Massachusetts Institute of Technology
Department of Electrical Engineering and Computer Science

6.002 – Circuits and Electronics
Spring 2003

Handout S03-025 - Quiz # 1

Wednesday March 5, 2003

Name: _____

Recitation Instructor (circle one):

Baldo Hutchinson Kolodziejski Schindall Wilson

Recitation Hour (circle one):

9 10 11 12 1 2

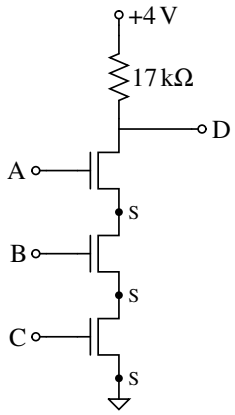
ALL PROBLEMS CARRY THE SAME WEIGHT

Problem	Points	Score	Grader
1	25		
2	25		
3	25		
4	25		
Total	100		

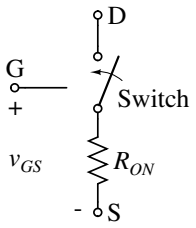
Name:_____

PROBLEM 1

Assume the convention that a high voltage level denotes a Boolean 1, and a low voltage level denotes a Boolean 0.



MOSFET MODEL



For $v_{GS} < V_T$ Switch is open

For $v_{GS} > V_T$ Switch is closed

$V_T = 1.0\,\text{V}$

$R_{ON} = 1\,\text{k}\Omega$

(A) What is the logical function of this circuit? Express your answer as a boolean function or as a truth table.

Name:_____

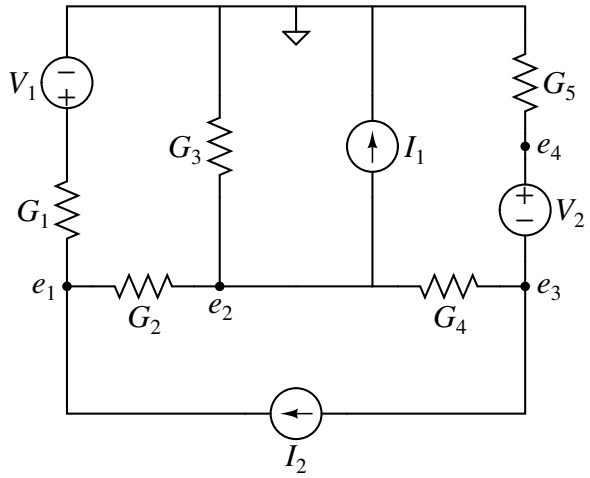
(B) What minimum value of 1-state voltage at the inputs will ensure proper operation of the circuit?

(C) What is the value of the 0-state output voltage?

Name:_____

PROBLEM 2

Use the node-to-reference voltages indicated on the circuit below to write a set of independent node equations (KCL statements) sufficient to solve for the unknown voltages. **Do not solve them**.



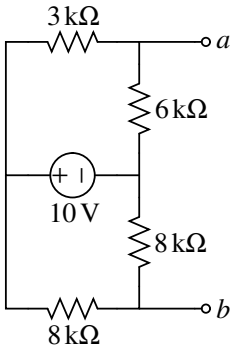
Please put your equations in a form in which all conductances are collected in factors. That is:

$$[\text{ conductances }] \cdot e_1 \pm [\text{ conductances }] \cdot e_2 \pm \cdots \quad \text{ETC.}$$

Name:_____

PROBLEM 3

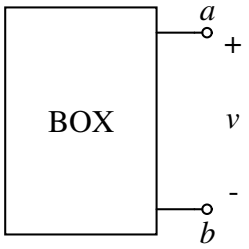
Devise Thevenin *And* Norton equivalent circuits at terminals a, b for the circuit below. **Be sure to specify units and polarities.**



Name:_____

PROBLEM 4

The box in the circuit below contains linear elements (resistances) and independent sources.



With a 100Ω resistor connected at the terminals, the voltage is $v = 6$ Volts.

<u>One</u> other measurement suffices to determine the Thevenin equivalent circuit of the box.

(A) Decide what circuit element, if any, you would connect, and describe the <u>one</u> measurement you would make.

(B) Assume a numerical value for that measurement and draw the corresponding Thevenin equivalent circuit with element values attached. **Specify units and polarities.**