EECS 40, Spring 2007
Prof. Chang-Hasnain
Midterm #1

September 17, 2007
Total Time Allotted: 50 minutes
Total Points: 100

1. This is a closed book exam. However, you are allowed to bring one page (8.5" x 11"), single-sided notes.
2. No electronic devices, i.e. calculators, cell phones, computers, etc.
3. SHOW all the steps on the exam. Answers without steps will be given only a small percentage of credits. Partial credits will be given if you have proper steps but no final answers.
4. Draw BOXES around your final answers.
5. **Remember to put down units.** Points will be taken off for answers without units.

Last (Family) Name:_____

First Name: _____

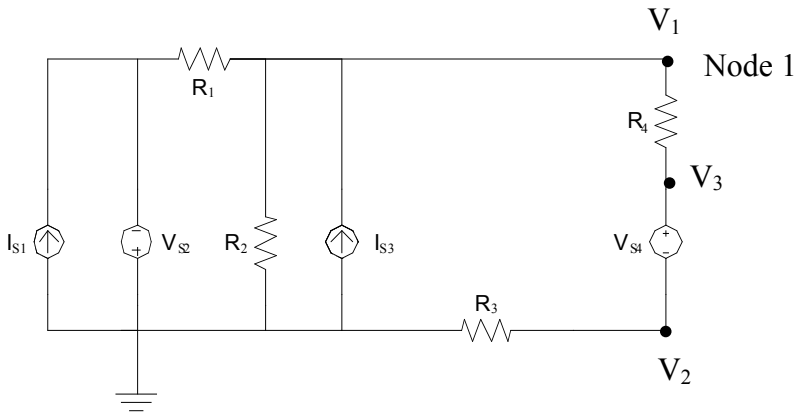
Student ID: _____ Discussion Session: _____

Signature: _____

Score:	
Problem 1 (25 pts)	
Problem 2 (43 pts):	
Problem 3 (32 pts)	
Total	

1. (25 pts) Node-Voltage Analysis

All voltages of the voltage sources, the currents of the current sources and the values of the resistors are given.



a) (7 pts) Does the current source I_{S1} have impact on voltages V_1 and V_2? Justify your answer. **(Hint: You do not need to solve the rest of the problem to do this part!!)**

Is1 does not impact V1 and V2 since it is in parallel with Vs3 and thus has the same voltage as Vs3. Also if one sets Is1 to 0 then it is clearly seen that it has no effect.

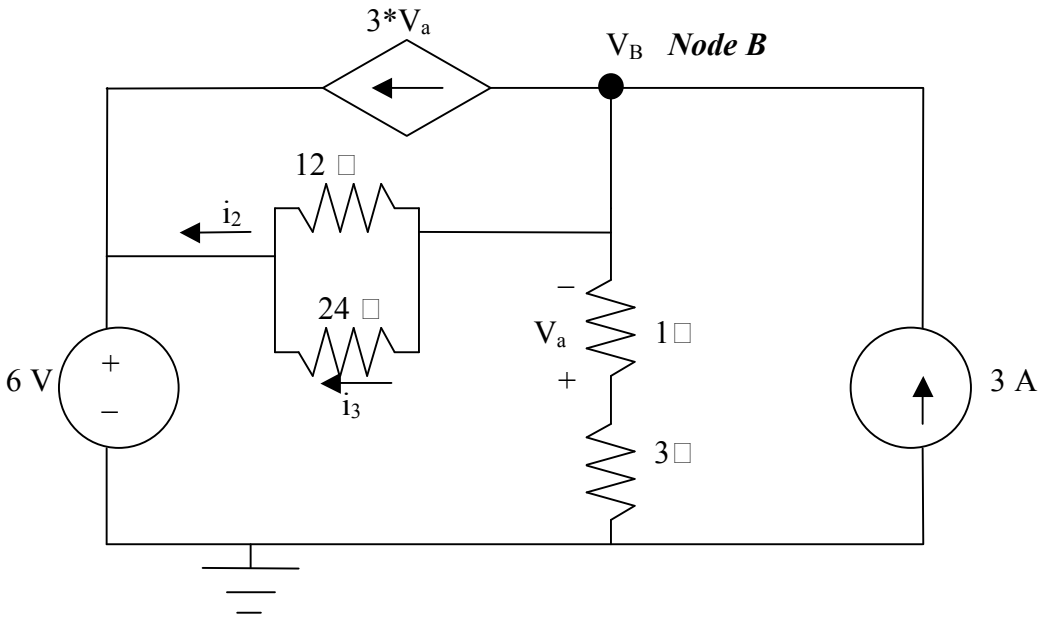
b) (12 pts) Write KCL equation for node 1.

Is3-(V1—Vs2)/R1-V1/R2-(V1-V3)/R4=0

c) (6 pts) Consider the two terminals surrounding V_{S4} a super node. Write a KCL equation for the branch connecting R_4, R_3 and V_{S4}.

-(V3-V1)/R4-V2/R3=0

2. (43 pts) Dependent Source



a) (4 points) Write V_a in terms of V_B (the voltage at node B).

VA=-1/4VB (by Voltage Divider Equation)

b) (18 points) Use KCL at node B, and your answer to part (a), to write an expression for V_B in terms of i_2 and constants in the problem.

3-Vb/4-3*Va-i2=0

3-vb/4+3/4*vb-i2=0

Vb=2(i2)-6

c) (8 points) Use KVL and Ohm's Law (of parallel resistors) to write an expression for i_2 in terms of V_B and constants in the problem.

Vb-6=8*i2

Vb=8(i2)+6

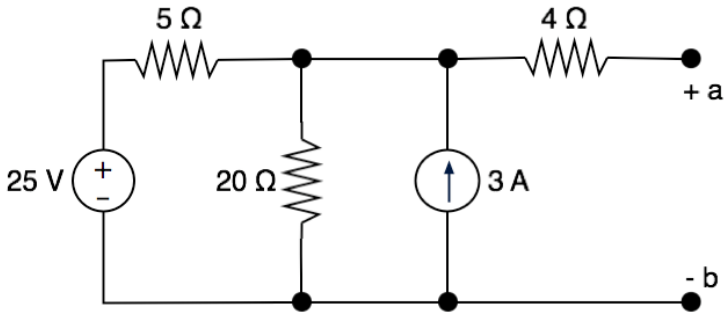
d) (8 points) Solve for V_B and i_2. Hint: both should be integers. If they are not, go back and check your work.

Combining b and c
2(i2)-6=8(i2)+6
6(i2)=-12
I2=-2 A
Plugging this back into c) you get:
vb=-10 V

e) (5 points) Determine the value of i_3.

Using Current Divider equation:
I3=(i2)(12/(12+24))
I3=-2/3 A

3. (32 pts) Thévenin and Norton Equivalent Circuits
   (a) (18 pts) Looking into terminals across a and b. What are the open circuit voltage $V_{ab,}$ and the Thevenin Resistance R_{th}?



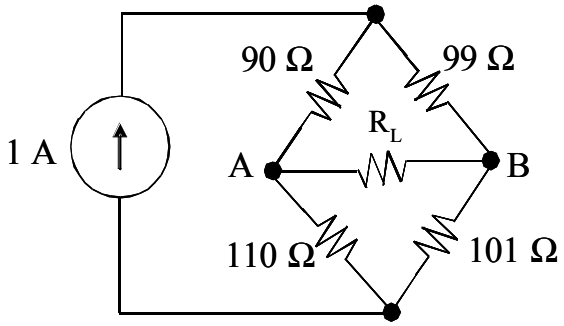
Let Vb=0, Vab=Va
(25-Va)/5+3=Va/20
8=Va (1/5+1/20)=Va (1/4)

Va=Vab=32 V

Thevenin Resistance
Voltage source is short, current source is open.

5 Ω parallel with 20 Ω= 4 Ohm
4 Ohm in series with 4 Ohm = Rth=8ohms

(b) (7 pts) Looking into terminals across A and B. What is the open circuit voltage V_{ab}?



Current in each path is equal at 0.5 A.
Vab = 0.5 (110-101)=4.5V

(c) (7 pts) Same circuit as above, looking into terminals across A and B. What is the Thevenin Resistance R_{th}? (You do not need to carry out the division.)

Thevenin Resistance
Current source is open.

(99+90)//(101+110)=211*189/400 Ohm