Q1: We would like to design a **full-wave** rectifier circuit according to the following requirements:

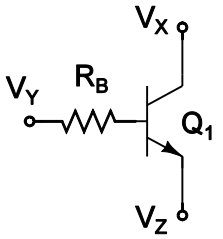
- Input AC voltage: $V_{IN} = 10\sin(2\pi \times 60 \times t)$;
- Output ripple voltage of less than $0.5V$ peak-to-peak;
- Constant load current of $100mA$.

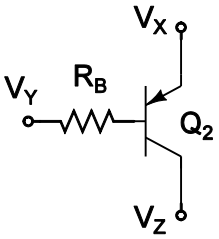
Answer the following questions:

a) What is the required capacitance to meet the specifications in the above?
b) What is the ***average*** DC voltage at the output of the rectifier? Assume $V_{D,on} = 0.6V$.
c) What is the **maximum** current through the diodes?

Q2: Determine the operating region of each of the transistors for the combination of voltages listed below.

a) $V_X = +5V,\ V_Y = 0V,\ V_Z = 0V$
b) $V_X = +5V,\ V_Y = 0V,\ V_Z = -5V$
c) $V_X = +5V,\ V_Y = +2V,\ V_Z = 0V$
d) $V_X = 0V,\ V_Y = 0V,\ V_Z = -5V$
e) $V_X = +5V,\ V_Y = -2V,\ V_Z = -5V$

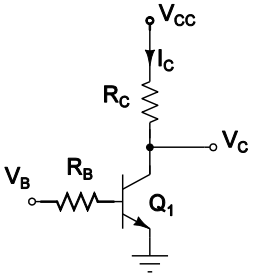


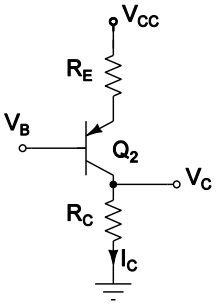


Q3: For the circuits shown here, determine the collector current and voltage for each of the transistors for the two cases listed below. Verify your assumed operating region for each case.

Assume $|V_{BE,on}| = 0.6V$, $|V_{CE,sat}| = 0.1V$,and $\beta = 100$ for all transistors (use $V_T = 25mV$); and $R_B = 250k\Omega$, $R_C = 5k\Omega$, and $R_E = 30k\Omega$.

a) $V_B = +2V$ and $V_{CC} = +10V$
b) $V_B = +10V$ and $V_{CC} = +10V$





Q4: Using the constant voltage model for the transistor, plot the input-output characteristic curve for the circuit (i.e., V_{OUT} vs V_{IN}) for $0 < V_{IN} < V_{CC}$. Label the breakpoints on your graph.

Assume $V_{CC} = +3V$, $R_C = 5k\Omega$, and $R_B = 100k\Omega$. For the transistor, assume $V_{BE,on} = 0.6V$, $\beta = 100$, and $V_{CE,sat} = 0.1V$ (use $V_T = 25mV$).