

**Midterm 1
EE40
Spring 2015**

NAME: _____

Instructions

Read all of the instructions and all of the questions before beginning the exam.

There are 4 problems in this exam. The total score is 100 points. Points are given next to each problem to help you allocate time. Do not spend all your time on one problem.

IMPORTANT

- **If you do not put your answers within the boxes labeled 'Solution' THEY WILL NOT BE COUNTED (no matter how correct they may be in the bottom left back corner of the third to last page of the exam.)**

- **If you have more than one solution in the box, that box will be given zero points.**

Unless otherwise noted on a particular problem, you must show your work in the space provided, on the back of the exam pages or in the extra pages provided at the back of the exam.

Be sure to provide units where necessary.

GOOD LUCK!

PROBLEM	POINTS	MAX
1		35
2		20
3		20
4		25

“The majority is always sane.”
- Ringworld, Larry Niven

Problem 1 *Warm-up*

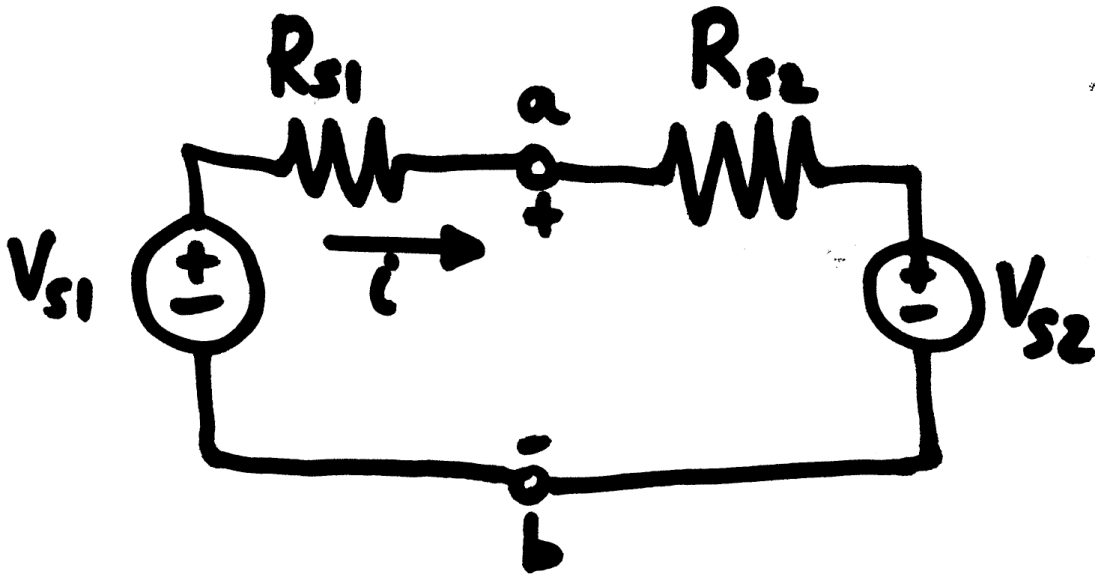
a) Consider the circuit below. (5 points)



What is the Thevenin equivalent circuit of the circuit above seen across terminal a,b?

Solution:

b) Consider the circuit below. $R_{S1} = 2 \text{ k}\Omega$, $R_{S2} = 1 \text{ k}\Omega$, $V_{S1} = 1 \text{ V}$, $V_{S2} = 4 \text{ V}$



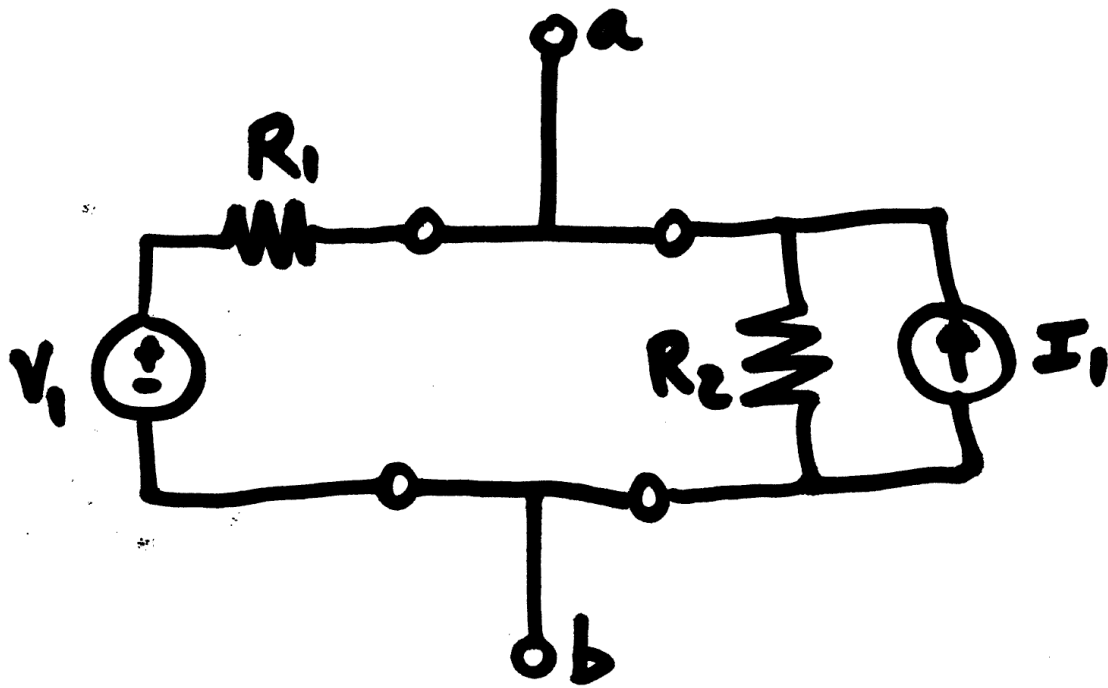
What is the value of the current, i , above? (5 points)

Solution:

What is V_{ab} ? (5 points)

Solution:

c) Consider the circuit below.



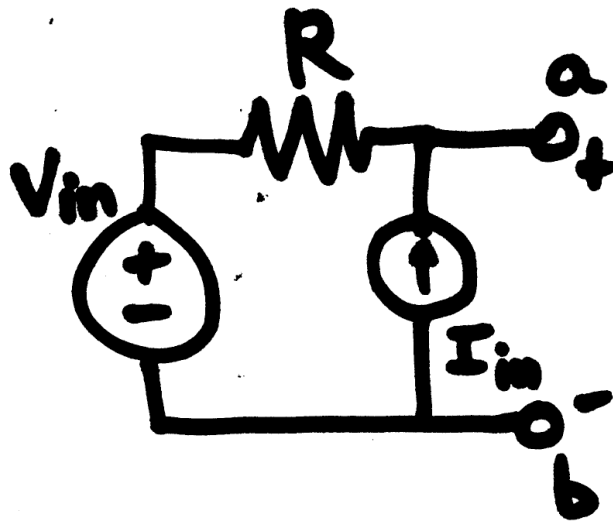
Provide an expression for the Thevenin equivalent voltage seen from terminals a and b. (5 points)

Solution:

Provide an expression for the Thevenin equivalent resistance seen from terminals a and b. (5 points)

Solution:

d) Consider the following circuit. $V_{in} = 1\text{ V}$, $R = 1\ \Omega$ and $I_{in} = 1\text{ A}$



Is the current source **consuming** or **supplying** power? (5 points)

Solution:

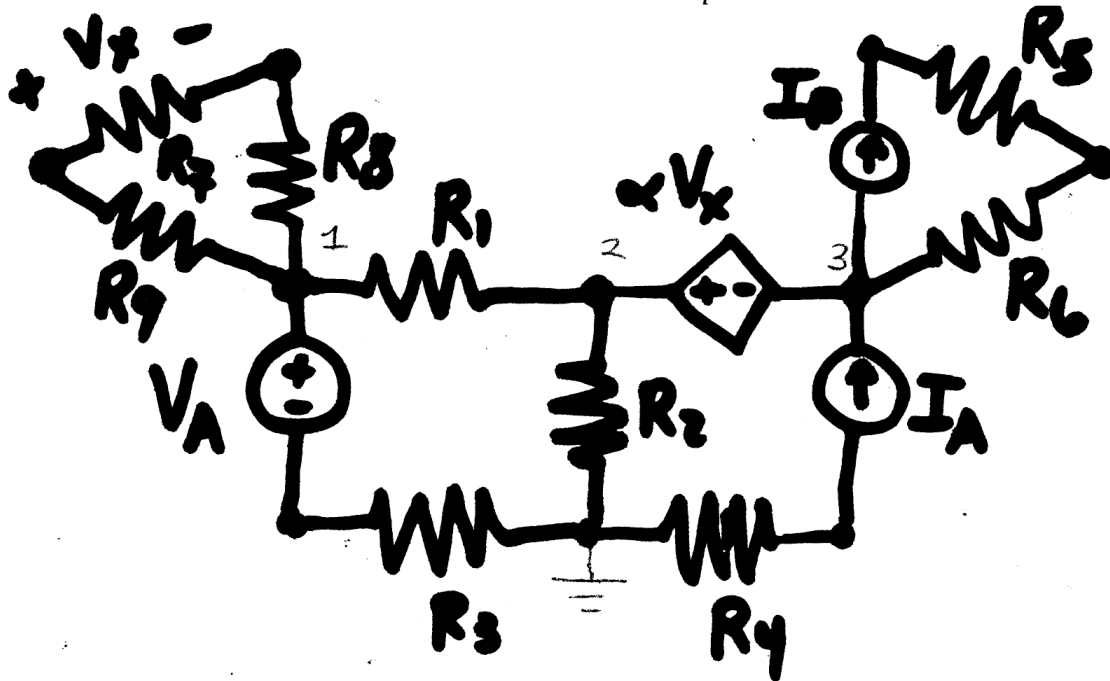
Provide a mathematical expression that demonstrates your answer above is true (5 points)

Solution:

There is a house. One enters it blind and comes out seeing. What is it?
 - 3800 year old Sumerian riddle

Problem 2 (20 points)

USING NODAL analysis, provide a **complete** set of equations which I can use to solve the circuit below. Use the node numbers and labels provided.



In the box below, provide your answer with equations in this form or lose points
 (v_1 refers to the voltage at node 1, etc):

$$(\quad)v_1 + (\quad)v_2 + \dots + (\quad)v_n = (\quad)$$

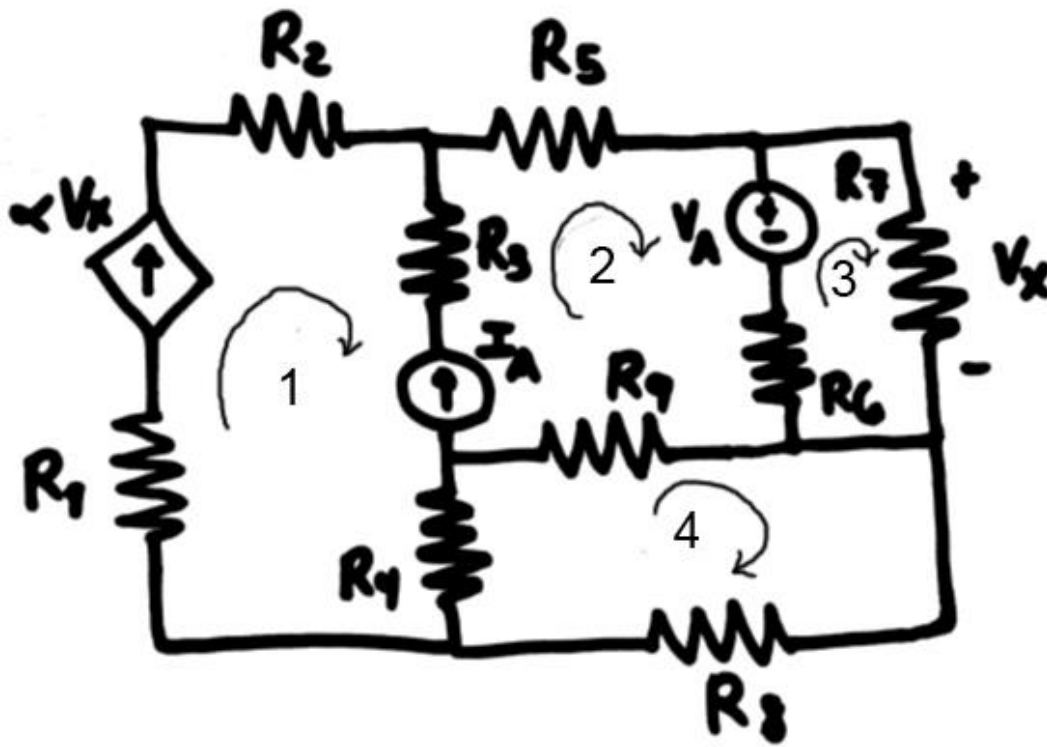
Solution:

Extra Space

I am Groot.
 - Groot, *Guardians of the Galaxy*

Problem 3 (20 points)

Using Mesh analysis, provide a **complete** set of equations which I can use to solve the circuit below. Use the labels provided.



In the box below, provide your answer with equations in this form or lose points (i_1 refers to mesh current 1, etc):

$$(_)i_1 + \dots + (_)i_n = (_)$$

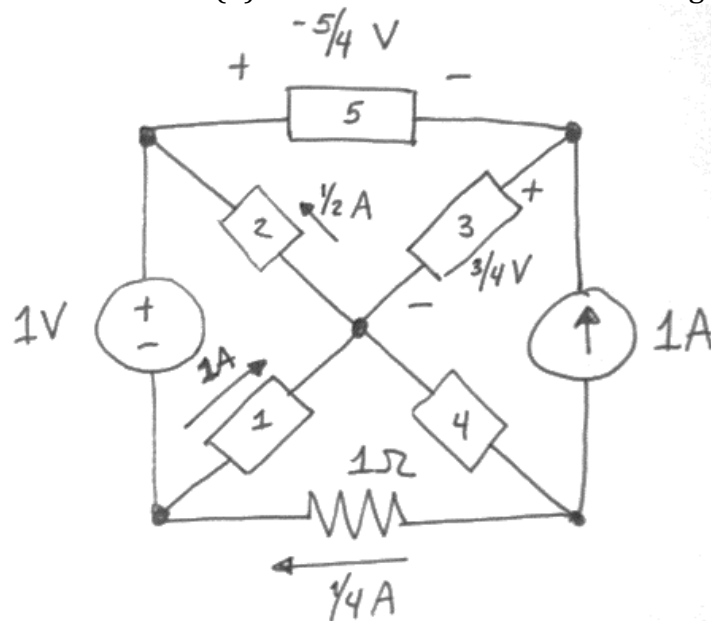
Solution:

Extra Space

Dobson: Anybody makes so much as a [Ma], entering the ship, shoots him in the head.]
- Firefly

Problem 4 (25 points)

Consider the circuit below. There are five (5) unknown elements. Some voltages and currents are labeled.



In the table below, please fill in:

- a) the complete symbol with appropriate value for each unknown element
- b) the magnitude of the consumed or supplied power
- c) whether the element is supplying or consuming power

Two greyed out columns are also provided WHICH WILL NOT BE GRADED but which you can use to note any relevant voltages or currents across the element.

Unknown Element	Symbol and Value	Power Magnitude (W)	Consuming or Supplying?	V (scratch)	I (scratch)
1					
2					
3					
4					
5					

Extra Space