

**Part I:** (30 points) Do this part individually. You will turn in your own copy of this work.

- *This exam is due at the beginning of class on Tuesday, 5/1/18. Be sure that all answers are written in your own words; i.e., do not write verbatim the same answer as another student.*
- *Your work should be typed except for calculations and graphs, which can be hand-written.*
- *Your work should incorporate all of the Minitab work mentioned below; i.e., copy and paste the Minitab results into your write-up.*

Scoring will be based on organization of your work, accuracy, and thoughtful, well-written answers using complete sentences!

Do your work on another sheet of paper. Please number and letter your answers to match the questions.

1. Write at least a paragraph, in your own words, to explain what a sampling distribution is and how it relates to making statistical inferences. Be sure to use the term “sampling variability” in your answer. You may use an example to illustrate your answer or you can just answer in general terms. Your response should be college level writing.
2. If you had census data from a population would you use a hypothesis test to learn something about that population? Explain.
3. Explain why we use the t-distribution instead of the z-distribution (the Normal distribution) for making inferences about population means.
4. Suppose you poll 30 students in the Math Lab and find that their average GPA is 3.26, with a standard deviation of 0.81.
  - a. By hand, construct a 95% confidence interval for the mean GPA of all students who use the Math Lab. Interpret the confidence interval in the context of the problem.
  - b. Based on the confidence interval, could you conclude that there are no individual students with a 4.0 GPA who use the Math Lab? Explain, based on what the confidence does or does not tell us about individuals in a population.
  - c. Suppose the average GPA of all Cuesta College students is 2.73. Could we conclude, based on just the confidence interval, that students who use the Math Lab have, on average, significantly higher GPA’s than general Cuesta students? Explain how you can tell.
  - d. Test (using a 1-Sample t-Test) whether students in the Math Lab have, on average, significantly higher GPA’s than general Cuesta students. Include all 4 steps of the hypothesis test. Write the hypothesis with symbols and with words. You may use Minitab for the Compute step, but draw a well-labeled curve that illustrates the sampling distribution, the sample mean, the t-value, and the P-value.
  - e. Can we conclude that using the Math Lab causes students to have higher GPA’s? Explain why or why not.

**Part II: (70 points) Comparing and Making Inferences about Two Populations**

You may do this part of the exam with one other student in the class. Please work on both of the problems together; i.e., do not have one person do one part and the other person do the other part.

Please turn in ONE COPY with BOTH NAMES on it.

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***Please number your responses as the questions are numbered below.***

You are going to do a study comparing two populations of interest with regard to proportions and to means.

1. Choose two different populations of interest. Write what your two populations of interest are.  
**Examples:** college athletes vs. college non-athletes; your major vs. not your major; college students vs. non-students; Cuesta students vs. Cal Poly students; people who attend church vs. people who do not attend church; men vs. women; gender neutral vs. gender identified.
2. Choose a qualitative (categorical) and quantitative variable of interest\* (see below\*) and then write your research question. Your research question is going to be whether there is a significant difference between the populations with regard to each of these variables.
3. Gather data from a sample of 25 people from each population. Describe how you collected your data. Organize your data in a table (or list it) and include this with the exam.
4. Qualitative variable: Ask your subjects a political/sociological question. You can ask a tame question or you can ask something edgier and more controversial but in either case **make your actual question as neutral as possible.**

**Examples** of possible questions with a qualitative variable: Choose ONE or come up with your own! Voter Participation: Did you vote in the last election? Animal Welfare: Do you think the U.S. should have stricter animal welfare laws? Energy: Do you think the U.S. government should invest more in developing alternative energy sources? Environment: Do you believe that human activity a cause of global warming? Death Penalty: Do you support having a death penalty for certain crimes? Education Priorities: Do you think art and music should be taught in elementary school?

**These are just examples.** I would prefer that you come up with your own question based on what interests you but you may use one of the example questions.

Compare the proportion of “yes” answers between the groups and make an inference for the populations. Do this as follows:

- a. Use Minitab to get a confidence interval for the difference in the 2 Proportions. Interpret the confidence interval and specifically say whether or not it indicates that there is a significant difference between the two groups and how you can tell.
  - b. Use Minitab to perform a 2-Proportion hypothesis test. Test whether your data provides evidence that there is a significant difference between the groups. Include all 4 steps of the hypothesis test!
5. Quantitative variable: Ask a question with a numerical answer. Again, you can ask a tame question (ex: hours of sleep) or an edgier question (ex: student loans, number of traffic tickets), your choice.

**Examples:** Choose ONE or come up with your own. Sleep: How many hours do you usually sleep on a weeknight? Study: How many hours do you study per week? Load: How many units are you taking this semester/quarter? Debt: How much is your student loan debt? Distance: How far away does your family (parents) live from your college/university; i.e., how far away is your home town? Tickets: How many traffic tickets have you gotten in your life?

**These are just examples.** I would prefer that you come up with your own question based on what interests you but you may use one of the example questions.

Compare the means of the two groups and make an inference about the populations.

- a. Use Minitab to get a confidence interval for the difference in means. Interpret the confidence interval and specifically say whether or not it indicates that there is a significant difference between the two groups and how you can tell.
  - b. Use Minitab to perform a 2-Sample t-test hypothesis test. Test whether your data provides evidence that there is a significant difference between the groups. Include all 4 steps of the hypothesis test!
6. Write a page summarizing the results of your analysis and critiquing your study. What did you learn?

*Futher instructions on hypothesis tests:*

**Write the hypotheses** using math symbols and also in words related to the problem.

**Check the conditions carefully.** Write complete sentences and thoroughly explain how the problem does or does not satisfy each condition and/or any assumptions you have to make.

For example, for the condition of “random sample” if you just write “yes” or “no” then you won’t get credit for checking that condition.

For the condition of “independent samples”, explain why the answers your subjects gave are or are not independent. This will tie in with how you collected your data.

**Computation** will be performed using Minitab. Cut and paste the Minitab results into your write-up.

**Interpretation** should be specific to the original research question.