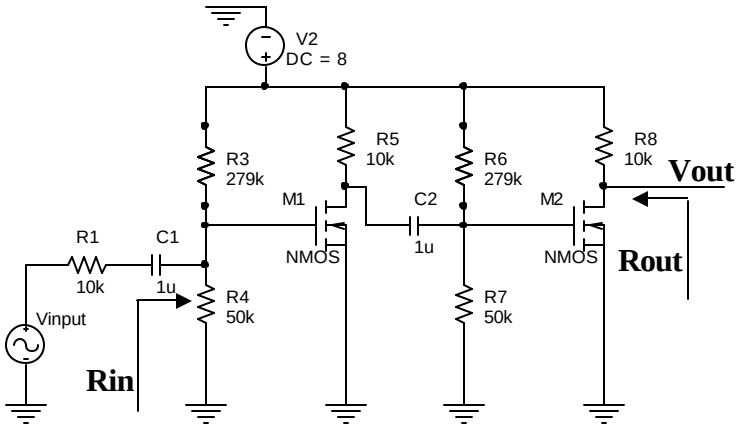
ECE2280 Homework #6 Spring 2007

1. If V_t=2, k_n'(W/L)=2mA/V^2, λ=0, what is the value of the current, I_D, flowing through an NMOS transistor for the following applied voltages:

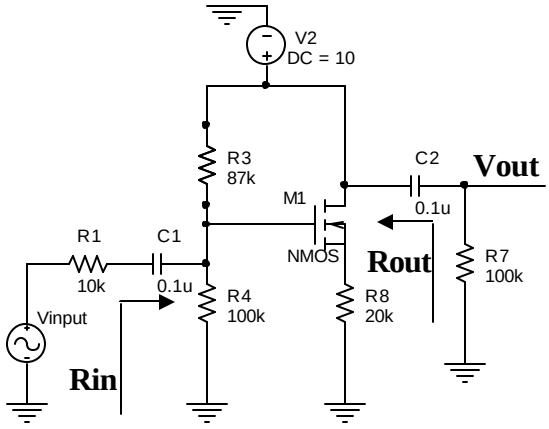
(a) V_G=5, V_D=10, V_S=4
(b) V_G=5, V_D=10, V_S=-5
(c) V_G=5, V_D=2, V_S=-5
(d) V_G=3, V_D=1, V_S=1
(e) V_G=-5, V_D=0, V_S=-10

2. (for each circuit: (a) worth 1 problem (b)-(e) worth 1 problem, (f)-(g) worth 1 problem; total=9 problems) For each circuit below, answer the following using: (i) V_t=0.8V, k_n'(W/L)=3.2mA/V^2 , λ=0; (ii) V_t=1V, k_n'(W/L)=1.6mA/V^2 , λ=0; (iii) V_t=1.5V, k_n'(W/L)=1mA/V^2 , λ=0. Assume V_{input} is an AC signal.

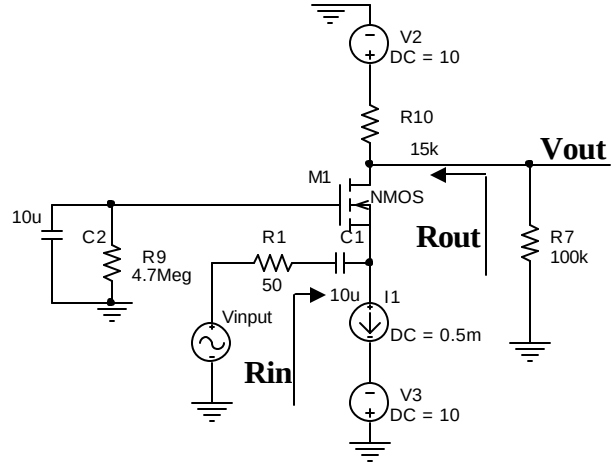
(a) Solve the DC circuit to find I_D and V_{GS}(assume caps open) for transistor(s)
(b) Draw the small-signal equivalent circuit (assume caps shorted)
(c) Find the midband gain V_{out}/V_{input} (V_{input} is an AC source)
(d) Find Rin
(e) Find Rout
(f) Solve the circuit below by including the capacitors in the AC small-signal equivalent circuit. Solve the frequency transfer function V_{out}/V_{input} and state the low frequency value, f_L in Hz.
(g) State the upper corner frequency for the entire amplifier, f_H in Hz if C_{gs}=1pF and C_{gd}=0.1pF.



(i)



(ii)



(iii)