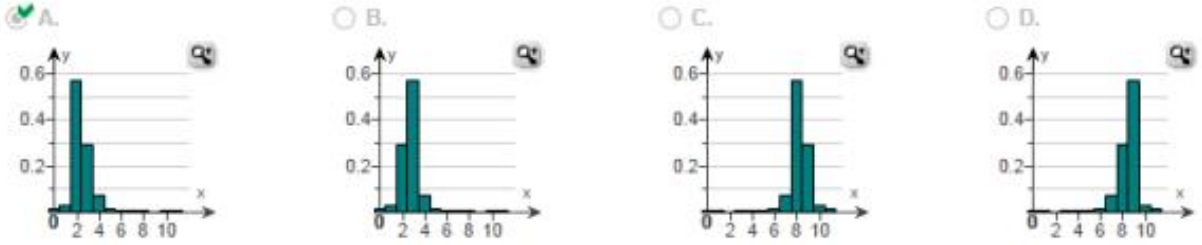
10.4 Putting it all together. Which Method? MATH 241 THOMPSON

1) This past year, an organization conducted a survey and asked, "What do you think is the ideal number of children for a family to have' The results of the survey are shown in the table. Complete parts (a) through (e).

Click the icon to view the data table.

(a) Construct a relative frequency histogram for the ideal number of children. Choose the correct graph below.



Comment on the shape of the distribution. Choose the correct answer below.

- A. The distribution is skewed right.
- B. The distribution is skewed left.
- C. The distribution is symmetric.
- D. The distribution is uniform.

STAT SUMMARY STATS – GROUPED/BIN DATA

(b) What is the mode ideal number of children? Select the correct choice and, if necessary, fill in the answer box to complete your answer.

- A. The mode ideal number of children is(are) 2.
  (Use a comma to separate answers as needed.)
- B. There is no mode.

WRITE DOWN MEAN AND STANDARD DEV NOT ROUNDED, NEEDED FOR TEST STAT

(c) Determine the mean number of children.

The mean number of children is 2.50.

Determine the standard deviation number of children.

The standard deviation number of children is 1.02.
(Round to two decimal places as needed.)

(d) Explain why a large sample size is needed to perform any inference regarding this population. Choose the correct answer below.

- A. The data are symmetric.
- B. The mean number is greater than the standard deviation.
- C. The data are clearly skewed to the right.
- D. The standard deviation is less than the mode.

(e) Ten years ago, the ideal number of children was considered to be 2.73. Do the results of this poll indicate that people's beliefs as to the ideal number of children have changed? Use $\alpha = 0.05$. Determine the null and alternative hypotheses.

T-STATS – ONE SAMPLE – WITH SUMMARY

H_0: μ = 2.73 children

H_1: μ ≠ 2.73 children

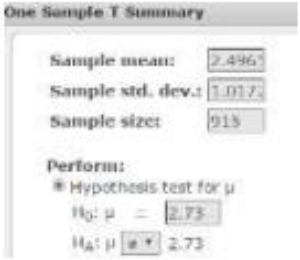
DO NOT ROUND MEAN AND SD TO GET t_0 AND P

Calculate the test statistic, t_0.

t_0 = −6.95

(Round to two decimal places as needed.)

Calculate the P-value. easies to copy and paste



P-value = .000

(Round to three decimal places as needed.)

State the conclusion for the test.

There is sufficient evidence at the $\alpha = 0.05$ level of significance to conclude that people's beliefs as to the ideal number of children have changed.

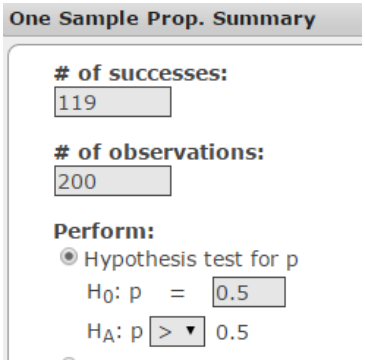
2) A simple random sample of size n = 200 drivers were asked if they drive a car manufactured in a certain country. Of the 200 drivers surveyed, 119 responded that they did. Determine if more than half of all drivers drive a car made in this country at the $\alpha = 0.05$ level of significance. Complete parts **(a)** through **(d)**.

Proportion stats – one sample – with sum

(a) Determine the null and alternative hypotheses.

H_0: p = 0.5

H_1: p > 0.5



(b) Calculate the P-value.

P-value = .004

(Round to three decimal places as needed.)

(c) State the conclusion for the test.

Choose the correct answer below.

Check the p value < or > 0.05

- A. Reject H_0 because the P-value is less than the $\alpha = 0.05$ level of significance. (selected)
- B. Do not reject H_0 because the P-value is less than the $\alpha = 0.05$ level of significance.
- C. Reject H_0 because the P-value is greater than the $\alpha = 0.05$ level of significance.
- D. Do not reject H_0 because the P-value is greater than the $\alpha = 0.05$ level of significance.

If P < 0.05 then reject IS sufficient

If P > 0.05 then do not IS NOT

(d) State the conclusion in context of the problem.

There is sufficient evidence at the $\alpha = 0.05$ level of significance to conclude that more than half of all drivers drive a car made in this country.

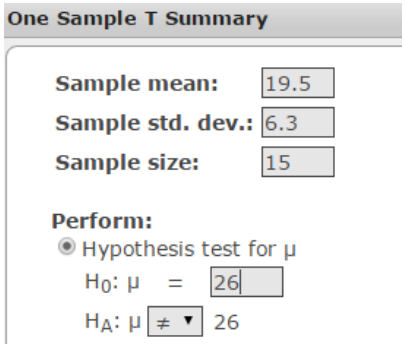
3) A simple random sample of size n = 15 is drawn from a population that is normally distributed. The sample mean is found to be $\bar{x} = 19.5$ and the sample standard deviation is found to be s = 6.3. Determine if the population mean is different from 26 at the $\alpha = 0.01$ level of significance. Complete parts **(a)** through **(d)** below.

(a) Determine the null and alternative hypotheses.

H_0: $\mu = 26$

H_1: $\mu \neq 26$

T-STATS with summary



(b) Calculate the P-value.

P-value = .001

(Round to three decimal places as needed.)

(c) State the conclusion for the test.

- A. Do not reject H_0 because the P-value is greater than the $\alpha = 0.01$ level of significance.
- B. Reject H_0 because the P-value is less than the $\alpha = 0.01$ level of significance. (selected)
- C. Reject H_0 because the P-value is greater than the $\alpha = 0.01$ level of significance.
- D. Do not reject H_0 because the P-value is less than the $\alpha = 0.01$ level of significance.

(d) State the conclusion in context of the problem.

There is sufficient evidence at the $\alpha = 0.01$ level of significance to conclude that the population mean is different from 26.

4) A simple random sample of size n = 40 is drawn from a population. The sample mean is found to be 107.1, and the sample standard deviation is found to be 22.3. Is the population mean greater than 100 at the $\alpha = 0.05$ level of significance?

Determine the null and alternative hypotheses.

H_0: $\mu = 100$

H_1: $\mu > 100$

T-STATS with summary

Compute the test statistic.

t_0 = 2.01 (Round to two decimal places as needed.)

Determine the P-value.

The P-value is .026. (Round to three decimal places as needed.)

What is the result of the hypothesis test?

Reject the null hypothesis because the P-value is less than the level of significance. At the $\alpha = 0.05$ level of significance, the population mean is greater than 100.

If P > 0.05 then do not IS NOT

One Sample T Summary

Sample mean: 107.1
Sample std. dev.: 22.3
Sample size: 40

Perform:
Hypothesis test for μ
H_0: μ = 100
H_A: μ > 100
Confidence interval for μ
Level: 0.95

If P-value < α, reject the null hypothesis.

5) A psychologist obtains a random sample of 20 mothers in the first trimester of their pregnancy. The mothers are asked to play Mozart in the house at least 30 minutes each day until they give birth. After 5 years, the child is administered an IQ test. It is known that IQs are normally distributed with a mean of 100. If the IQs of the 20 children in the study result in a sample mean of 104.3 and sample standard deviation of 16, is there evidence that the children have higher IQs? Use the $\alpha = 0.10$ level of significance. Complete parts **(a)** through **(d)**.

(a) Determine the null and alternative hypotheses.

T-STATS with summary

H_0: μ = 100

H_1: μ > 100

(b) Calculate the P-value.

P-value = .122 (Round to three decimal places as needed.)

(c) State the conclusion for the test.

Choose the correct answer below.

One Sample T Summary

Sample mean: 104.3
Sample std. dev.: 16
Sample size: 20

Perform:
Hypothesis test for μ
H_0: μ = 100
H_A: μ > 100

- A. Reject H_0 because the P-value is less than the $\alpha = 0.10$ level of significance.
- B. Reject H_0 because the P-value is greater than the $\alpha = 0.10$ level of significance.
- C. Do not reject H_0 because the P-value is greater than the $\alpha = 0.10$ level of significance.
- D. Do not reject H_0 because the P-value is less than the $\alpha = 0.10$ level of significance.

(d) State the conclusion in context of the problem.

There is not sufficient evidence at the $\alpha = 0.10$ level of significance to conclude that mothers who listen to Mozart have children with higher IQs.

If P-value < α, reject the null hypothesis.

Confidence Interval Critical Values, $z_{\alpha/2}$

evel of Confidence	Critical Value, $z_{\alpha/2}$
0.90 or 90%	1.645
0.95 or 95%	1.96
0.98 or 98%	2.33
0.99 or 99%	2.575

(c) Hypothesis Testing Critical Values

Level of Significance, α	Left-Tailed	Right-Tailed	Two-Tailed
0.10	−1.28	1.28	±1.645
0.05	−1.645	1.645	±1.96
0.01	−2.33	2.33	±2.575

6)

In 1945, an organization asked 1400 randomly sampled American citizens, "Do you think we can develop a way to protect ourselves from atomic bombs in case others tried to use them against us?" with 721 responding yes. Did a majority of the citizens feel the country could develop a way to protect itself from atomic bombs in 1945? Use the $\alpha = 0.1$ level of significance.

Click here to view the standard normal distribution table (page 1). Click here to view the standard normal distribution table (page 2).

What are the null and alternative hypotheses? Proportion stats – one sample – with sum

H_0: p = .5 versus H_1: p > .5 Always 0.5 on this problem

(Type integers or decimals. Do not round.)

Determine the test statistic, z_0.

z_0 = 1.12 (Round to two decimal places as needed.)

Determine the critical value(s). Select the correct choice below and fill in the answer box to complete your choice. (Round to two decimal places as needed.)

From yellow table above for 0.1 right tailed which is +

- A. The critical values are ± ____.
- B. The critical value is 1.28.

What is the correct conclusion at the $\alpha = 0.1$ level of significance? check your p-value in statcrunch

Since the test statistic is less than the critical value, do not reject the null hypothesis. There is not sufficient evidence to conclude that the majority of the citizens feel the country could develop a way to protect itself from atomic bombs.

7) According to a recent article about individuals who have credit cards, the mean number of cards per person with credit cards is 4. To test this result a random survey of 60 individuals who have credit cards was conducted. The survey only includes the number of credit cards per participant. The results of the survey are attached below.

(a) What is the variable of interest in this study? Is it qualitative or quantitative?

(b) Do the results of the survey imply that the mean number of cards per individual is less than 4? Use the $\alpha = 0.05$ level of significance.

Click the icon to view the data from the survey.

T-STATS with summary

(a) What is the variable of interest in this study? Is it qualitative or quantitative?

The variable of interest is number of credit cards. It is a quantitative variable.

(b) Do the results of the survey imply that the mean number of cards per individual is less than 4? Use the $\alpha = 0.05$ level of significance. State the null and alternative hypotheses.

H_0: $\mu = 4$

H_1: $\mu < 4$

(Type integers or decimals.)

Determine the t-statistic.

t_0 = −1.16 (Round to two decimal places as needed.)

Determine the P-value.

P-value = .126 (Round to three decimal places as needed.)

Make a conclusion regarding the hypothesis.

The P-value is greater than the level of significance. Do not reject the null hypothesis. There is not sufficient evidence to claim that the mean number of credit cards is less than 4.

EXTRA EXAMPLE:

A certain vehicle emission inspection station advertises that the wait time for customers is less than 10 minutes. A local resident is skeptical and collects a random sample of 49 wait times for customers at the testing station. He finds that the sample mean is 9.53 minutes, with a standard deviation of 4.4 minutes. Does the sample evidence support the resident's skepticism? Use the $\alpha = 0.05$ level of significance to test the advertised claim.

What are the correct hypotheses for this test?

- A. H_0: $\mu > 10$ minutes; H_1: $\mu = 10$ minutes
- B. H_0: $\mu = 10$ minutes; H_1: $\mu > 10$ minutes
- C. H_0: $\mu = 10$ minutes; H_1: $\mu \neq 10$ minutes
- D. H_0: $\mu \neq 10$ minutes; H_1: $\mu = 10$ minutes
- ✔ E. H_0: $\mu = 10$ minutes; H_1: $\mu < 10$ minutes
- F. H_0: $\mu < 10$ minutes; H_1: $\mu = 10$ minutes

One Sample T Summary

Sample mean:	9.53
Sample std. dev.:	4.4
Sample size:	49

Perform:
Hypothesis test for μ
H_0: μ = 10
H_A: μ < 10

What is the value of the test statistic?

t_0 = −.75 (Round to two decimal places as needed.)

What is the P-value?

P-value = .229 (Round to three decimal places as needed.)

Hypothesis test results:
μ : Mean of population
H_0 : μ = 10
H_A : μ < 10

Mean	Sample Mean	Std. Err.	DF	T-Stat	P-value
μ	9.53	0.62857143	48	-0.74772727	0.2291

Use the $\alpha = 0.05$ level of significance to test the advertised claim.

Since the P-value is greater than α, do not reject the null hypothesis. There is not sufficient evidence to conclude that the mean wait time is less than 10 minutes. In other words, the evidence supports the resident's skepticism.

With a previous contractor, the mean time to replace a streetlight was 3.2 days. A city councilwoman thinks that the new contractor is not getting the streetlights replaced as quickly. She selects a random sample of 12 streetlight service calls and obtains the following times to replacement (in days). Is there enough evidence to support the councilwoman's belief at the $\alpha = 0.10$ level of significance? Complete parts **(a)** through **(e)** below.

6.4	7.0	5.3	5.4	7.5	2.8	4.2	2.7	3.6	0.6	5.5	1.7

(a) Because the sample size is small, she must verify that replacement time is normally distributed and the sample does not contain any outliers. The normal probability plot and boxplot are shown. Are the conditions for testing the hypothesis satisfied?

Choose the correct answer below.

- ✔ Yes
- No

(b) Determine the null and alternative hypotheses.

H_0: μ = 3.2
H_1: μ > 3.2

(c) Calculate the P-value.

T-STATS – WITH DATA

Select the correct choice below and, if necessary, fill in any answer boxes to complete your choice.

- ✔ A. P-value = .041 (Round to three decimal places as needed.)
- B. The conditions for testing the hypothesis are not satisfied.

(d) State the conclusion for the test.

Choose the correct answer below.

- ✔ A. Reject H_0 because the P-value is less than the $\alpha = 0.10$ level of significance.

(e) State the conclusion in context of the problem.

Choose the correct answer below.

- ✔ A. There is sufficient evidence at the $\alpha = 0.10$ level of significance to conclude that new contractor is not getting the streetlights replaced as quickly.