ECE 111 - Homework #8

EE 206 Circuits I

V = IR, P = VI

1) A resistor has the following volts / amps / resistance / power. Determine the missing parameters:

Volts	Amps	Ohms	Watts
32V	2.4A	13.33 Ohms	76.8W
32V	4.00A	8	128W
40.0V	3.0A	13.33 Ohms	120W
32V	3.00A	10.67 Ohms	96W

Sample Calculations

$$V = IR$$

$$32V = 2.4A \cdot R$$

$$R = \left(\frac{32V}{2.4A}\right) = 13.33\Omega$$

$$P = VI$$

$$P = (32V)(2.4A) = 76.8W$$

Resistor Color Codes

2) Determine the value of the following resistors

a) Brown - Black - Green

$$1 - 0 - 5$$
$$R = 10 \cdot 10^{5}$$
$$R = 1M\Omega$$

b) Orange - Orange - Red

$$3 - 3 - 2$$
$$R = 33 \cdot 10^{2}$$
$$R = 3.3k\Omega$$



c) Red - Yellow - Yellow

2 - 4 - 4 $R = 24 \cdot 10^4 \Omega$ $R = 240k\Omega$

Kirchoff's Laws:

3) Use conservation of voltage to determine the unknown voltages



Apply conservation of voltage: around any closed path, the voltages have to sum to zero.

Example Window (2, 1) -100V + 14V + D = 0 D = 86V

Window (2,2)

-86V + 26V + E = 0E = 60V

etc.

4) Use conservation of current to determine the unknown currents



Apply conservation of current: Current In = Current Out

Top left corner:

A = 80A

Middle Left

100A = A + EE = 20A

etc

Resistors in Series and Parallel

5) Find the total resistance Rab by hand





Combine resistors in series and parallel

In series

$$R_{net} = R_1 + R_2$$

In parallel

$$\boldsymbol{R}_{net} = \left(\frac{1}{R_1} + \frac{1}{R_2}\right)^{-1}$$

300 + 200 = 500 500 || 450 = 236.84 236.84 + 75 = 311.84 311.84 || 250 = 138.76 138.76 + 50 = 188.76

On an HP42 or HP Prime

HP Prime: to get to RPN mode, Settings - Entry - RPN 200

100
enter
300
+
1/x
450
1/x
+
1/x
75
+
1/x
250
1/x
+
1/x
50
+

HP Prime Graphing Calculator	
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ALPHA LAST X MODES DISP CLEAR ENTER X2Y +/- E
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SST BASE CONVERT FLAGS PROB
ASSIGN CUSTOM PGM.FCN PRINT
OFF TOP.FCN SHOW PRGM CATALOG EXIT O • R/S +

6) Find the total resistance Rab using CircuitLab

- Apply a 10V source to a and b.
- Determine the current draw from the 10V source
- Calculate the net resistance from V = IR

Calculations

V = IR

 $10V = 52.98mA \cdot R$

$$R = 188.75\Omega$$

(calculations were 188.76 Ohms)





7) Find the total resistance Rab by hand



Problem 7 & 8

Again, add resistors in series and parallel

125 + 400 = 525 525 || 300 = 130.909 130.909 + 75 = 265.909 265.909 || 200 = 114.14 114.14 + 50 = 164.14

On an HP42 or HP Prime:

HP Prime: to get to RPN mode, Settings - Entry - RPN

125 enter 400 $^{+}$ 1/x 300 1/x +1/x 75 +1/x 200 1/x +1/x 50 +

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$\begin{array}{cccc} \Sigma^{-} & y^{x} & x^{2} & 10^{x} & e^{x} \\ \Sigma^{+} & 1/_{X} & \sqrt{X} & LOG & LN & XEQ \end{array}$
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SST BASE CONVERT FLAGS PROB
ASSIGN CUSTOM PGM.FCN PRINT
OFF TOP.FCN SHOW PRGM CATALOG EXIT 0 • R/S +

8) Find the total resistance, Rab, using CircuitLab

- Apply a 10V source to a and b.
- Determine the current draw from the 10V source
- Calculate the net resistance from V = IR

Calculations

V = IR

 $10V = 60.92mA \cdot R$

 $R = 164.1497\Omega$

Calculated resistance was 164.1463 Ohms





Voltage Division

9) Use voltage division to find V1, V2, and V3.



Problem 9 & 10

Trick:

- Find the net resistance at V1 looking right
- R = 114.14 Ohms (series and parallel combinations)
- Use voltage division to find V1

$$V_1 = \left(\frac{114.14}{114.14+50}\right) V_0$$
$$V_1 = 6.9539V$$

Find the net resistance at V2 looking right

$$R = 190.909$$
$$V_2 = \left(\frac{190.909}{190.909+75}\right)V_1$$
$$V_2 = 4.9926V$$

Find the net resitance at V3 looking right

$$R = 400$$
$$V_3 = \left(\frac{400}{400 + 125}\right) V_2$$
$$V_3 = 3.8039V$$

- 10) Use CircuitLab to find V1, V2, V3.
 - The results are the same as problem #9

V(V0)	10.00 V	1	0
V(V1)	6.954 V	1	0
V(V2)	4.993 V	1	0
V(V3)	3.804 V	1	0
+ Add Expre	ssion		

