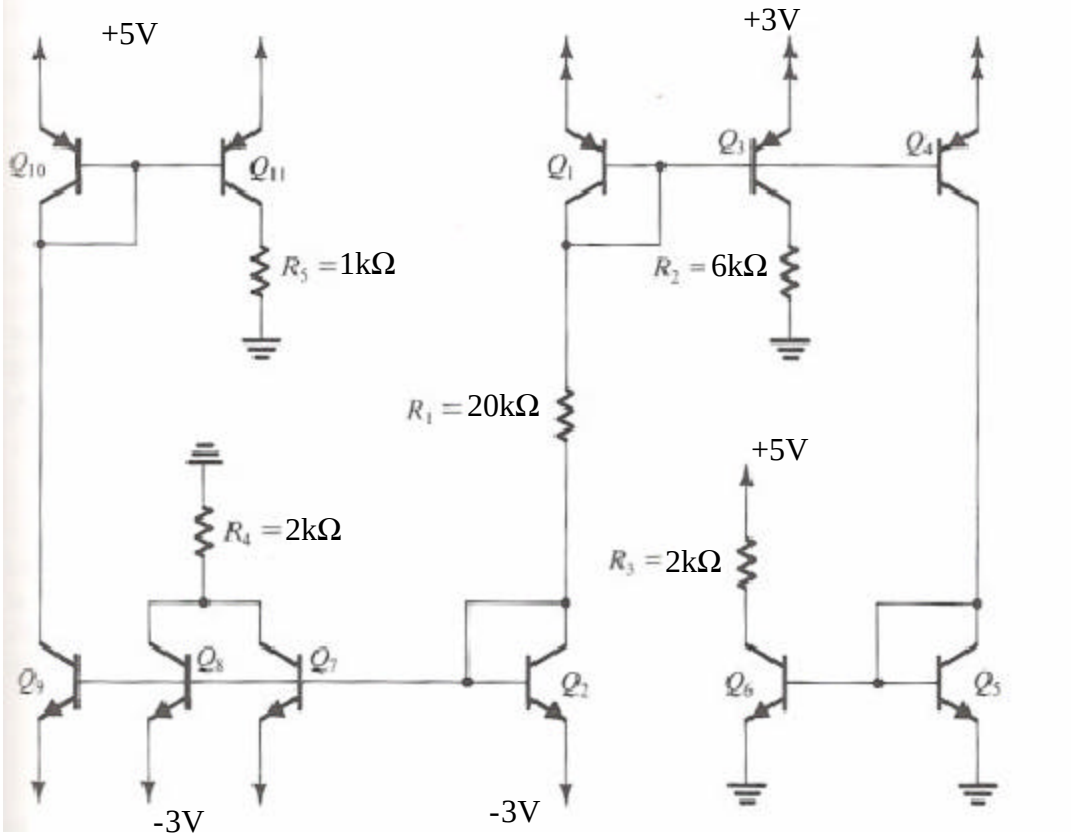
ECE3110 **Homework #2** **Fall 2005**

(Due Sept. 7 by 6pm in homework locker)

1. Design the circuit of Fig. 6.4 to obtain an output current whose nominal value is 25μA. Find R when Q_1 and Q_2 are matched with channel lengths of 1μm, channel widths of 10μm, V_t=1V, k'_n=100μA/V^2, V_A=20V, V_{DD}= 3V and I_{REF}=25μA. What is the minimum allowable value of Vo for proper operation? What is the output resistance? What is the change in the output current when Vo is changed by +1V?

2. Design the circuit of Fig. 6.10 to obtain an output current whose nominal value is 100μm when V_o is 2V. Find R, I_{REF}, V_{omin} when $I_s=10^{-15}$A, β=100, V_{CC}=6V, and V_A=60V. If V_o is changed to 5V, what is I_o?

3. Find voltages at all nodes and currents through all branches in the circuit below. Assume $|V_{BE}|$ = 0.7V and β=∞.



4. Design a current source that generates a constant current I_o=50μA that operates from a 3V supply. State all values if resistors are used. Assume that V_{BE} is 0.7V at a current of 1mA and neglect the effect of a finite β. You can only use resistors that are less than 50kΩ.