Department of Electrical and Computing Engineering

UNIVERSITY OF CONNECTICUT

ECE 3411 Microprocessor Application Lab: Fall 2015

Lab Test II

There are 2 longer programming problems in this test. There are 2 pages in this booklet. Answer each question according to the instructions given.

You have **100 minutes** to answer the questions. Once you are done, you need to show the output to the Instructor or TA and e-mail the code to the TA.

Some questions are harder than others and some questions earn more points than others—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

1 (x/40)	2 (x/60)	Total (xx/100)

Name:

Student ID:

1. [40 points]: Write a 4-digit PIN based User Authentication program for your AVR. The detailed description of this program is as follows.

- **Setup Phase:** Upon startup, the system prints a message over UART asking the user to setup a new 4-digit PIN code. The user enters the PIN by typing it in the Terminal. Once the PIN is received, it is saved for future use.

- **Login:** Once the PIN is setup, if a push switch SW1 is pushed then the system asks the user over UART to enter the PIN code in order to 'Login'. If this PIN matches the previously stored PIN, an LED starts blinking at constant 1Hz frequency indicating that the user is logged in. As long as the user is logged in, any further pushes to SW1 switch should have no effect.

- **Logout:** If the user is currently logged in and a push switch SW2 is pushed, the blinking LED should turn OFF indicating that the user is logged out.

Notice that the system will go through the Setup Phase everytime the AVR is turned on from powered off state.

Hint: Both SW1 and SW2 can be programmed without debouncing. Also the UART can be programmed using `fscanf` and `fprintf` functions.

Bonus Question: Explain why the two push switches can be used without debouncing and why UART can be programmed with blocking functions (`fscanf` and `fprintf`).

2. [60 points]: In this question, you are required to configure your on-board LED through UART commands.

Commands:

- ON x, where x is a non-zero single digit integer.
  - If you enter "ON x", then your LED should be on for x seconds and then turn off.
- BLINK x y, where x is a non-zero single digit integer and y is an integer between 0 and 100.
  - This command takes two arguments: x is the frequency in Hz and y is the duty cycle in percentage. It means that your LED should be on for $\frac{y}{100*x}$ seconds, and be off for $\frac{100-y}{100*x}$ seconds.
  - For example: if you enter "BLINK 2 80", then your LED should be on for $80\% * 500 = 400$ milliseconds and be off for $20\% * 500 = 100$ milliseconds in every 500 milliseconds.

Your program should ask the user over the UART to input a command every 10 seconds.

End of Quiz

Please double check that you wrote your name on the front of the quiz.

Initials: