

ECE 111 - Homework #8

EE 206 Circuits I
Due Monday, October 16th

$$V = IR, P = VI$$

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

Volts	Amps	Ohms	Watts
24V	1.6A	15 Ohms	38.4 W
24V	3.0A	8	72.0 W
68.12V	2.2A	30.99 Ohms	150W
24V	4.00A	6.00 Ohms	96W

Sample Calculation

$$P = V \cdot I$$

$$P = 24V \cdot 1.6A$$

$$P = 38.4W$$

$$V = I \cdot R$$

$$24V = 1.6A \cdot R$$

$$R = 15\Omega$$

Resistor Color Codes

2) Determine the value of the following resistors

0	1	2	3	4	5	6	7	8	9
black	brown	red	orange	yellow	green	blue	violet	grey	white

a) Brown - Black - Red

1 - 0 - 2

$$R = 10 \cdot 10^2 \Omega$$

$$R = 1k\Omega$$

b) Yellow - Violet - Orange

4 - 7 - 3

$$R = 47 \cdot 10^3 \Omega$$

$$R = 47k\Omega$$

c) White - Brown - Yellow

9 - 1 - 4

$$R = 91 \cdot 10^4 \Omega$$

$$R = 91k\Omega$$

Kirchoff's Laws:

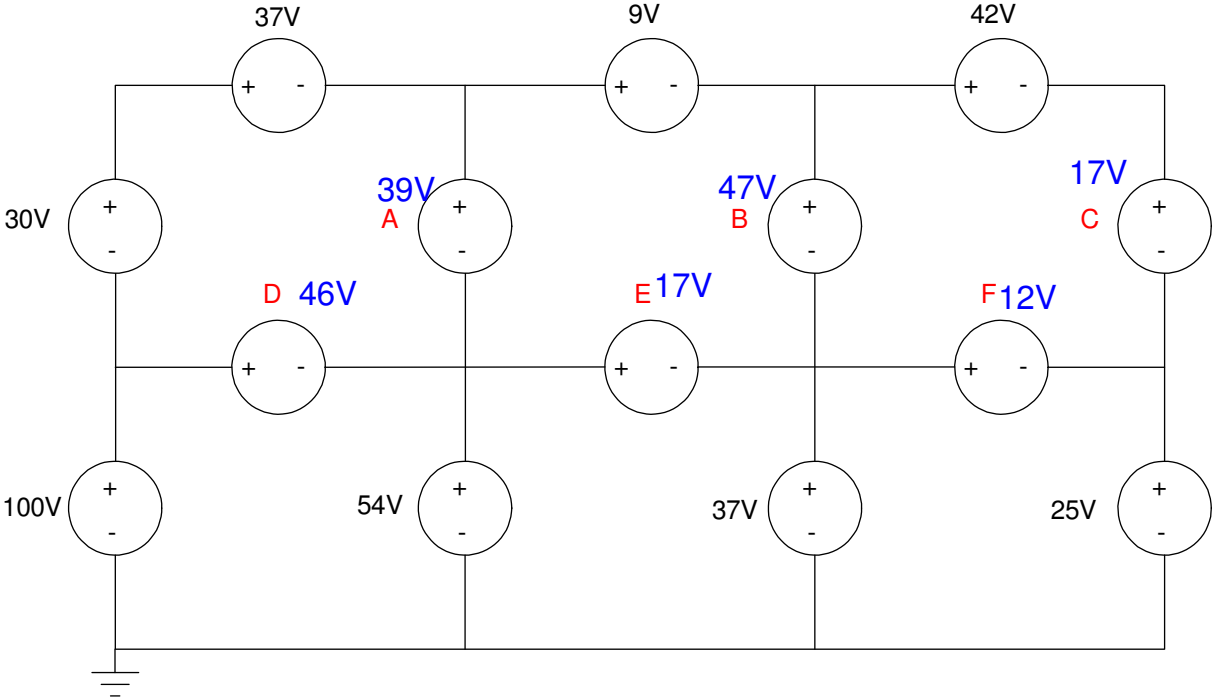
3) Use conservation of voltage to determine the unknown voltages

around any closed path, the voltages must sum to zero

- add if you hit the + sign first
- subtract if you hit the - sign first

Example: Upper left corner

$$-30V + 37V + A - D = 0$$



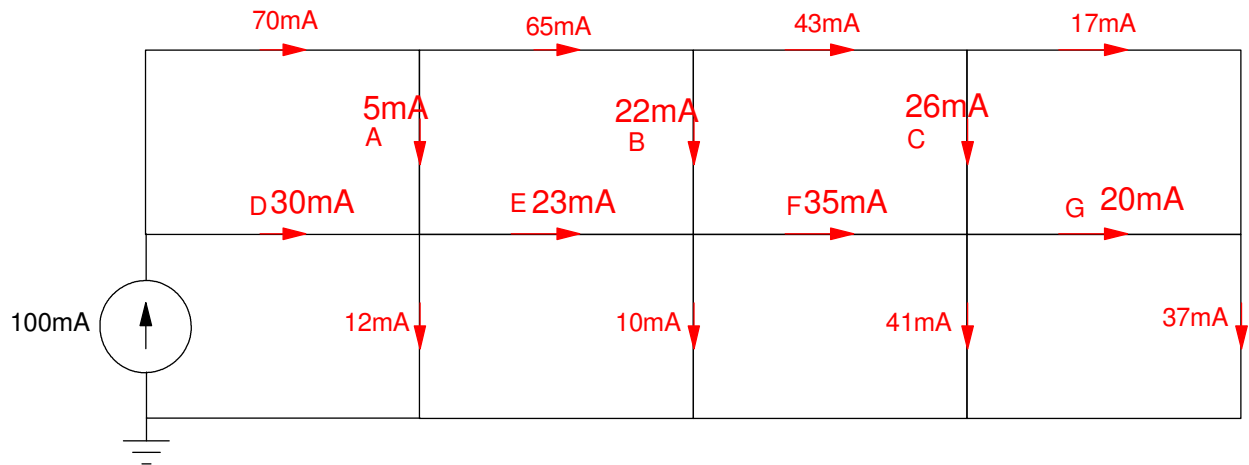
4) Use conservation of current to determine the unknown currents

At any node,

- Current In = Current Out
- The sum of the current from the node must be zero

Example:

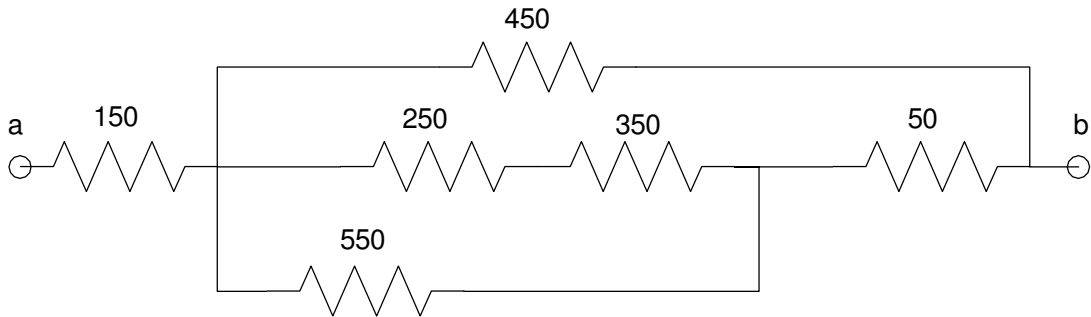
$$A + D = E + 12mA$$



Resistors in Series and Parallel

5) Find the total resistance R_{ab} by hand

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$$250 + 350 = 600$$

$$600 \parallel 550 = 286.95$$

$$286.95 + 50 = 336.95$$

$$336.95 \parallel 450 = 192.68$$

$$192.68 + 150 = 342.68$$

ans: 342.68 Ohms

On an HP Prime

```
350
enter
250
+
x-1
550
x-1
+
x-1
50
+
x-1
450
x-1
+
x-1
150
+
```

6) Find the total resistance R_{ab} using CircuitLab

- Apply a 10V source to a and b.
- Determine the current draw from the 10V source

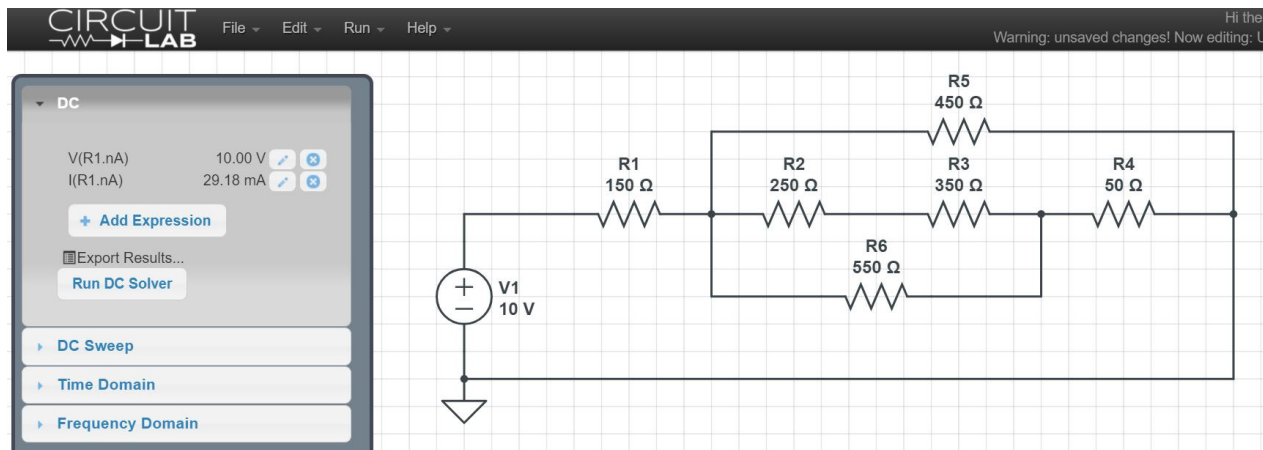
Calculate the net resistance from $V = IR$

$$V = IR$$

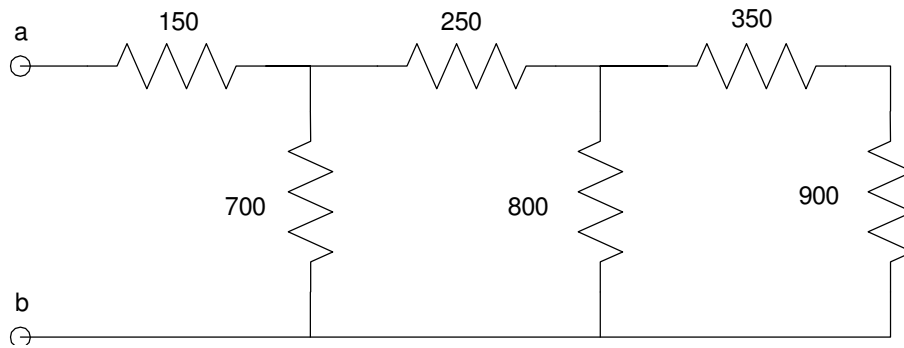
$$10V = 29.18mA \cdot R$$

$$R = 342.70\Omega$$

Calculated value = 342.68 Ohms



7) Find the total resistance R_{ab} by hand



$$350 + 900 = 1250$$

$$1250 \parallel 800 = 487.80$$

$$487.80 + 250 = 737.80$$

$$737.80 \parallel 700 = 359.20$$

$$359.20 + 150 = 509.20$$

ans: $R_{ab} = 509.20$ Ohms

With an HP Prime calculator

```
900
enter
350
+
```

```
x-1
800
x-1
+
```

```
250
+
```

```
x-1
700
x-1
+
```

```
150
+
```

8) Find the total resistance, R_{ab} , using CircuitLab

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

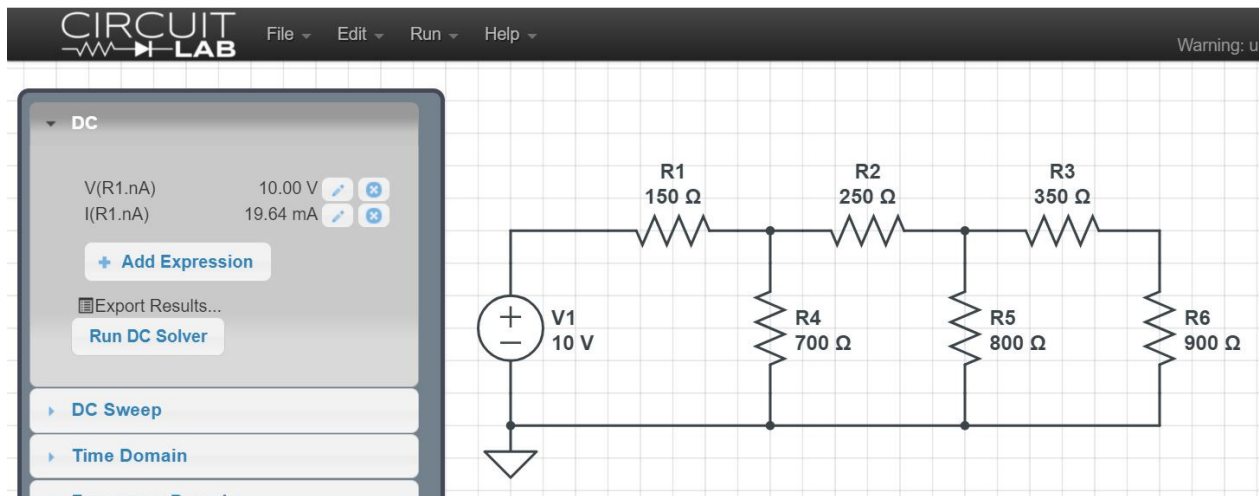
Calculations

$$V = IR$$

$$10V = 19.64mA \cdot R$$

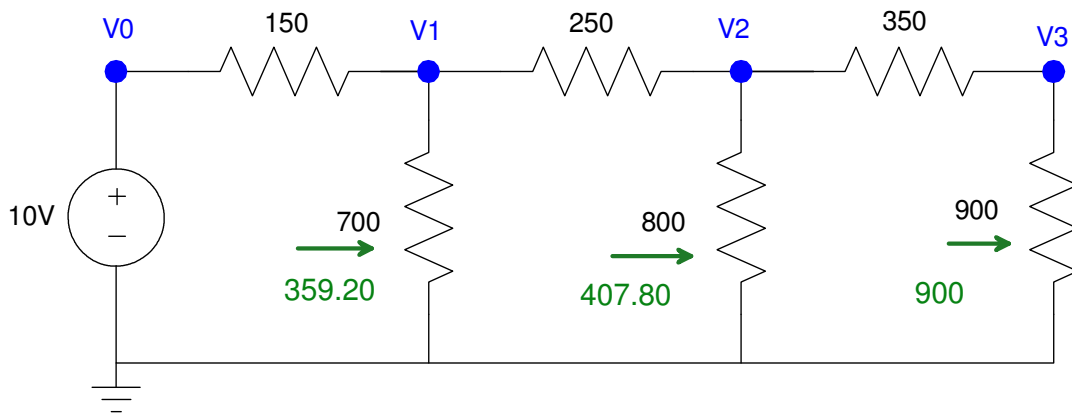
$$R = 509.16\Omega$$

Calculated = 509.20 Ohms



Voltage Division

9) Use voltage division to find V_1 , V_2 , and V_3 .



Start by finding the impedance looking right at V_1 , V_2 , and V_3

$$R_3 = 900 \text{ Ohms}$$

R2:

$$350 + 900 = 1250$$

$$1250 \parallel 800 = 407.80$$

R1:

$$407.80 + 250 = 657.80$$

$$657.80 \parallel 700 = 359.20$$

Now use voltage division

$$V_1 = \left(\frac{359.20}{359.20 + 150} \right) V_0$$

$$V_1 = 7.054V$$

$$V_2 = \left(\frac{407.80}{407.80 + 250} \right) V_1$$

$$V_2 = 4.664V$$

$$V_3 = \left(\frac{900}{900 + 350} \right) V_2$$

$$V_3 = 3.358V$$

10) Use CircuitLab to find V1, V2, V3.

Same results as problem #9

