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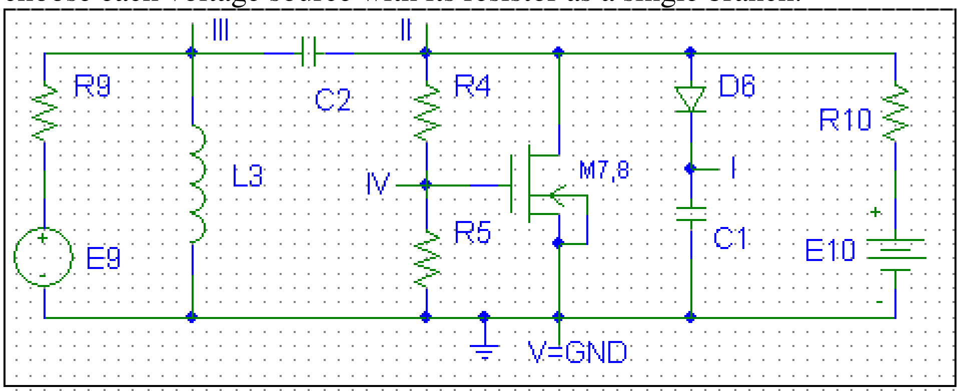
610 Fall 2008 – Homework 1

Corrected misprint: A_s^T to A_a^T 10/02/08; transposed in 1b & branch #s in 1a 10/27/08

1. circuit graph

a. For the following circuit draw its oriented graph. For this number the 10 branches as per the part numbers (for the transistor use branch 7 as gate-source and branch 8 as drain-source). Also number the 5 nodes as designated in the circuit with Roman numerals. Orient the branches either to the right or down and choose each voltage source with its resistor as a single branch.



b. Choose a tree using the 4 lowest possible branch numbering and from it obtain the cutest and tie set matrices. Check these by multiplying the cutset matrix by the tieset matrix transposed.

c. Choose a different tree using the 4 highest possible branch numbering and from it obtain the cutest and tie set matrices. Again check these by multiplying the cutest matrix transposed by the tieset matrix.

d. Multiply the cutset matrix transposed of part b by the tieset matrix of part c.

e. Obtain the (augmented) incidence 5x10 matrix, A_a. Problem 3.12 of the book, p. 124, states that the number of trees is given by a determinant, $\det(A_aA_a^T)$ where this T denotes matrix transpose. However, this has a critical misprint in that A_a should be A where A is A_a with any row deleted (maybe best the ground node). Determine how many trees are in this graphs (this determinant is 4x4 so it is quite possible to calculate it by hand but it may be worth investigating the use of Matlab or Mathcad and also evaluating $\det(A_aA_a^T)$).