



Department of Electrical and Computing Engineering

UNIVERSITY OF CONNECTICUT

ECE 3411 Microprocessor Application Lab: Spring 2019

Lab Test 4

This two-page booklet contains one multi-part test problem. Answer the questions according to the instructions given.

You have **120 minutes (3:30 p.m. to 5:30 p.m.)** to program your AVR. You must upload the code by PDF/Word via Husky CT “Lab Test 1” by 5:30 p.m. The tasks in this test are also to be demonstrated to the instructor or TA from 5:00 p.m. – 6:00 p.m.

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. For clarification you may watch the TA demo video clip in HuskyCT.

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.

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

Name:

Student ID:

Q1. [100 points] Write C code to program the ATmega328PB XPlained mini kit and demonstrate that it implements the following tasks:

- a. [40 points] Configure Timer 0 and Timer 3 to generate a 2kHz and 5kHz PWM signal respectively.
 - Connect LEDs to pins OC0B and OC3B to observe the PWM signals.
 - Configure Timer 3 in PWM mode using the duty cycle of 70%.
 - In this stage of implementation, you may ignore the interrupt sub routine.

- b. [30 points] Set up the ADC based temperature sensor (MCP9701) and photo sensor (PDA-P9001) to display the ambient temperature and light on the LCD.
 - The first row of the LCD will display the temperature in Celsius. The display format is “**T(C)=23.18**”
 - Second row will display the brightness level between 0 to 10. The format display format is “**Bright = 5**”. 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.
 - *Read the values from the ADC. Use the full 10-bit ADC resolution.
 - **Average the values ADC readings and refresh the LCD every 500ms. At the end of the LCD refresh, toggle a LED connected to **PD1**.
 - ***You are not allowed to use the delay_ms or delay_us function.

- c. [30 points] Modulate the PWM signal of Timer 0 based on the fractional part of the temperature reading.
 - i.e. if the temperature reading is “**T(C)=23.18**” then, the duty cycle of the PWM signal will be **18%**.
 - Update the PWM duty cycle at the end of the LCD refresh.
 - Parts (a) and (b) should work together with (c).