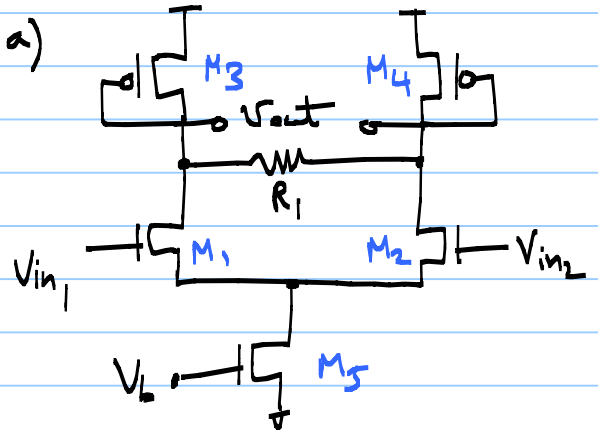
Practice Problem Set 1 (Diffamps)

Note Title 4/14/2011

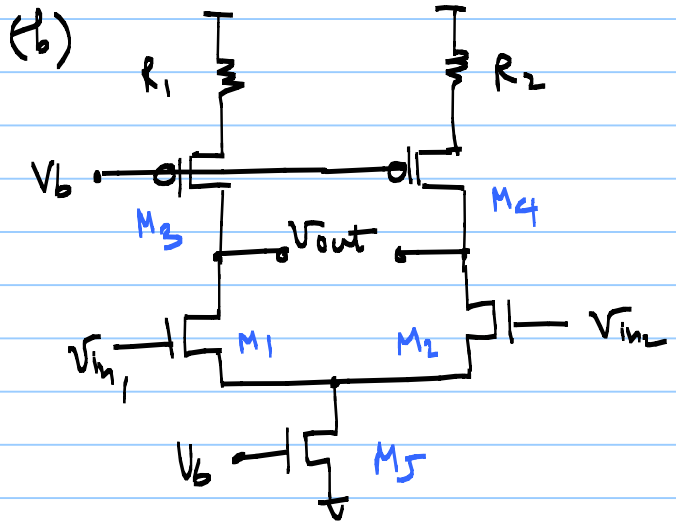
① Do problems A22.1 – A22.4, A22.9 from the additional textbook problem set.

(2) Assuming all the circuits shown below are symmetric, calculate the small-signal differential voltage gain of each circuit. ($\lambda \neq 0$)

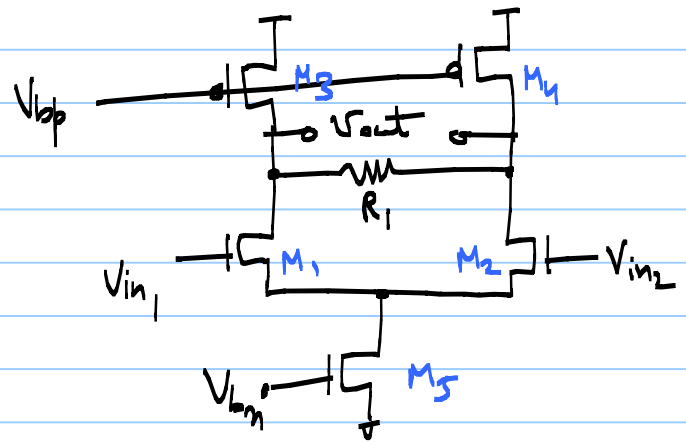
(a)



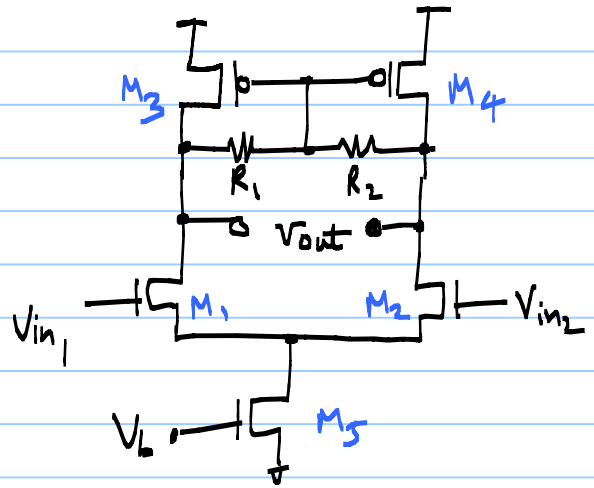
(b)



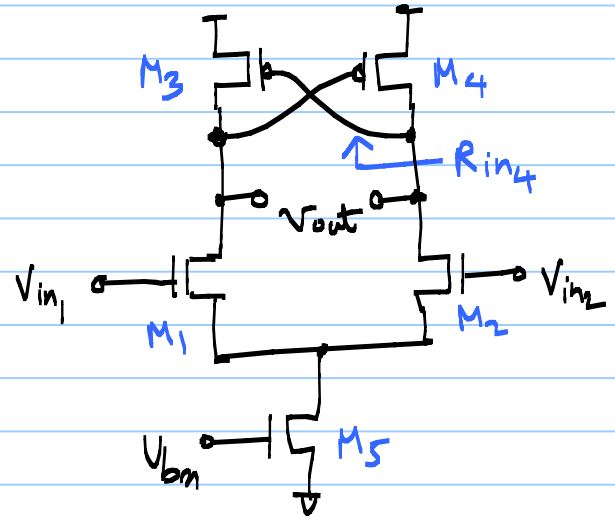
(c)


V_{bp}
M_3
M_4
V_{out}
R_1
V_{in_1}
M_1
M_2
V_{in_2}
V_{bn}
M_5

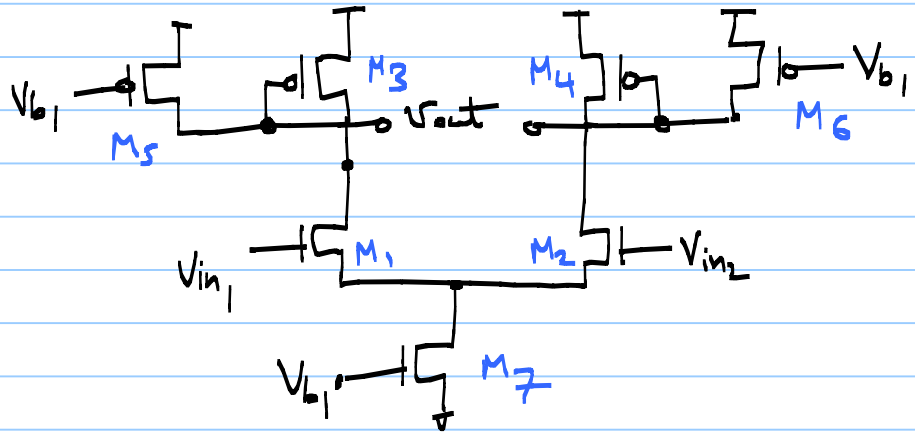
(d)


M_3
M_4
R_1
R_2
V_{out}
V_{in_1}
M_1
M_2
V_{in_2}
V_b
M_5

(e)

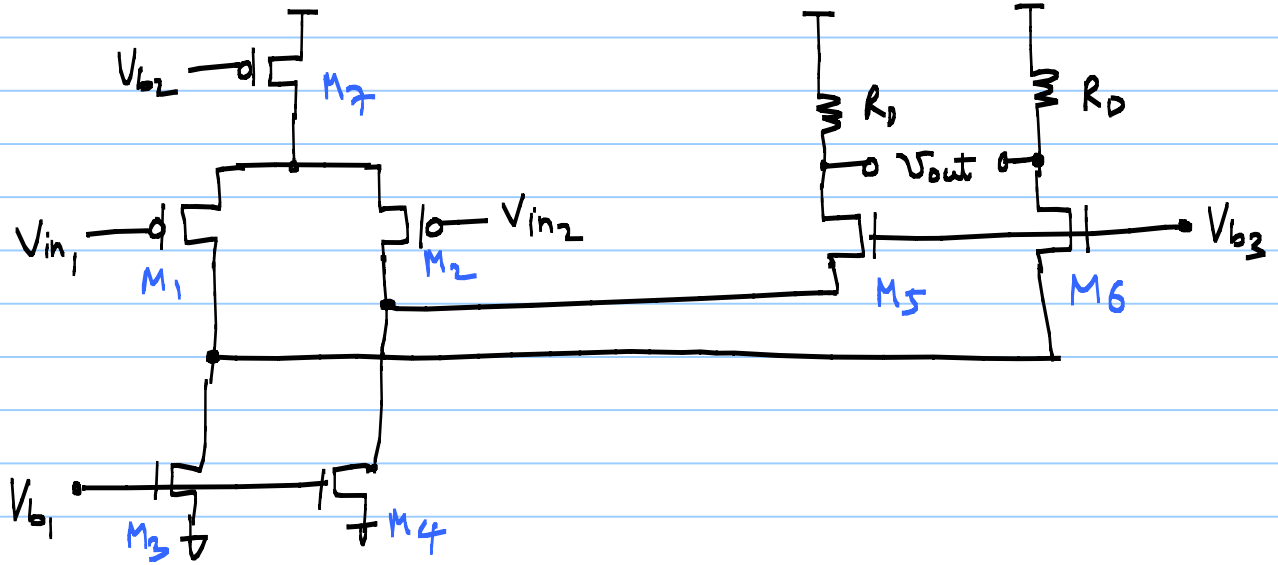


(f)



Hint: find the impedance R_{in4} first.

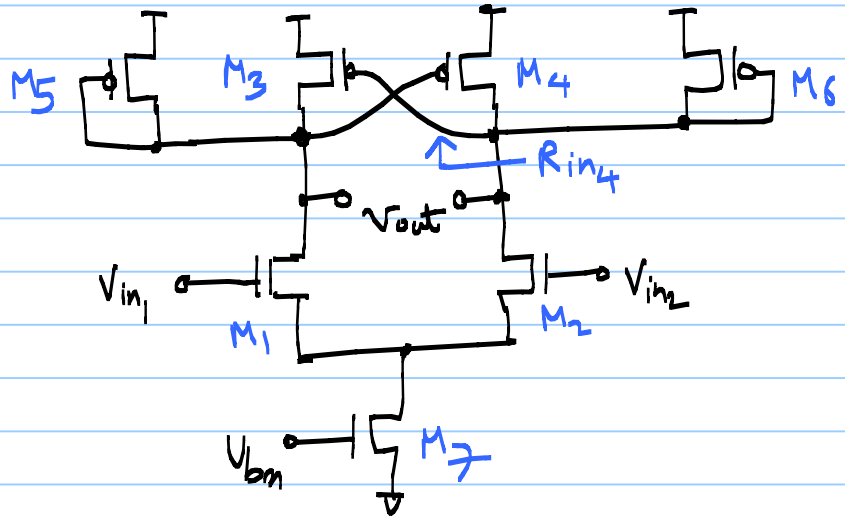
(g)



(3) Consider the circuit shown below:

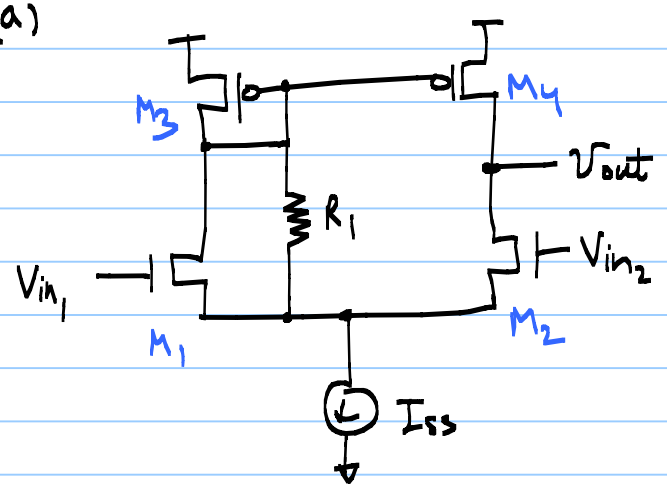
(a) sketch V_{out} as V_{in_1} & V_{in_2} vary differentially from 0 to V_{DD}

(b) If $\lambda = 0$, obtain an expression for voltage gain. What is the voltage gain when $W_{3,4} = 0.8\, W_{5,6}$

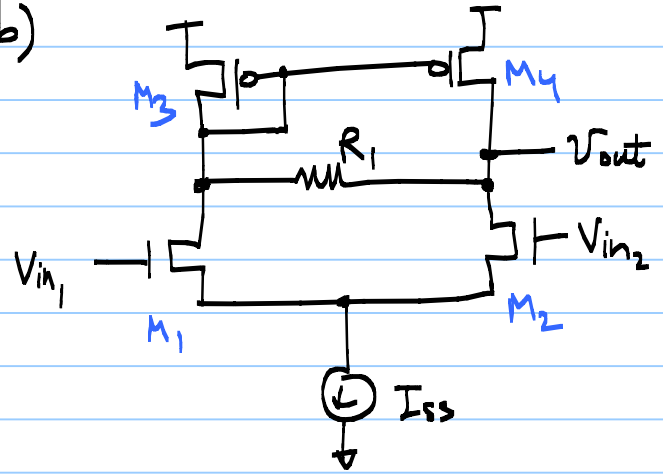


④ Calculate gain of the following circuits.

(a)

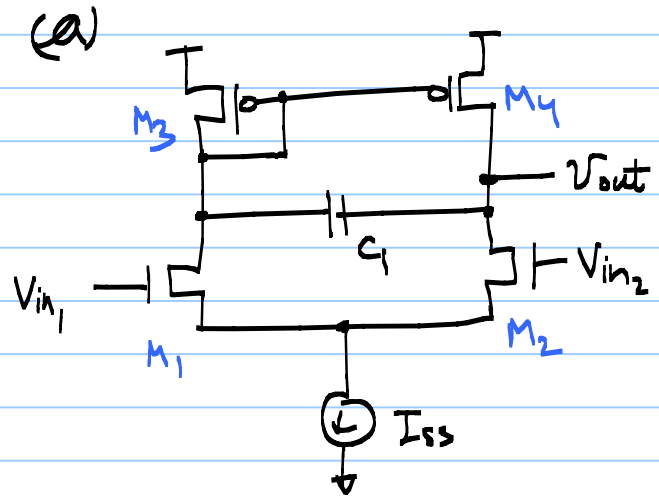


(b)

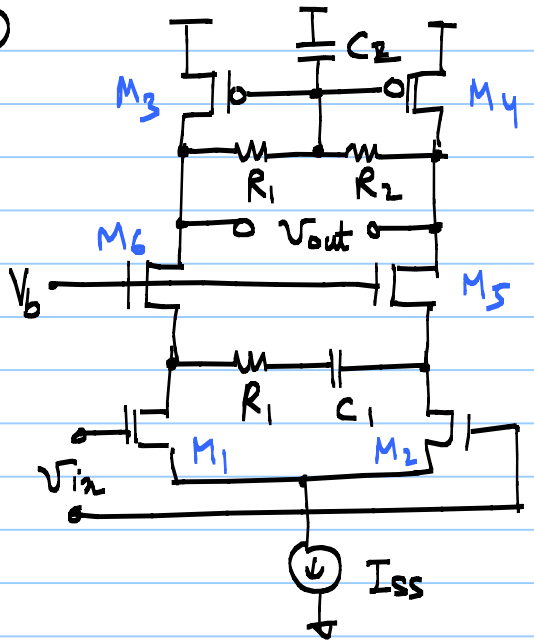


(5) Calculate the gain of each circuit at very low and very high frequencies. Neglect all other capacitances and assume $\lambda = \gamma = 0$.

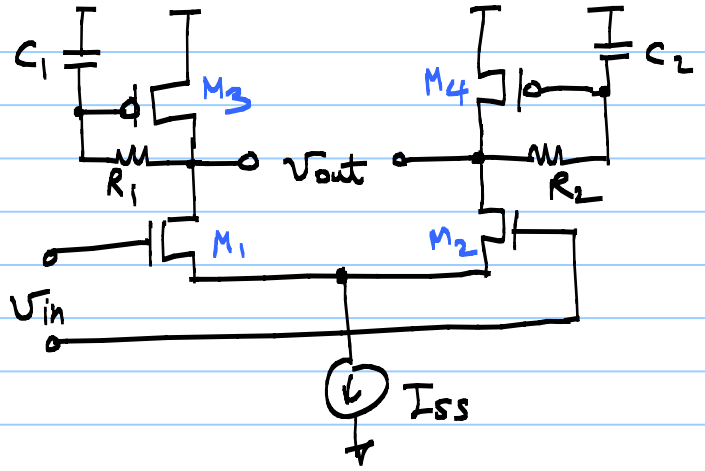
(a)



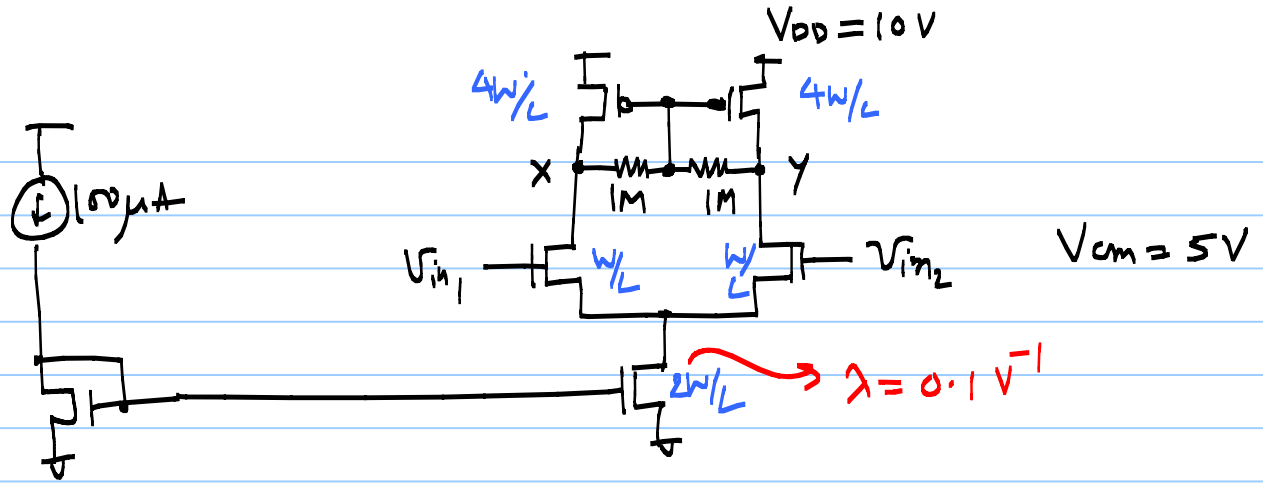
(b)



⑥ For the circuit below, neglecting other capacitances, determine the transfer function. Explain under what conditions the load exhibits an inductive behavior.



(7)



$V_{cm} = 5V$

Given:

$K_{P_n} = 200\,\frac{\mu A}{V^2}$

$K_{P_p} = 50\,\frac{\mu A}{V^2}$

$V_{THN} = V_{THP} = 1V$

Unless specified for a device, assume $\lambda = 0$.

(a) Determine Dc operating point at X & Y.

(b) Determine Ac voltages at X & Y

(c) Find CMRR and the input CM range.