EQUIVALENT RESISTANCE

1. Resistors in Series and Parallel

Apply Kirchoff's Laws to circuits (a) and (b) in Figure 1 to derive the well known equations for the equivalent resistance of two resistors in series and in parallel. In each case, consider the special cases $R_1 = R_2$, $R_1 >> R_2$, and $R_1 << R_2$.

2. Exercises

Find the equivalent resistance of the networks of resistors (c) and (d) in Figure 1, using $R_1 = 1\ \Omega$, $R_2 = 10\ \Omega$, and 50 Ω for unlabeled resistors.

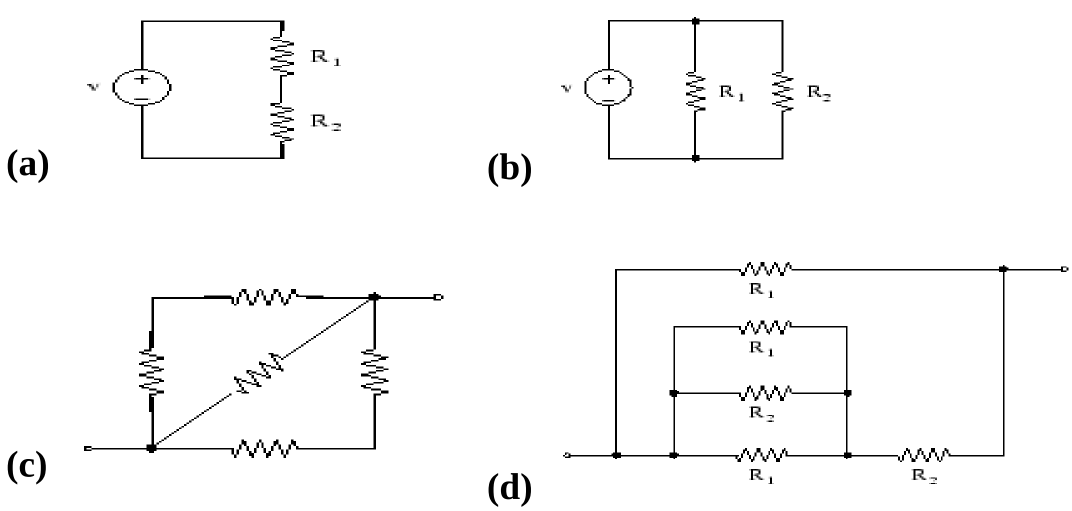

Figure 1: (a) and (b) are simple (simplest) circuits with two resistors connected in series and parallel, respectively. (c) and (d) are resistor networks.

3. **Δ-Y Transformations**

Practice working with Delta-Wye (Δ-Y) transformations by finding the equivalent resistance of the resistor networks (a) and (b) in Figure 2.

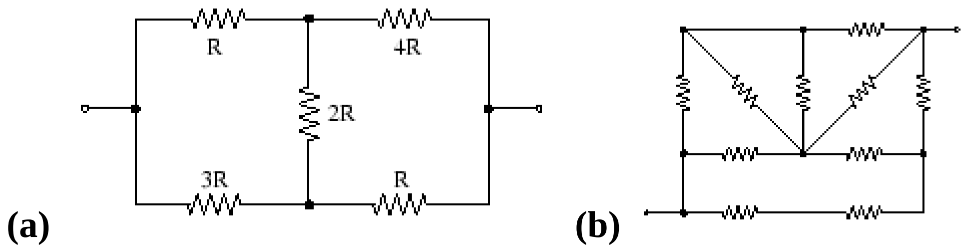

Figure 2: Resistor networks requiring Δ-Y transformations. $R = 100\ \Omega$, unlabeled resistors are 1 kΩ.

4. **Experiment**

Build the resistor network shown in Figure 2(a) and check your calculation of its equivalent resistance experimentally.

Methods of Circuit Analysis

1. **The Node Voltage Method**

Construct, in your own words, a step by step description of the Node Voltage Method of circuit analysis. Include an example circuit diagram. (Acknowledge the resources you use.)

2. **The Mesh Current Method**

Construct, in your own words, a step by step description of the Mesh Current

Method of circuit analysis. Include an example circuit diagram. (Acknowledge the resources you use.)

3. **Exercises**

Find the unknown currents and voltages for circuits (a) - (d) in Figure 3 using *both* the node voltage and mesh current methods.

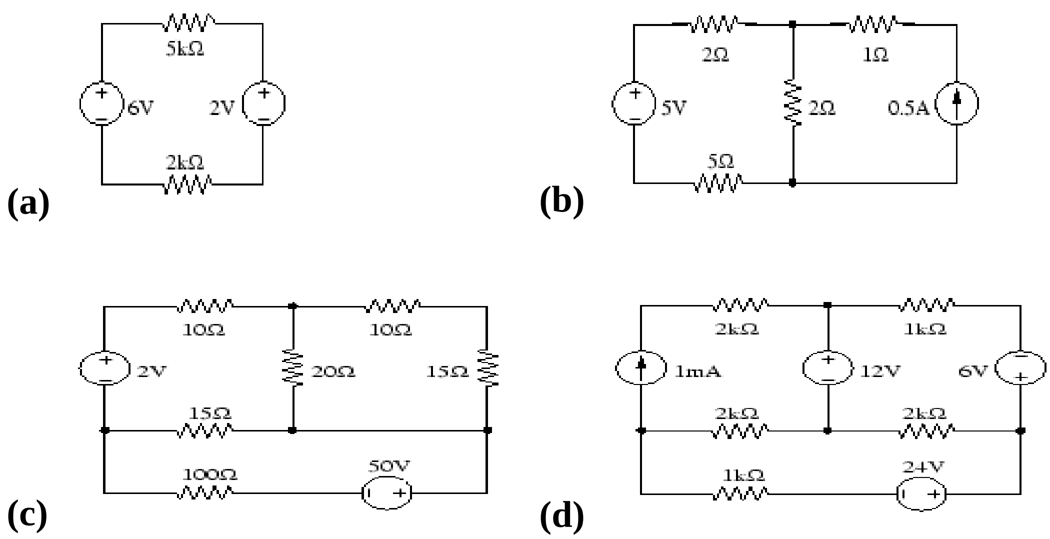

Figure 3: DC circuits with resistor networks and power supplies.

The Spice Circuit Simulation Program

Use Spice to verify your calculations of Section 3. Hand in printouts of your circuit files and output. However, do not assume that they speak for themselves. Summarize important results.

Source: http://webpages.ursinus.edu/lriley/ref/circuits/node2.html