GEORGIA INSTITUTE OF TECHNOLOGY
School of Electrical and Computer Engineering

Course ECE 2040

Circuit Analysis

Assigned: September 8, 2000
Due: September 15, 2000

Problem Set #3

Reading: Read the following sections from the class notes:
Chapter 2, Sections 2.1.4, 2.1.5, 2.2

Reading: Read the following sections from Dorf and Svoboda:
Chapter 4, Section 4.3, 4.4, 4.5; (node method)
Chapter 5, Section 5.4 (source superposition)

Problem 3.1: Use the node method to write a set of equilibrium equations for the network of Figure 1. Use as variables the voltages $e_a(t)$, $e_b(t)$, and $e_c(t)$. Do not solve the set of equations.

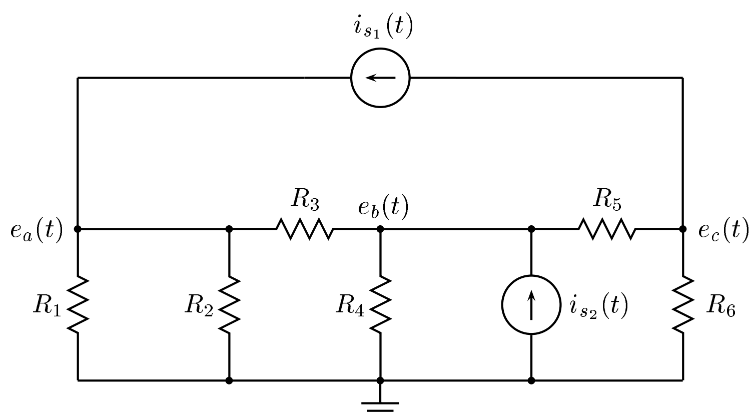

Figure 1: Circuit for Problem 3.1.

Problem 3.2: In this problem we shall solve the circuit in Figure 2 using the node method.

(a) Write the KCL equations at nodes a and b in terms of the node potentials at those nodes, $e_a(t)$ and $e_b(t)$.

(b) Put your equations in matrix-vector form by supplying the missing constants in the frame-

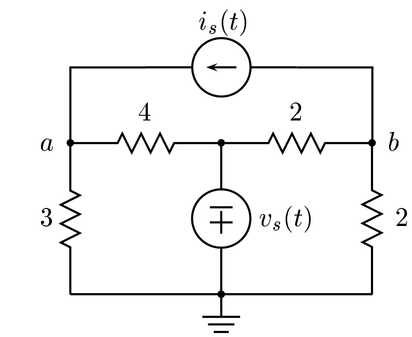

Figure 2: Circuit for Problem 3.2.

work below.

$$\begin{bmatrix} \quad & \quad \\ \quad & \quad \end{bmatrix} \begin{bmatrix} e_a(t) \\ e_b(t) \end{bmatrix} = \begin{bmatrix} \quad \\ \quad \end{bmatrix} i_s(t) + \begin{bmatrix} \quad \\ \quad \end{bmatrix} v_s(t)$$

(c) Solve them for $e_a(t)$ and $e_b(t)$.

Problem 3.3: Determine the voltage at each connection point in the circuit in Figure 3 with respect to the indicated ground.

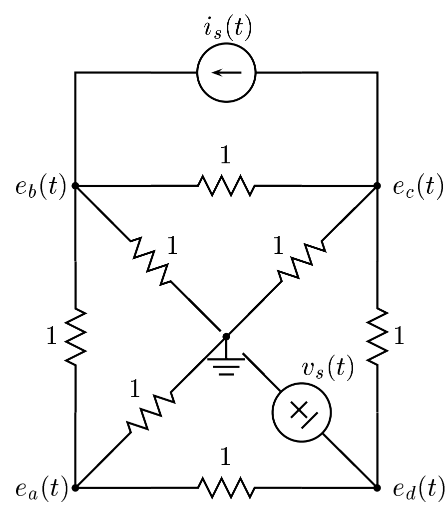

Figure 3: Circuit for Problem 3.3

Problem 3.4: We wish to solve the circuit in Figure 4 using the node method. Let $e_a(t)$ be the node potential at the indicated node.

(a) Express $i(t)$ in terms of $e_a(t)$ and $v_s(t)$.

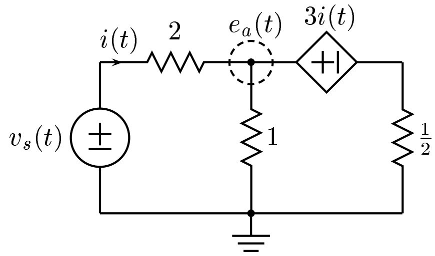

Figure 4: Circuit for Problem 3.4.

(b) Write a KCL equation at the surface in the complete network that corresponds to the non-ground node in the basic network. This equation should involve only the variables $e_a(t)$ and $v_s(t)$.

(c) Determine $e_a(t)$.