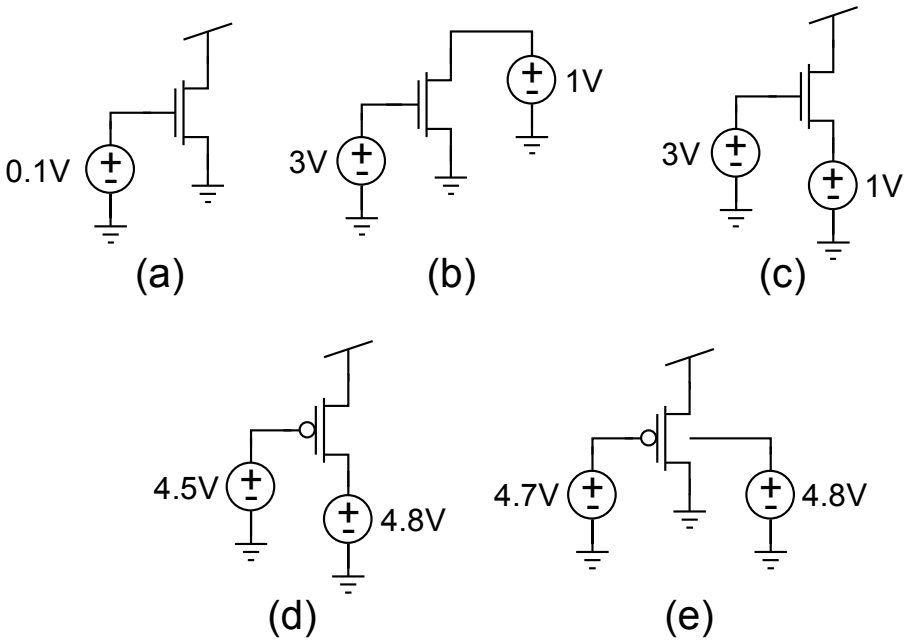
EE 551 Linear Integrated Circuits
Homework 3

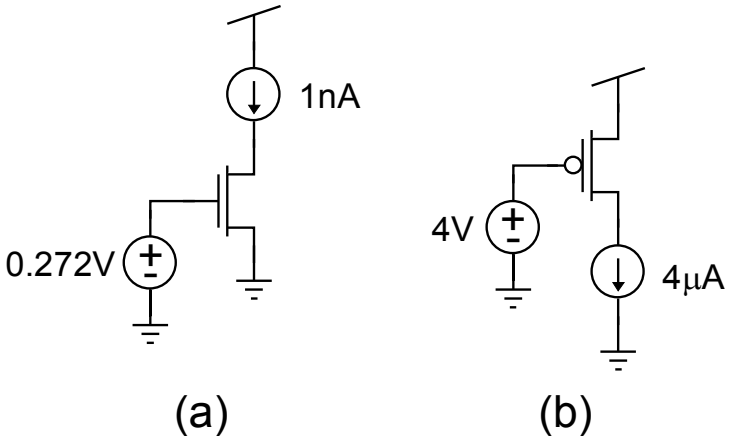
Unless otherwise specified, use the following transistor parameters.

$V_{T0} = 0.7V$, $\gamma = 0.45V^{1/2}$, $2\varphi_F = 0.9V$, $\kappa_n = \kappa_p = 0.65$ (subthreshold), $\mu_n=1360cm^2/Vs$, $\mu_p=460cm^2/Vs$, $K = 100\mu A/V^2$, $I_0 = 1pA$, $I_{th} = 1\mu A$, $V_A = 50V$, $K_s=11.8$, $\varepsilon_0=8.854x10^{-12}F/m$, $T=300K$, $V_{dd} = 5V$

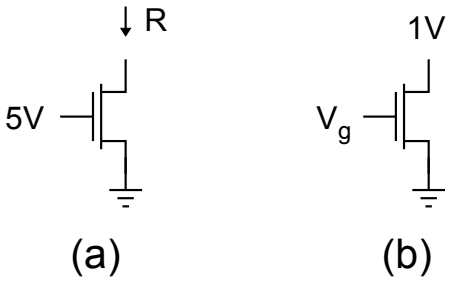
1. Determine the current flowing through each transistor.



2. Determine the DC operating point of each transistor (i.e. determine the voltage at each node and the current flowing into/out of each node).



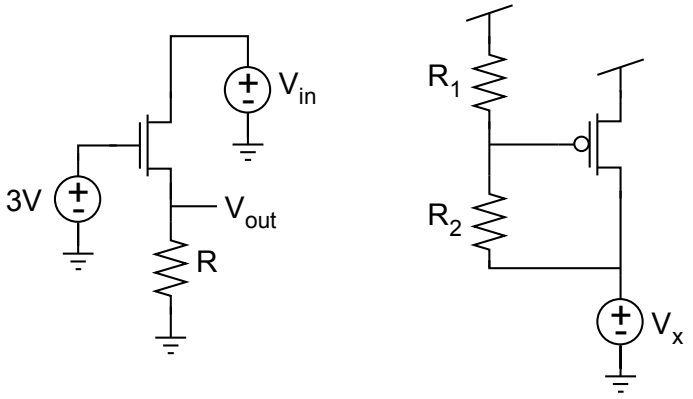
3. Create a resistive element from a transistor using the following information and the figures for the respective parts.



(a) (b)

a. What value of transistor width causes the transistor to have a resistance of 100Ω if C_{ox} = 347nF/cm^2, L = 1μm, and V_d is such that the transistor is operating in the deep ohmic region?
b. Determine the bias voltage required to create a 2.5kΩ resistance, assuming K = 100μA/V^2.

4. Use the following figures for Parts a and b. For both parts, assume that $\gamma = \lambda = 0$ and also I_0 = 0 (no subthreshold current).



(a) (b)

a. Determine V_{out} when sweeping V_{in} from ground to V_{dd} (expressions and a sketch of values) for Figure a.
b. Determine the channel current as V_x is swept from ground to V_{dd} (expressions and a sketch of values) for Figure b.