

Madison Area Technical College  
Microcontroller  
Laboratory Activity

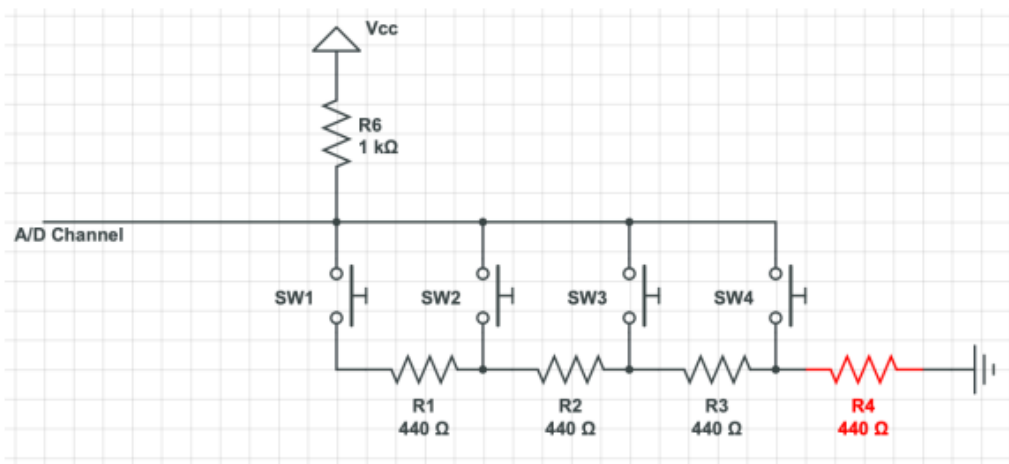
Name: \_\_\_\_\_

### Laboratory Activity - Analog to Digital Conversion

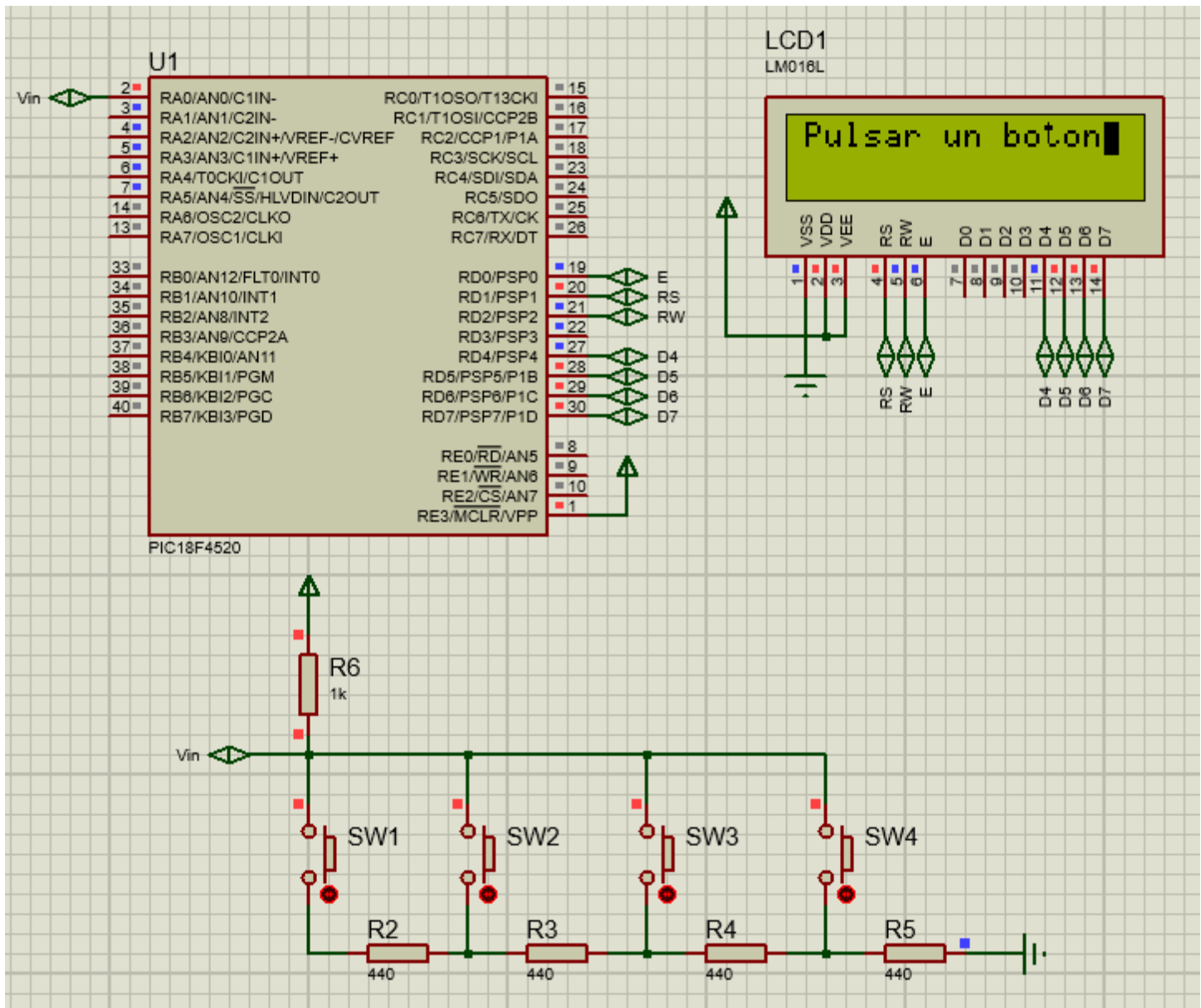
The Microchip PIC 18F4520 has an interruptible N=10 bit A/D circuit controlled by the registers ADCON0, ADCON1 and ADCON2. The registers used to control the A/D interrupt circuit are INTCON and PIE1. In the PCW-CCS compiler the preprocessing command `#INT_AD` is used to link the user defined interrupt vector to the corresponding service routine.

### Activity Description

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



The Microcontroller will show the results on a 16x2 alphanumeric LCD panel. The user does not have to detect a multi-button press event.



```

1  #include <18f4520.h>
2  #use delay (clock = 20000000)
3  #fuses HS, NOWDT, NOLVP
4  #include "../Library/myLibrary.h"
5  #include "../Library/modifiedlcd.h"
6
7  float Vin = 0;
8
9  #INT_AD
10 void int_ad_isr() {
11     Vin = *Q * (5.0 / 1023.0 );
12 }
13
14 main(){
15     // Initialize LCD
16     lcd_init();
17
18     // Analog setup
19     *TRISA = 0x01;
20     ADCON1 -> PCFGx = 0xE;
21     ADCON0 -> ADON = 1;
22     ADCON0 -> CHSx = 0;    // Channel 0
23     ADCON1 -> VCFG0 = 0;
24     ADCON1 -> VCFG1 = 0;
25     ADCON2 -> ADFM = 1;    // Right Justified
26     ADCON2 -> ACQTx = 5;
27     ADCON2 -> ADCSx = 5;
28
29     // Interrupt setup
30     PIE1 -> ADIE = 1;
31     INTCON -> PEIE = 1;
32     INTCON -> GIE = 1;
33
34     while(1){
35         ADCON0 -> GODONE=1;    // Trigger
36         delay_ms( 250 );
37
38         if( Vin > 3.18 && Vin < 3.20 ) {
39             printf(lcd_putc, "\fSW1");
40         }
41         else if( Vin > 2.80 && Vin < 2.90 ) {
42             printf(lcd_putc, "\fSW2");
43         }
44         else if( Vin > 2.30 && Vin < 2.40 ) {
45             printf(lcd_putc, "\fSW3");
46         }
47         else if( Vin > 1.50 && Vin < 1.60 ) {
48             printf(lcd_putc, "\fSW4");
49         }
50         else {
51             printf(lcd_putc, "\fPulsar un boton");
52         }
53     }
54 }
55

```

...done independently but "Student A" helped me troubleshoot and change a few lines of code.

This is a voltage divider / R2R circuit...

SW1

$$V_{out} = 5 \left( \frac{1760}{1000 + 1760} \right) = 3.18 \text{ V}$$

$$V_{out} = V_s \left( \frac{R_2}{R_1 + R_2} \right)$$

SW2

$$V_{out} = 5 \left( \frac{1320}{1000 + 1320} \right) = 2.84 \text{ V}$$

SW3

$$V_{out} = 5 \left( \frac{880}{1000 + 880} \right) = 2.34 \text{ V}$$

SW4

$$V_{out} = 5 \left( \frac{440}{1000 + 440} \right) = 1.52 \text{ V}$$