EE 42 – Introduction to Electronics for Computer Science

Fall 2003, **Prof. A. R. Neureuther**
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UC Berkeley **Office Hours M1, Tu, Tu 10:30-11:30, F 1**
Course Web Site http://www-inst.eecs.berkeley.edu/~ee42/

Problem Set # 2

Due:1 PM Sep 10th, 2003 in box outside 275 Cory

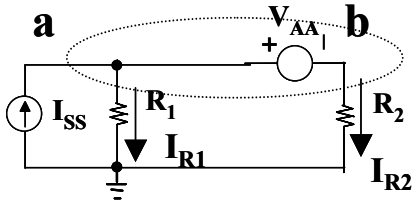
Announcements:
Professor Neureuther will be at a workshop and will not hold office hours Wed. & Thurs 9/3 & 9/4. Professor King will give the lecture on 9/4.
Reading: Schwarz and Oldham 2.1, 2.2, 5.1, 5.2

1.1 Loop and Node Equations: Use the circuit in Figure 2.31 of the text page 78.

a) Use KVL in a loop with the 5V and 5 kΩ to find the voltage at node A.
b) Use KVL around the outside loop to determine the voltage at node B.
c) Use **Ohms Law** at node B to find the current downward through the 4kΩ resistor.
d) Use KCL at node A to find the current upward through the 5V voltage supply.

1.2 KCL with bag:

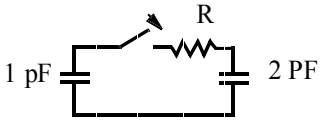
a) Place a bag around the voltage source V_{AA} and node **a** and **b**. Apply KCL to the bag to find I_{R2}.
b) Use KVL around the right window to find the voltage of node **a**.
c) From the voltage of node **a** determine R_1.
d) Show that adding the equations for KVL around the left window and KVL around the right window is the same as the equation for KVL around the outside loop. (Let the voltage on I_{SS} be V_{SS} with plus at the top.)



I_{SS} = 2 mA I_{R1} = 1 mA
R_2 = 2kΩ V_{AA} = 1 V

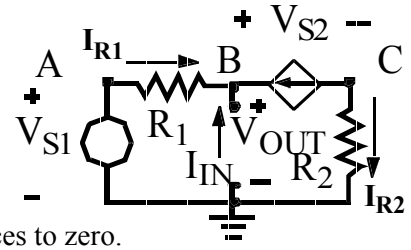
1.3 Capacitors, Current and Energy: A 1 pF capacitor is charged by a 1 mA constant current.

a) How long does it take to go from 0 to 2V, and from 2 to 4 V?
b) How much energy is added in going from 2 to 4 V compared to going from 0 to 2 V?
c) The 1 pF capacitor after being charged to 4V is connected through a resistor to an uncharged 2 pF capacitor. Find the voltage on the two capacitors in parallel (at the same voltage) assuming that their combined total charge is equal to the charge on the 1 pF capacitor before they were connected.
d) Find the total energy on the two capacitors after they are connected in parallel.
e) How much energy is lost in connecting them in parallel? (Where did it go?)



1.4 Current versus Voltage:

a) Find V_{OC}.
b) Find I_{SC}.
c) Find I_{OUT} when V_{OUT} = 1V
d) Sketch I_{OUT} vs V_{OUT}
e) Find the Thevenin equivalent circuit
f) Find the Norton equivalent circuit
g) Show that R_{TH} can be found by turning the sources to zero.



V_{S1} = 5V
I_{S2} = 1 mA
R1 = 1kΩ
R2 = 2 kΩ