EECS40 **Spring 2004**

Midterm Exam # 1
March 2, 2004
Time Allowed: 90 minutes

Name:_____, _____
Last First

Student ID #:_____, Signature:_____

Discussion Section:_____

This is a closed-book exam, except for use of one 8.5 x 11 inch sheet of your notes. Show all your work to receive full or partial credit. Write your answers clearly in the spaces provided.

Problem #:	Points:
1	/20
2	/20
3	/10
Total	/50

1.

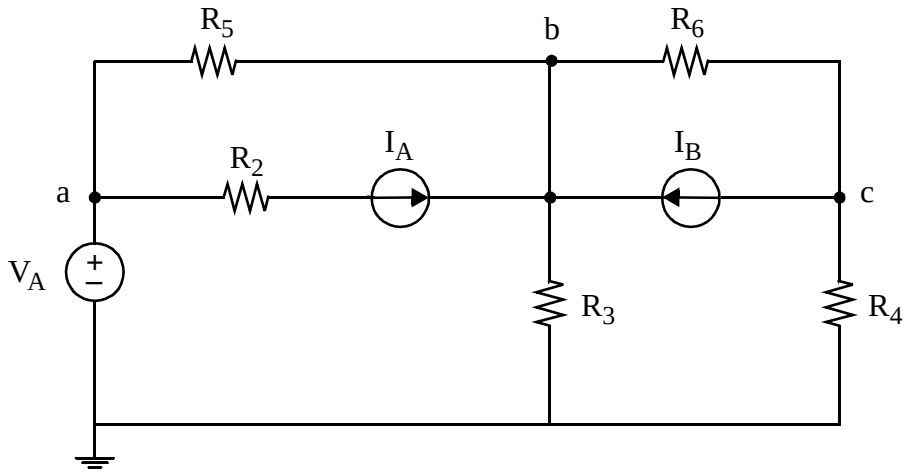

Figure 1(a)

a) (2 points)
In the circuit shown in Figure 1(a), the independent source values and resistances are known. Given the indicated reference potential, list the unknown node potentials in the circuit of Figure 1(a).

b) (8 points)
Write down a complete set of node equations sufficient to solve for the node potentials you listed in part (a). Do not solve! Write your node equations in the box below.

c) (2 points)
How many meshes would be required to solve the circuit of Figure 1(a) by the mesh analysis method?

d) (8 points)

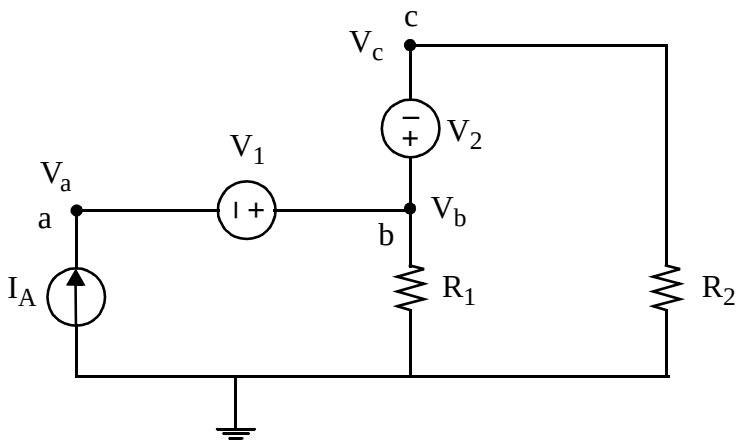

Figure 1(d)

In the circuit of Figure 1 (d), the independent source values and resistances are known. Use the node voltage method to write three equations sufficient to solve for the node potentials V_a, V_b, and V_c. Write your equations in the box below. Do not solve!

2.

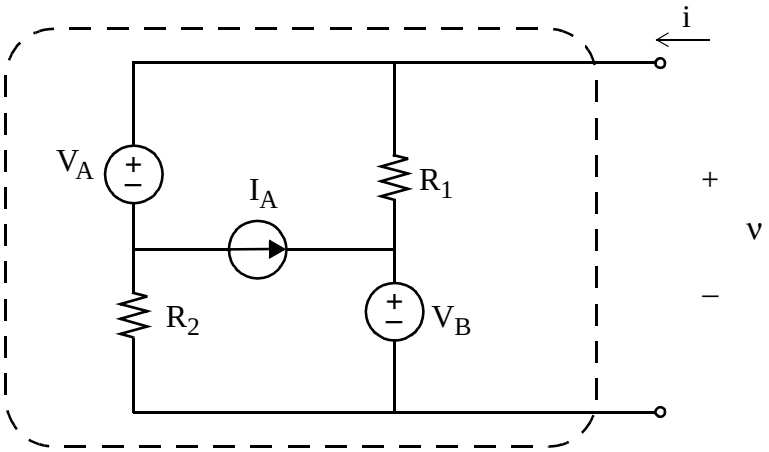

Figure 2(a)

a) (10 points)
Determine the Thevenin equivalent circuit for the circuit in Figure 2(a).
Hint: superposition. Write your answer in the box at the bottom of the page.

V_{th} =
R_{th} =

b) (10 points)

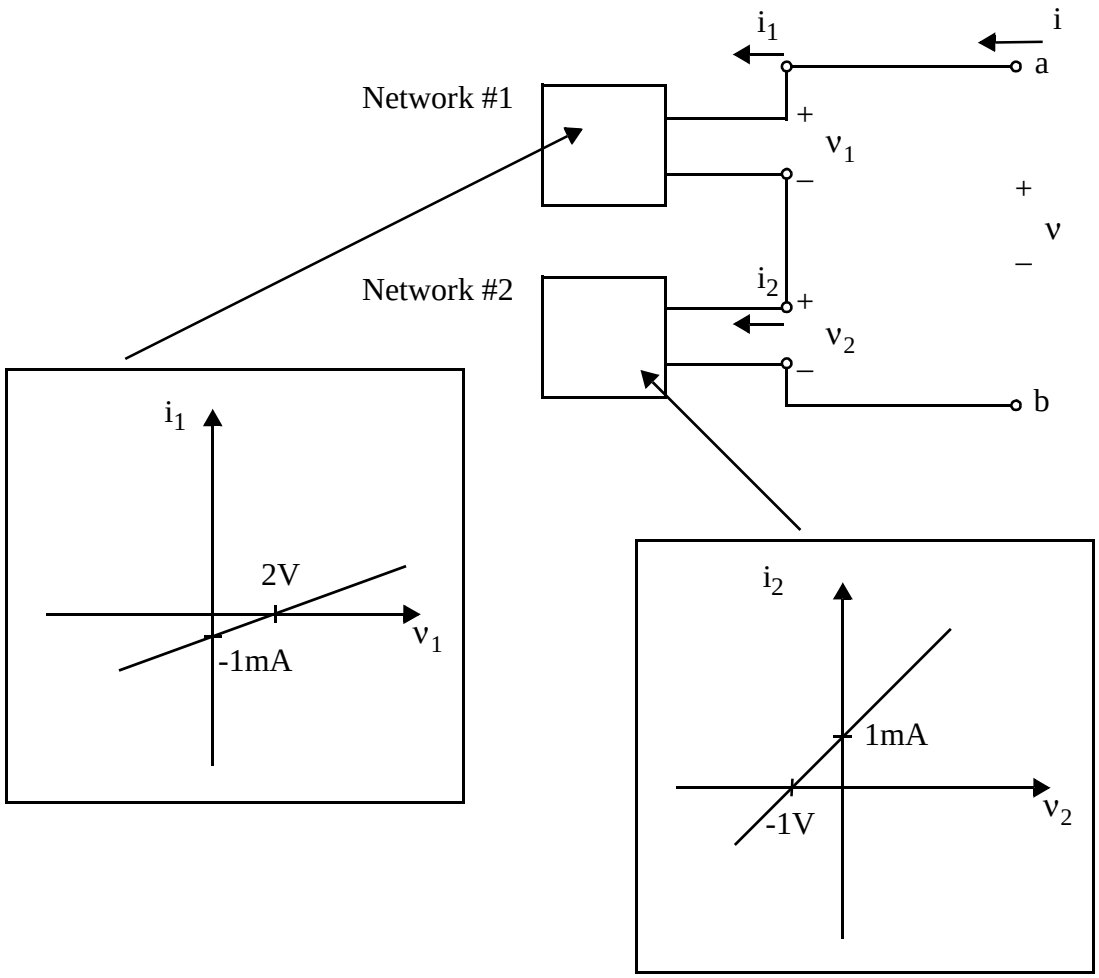

Figure 2(b)

One-port Networks #1 and #2 are interconnected as shown in Figure 2(b). Each of the one-port networks in Figure 2(b) is characterized by its indicated ν-i graph. Determine the Thevenin equivalent network and the Norton equivalent networks for the one-port network shown in the figure by accessing the circuit at the terminals labeled a and b. Write your answer in the box below.

V_{th}=	R_{th}=
I_N=	R_N=

3)

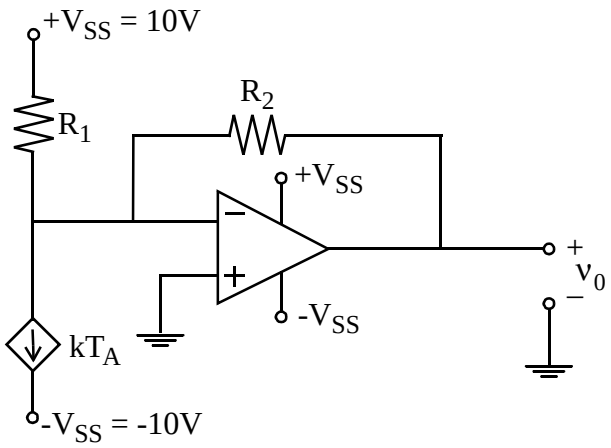

Figure 3

The op-amp in Figure 3 is ideal. The figure shows a temperature sensor modeled as a temperature-controlled current source. This device senses absolute temperature T_A in the $(°K)$ Kelvin scale and delivers a current kT_A, where $k = 1\mu A/°K$.

a) (5 points)
Determine the output voltage as a function of temperature $T_A(°K)$ in terms of the circuit parameters.

b) (5 points)
Determine values for R_1 and R_2 so that the output voltage sensitivity is $100\ mV/°K$ and the output is zero volts at $300°K$. Write your answer in the box below.

R_1 =
R_2 =