EECS 211  Circuits I  
Fall Semester 2017
Assignment #5  Due 26 September 2017

Reading: Sections 4.2 - 4.5 in Hayt/Kemmerly/Durbin

Do all of the Practice problems in the Reading assignment (but do not hand them in).

NOTE 1: All of the problems below have an indicated method (e.g., nodal analysis, mesh analysis). You must use the indicated method to solve the problem, but you may check your answers using any method. NOTE 2: Many of the problems direct you to perform some sort of a check on your work. This check must be done to receive full credit for the problem.

1. Problem 4.16, p. 112. Nodal analysis with independent and dependent current sources. Correction: the independent current source should be labeled 10 A, not 10 V! Use the bottom node as the reference node. Check your work using a KCL equation at the reference node.

2. Problem 4.18, p. 112. Nodal analysis with independent current and voltage sources. Check your work using a KCL equation at the reference node.

3. Problem 4.24, p. 113. Nodal analysis with dependent voltage source. Check your work using a KCL equation at whichever node you chose for the reference node.

4. Problem 4.30, p. 115. Simple mesh analysis with only independent voltage sources. Check your work with a KVL equation around the outermost loop.

5. The circuit below is a DC version of a typical 120V/240V, three-wire power distribution system in a house. The resistors $R_1$, $R_2$, and $R_3$ represent the resistances of the three conductors that connect the three loads $R_a$, $R_b$, and $R_c$ to the 120/240-V voltage supply. The resistors $R_a$ and $R_b$ represent loads (such as a stereo, microwave, etc.) connected to the 120-V circuits, and $R_c$ represents a load (such as an electric stove or air conditioner) connected to the 240-V circuit.
   a. Calculate $V_a$, $V_b$, and $V_c$ using mesh analysis.
   b. Calculate the power delivered to (absorbed by) the three loads $R_a$, $R_b$, and $R_c$.
   c. Calculate the power delivered by (supplied by) each source.
   d. What percentage of the source power is delivered to the loads?
   e. The $R_2$ branch represents the neutral conductor in the distribution circuit. What adverse effect occurs if the neutral conductor is open-circuited? (Hint: Calculate $V_a$ and $V_b$ and note that appliances or loads designed for use in this circuit would have a nominal voltage rating or limit of 120 V.)
6. Problem 4.38, p. 116. Mesh analysis with a dependent voltage source. Check your work with a KVL equation around the outermost loop.

7. Problem 4.42, p. 117. Mesh analysis with independent current source. Check your work with a KVL equation around the outermost loop.

8. Problem 4.17, p. 112. The problem says to use nodal analysis, but I want you to use mesh analysis for this circuit involving both independent and dependent current sources. Check your work with a KCL equation at the center node.


\[ R_1 = 0.1 \, \Omega \]
\[ R_2 = 0.2 \, \Omega \]
\[ R_3 = 0.1 \, \Omega \]
\[ R_a = 8.4 \, \Omega \]
\[ R_b = 18.4 \, \Omega \]
\[ R_c = 13.2 \, \Omega \]