

ECE 376 - Homework #3

Binary Outputs, Timing, LEDs

Solder your PIC board (50pt)

Demonstrate that your PIC board works

- In person, video, demo during Zoom office hours
- 50pt: Board you built powers up & you're able to download code
- 25pt: Board you built is soldered but not working (swap for a working board)
- note: If your board doesn't work, we have working boards we can swap with you. You'll need a working board for the rest of the course.

Binary Outputs

1) Design a circuit which allows your PIC board to turn on and off an RGB Piranha LED at 0mA (off) and 20mA (on). Assume the specifications for the LEDs are:

Color	Vf @ 20mA	mcd @ 20mA
red	2.0V	10,000
green	3.2V	10,000
blue	3.2V	10,000

1W Star LED Flashlight

2) Write an assembler program which

- Turns on RC0 when button RB1 is pressed, and
- Turns off RC0 when button RB0 is pressed

Turn in

- The assembler code, and
- Compilation results



3) The star LED in your lab kit is a 1W white LED in series with 6.8Ω .

- $V_f = 3.0V$ @ 330mA
- 200LM @ 330mA

a) Set up the following circuit so your PIC board can turn the LED on/off

- The 100 Ohm resistor limits the current
- (the PIC can only output 25mA)

b) Compute the

- Current to the LED
- The brightness of the LED

c) Build this circuit and measure

- I_d (hint: measure V_r and compute the current)
- V_f (the voltage drop across the LED)

4) Use a 6144 NPN transistor as an electronic switch to turn on and off the LED (and amplify current).

- $I_c(\max) = 3A$ ($I_b(\max) = 25mA$ - the max output of a PIC)
- $h_{fe}(\beta) > 200$

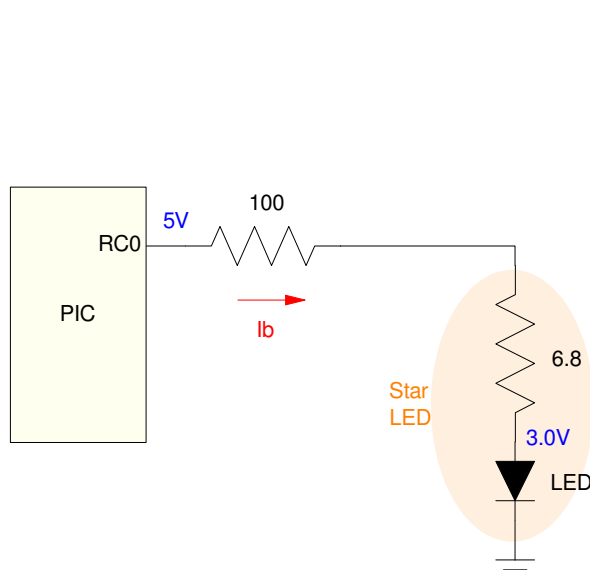
a) Set up the following circuit so that your PIC board can turn on and off the LED

b) Compute

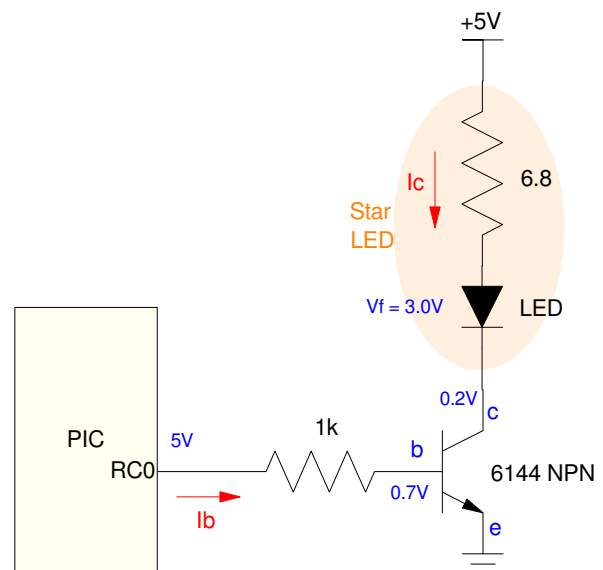
- The currents I_b and I_c

c) Measure

- The currents I_b and I_c
- The voltages V_b , V_c , and $V(\text{LED})$



Problem #3



Problem #4

Timing:

- 5) Write a program which outputs the music note F3 (174.61 Hz)
 - Verify the frequency of the square wave you generate
 - (Pano Tuner app on you cell phone works well for this)

4-Key Piano:

Design an embedded system to play four notes:

- Inputs: Buttons on RB0 / RB1 / RB2 / RB3
- Outputs: RC0
- Relationship: Output a square wave on RC0 based upon the button pressed:
 - RB0 F3 174.61 Hz
 - RB1 G3 196.00 Hz
 - RB2 A3 220.00 Hz
 - RB3 B3 246.94 Hz

- 6) Give a flow chart for your program
- 7) Give an assembler program for the 4-key piano.
 - Include computations for the wait loops
- 8) Validation: Collect data in the lab to verify your code works.
 - Are the frequencies correct?
- 9) Demonstration: Demonstrate that your 4-key piano works
 - either in person or with a video
 - corresponding dance routine optional