Embedded Systems (CS [45]163)
Homework 3

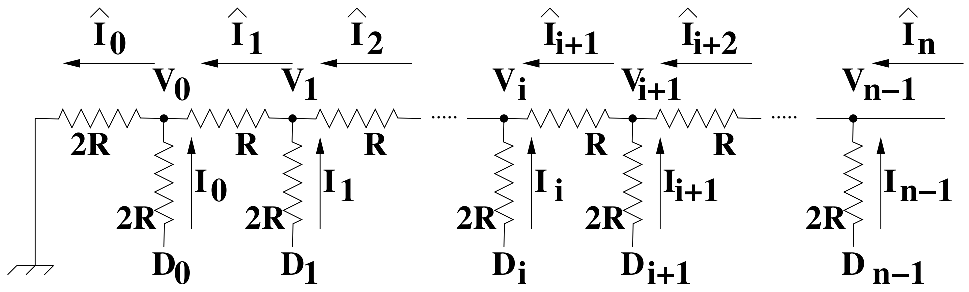
April 16, 2009

This homework assignment is due on Thursday, May 7th at 5:00pm. Your work may be handed in electronically (use the **Homework 3** digital dropbox on D2L) or in hardcopy form (in person or under 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 digital-to-analog conversion circuit. Note that there are only two types of resistors in this network. The output is V_{n-1}. Our task is to solve for the output given the binary digital inputs.



Note that $\hat{I}_n$ is given for mathematical convenience, but you should assume that it is equal to zero.

1. (10pts) List the equations that are given to us by Ohm's law. Be as generic as possible.

2. (10pts) List the equations that are given to us by Kirchhoff's current law.

3. (30pts) Solve for V_{n-1} as a function of $D_0 ... D_{n-1}$ (there will be no other parameters or variables). Undergraduates: you may assume that $n = 3$; Graduates: solve for a generic $n > 2$.

   Hint: Start by solving for V_0 as a function of D_0 and $\hat{I}_1$ (and there will be an R term as well). Then solve for V_1 as a function of D_0, D_1, and $\hat{I}_2$. Follow the recursion from there.