Name:	**Student ID #:**

University of California at Berkeley
Electrical Engineering and Computer Science
EE105 Midterm Examination #1
March 5, 2014
(50 minutes)

CLOSED BOOK; Two standard 8.5" x 11" sheet of notes (both sides) permitted

IMPORTANT NOTES

- Read each problem completely and thoroughly before beginning to work on it
- Summarize all your answers in the boxes provided on these exam sheets
- Show your work in the space provided so we can check your work and scan for partial credit
- Remember to put your name in the space above

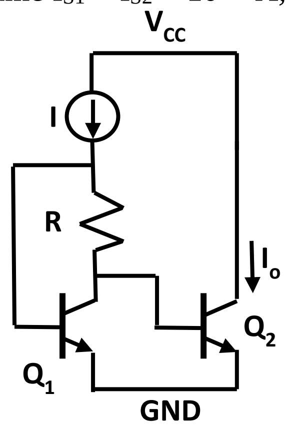
Problem #	Points Possible	Score
1	20	
2	40	
3	40	
Total	100	

1. True/False questions (20 points)

For each of the following statements, state "T" for true or "F" for false. No explanation necessary. Correct answers are worth +2 point and incorrect answers yield -2 point. 0 points for unanswered questions. Your minimum total score on this problem is zero points.

(a) The input resistance of a common-base stage depends on the load resistance, R_L. (Include r_o)	
(b) Assuming a constant current source load, the voltage gain, A_V, of a cascode common-emitter amplifier is twice as large as that of a common-emitter amplifier without cascode.	
(c) The Early voltage of a BJT can be increased by increasing the doping density in the base region.	
(d) In an abrupt-junction pn diode, the depletion region is greater on the more lightly doped side.	
(e) In an abrupt-junction pn diode, the potential drop is greater on the more lightly doped side.	
(f) In a common-emitter amplifier with a fixed load resistance, R_L, properly biased for maximum signal swing at the output, the voltage gain is doubled as the power supply voltage, V_{CC}, is doubled. Assume $V_{CE}(sat) = 0V$	
(g) Cascoding can be used to increase the small-signal output resistance of a common-emitter stage.	
(h) In a common-collector amplifier with an ideal current source connected from the emitter to ground, the small-signal input resistance is r_π.	
(i) The combination of a degenerated common-emitter amplifier cascaded with a common-collector amplifier is suitable for current amplification.	
(j) Oski got his/her undergraduate degree at Stanford.	

2. DC Bias Circuits (40 points). In the circuit below, all devices operate in the forward-active region (FAR). In all cases, assume $I_{S1} = I_{S2} = 10^{-17}$ A, I = 1 mA and R = 100 Ω.



(a) Find the value of I_O with $\beta_1 = \beta_2 = \infty$.

(a) I_O =	

(b) Find the value of I_O with $\beta_1 = 100$ and $\beta_2 = \infty$.

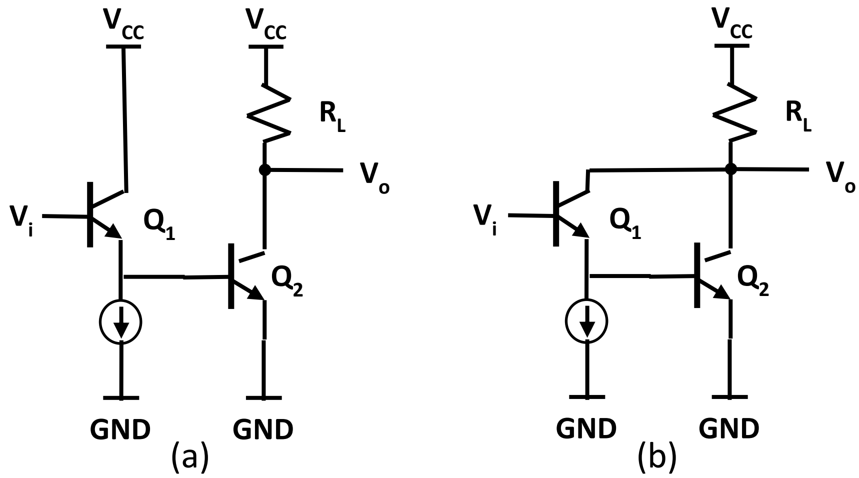
(b) I_O =	

(c) Find the value of I_O with $\beta_1 = \infty$ and $\beta_2 = 100$.

(c) I_O =	

3. (40 points) Small-signal gain calculations. In the circuits below, all devices operate in the forward-active region (FAR). In both cases, assume for DC $V_{BE1} = V_{BE2}$, $\beta_1 = \beta_2 = \infty$ and $V_{A1} = V_{A2} = \infty$.

Derive expressions for the small-signal voltage gains, $A_V = V_O/Vi$ and compute the value of the ratio of the two gains, $A_V(b)/A_V(a)$.



Blank Work Sheet for Problem #3.

Vo/Vi(a) =	
Vo/Vi(b) =	
Gain Ratio =	