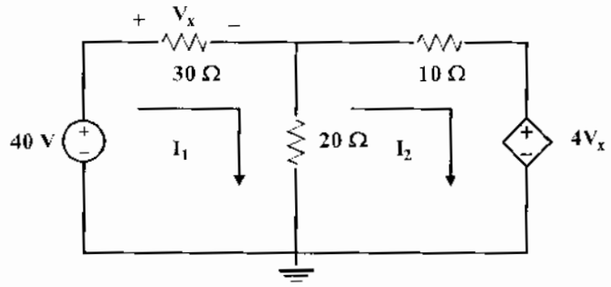

Figure 3: Circuit for problem 3.

(4) You are given the circuit of Figure 4.
(a) Use nodal analysis to find V_1 and V_2.
(b) Find the current I_o in the 30 Ω resistor.

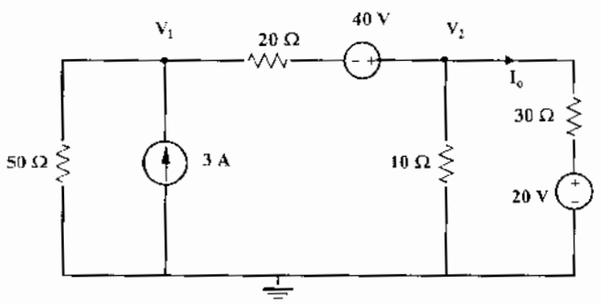

Figure 4: Circuit for problem 4.

(5) You are given the circuit of Figure 5.
(a) Find V_{TH} and R_{TH} for the circuit looking into terminals a-b.
(b) Draw the Thevenin circuit. Show the terminals a-b on your diagram.
(c) Using the information from the Thevenin circuit, draw the Norton equivalent circuit to the left of a-b. Show terminals a-b on your drawing.

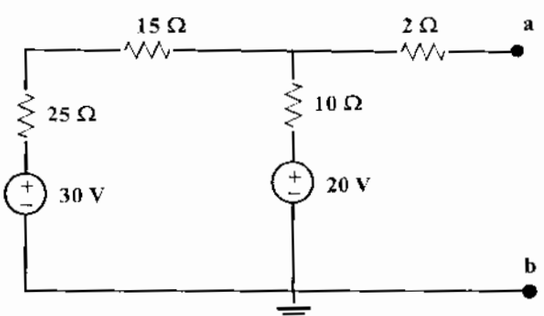

Figure 5: Circuit for problem 5.

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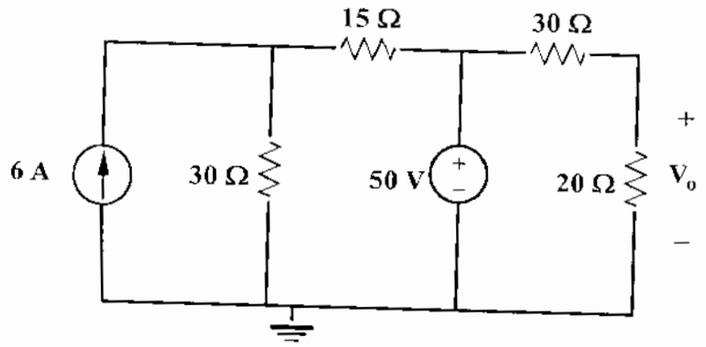
① Find V_o in the circuit below.



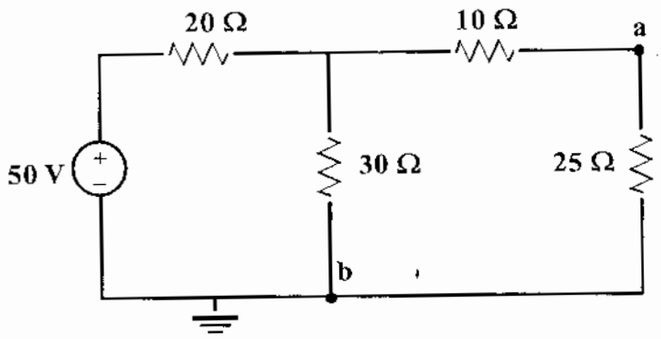
Since the 50V source is directly across the 30Ω and 20Ω resistors, we can use the voltage division rule.

$$V_o = \frac{50 \times 20}{20+30}$$

$$\boxed{V_o = 20\,V}$$

Log
Version A

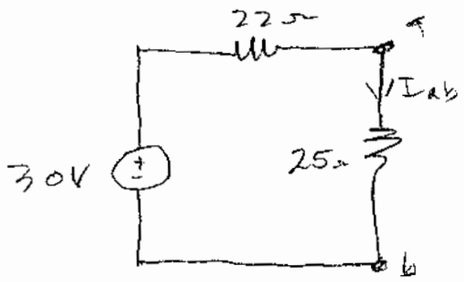
(2) In the circuit below
- find Vab
- find pwr in 10Ω resistor



The Thevenin equivalent ckt to the left of ab is shown below.

$$V_{TH} = \frac{50 \times 30}{20 \| 30} = 30V$$

$$R_{TH} = 10 + 20 \| 30 = (10 + 12)\Omega$$



$$V_{ab} = \frac{-30 \times 25}{25 + 22} = 15.96V$$

$$V_{ab} = 15.96V$$

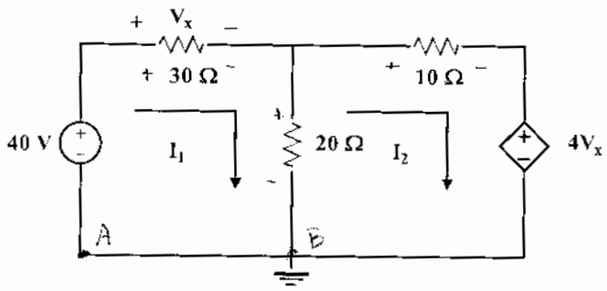
$$I_{ab} = I_{10} = \frac{30}{22+25} = 0.638\,A$$

$$P_{10} = (.638)^2 \times 10$$

$$P_{10} = 4.07\ W$$

Version A

(3) Use mesh analysis to find I_1 and I_2.



Start at A, go cw, use drops = 0

$$-40 + 30I_1 + 20(I_1 - I_2) = 0$$

$$50I_1 - 20I_2 = 40$$

start at B, go cw, use drops = 0

$$-20(I_1 - I_2) + 10I_2 + 4V_x = 0$$

but; $V_x = 30I_1$

$$-20I_1 + 20I_2 + 10I_2 + 4 \times 30I_1 = 0$$

$$100I_1 + 30I_2 = 0$$

$$\begin{bmatrix} 50 & -20 \\ 100 & 30 \end{bmatrix} \begin{bmatrix} I_1 \\ I_2 \end{bmatrix} = \begin{bmatrix} 40 \\ 0 \end{bmatrix}$$

$I_1 = 0.343$ A

$I_2 = -1.143$ A

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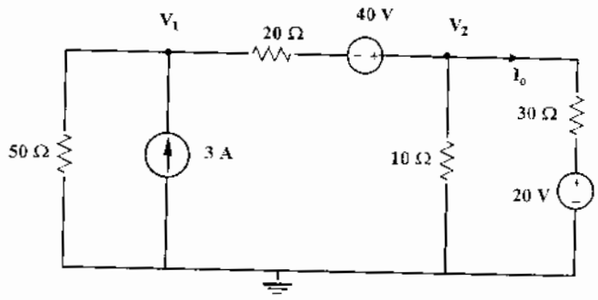
④ (i) Use nodal analysis to find V_1 and V_2

(ii) Find I_o in the 30Ω resistor.



At V_1

(100)

$$\frac{V_1}{50} + \frac{V_1 + 40 - V_2}{20} = 3$$

$$2V_1 + 5V_1 + 200 - 5V_2 = 300$$

$$\boxed{7V_1 - 5V_2 = 100}$$

At V_2

(60)

$$\frac{V_2}{10} + \frac{V_2 - 20}{30} + \frac{V_2 - 40 - V_1}{20} = 0$$

$$6V_2 + 2V_2 - 40 + 3V_2 - 120 - 3V_1 = 0$$

$$\boxed{-3V_1 + 11V_2 = 160}$$

$$\begin{bmatrix} 7 & -5 \\ -3 & 11 \end{bmatrix} \begin{bmatrix} V_1 \\ V_2 \end{bmatrix} = \begin{bmatrix} 100 \\ 160 \end{bmatrix}$$

$$\boxed{V_1 = 30.65\,V \qquad V_2 = 22.9\,V}$$

$$I_o = \frac{V_2 - 20}{30} = 0.097\,A$$

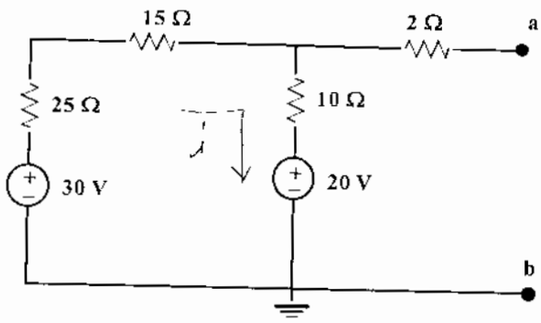
$$\boxed{I_o = 0.097\,A}$$

wkg

Version A

(5) i) Find V_{TH}, R_{TH}; show diagram.

ii) Give Norton; show diagram.



R_{TH}: Disable 20V and 30V sources:

(i)

$$R_{TH} = 2 + 10 \| 40 = 2 + \frac{400}{50} = 10\,\Omega$$

$$\boxed{R_{TH} = 10\,\Omega}$$

For V_{TH}:

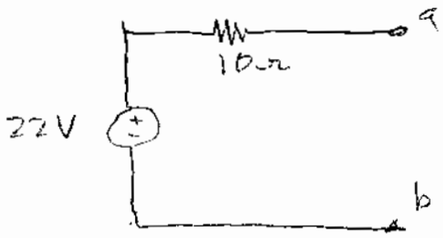
With a-b open,

$$-30 + 25i + 15i + 10i + 20 = 0$$

$$50i = 10$$

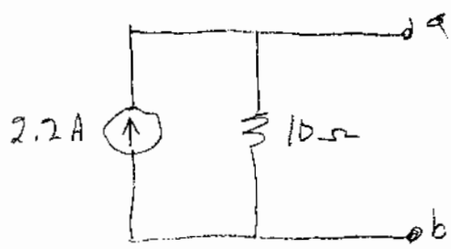
$$i = 0.2\,A$$

$$V_{ab} = 20 + 10 \times 0.2 = \boxed{22V = V_{TH}}$$



Thevenin ckt

(ii)



Norton CKt