

Q1 (a)

1.) (50 points total)

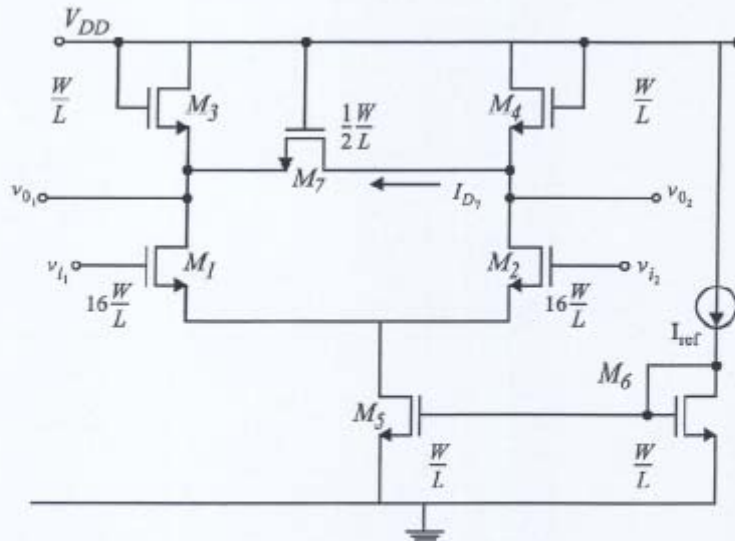


Figure 1

a.) (10 points)

Suppose $v_{i_1} = v_{i_2} = v_{i_{CM}}$ is set so that transistors M_1 - M_6 are in saturation. What region does transistor M_7 operate in?

What is the nominal drain current I_{D_7} in M_7 ?

Q1 (b)

Draw a small signal half-circuit model corresponding to differential mode operation

Q1 (c)

Determine the differential mode gain A_{DM} . You may express your solution in terms of g_m , r_o , etc.

Q1 (d)

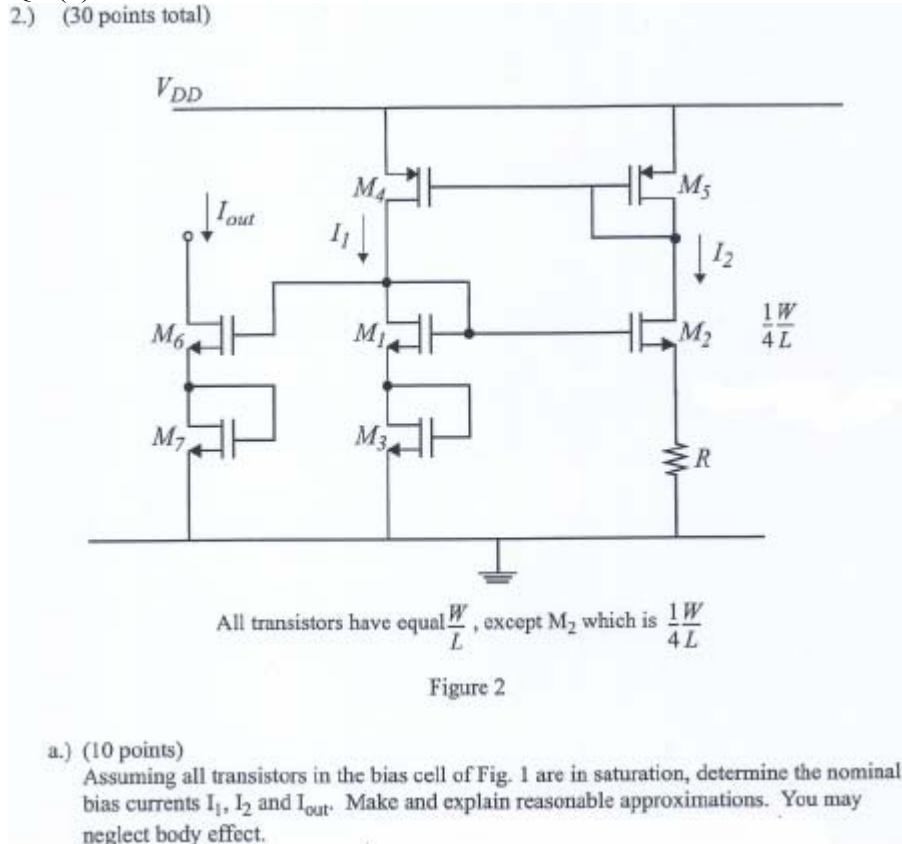
Draw a small signal half-circuit model for common mode operation

Q1 (e)

Determine the common mode gain A_{CM} . You may express your solution in terms of g_m , r_o , etc.

Q2 (a)

2.) (30 points total)



Q2 (b)

Determine the minimum supply voltage V_{DD} that keeps all transistors in saturation. Express your answer in terms of V_{Tn} , V_{Tp} , ΔV_1 , ΔV_2 , ΔV_3 , ΔV_4 , ΔV_5 , etc.

Q2 (c)

Determine R_{out} , the small signal output resistance looking into the drain of M_6 .