

## Chapter 9: Hypothesis Testing With One Sample

### Part Two: Perform the Hypothesis Test

**Objectives:** By the end of this lecture, a student should be able to:

- Conduct and interpret hypothesis tests for a **single population mean**, when the **population standard deviation is known**
- Conduct and interpret hypothesis tests for a **single population mean**, when the **population standard deviation is unknown**
- Conduct and interpret hypothesis tests for a **single population proportion**
- Utilize the **p-value method** of hypothesis testing
- Utilize the **critical value method** of hypothesis testing

### **Important Reminders:**

- The claim may belong to the null hypothesis ( $H_0$ ) or the alternative hypothesis ( $H_a$ )
- Claim is a statement about a **population parameter**
- **Equality** is always assigned to the null hypothesis
- The **tail of the test** corresponds to the inequality symbol in the alternative hypothesis
- Interpret your results in a meaningful way using **full sentences that reference the claim**

### **Recall: Summarize the Results/State the Conclusion**

Interpret the results of the test in a meaningful way. **Use full sentences that restate the claim and the significance level** of the hypothesis test. The claim may be either  $H_0$  or  $H_a$ .

- Claim is  $H_0$ 
  - Reject  $H_0$ : “At the \_\_\_\_% significance level, there is enough evidence to reject the claim that ...”
  - Do Not Reject  $H_0$ : “At the \_\_\_\_% significance level, there is not enough evidence to reject the claim that ...”
- Claim is  $H_a$ :
  - Reject  $H_0$ : “At the \_\_\_\_% significance level, there is enough evidence to support the claim that ...”
  - Do Not Reject  $H_0$ : “At the \_\_\_\_% significance level, there is not enough evidence to support the claim that ...”

### **Note:**

- We **cannot say that the claim is true**. We can only say that there is enough evidence to support the claim.
- We **cannot say that the claim is false**. We can only say that there is not enough evidence to support the claim.

**Example 1:**

A medical researcher claims that less than 25% of adults in America are vegetarian. In a random sample of 200 American adults, 18.5% say that they are vegetarian. At  $\alpha = .05$ , test the researcher's claim.

**Step 1:** Write the claim in symbol form

**Step 2:** Assign the claim to either  $H_0$  (Null Hypothesis has equality) or  $H_a$

Claim:	$H_0$	$H_a$

**Step 3:** State level of significance and circle the type of test it is.

$\alpha =$

Left-tailed

Right-tailed

Two-tailed

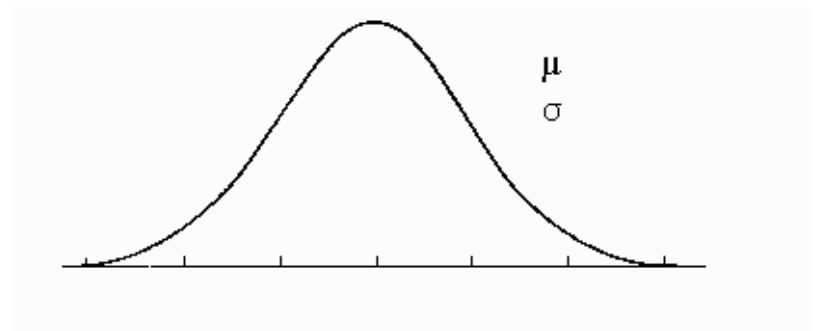
**Step 4:** Determine the sampling distribution.

ZTest

TTest

1-propZTest

Is the distribution normal or approximatly normal?



**Step 5:** Draw a diagram. Determine the critical value of the rejection region.

**Step 6:** Find the test statistic. Label the test statistic on the diagram.

**Step 7:** Find the p-value of the test statistic. (Probability value)

p-value =

**Step 8:** Circle conclusion:                      Reject  $H_0$                       Do Not Reject  $H_0$

Reason:              p-value \_\_\_\_\_  $\alpha$     OR    test statistic \_\_\_\_\_ critical value

Note:

- When our reason uses the p-value compared to alpha ( $\alpha$ ), we are using the **p-value method** of testing
- When our reason uses the test statistic compared to the critical value, we are using the **critical value method** of testing
- Both methods are valid for drawing conclusions during hypothesis testing

**Step 9:** Translate the conclusion into a formal sentence.

### **Summary: Process for Hypothesis Testing**

- 1) Set up **two contradictory hypotheses**, the null hypothesis and the alternative hypothesis
- 2) Determine the **correct sampling distribution** to perform the calculations
- 3) Assuming that the null hypothesis is true, **calculate the probability** of getting sample data like that observed from the sample
- 4) If this probability is sufficiently small, **reject the null hypothesis**
- 5) **Interpret the decision** to write a meaningful conclusion, i.e. interpret the decision to answer the original question

