Department of Electrical and Computing Engineering

UNIVERSITY OF CONNECTICUT

ECE 3411 Microprocessor Application Lab: Spring 2018

Lab Test 4

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 4". 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/40)	c(x/30)	Total 100(xx/100)

Name:

Student ID:

Q1. [100 points] Write a **task-based C program** for ATmega328P XPlained mini kit and demonstrate its performance that it shows the following functions:

a. [30 points] Set up the ADC based temperature sensor (MCP9700) and photo sensor (PDV-P9001) to sense the ambient temperature and brightness. You need to display the readings to LCD.
(i) First row of the LCD will display the temperature in Celsius and second row will display brightness in a level of 0 to 10. i.e. "T(C)=23.18" in the first row and "Bright level=5" in the second row.
Note: If photo-sensor gives 0V, then bright level =0; if it gives 0.5V, bright level =1; if 1V, bright level =2;…….. if 5V, bright level =10.
(ii) ADC values will be sensed in every 50ms. Then, these values will be averaged after 300ms. LCD will be refreshed in every 300ms for averaged values from ADC. Use datasheet to convert ADC value to temperature and brightness level properly.

b. [40 points] Use SPI to control the glow of LED.
(i) Use SPI based DAC (MCP4921). Connect a LED and a resistor to the output of the DAC to control the glow of LED.
(ii) Control the glow of LED in the range of level 0 to 10. If level is 0, the LED will be completely off or emit minimum light. If level is 10, then LED will glow with maximum brightness.
(iii) The level of the LED should be corresponding to the brightness level displayed in the second row of the LCD.

c. [30 points] Modulate the brightness level using a 5kHz PWM signal connected to one of the pins of PORT D.
(i) Set up 5kHz PWM signal to be output in one of the pins of PORT D. Keep the LED connected to that pin also.
(ii) Duty of the PWM will be 0 to 100% based on the brightness levels. i.e. if level is 5, then duty is 50%.
(iii) The described functions in (a) and (b) will be fully functional with (c).

※ **Write a task-based C program. Otherwise, you will not get full credit.**