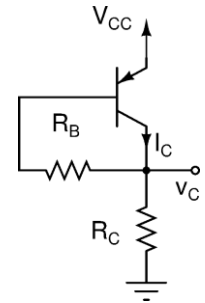


For all transistors, assume: $|V_{BE,on}| = 0.7V$, $\beta = 100$, and $|V_{CE,sat}| = 0.1V$.

For all MOSFETs, assume: $|V_{TH}| = 0.7V$ and $\mu C_{ox} = 100 \frac{\mu A}{V^2}$.

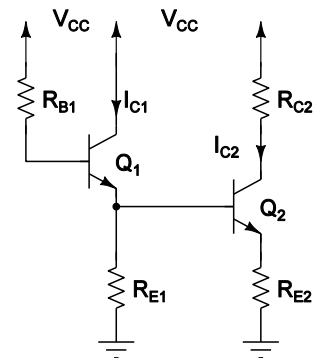
Q1: Consider the circuit shown to the right where $R_B = 100k\Omega$, $R_C = 1k\Omega$, and $V_{CC} = +3V$.

- Determine the collector current and voltage. Verify your assumed operating region.
- Considering all potential cases for the supply voltage and resistor values, what are the possible operating regions for the transistor?



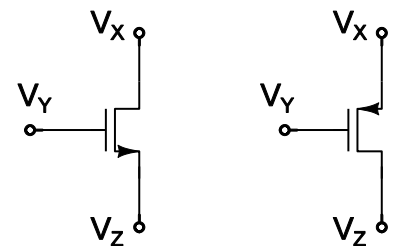
Q2: For the circuit shown to the right, assume $R_{B1} = 200k\Omega$, $R_{E1} = 2k\Omega$, $R_{C2} = 3k\Omega$, $R_{E2} = 3k\Omega$, and $V_{CC} = +9V$. Do NOT ignore base currents in your calculations.

Calculate the bias point parameters (I_C and V_{CE}) for both transistors.



Q3: Determine the operating region of the transistors for the combination of voltages listed below.

- $V_X = +5V$, $V_Y = 0V$, $V_Z = 0V$
- $V_X = +5V$, $V_Y = 0V$, $V_Z = -5V$
- $V_X = +5V$, $V_Y = +2V$, $V_Z = 0V$
- $V_X = 0V$, $V_Y = 0V$, $V_Z = -5V$
- $V_X = +5V$, $V_Y = -2V$, $V_Z = -5V$



Q4: For the circuits below, determine the drain currents and operating regions for the transistors where $\frac{W_1}{L_1} = 100$ and $\frac{W_2}{L_2} = 500$. Assume $R_D = 3k\Omega$, $R_{G1} = 100k\Omega$, $R_{G2} = 500k\Omega$, $R_S = 1k\Omega$, and $V_{DD} = -V_{SS} = +3V$.

