Name: _____ (please print)

Signature: _____

ECE 3355
Quiz #5
July 20, 2017

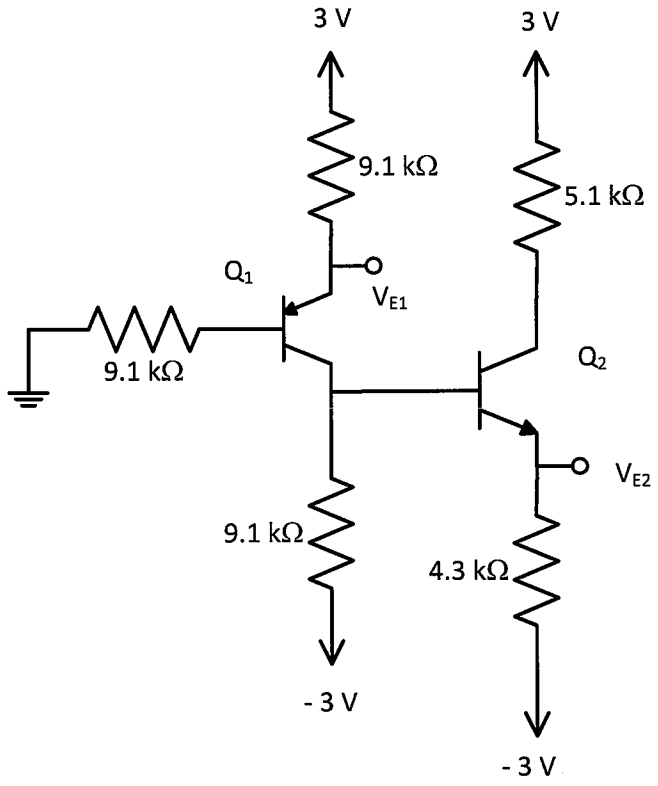
1. You may have an 8 ½ x 11" crib sheet, but no other materials, and no communication devices of any kind.
2. Show all work necessary to complete the problem on these pages. If you go on to another page, indicate clearly where your work can be found. A solution without the work shown will receive no credit.
3. Show all units in expressions and figures.
4. Do not use red ink.
5. You will have 25 minutes to work on this quiz.

_____/25

Room for extra work

In the circuit below, neither of the BJTs is in cutoff. Find V_{E1} and V_{E2}. For both devices, $\beta = 100$ and the magnitude of $V_{CE,sat} = 0.3$ V.

To receive full credit, you must prove that your assumption as to the state of the BJTs is correct. Credit will be given for incorrect assumptions if you prove that the assumptions are incorrect.



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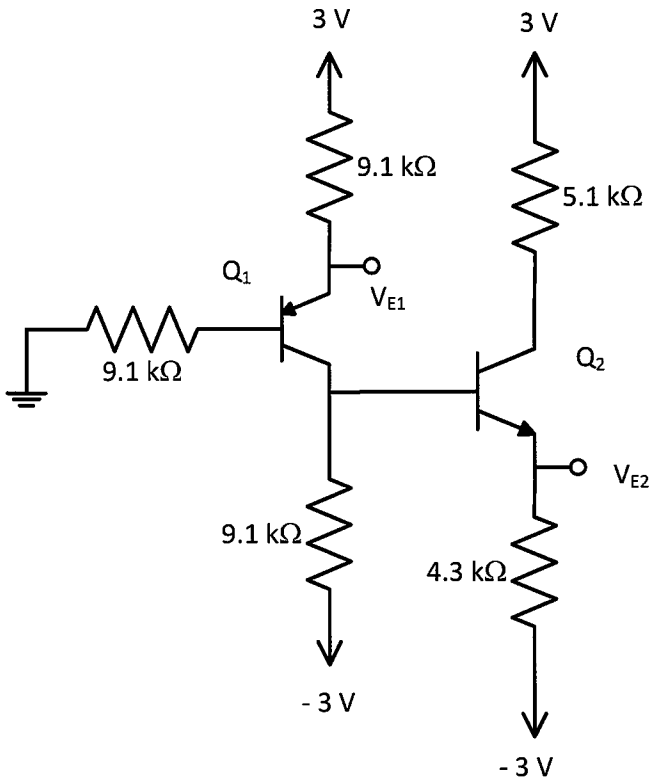
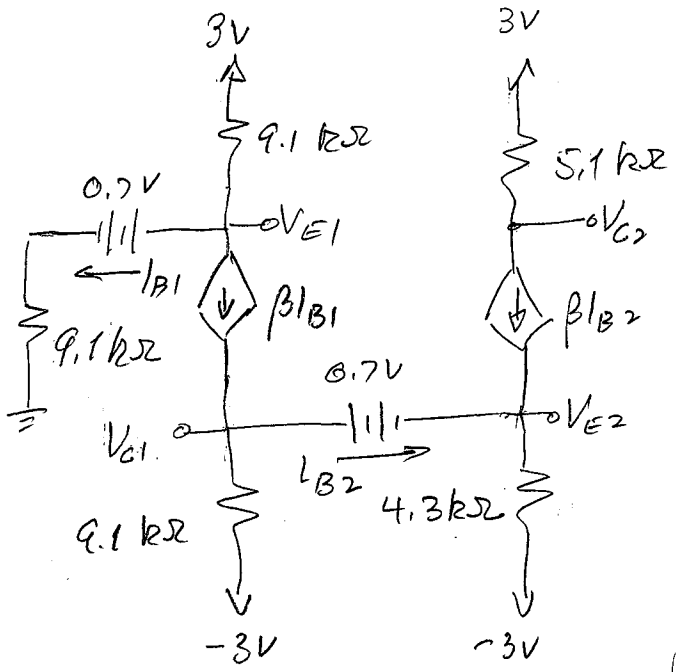


Looking at the flow of charge carriers, it seems clear that holes will move from Q1 emitter into Q1 base and then out through the collector. Same for electrons in Q2. So we assume active region for both.

Room for extra work



$$\frac{V_{E1}-3}{9100}+\frac{V_{E1}-0.7}{9100}+\beta\frac{V_{E1}-0.7}{9100}=0$$

$$\Rightarrow \boxed{V_{E1}=0.7225\,V}$$ ✓

$$\boxed{I_{B1}=\frac{V_{E1}-0.7}{9100}=2.473\,\mu A}$$

Supernode V_{C2}, V_{E2}:

$$\frac{V_{E2}+3}{4300}-\beta I_{B2}+\frac{V_{E2}+0.7+3}{9100}-\beta I_{B1}=0$$

$$(\beta+1)I_{B2}=\frac{V_{E2}+3}{4300}$$

$$\Rightarrow \boxed{V_{E2}=-1.481\,V}$$

$$\boxed{I_{B2}=3.497\,\mu A}$$ ✓

TEST:

$I_{B1}>0$

$V_{CE1}<-0.3V$

$I_{B2}>0$

$V_{CE2}>0.3V$

$$\boxed{V_{C1}=0.7+V_{E2}=-0.781\,V}$$

$$\boxed{V_{C2}=3-\beta I_{B2}\cdot 5100=1.217\,V}$$

$$\boxed{V_{C1}-V_{E1}=-1.504\,V}$$ ✓

$$\boxed{V_{C2}-V_{E2}=2.698\,V}$$ ✓

So tests check out and

$$\boxed{V_{E1}=0.7225\,V}$$

$$\boxed{V_{E2}=-1.481\,V}$$