

ECE 376 - Homework #4

C Programming - Due Monday, February 12th

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 128

```
unsigned char i
while(1) {
    i = (i + 1) % 128;
    if(i == 0) PORTC += 1;
}
```

1b) Counting mod 127

```
unsigned char i
while(1) {
    i = (i + 1) % 127;
    if(i == 0) PORTC += 1;
}
```

1c) Floating Point Multiplication

- note: you need to include Math.h #include <math.h>

```
float A, B, C;
A = sqrt(3);
B = sqrt(2);
while(1) {
    i = (i + 1) % 16;
    if(i == 0) PORTC += 1;
    C = A * B;
}
```

1d) Floating Point Square Root

```
float A, B, C;
A = sqrt(3);
B = sqrt(2);
while(1) {
    PORTC += 1;
    C = sqrt(A);
}
```

Stoplight in C (take 1)

2) Write a C program which turns your PIC into a stoplight:

	7	6	5	4	3	2	1	0
PORTA (E/W)	-	-	R	R	Y	Y	G	G
PORTC (N/S)	-	-	R	R	Y	Y	G	G

The stoplight cycles every 14 seconds

Seconds	E/W	N/S
5 seconds	G	R
2 seconds	Y	R
5 seconds	R	G
2 seconds	R	Y

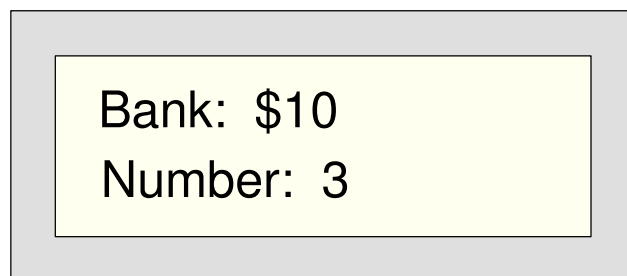
3) Verify your program runs on your PIC board

- Include the size of the compiled C code
- Check the timing by observation (an oscilloscope would be better...)

Roulette!

Problem 4-8) Turn your PIC board into a Roulette wheel

- Start the game by pressing RB0.
- When pressed, a random number in the range of 0..7 is generated.
- The roulette ball then rolls along the roulette wheel, displayed on PORTC and on the LCD display, beeping on each number.
- If the ball stops on #7, you win and your bank increases by eight.
- Otherwise, you lose and your bank decreases by one.



Ball Position



PORTC

Moves one space every 200ms

Problem 4) Display Routine

Write a subroutine in C which

- Is passed a number from 0..7
- The routine displays the number on the LCD display, and
- It light up RCx where x is the number (0..7)

Check your subroutine

Problem 5) Random Number Generator.

Program your PIC board to generate a random number in the range of 0..7 every time you press and release RB0.

- Display this number on the LCD and on PORTC

Generate 5+ random numbers and check your random number generator works.

Problem 6) Spin the Wheel

Modify this code so that each time you press RB0

- You generate a random number from 0..7
- You set a counter to N where $N = 32 + \text{the random number}$

You then start counting down to zero

- Each count is 200ms
- Each count the ball moves one position. (if the ball moves to position #8, it goes back to #0)
- Display the ball position on the LCD and on PORTC

Check you code

Problem 7) Winning Numbers

Modify the code so that after N steps, you check if you won or not.

- If the ball ends up in position #7 (lucky 7), you win and your bank value is increased by \$8
- Otherwise, you lose and your bank value is decreased by \$1.

Check your code to see that you win on seven and lose otherwise.

Problem 8) Beep

Finally, modify your code so that a speaker beeps every count

- Frequency = 200Hz
- Duration = 50ms (20 toggles)

Problem 9) Demo (20 pt)

Demonstrate your Roulette wheel