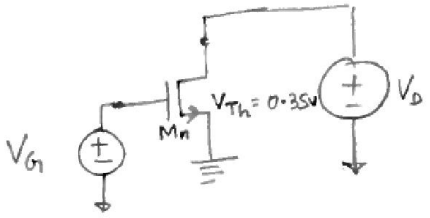
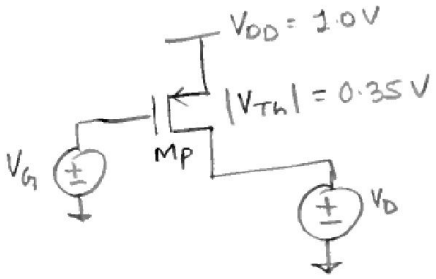
EECE 457 / 571F Homework #0

This assignment is meant for those who have not been able to satisfy the pre-requisits for the course but wish to register for EECE 457/571F. Please study chapter 3 of Johns & Martin textbook and then attempt these problems. Show me your attempts and based on that, I can waive the pre-requisite requirements for you.

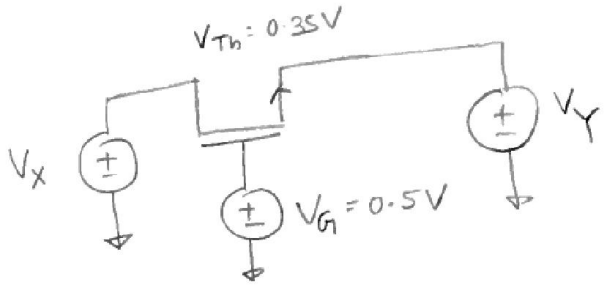
Q1) Mark the operating region of the two transistors shown below: { Saturation, Linear, OFF }





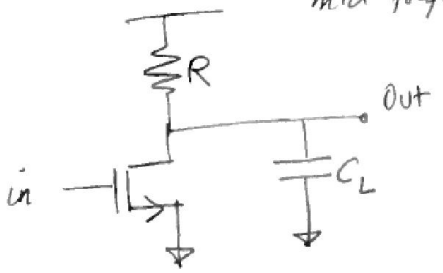
V_G	V_D	M_n	M_p
0.7V	1.0V		
0.7V	0.7V		
0.7V	0.6V		
0.2V	0.8V		
0.5V	0.1V		

Q2)

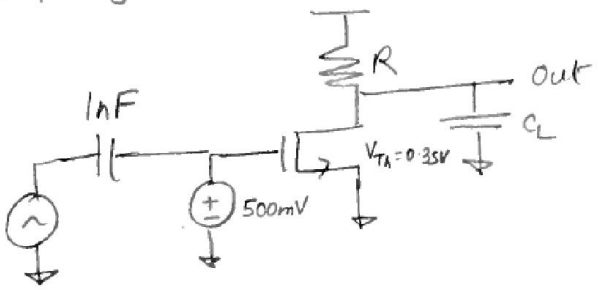


Which is the drain node of this transistor?

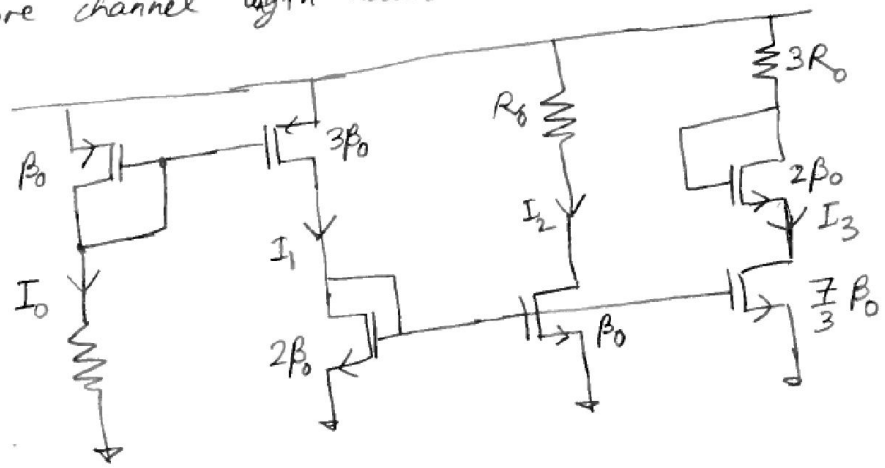
Q3) Assuming the transistor is biased in saturation, calculate the low frequency mid-frequency and high frequency small-signal gain of this amplifier. Ignore body and bulk effect, and assume parasitic capacitances of C_{gs}, C_{gd} and C_{ds}.



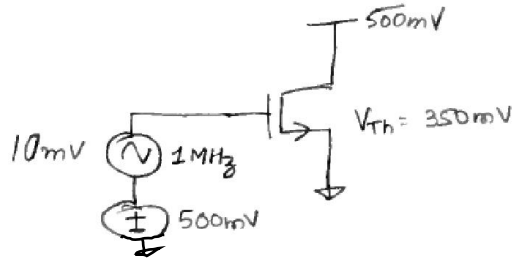
Q4) Does the answer for mid-frequency small-signal gain change when the amplifier is biased as below?

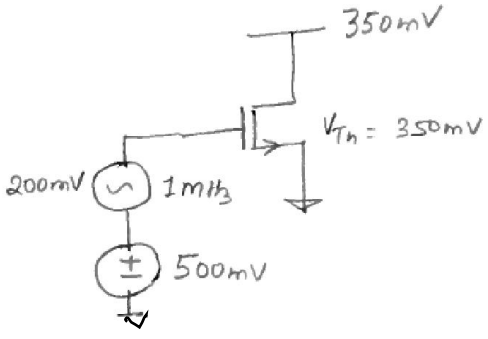


Q5) Find out the expression for I_1, I_2, I_3 in terms of I_0, β_0 and R_0. Ignore channel length modulation.



Q6) Comment on the operating condition (OFF / Linear / Saturation) for the following two transistors

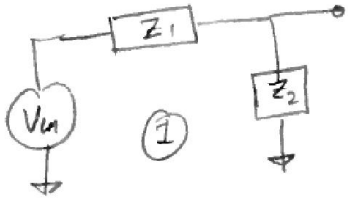


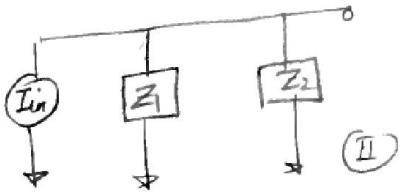


Q7) What is the small signal low frequency impedance at Port X ?

Ignore g_{mb}

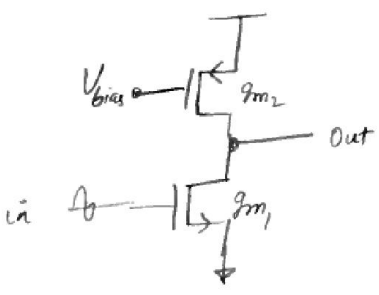
Q8) Complete the following table with expressions for voltage and current for Z_1 & Z_2

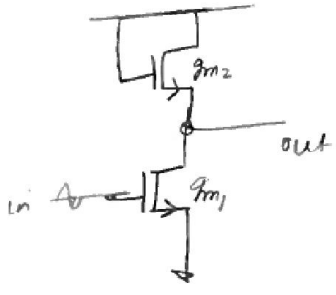




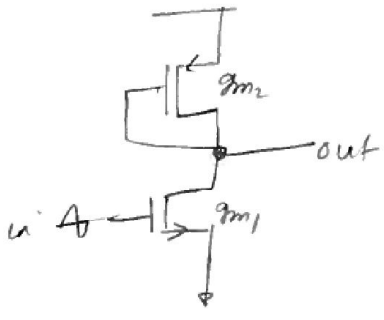
	I	II
V_{Z_1}		
V_{Z_2}		
I_{Z_1}		
I_{Z_2}		

Q9) Find the expression for small-signal low-frequency gain for the following three amplifiers. Assume that the transistors are biased in saturation





(Ignore r_o)



(Ignore r_o)

Q10) Calculate the small-signal low-frequency differential-mode and common-mo gain of the following amplifier. I_o is an ideal current source and M_1 & M_2 are biased in saturation