Duke University
Edmund T. Pratt, Jr. School of Engineering

EE 61L Section 2, Fall 2001

Test II

Michael R. Gustafson II

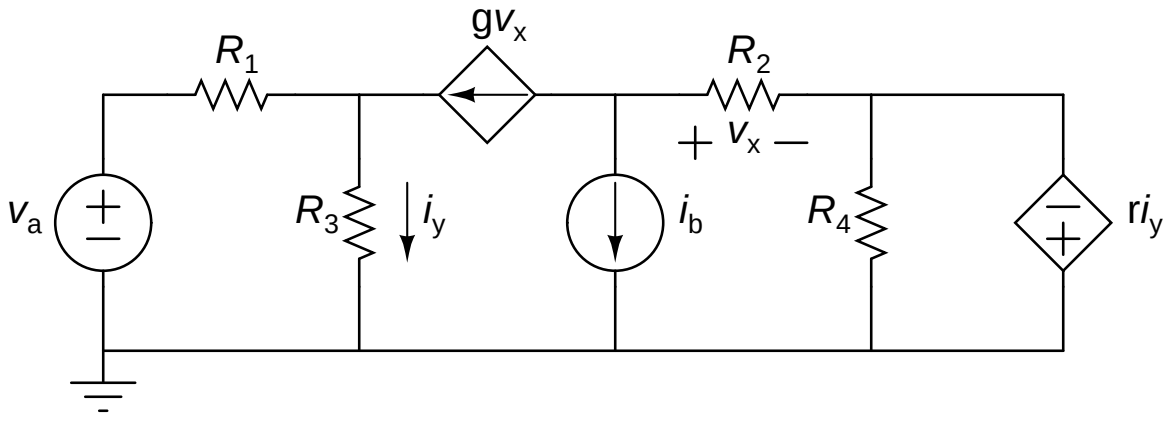
Name (please print)_____

In keeping with the Honor Code, I have neither provided nor received any assistance on this test. I understand if it is later determined that I gave or received assistance, I will fail the class and will be brought before the Undergraduate Judicial Board.

Signature:_____

Problem I: [25 pts.] Superposition

Given the following circuit:

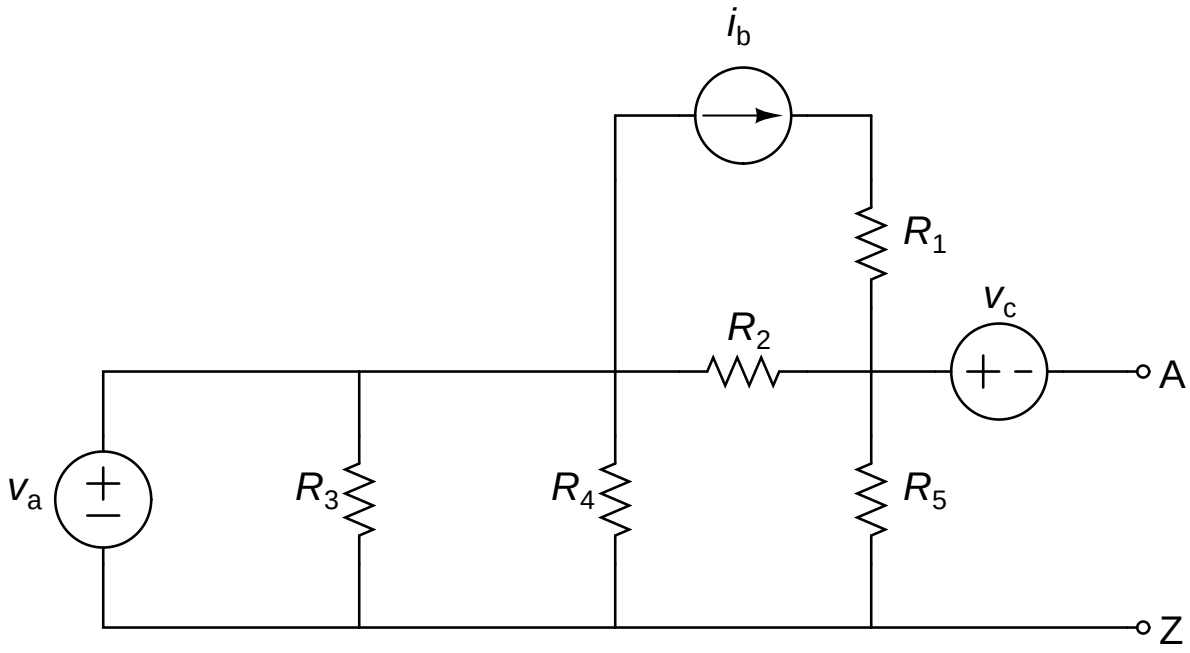


and known values r, g, R_1, R_2, R_3, R_4, v_a, and i_b, find p_{abs,R_4} using superposition. You *must* redraw the circuit each time to get full credit for this problem.

Name (please print):
Honor Code (please initial):

Problem II: [20 pts.] Thévenin-Norton

Given the following circuit:



and known values R_1, R_2, R_3, R_4, R_5, v_a, i_b, and v_c, determine *and draw* both the Thévenin and Norton equivalent circuits as seen at terminals A-Z.

Name (please print):
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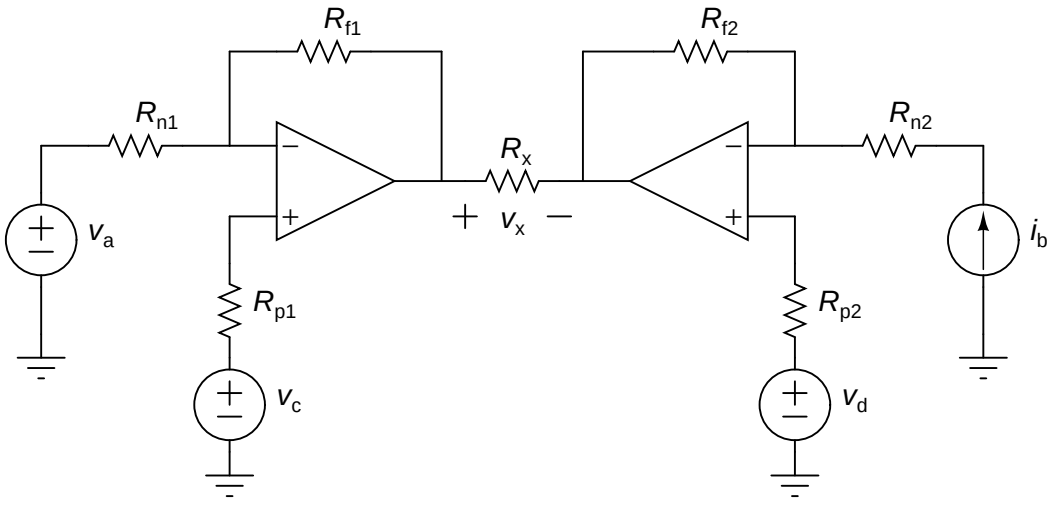
Problem III: [25 pts.] Operational Amplifiers

Given the following circuit:



and known values R_{n1}, R_{f1}, R_{p1}, R_{n2}, R_{f2}, R_{p2}, R_x, v_a, i_b, v_c, and v_d, find v_x in terms of the known values. You may assume both operational amplifiers are ideal.

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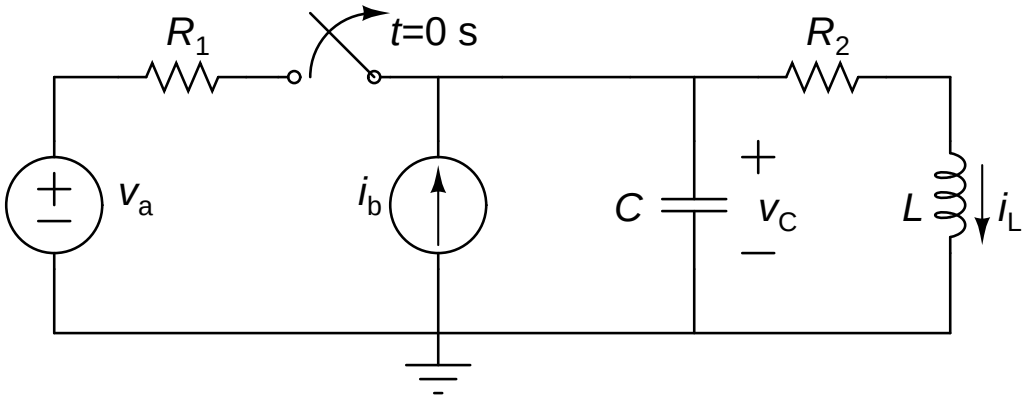
Problem IV: [30 pts.] Inductors and Capacitors

Given the following circuit:



and known values R_1, R_2, L, C, v_a, and i_b,

(1) Assume that the two independent sources are constant and that this circuit has been in place for a very long time before $t = 0$ s. Determine the capacitor voltage v_C and inductor current i_L for time $t = 0^-$ s.

(2) Determine the capacitor current i_C and inductor voltage v_L for time $t = 0^+$ s. You may assume that the values of the state variables $v_C(0^+)$ and $i_L(0^+)$ are known, but *not* that the *derivatives* of the state variables are known.

(3) Assume that the two independent sources are constant and that this circuit has been in place for a very long time after $t = 0$ s. Determine the capacitor voltage v_C and inductor current i_L for time $t \to \infty$ s.

(4) Find a differential equation for i_L in terms of the known values for $t > 0$ s. If done correctly, you will end up with a *second* order differential equation. *Hint:* use v_C and i_L as your only unknowns to develop two equations for the circuit, then substitute one into the other to get a single equation with i_L and its derivatives.