MAE 140 – Linear Circuits – Winter 2009
Midterm

Instructions

1) This exam is open book. You may use whatever written materials you choose, including your class notes and textbook. You may use a hand calculator with no communication capabilities.
2) You have 70 minutes.
3) Write your name, student number and instructor.

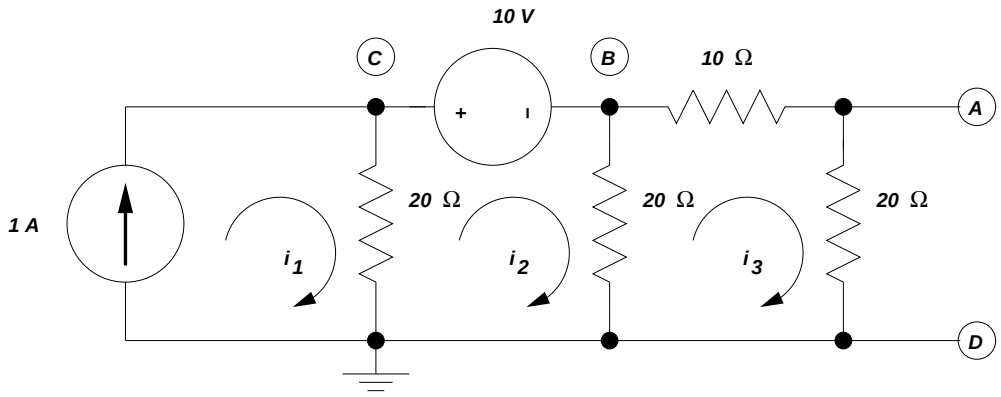

Figure 1: Circuit for questions 1-4.

Questions

1. **Equivalent circuits**
   (a) (2 points) Turn off all the sources in the circuit of Figure 1 and find the equivalent resistance as seen from terminals A and D.
   (b) (3 points) Find the Thévenin equivalent as seen from terminals A and D.
   (c) (1 point) Find the power absorbed by a $10\,\Omega$ resistor if connected to terminals A and D.

2. **Mesh current analysis**
   (a) (6 points) Formulate mesh-current equations for the circuit in Figure 1. Use the mesh currents shown in the figure and clearly indicate how you handle the presence of a current source, the final equations and the unknowns they must be solved for. **Do not modify the circuit or the labels in any way**. **Do not use source transformation**. **Do not solve any equations**!

3. **Nodal voltage analysis**
   (a) (6 points) Assuming that the node labeled D is the ground node (reference), formulate node-voltage equations for the circuit in Figure 1. Use the node labels provided in the figure and clearly indicate how you handle the presence of a voltage source, the final equations, and the unknowns they must be solved for. **Do not modify the circuit or the labels in any way**. **Do not use source transformation**. **Do not solve any equations**! *Hint: Use a super-node.*

4. **Bonus Question**
   (a) (1 point) If you were allowed to modify the circuit in Figure 1, describe what would you do in order to avoid having to use a super-node in Question 3? **Do not write or solve any equations**!