University of Rochester  
Department of Electrical & Computer Engineering  
ECE111                                      Examination #1  
10-9-09

This is a closed-book examination. No computers are allowed but you may use a hand-held calculator. Do all work in the bluebook provided, clearly indicating answers. Partial credit is more likely for neat, well-organized solutions. Put your name on your exam booklet. The four problems are weighted equally.

_Specify units in all numerical answers and do not overstate or understate their precision._

1) Consider the circuit below. (a) Find the **Thevenin** equivalent by solving for the open circuit voltage and short circuit current. Fully explain your methods in words and appropriate ckt diagrams. (b) Carefully plot $v_{out}$ versus $i$.

![Circuit Diagram](image)

2) The specified precision requirement for the 10x resistive **current divider** shown below is ±5%, i.e., $i_2/i_o = 0.10$ (±0.005). (a) What must be the ratio of the values for the resistors $R_1$ and $R_2$? (b) Use **worst-case analysis** to determine whether or not ±3% resistors can be used to achieve the ±5% precision requirement specified for the divider.

![Current Divider Diagram](image)

_HINT: An effective way to do part (b) is to select convenient numerical values (in Ω) for the two resistors that achieve the voltage ratio, and then perform the worst-case analysis using these values with their assumed ±3% tolerances._
3) For the circuit below, find the current $i$ in Amps flowing through the 2-Ohm resistor at the right side of the circuit by direct application of the **superposition principle**. Explain your method fully in words using appropriate circuit diagrams.

![Circuit Diagram](image)

*Do not use source reduction or a Thevenin equivalent for this problem.*

4) For the circuit below, use **nodal analysis** to obtain the set of two equations needed to solve for the nodal voltages (which you should define in a sketch of the circuit in your exam booklet. Show all steps of your work. *Do not solve for the voltages!*

![Circuit Diagram](image)

*Do not solve for the nodal voltages.*