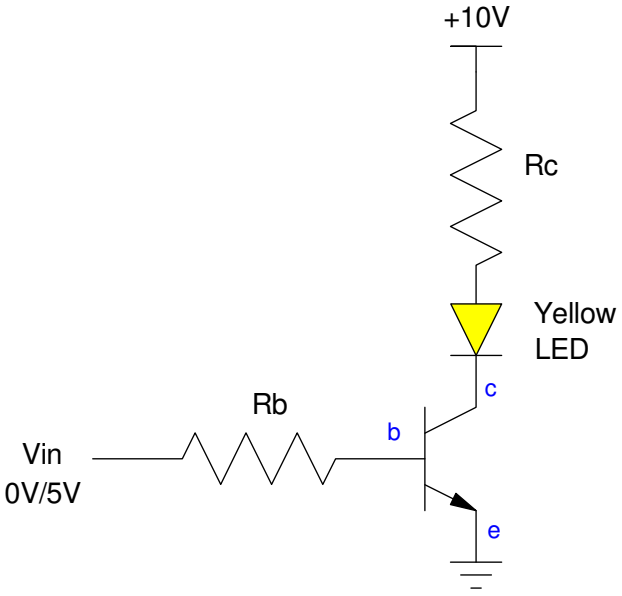
ECE 320: Handout #12

Using a transistor as a switch

Find Rc and Rb so that Ic = 100mA when Vin = 5V.

Assume

- Yellow LED: Vf = 1.9V @ 750mA. 15LM @ 750mA
- 3904 Transistor: Vbe = 0.7V, Vce(sat) = 0.2V, $\beta = 100$
- Vin is capable of up to 20mA



ECE 320: NPN Switch - Solution

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Assume

- Yellow LED: Vf = 1.9V @ 750mA. 15LM @ 750mA
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- Vin is capable of up to 20mA

First find Rc for 100mA

$$R_c = \left(\frac{10V - 1.9V - 0.2V}{100mA}\right) = 79\Omega$$

Next, find Rb. To saturate the transistor, you need

$$\beta I_b > I_c$$

$$I_b > \frac{100mA}{100} = 1mA$$

Pick a current more than 1mA and less than 20mA (the limit on Vin). Let

$$I_b = 2mA$$

$$R_b = \frac{5V - 0.7V}{2mA} = 2.15k\Omega$$

Rb doesn't have to be *eactly* 2.15k (the 2mA assumed was somewhat arbitrary). Rb = 2k or Rb = 2.2k also works.