ECE 376 - Test #3: Name _

Fall 2024. Open-Book, Open Note

1) Interrupts: Write a C program which uses one or more interrupts to output a square wave whose frequency is 1/3 the input frequency (period is 3x the period of the input)

- Input: 1kHz to 2kHz square wave
- Output: Square wave whose period is 3x the period of the input

Your pick on which interrupts to use

• note: the edges do not need to be synchronized - only the frequency (or period) matters

Input 1-2kHz Output 3x period	
Interrupt Used	Interrupt Set Up (rising / falling edge, # clocks, etc)
Main Routine	Interrupt Service Routine
<pre>while(1) { // main loop</pre>	

2) Multiple Interrupts: Write a C program which uses interrupts to output a square wave whose frequency is 32.2% the input frequency (period is 3.1x the period of the input)

- Input: 1kHz to 2kHz square wave
- Output: Square wave whose period is 3.1x the period of the input

Your pick on which interrupts to use

• note: the edges do not need to be synchronized - only the frequency (or period) matters



Interrupt Set-Up:

Input (measu	re the period)	Output (output	a square wave)
Interrupt Used	Interrupt Set-Up	Interrupt Used	Interrupt Set-Up

Interrupt Service Routines

Input (measure the period)	Output (output a square wave)

3) Compare Interrupts: Write a subroutine which outputs a square wave which

- Is the same frequency as the input waveform (1-2kHz square wave), but
- Is delayed by 547 clocks (54.7us for a precise phase shift)
- Using Timer1 Capture / Compare interrupts

Assume Timer1 is set up with PS=1

Input: RC2 1-2kHz	
Output: RC1	
⊢ ► 547 clock delay	
Capture 1 Interrupt Record the time of the edges on pin RC2 (input)	Compare 2 Interrupt Set / Clear RC1 547 clocks after RC2
if(CCP1IF) {	if(CCP2IF) {

4) **Digital Filter Design:** Assume X and Y are related by the following transfer function:

$$Y = \left(\frac{3s}{(s+2)(s+6)}\right)X$$

Give the transfer function for a digital filter, G(z), with approximately the same gain vs. frequency when the sampling rate is 50ms (T = 0.05)