Lab 13: Confidence Intervals

Group Number: _____   Section Number:_____

Name _____

Other team members _____

(Circle the name of the person who acted as leader/coordinator this week--make sure you get a turn every 4th lab)

Safety

This lab requires you to partially repeat one of the previous labs. Therefore, please refer to the safety section of the previous lab.

Begin your lab by holding a team planning session (10 minutes)

1. Select a prior lab you can use to do repeated collection of some measurement. Review that lab and its relevant safety information. Also read the Concept document posted on Learning Suite to familiarize yourself with important statistical concepts.
2. One person should serve as leader/coordinator. All team members should strive to take make the team function better through various roles: observer, recorder, devil's advocate, etc. Ask for each other's input and opinions, help each other, and try to come to consensus after an appropriate amount of brainstorming and analysis.
3. Make a plan for how you will complete the lab activities. Each person should fill out their own lab report as activities are completed. At the end of the hour, after cleaning up, get the TA to initial the end of your report.

Background

In order to make appropriate engineering decisions based on experimental data, we must have sufficient certainty in the accuracy of those data. There is always some risk that the data are wrong. If such is the case, this could lead to injury, loss of life, or loss of money, and so we need to quantify the risk. A chemical engineer therefore needs to be able to assign a *confidence interval* to measured values. A confidence interval can be expressed as a sample mean ± margin of error.

This lab will allow you to review (or learn for the first time!) the statistical concepts of confidence interval, margin of error, and independent samples. First read the *Confidence Interval Concepts* document posted on Learning Suite. You may also need to view an online tutorial or "how to" on calculating a confidence interval. Wikipedia is not necessarily the best source for such information because the article may not be written for beginners.

Project

For this lab you need to make a measurement of some quantity (e.g. time, pressure, flow rate) with at least 10 replicates. Then compute the confidence interval of that quantity at the 95% confidence level. You will do this on an Excel sheet.

Pre-Lab

1. What quantity are you going to collect? What is the physical unit of that quantity?

2. How many samples will you collect? (at least 10)

3. List at least one possible physical source of variability or fluctuation in your measurement.

4. How will you ensure that your repeated samples are statistically *independent*? Be specific.

Lab

1. Collect your data

2. Put your sample values in a single column of an Excel spreadsheet. Also on your spreadsheet give the following values in *appropriately labeled and formatted* summary cells.
   a. Sample mean $\bar{x}$
   b. Sample standard deviation s
   c. Number of samples n
   d. t value (dimensionless) for 95% confidence level and the value of n.
   e. Margin of error, reflecting how repeatable the sample mean is.

   Your spreadsheet should be easy to read and interpret. *Change the number of displayed digits* for the sample mean and margin of error cells so that they have the appropriate

level of precision, as discussed in the Concept document. Specify physical units next to summary cells.

Attach a printout of your sheet to this lab report. An annotated example report is shown below, showing the Excel functions used.

	A	B	C	D	E	F	G	H
1	**Example Report**							
2								
3	Sample time (s)			Summary statistics			cell formulas used	
4	6.3			mean =	6.11	s	=AVERAGE(A4:A18)	
5	6.2			std dev =	0.31	s	=STDEV.P(A4:A18)	
6	6.2			n =	15		=COUNT(A4:A18)	
7	6.4			t =	2.1314495		=T.INV.2T(0.05,E6)	
8	5.7			marg err =	0.17	s	=E5*E7/SQRT(E6)	
9	6.3							
10	6.3			Notes:				
11	6.2			*Specify units for mean and margin of error.				
12	6.5			*Level of significance used in two-tailed t value is 0.05.				
13	6.5			*Margin of error is rounded to two sig figs, making				
14	5.8			0.01 the level of precision here. So the mean is				
15	5.6			rounded to that level as well.				
16	5.5			*To round a cell, right-click on it and use				
17	6.0			Format Cells --> Number --> Decimal Places				
18	6.2							
19								

Brainstorm: Do you have any ideas for future changes to this Lab?

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Grading Rubric (to be completed by TAs)

	Points	Max
Completed Activities and write-up		5
Excel sheet appropriately formatted and calculations done correctly		4
Safety and cleanup: **TA initial:**_____		1
Total		10