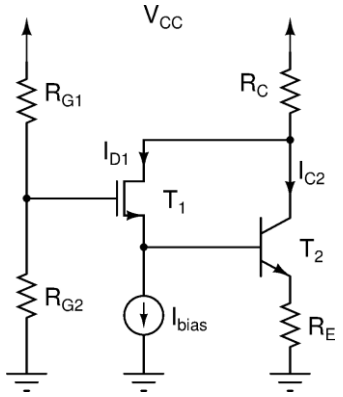
For all BJTs, assume: $|V_{BE,on}| = 0.7V$, $\beta = 100$, and $|V_{CE,sat}| = 0.1V$ (use $V_T = 25mV$).

For all MOSFETs, assume: $|V_{TH}| = 1V$ and $\mu\, C_{ox} = 10\,\frac{\mu A}{V^2}$.

Q1: Calculate the bias points of the transistors shown in the circuit to the right.

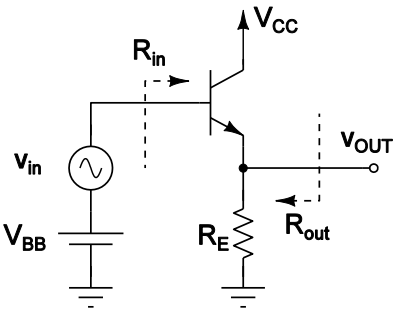
Assume $V_{CC} = +10V$, $I_{bias} = 1mA$, $\left(\frac{W}{L}\right)_1 = 500$, $R_{G1} = 70k\Omega$, $R_{G2} = 30k\Omega$, $R_E = 1k\Omega$, and $R_C = 3k\Omega$.

Verify the operating region of the transistors and report values for I_{D1}, I_{C2}, V_{DS1}, and V_{CE2}.



Q2: For the circuit shown to the right, assume $R_E = 1k\Omega$, $V_{BB} = +1V$, and $V_{CC} = +3V$. v_{in} is a small-signal source. Calculate:

a) Calculate the bias point parameters (I_C and V_{CE}) for the transistor.
b) Calculate the small-signal parameters and draw the small-signal equivalent circuit.
c) Calculate the voltage gain of the circuit, $A_v = \frac{v_{out}}{v_{in}}$, using your small-signal model.
d) Calculate the input resistance, R_{in}, of the circuit as marked on the circuit.
e) Calculate the output resistance, R_{out}, of the circuit as marked on the circuit.



Q3: Consider the circuit shown to the right where $\frac{W}{L} = 100$. Resistor values are: $R_{G1} = 1M\Omega$, $R_{D1} = 10k\Omega$, $R_{S1} = 500\Omega$, $R_L = 20k\Omega$, and $R_S = 100k\Omega$. The capacitors should be assumed short-circuits at the operating frequency of the circuit and $V_{DD} = -V_{SS} = +3V$.

a) Calculate the bias point parameters (I_D and V_{DS}) for the transistor and verify your assumed operating region.
b) Calculate the small-signal parameters and draw the small-signal equivalent circuit.
c) Calculate the voltage gain of the circuit, $A_v = \frac{v_{out}}{v_s}$, using your small-signal model.
d) Calculate the input resistance, R_{in}, of the circuit as marked on the circuit.
e) Calculate the output resistance, R_{out}, of the circuit as marked on the circuit.