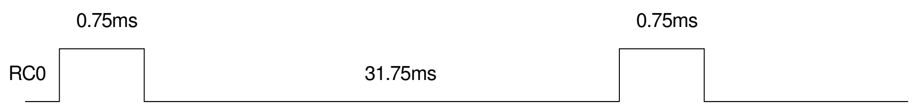
ECE 376 - Test #3: Name ____________________

Spring 2022. Open-Book, Open Note

1) Single Interrupt - Strobe Light: Using Timer2 interrupts, write a C program which outputs the following signal on RC0:

- On for 3 interrupts (0.75ms)
- Off for 127 interrupts (31.75ms)
- Repeat



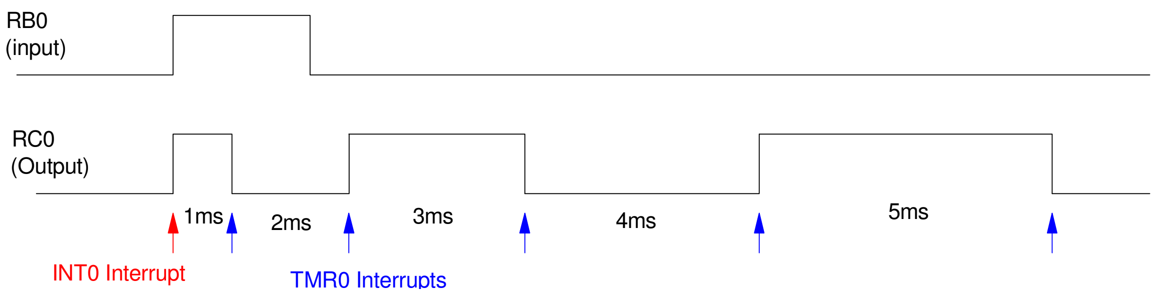
Timer2 Initialization: Set up Timer2 for 250us

N 250us = N clocks	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: Write a C program which uses interrupts to do the following:

- When RB0 goes high
- RC0 outputs three pulses
  - 1ms high
  - 2ms low
  - 3ms high
  - 4ms low, then
  - 5ms high




```
// Global Variables

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

Main Routine if needed	INT0 rising edge of RB0	Timer0 set / clear RC0
`while(1) {`	`if(INT0IF) {`	`if(TMR0IF) {`

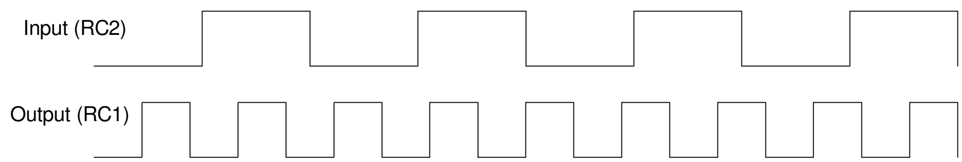
3) Timer1 Capare/Compare: Frequency Multiplier

Write the interrupt service routine for a C program which uses Timer1 Compare and Timer1 Compare to output a square wave which is X times the frequency of the input square wave. Assume

- The input square wave is in the range of 200Hz to 1000Hz
- Timer1 Capture1 (RC2) receives a 0V/5V square wave, and
- Timer1 Compare 2 (RC1) outputs a square wave with a frequency X times the frequency of the input

where

$X = \left(1 + \left(\frac{\text{birth day (1..31)}}{10}\right)\right)$	X =



if X = 2.2, the output is 2.2 times the frequency of the input

```
// Interrupt Initialization
```

Timer1 pre-scalar (1 / 2 / 4 / 8)	Capture 1 (RC2) falling edge / rising edge / 4th rising / 16th rising	Compare 2 (RC1) Set RC1 / Clear RC1 / No Change

```
// Global Variables (if needed)
```

```
// Interrupts
```

Timer1	Capture 1 Input squre wave on RC2	Compare 2 Output a square wave on RC1
`if(TMR1IF) {`	`if(CCPR1IF) {`	`if(CCPR2IF) {`

4) Filter Analysis: Assume X and Y are related by the following transfer function

$$Y = \left(\frac{2(z-0.9)}{(z-0.8)(z-0.5)}\right)X = \left(\frac{2z-1.8}{z^2-1.3z+0.4}\right)X$$

a) What is the difference equation that relates X and Y?

b) Find y(t) assuming

$$x(t) = 2 + 3\cos(500t) + 4\sin(500t)$$

Assume a sampling rate of T us where

T = 900 + 100*(your birth month) + (your birth date) micro-seconds

T 900 + 100*mo + day (microseconds)	a) difference equation:
	b) y(t) =

5) Filter Design: Give the transfer funciton for a digital filter which has approximately the same frequecy response as

$$G(s) = \left(\frac{5000(s+200)}{(s+700)(s+900)} \right)$$

Assume a sampling rate of T us where

T = 900 + 100*(your birth month) + (your birth date)   micro-seconds

T 900 + 100*mo + day (microseconds)	G(z)