

ECE 376 - Homework #4

C Programming, LCD Displays, & Keypads. Due Monday, September 29th

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 256

- 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) % 256;
    if(i == 0) PORTC += 1;
}
```

1b) Counting mod 255

```
unsigned char i
while(1) {
    i = (i + 1) % 255;
    if(i == 0) PORTC += 1;
}
```

1c) Integer Multiply

```
unsigned int A, B, C;
unsigned char i;
A = 0x1234;
B = 0x5678;
while(1) {
    i = (i + 1) % 256;
    if(i == 0) PORTC += 1;
    C = A*B;
}
```

1d) Floating point multiply

```
float A, B;
A = 1.0002;
B = 0.02;
while(1) {
    i = (i + 1) % 256;
    if(i == 0) PORTC += 1;
    B = B * A;
}
```

Master-Mind

In the game of Master-Mind, you try to guess a secret code

At the start of the game, a random 4 digit number is selected (each digit can be 0..6)

Each round, you guess what the 4-digit code is

- The computer then looks at the code, digit by digit.
- If the number in the code is also in the guess but wrong spot, the player scores 1 point.
- If the number in the code is also in the guess but right spot, the player scores 10 points.

The game continues until the player gets all 4 digits correct (and scores 40 points)

2) Write a C program which starts the game

- Start the game by pressing RB0
- This generates a random 4-digit number from 0000 to 5555 (all digits 0..5)
- note: generate a random number from 0..1295 and pull out the digits one by converting to base-6

Verify your code.

3) Add to this code the user inputting a 4-digit guess using the numeric keypad (0000 to 5555)

- Display the guess on the LCD display
- Verify your code

4) Add to this code calculations of the player's score

- Check each number one-by-one
- If the number in the code is also in the guess but wrong spot, the player scores 1 point.
- If the number in the code is also in the guess but right spot, the player scores 10 points.

Verify your code

5) Add to this code a loop where you keep playing until the player scores 40 points

- All 4 digits correct

6) Demo your resulting Master-Mind game

- In-person or on a video

notes:

- Displaying the code while playing makes debugging easier
- Hiding the code and having you figure it out makes the game more challenging.