

## CSC 230 Assignment 4 Part 2

Fall 2016

**Submissions due on November 28, 2016.**

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This assignment has two parts:

- 1) **Written Part:** A small written part is available on the Connex site: Tests&Quizzes.
  - 2) **Programming Part:** Submit it via the Assignments link on the Connex site.
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### Objectives

- Gain confidence with “C” programming.
- Create effective subroutines/functions.
- Use peripherals: the LCD, timer interrupts and buttons

### Academic Integrity

Prior to submitting your assignment, carefully read the University policy on Academic Integrity:  
<http://web.uvic.ca/calendar2014/FACS/UnIn/UARe/PoAcl.html>

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### Assignment 4: Programming Part [25]

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Recall that in Lab 8 and Lab 9 you wrote “C” code to use the LCD display, buttons and timers. This programming exercise is to combine all of this functionality into one to produce a **stop watch**. You can reuse the code from main.c of Lab8, button.c and timer\_interrupt.c of Lab9 and the LCD driver files provided in the lab for this purpose. Your program should do the following:

1. Use a timer to generate interrupts. Choose the timer initial value and scaling factors appropriately.
2. The Interrupt service routine will maintain four counters, hours, minutes, seconds and sub-seconds. Sub-second counter is incremented every 1/100 second.
3. These counters are updated appropriately based on the interrupt.
4. Display the time as “hr:min:sec.sub\_sec” format on Line 1 of display, two digits for each.
5. Display the same time on Line 2 of the display.
6. When a button is pressed (any button), Line 2 is paused while the time in Line 1 continues to increment.
7. When a button is pressed again (any button), the time displayed in Line 2 resumes and syncs with the same time as Line1.
8. Note that the display program takes ASCII characters for display. So if you need to display a number you need to convert that into equivalent ASCII string. For example to display the number 59, you may not be able to pass the value of 59 directly to the LCD. Instead it should be converted to two ASCII characters, as 53 (for 5) and 57 (for 9).
9. **Submit your “main.c” program and .hex file on connex**

### Grading note:

- a. If you submit a program that does not compile you will receive 0 for that part of the assignment.