ECE 376 - Homework #6

A/D Converters, Chi-squared Test - Due Monday, March 3rd

A/D Conversion

1) Write a C program which

- Uses the A/D converter and a thermistor to measure the temperature of something, and
- Displays on the LCD the temperature in degrees C with a resolution of 0.01C.

Give

- Your C code, and
- The compiled size of your code

Thermistor Resistance vs. Temperature relationship:

$$R = 1000 \cdot \exp\left(\frac{3905}{T+273} - \frac{3905}{298}\right)\Omega$$

2) With your temperature sensor, measure the temperature of four different things. Some suggestions are:

- The temperature of cold tap water
- The temperature of hot tap water
- The temperature of a refrigerator
- The temperature of a freezer
- Other

Chi-Squred Test

3) Determine experimentaly using a chi-squared test whether or not the following C code produces a fair 6-sided die:

```
while(1) {
   while(!RB0);
   while(RB0) DIE = (DIE + 1) % 6;
   DIE += 1;
   LCD_Move(1,0);  LCD_Out(DIE, 1, 0);
   SCI_Out(DIE, 1, 0);
   SCI_CRLF();
   }
```

4) Determine experimentaly using a chi-squared test whether or not the following C code produces a fair 6-sided die:

```
while(1) {
   while(!RB0);
   while(RB0) {
      DIE = (DIE + 1) % 13;
      }
   DIE = (DIE % 6) + 1;
   LCD_Move(1,0);  LCD_Out(DIE, 1, 0);
   SCI_Out(DIE, 1, 0);
   SCI_CRLF();
   }
```

Roulette!

Write a C program to play roulette:

- On reset, you start with $100 in your bank
- To start a game, press buttons RB0..RB7 to bet on the numbers 0..7
- When you release the button, a random number in the range of 0..8 is generated (nine numbers).
  - 0-7 corresponds to the winning number being 0..7
  - If you roll an eight, the winning number is the number you picked minus one (just missed)
- The PIC processor then counts 32 + N times (N = the random number), with 100ms between counts
- As it counts, the LCD display shows the ball position (0..7)
- When done counting, it checks if you won
  - If the number you pressed is equal to the final ball position, you win $8
  - If different, you lose $1

5) Give a flow chart for this program

6) Write the C code for this program

7) Collect data to verify your program is working correctly

8) Determine using a chi-squared test if this is a fair game (the probability of each number coming up is 1/8, and/or the probability of winning is 1/8