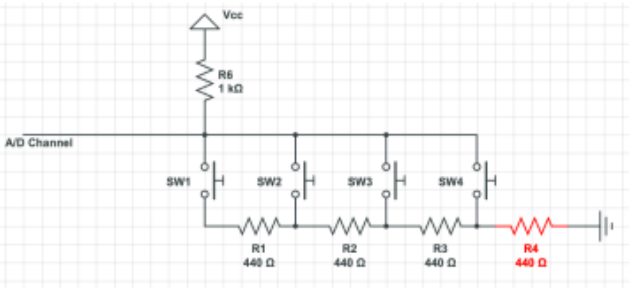
Madison Area Technical College
Microcontroller
Laboratory Activity Name:_____

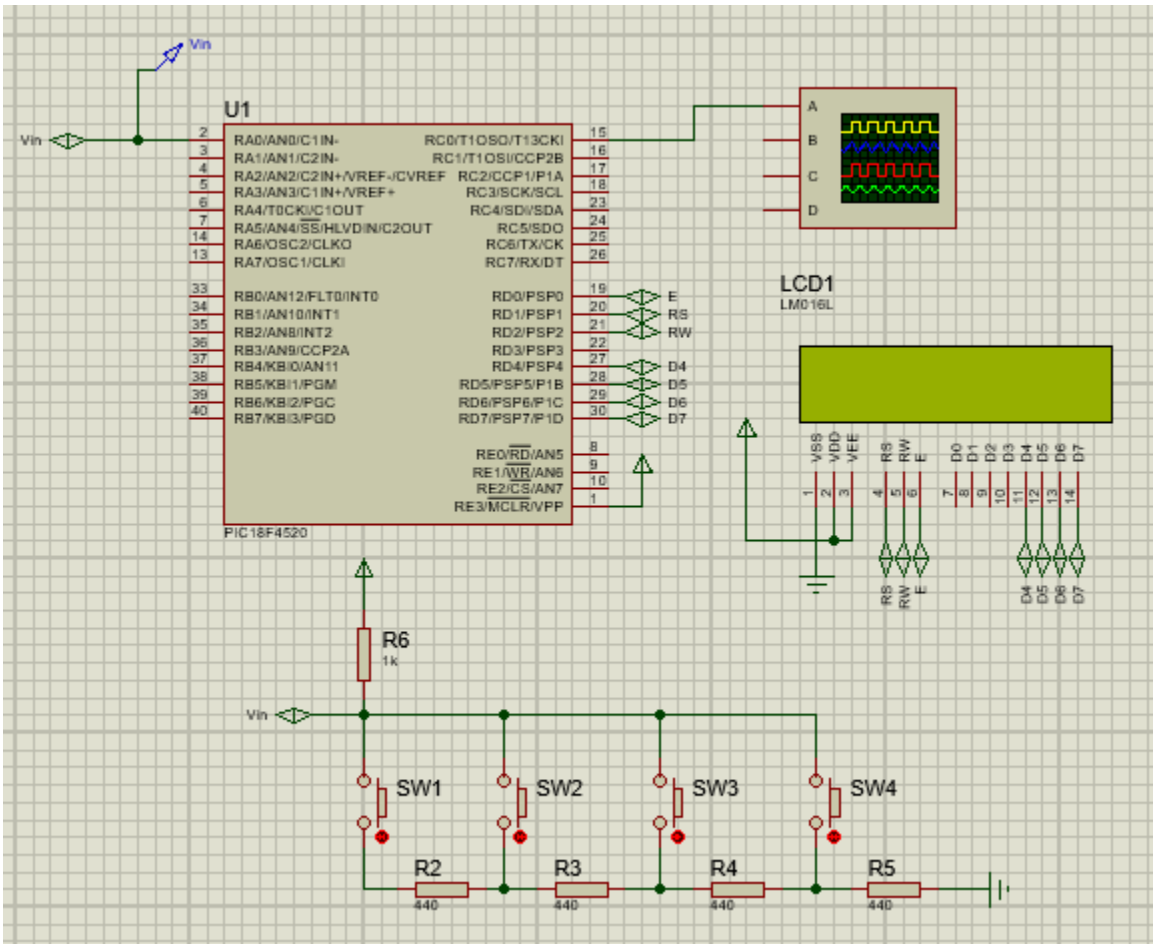
Laboratory Activity - Timer Overflow to Generate a Square Waves

The Microchip PIC 18F4520 has several interruptible TIMER overflow circuits. In class we covered TIMER 0 and TIMER 1 overflow circuits and the mathematics that dominate the circuits.

Activity Description

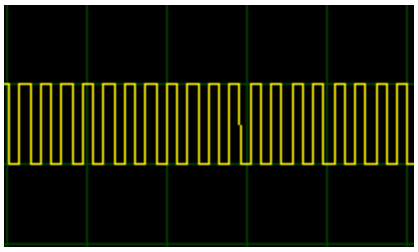
Design a C program for the 18F4520 capable of determining which push button was pressed based on a single analog measurement.

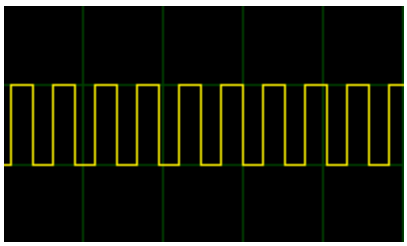


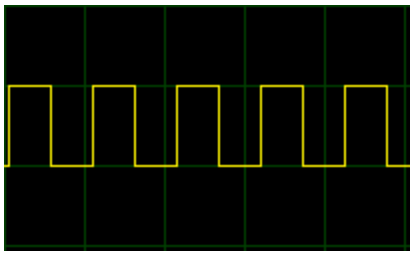


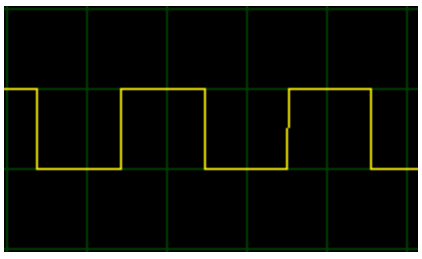
```c
#include <18f4520.h>
#use delay (clock = 20000000)
#fuses HS, NOWDT, NOLVP
#include "../Library/myLibrary.h"
#include "../Library/modifiedlcd.h"

float Vin = 0;

#INT_AD
void int_ad_isr() {
   Vin = *Q * (5.0 / 1023.0 );
}

#INT_TIMER1
void int_timer1_isr() {
   *LATC ^= 0x01;
}

main(){
   // Initialize LCD
   lcd_init();

   // Analog setup
   *TRISA = 0x01;
   ADCON1 -> PCFGx = 0xE;
   ADCON0 -> ADON = 1;
   ADCON0 -> CHSx = 0;    // Channel 0
   ADCON1 -> VCFG0 = 0;
   ADCON1 -> VCFG1 = 0;
   ADCON2 -> ADFM = 1;    // Right Justified
   ADCON2 -> ACQTx = 5;
   ADCON2 -> ADCSx = 5;

   // Timer 1 setup
   *TRISC = 0x00;
   T1CON -> TMR1ON = 1;
   T1CON -> TMR1CS = 0;
   T1CON -> T1OSCEN = 0;
   T1CON -> T1CKPSx = 0;
   PIE1 -> TMR1IE = 1;

   // Interrupt setup
   PIE1 -> ADIE = 1;
   INTCON -> PEIE = 1;
   INTCON -> GIE = 1;
```

```
46
47      while(1){
48          ADCON0->GODONE=1;    // Trigger
49          delay_ms( 250 );
50
51          if( Vin > 3.18 && Vin < 3.20 ) {
52             printf(lcd_putc,"\fSW1 - 1:1");
53             T1CON -> T1CKPSx = 0;
54          }
55          else if( Vin > 2.80 && Vin < 2.90 ) {
56             printf(lcd_putc,"\fSW2");
57             T1CON -> T1CKPSx = 1;
58          }
59          else if( Vin > 2.30 && Vin < 2.40 ) {
60             printf(lcd_putc,"\fSW3");
61             T1CON -> T1CKPSx = 2;
62          }
63          else if( Vin > 1.50 && Vin < 1.60 ) {
64             printf(lcd_putc,"\fSW4");
65             T1CON -> T1CKPSx = 3;
66          }
67          else {
68             printf(lcd_putc,"\fPush somethin'");
69             T1CON -> T1CKPSx = 0;
70          }
71      }
72  }
73
```









SW1 = 1:1 Prescaler

$$T_{1C=\frac{4*1}{20MHz}=0.2uS}$$

$$T_{1F=2^{16}*0.2uS=13.1uS}$$

$$T_{GPIO=2*13.1uS} = 26.2uS$$

SW2 = 1:2 Prescaler

$$T_{1C=\frac{4*2}{20MHz}=0.4uS}$$

$$T_{1F=2^{16}*0.4uS=26.2uS}$$

$$T_{GPIO=2*26.2uS=52.4uS}$$

SW3 = 1:4 Prescaler

$$T_{1C=\frac{4*4}{20MHz}=0.8uS}$$

$$T_{1F=2^{16}*0.8uS=52.4uS}$$

$$T_{GPIO=2*52.4uS} = 104.8uS$$

SW4 = 1:8 Prescaler

$$T_{1C=\frac{4*8}{20MHz}=1.6uS}$$

$$T_{1F=2^{16}*1.6uS=104.8uS}$$

$$T_{GPIO=2*104.8uS} = 209.7uS$$

This math is my own work.