Score summary (leave blank):	
Extra:	_____
P1:	_____
P2:	_____
P3:	_____
P4:	_____
Total:	_____

Name: _____

SID: _____

Name of student at your left:

_____

Name of student at your right:

_____

UNIVERSITY OF CALIFORNIA
College of Engineering
Department of Electrical Engineering
and Computer Sciences

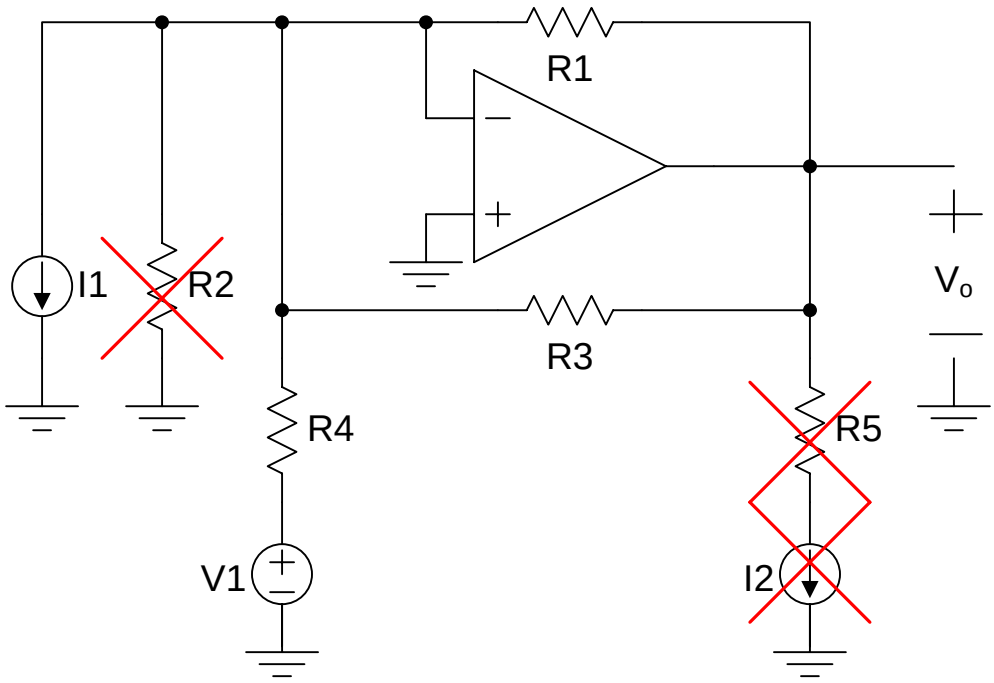
B. E. BOSER | **Midterm 1** **Solution** | **EECS 42/100** **FALL 2006**

- *Closed book, closed notes.*
- *No calculators.*
- *Copy your answers into marked boxes on exam sheets.*
- *Simplify numerical and algebraic results as much as possible.*
  Up to 10 points penalty for results that are not reasonably simplified.
- *Mark your name and SID at the top of the exam and all extra sheets.*
- *Be kind to the graders and write legibly. No credit for illegible results.*
- *No credit for multiple differing answers for same problem.*

Grading:

- **Max partial credit for any problem: 23pts (25pts only for correct results)**
- **Sign error: -3pts**
- **Result in terms of G's (rather than R's): -3pts**

Problem 1 [25 points]



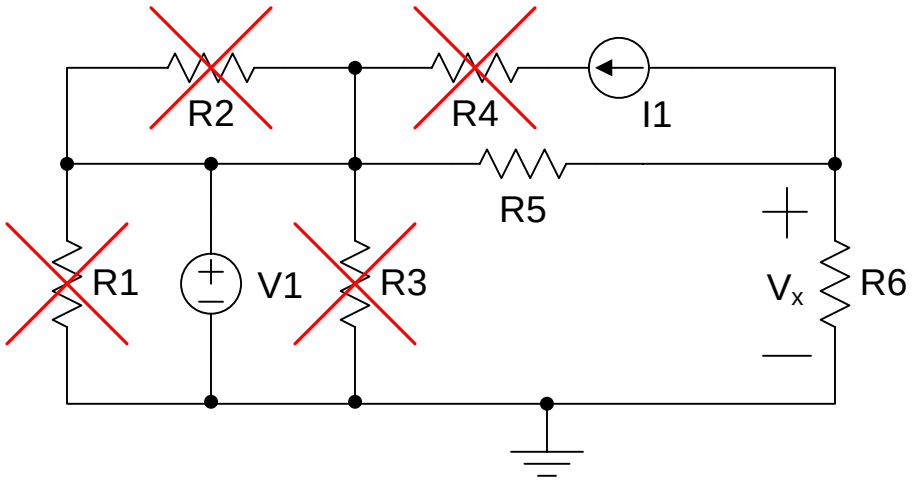
Find an algebraic expression for V_o. Assume that the operational amplifier is ideal.

$$V_o = \left(I_1 - \frac{V_1}{R_4}\right)\left(R_1 \| R_3\right) = \left(I_1 - \frac{V_1}{R_4}\right)\frac{R_1 R_3}{R_1 + R_3}$$

Partial credit:

- **I1 term: 12 pts max**
- **V1 term: 13 pts max**
- **Sign error -3pts**
- **If result wrong but recognized that I2, R2, R5 are irrelevant: 4pts each**
- **Recognized R1//R3: 8pts**

Problem 2 [25 points]



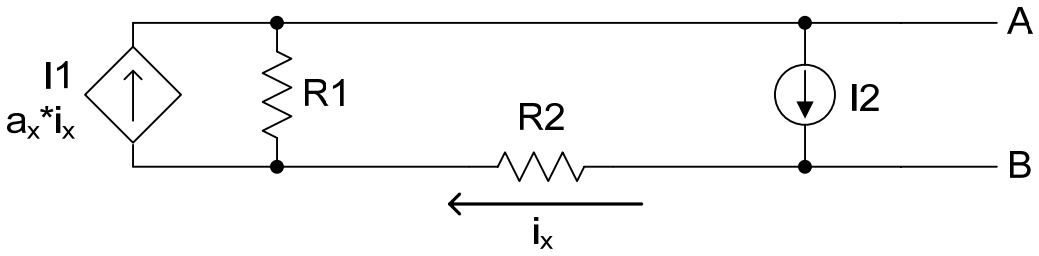
Find an algebraic expression for V_x.

$$V_x = (V_1 - I_1 R_5)\frac{R_6}{R_5 + R_6}$$

Partial credit:

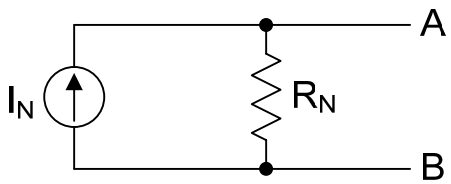
- **V1 term: 12 pts max**
- **I1 term: 13 pts max**
- **Sign error -3pts (each sign)**
- **If result wrong but recognized that independent of**
  - **R2: 4pts**
  - **R1: 5pts**
  - **R3: 5pts**
  - **R4: 7pts**
- **If result wrong but attempted to solve with superposition: 6pts**

Problem 3 [25 points]



Draw a Norton equivalent for terminals (A,B) in the circuit shown above and specify algebraic expressions for the element values.

Norton equivalent circuit (mark terminals A, B):



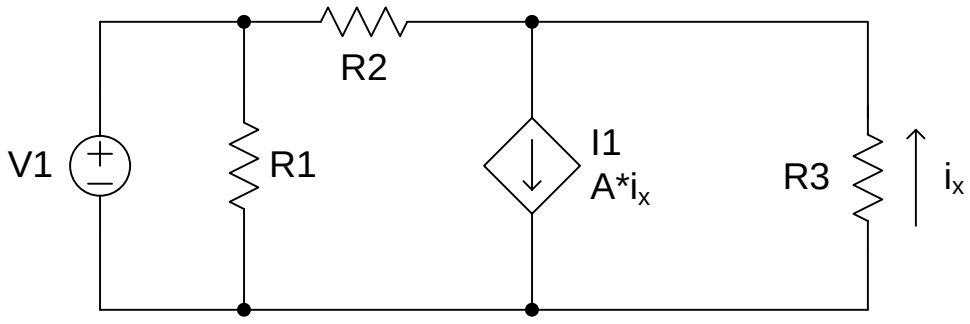
$I_N =$ *-I_2 (plus arbitrary current though I1)*

$R_N = R_1(1-a_x)+R_2$

Partial credit:

- **Equivalent circuit: 10pts**
- **I_N: 5pts**
- **R_N: 10pts (Voc only: 8pts)**
- **Sign errors: -3pts**

Problem 4 [25 points]



Find an algebraic expression for the power delivered to the circuit by the controlled current source *I1*.

$$i_x = \frac{-V_1}{R_2(1-A)+R_3}$$

$$V_x = -i_x R_3$$

$$P = -V_x A i_x = A R_3 i_x^2$$

$$P = AR_3\left(\frac{V_1}{R_2(1-A)+R_3}\right)^2$$

Partial credit:

- **Power –Vx*A*ix is 10 pts**
- **Ix = f(V1,R2,R3,A) is 18pts**
- **Vx is 10 pts (5 pts for –ix*R3)**
- **Correct units (result ~V1^2: 8pts)**
- **Sign errors: -3pts**