EE 40

Midterm Exam #1

February 20, 2003

PLEASE WRITE YOUR NAME ON EACH ATTACHED PAGE
SHOW WORK TO OBTAIN MAXIMUM PARTIAL CREDIT

Problem 1:	15 Points Possible	_______
Problem 2:	5 Points Possible	_______
Problem 3:	15 Points Possible	_______
Problem 4:	15 Points Possible	_______
Problem 5:	15 Points Possible	_______
Problem 6:	10 Points Possible	_______
Problem 7:	15 Points Possible	_______
Problem 8:	10 Points Possible	_______
Total:	100 Points Possible	______

Problem 1: 15 Points Possible

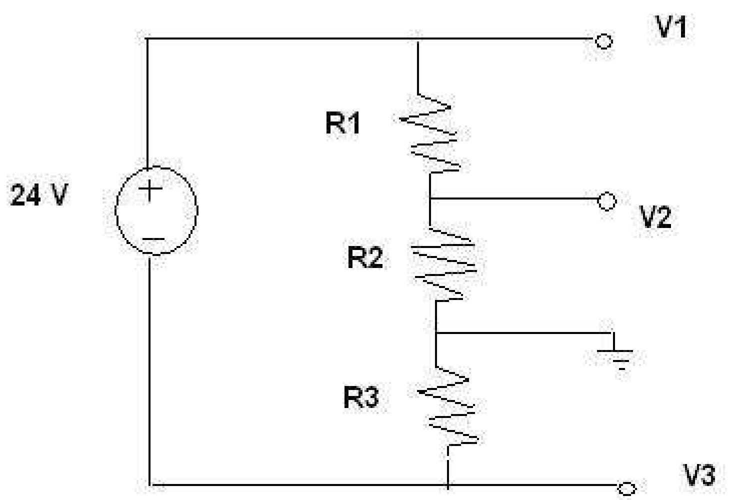
The memory components of many personal computers require voltages of -12V, 5V, and 12V all with respect to a common reference terminal (ground).

Find R_1, R_2, and R_3 in the circuit below so that (when nothign additional is attached to the circuit)

1) The power generated by the voltage source is 48 mW

AND

2) V_1 = 12 V, V_2 = 5 V, and V_3 = -12 V with respect to ground.



Problem 2: 5 Points Possible

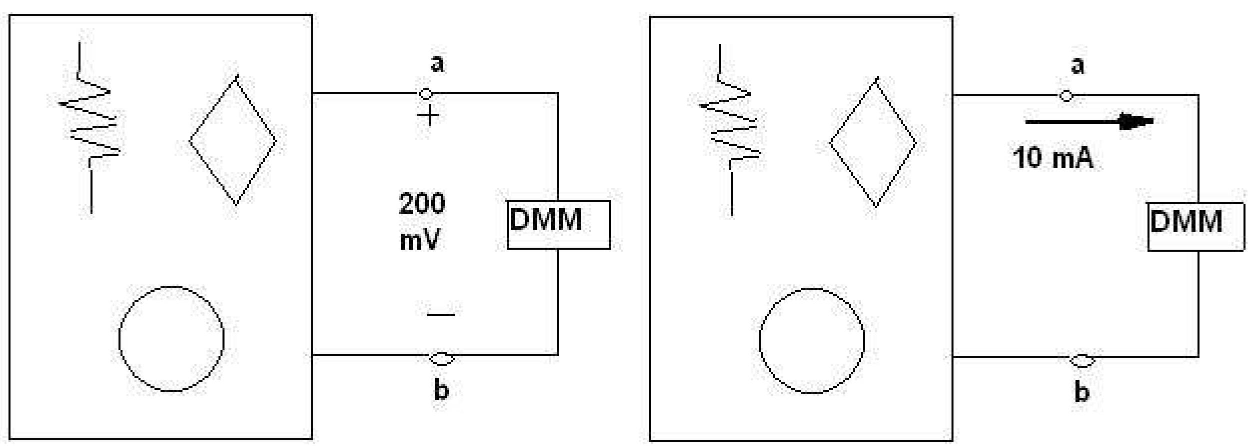
Someon has provided me with a two-terminal "mystery circuit", telling me only that the components inside will create a linear I-V relationship.

To identify the Thevenin equivalent fot the circuit inside, I use a voltmeter to measure the voltage from terminal a to terminal b when nothing else is connected.

The reading is 200 mV.

Then I measure the current flowing from terminal a to terminal b, through an ammeter connected from a to b.

The reading is 10 mA.



Assuming the voltmeter and ammeter are ideal, what is the Thevenin equivalent?

Problem 3: 15 Points Possible

Refer to Problem 2. Suppose I find out that the voltmeter has an internal resistance of 20 M ohm and the ammeter has an internal resistance of 2 ohm.

So, the answer from Problem 2 is not the true Thevenin equivalent.

I want to know how the actual Thevenin parameters, which we will call $V_{T(actual)}$ and $R_{T(actual)}$, compare to the guesses from Problem 2, which we will call $V_{T(measured)}$ and $R_{T(measured)}$.

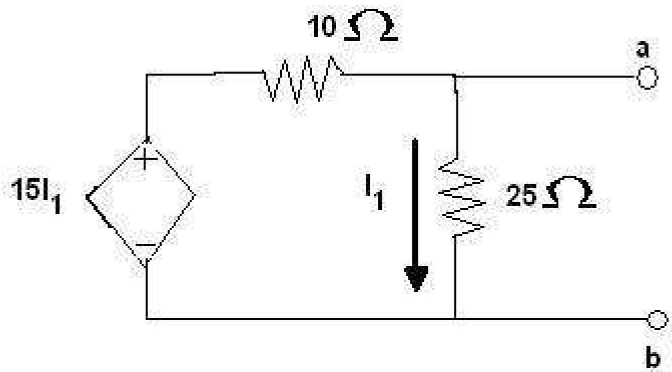
a) Which internal resistance (the voltmeter resistance or the ammeter resistance) accounts for most of the difference between the actual and measured parameters?

b) Should V_{T} (actual) be higher, lower, or about the same as $V_{T(measured)}$?
Should $R_{T(actual)}$ be higher, lower, or about the same as $R_{T(measured)}$?

c) Neglect the effect of the meter which does not make much of a difference, and find V_{T} (actual) and $R_{T(actual)}$.

Problem 4: 15 Points Possible

Find the Thevenin equivalent circuit as measured at terminals a and b, for the circuit below.

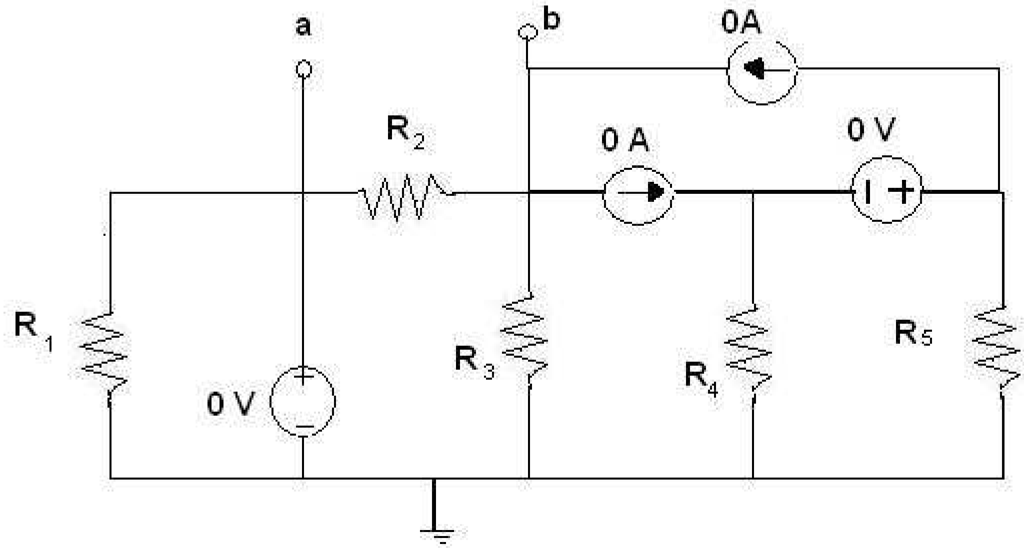


Problem 6: 10 Points Possible

While you were finishing up that nodal analysis from Problem 5, clumsy old Prof. Ross walked across the room and tripped on a power cord, pulling it out of the wall outlet.

As a result, the independent source voltages and currents from Problem 5 are now 0 V and 0 A.

Now find the equivalent resistance of the remaining circuit with respect to points a and b.



Problem 7: 15 Points Possible

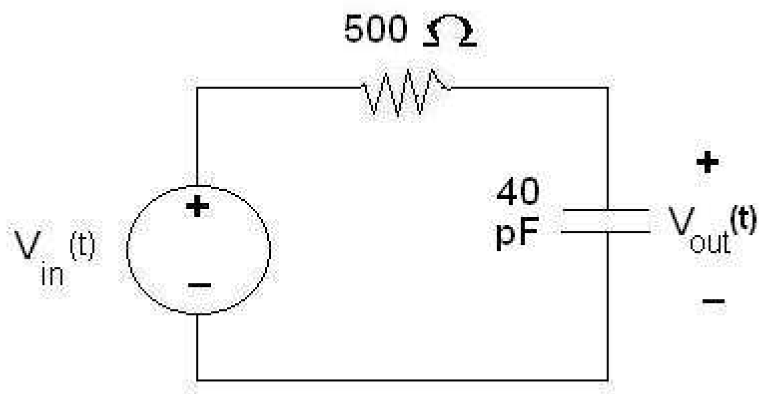
Consider the RC circuit below, which models a digital logic gate.

Wehn changing Vin from logic 1 (5 V) to logic 0 (0 v) and back to perform different computations, we want to make sure that there is enough time between input changes to allow the output, Vout, to fully respond.

Specifically, we would like to ensure that Vout reaches the minimum value recognizable as logic 1 after the input steps from low to high (0 V to 5 V). This value, V_{IH}, is 3.5 V.

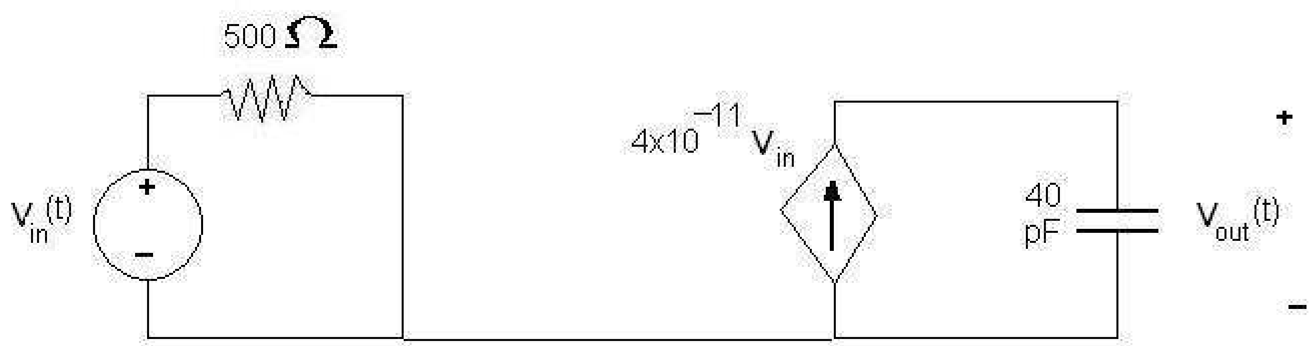
Also, we would like to ensure that Vout discharges to the maximum value recognizable as logic 0 after the input steps from high to low (5 V to 0V). This value, V_{IL} is 11.5 V.

Determine the amount of time it takes for the discharged capacitor to charge to 3.5 V, and the amount of time it takes for the fully charged (5 V) capacitor to discharge to 1.5 V.



Problem 8: 10 Points Possible

Consider the circuit below, where the capacitor is discharged for t <= 0.



a) Find $V_{out}(t) = 2$ V (constant), for t>=0.

b) In one word, what operation does this circuit perform on Vin?