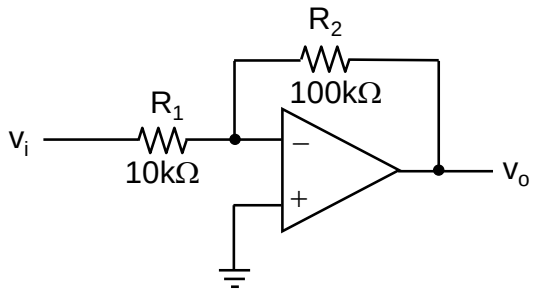
MS Exam: ECE102 (Spring 2014)

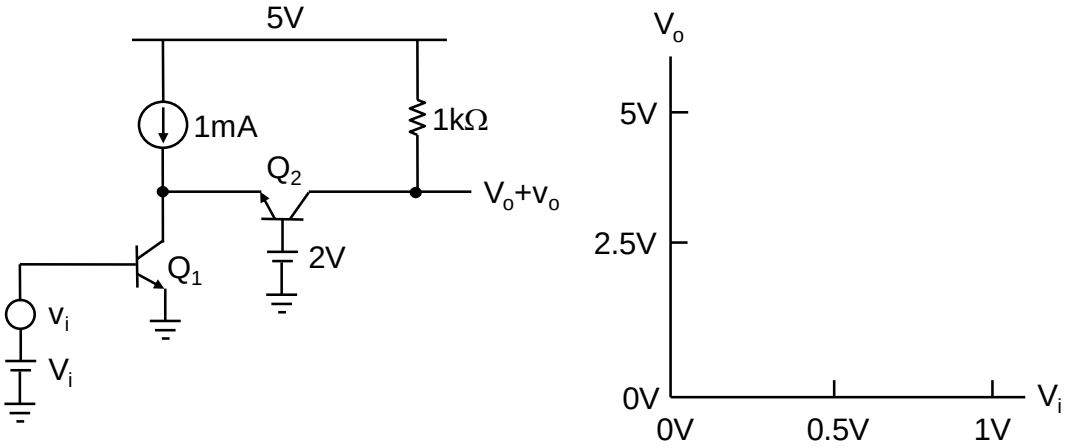
Problem #1:



A feedback amplifier is made using a two-stage opamp as shown above. The Miller-compensated opamp has a DC gain of 100dB and a bandwidth of 11Hz. Assume it has a fixed non-dominant pole at 10MHz.

1. What is the -3dB bandwidth of this amplifier in Hz unit?
2. Estimate the phase margin of this negative feedback.
3. When the AC input is $v_i(t) = \sin\{2\pi(100\text{kHz})t\}$, write the equation of the output $v_o(t)$.
4. What is the new -3dB bandwidth in Hz unit if R_2 is bypassed with a 160pF capacitor?
5. Repeat 3 in the case of 4.

Problem #2:



Use the following parameters: β=100, V_T = 25mV, V_{CESat}=0.2V, and V_{BE}=0.7V.

1. Sketch the DC transfer function of V_o vs. V_i.
2. Estimate the low-frequency small-signal gain v_o/v_i when V_o = 3.5V.
3. Also estimate the -3dB small-signal bandwidth when V_o = 3.5V in Hz unit assuming the next stage loading capacitance is about 16pF.
4. What is I_{C1} when both transistors Q_1 and Q_2 are saturated?
5. Estimate the driving-point small-signal input resistance seen at the input port?