GEORGIA INSTITUTE OF TECHNOLOGY
School of Electrical and Computer Engineering

Course ECE 2040

Circuit Analysis

Assigned: September 22, 2000
Due: September 29, 2000

Problem Set #5

Reading: Read the following sections from the class notes:
Chapter 3, Section 3.2
Chapter 4, Section 4.1, 4.2

Reading: Read the following sections from Dorf and Svoboda:
Chapter 3, Section 3.3–3.8; (series and parallel)
Chapter 5, Section 5.5, 5.6; (Thevenin and Norton)
Chapter 6, Section 6.3–6.5; (operational amplifiers)

Announcement: The second quiz will be held during the class hour on Friday, October 6, 2000. It will be a closed book test, although calculators are permitted (but probably not necessary). It will cover the same material that is covered in Problem Sets 3–5.

Problem 5.1: For the circuit in Figure 1 the source voltage on the left is a battery (i.e., a constant voltage source). Determine the value of V required to produce a value for V_o of 1 volt. For the

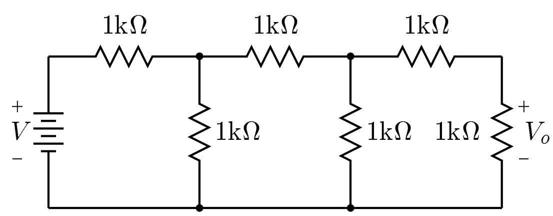

Figure 1: Circuit for Problem 5.1.

circuit in Figure 1 the source voltage on the left is a battery (i.e., a constant voltage source). Determine the value of V required to produce a value for V_o of 1 volt.

Problem 5.2:

(a) Find the Thévenin equivalent network corresponding to the two-terminal network in Figure 2.

(b) Find the Norton equivalent network.

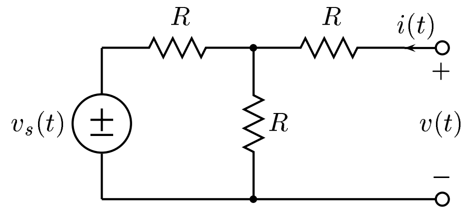

Figure 2: Circuit for Problem 5.2.

Problem 5.3: Sketch the Thevenin equivalent circuit corresponding to the one-port in Figure 3.

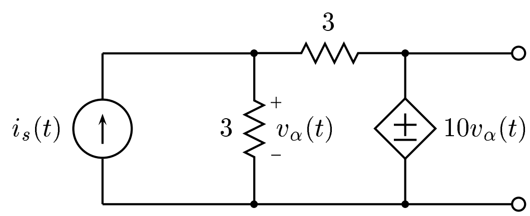

Figure 3: Circuit for Problem 5.3.

Problem 5.4: Consider a one-port network consisting of two capacitors with capacitances C_1 and C_2 connected in parallel, as shown in Figure 4.

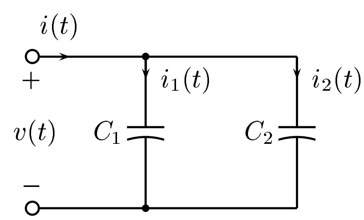

Figure 4: Two capacitors connected in parallel.

(a) Show that this network is equivalent to a single capacitor.

(b) Derive a formula for the equivalent capacitance C_{eq} in terms of C_1 and C_2.

(c) Derive expressions for the current $i_1(t)$ that passes through capacitor C_1 and the current $i_2(t)$ that passes through C_2 in terms of the current $i(t)$ entering the one-port.

Problem 5.5:

Determine $v_{out}(t)$ in terms of $v_{in}(t)$ for the circuit in Figure 5.

Problem 5.6: Find the voltage gain of the circuit in Figure 6. The voltage gain is defined as $G = v_{out}(t)/v_{in}(t)$.

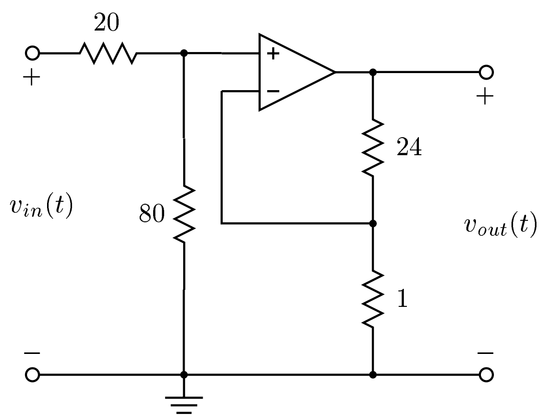

Figure 5: Circuit for Problem 5.5.

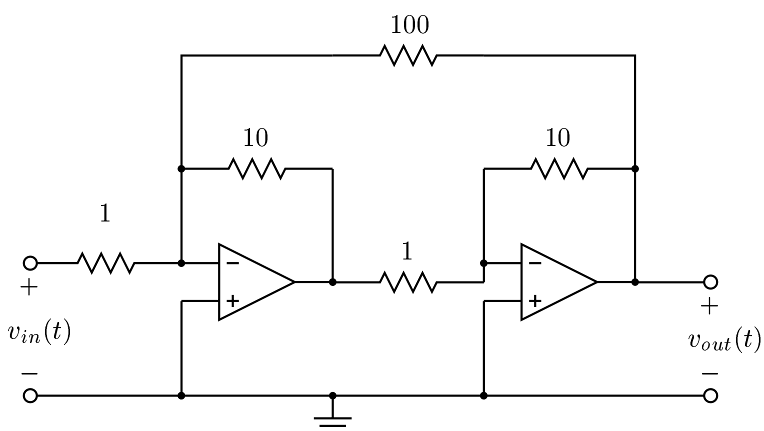

Figure 6: Circuit for Problem 5.6.