

ECON 0150 | Fall 2024 | Homework 6

Due: Tuesday, November 19

Homework is designed to both test your knowledge and challenge you to apply familiar concepts in new applications. Answer clearly and completely. You are welcomed and encouraged to work in groups so long as your work is your own. Use the datafiles to answer the following questions. Then submit your answers to Gradescope.

This homework covers confidence intervals and hypothesis testing.

Q1. The quality control department has collected data on defective products produced over a 24-hour time span. Using a random sample of 900 products, they discover that the average number of defects is 295, while the sample standard deviation is 60. The department wants to conduct a test of whether the average number of defective product is 300 or not. Use python to determine which of the following statements is true.

- I. The null hypothesis can be rejected with 68% confidence.
- II. The null hypothesis can be rejected with 95% confidence.
- III. The null hypothesis can be rejected with 99.7% confidence.

- A) I only
- B) II only
- C) Both I and II
- D) All three statements

Q2. Consider the same setup as Question 1 except for two changes: (1) the sample size is now 700; and (2) the sample standard deviation is now 70.

a. Determine which of the following statements is true.

- I. The null hypothesis can be rejected when the significance level is 0.32.
- II. The null hypothesis can be rejected when the significance level is 0.05.
- III. The null hypothesis can be rejected when the significance level is 0.003.

- A) I only
- B) II only
- C) III only
- D) All three statements

b. Determine which of the following statements is true.

- I. The null hypothesis can be rejected with a confidence level of 60%.
- II. The null hypothesis can be rejected with a confidence level of 97.5%.

- A) I only
- B) II only
- C) Both I and II
- D) Neither I nor II

c. Determine which of the following statements is true.

- I. The null hypothesis can be rejected with a confidence level of 60% or above.
- II. The null hypothesis can be rejected with a confidence level of 97.5% or above.

- A) I only
- B) II only
- C) Both I and II
- D) Neither I nor II

Q3. The owner of a local nightclub has recently surveyed a random sample of 250 customers of the club. She would now like to determine whether or not the mean age of her customers is 30. Suppose she found that the sample mean was 29.55 years and the sample standard deviation was 5 years. At a significant level of 0.1, what decision should she make?

- A) Reject H_0
- B) Reject H_a
- C) Do not reject H_0
- D) We cannot tell what her conclusion should be from the information given

Q4. It is desired to estimate the mean total compensation of CEOs in the Service industry. Data were randomly collected from 18 CEOs and the 95% confidence interval was calculated to be (2,181,260, 5,836,180). Based on the interval above, do you believe the mean total compensation of CEOs in the Service industry is more than 3,000,000?

- A) Yes, and I am 95% confident of my conclusion
- B) No, and I am 95% confident of my conclusion
- C) Yes, and I am 78% confident of my conclusion
- D) I cannot conclude that the mean exceeds 3,000,000 at the 95% confidence level

Q5. Use Excel and the file "HW_6_Q5.xlsx" to answer this question. A tortilla chip maker is looking at the efficiency of their packaging system. According to company specification, the average number of tortilla chips in a bag should be 120. If the average number of tortilla chips in a bag is different from this desired level, the production director needs to stop production and adjust the packaging machine. If the average mean is not different from this desired level, she is happy for production to go on undisturbed. To study whether interruption of production is needed, the chip maker collects a sample of 100 bags. The number of tortilla chips in each bag is given in the Excel file.

- a) State the null hypothesis (H_0) and alternative hypothesis (H_a).
- b) To test the validity of the null hypothesis, what is (the value of) the test statistics?
- c) Can you reject the null hypothesis with 95% confidence?
- d) What is (the value of) the p-value?
- e) Suppose you can reject the null hypothesis at some confidence level α . What is the range of α ?