

ECE 376 - Homework #6

A/D Converters, Chi-Squared Test

A/D Converters

- 1) Use your PIC board along with your thermistor to measure resistance and temperature.
 - Take an A/D reading every 1 second
 - Display the raw A/D reading, the computed resistance, and the computed temperature on the LCD display

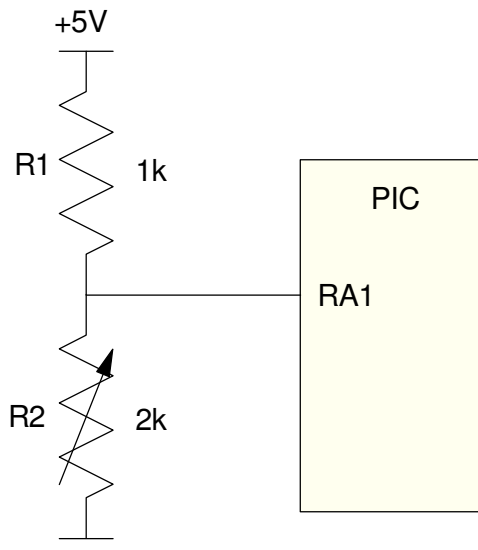
Assume the resistance-temperature of the thermistor in your lab kit is

$$R = 2000 \cdot \exp\left(\frac{3905}{T+273} - \frac{3905}{298}\right) \Omega$$

(as a check, the resistance at room temperature should be close to 2000 Ohms (25C). If not, you might have a 1k or 10k thermistor in your lab kit (change the formula accordingly).

Give your resulting C code and compiled code size.

- 2) Check the accuracy of your resistance meter
 - Replace R2 with a known resistor in the range of 100 to 10k Ohms
 - Find the measured value of R
 - Compare the measured value vs. the marked value (or actual resistance if you have an ohm-meter)
- 3) Using a thermistor, measure the temperature of four different items
 - Replace R2 with your thermistor
 - Record the raw A/D reading, the computed resistance, and the computed temperature



Hardware for an Ohm-meter or digital thermometer

Chi-Squared Test - Fair Die

The following code implements a fair 8-sided die

```
while(1) {
    while(!RB0);
    while(RB0) {
        d8 = (d8 + 1) % 8;
    }
    d8 = d8 + 1;
    LCD_Move(1,8); LCD_Out(d8, 1, 0);
    SCI_Out(d8, 1, 0);
    SCI_CRLF();
}
```

4) Collect data for the fair 8-sided die. From your data, what is the probability that the die is fair?

Chi-Squared Test - Loaded Die

The following code implements a fair 8-sided die (the number 1 should come up 3/17 of the time rather than 2/16).

```
while(1) {
    while(!RB0);
    while(RB0) {
        d8 = (d8 + 1) % 17;
    }
    d8 = (d8 % 8) + 1;
    LCD_Move(1,8); LCD_Out(d8, 1, 0);
    SCI_Out(d8, 1, 0);
    SCI_CRLF();
}
```

5) Collect data for the loaded 8-sided die. From your data, what is the probability that the die is fair?

6) How loaded does the die have to be for you to be able to reliably detect that something is amiss?

Am I Psychic?

7) Going back to the fair 8-sided die...

- Predict what number is going to come up, then roll the die.
- Count the number of times you're right and wrong.

Use a chi-squared test to determine if you're just guessing ($p = 1/8$) or if you're psychic.