Math 247: Test 4 (Wright, Fall 2019)   Name:_____

_____/100 pts

I encourage you to work with other students in the class but the final work you hand in must be your own. Your answers must match every step of your work; otherwise, you may lose most or all of the points for the problem. You may consult with tutors but do not ask them to solve the problems for you!

- *This exam is due <u>at the beginning of class</u> on Tuesday, 12/3/19. <u>Be sure that all answers are written in your own words</u>; i.e., do not write verbatim the same answer as another student.*
- *Include printouts for all StatCrunch work. Please label the StatCrunch printouts with corresponding problem number and letter from the test.*

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

1. (10 pts) The following is the taken from the "Annual Drinking Water Quality Report", from 2004, for the town of Brookston, Indiana. In the final report there was this statement:

    "I'm pleased to report that our drinking water is safe and meets federal and state requirements."

    Here are some of the actual test results: Violation "Y/N" means Yes/No. Yes = violation because the water exceeds the safety standard; No = no violation because the water is under the MCL.

    MCL is the maximum contaminant level, the highest level of a contaminant that is allowed in drinking water.

    Beta/photon emitters and alpha emitters refers to radioactivity detected in the water.

    The Level Detected values are confidence intervals in the Margin of Error format.

Contaminant	Violation Y/N	Level Detected	Unit measurement	MCL
Beta/photon emitters	N	2.1 ± 3.2	mrem/yr	4
Alpha emitters	N	0 ± 1.6	pCi/l	15

One of these contaminant violation results should actually be a "yes" instead of a "no." Which one is it and why? Include a discussion of what the numbers in the confidence interval tell you about the sample mean (that came from water samples) and what the inference is for the population (the entire water supply).

2. (20 pts) Research conducted in 2015 showed that 35% of Cuesta students had travelled outside the US. A recent survey in 2019 showed that out of the 100 randomly sampled students, 48 have travelled outside the US.

(a) By hand, construct a 95% confidence interval for the proportion of all Cuesta students who have traveled out of the US. For full credit, clearly show all of your work.

(b) Find the confidence interval using StatCrunch. Print out and attach your work to this test.

(c) Interpret the confidence interval the context of the problem.

(d) What would the hypotheses be if you wanted to test whether there has been a significant change in the proportion of Cuesta students who have traveled outside of the US since 2015?

(e) Would you reject or fail to reject the null hypothesis above at the .05 significance level, based on the confidence interval you found in part (a)? Explain your answer.

3. (40 pts) A student doing a research project on whether the Academic Success Center helps students took a random sample of 30 students in the Math Lab and found they had a mean GPA of 3.26, with a standard deviation of 0.81. The average GPA of all Cuesta College students is 2.93.

(a) Test whether the students in the Math Lab have, on average, significantly different GPA's than general Cuesta students. <u>Include all 4 steps of the hypothesis test</u>. Write the hypotheses with symbols and with words. Do all compute work by hand, up to finding the P-value. Use StatCrunch to confirm your results and to find the P-value. Draw a well-labeled curve that illustrates the sampling distribution, the sample mean, the t-value, and the P-value. Include a printout of the StatCrunch work.

(b) Referring to the hypothesis test in part (a), if we were to change the test to see whether the mean GPA of students in the Math Lab is significantly <u>higher than</u> from the general Cuesta student mean GPA,

- What would the new Alternative Hypothesis be? _____

- What would the new P-value be? _____

- Would changing the Alternative Hypothesis change the outcome of the hypothesis test? Explain.

- Which test is stricter (harder to get a significant result)?   One-Tailed Test   Two-Tailed Test

#3 (continued)

    (c) By hand, construct a 95% confidence interval for the mean GPA of all students who use the Math Lab.

    (d) Use StatCrunch to find the CI. Include the printout with your test.

    (e) Interpret the confidence interval in the context of the problem.

    (f) Does the CI support your conclusion to the hypothesis test in part(a)? Explain.

    (g) Does the CI support your conclusion to the hypothesis test in part (b)? Explain.

    (h) In order to relate a confidence interval to a hypothesis test, the test must be _____ - Tailed.

    (i) Can we conclude that using the Math Lab _causes_ students to have higher GPA's? Explain why or why not.

4. (30 points) Dr. Dean Ornish conducted a five-year study (https://jamanetwork.com/journals/jama/fullarticle/188274) in which he showed that coronary artery disease (CAD) is reversible. Patients with advanced CAD were randomized (randomly assigned) to an intensive lifestyle change group (low-fat vegetarian diet, moderate aerobic exercise, stress-management training, group support) or to a usual-care control group. After 5 years, the control group of 20 patients had an average of 2.25 cardiac "events" per patient (heart attack, hospitalization, by-pass surgery, cardiac-caused death), with standard deviation of 1.15. The experimental group of 28 patients had an average of .89 cardiac events per patient with standard deviation .38.

   (a) Perform a hypothesis test to see whether there is a significant difference in the mean number of cardiac events between the two groups. Include all 4 steps of the hypothesis test. Write the hypotheses with symbols and with words. Use StatCrunch to do the compute step but draw a well-labeled curve by hand that illustrates the sampling distribution of the difference in means, the observed difference, the Test Statistic (t-value), and the P-value. Include a printout of the StatCrunch work. Use alpha = .05

#4 (continued)

(b) Does the result from the hypothesis test above tell us whether there were significantly *fewer* cardiac events in the Lifestyle Change group? Explain.

(c) Find the 95% confidence interval for the difference in means using StatCrunch (include printout)

CI:

(d) Explain how you can tell whether or not to reject the null hypothesis by just looking at the CI.

(e) Interpret the confidence interval in the context of the study. Include what the confidence interval tells us about which group had significantly fewer cardiac events, on average.