ECE-255
Exam III
April/13/2009

Name: _____
(Please print clearly)

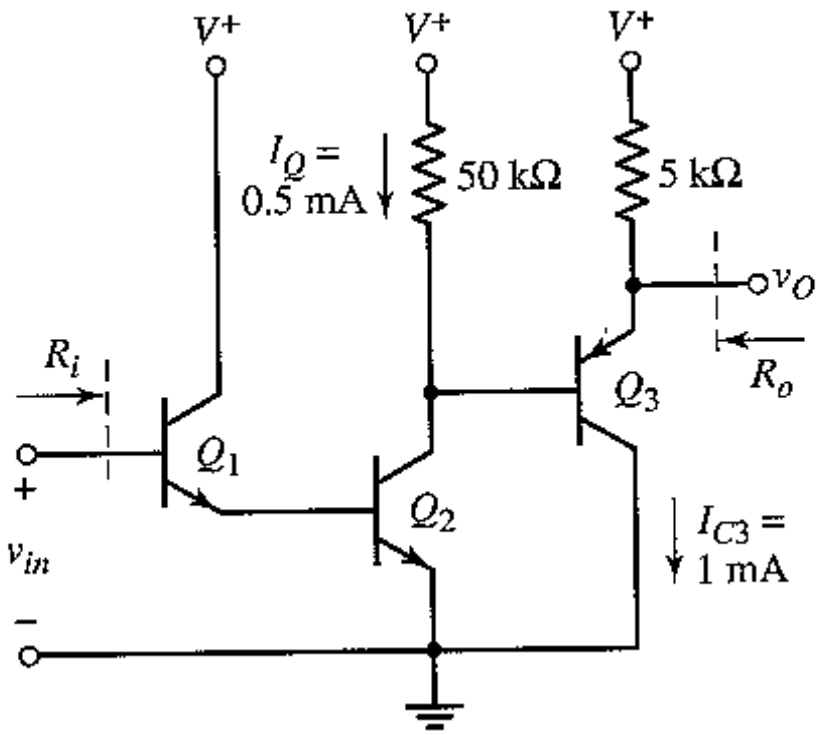
Student ID: _____

INSTRUCTIONS

- This is a closed book, closed notes exam.
- Carefully mark your multiple choice answers on the scantron form. Work on multiple choice problems and marked answers in the test booklet will not be graded. Nothing is to be on the seat beside you.
- When the exam ends, all writing is to stop. This is not negotiable. No writing while turning in the exam/scantron or risk an F in the exam.
- All students are expected to abide by the customary ethical standards of the university, i.e., your answers must reflect only your own knowledge and reasoning ability. As a reminder, at the very minimum, cheating will result in a zero on the exam and possibly an F in the course.
- Communicating with any of your classmates, in any language, by any means, for any reason, at any time between the official start of the exam and the official end of the exam is grounds for immediate ejection from the exam site and loss of all credit for this exercise.

Perform all calculations to two decimal points

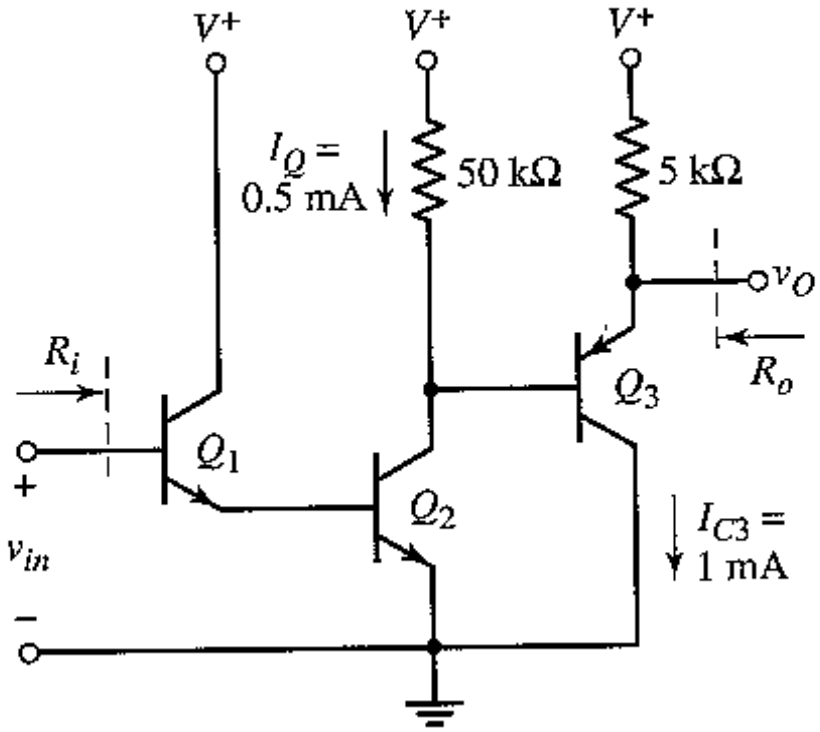
1) What is the configuration of the multi-stage amplifier shown below?



(1) CC-CE-CE **(2) CC-CE-CC** (3) CE-CE-CC (4) CE-CE-CE
(5) CB-CE-CC (6) None of the above

2) For the circuit shown below R_i=? (Bias currents for Q_2 and Q_3 are indicated on the Figure)

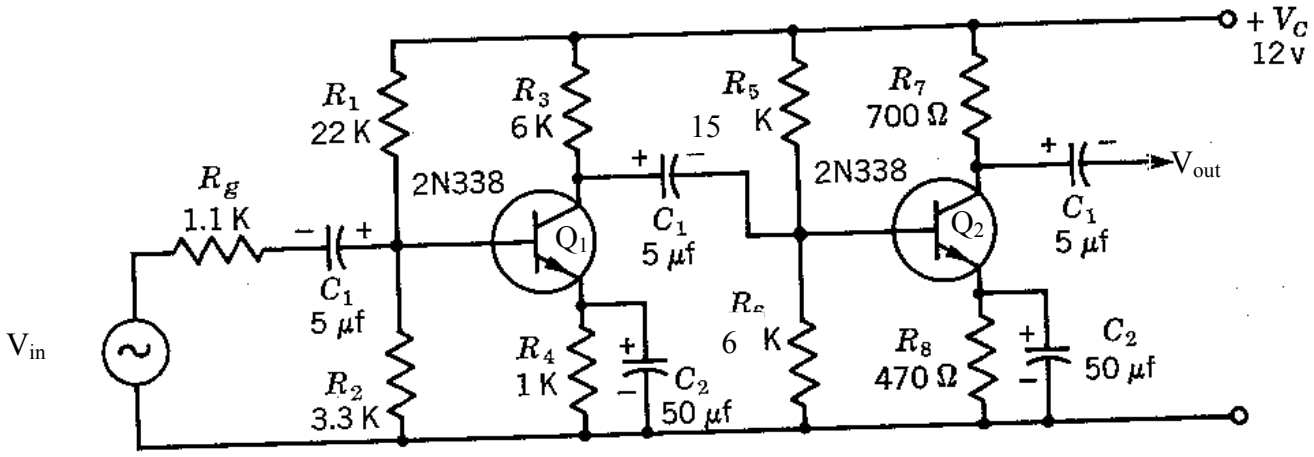
Assume β=100, V_A=∞, V_{BE} (on)=0.7V, V_T=25mA. (Assume α≈1)



(1) ≈ 500kΩ (2) ≈ 5kΩ (3) ≈ 250kΩ (4) ≈ 1.5MkΩ

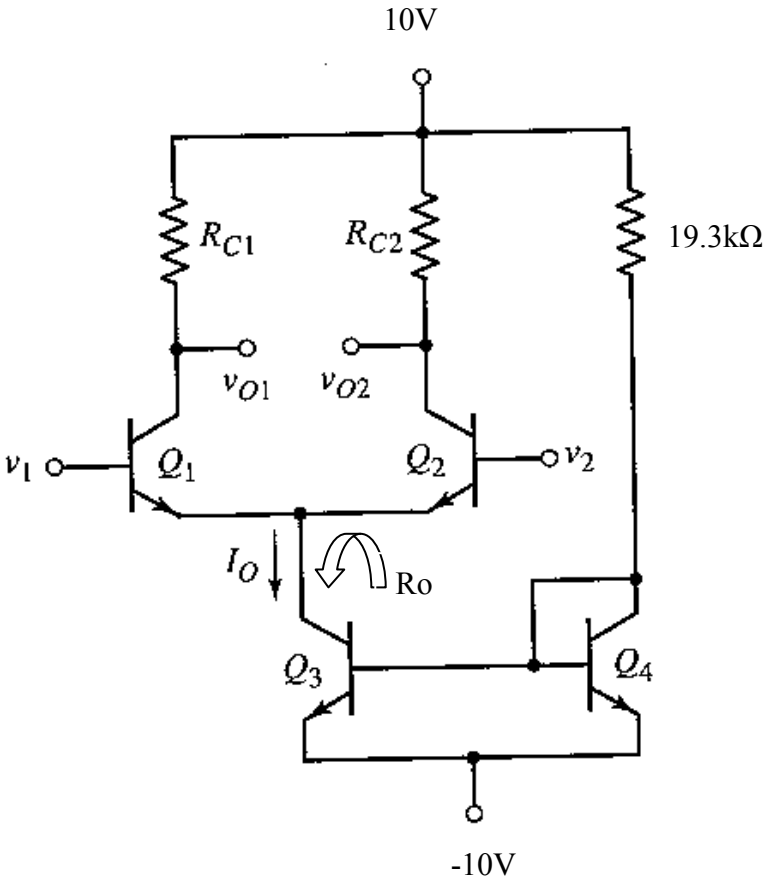
(5) ≈ 1MΩ (6) None of the above

3) What is the overall gain ($|A_v|=|V_o/V_{in}|$) for the two stage amplifier shown below? I_{C2}=6mA and I_{C1}=1mA, Assume β=100, $V_A=\infty$, V_{BEon}=0.7V



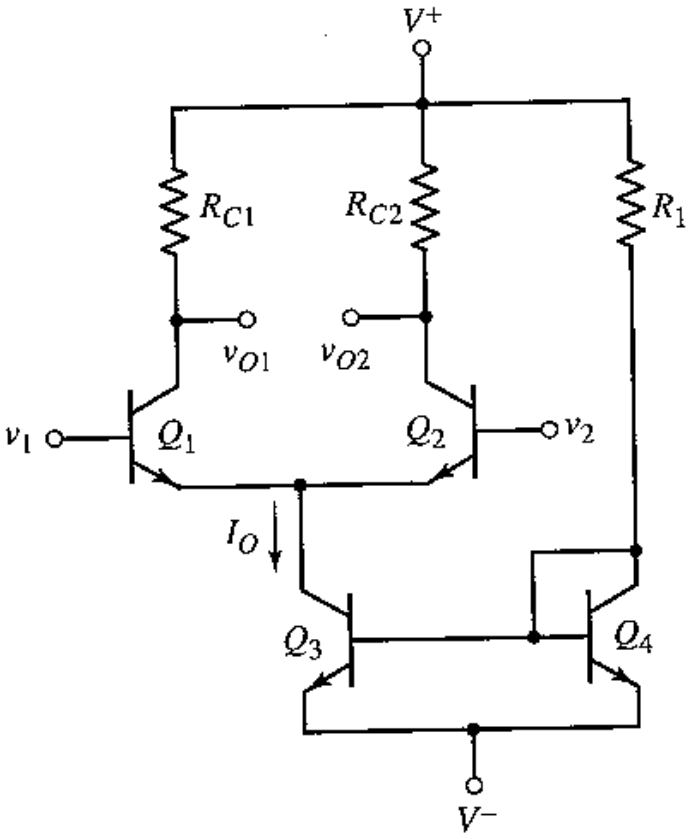
(1) ~ 168 (2) ~ 14 **(3) ~ 1320** (4) ~1
(5) ~2352 (6) None of the above

4) For the differential amplifier shown below, what is the tail current (Io) and output impedance (Ro) of the current mirror?? Assume β=∞ (i.e., ignore base currents in Q_3 and Q_4), V_A=80V, V_{BEon}=0.7V. Assume Q_3 and Q_4 are identical.



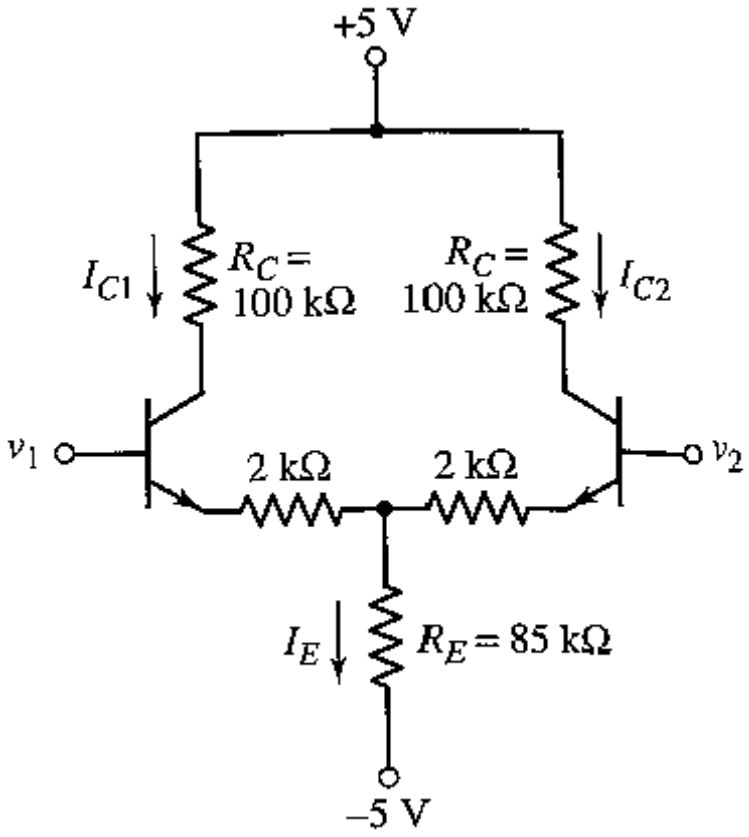
(1) Io=1mA, Ro=∞
(2) Io=1mA, Ro=80kΩ
(3) Io=0.47mA, Ro=40kΩ
(4) Io=1mA, Ro=40kΩ
(5) Io=2mA, Ro=∞
(6) None of the above

5) For the differential amplifier shown below, what is the common-mode gain ($|A_{cm}|$) if Io=1mA and $R_{C1}=R_{C2}=10k\Omega$? Assume $\beta=\infty$, $V_{BE}(ON)=0.7V$, $V_A=100V$



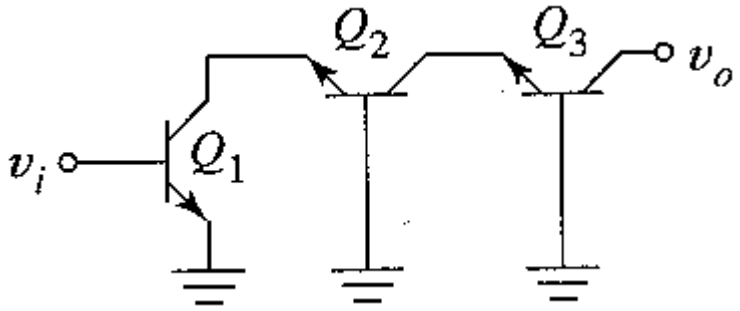
(1) 0.05 (2) 0 (3) 1 **(4)** 0.1
(5) ∞ (6) None of the above

6) What is the common-mode gain ($|A_v|$) for the circuit shown below? (use the half circuit model)



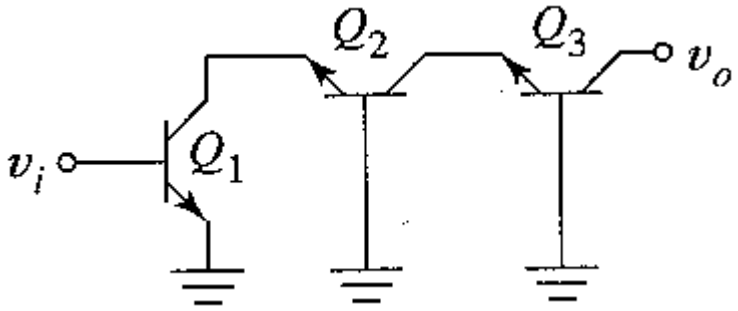
(1) 50 (2) 0.02 (3) 1 **(4)** 25
(5) 0.58 (6) None of the above

7) What is the configuration of the multi-stage amplifier shown below?



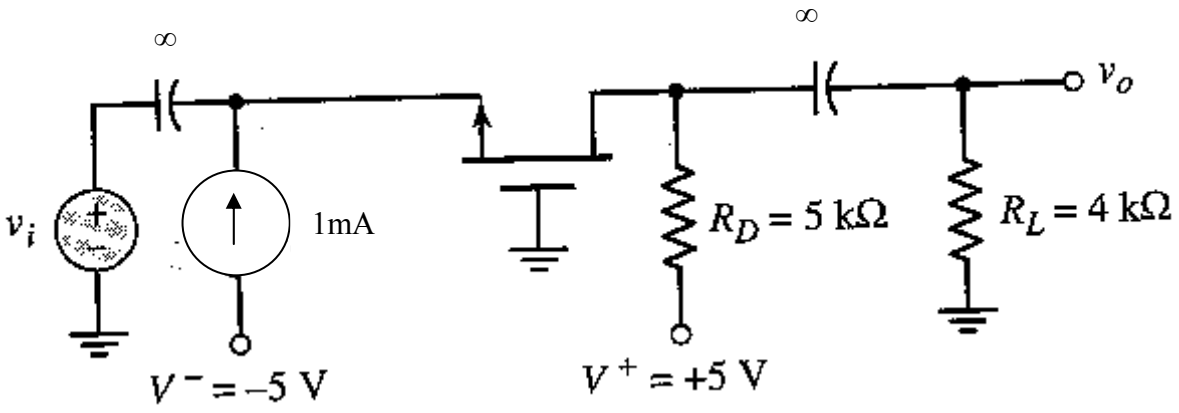
(1) CE-CE-CB (2) CE-CB-CE (3) CE-CE-CC **(4) CE-CB-CB**
(5) CC-CB-CB (6) None of the above

8) For the amplifier shown below known as double cascade, what is the gain |Av|? All transistors are identical.
Note since $I_{c1}=I_{c2}=I_{c3}$, therefore $g_{m1}=g_{m2}=g_{m3}$, $r_{o1}=r_{o2}=r_{o3}$, $r_{\pi 1}= r_{\pi 1}= r_{\pi 1}$
Assume $r_o>>r_e$



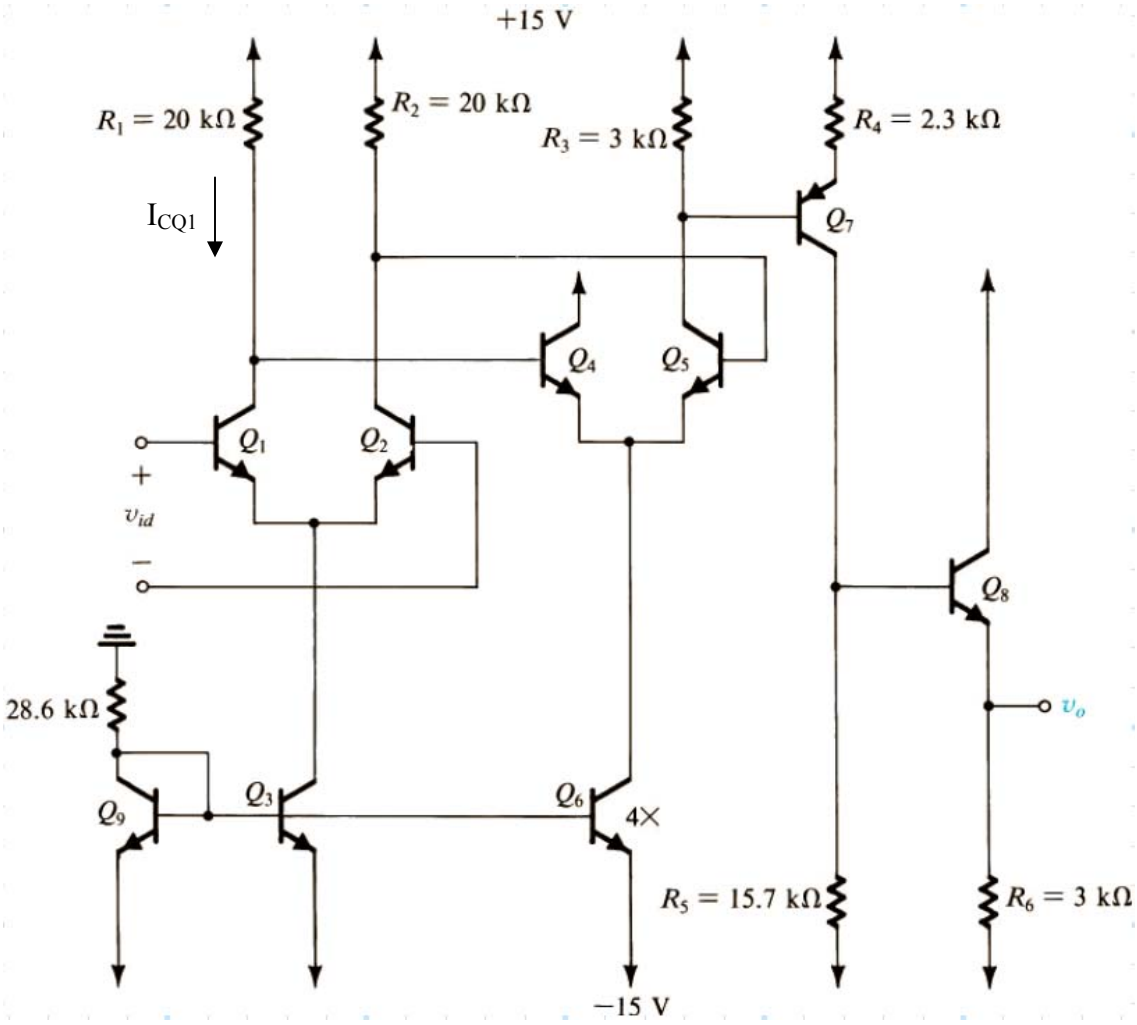
(1) $g_m r_o$ (2) $g_m^3 r_o^3$ (3) 1 (4) $g_m^2 r_o^2$
(5) $g_m r_o/r_\pi$ (6) None of the above

9) For the common gate amplifier shown below, what is the overall gain (Vo/Vi)? Assume V_{tn}=1V, K_n=3mA/V^2, and λ=0



(1) Gain=1
(2) Gain=9.8
(3) Gain=22
(4) Gain=5.5
(5) Gain=88
(6) None of the above

10) Figure below is internal structure of an OpAmp, what is the current I_{CQ1}? Assume Q_1 and Q_2 are identical, β=100, and $V_{BE}(ON)$=0.7V



(1) 0.5mA (2) 0mA (3) **0.25mA** (4) 0.27mA
(5) 1mA (6) None of the above