

L11: Homework Answer Key

Instructions: You are encouraged to collaborate with other students on the homework, but it is important that you do your own work. Before working with someone else on the assignment, you should attempt each problem on your own.

1. Compare the t-score to the z-score. What is the primary difference between the two scores?

$$t = \frac{\bar{x} - \mu}{s/\sqrt{n}}$$

$$z = \frac{\bar{x} - \mu}{\sigma/\sqrt{n}}$$

The primary difference is that a t-score uses the sample standard deviation (s) whereas a z-score uses the population standard deviation (σ).

2. The null hypothesis is $H_0: \mu = 24$ and the alternative hypothesis is $H_a: \mu > 24$ and the population standard deviation σ is not known. You collect a sample of size $n = 18$ and compute a mean of $\bar{x} = 27$ and a standard deviation of $s = 8$. Compute the t-score using this information.

$$t = 1.591$$

Shane Goodwin and other researchers studied factors that affect a student's confidence on a multiple-choice mathematics exam. A group of $n = 139$ students in an Intermediate Algebra course at BYU-Idaho participated in the study. In addition to marking their test question responses, they evaluated their confidence for each question on a scale of 1 to 6:

Confidence Rating	
1	Random guess (no clue)
2	Very unsure
3	Somewhat unsure
4	Somewhat sure
5	Very sure
6	Certain (absolutely sure)

Confidence ratings were not relayed to the instructor, and they did not affect the grade on the exam. The mean confidence rating marked by each student is given together with their score on the exam. (The maximum score possible on the exam was 100 points.) Open the data file [MathSelfEfficacy](#). Use this information to answer questions 3 through 5.

3. What is the mean score on the exam earned by the $n = 139$ students in the sample?
74.72 points
4. Find and interpret a 95% confidence interval for the true mean *score* on this Intermediate Algebra exam.
(71.98, 77.47) We are 95% confident that the true mean score for all students who take this exam is between 71.98 and 77.47.

5. Find and interpret a 95% confidence interval for the true mean *confidence rating* expressed by students on this Intermediate Algebra exam.

(4.257, 4.571) We are 95% confident that the true mean confidence rating for all students who take this exam is between 4.257 and 4.571.

Two years ago in a similar study, the mean student confidence rating (on a scale from 1 to 6) was found to be 4.12. We want to know if the mean confidence rating of math students has gone up in the last two years. Do a hypothesis test to see if the new study has a mean student confidence rating that is significantly higher than two years ago. Use 0.05 as your level of significance. Use this information to answer questions 6 through 12.

6. What are the assumptions that should be met to conduct this hypothesis test? Are they met?

- Data was collected by a simple random sample. (We assume that this is true)
- \bar{x} is normally distributed. (We can assume the distribution of sample means is normally distributed due to the central limit theorem)

7. State the null and alternative hypotheses.

$$H_0: \mu = 4.12$$

$$H_a: \mu > 4.12$$

8. Compute the sample test statistic.

$$t = 3.693$$

9. State the degrees of freedom.

$$df = 138$$

10. Find the P-value and compare it to the level of significance.

$$P\text{-value} = 0.00015 < 0.05 = \alpha$$

11. State your decision. Do we reject the null hypothesis or fail to reject it?

Reject the null hypothesis.

12. State your conclusion in an English sentence, relating the result to the context of the problem.

There is sufficient evidence to suggest that the confidence rating scores for this year are significantly higher than two years before.

A group of students carefully scraped the white filling (the “Stuf”) from traditional and DoubleStuf Oreo cookies. They took about 50 samples of each type of cookie and measured (in grams) the amount of stuffing in each cookie to determine if DoubleStuf Oreos really contain “double” the amount of filling. Open the data file [OreoDoubleStuf](#). Use this information to answer questions 13 through 15.

13. Find and interpret a 90% confidence interval for the true mean weight of the filling in traditional Oreo cookies.
(2.808, 2.988) We are 90% confident that the true mean weight of the filling in traditional Oreo cookies is between 2.808 and 2.988grams.
14. Find and interpret a 90% confidence interval for the true mean weight of the filling in DoubleStuf Oreo cookies.
(5.591, 5.920) We are 90% confident that the true mean weight of the filling in DoubleStuf Oreo cookies is between 5.591 and 5.920 grams.
15. Based on your observations in this exercise, would you say that DoubleStuf Oreo cookies actually contain double the filling compared to traditional Oreo cookies? Justify your answer.
It is likely. The mean for the double stuf Oreos is a little more than twice as big as the mean for the traditional Oreos. The confidence intervals provide plausible true means for each cookie type. The intervals indicate that there might be a little less than twice the stuffing or a little more than twice the stuffing.