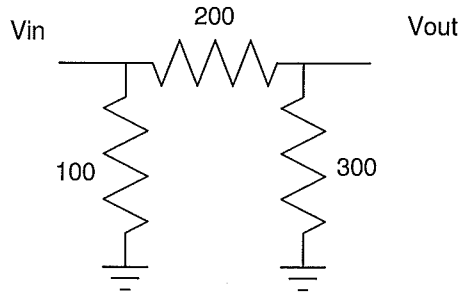
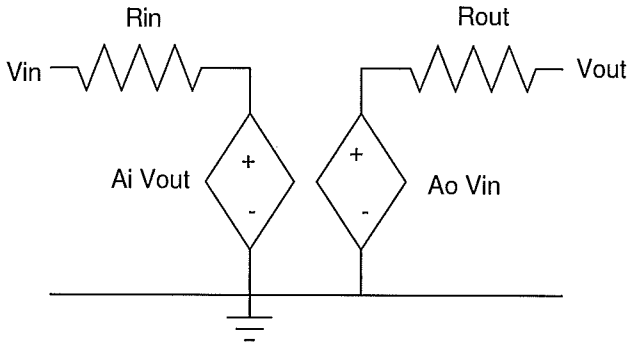
ECE 321 - Quiz #4. Name _____

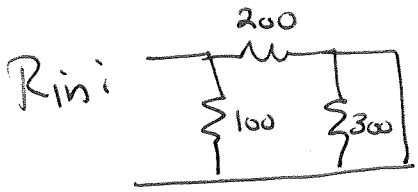
2-Port Models, Common Emitter Amplifiers. April 26, 2018

1) Find the 2-port model for the following circuit:

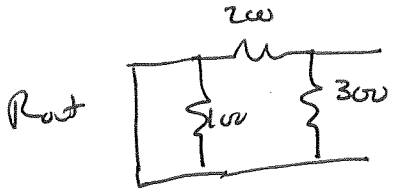
Rin	Ai	Rout	Ao
66.67	1/3	120	3/5



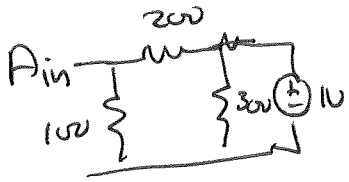




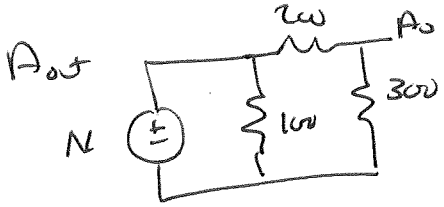
$R_{in} = 100 \| 200$
$= 66.67$



$R_{out} = 200 \| 300 = 120$



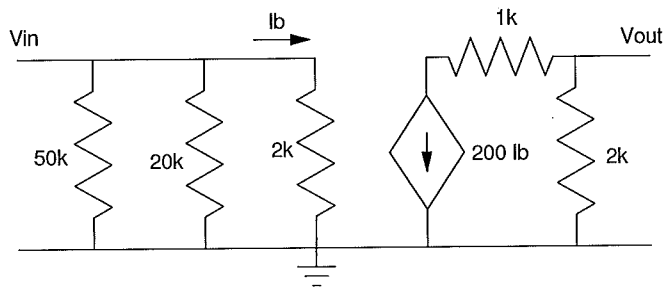
$A_{in} = 1/3$

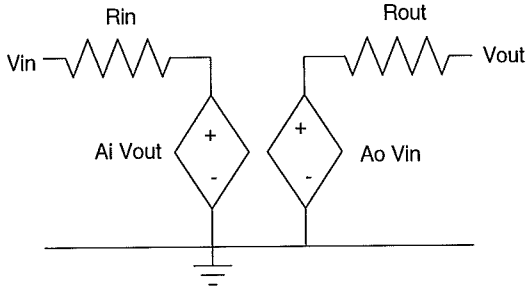


$A_o = \left(\frac{3}{5}\right)$

2) Find the 2-port parameters for the following circuit:

Rin	Ai	Rout	Ao
1754	0	2k	-200





$R_{in} = 50k \parallel 20k \parallel 2k$

$= 1754$

$A_i = 0$

R_{out}:

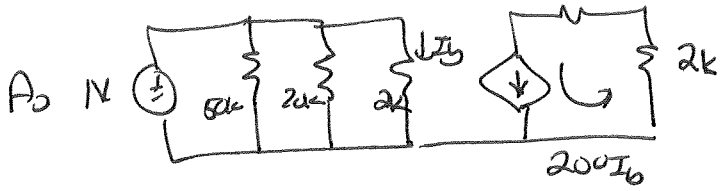
Set $V_{in} = 0$

$I_b = 0$

$\beta I_b = 0$

$R_{out} = 2k$

A_v:



$I_b = \frac{1}{2k}$

$V_o = -2k(200 I_b)$

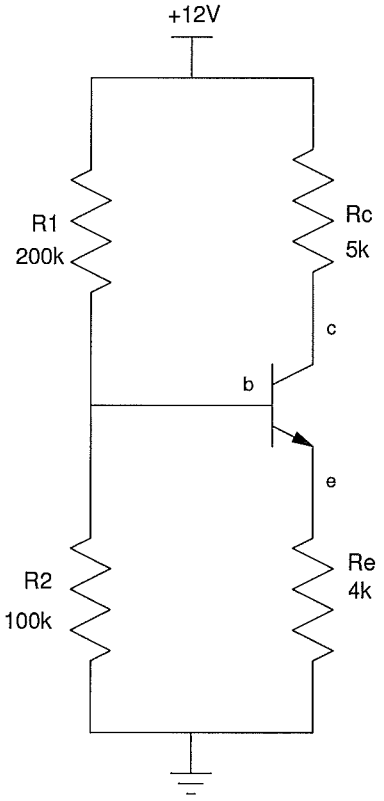
$= -2k(200)\left(\frac{1}{2k}\right)$

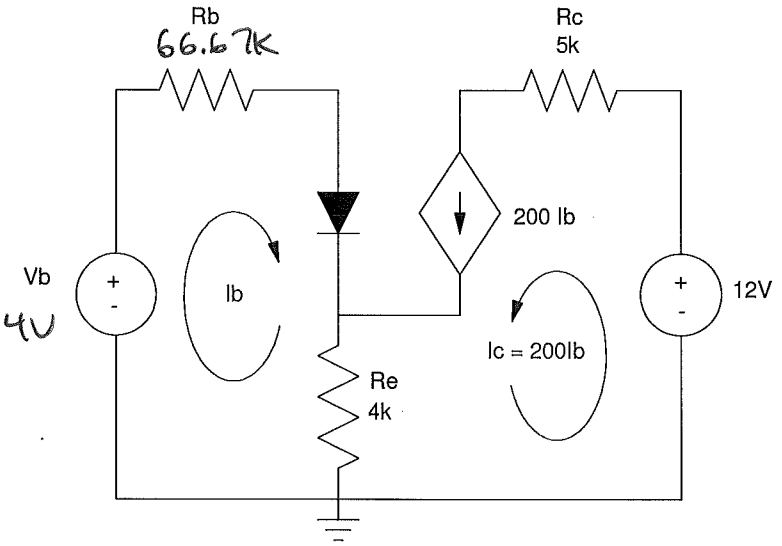
$= -200$

3) (Analysis) Determine the Thevenin equivalent for R1 / R2 / 12V source and the Q-point (Vce, Ic) for the following circuit. Asssume

- $\beta = 200$

Vb (Vth)	Rb (Rth)	Vce	Ic
66.67K	4.00V	5.16V	758μA





$R_b = R_1 \| R_2$

$= 66.66K$

$V_b = \left(\frac{100k}{100k + 200k}\right) \cdot 12$

$V_b = 4V$

$I_b = \frac{4 - 0.7}{66.67k + (1+200) \cdot 4k}$

$I_b = 3.79\mu A$

$I_c = 200\ I_b = 758\mu A$

$V_c = 12 - 5k \cdot I_c = 8.21V$

$V_e = 4k(I_b + I_c) = 3.047V$

$V_{ce} = 5.16V$

4) Find R1 and R2 so that

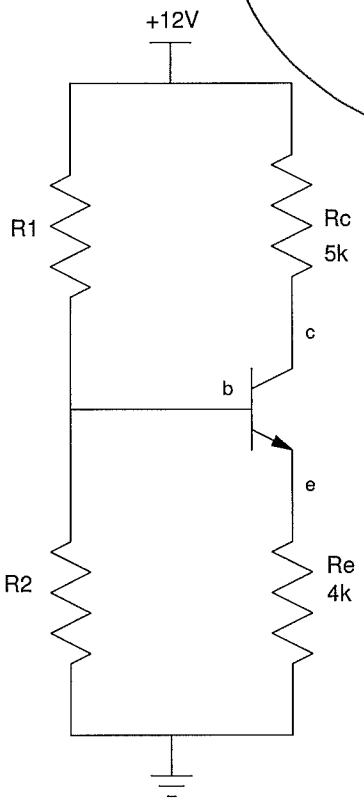
- The Q-point is stabilzied for variations in β ($(1+\beta)R_e >> R_b$), and
- The Q-point is Vce = 6V (Ic = 665.2uA).

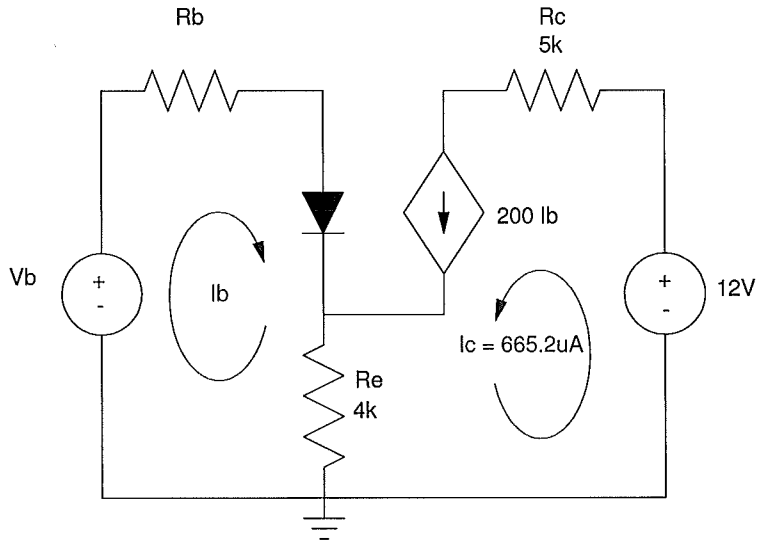
R1	R2	Vb	Rb
263k	114k	3.64	80k

Voltage division gives 3.64V

a << 804k

parallel = 80k





$(1+\beta)R_e >> R_b$

$804k >> R_b$

Let $R_b = 80K$

$V_b = R_b I_b + 0.7 + 4k(I_b + I_c)$

$V_b = 3.64$

$R_1 \| R_2 = 80k$

$\left(\frac{R_2}{R_1+R_2}\right) 12V = 3.64V$

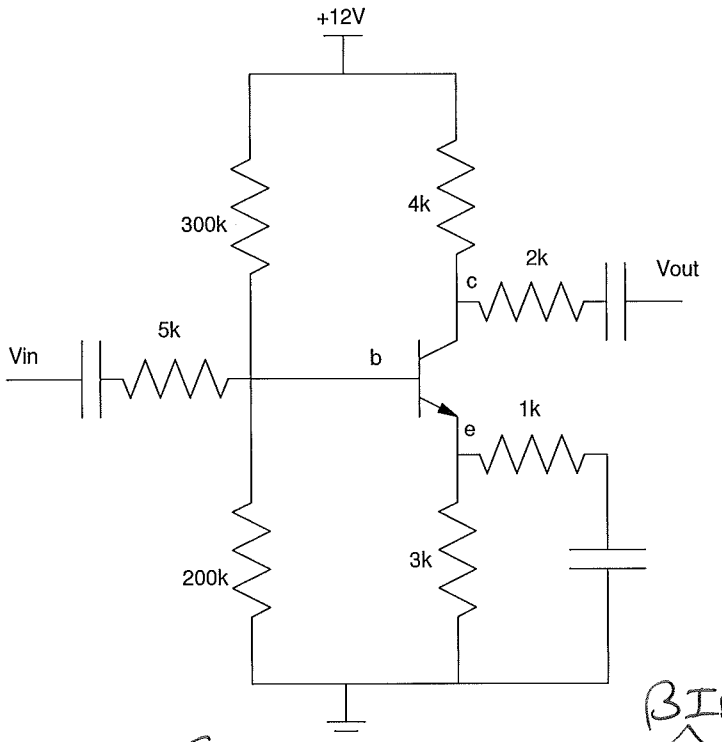
$R_1 = \left(\frac{12V}{3.64V}\right) \cdot 80K$

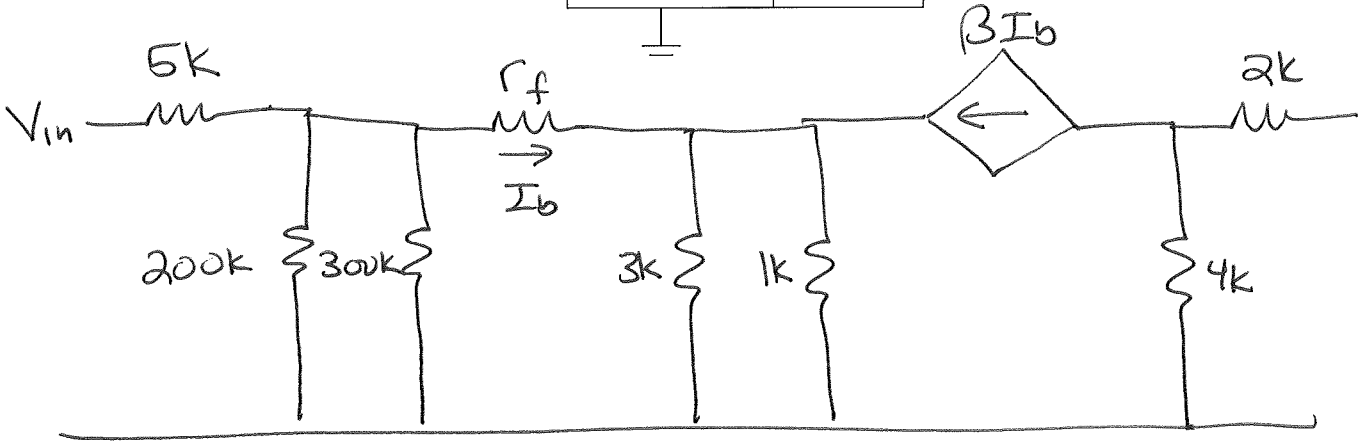
$R_1 = 263k$

$R_2 = 114k$

5) Draw the small-signal model for the following common-emitter amplifier. Assume

- All capacitors are large $\left(\left(\frac{1}{j\omega C}\right) \approx 0\right)$
- $\beta = 200$
- $r_f = 2500\Omega$





Bernie Sanders vs. Godzilla Bonus!!! Who has more kids: Bernie Sanders or Godzilla?

Lani (one) / two +

- note: Clones count as kids

Biollante: Clone of Godzilla, Rose Bush, Mad Scientist's daughter

Baby Godzilla (in Godzilla vs Destroyah)

Space Godzilla: Godzilla DNA exposed to radiation from a black hole

Son of Godzilla: (he was adopted... doesn't count)