Embedded Systems (CS [45]163)
Homework 1

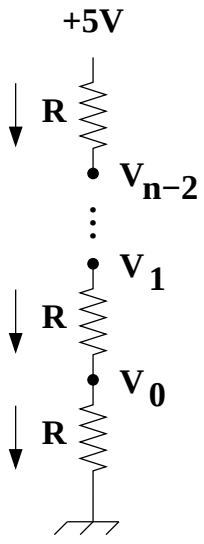
January 27, 2010

This homework assignment is due on Tuesday, February 9th at 5:00pm. Your work may be handed in electronically (use the **Homework 1** digital dropbox on D2L) or in hardcopy form (in person or under office door).

This assignment must be done individually: do not share/discuss your answers with others or look at the answers of others.

Question 1

Consider the following circuit that is composed of n resistors:



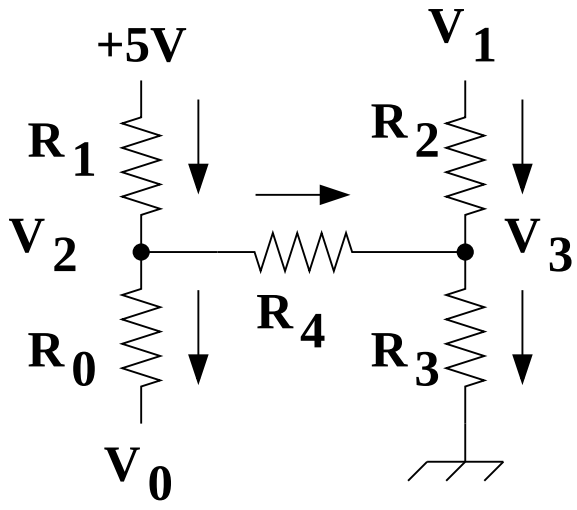
1. (20pts) Derive equations for V_i. Hint: you may use your knowledge of series resistors in your derivation.

2. (5pts) Assume that $n = 5$, what are the four V's?

3. (5pts) Assume that $n = 10$, what are the nine V's?

Question 2

Consider the following circuit:



Assume that V_0, V_1 and R_i are given.

1. (10pts) List the fundamental equations that are derived directly from the circuit (note that you should have the same number of equations as unknowns).

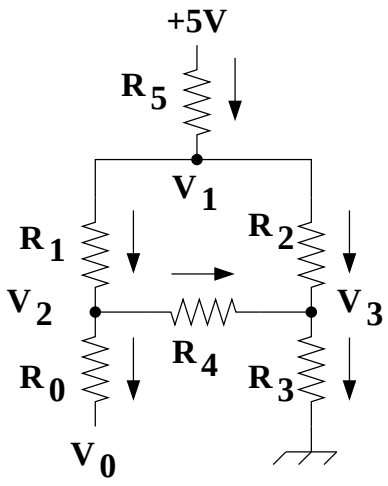
2. (20pts) Derive equations for V_2 and V_3. One of the two should be a function of only known variables; the other may assume knowledge of the first.

3. (10pts) Assume $R_0 = 100\Omega$, $R_1 = 200\Omega$, $R_2 = 300\Omega$, $R_3 = 400\Omega$, $R_4 = 100\Omega$ and $V_1 = +8V$. Show a plot of I_4 as V_0 is varied from $-10V$ to $+10V$. You are encouraged to use a tool such as Matlab to produce this plot.

4. (10pts) Given the same assumptions as above, show a plot of V_2 and V_3 as V_0 is varied from $-10V$ to $+10V$ (place both of these curves on the same plot). Describe any interesting relationships between this plot and the previous one.

Question 3

Consider the following circuit:



Assume that V_0 and R_i are given.

1. (20pts) Assuming that $R_4 = 0\Omega$, show the simplest equivalent circuit. You may use your knowledge of the series/parallel resistor rules.

2. (10pts) List the fundamental equations that are derived directly from the simplified circuit (note that you should have the same number of equations as unknowns).

3. (20pts) Derive equations for V_1, V_2 and V_3 for the simplified circuit. One should be a function of only known variables; the others may also assume knowledge of those that have already been derived.

4. (10pts) Assume $R_0 = 100\Omega$, $R_1 = 200\Omega$, $R_2 = 300\Omega$, $R_3 = 400\Omega$ and $R_5 = 200\Omega$ (again, for the simplified circuit). Show a plot of V_1 and V_2 as V_0 is varied from $-10V$ to $+10V$.

Graduate Only

5. (10pts) Given the original circuit, list the fundamental equations that are derived directly from the circuit (note that you should have the same number of equations as unknowns).

6. (20pts) Derive equations for V_1, V_2 and V_3. One should be a function of only known variables; the others may also assume knowledge of those that have already been derived.

7. (10pts) Assume $R_0 = 100\Omega$, $R_1 = 200\Omega$, $R_2 = 300\Omega$, $R_3 = 400\Omega$, $R_4 = 100\Omega$ and $R_5 = 200\Omega$. Show a plot of V_1, V_2 and V_3 as V_0 is varied from $-10V$ to $+10V$.

Question 4 (ALL)

How much time did you spend on this homework assignment?