

ECE 376 - Homework #6

A/D Converters & Data Collection. Due Monday, February 28th

A/D Converters

1) (10pt) Determine how long it takes to do an A/D conversion with a PIC processor

```
void main(void)
{
    TRISC = 0;
    ADCON1 = 0x0F;

    // Turn on the A/D input
    TRISA = 0xFF;
    TRISE = 0x0F;
    ADCON2 = 0x95;
    ADCON1 = 0x07;
    ADCON0 = 0x01;

    while(1) {
        A2D = A2D_Read(0);
        PORTC = PORTC + 1;
    }
}
```

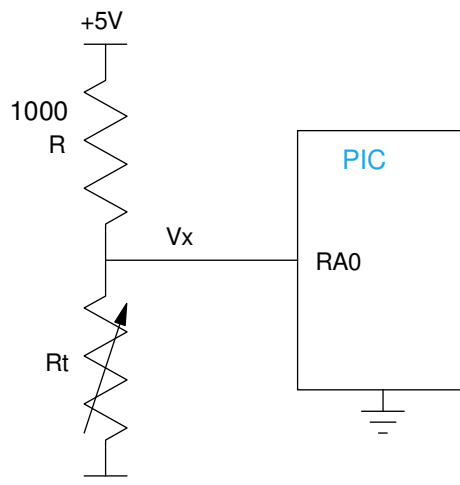
2) (10pt) Assume the A/D reads 813 for the following circuit.

- What is the voltage, V_x ?
- What is the resistance, R_t ?
- What is the temperature?

Assume R_t is a thermistor like the one in your lab kit:

$$R_t = 1000 \cdot \exp\left(\frac{3904}{T+273} - \frac{3905}{298}\right) \Omega$$

where T is the temperature in degrees C



3-5) Design an embedded system which uses the analog input on RA0. Some suggestions are:

- Electronic Trombone: Play 400Hz (A/D=0) to 500Hz (A/D = 1023) when you press RB0
- Electronic Die: Control the number of sides of the die with the analog input (N = 1..20). Roll an N sided die each time you press RB0. Flash the lights on PORTA when the roll is N.
- Stepper Motor Thermometer: Read the temperature with the A/D input. Indicate the temperature on a stepper motor (0 steps = 0 degrees, 100 steps = 100 degrees)
- Other

3) Requirements: Specify

- The inputs (including at least one analog input).
- The outputs, and
- How they relate (i.e. what it does)

4) C-code and flow chart

5) Testing and Validation

- Collect data to show you met the requirements

Data Collection

6) Use your PIC board to measure and record via the serial port (pick one)

- The voltage across a 100uF capacitor as it discharges from 5.00V
- The temperature of hot water in a coffee cup with a lid
- The temperature of hot water in a coffee cup without a lid
- The voltage across a AA battery as it discharges across a 10 Ohm resistor,
- Other

Collect

- At least 100 data points for each test, and
- At least 2 test runs (you will need at least two data sets for homework #7)

Plot your data in Matlab (or your favorite program)

7) Convert your data to a number

- The time constant (τ) for a 100uF capacitor: $V = V_0 \exp(-t/\tau)$
- The time constant for the hot cup of coffee: $T = T_0 \exp(-t/\tau) + T(\text{room})$
- The energy in the battery in Joules: $E = \int \left(\frac{V^2}{R} \right) dt$