Embedded Systems (CS [45]163)
Homework 4

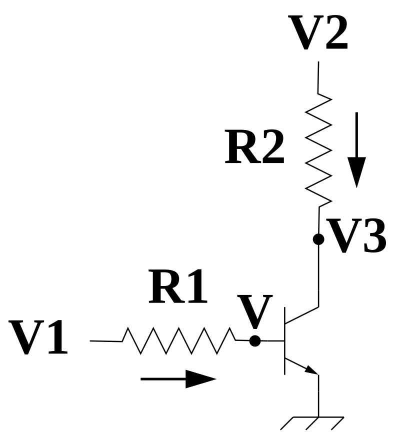
April 28, 2010

This homework assignment is due on Tuesdau, May 4th. Your work may be handed in electronically (use the **Homework 4** digital dropbox on D2L) or in hardcopy form.

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:



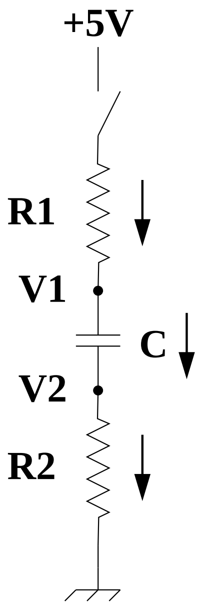
1. (5pts) What is always true no matter the state of the transistor? (i.e., what are the fundamental equations?)

2. (15pts) Assume that $V1 = 5V$, $V_f = 0.7V$, $R1 = 2K\Omega$, $g = 10000$ and $R2 = 10\Omega$. Show I_{CE}, V and $V3$ as a function of $-2 \leq V_2 \leq 20$.

3. (10pts) Assume the same resistances as above and that $V2 = 20V$. What would $V1$ have to be such that $V3 = 15V$?

Question 2

Consider the following circuit:



Assume that the switch closes at $t = 0$ and that $V1(0) = V2(0) = 0V$. Define $V = V_1 - V_2$

1. (10pts) What are the fundamental equations that determine the behavior of this circuit?

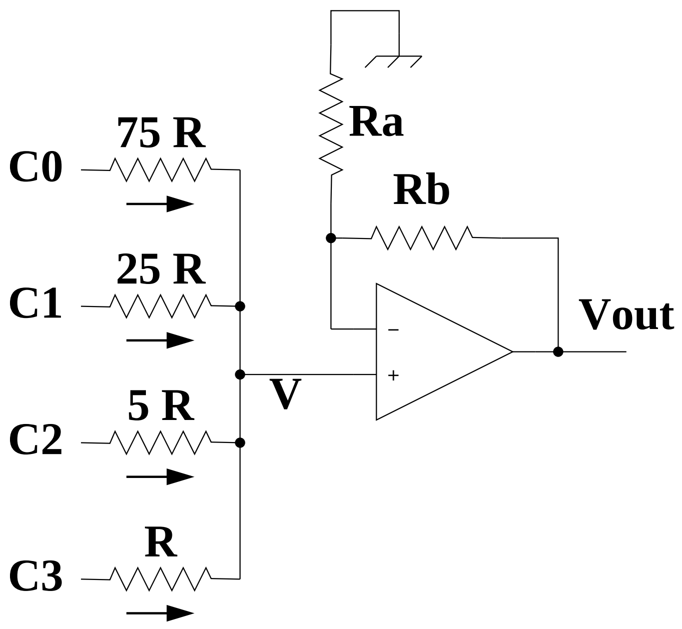
2. (10pts) Derive an equation for I_C in terms of V, R_1, and R_2.

3. (20pts) Derive an equation for $V(t)$. Hint: V_1 and V_2 should drop out of the equations.

4. (10pts) Derive equations for $V_1(t)$ and $V_2(t)$.

Question 3

Consider the following circuit:



1. (10 pts) What are the fundamental equations that determine V and other associated unknown variables (for the left-hand-side of the circuit).

2. (10 pts) Derive an equation for V.

3. (10 pts) Assume that $R_a = 100\Omega$ and $R_b = 300\Omega$. Show an equation for V_{out} in terms of V.

4. (10 pts) Show V_{out} as a function of the binary number C. (show a graph)

Question 4 (ALL)

How much time did you spend on this homework assignment?