ECE 376 - Homework #3

Binary Inputs, Binary Outputs, and Timing. Due Monday, January 30th
Please submit as a hard copy or submit on BlackBoard

Solder your PIC board (50pt)

Demonstrate that your PIC board works

- In person, video, de1mo during Zoom office hours
- 50pt: Board your built powers up & you're able to download code
- 25pt: Board 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

Binary Inputs (hardware)

Assume a thermistor has a resistance-temperature relationship of

$$R = 1000 \cdot \exp\left(\frac{3905}{T+273} - \frac{3905}{298}\right)\Omega$$

1) Design a circuit which outputs

- 0V when T < -15C
- 5V when T > -15C

2) Design a circuit which outputs

- 0V when T < -20C
- 5V when T > -15C

3) Design a circuit which outputs

- 5V when -20C < T < -15C
- 0V otherwise

Binary Outputs

4) Design a circuit which allows your PIC board to turn on and off an RGB Piranah 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

5) Design a circuit which allows your PIC board to turn on and off a 5W LED. The specs for the LED are:

- Vf = 6.0-7.0V
- Current = 700mA
- 500-600 Lumens (equivalent to a 60W light bulb).

https://www.ebay.com/itm/1W-3W-5W-10W-50W-100W-High-power-SMD-Chip-LED-COB-White-Blue-Red-Light-Beads/124011607823

Assume you have a 6144 NPN transistor:

- max continuous current = 3A
- current gain = 300
- Vbe = 0.7V, Vce(sat) = 0.2V

Timing:

6) Write a program which outputs the music note D3 (146.83 Hz)

- Verify the frequency of the square wave you generate
- (Pano Tuner app on you cell phone works well for this)

Lab: LED Flashlight

7) Give the flow chart for a program to turn your PIC board into an LED flashlight:

- PORTB = input
- PORTC & D are output (the LED's)
- RB0: All lights turn off (PORTC = PORTD = 0);
- RB1: Half of the lights are on (PORTC = 0, PORTD = 255)
- RB2: All lights are on (PORTC = PORTD = 255)

To save energy, one LED turns off every 500ms.

Once all LEDs are off, they remain off until RB1 or RB2 are pressed.

8) Write the corresponding assembler code

9) Test your code.

- Compile and program your PIC board
- Verify each button's operation

10) (20 points) Demonstration

- In-person of with a video