University of California, Berkeley
College of Engineering
Department of Electrical Engineering and Computer Sciences
**EECS 40**
Midterm Examination #1
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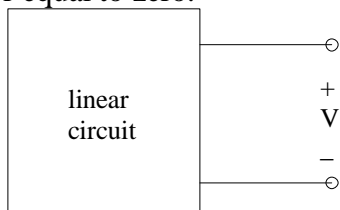**Problem 1, Part I (9 Points)**
Assume Resistors cannot have negative values. Reminder: Linear DC circuits can include both independent and dependent sources.

Answer True (T) or False (F):
___ (a) When an amplifier block, whose 3 parameters are Ri, Ro, and A, is used as part of a larger circuit, the input resistance of the larger circuit, Ri' will be affected by a load resistance R_L connected between the output terminals of the larger circuit only if one or both of the amplifier block's output terminals is fed back to one or both of the amplifier block's input terminals.
___ (b) All linear circuits must have both Thevenin and Norton equivalents.
___ (c) Two circuits with identical I-V characteristics must be identical.
___ (d) In any given circuit, the power which is dissipated by an ideal resistor always increases with its resistance.
___ (e) A two-terminal linear dc circuit cannot have the I-V characteristic below
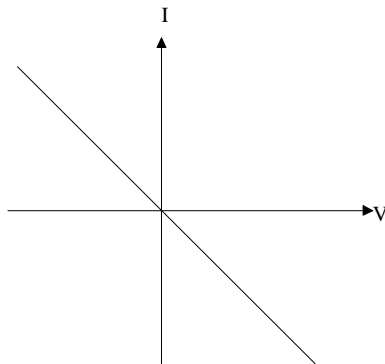
___ (f) The parallel combination of any number of resistors is equivalent to a single resistor with value smaller than the rest of the resistors.
___(g) Kirchoff's laws are valid for non-linear circuits as well as linear circuits.
___ (h) No power is dissipated in an ideal voltmeter.

___ (i) For a dc linear circuit, the I-V characteristic will always have a slope $\frac{\Delta I}{\Delta V}$ greater than or equal to zero.
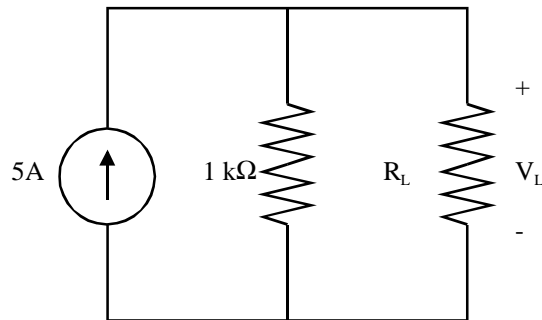
Problem 1, Part II (9 points)

Multiple choice:

Answer (a) if it cannot be determined how the indicated parameter varies with R_L.
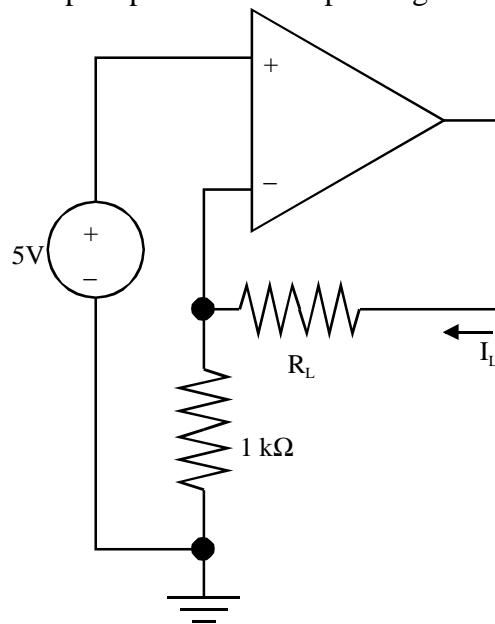
  (b) if the indicated parameter does not depend on R_L.

  (c) if the indicated parameter decreases with increasing R_L.

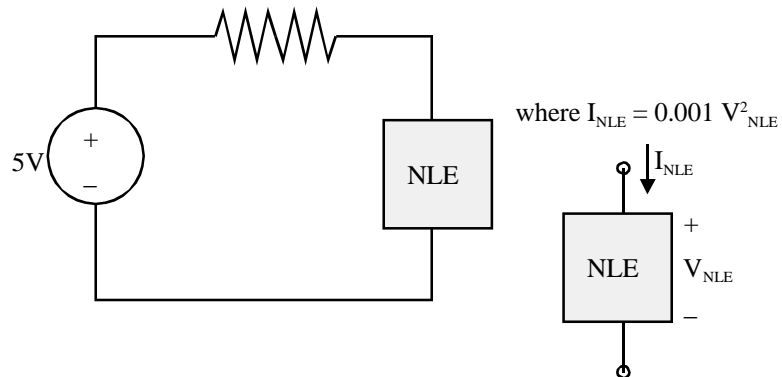 (d) if the indicated parameter increases with increasing R_L.

____ (V_L)

____ (I_L) (assume that the op-amp is ideal and operating linearly)

____ (I_L)

where $I_{NLE} = 0.001 \; V^2_{NLE}$

Problem 2 (20 points)

In the circuit below, the independent source values and resistances are known.

    (a) The nodal analysis to write the five equations sufficient to solve V_A, V_B, V_C, V_D, and V_E.

    (b) Use nodal analysis to write the five equations sufficient to solve for I_A, I_B, I_C, I_D, and I_E.

Note: I_x should not appear in these equations.

DO NOT SOLVE THESE EQUATIONS!

To receive credit, you must put your answers in the space provided on Page 4.
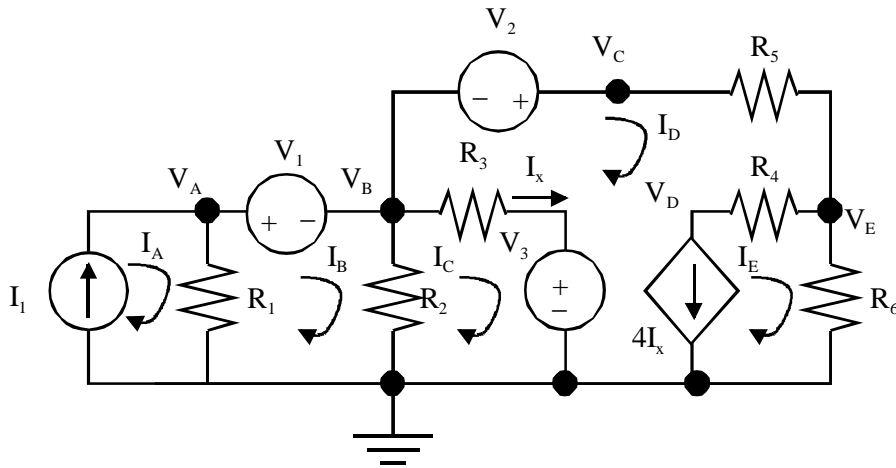
(a)   EQ1_____

        EQ2_____

        EQ3_____

        EQ4_____

        EQ5_____

(b)   EQ1_____

        EQ2_____

        EQ3_____

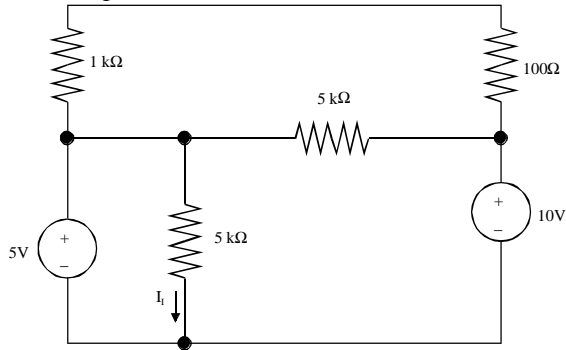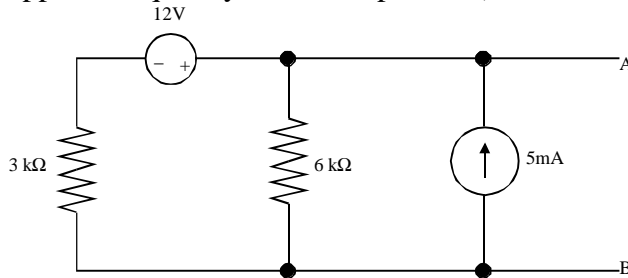   EQ4_____

        EQ5_____

Problem 3 (20 points)
(Note: Do not attempt to solve these problems by nodal analysis; they can be solved almost by inspection.)
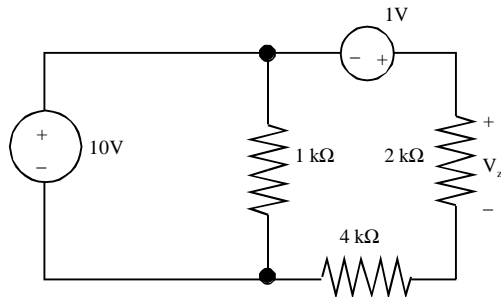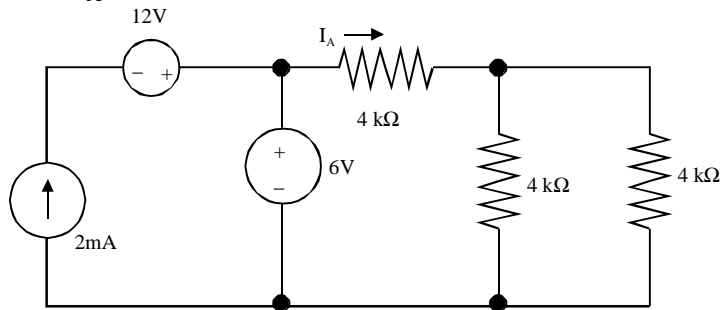
(a) Find V_Y.

(b) Find the Norton equivalent of this circuit (Hint: Source transformation can be applied to quickly solve this problem)
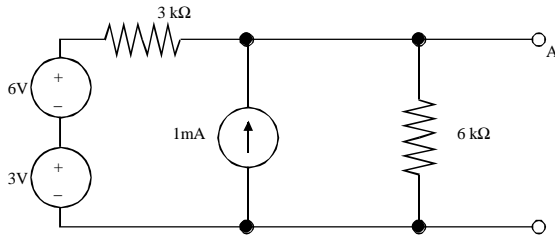

(c) Find V_Z.

(d) Find I_A.

Problem 4 (20 points)

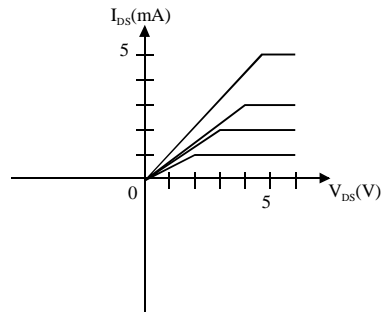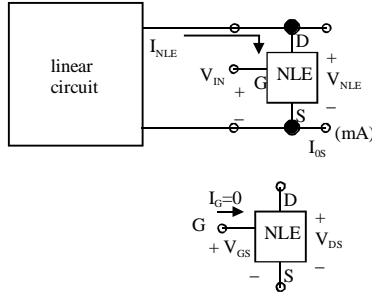(a) Draw the Thevenin equivalent of the circuit, for $V_S = 0v$.

V_T___

R_T___

(b) Suppose now that the circuit in (a) with $V_S = 0V$ is used to supply power to a three-terminal non-linear element:

Find V_{NLE} and the power dissipated in the NLE for $V_{IN} = 0V$ and 4V.

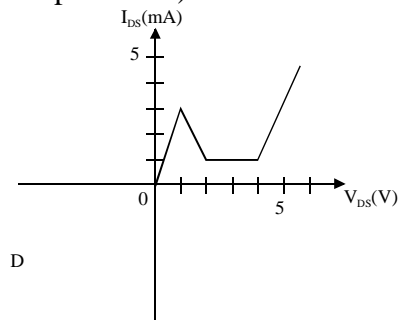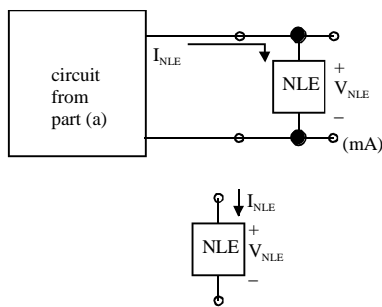$V_{IN} = 0V$: V_{NLE}___

P_{NLE}___

$V_{IN} = 4V$: V_{NLE}___

P_{NLE}___

(c) Suppose now that the circuit in (a) is connected to a two-terminal non-linear element:

How many operating points exist for this circuit, for $V_S = 0V$?

For what values of V_S will there exist only a single operating point for this circuit?
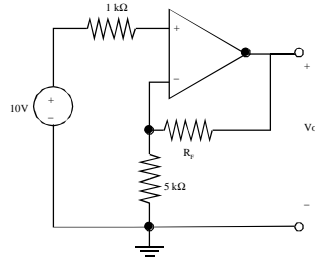
(Hint: The superposition method might be helpful here.)

Number of Operating Points = _____
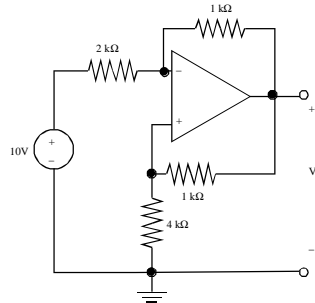
V_S must be _____ to ensure a single operating point

Problem 5 (20 points)

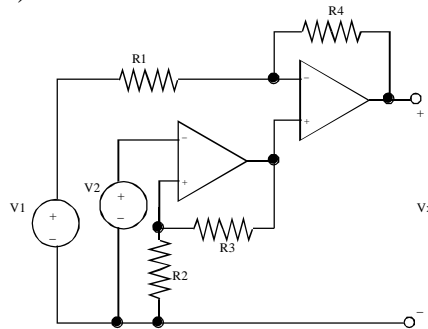Assume the op-amps below are ideal, and that their saturation voltages are $V_D = \pm 16V$

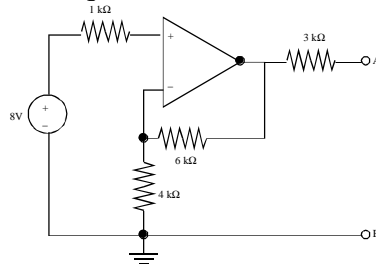(a) For what values of R_F will the op-amp be saturated?

R_F _____

(b) Find V_0.

$V_0 =$ _____

(c) Find V_X in terms of V_1, V_2, R_1, R_2, R_3, R_4. (Hint: The superposition method might be helpful here.)

$V_X =$ _____

(d) Find the Thevenin Equivalent of this circuit.

V_T _____

R_T _____