Lab2 Assignment

Note that all students are required to work on this lab assignment in teams of two (see ICON —> Embedded Systems —> People —> Lab2). Teams cannot change during labs. For Lab2, one report per group is sufficient. All software development for Lab2 must be done in assembly language.

Note that each team member must be able to explain all hardware and software components.

Objective
Gain some experience in writing an assembly language program and connecting external hardware to the microcontroller.

Mid-lab reviews (February 8 and February 15) - show the TA your progress towards completing the lab (see below)
Deadline: February 22 (see calendar on ICON for checkoff sign up)

Lab Description
In this lab, students will build a simple programmable countdown timer using two 8-bit shift registers, two 7-segment LED displays (Fig. 1), and two pushbutton switches (A and B).

When the power is turned on, the 7-segment displays will show "00". Setting a start value for the countdown timer can be done as follows. When the user presses and releases pushbutton switch A, the internal counter of the timer will increment by 1 and the 7-segment LED displays will be updated accordingly (“01”). As the user continues operating pushbutton switch A, the counter will be incremented further until a maximum value of 25 seconds is reached. At this point, operating pushbutton switch A will not cause a change of the counter. To reset the counter, pushbutton switch A must be pressed for more than 1 second and the counter will be set to 00.

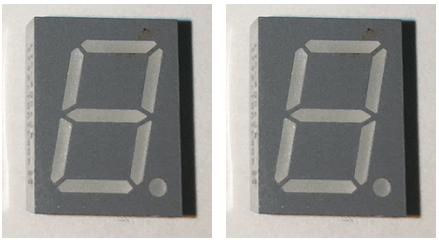

Fig. 1. Two seven-segment LED displays.

To start the countdown timer, pushbutton switch B must be operated, and the counter will start decrementing every second, and the display will be updated accordingly. Once the countdown timer reaches zero, two dashes (“- -“) will be shown and start blinking on the display for 4 seconds (LED on: 0.5 s, LED off 0.5 s). Subsequently, the display will show “00”, and the countdown timer can be programmed again as outlined above.

Note that all action must be applied once the pushbutton is released. Your implementation must use a switch debounce approach. Suitable approaches will be discussed in lecture.

Design the interface to the 7-segment display such that the current required to drive a segment is equal to or less than 5 mA. Details regarding the shift register IC, the 7-segment display, connection to microcontroller, etc. will be covered in class. The corresponding lecture slides and other relevant resources (e.g., data sheets) will be available on ICON.

After completing the assignment, upload your code and report to ICON (note that one source code file and report per group is sufficient). If you plan to see a TA on the day the lab is due, a sign up for check off is required (see calendar on ICON).

Mid-lab reviews - Show a TA your progress towards completing Lab2 (use the ICON calendar for sign up).

February 8: It is expected that you can demonstrate that your program on the microcontroller can successfully interact with the pushbuttons as well as the 7-segment displays (showing different digits on the displays, debounce approach implemented and working, as well as demonstrating a response by the microcontroller when one of the pushbuttons is operated).

February 15: It is expected that you can demonstrate all functionality needed to set and reset the countdown timer.