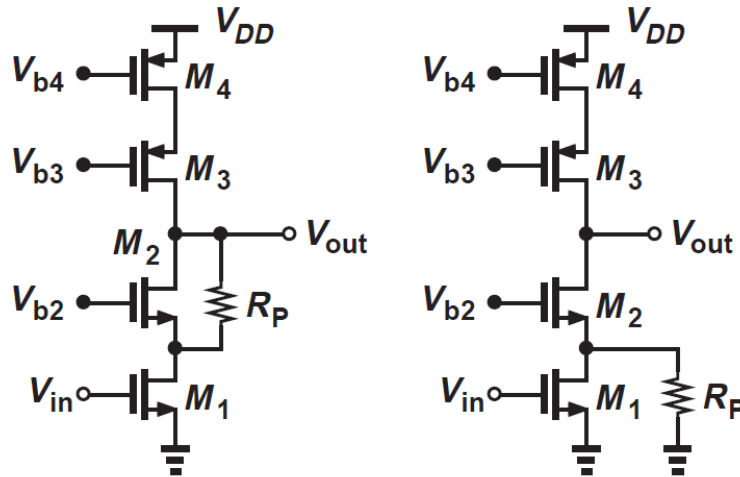
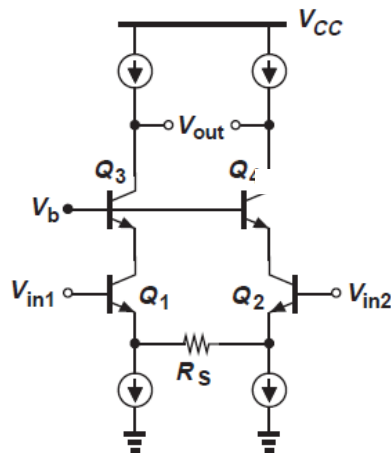


Due: 8 November 2020 @22:00 o'clock – **No late homework will be accepted.**

- 1) Derive an expression for the voltage gain of the following amplifiers. In the circuit below right, you should take R_p into account when calculating G_m while neglecting the effect of r_{o1} and r_{o2} .



- 2) Derive an expression for the differential voltage gain of the following amplifier.



- 3) Calculate the input resistance and the voltage gain of the circuit below left. Assume that all transistors are in saturation, and $\lambda \neq 0$.
- 4) Assuming perfect symmetry and $V_A > 0$, calculate the differential voltage gain of the amplifier below right. Design the circuit in LTSPICE/PSPICE by assuming that $V_{CC} = 2.4V$ and $I_{EE} = 1.2mA$. Optimize your circuit to obtain a high differential gain. Use Q2N2222 and Q2N2907 transistors for npn and pnp, respectively. Provide the AC simulation plot of your amplifier. Also, provide the transient response of your amplifier to a sine wave of 10 mV amplitude and 1 kHz frequency.

