

ECE 376 - Homework #4

C Programming, LCD Displays

1) Determine how many clocks the following C code takes to execute

- Compile and download the code (modify working code and replace the main loop)
- Measure the frequency you see on RC0 (toggles every loop).
 - Use an oscilloscope - or -
 - Connect a speaker to RC0 with a 200 Ohm resistor and measure the frequency with a cell phone app like Piano Tuner
 - RC1 is 1/2 the frequency of RC0, RC2 is 1/4th, RC3 = 1/8th, etc
- The number of clocks it takes to execute each loop is

$$N = \left(\frac{10,000,000}{2 \cdot Hz} \right)$$

1a) Counting mod 16

- note: if using your cell phone to measure the frequency, you might have to try different pins on PORTC until you get one in the audio range. Each pin is 1/2 the frequency of the previous pin

```
unsigned char i
while(1) {
    i = (i + 1) % 16;
    if(i == 0) PORTC += 1;
}
```

1b) Counting mod 17

```
unsigned char i
while(1) {
    i = (i + 1) % 17;
    if(i == 0) PORTC += 1;
}
```

1c) Integer Multiply

```
unsigned int A, B, C;
unsigned char i;
A = 0x0432;
B = 0x2468;
while(1) {
    PORTC += 1;
    C = A*B;
}
```

1d) Floating point multiply

```
float A, B;
A = 1.01;
B = 0.00123;
while(1) {
    PORTC += 1;
    B = B * A;
}
```

LED Flashlight & LCD Displays

Write a C program which turns your PIC board into an LED flashlight

Input:

- Push buttons on PORTB

Output:

- LCD display
- Lights on PORTC

Relationship: The buttons control the brightness of the LEDs

- RB0: 0% on
- RB1: 1/7 duty cycle (14% on)
- RB2: 2/7 duty cycle (28% on)
- :
- RB7: 7/7 duty cycle (100% on)
- Frequency of lights = 50Hz (20ms cycle time)

The LCD display should show the current duty cycle

The lights on PORTC are all ON or OFF - for the brightness of the flash light.

Grading:

- 10pt: LCD display shows the duty cycle from 0/7 to 7/7
- 10pt: Able to input the numbers 0 to 7 using the push buttons
- 10pt: PORTC outputs a square wave with a duty cycle varying from 0/7 to 7/7
- 10pt: Measured frequency of the square wave is 50Hz
- 10pt: Measured duty cycle is 0/7 to 7/7 (hint: measure the DC voltage (average voltage). The duty cycle should be

$$duty = \left(\frac{\text{DC voltage}}{5V} \right) \cdot 100\%$$

- 10pt Demo. Video or in-person