

Lab Activity: Hypothesis Testing – Single Population Mean

In this lab activity, you will conduct hypothesis testing for claims involving a single population mean.

Student Learning Outcomes

By the end of this chapter, you should be able to do the following:

- Perform hypothesis testing for a single population mean using Statcato
- Interpret the results of hypothesis tests

Preliminary

Read Chapter 9 Hypothesis Testing: Single Mean and Single Proportion in:

Illowsky, Barbara, and Susan Dean. Collaborative Statistics. Connexions. 2 Mar. 2010
<<http://cnx.org/content/col110522/1.37/>>.

Make sure you understand the following **key terms** (LR:Key Terms):

hypothesis testing, hypothesis, null hypothesis, alternative hypothesis, Type I error, Type II error, rare event rule, p-value

Background

The U.S. Census Bureau defines the household size to be the total number of people living in a housing unit. According to the U.S. Census 2000, the average household size is 2.59. However, you suspect that the average household size of the students at your school is higher since you believe that most students live with their parents and siblings. You will conduct hypothesis tests for the average household size using (1) a Normal z-test (assuming a known population standard deviation σ) and (2) a Student t-test (assuming an unknown σ).

Sampling Data

Survey 30 students for the study using a random sampling method of your choice. Ask each subject the size of his or her household. Discuss the details and results of the data collection process in **LR: Data**.



Here you will input the samples into Statcato for further processing later in the lab.

- Go to **File > Save Project** in order to save the project.
- Enter the 30 samples in column **C1**.

Formulating the Hypothesis Test

Answer the following questions in **LR: Hypotheses**.

- State the claim that you are testing.
- State the null and alternative hypotheses.

- H_0 :
- H_a :
- Is this a right-tailed, left-tailed, or two-tailed test?
- Define the random variable for this test.

Performing the Hypothesis Test – Known σ

Using Statcato, you will perform calculations for the hypothesis test assuming that the population standard deviation σ is known to be 1.0 and using a significance level of 0.05 ($\alpha = 0.05$).



Performing Hypothesis Test: 1-Population Mean

Go to `Statistics > Hypothesis Tests > 1-Population Mean`.

- For **Inputs**, select **Samples in column**. Then in the drop-down menu, select **C1**.
- For **Population Standard Deviation**, select **Known**. Enter **1.0** in the corresponding text box.
- For **Significance Level**, enter **0.05**.
- For **Alternative Hypothesis**, choose **Greater Than** in the drop-down menu. Enter **2.59** in the **Hypothesized Mean** text box.
- Click **OK**.

Copy the computation results to **LR: Hypothesis Test – Known σ** .

Performing the Hypothesis Test – Unknown σ

Using Statcato, you will perform calculations for the hypothesis test assuming that the population standard deviation σ is unknown and using a significance of 0.05 ($\alpha = 0.05$).



Performing Hypothesis Test: 1-Population Mean

Go to `Statistics > Hypothesis Tests > 1-Population Mean` (or select the corresponding item in the Dialog History).

- For **Inputs**, select **Samples in column**. Then in the drop-down menu, select **C1**.
- For **Population Standard Deviation**, select **Unknown**.
- For **Significance Level**, enter **0.05**.
- For **Alternative Hypothesis**, choose **Greater Than** in the drop-down menu. Enter **2.59** in the **Hypothesized Mean** text box.
- Click **OK**.

Copy the computation results to **LR: Hypothesis Test – Unknown σ** .

Making Conclusions

Based on the computer-generated results, you will make decisions and draw conclusions for the hypothesis tests. Record your answers in **LR: Interpretation**.

Decisions on Null Hypothesis

Recall that

- If $\alpha \leq p\text{-value}$, do not reject H_0 .
- If $\alpha > p\text{-value}$, reject H_0 .

Based on the significance level α and the computed p-values, decide whether to reject H_0 and explain why.

Conclusions

Based on your decisions on the null hypothesis, make a conclusion about your claim. For example, your conclusion could be worded as follows:

At the 5% level of significance, the sample data (shows / does not show) sufficient evidence to support the claim that _____.

Discussion

Answer the following questions in **LR: Discussion**.

1. What is the main difference between a hypothesis test for a single mean assuming that σ is known and one assuming that σ is unknown?
2. State the Type I and Type II errors for this study.
3. How would you change the hypothesis tests if you want to reduce the probability of committing the Type I error?