ECE 376 - Test #3: Name _____

Fall 2025 Open-Book, Open Note

1) Single Interrupt: Traffic Light, Write a program which uses Timer2 interrupts to control the timing of a traffic light. The red / yellow / green times are to be:

Color	Duration	RC2	RC1	RC0
Green	X seconds	0	0	1
Yellow	1 sec	0	1	0
Red	5 sec	1	0	0

where

- X = 5 + 0.01*A2D seconds (5 to 15 seconds, depending upon traffic)

Timer2 Initialization:

N # clcoks between interrupts	A	B	C

Main Routine - main loop cycle from green to yellow to red & repeat Assume Timer2, A/D, etc are intialized	Timer2 Interrupt Routine
`while(1) {`	`void Interrupt(void) {` `if(TMR2IF) {`

2) Multiple Interrupts: Telephones operate by generating dual tones when you press a button. Use interrupts to turn your PIC into a dual tone generator that works for numbers 1 (RB1) and 5 (RB5)

- When RB1 is pressed, RC0 plays 687Hz & RC1 plays 1209Hz for 200ms
- When RB5 is pressed, RC0 plays 770Hz & RC1 plays 1336Hz for 200ms

```
// Global Variables


// main loop and interrupts:  (specify these sections of code)
```

Main Routine monitor the buttons, controls the interrupts	Timer0 plays a note on RC0	Timer1 plays a note on RC1
`while(1) {`	`if(TMR0IF) {`	`if(TMR1IF) {`

3) Timer1 Capture: Write a program which uses Timer1 Capture interrupts to monitor a game show.

- As the start of the game, the host presses RB0. This clears the contestant's lights (RA2 = 0, RA1 = 0);
- The host then reads a question. If a contestant thinks they know the answer, they press their button.
  - RC2 = Player A (Capture 1)
  - RC1 = Player B (Capture 2)
- If contestant A presses their button and B does not, A wins (RA2 = 1, RA1 = 0)
- If contestant B presses their button and A does not, B wins (RA2 = 0, RA1 = 1)
- If both contenstants press their buttons, whoever pressed their button first wins
  - Times recorded by Timer1 Capture interrupts, accurate to 100ns

Specify the global variables used, the main loop, and each interrupt

```
// Global variables


// Interrupts
```

Main Loop	Timer1	Capture1 rising edge on RC2 (player A)	Capture2 rising edge on RC1 (Player B)
`while(1) {`	`if(TMR1IF) {`	`if(CCP1IF) {`	`if(CCP2IF) {`

4) Filter Design: Design a digital filter, G(z), which has approximately the same gain vs. frequency as

$$G(s) = \left(\frac{20(s+5)}{s+20}\right)$$

Assume a sampling rate of T = 0.01 second.