MODULE 2 LIVE LECTURE

INFERENTIAL STATISTICS AND ANALYTICS

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- Module 2 Confidence interval
- Module 2 homework
- Quiz 2
- Course project phase 2
- Module 2 Live classroom Grading
- Summary

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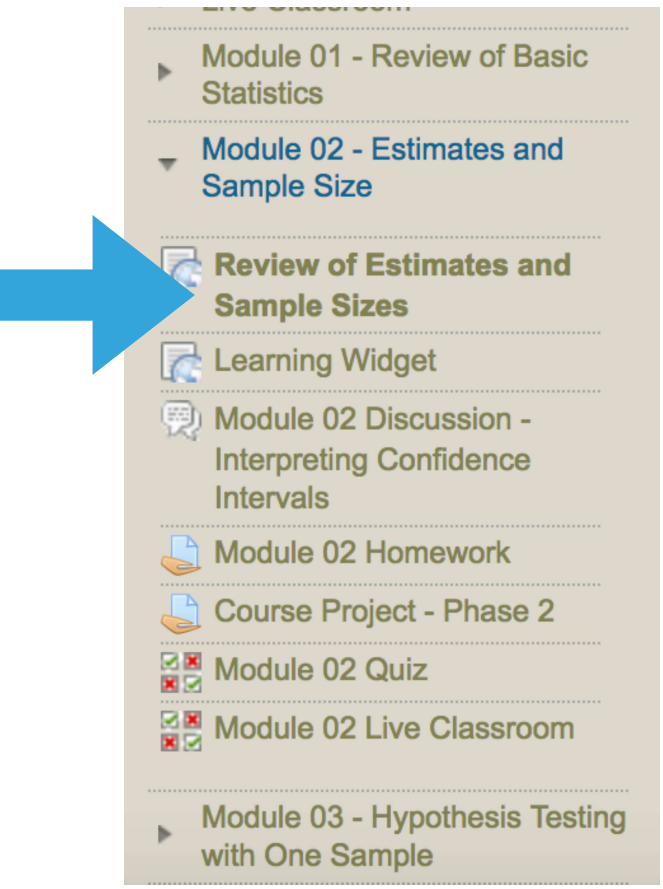
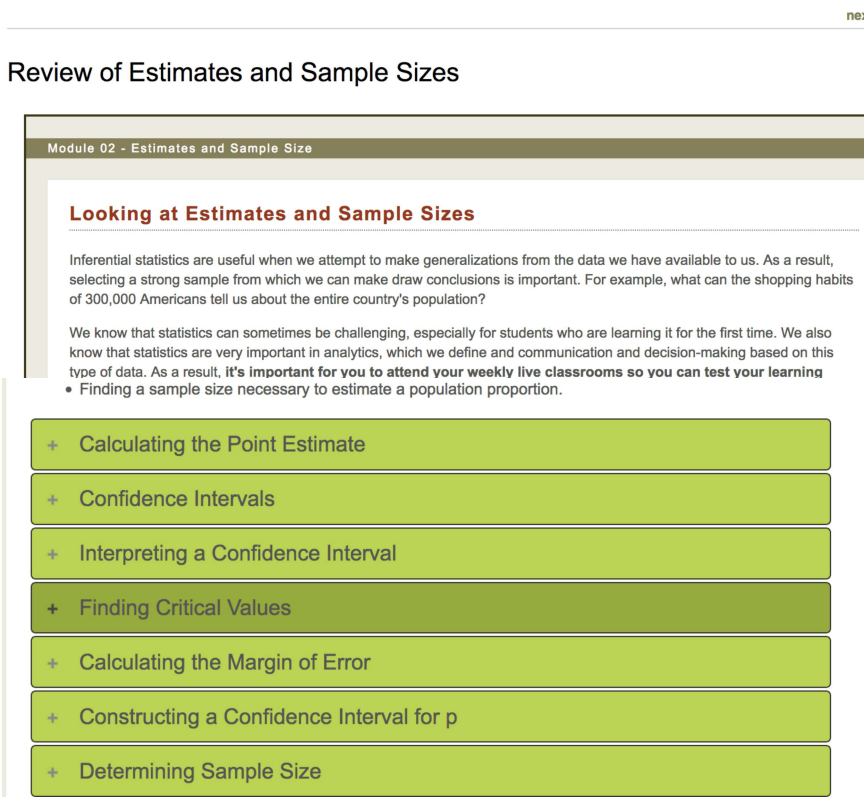
MODULE 2 REVIEW OF ESTIMATES AND SAMPLE SIZES





- ***Confidence Intervals for the Unknown population Mean and the known population Standard Deviation***

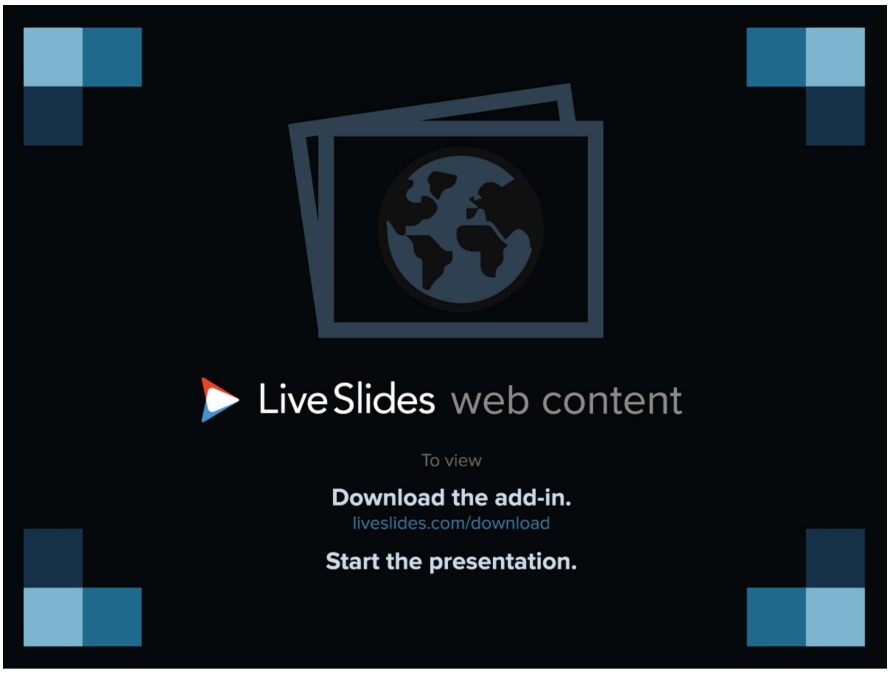
- When estimating a population mean, the **population standard deviation** is ***known***. In this case, we construct the confidence interval using the standard normal distribution.

- ***How to construct the confidence interval for the unknown population mean and the known population standard deviation?–––>>***

Confidence Intervals for Unknown population Mean and known population Standard Deviation

- When estimating a population mean, the standard deviation is ***known***. In this case, we construct the confidence interval using the standard normal distribution.

- ***How to construct the confidence interval for unknown population mean and known population standard deviation?–––>>***



https://www.youtube.com/watch?v=KG921rfbTDw&index=3&list=PLvxOuBpazmsMdPBRxBTvwLv5Lhuk0tuXh

Confidence Intervals for the Unknown population Mean and the Unknown population Standard Deviation

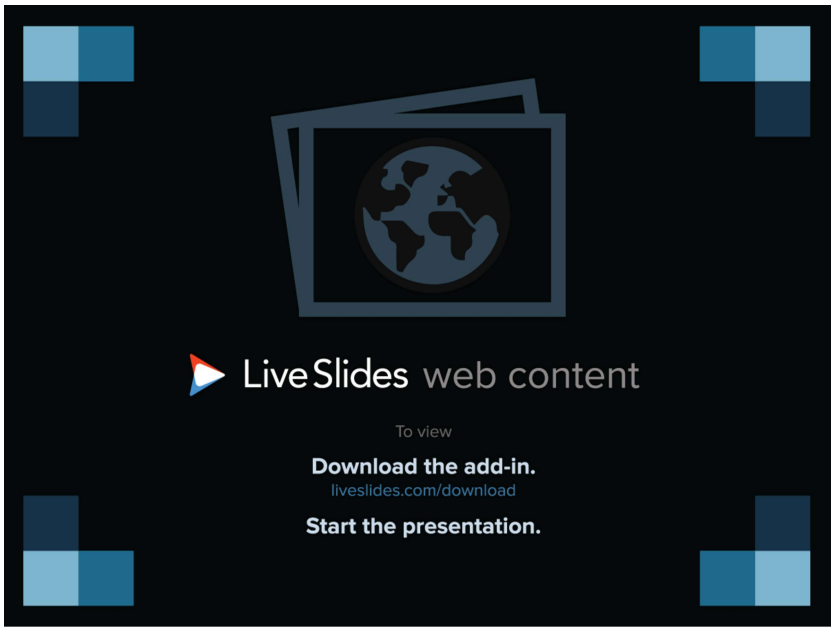
- **When estimating a population mean, it is rare that the population standard deviation is known. In this case, we construct the confidence interval using the Student's t distribution instead of a standard normal distribution.**

- ***How to construct the confidence interval for the unknown population mean and the unknown population standard deviation?--->>***

Confidence Intervals for Unknown population Mean and Unknown population Standard Deviation

- When estimating a population mean, it is rare that the population standard deviation is known. In this case, we construct the confidence interval using the **Student's t distribution** instead of a standard normal distribution.

- ***How to construct the confidence interval for unknown population mean and unknown population standard deviation?–––>>***



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MODULE 2 HOMEWORK

Problem1:The local news provided poll results from 2000 adults who interview job applicants. The results showed that 35% of the adults said their biggest issue with interviewers is them not knowing company history

a)What important piece of information was omitted from the statement above?
Confidence interval

Confidence interval estimate of the sample proportion $\hat{p}$.
eg. the confidence level is 90%

b)What is meant by the statement that "the margin of error is +/- 4 percentage points"?
When using 35% to estimate the value of the population percentage, the maximum likely difference between 35% and the true population percentage is 4 points.
$35\% - 4\,\% < \hat{p} < 35\% + 4\,\%$

c)the sample proportion $\hat{p} = 35\,\%$, $\hat{q} = 1 - \hat{p}$
the population proportion p is unknown.

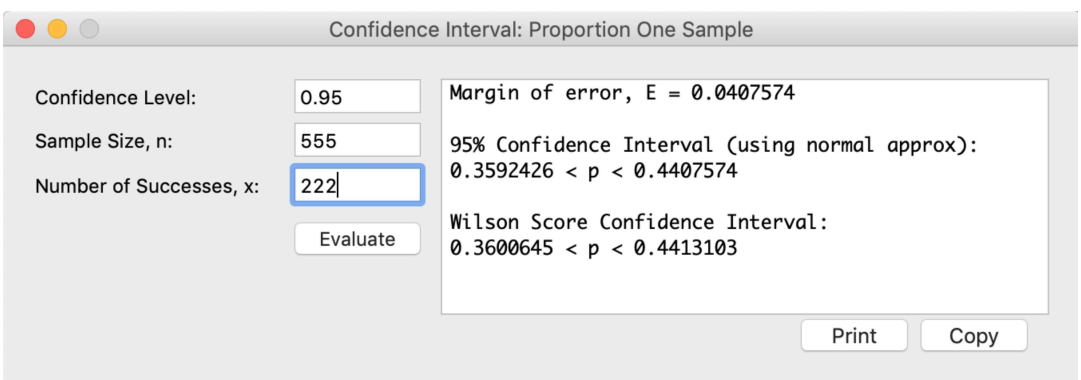
d)If the confidence level is 95%, what is the value of α?
$\alpha = 1 - 95\,\%$

Problem 2: In a poll of 555 randomly selected students, 40% stated that they enjoyed statistics. Answer the following questions:

a. Identify the number of students who say that they enjoy statistics

555 x 40%=222

b. Construct a 95% confidence interval estimate of the percentage of all students who say that they enjoy statistics.



Problem 3: The following information provided below shows the output from the results of performing a confidence interval for a population mean. Answer the following questions:

Confidence Interval	**(233.4, 256.65)**
$\bar{x}$	**245.025**
S_x	**36.357546**
n	**40**

a.Identify the best point estimate of μ.
The sample mean $\bar{x}$ is the best point estimate of the population mean μ.

b. Find the degrees of freedom.
the degrees of freedom df=n-1

d. Find the margin of error E
Confidence interval (233.4, 256.65)

$\bar{x} - E = 233.4$

$\bar{x} + E = 256.65$

$\bar{x} = 245.025$

$E = 256.65 - 245.025$

c.Find the critical value $t_{\alpha/2}$ that corresponds to n = 40.

$$E = t_{\alpha/2}\frac{S_x}{\sqrt{n}}$$

$E = 256.65 - 245.025$ $\quad S_x = 36.35754604$ $\quad$ n=40

Problem 4:The cholesterol levels of 40 women were sampled and a 95% confidence interval estimate was obtained below. The units of measurement for the interval below are $917.562 < \sigma^2 < 2254.129$

a. Identify the confidence interval for the population standard deviation σ. Include the appropriate units of measure. Find the degrees of freedom.

$$\sqrt{917.562} < \sigma < \sqrt{2254.129}$$

The units of σ is mg/dL

Problem 5: You want to estimate the mean amount of time college students spend on the Internet each month. How many college students must you survey to be 95% confident that your sample mean is within 15 minutes of the population mean? Assume that the standard deviation of the population of monthly time spent on the Internet is 210 minutes.

The required sample size is $n = (\frac{Z_{\alpha/2}\sigma}{E})^2$

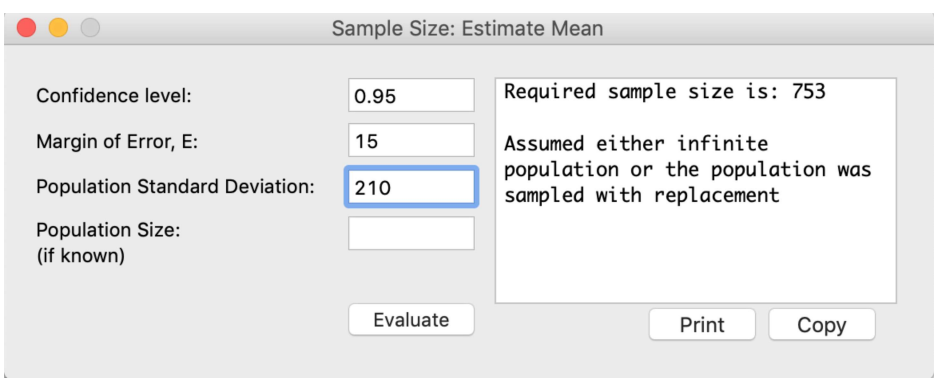
Margin of Error E=15

Population standard deviation $\sigma = 210$

The critical Value $Z_{\alpha/2} = 1.959962$

You can use Statdisk to estimate the sample size.

Please go to Statdisk-> Analysis->Sample Size Determination-> Estimate Mean



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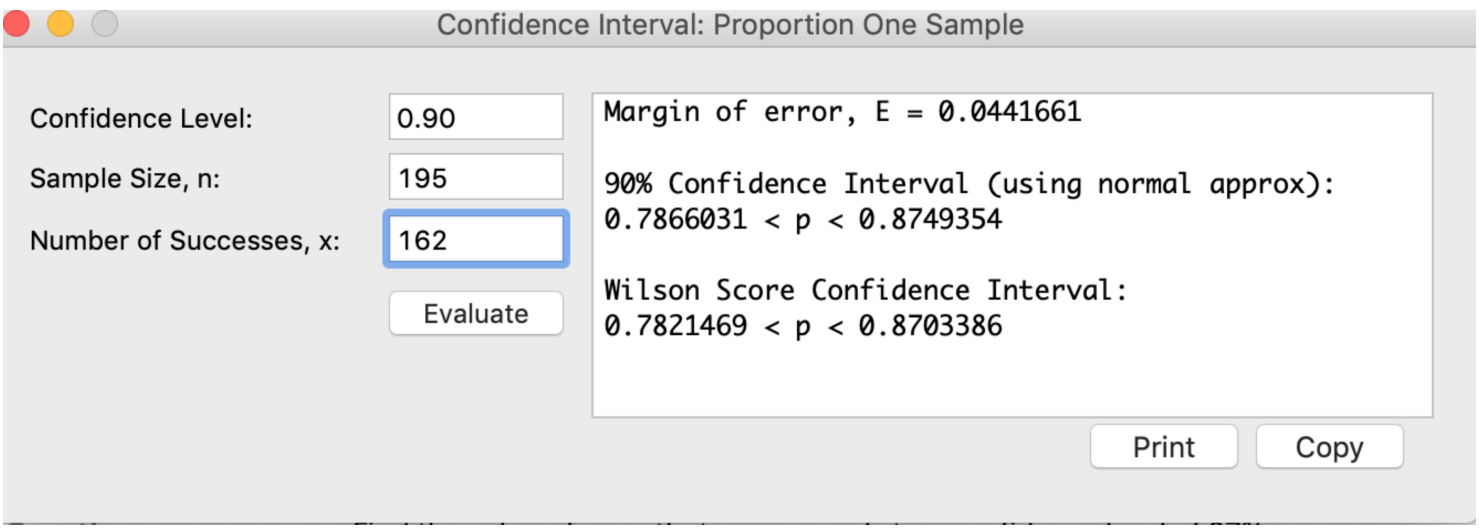
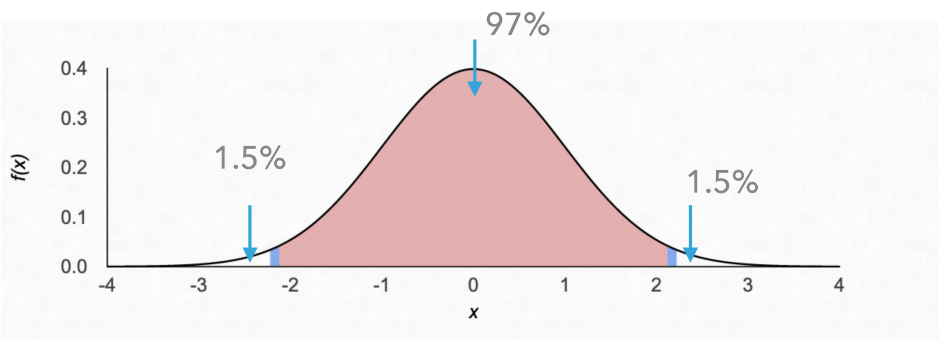
QUIZ 2

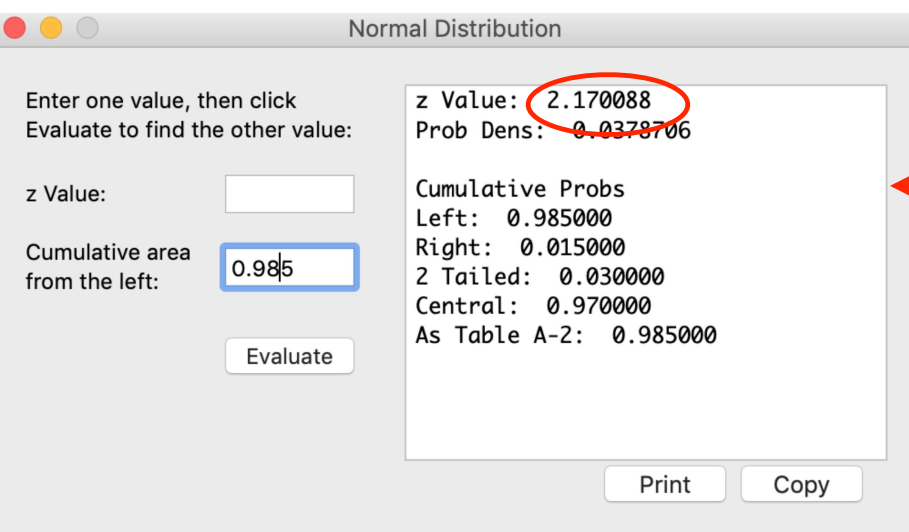
1) Use the given degree of confidence and sample data to construct a confidence interval for the population proportion p. n = 195, x = 162; 90% confidence



QUIZ 2

2)Find the value of z_α/2 that corresponds to a confidence level of 97%.





Cumulative area from the left

=1.5%+97%

=98.5%

=0.985

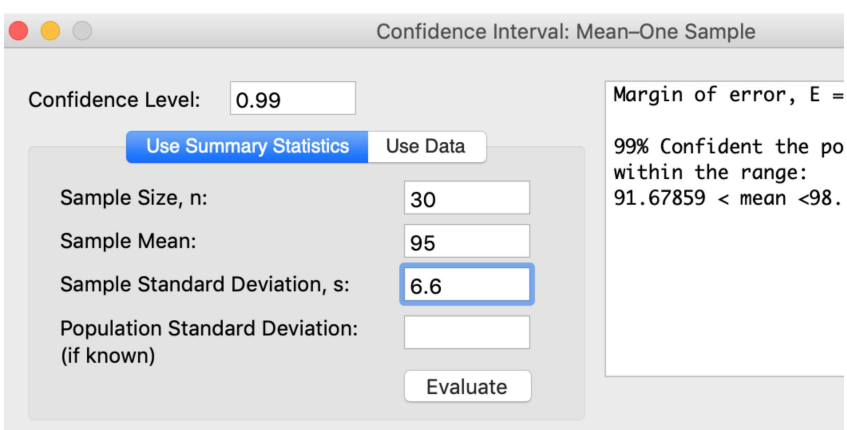
QUIZ 2

3)2000 people are selected randomly from a certain population and it is found that 389 people in the sample are over 6 feet tall. What is the point estimate of the proportion of people in the population who are over 6 feet tall?

$$\hat{p} = \frac{x}{n} \qquad x = 389 \; n = 2000$$

$$\hat{p} = \frac{389}{2000}$$

4)Thirty randomly selected students took the calculus final. If the sample mean was 95 and the standard deviation was 6.6, construct a 99% confidence interval for the mean score of all students.



QUIZ 2

5)Use the given data to find the minimum sample size required to estimate the population proportion.
Margin of error: 0.028; confidence level: 99%; $\hat{p}$ and $\hat{q}$ unknown

The margin of error denoted E is the error in the differe[illegible]n the sample proportion and population proportion p. It is found by $E = z_{\alpha/2}\sqrt{\frac{\hat{p}\hat{q}}{n}}$ the critical value by the standard deviation of the sample proportion.

The formula to calculate the margin of error is .

$$n = \frac{[z_{\alpha/2}]^2 \hat{p}\hat{q}}{E^2} \text{ when } \hat{p} \text{ is known and } n = \frac{[z_{\alpha/2}]^2 0.25}{E^2} \text{ when } \hat{p} \text{ is unknown}$$

Confidence level 99%

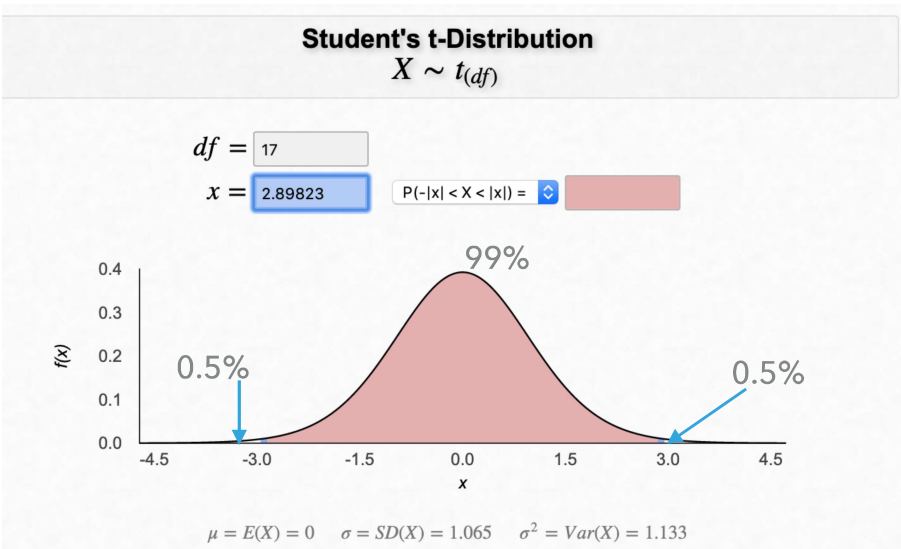
z=2.576

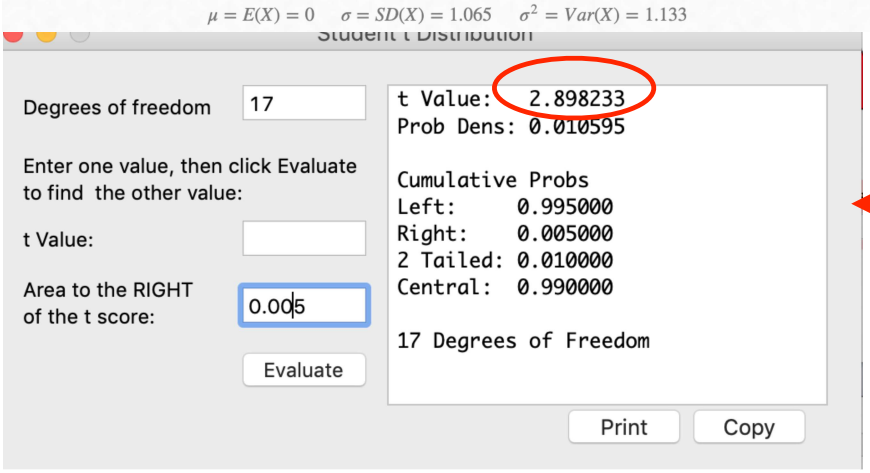
E=0.028

$$n = \frac{2.576^2 \times 0.25}{E^2}$$

QUIZ 2

6)Find the appropriate critical value for the following: 99% confidence level ; n = 18; σ is unknown; population appears to be normally distributed.





Cumulative area

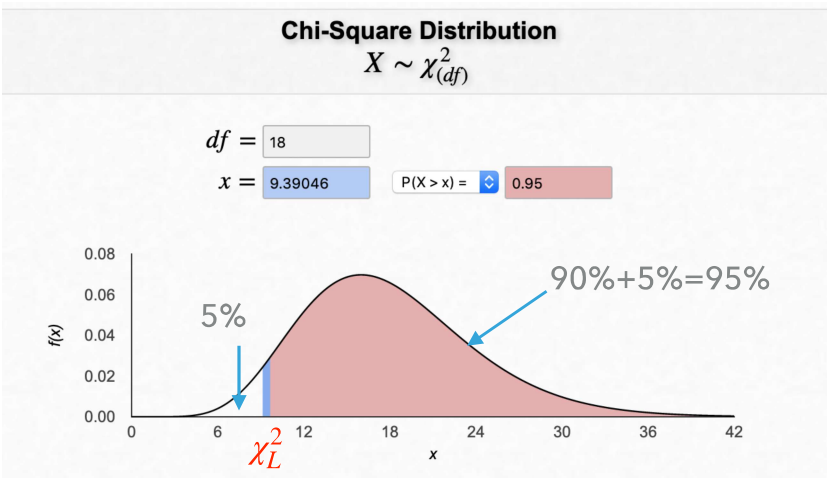
from the right of the t score

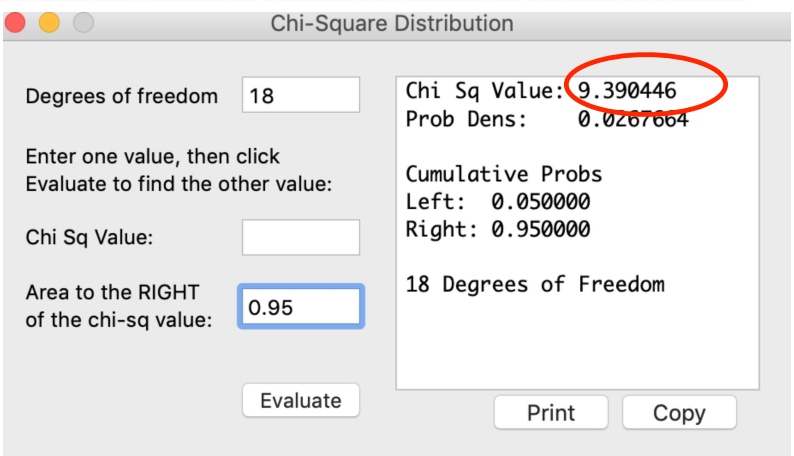
=0.5%=0.005

df=n-1=18-1=17

QUIZ 2

7)Find the critical value χ^2_L corresponding to a sample size of 19 and a confidence level of 90 percent if the test it two-tailed.





Area to the right

of the chi-sq value

=5%+90%

=95%

=0.95

df=n-1=19-1=18

QUIZ 2

9)A survey reported that 40% of people save loose change to pay bills. The margin of error was given as 3.1 percentage points. Which confidence interval corresponds to the given information?

$$\text{Margin of error} = t(\frac{s}{\sqrt{n}})=0.031$$

$$\text{Confidence Interval p} = \bar{p} \pm t(\frac{s}{\sqrt{n}}) = 0.4 \pm 0.031$$

$$0.4 - 0.031 < p < 0.4 + 0.031$$

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COURSE PROJECT PHASE 2

- Construct 95% confidence intervals for the population mean. Assume that your data is normally distributed and the population standard deviation is unknown.
  - Step 1: Find $n, \overline{x}, s$
  - option 1(mean=62339,n=350, sample standard deviation s=19360)
    option 2(mean=62.54,n=65, sample standard deviation s=9.257)
  - Step 2: Find the critical value t for a 95% confidence level. Use the ***t-distribution*** table to find the critical value. Alpha=0.05 in two tails with df=n-1 degrees of freedom. For example:
    Option 1 a 95% confidence interval with 349 degrees of freedom, t=1.967
    Option 2 a 95% confidence interval with 64 degrees of freedom, t=1.998
  - Step 3: Find the margin of error, E.

$$E = t\frac{s}{\sqrt{n}}$$

  - Step 4: Construct the confidence interval

$$\overline{x} - E < \mu < \overline{x} + E$$

COURSE PROJECT PHASE 2

- Construct 95% confidence intervals for the population mean. Assume that your data is normally distributed and the population standard deviation is unknown.
  - Use Statisk to find the margin errors and confidence intervals
  - option 1(mean=62339,n=350, sample standard deviation s=19360)
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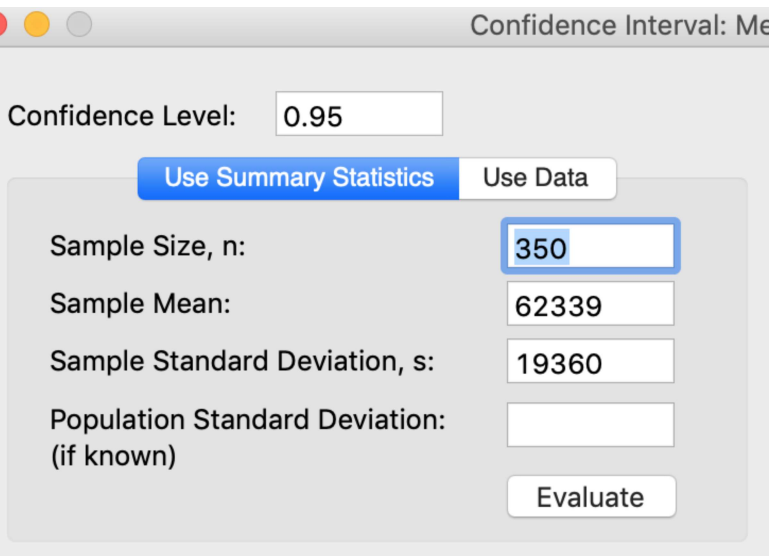

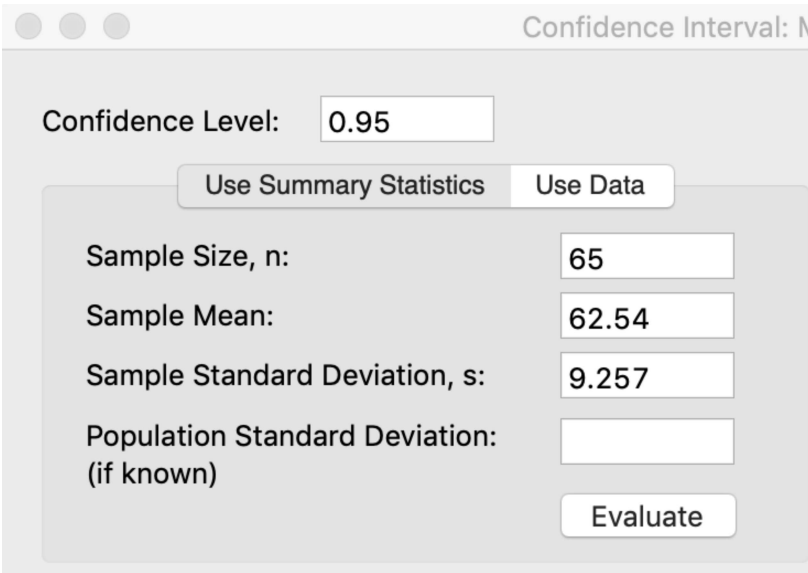

COURSE PROJECT PHASE 2

- Construct 99% confidence intervals for the population mean. Assume that your data is normally distributed and the population standard deviation is unknown.
  - Step 1: Find $n, \overline{x}, s$
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    option 2(mean=62.54,n=65, sample standard deviation s=9.257)
  - Step 2: Find the critical value t for a 99% confidence level. Use the ***t-distribution*** table to find the critical value. Alpha=0.01 in two tails with df=n-1 degrees of freedom.
    For example:
    Option 1 a 99% confidence interval with 349 degrees of freedom, t=2.590
    Option 2 a 99% confidence interval with 64 degrees of freedom, t=2.655
  - Step 3: Find the margin of error, E.

$$E = t\frac{s}{\sqrt{n}}$$

  - Step 4: Construct the confidence interval

$$\overline{x} - E < \mu < \overline{x} + E$$

COURSE PROJECT PHASE 2

- Construct 99% confidence intervals for the population mean. Assume that your data is normally distributed and the population standard deviation is unknown.
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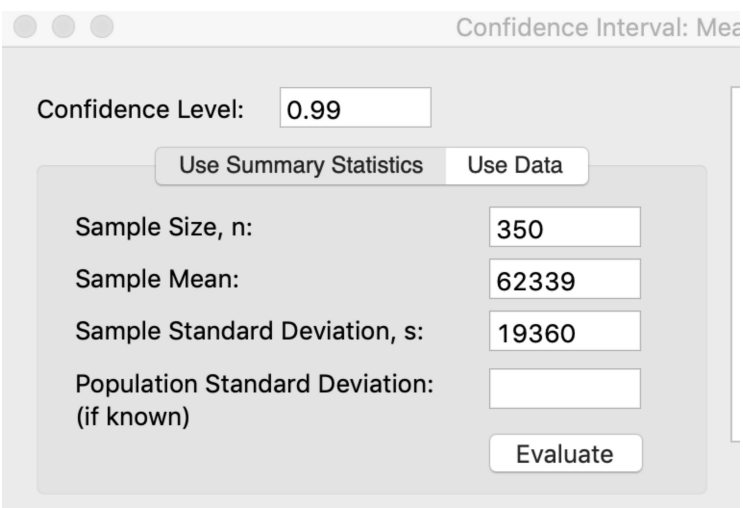

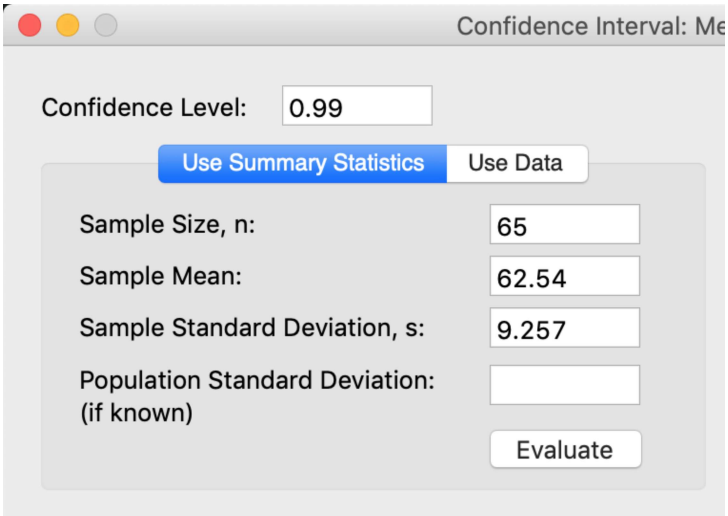

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MODULE 2 LIVE CLASSROOM GRADING

The live classroom session archive will be added after the session ends. The following is how you will receive your points for the module 2 live classroom session:

Question: **What distribution will we use in the course project phase 2? the Standard Normal distribution or Student's t distribution?**

Please go to module 2 live classroom, enter your response.

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

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SUMMARY

- When estimating a population mean, the population standard deviation is known. In this case, we construct the confidence interval using the standard normal distribution.
- When estimating a population mean, the population standard deviation is unknown. In this case, we construct the confidence interval using the Student's t distribution instead of a standard normal distribution.
- Module 2 Question: ***What distribution will we use in the course project phase 2? The Standard Normal Distribution or Student's t distribution?***