

ECE 376 - Homework #3

Binary Inputs, Binary Outputs, & LEDs - Due Monday, January 29th

Solder your PIC board (50pt)

Demonstrate that your PIC board works

- In person, video, or during Zoom office hours
- 50pt: Board you 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

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 $T < 10^\circ\text{C}$
- 5V when $T > 10^\circ\text{C}$

2) Design a circuit which outputs

- 0V when $T < 10^\circ\text{C}$
- 5V when $T > 15^\circ\text{C}$

3) Design a circuit which outputs

- 5V when $10^\circ\text{C} < T < 15^\circ\text{C}$
- 0V otherwise

Binary Outputs

4) Design a circuit which allows your PIC board to turn on and off an RGB Piranha LED at 0mA (off) and 10mA (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 at 250mA. The specs for the LED are:

- $V_f = 6.0-7.0V$
- 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
- $V_{be} = 0.7V$, $V_{ce(sat)} = 0.2V$

Timing:

6) Write a program which outputs the music note E4 (329.63 Hz)

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

Lab: PIC Stoplight

7) Give the flow chart for a program to turn your PIC board into a stoplight

- PORTC = East/West
- PORTD = North/South

	7	6	5	4	3	2	1	0
PORTC (E/W)	-	-	R	R	Y	Y	G	G
PORTD (N/S)	-	-	R	R	Y	Y	G	G

The stoplight cycles every 14 seconds

Duration (seconds)	E/W	N/S
5s	G	R
2s	Y	R
5s	R	G
2s	R	Y

8) Write the corresponding assembler code

- Include a routine which waits

9) Test your code.

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

10) (20 points) Demonstration

- In-person or with a video