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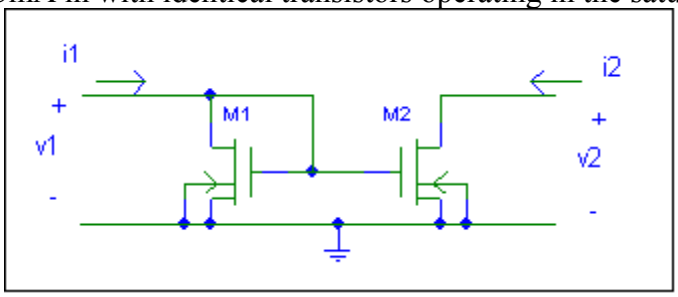
EE 303 Midterm Spring 2008
Open book, open notes. Only signed exam books, certifying all work is your own, will be graded. Be sure to show your reasoning for partial credit & move on if stuck. (75 min.)

When numerical values are requested use the spice parameters KP=$2x10^{-5}A/V^2$, W=L=10u, VTO=0.8V, LAMBDA=$2x10^{-3}$/V Cgs=Cgd=5pFd, BF=120, VAF=110V, IS=10^{-14}A, VBE=0.7V. For thermal voltage use VT=0.026V.

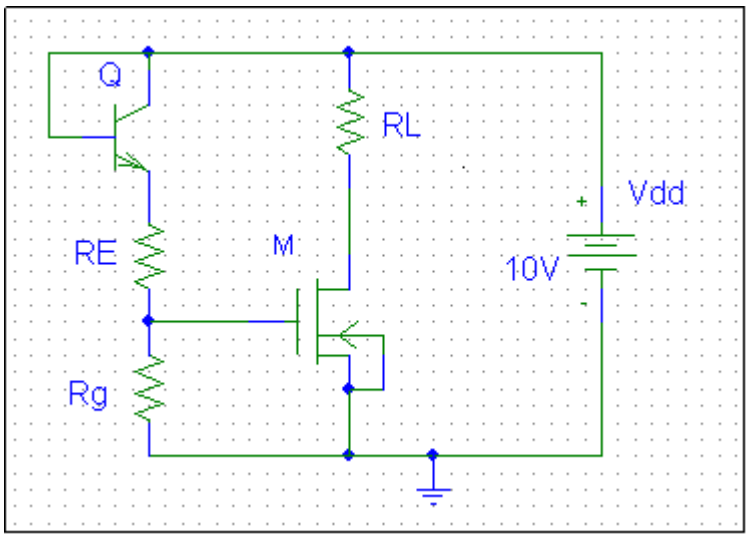
1. (50 points; 30 minutes)

For the following current mirror, assume that at DC the mirror gives I_2=3mA out for I_1=3mA in with identical transistors operating in the saturation region.



a) draw the small signal 2-port equivalent circuit.
b) analytically (not numerically) find the Y matrix in terms of the Spice parameters (including both gate capacitors).
c) numerically evaluate Y(s) and comment upon the poles and zeros.
d) assuming a load conductance g_L is placed across port 2, analytically find the small signal voltage gain, (v_2/v_1)=G(s). Evaluate G(s) numerically for g_L=2mMho.

2. (50 points; 30 minutes)



For this circuit

a) Numerically find RE and Rg so that the $V_{GS} = 2V$.
b) Given the result of part a) find numerically the maximum RL (call it Rmax) such that the transistor M remains in saturation for all smaller values of the non-negative load resistance RL.
c) Calculate numerically the drain current, i_D, of M for $0 \le RL \le Rmax$ and sketch i_D vs RL.