Midterm Exam 3 Math 243, Summer '20, Pohl

Instructions:

The *only* resources you may use to complete this exam is a calculator with a stats package and the z- and t-tables provided on Canvas. Do **not** use your textbook, notes, or the internet. If you use your calculator to answer a question, you must indicate the command used (e.g. `normalcdf(50, 70, 60, 10)`) to receive credit.

Check your answers. Take the time before you turn in your test to make sure you have read the directions correctly and in their entirety, that all your work shown is correct, and that you have clearly stated your answer (by boxing or circling it where appropriate). The exam is five pages long.

Show your work. For short answer and free response questions, in order to receive credit, you must show your work. Answer without explanation will receive no credit.

Pace yourself. If you're stuck on a problem, move on and come back to it later. Don't risk forcing yourself to give partial answers if you run out of time near the end of the test. Do the easy ones first. There are 25 total possible points on this exam.

- Multiple choice and fill in the blank questions are worth one point each.

- All other questions are marked with their point values.

Watch the time. This is a 50 minute exam. The extra 20 minutes at the end of the exam are for you to upload your exam to Canvas as a pdf. Keep in mind that Canvas will not allow exam submission after 12:10 PM.

Write clearly. Please make sure that your Canvas submission is clear and legible. I cannot grade solutions that I am unable to read.

Good luck!

1. **Multiple Choice:** Samples were collected from two ponds in the Bahamas to compare salinity values (in parts per thousand). Several samples were drawn at each site. Here's the data:

Pond 1	38.85	37.02	37.01	37.36	37.71	37.03	36.75
Pond 2	39.21	38.71	38.51	39.05	38.53		

Suppose now that we perform an $\alpha = 0.05$ significance level two-sample t-test to investigate the claim that the two ponds have the same mean salinity value. We should

   (a) not take the results too seriously since neither sample is big enough to be meaningful.

   (b) check to see if the data appear close to Normal since the sum of the sample sizes is less than 15.

   (c) remove the largest and smallest values from the larger data set and only test equal size samples.

   (d) All of the above.

2. **Multiple choice:** You have an SRS of four observations from a Normally distributed population. What critical value would you use to obtain an 80% confidence interval for the mean μ of the population?

   (a) 1.533

   (b) 1.638

   (c) 2.353

3. Which inference procedure should you use in each of the following settings: a matched pairs t-test, or a two-sample t-test?

   (a) [2 pts] You interview both the instructor and one of the students in each of 20 introductory statistics classes and ask each how many hours per week homework assignments require.

   (b) [2 pts] You interview a sample of 15 instructors and another sample of 15 students and ask each how many hours per week homework assignments require.

   (c) [2 pts] You interview 40 students in the introductory statistics course at the beginning of the semester and again at the end of the semester and ask how many hours per week homework assignments require.

4. **Multiple Choice:** The coach of a Canadian university's men's hockey team records the resting heart rates of the 26 team members. You should not trust a confidence interval for the mean resting hear rate of all male students at this Canadian university based on these data because

   (a) with only 26 observation, the margin of error will be large.

   (b) heart rates may not have a normal distribution

   (c) the members of the hockey team can't be considered a random sample of all students.

Free Response: Answer clearly and concisely, including all work. If asked to explain something, use complete sentences. If you are performing a hypothesis test, be sure to include hypotheses, a test statistic, a p-value, and an interpretation with context from the problem.

5. A class survey in a large class for first-year college students asked, "About how many hours do you study during a typical week?" The mean response of the 81 students was $\overline{x} = 13.7$ hours. Suppose that the study follows a normal distribution with sample standard deviation $s = 7.4$.

   (a) [5 pts] Use the survey results to **construct** a 99% confidence interval for the mean study time of all first-year students. (You do not need to interpret the interval or check conditions for this part of the problem.)

   (b) [1 pt] What condition not yet mentioned is required for your confidence interval to be valid?

6. An SRS of 148 three-star and four-star hotels were rated on a scale from 1 to 10 on cleanliness. The sample of hotels had a mean cleanliness score of $\bar{x} = 5.29$. The mean score for all hotels in the United States 5.19. On average, are three-star and four-star hotels cleaner than the general population of hotels? Assume that the standard deviation of scores in the population of all hotels is $\sigma = 0.78$.

   (a) [2 pts] State the null and alternative hypotheses in terms of μ, the true mean cleanliness score of three- and four-star hotels.

   (b) [1 pt] Find the z test statistic.

   (c) [2 pts] What is the p-value for your test statistic? What can you conclude from your hypothesis test?

7. [5 pts] Do wearable devices that monitor diet and physical activity help people lose weight? Researchers had 101 subjects, already involved in a program of diet and exercise, use wearable technology for 24 months. They measured their weight (in kilograms) before using the technology and 24 months after using the technology. The 101 differences in weight (weight after 24 months minus weight before using the wearable technology) had $\bar{x} = -3.5$ and $s = 7.8$. Is there significant evidence of a reduction in weight after using the wearable technology?

8. [Extra credit] List at least five distinct inference procedures that we have discussed so far. I'll start you off:

    i. One-sample t-test

   ii.

  iii.

  iv.

   v.