Name: Key
Section: ≈

EE331 Homework PS2 – fall 2012

Problems from Alexander & Sadiku:

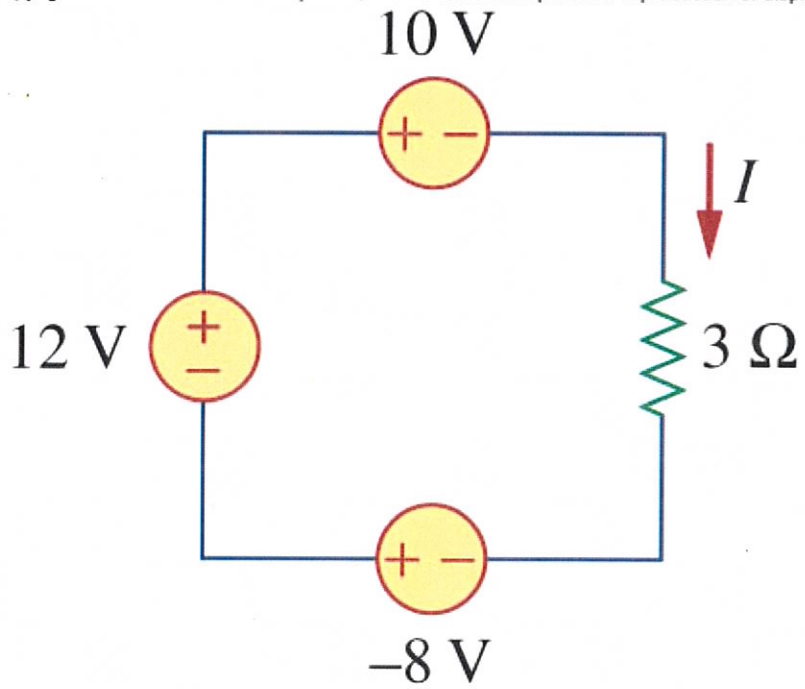
CH2

- 2.19 – **Warm up!**
- 2.27
- 2.36 (maintain your intermediate resistor combination steps to help you get the output voltage using voltage divider and/or current divider) *Ans:* $i = 0.2\text{A}$, $V_o = 600\text{mV}$
- 2.39
- 2.67
- 2.74

Additional Problems (Instructor Option):

- 3.11 – Give **Nodal Analysis** a go!
- Any as assigned by instructor

Figure 2.83



Chapter 2, Solution 19

Applying KVL around the loop, we obtain

$$-(-8) - 12 + 10 + 3i = 0 \longrightarrow \mathbf{i = -2A}$$

Power dissipated by the resistor:

$$p_{3\Omega} = i^2R = 4(3) = \mathbf{12W}$$

Power supplied by the sources:

$$p_{12V} = 12\,((-2)) = \mathbf{-24W}$$

$$p_{10V} = 10\,(-(-2)) = \mathbf{20W}$$

$$p_{8V} = (-8)(-2) = \mathbf{16W}$$

Chapter 2, Problem 27.

Calculate I_o in the circuit of Fig. 2.91.

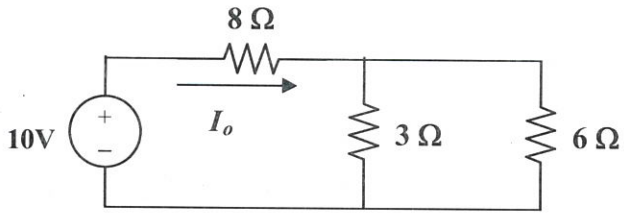


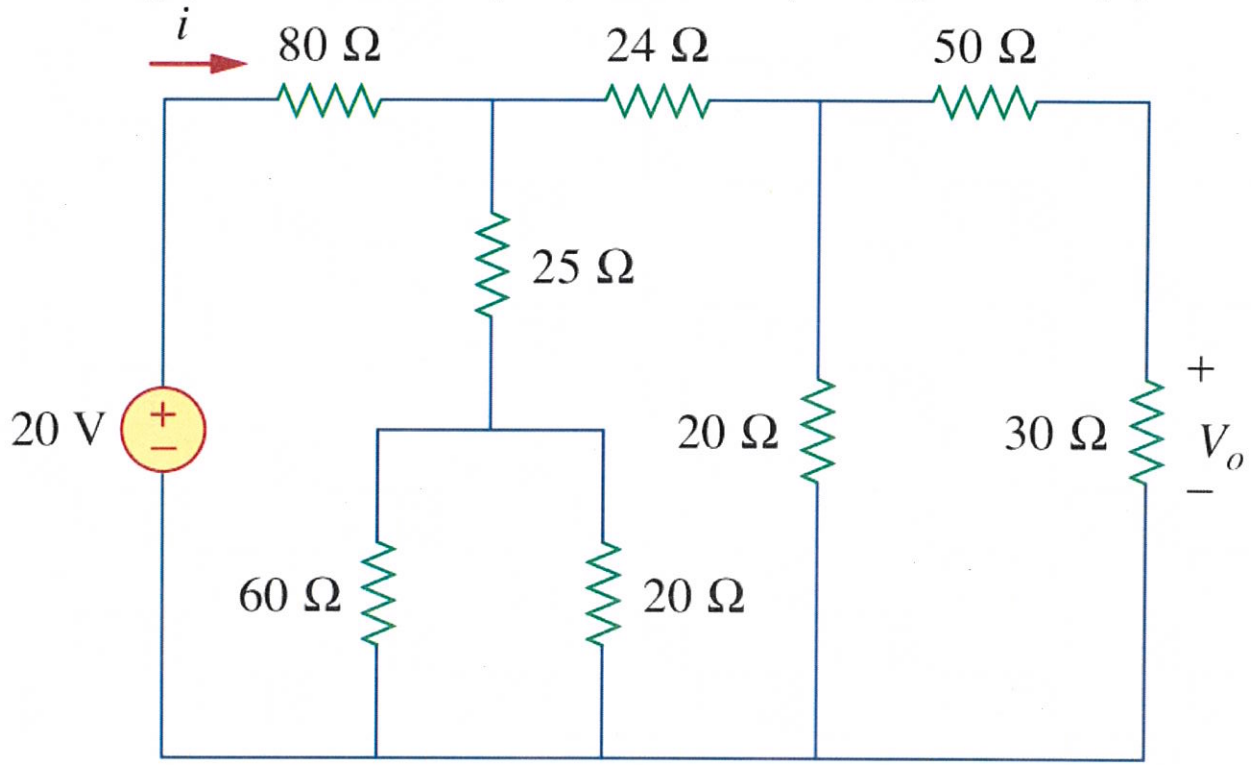
Figure 2.91
For Prob. 2.27.

Solution

The 3-ohm resistor is in parallel with the 6-ohm resistor and can be replaced by a [(3x6)/(3+6)] = 2-ohm resistor. Therefore,

$$I_o = 10/(8+2) = \mathbf{1\ A}.$$

Figure 2.100



Chapter 2, Solution 36

$20//(30+50) = 16,\ 24 + 16 = 40,\ \ 60//20 = 15$

$R_{eq} = 80+(15+25)40 = 80+20 = 100\ \Omega$

$i = 20/100 = 0.2\ A$

If i_1 is the current through the 24-Ω resistor and i_o is the current through the 50-Ω resistor, using current division gives

$i_1 = [40/(40+40)]0.2 = 0.1$ and $i_o = [20/(20+80)]0.1 = 0.02$ A or

$$v_o = 30i_o = 30x0.02 = \mathbf{600\ mV}.$$

Chapter 2, Problem 39.

Evaluate R_{eq} for each of the circuits shown in Fig. 2.103.

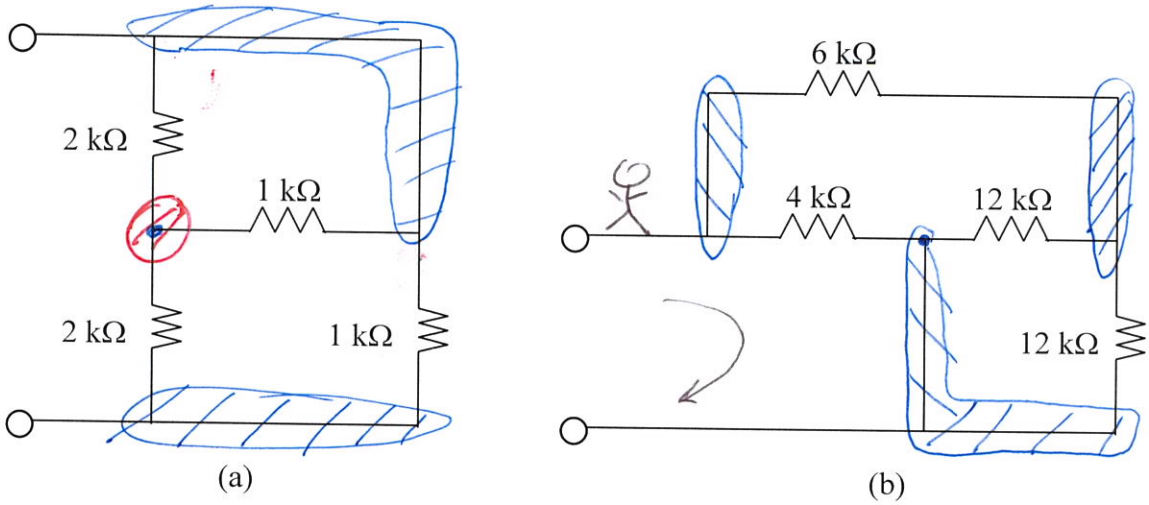


Figure 2.103 For Prob. 2.39.

- $R_{eq_a} = [(2k // 1k) + 2k] // 1k$

$= (\frac{2}{3}k + 2k) // 1k$

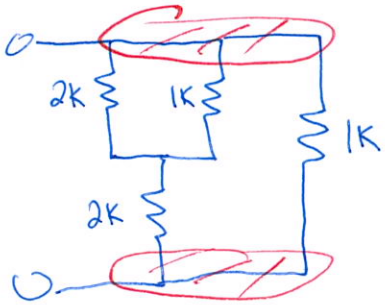
$R_{eq_a} = 0.728\,k\Omega$ or $728\,\Omega$

- $R_{eq_b} = 4k // (6k + 12k // 12k)$

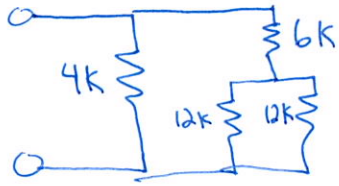
$= 4k // 12k$

$R_{eq_b} = 3\,k\Omega$

Could Re-draw – Can make easier



Re-draw



Chapter 2, Problem 67.

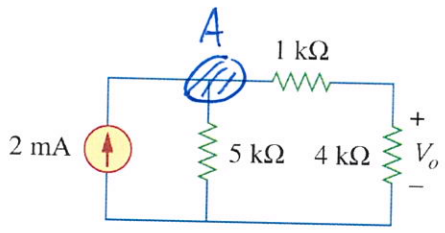
(a) Obtain the voltage v_o in the circuit of Fig. 2.127(a)

(b) Determine the voltage v'_o measured when a voltmeter with 6-kΩ internal resistance is connected as shown in Fig. 2.127(b)

(c) The finite resistance of the meter introduces an error into the measurement. Calculate the percent error as

$$\left|\frac{v_o - v'_o}{v_o}\right| \times 100\%.$$

(d) Find the percent error if the internal resistance were 36 kΩ.

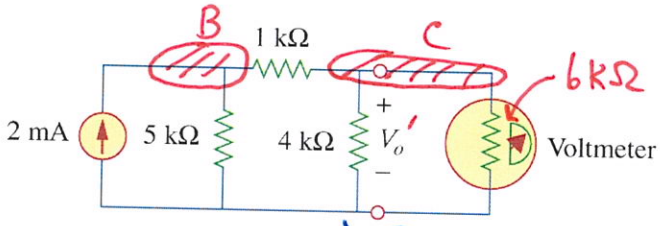


(a)

a) $R_{eq} = 5k // (1k+4k) = 2.5k\Omega$

$V_A = 2mA \cdot 2.5k\Omega = 5V$

$V_o = 5V\left(\frac{4k\Omega}{1k\Omega+4k\Omega}\right) = 4V$



(b) $R_1 = 4k\Omega // 6k\Omega = 2.4k\Omega$

$R_2 = 1k\Omega + 2.4k\Omega = 3.4k\Omega$

$R_{eq} = 5k\Omega // 3.4k\Omega = 2.024k\Omega$

b) $V_B = 2mA \cdot 2.024k\Omega = 4.05V$

$V_C = V_o' = 4.05V\left(\frac{2.4k\Omega}{3.4k\Omega}\right)$ ← (want)

$V_o' = 2.86V$

c) $\left|\frac{4V-2.86V}{4V}\right| \cdot 100\% = 28.5\%$

d) $R_1' = 4k\Omega // 36k\Omega = 3.6k\Omega$

$R_2' = 4.6k\Omega \Rightarrow V_B' = 2mA \cdot 2.4k\Omega = 4.8V$

$R_{eq} = 2.4k\Omega$

$V_C' = V_o'' = 4.8V\left(\frac{3.6k\Omega}{4.6k\Omega}\right) = 3.76V$

$\left|\frac{4V-3.76V}{4V}\right| \cdot 100\% \cong 6\%$ ← Nice Improvement!

Chapter 2, Problem 74.

The circuit in Fig. 2.134 is to control the speed of a motor such that the motor draws currents 5 A, 3 A, and 1 A when the switch is at high, medium, and low positions, respectively. The motor can be modeled as a load resistance of 20 mΩ. Determine the series dropping resistances R_1, R_2, and R_3.

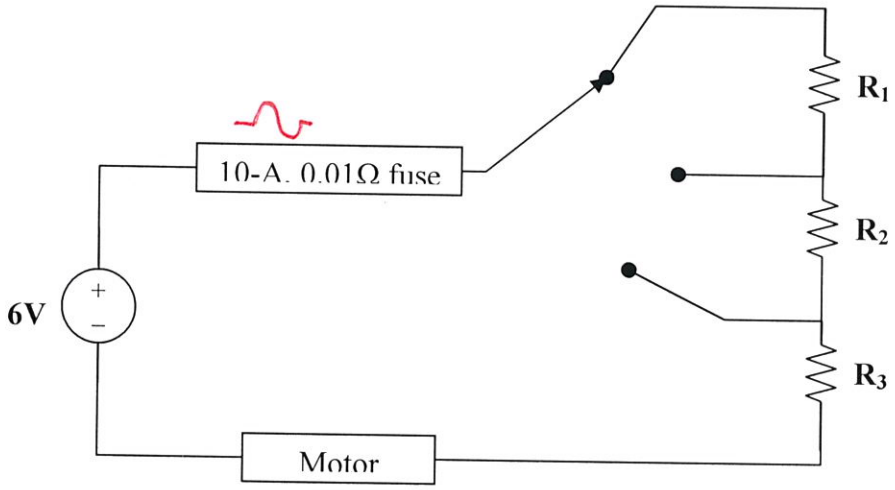


Figure 134

Fuse ~ Motor ~

High – $6V = 5A(0.01\Omega + R_3 + 0.02\Omega)$

$R_3 = 1.17\Omega$

MED. – $6V = 3A(0.01\Omega + (R_2+R_3) + 0.02\Omega)$

$R_2+R_3 = 1.97\Omega$

$R_2 = 0.8\Omega$

Low – $6V = 1A(0.01\Omega + (R_1+R_2+R_3) + 0.02\Omega)$

$R_1+R_2+R_3 = 5.97\Omega$

$R_1 = 4\Omega$

Chapter 3, Solution 11

Find V_o and the power absorbed by all the resistors in the circuit of Fig. 3.60.

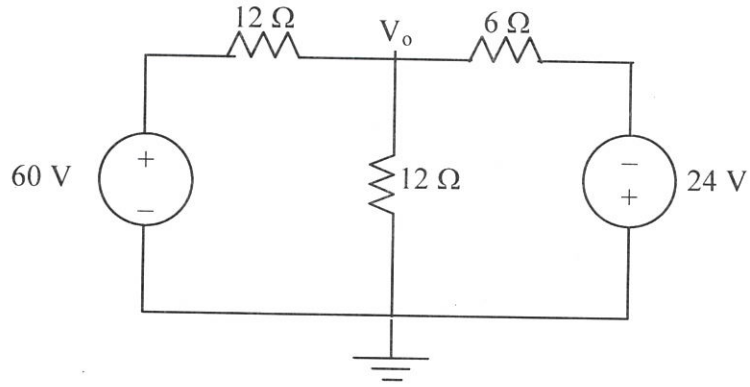


Figure 3.60
For Prob. 3.11.

Solution

At the top node, KCL produces $\frac{V_o - 60}{12} + \frac{V_o - 0}{12} + \frac{V_o - (-24)}{6} = 0$

$(1/3)V_o = 1$ or $V_o = \mathbf{3\ V}$.

$P_{12\Omega} = (3-60)^2/12 = \mathbf{293.9\ W}$ (this is for the 12 Ω resistor in series with the 60 V source)

270.75 W

$P_{12\Omega} = (V_o)^2/12 = 9/12 = \mathbf{750\ mW}$ (this is for the 12 Ω resistor connecting V_o to ground)

$P_{4\Omega} = (3-(-24))^2/6 = \mathbf{121.5\ W}$.