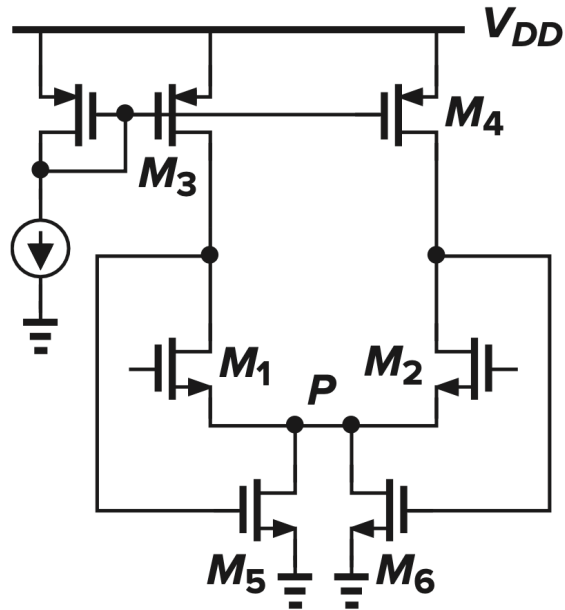
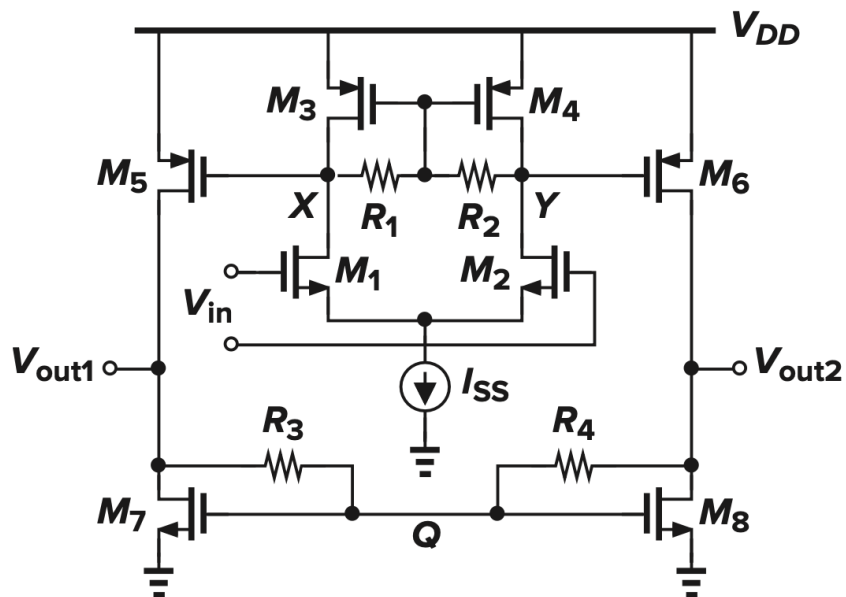


## EE-523 – Exercise 2

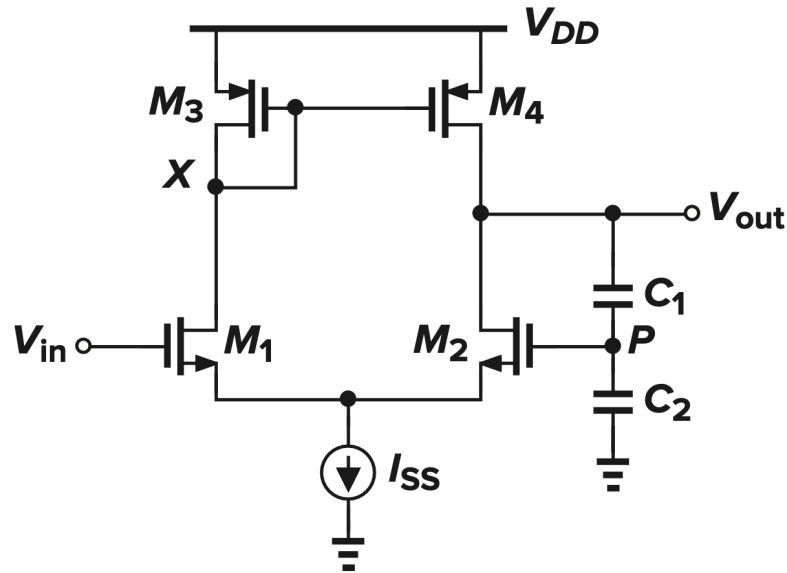
1. In the following circuit, due to voltage headroom limitations, the tail current source is replaced by two triode devices that sense the output CM level,  $V_{out,CM}$ . Determine the small-signal gain from the input CM level to the output CM level. Assume (for simplicity) that  $\lambda = \gamma = 0$  for  $M_1$  and  $M_2$ .



2. Calculate the differential voltage gain of the following circuit with CMFB in each stage.



3. Calculate the low-frequency PSRR of the feedback circuit shown below. To simplify the calculations, you can neglect channel-length modulation in  $M_1$ – $M_3$ .



4. Assuming that all transistors are in saturation and  $(W/L)_{1,2} = 50/0.6$ ,  $(W/L)_{3,4} = 10/0.6$ , find the equation for the input-referred noise voltage of the following amplifier. Assume  $\mu_n C_{ox} = 75 \mu\text{A}/\text{V}^2$ ,  $\mu_p C_{ox} = 30 \mu\text{A}/\text{V}^2$ , and  $\gamma = 2/3$ .

