ECE 320: Handout #13
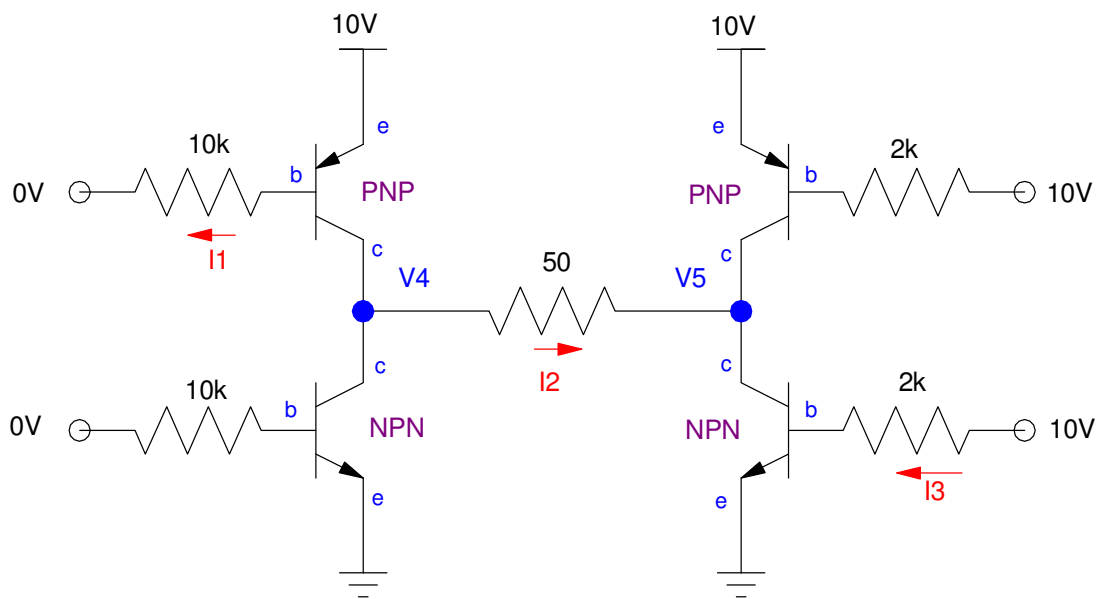
H Bridges

Determine the voltages and currents. Assume 3904 and 3906 transistors
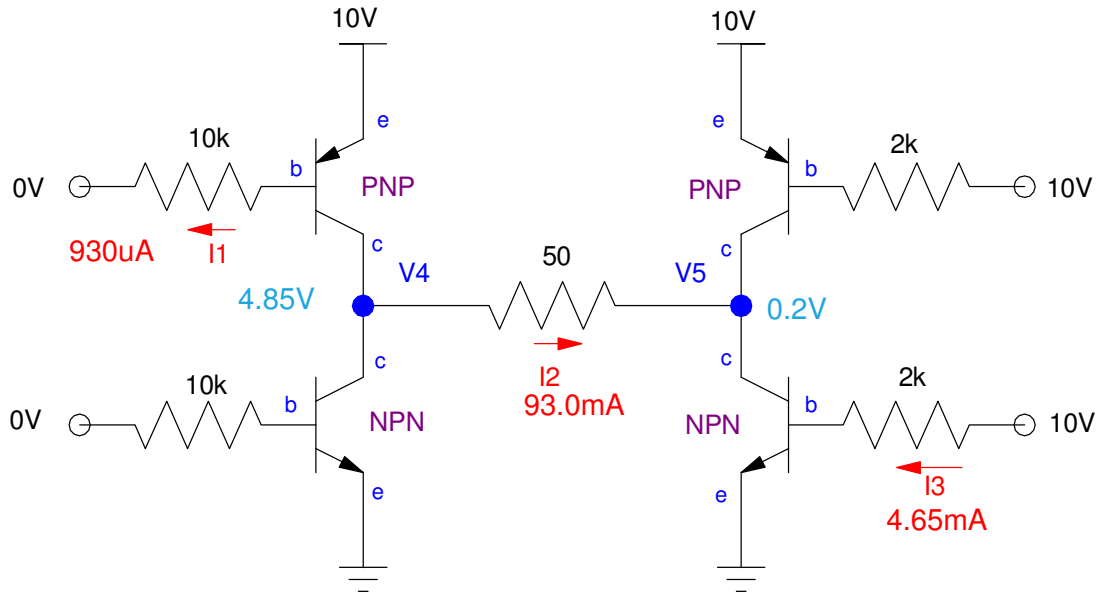
- $|Vbe| = 0.7V$
- $|Vce(sat)| = 0.2V$
- $\beta = 100$

Modify the circuit so that the transistors are saturated when on

Solution:

Determine the voltages and currents. Assume 3904 and 3906 transistors

10V   10V

10k   2k

0V   PNP   PNP   10V

930uA   I1   50   V5

V4   4.85V   0.2V

10k   2k

0V   NPN   I2   NPN   10V

93.0mA   I3
4.65mA

Current   allows....

$$I_1 = \left(\frac{10-0.7}{10k} \right) = 930\mu A \qquad\qquad \beta I_1 = 93.0 mA$$

$$\max(I_2) = \left(\frac{10V-0.2V-0.2V}{50} \right) = 192 mA$$

$$I_3 = \left(\frac{10V-0.7V}{2k} \right) = 4.65 mA \qquad \beta I_3 = 465 mA$$

The smallest current wins...

$$I_2 = 93.0 mA$$

Transistor #1 is active mode (Ic = 100 Ib)

Transistor #4 is saturated (100 Ib = 465mA > 93mA)

$$V_5 = 0.2V \qquad\qquad \textit{transistor \#4 is saturated}$$

$$V_4 = 0.2V + 50\Omega \cdot 93.0 mA$$

$$V_4 = 4.85V$$