EE 42 Introduction to Digital Electronics

Fall 2003 **Prof. A. R. Neureuther**
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UC Berkeley **Office Hours M 1, Tu/Th 10:30-11:30, F 11**
Course Website **www-inst.eecs.Berkeley.edu/~ee42/**

Midterm #1
2 October 2003

Closed Book, Closed Notes
Write on the Exam paper

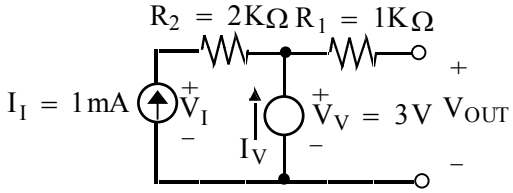
Print Your Name:_____

Sign Your Name:_____

Show your work so that the method as well as the answer can be graded for correctness and completeness. Correct answers alone are only worth 70% of full credit.

Problem	Possible	Score
I	25	
II	25	
III	25	
IV	25	
Total	100	

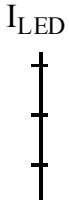
I. (25 points) Basic Circuit Analysis



a) (13 pts.) Find V_{OUT} and voltage on the current source V_I when the output is open circuited.

b) (12 pts.) Find the current on the voltage source I_V when the output is shorted.

II. (25 points) Load Lines



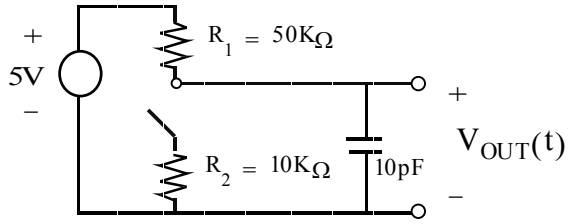
LED Device
Desired operating point
$V_{\text{LED}} = 1.5$
$I_{\text{LED}} = 5\text{mA}$

a) (15 pts.) Choose a Thévenin voltage in the range from 1 to 4 volts and a Thévenin resistance in the range 400 to 4k ohms to operate the LED device at the desired operating point given above. Values found from a graphical solution are adequate.

b) (12 pts.) For your choice in a), above, what fraction of the power delivered by the Thévenin voltage source is consumed by the load?

III. (25 points) Transient

This circuit charges when the switch is open and discharges when the switch is closed.

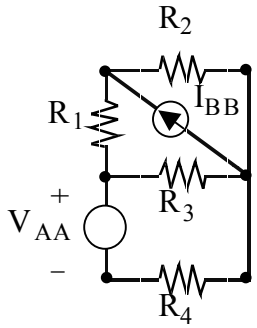


a) (6 pts.) Determine the maximum and minimum voltage on the capacitor.

b) (13 pts.) Find $V_{\mathrm{OUT}}(t)$ in discharging the capacitor.

c) (6 pts.) Find the initial current out of the capacitor when discharging the capacitor.

IV. (25 points) Node Equations



a) (5 pts.) Six nodes are shown. Determine the nodes that have potentially different voltages and assign only these nodes a label $a, b, c \ldots$ and voltage $V_a, V_b, V_c \ldots$.

b) (5 pts.) Choose one of the remaining nodes as a reference an set its voltage to zero. Which of your remaining nodes have nonzero voltages that cannot be found directly from the voltages of the other nodes? In other words, how many unknown node voltages are there and node equations are you going to need?

c) (15 pts.) Using the node equation method and your node labeling in a), above, write a sufficient set of equations to solve for the unknown node voltages. [Only V_{AA}, I_{BB}, the resistors and your node voltages from b) should appear.]