



Department of Electrical and Computing Engineering

UNIVERSITY OF CONNECTICUT

ECE 3411 Microprocessor Application Lab: Spring 2018

Lab Test 3

There are 1 set of problem in this test. There are 2 pages in this booklet. Answer each question according to the instructions given.

You have **180 minutes** to answer the questions. Once you are done, you need to show the output to the Instructor or TA and upload in Husky CT “Lab Test 3”. Upload option in the Husky CT will be unavailable after 180 Minutes.

Answer questions sequentially to complete the tasks easily — you may want to skim all questions before starting. If you find a question ambiguous, be sure to write down any assumptions you make.

Be neat and legible. If we can’t understand your answer, we can’t give you credit! Write your name in the space below. Write your initials at the bottom of each page.

THIS IS AN OPEN BOOK, OPEN NOTES TEST. YOU CAN USE YOUR LAPTOP BUT PLEASE TURN YOUR NETWORK DEVICES OFF.

Any form of communication with other students is considered **cheating** and will merit an F as final grade in the course.

Do not write in the boxes below

a(x/30)	b(x/30)	c(x/40)	Total 100(xx/100)

Name:

Student ID:

Q1. [100 points] Write C code to program ATmega328P XPlained mini kit and demonstrate its performance that it shows the following functions:

- a. [30 points] Set up the ADC based temperature sensor to display the ambient temperature in LCD. You could use timer to maintain proper update and refresh rate. You need to use non-blocking LCD display scheme to make the functions perfect.

(i) First row of the LCD will display the temperature in Celsius and second row will display in Fahrenheit. i.e. “T(C)=23.18” in first row and “T(F)=73.72” in second row. Formula for Celsius to Fahrenheit is as follows:

$$T(^{\circ}\text{F}) = 1.8T(^{\circ}\text{C}) + 32$$

(ii) ADC values will be sensed in every 40ms. Then, it will be averaged after 200ms. LCD will be refreshed in every 200ms for averaged temperature from ADC. Use datasheet to convert ADC value to temperature properly.

- b. [30 points] Use INT1 to pause the ADC update for 3 seconds when button is pressed.

(i) Connect the external push button to the INT1.

(ii) Use timer to maintain pause time for ADC.

(iii) LCD will be refreshed in every 200ms.

(iv) LCD display format will be the same as (a)

- c. [40 points] Modulate fraction of the temperature displayed in LCD with 2kHz PWM signal using one of the pins of PORT D.

(i) Read the temperature as you did in (a).

(ii) Set up 2kHz PWM signal to be output in one of the pins of PORT D. Keep the LED connected to that pin also.

(iii) Use the fractional part of the temperature from degree Celsius reading to modulate the PWM signal. i.e. if temperature is 23.18 degree Celsius, the duty will be 18%.

(iv) The described functions in (a) and (b) will be fully functional with (c).