

ECE 376 - Homework #6

A/D Converters, Chi-squared Test - Due Monday, October 14th

A/D Conversion

Use the A/D input on your PIC to vary something with 50+ steps:

- The brightness of a NeoPixel (A/D sets the brightness, lock in when you press RB0)
- The color of a NeoPixel (A/D sets the brightness, lock in R/G/B when you press RB0/RB1/RB2)
- The angle of a stepper motor (set the target angle with the A/D, move to that location on RB0)

1) Requirements: Specify

- The inputs (A/D)
- The outputs
- How they relate

2) C code and flow chart: Give the corresponding C code and flow chart

3) Validation: Collect data to verify you met your requirements

Fair & Loaded Dice

4) Determine experimentally 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();
}
```

5) Determine experimentally 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;
        X = (X + 1) % 7;
    }
    DIE = DIE + 1;
    if(X == 0) DIE = 6;

    LCD_Move(1,0); LCD_Out(DIE, 1, 0);
    SCI_Out(DIE, 1, 0);
    SCI_CRLF();
}
```

Am I Psychic?

- 6) Write a C program which tests if you're psychic with a 4-sided die:
 - Each round, predict which number is going to come up (0..3)
 - Press the corresponding button RB0..RB3.
 - When you release the button, a random number in the range of 0..3 is generated
 - If you were right, the PIC records that. Likewise if you were wrong.
 - The LCD display displays how many times you were right and wrong.

- 7) Collect data with your program.

- 8) Determine the chance that you were not just guessing using a chi-squared test
 - Null hypothesis: you are just guessing (correct 25% of the time).