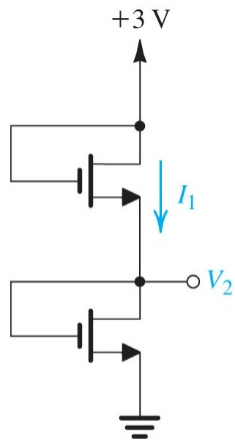


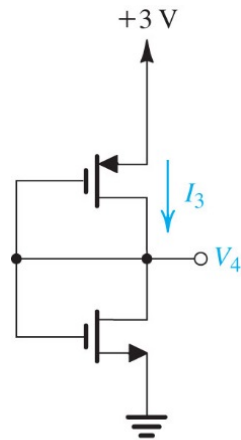
HW#7

(Submit to bCourses by 11 pm on 3/22)

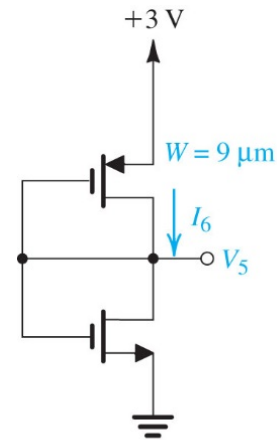
- 1) For the circuits below, $\mu_n C_{ox} = 3\mu_p C_{ox} = 0.27 \text{ mA/V}^2$, $|V_t| = 0.5 \text{ V}$, $\lambda = 0$, $L = 1 \mu\text{m}$, and $W = 3 \mu\text{m}$, unless otherwise specified. Find the labeled currents and voltages.



(a)

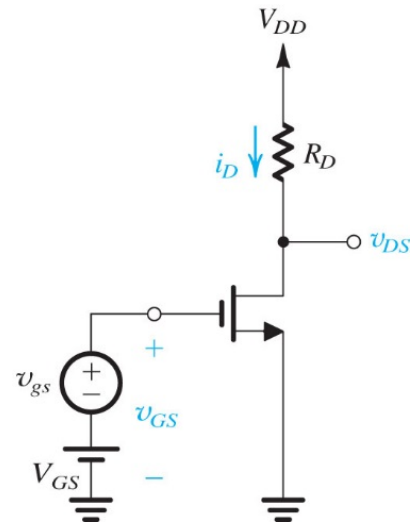


(b)



(c)

- 2) Consider the amplifier on the right with $V_{DD} = 5 \text{ V}$, $R_D = 24 \text{ k}\Omega$, $k_n = 1 \text{ mA/V}^2$, and $V_t = 1 \text{ V}$. Find the coordinates (V_{GS} , V_{DS}) of the two end points of the saturation-region segment of the amplifier transfer characteristics (i.e., points A and B on Fig. 7.2(b) of the textbook).



- 3) Consider the circuit on of Problem 2) with $V_t = 0.4 \text{ V}$, $k_n = 5 \text{ mA/V}^2$, $V_{GS} = 0.6 \text{ V}$, $V_{DD} = 1.8 \text{ V}$, and $R_D = 10 \text{ k}\Omega$.
- Find the bias point, I_D and V_{DS} .
 - Calculate the transconductance g_m at the bias point.
 - Calculate the voltage gain.
 - If the NMOS has $\lambda = 0.1 \text{ V}^{-1}$, find the output resistance of the NMOS, r_o , at the bias point. Calculate the voltage gain considering r_o .