

Last Name (Print): \_\_\_\_\_

First Name (Print): \_\_\_\_\_

ID number (Last 4 digits): \_\_\_\_\_

Section: \_\_\_\_\_

Submission deadline: Please submit your solutions as a PDF file to the EE 200 CANVAS page by 11:59 pm on Tuesday November 8<sup>th</sup>. Your solution must include this page as a cover sheet.

Problem	Weight	Score
13	Lab Attendance	
14	25	
15	25	
16	25	
17	25	
Total	100	

The solution submitted for grading represents my own analysis of the problem, and not that of another student.

Signature: \_\_\_\_\_

Neatly print the name(s) of the students you collaborated with on this assignment.

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### **Problem 13:** (Lab Attendance)

Liquid crystal displays (LCDs) are ubiquitous in consumer electronic devices as well as technical instrumentation owing to their low-cost, low-power consumption, and ease of programming. The physics and display programming will be covered in EE 200 lectures. Each EE 200 component kit contains a single LCD module that displays 2 lines by 16 characters. In upcoming laboratory exercises you will program the LCD display using the the Microchip Technology PIC (Peripheral Interface Controller) microcontroller and the digital output lines of the myDAQ. In order to plug the LCD module into a protoboard, you must first solder the 16-way, 1-row board-board connector shown in Figure 1 to the LCD module as shown in Figure 2. Each EE 200 student must complete this task and show the LCD module with the soldered connector to the instructor during recitation sections on either Thursday November 3 or Friday November 4. Complete this task by following the steps below.

1. First and foremost you must adhere to the following safety guidelines:
  - Wear eye protection to prevent eye damage from solder splatter.
  - Never touch the element or tip of the soldering iron. They are very hot (about 320°C) and will burn.
  - Hold wires to be heated with tweezers or clamps.
  - Keep the cleaning sponge wet during use.
  - Always return the soldering iron to its stand when not in use. Never place it on the workbench.
  - Turn the unit off or unplug it when not in use.
  - Use a bench-top fume extractor to remove harmful fumes caused by solder and flux.
  - Wear nonflammable or 100% cotton clothing that covers your arms and legs to help prevent burns.
  - In case of burns
    - Immediately cool the affected area under cold water for 15 minutes
    - Do not apply any creams or ointments. Cover with a band-aid
    - Seek medical attention if the burn covers an area bigger than 3 inches across
2. Read the attached files on soldering techniques and online soldering tutorial:
  - Soldering is Easy (FullSolderComic\_EN.pdf)
  - Better Soldering (WellerSoldering.pdf)
  - <http://www.aaroneake.net/electronics/solder.htm>
3. Figure 1 shows that the opposite sides of the 16-way, 1-row board-board connector have different pin lengths. The short pin side is soldered to the module, as the long pin side is needed for connection to the protoboard. Figure 2 shows that the board-board connector is mounted below the LCD display. Use the soldering stations available at the Learning Factory or borrow one for the EE stockroom to complete this exercise.

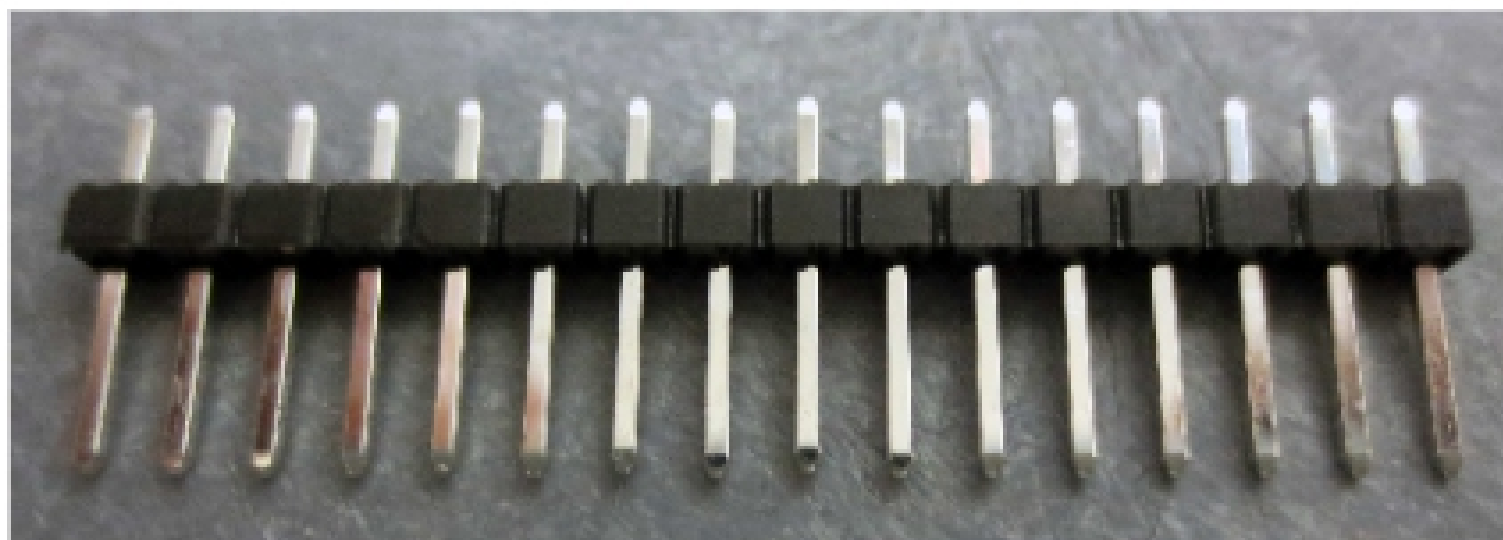


Figure 1: LCD module connector.



Figure 2: LCD module with connector.

**Problem 14:** (25 points)

Consider the VI in Figure 3, where the front panel control Boolean uses switch when released mechanical action. Before the VI starts, the front panel Boolean control is set to false.

1. (5 points) Specify the value of the indicator Count when the VI first starts. Justify your answer using one or two short sentences.
2. (15 points) The user starts the VI, clicks on the front panel control Boolean five times, and then clicks on the stop button. What value does the indicator Count display after the VI stops executing? To receive credit, you must show how you arrived at your answer. For examples of acceptable solution detail, review the solutions posted for Problem Set 4.
3. (5 points) After the VI completes execution in part 2, is the value of the Boolean control true or false? As in part 2, you must justify your answer.