MODULE 3 LIVE LECTURE

INFERENTIAL STATISTICS AND ANALYTICS

INFERENTIAL STATISTICS AND ANALYTICS–MODULE 3 LIVE LECTURE

- Module 3 Hypothesis Testing
- Module 3 Homework
- Quiz 3
- Course project phase 3
- Module 3 Live classroom Grading
- Summary

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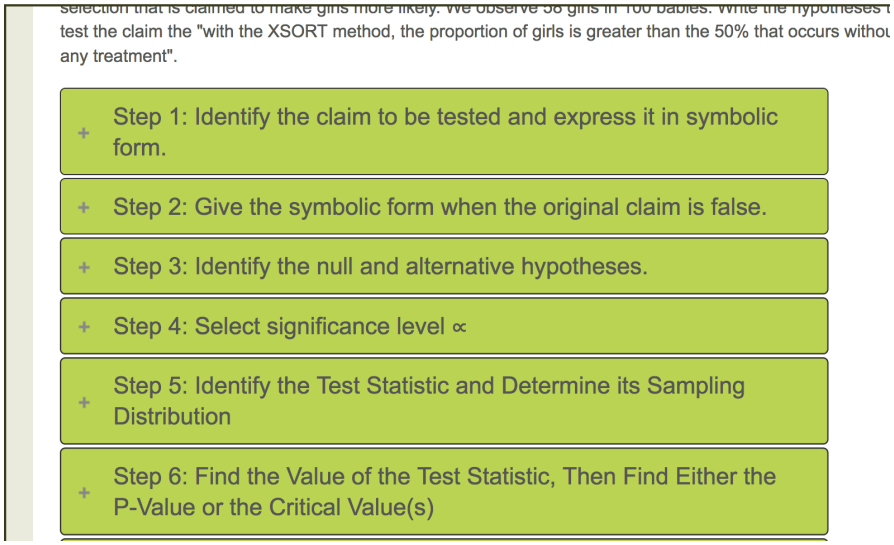
Module 03 Lesson Content

Hypothesis Testing Explained and Explored



HYPOTHESIS TESTING

- The best way to determine whether a statistical hypothesis is true would be to examine the entire population. Since that is often impractical, researchers typically examine a random sample from the population. If sample data are not consistent with the statistical hypothesis, the hypothesis is rejected.

- Depending on the alternative hypothesis operator, greater than operator will be a right tailed test, less than operator is a left tailed test, and not equal operator is a two tailed test.

- $H_1 : \mu > \mu_0 \longrightarrow$ **Right Tailed test**
- $H_1 : \mu < \mu_0 \longrightarrow$ **Left Tailed test**
- $H_1 : \mu \neq \mu_0 \longrightarrow$ **Two Tailed test**

HYPOTHESIS TESTING

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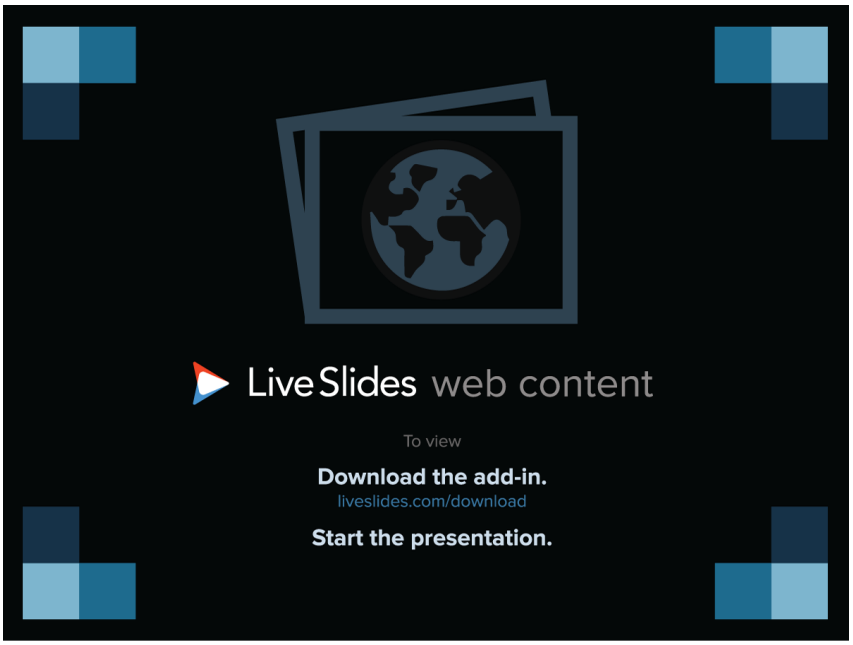

- Depending on the alternative hypothesis operator, greater than operator will be a right tailed test, less than operator is a left tailed test, and not equal operator is a two tailed test.

- $H_1 : \mu > \mu_0$ ⟶ **Right Tailed test**
- $H_1 : \mu < \mu_0$ ⟶ **Left Tailed test**
- $H_1 : \mu \neq \mu_0$ ⟶ **Two Tailed test**

https://www.youtube.com/watch?v=T9nI6vhTU1Y&list=PLvxOuBpazmsNo893xlpXNfMzVpRBjDH67&index=14

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MODULE 3 HOMEWORK

1. A formal hypothesis test is to be conducted using the claim that the mean body temperature is equal to 98.6 degrees Fahrenheit.

a. Identify the symbolic form of the null hypothesis
b. Identify the symbolic form of the alternative hypothesis
$H_0 : \mu = 98.6$
$H_1 : \mu \neq 98.6$

c. Is the test two-tailed, left-tailed or right-tailed? Explain.

Depending on the alternative hypothesis operator,
greater than operator means a right tailed test,
less than operator means a left tailed test,
and not equal operator means a two tailed test.

MODULE 3 HOMEWORK

1. A formal hypothesis test is to be conducted using the claim that the mean body temperature is equal to 98.6 degrees Fahrenheit.

$H_0 : \mu = 98.6$
$H_1 : \mu \neq 98.6$

e. After performing the hypothesis test, the p-value is found to be 0.034. Using a significance level of 0.05, Should you reject or fail to reject the null hypothesis? Explain.
p-value method:

If $p - value \leq \alpha$, reject H_0.

If $p - value > \alpha$, fail to reject H_0.

2.In general, what is a Type I error? What is Type II error?

a.Type I error:The incorrect rejection of a true null hypothesis.

b.Type II error: Incorrectly retaining a false null hypothesis.

For more information about Type I and Type II errors, please check out

https://www.stat.berkeley.edu/~hhuang/STAT141/Lecture-FDR.pdf

3. Determine whether the hypothesis test involves a sampling distribution of means that is a normal distribution, Student t distribution or neither. The sample data appear to come from a normally distributed population with the population standard deviation $\sigma = 28$. Explain.

Claim: $\mu = 977$.
Sample data: $n = 25$, mean= 984, $s = 25$.

Use the standard normal distribution if the population standard deviation is known.
Use the Student t-distribution if the population standard deviation is unknown.

MODULE 3 HOMEWORK

4.In a recent poll of 737 adults, 92% said that they do not open unfamiliar emails.Use a 0.01 significance level to test the claim that more than 75% of adults do not open unfamiliar emails.

a. Identify the null and alternative hypotheses.

$H_0 : p = 75\,\%$

$H_1 : p > 75\,\%$

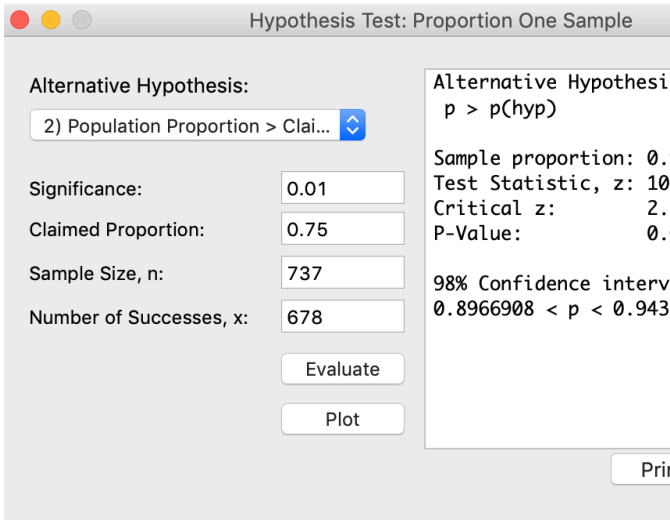
b.Is the test two-tailed, left-tailed or right-tailed? Explain.

Depending on the alternative hypothesis operator,
greater than operator means a right tailed test,
less than operator means a left tailed test,
and not equal operator means a two tailed test.

c. What is the test-statistic? d.What is the p-value?e.What is the critical value?

$x = 737 \times 92\,\% = 678$

P-value Method: Since the p-value of 0.0000 is less than the significance level of 0.01, reject the null hypothesis.

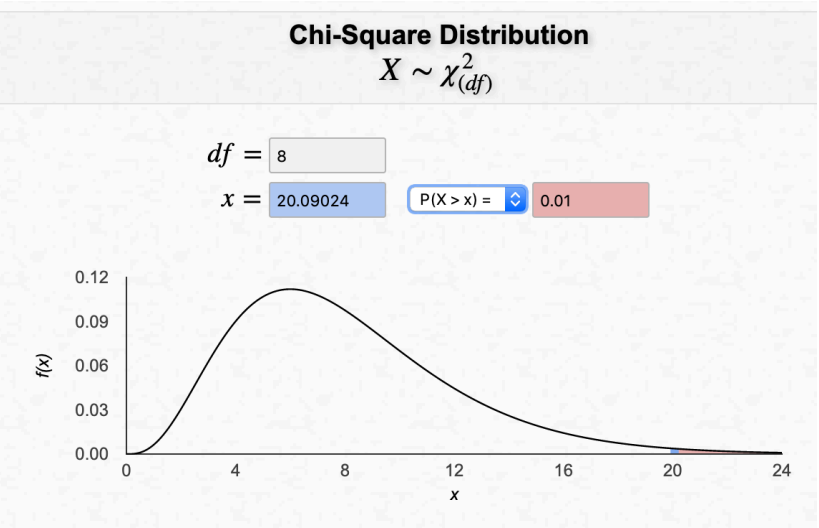


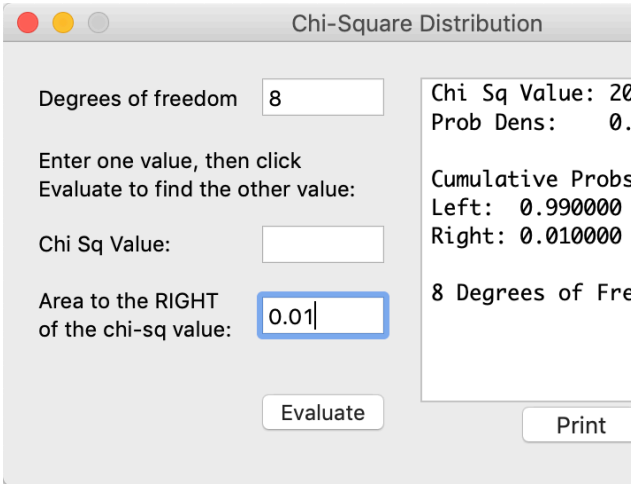
5. Find the critical value or values of χ^2 based on the given information. H_1: $\sigma > 26.1, n = 9, \alpha = 0.01$

Since H1: σ > 26.1, this indicates a right-tailed test.

Using the Chi-Square distribution table,

df = 9-1=8 and α = 0.01





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QUIZ 3

1.In a recent poll of 511 adults, 64% said that they were in favor of the death penalty for a person convicted of murder. If the claim is that the majority of adults are in favor of the death penalty for a person convicted of murder, identify the set of hypotheses that satisfy this claim.

Ho: $p = 0.5$

H1: $p > 0.5$

QUIZ 3

2. In a recent poll of 511 adults, 64% said that they were in favor of the death penalty for a person convicted of murder. The claim is that the majority of adults are in favor of the death penalty for a person convicted of murder. Using a 0.01 significance level, find the value of the test statistic.

Ho: p= 0.5

H1: p > 0.5

$$z = \frac{\hat{p} - p}{\sqrt{pq/n}}$$

From null hypothesis , p=0.5

Since q=1-p=0.5

In a poll of 511 adults, 64% said that they were in favor of the death penalty.

$\hat{p} = 0.64$

n=511

$$z = \frac{\hat{p} - p}{\sqrt{pq/n}} = \frac{0.64 - 0.5}{\sqrt{0.5 \times 0.5/511}}$$

QUIZ 3

3. In a recent poll of 511 adults, 64% said that they were in favor of the death penalty for a person convicted of murder. The claim is that the majority of adults are in favor of the death penalty for a person convicted of murder. Using a 0.01 significance level, we find a p-value of 0.0001. What should we conclude about the original claim?

Ho: p= 0.5

H1: p > 0.5

p-value method:

If $p - value \leq \alpha$, reject H_0.

If $p - value > \alpha$, fail to reject H_0.

Using a $\alpha = 0.01$ significance level, p-value=0.0001 < α, we would reject H_0.

There is sufficient evidence to support the claim that the majority of adults are in favor of the death penalty for a person convicted of murder.

QUIZ 3

6.A consumer advocacy group claims that the average mileage for the Carter Motor Company's new SUV is less than 30 miles per gallon. Identify the type I error for the test.

$H_0 : \mu = 30$

$H_1 : \mu < 30$

Type I Error: A Type I error is the mistake of rejecting the null hypothesis when it is actually true.

Reject the claim that the mean is equal to 30 miles per gallon when it is actually 30 miles per gallon.

QUIZ 3

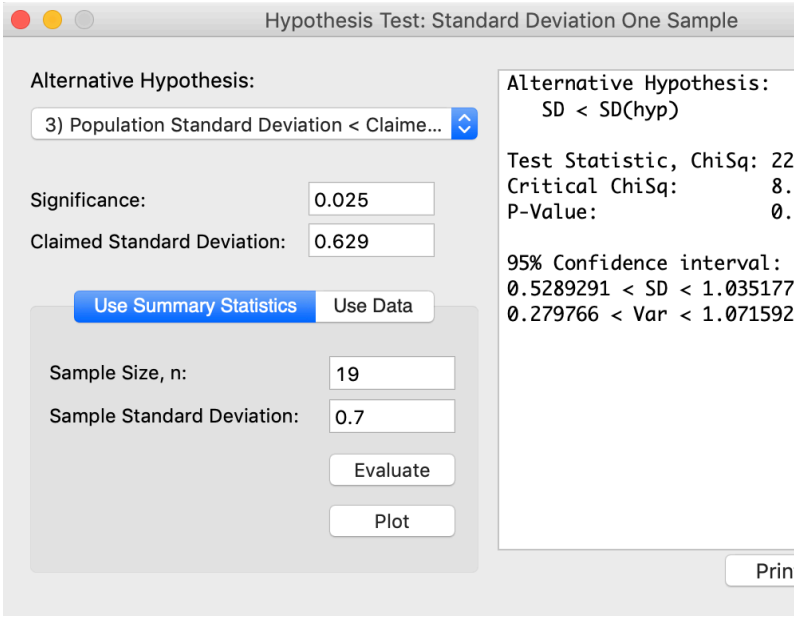
7.Find the critical value or values of χ^2

based on the given information.

$H_1: \sigma < 0.629$

$n = 19$

$\alpha = 0.025$



QUIZ 3

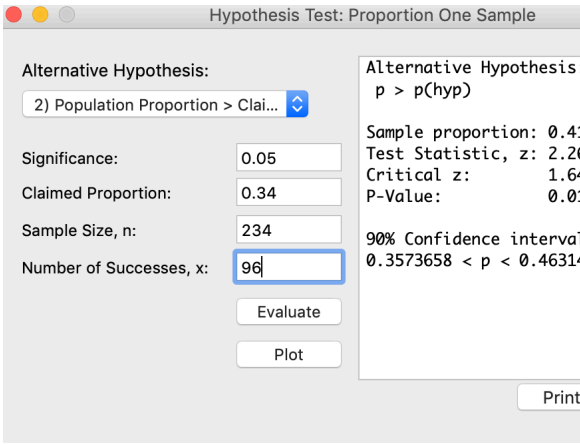
9.An article in a journal reports that 34% of Americans play the lottery. A researcher claims that the figure is higher for adults in a small city in Florida. A random sample of 234 adults from the city resulted in 96 adults playing the lottery. Test the researcher's claim at the 0.05 significance level. Find the p –value and state the conclusion about the null hypothesis.

Ho: p=34%

H1: p > 34%

p=0.34, significance level=0.05

A random sample of 234 adults from the city resulted in 96 adults playing the lottery.



Using the 0.05 significance level, p-value $<\alpha$, we would reject .

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COURSE PROJECT PHASE 3 - HYPOTHESIS TEST

- Option 1 Original Claim: The average salary for all jobs in Minnesota is less than $65,000. Test the claim using α = 0.05 and assume your data is normally distributed and σ is unknown.
- Step 1 State the null and alternative hypotheses.

$$H_0 : \mu = \$65,000$$
$$H_1 : \mu < \$65,000$$

- Step 2 Find the test statistic
- $$t = \frac{\overline{x} - \mu}{\frac{s}{\sqrt{n}}}$$

$\mu = 65000$

$\bar{x} = 62339$

s=19360

n=350

- Step 3 Find the critical value(s) and state decision about null hypothesis.
- Since $H_1 : \mu < \$65,000$
- This is a ***left-tailed test.***
- The *P*-value is the area in the left tail.
- If P value is less than 0.05, reject the null hypothesis.

COURSE PROJECT PHASE 3 - HYPOTHESIS TEST

Option 1 Original Claim: The average salary for all jobs in Minnesota is less than $65,000. Test the claim using $\alpha = 0.05$ and assume your data is normally distributed and σ is unknown

$$H_0 : \mu = \$65,000$$
$$H_1 : \mu < \$65,000$$

$\mu = 65000$

$\bar{x} = 62339$

s=19360

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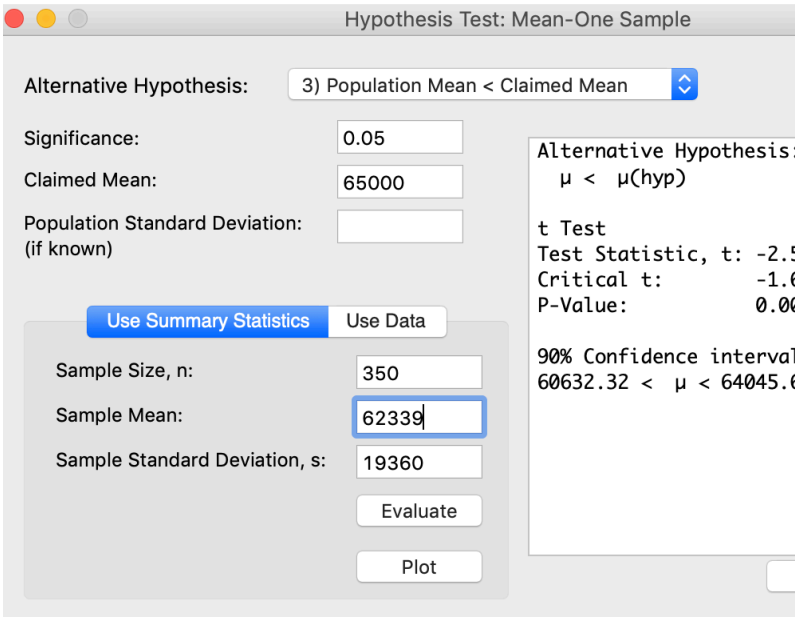


- P value is less than 0.05, reject the null hypothesis.

COURSE PROJECT PHASE 3 - HYPOTHESIS TEST

- Option 2 Original Claim: The average age of all patients admitted to the hospital with infectious diseases is less than 65 years of age. Test the claim using α = 0.05 and assume your data is normally distributed and σ is unknown.
- Step 1 State the null and alternative hypotheses.

$$H_0 : \mu = 65$$

$$H_1 : \mu < 65$$

- Step 2 Find the test statistic

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

$\mu = 65$

$\bar{x} = 62.54$

s=9.257

n=65

- Step 3 Find the critical value(s) and state decision about null hypothesis.
- Since $H_1 : \mu < 65$
- This is a ***left-tailed test.***
- The *P*-value is the area in the left tail.
- If P value is less than 0.05, reject the null hypothesis.

COURSE PROJECT PHASE 3 - HYPOTHESIS TEST

Option 2 Original Claim: The average age of all patients admitted to the hospital with infectious diseases is less than 65 years of age. Test the claim using $\alpha = 0.05$ and assume your data is normally distributed and σ is unknown.

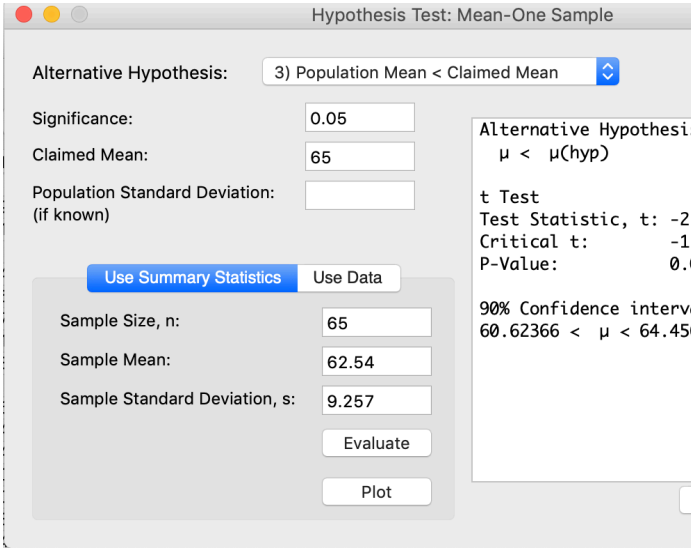
$$H_0 : \mu = 65$$
$$H_1 : \mu < 65$$

$\mu = 65$

$\bar{x} = 62.54$

s=9.257

n=65



- P value is less than 0.05, reject the null hypothesis.

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MODULE 3 LIVE CLASSROOM GRADING

The live classroom session archive as a URL will be added after the session has ended. The following is how you will receive your points for the module 3 live classroom session:

Question:**Is the hypothesis test in the course project phase 3 two-tailed, left-tailed, or right-tailed?**

Please go to module 3 live classroom, enter your response to receive your points.

You have until midnight CST on Sunday to confirm that you have viewed the live classroom session archive.

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SUMMARY

- Alternative hypothesis has the greater than operator, ***right tailed test.***
- Alternative hypothesis has the less than operator, ***left tailed test.***
- Alternative hypothesis has the not equal operator, ***two tailed (left and right) test.***

- Module 3 Question: ***Is the hypothesis test in the course project phase 3 two-tailed, left-tailed, or right-tailed?***