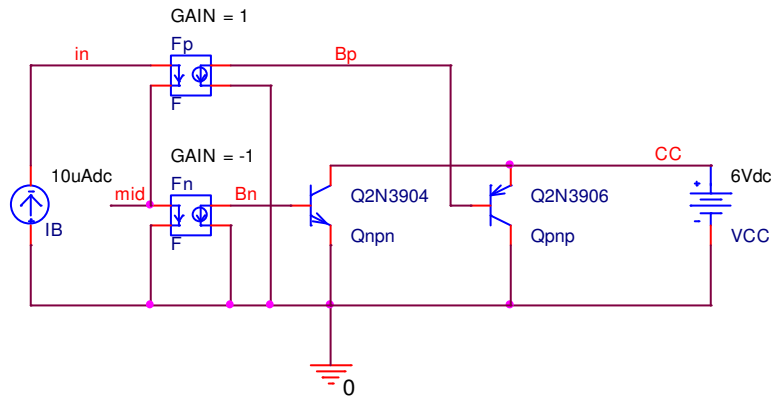


1. (40 points, BJT curves)

a) For the following circuit run curves for  $I_C$  versus  $V_{CC}$  with  $0 \leq I_B \leq 40 \mu A$  in  $10 \mu A$  steps.

b) If the Q points are at  $V_{CE_{npn}} = 3 = -V_{CE_{pnp}}$  and  $|I_C| = 3 mA$ , give the  $g_m$ 's  $g_{\pi}$ 's and  $g_o$ 's for both the npn and the pnp



2. (60 points, Current Mirrors)

In the following circuit from Homework 2 replace the transistors by BJTs (2n3904 & 2n3906). Use PSpice DC runs varying  $V_{dd}$  near 5V to obtain the desired results.

- With parameterized  $R_{in}$  for  $100 \leq R_{par} \leq 100K$  in logarithmic steps, 1 curve per step, determine the resulting currents into all the transistors. Show the  $I_{Cn}$ 's in one plot and the  $I_{Cp}$ 's in another)
- Over the same range of  $R_{in}$  determine the voltages at in, mid, and out
- Since the currents are supposed to be equal, explain why they are not.

