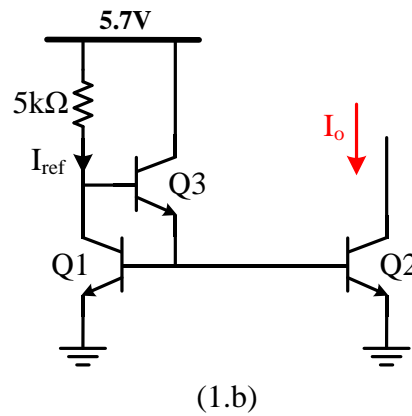
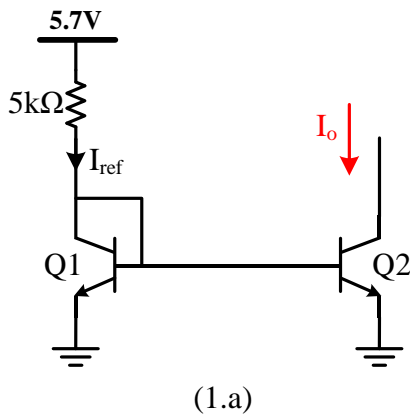


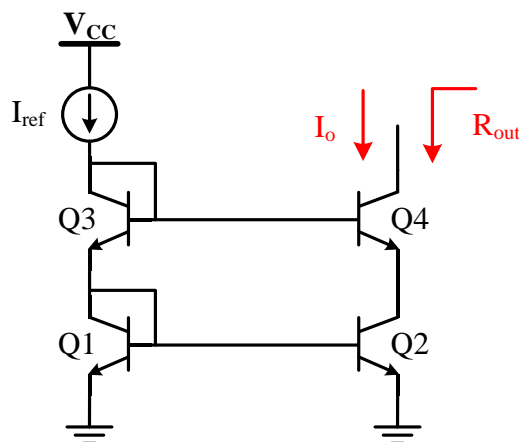
Electronics 2, Assignment #5, Current sources and Current mirrors.

1- For the following circuits, the transistors are the same and $V_{BE} = 0.7V$.

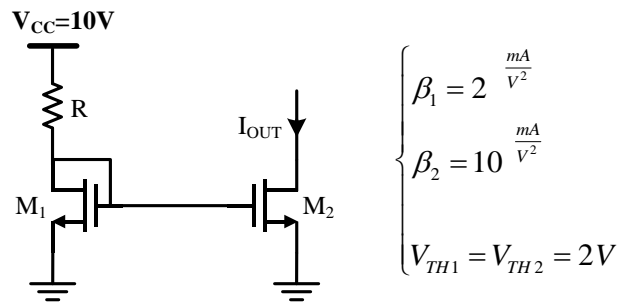
- Calculate I_{ref} in fig. 1.a.
- Determine I_o / I_{ref} in terms of β and compute its value for $\beta = 50, \beta = 200, \beta = \infty$. Discuss about the results (Fig. 1.a).
- In order to alleviate the undesirable effect of β in BJT current mirrors, the circuit which is depicted in fig. 1.b can be used. For this circuit, calculate I_o / I_{ref} and compare the results with those in (b). Assume $\beta = 50$.



- The following circuit is known as the “cascade” current-mirror. Determine the output current and the output resistance (Assume $\lambda \neq 0$ and neglect β effect). What are the advantages of this configuration over the simple current-mirror scheme?

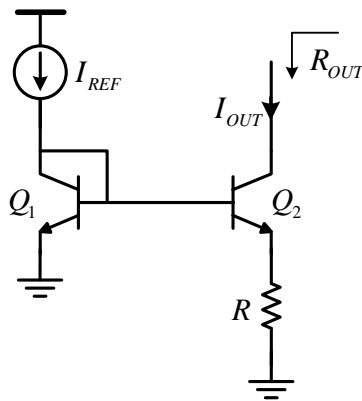


3- Specify the value of R so that $I_{OUT} = 5 \text{ mA}$.



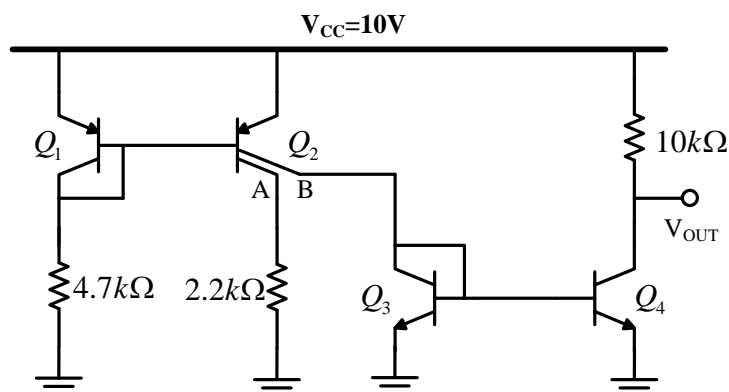
4- In the following circuit,

- Determine the output resistance. Assume that the current source is ideal.
- Specify R such a way that $I_{REF} = 2 \times I_{OUT}$. The transistors are the same and $\beta \gg 1$.

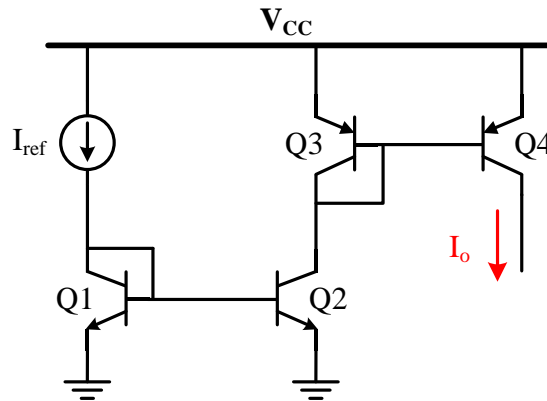


5- In the following circuit, all of the transistors are the same. The effective area of the collector “A” of Q_2 is 3 times larger than the effective area of the collector “B” of Q_2 . Calculate the output voltage.

(Hint: Q_2 is a transistors with two collector terminals, which, their currents are proportional to their effective areas. The total effective collector area of Q_2 is the same as that of Q_1).



- 6- In the following circuit, specify a relation for I_o in terms of I_{ref} (neglect β and λ effects). The collector areas of Q_2 and Q_4 is 2 times larger than Q_1 and the collector area of Q_3 is 3 times larger than Q_1 .



Good Luck- M.R. Ashraf