P-value

$H_a : p_1 - p_2 < 0$

Left-tailed P-value

P-value

$H_a : p_1 - p_2 > 0$

Right-tailed P-value

P-value is double this area

$H_a : p_1 - p_2 \neq 0$

Two-tailed P-value

Type I error (false positive) occurs when you incorrectly reject a true null hypothesis,

Type II error (false negative) happens when you fail to reject a false null hypothesis.

p = population proportion   σ = population standard deviation

μ = mean

1) The null and alternative hypotheses are given. Determine whether the hypothesis test is left-tailed, right-tailed, or two-tailed. What parameter is being tested?

$H_0 : \mu = 2$

$H_1 : \mu \neq 2$

What type of test is being conducted in this problem?

★ Two-tailed test

◯ Right-tailed test

◯ Left-tailed test

What parameter is being tested?

★ Population mean

◯ Population proportion

◯ Population standard deviation

2) The null and alternative hypotheses are given. Determine whether the hypothesis test is left-tailed, right-tailed, or two-tailed. What parameter is being tested?

H_0: $p = 0.2$
H_1: $p < 0.2$

Choose the correct answer below.

○ Right-tailed

○ Two-tailed

★ Left-tailed

What parameter is being tested?

★ p

○ μ

○ σ

3) For students who first enrolled in two-year public institutions in a recent semester, the proportion who earned a bachelor's degree within six years was 0.393. The president of a certain junior college believes that the proportion of students who enroll in her institution have a higher completion rate.
(a) State the null and alternative hypotheses in words.
(b) State the null and alternative hypotheses symbolically.
(c) Explain what it would mean to make a Type I error.
(d) Explain what it would mean to make a Type II error.

(a) State the null hypothesis in words. Choose the correct answer below.

★ A. Among students who enroll at the certain junior college, the completion rate is 0.393.

★ D. Among students who enroll at the certain junior college, the completion rate is greater than 0.393.

(b) State the hypotheses symbolically.

H_0: p $=$ 0.393
H_1: p $>$ 0.393

(c) What would it mean to make a Type I error?

The president rejects the hypothesis that the proportion of students who earn a bachelor's degree within six years is equal to 0.393 when, in fact, the proportion is equal to 0.393.
(Type integers or decimals. Do not round.)

(d) What would it mean to make a Type II error?

The president fails to reject the hypothesis that the proportion of students who earn a bachelor's degree within six years is equal to 0.393 when, in fact, the proportion is greater than 0.393.
(Type integers or decimals. Do not round.)

4) Three years ago, the mean price of an existing single-family home was $243,748. A real estate broker believes that existing home prices in her neighborhood are lower.
(a) State the null and alternative hypotheses in words.
(b) State the null and alternative hypotheses symbolically.
(c) Explain what it would mean to make a Type I error.
(d) Explain what it would mean to make a Type II error.

(a) State the null hypothesis in words. Choose the correct answer below.

★D. The mean price of a single family home in the broker's neighborhood is $243,748.

State the alternative hypothesis in words. Choose the correct answer below.

○ A. The mean price of a single family home in the broker's neighborhood is different from $243,748.

★B. The mean price of a single family home in the broker's neighborhood is less than $243,748.

(b) State the hypotheses symbolically.

H_0: μ = $ 243,748
H_1: μ < $ 243,748
(Type integers or decimals. Do not round.)

(c) What would it mean to make a Type I error?

The broker   rejects   the hypothesis that the mean price is   equal to $ 243,748 , when the true mean price is   equal to $ 243,748 .
(Type integers or decimals. Do not round.)

(d) What would it mean to make a Type II error?

The broker fails to reject the hypothesis that the mean price is   equal to $ 243,748 , when the true mean price is   less than $ 243,748 .
(Type integers or decimals. Do not round.)

5) The standard deviation in the pressure required to open a certain valve is known to be $\sigma = 0.5$ psi. Due to changes in the manufacturing process, the quality-control manager feels that the pressure variability has been reduced.
(a) State the null and alternative hypotheses in words.
(b) State the null and alternative hypotheses symbolically.
(c) Explain what it would mean to make a Type I error.
(d) Explain what it would mean to make a Type II error.

(a) State the null hypothesis in words. Choose the correct answer below.

★D. The standard deviation in the pressure required to open a certain valve is 0.5 psi.

State the alternative hypothesis in words. Choose the correct answer below.

○ A. The standard deviation in the pressure required to open a certain valve is 0.5 psi.

★B. The standard deviation in the pressure required to open a certain valve is less than 0.5 psi.

(b) State the hypotheses symbolically.

$H_0:$ σ $=$ 0.5 psi

$H_1:$ σ $<$ 0.5 psi

(Type integers or decimals. Do not round.)

(c) What would it mean to make a Type I error?

The manager   rejects   the hypothesis that the pressure variability is   equal to   0.5 psi, when the true pressure variability is   equal to   0.5 psi.
(Type integers or decimals. Do not round.)

(d) What would it mean to make a Type II error?

The manager fails to reject the hypothesis that the pressure variability is   equal to   0.5 psi, when the true pressure variability is   less than   0.5 psi.
(Type integers or decimals. Do not round.)

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6) According to a report, the standard deviation of monthly cell phone bills was $4.99 in 2017. A researcher suspects that the standard deviation of monthly cell phone bills is different today.
(a) State the null and alternative hypotheses in words.
(b) State the null and alternative hypotheses symbolically.
(c) Explain what it would mean to make a Type I error.
(d) Explain what it would mean to make a Type II error.

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(a) State the null hypothesis in words. Choose the correct answer below.

⭐D. The standard deviation of monthly cell phone bills is $4.99.

State the alternative hypothesis in words. Choose the correct answer below.

○ A. The standard deviation of monthly cell phone bills is greater than $4.99.

○ B. The standard deviation of monthly cell phone bills is $4.99.

⭐C. The standard deviation of monthly cell phone bills is different from $4.99.

(b) State the hypotheses symbolically.

$H_0:$ σ $=$ $ 4.99

$H_1:$ σ $\neq$ $ 4.99

(Type integers or decimals. Do not round.)

(c) What would it mean to make a Type I error?

⭐C. The sample evidence led the researcher to believe the standard deviation of monthly cell phone bills is different from $4.99 when, in fact, the standard deviation of bills is $4.99.

(d) What would mean to make a Type II error?

○ A. The sample evidence led the researcher to believe the standard deviation of monthly cell phone bills is different from $4.99 when, in fact, the standard deviation of bills is $4.99.

⭐B. The sample evidence did not lead the researcher to believe the standard deviation of monthly cell phone bills is different from $4.99 when, in fact, the standard deviation of bills is different from $4.99.

7) Suppose the null hypothesis is rejected. State the conclusion based on the results of the test.

Three years ago, the mean price of a single-family home was $243,741. A real estate broker believes that the mean price has increased since then.

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Which of the following is the correct conclusion?

A. There is sufficient evidence to conclude that the mean price of a single-family home has increased.

z8) State the conclusion based on the results of the test.

According to the report, the mean monthly cell phone bill was $48.41 three years ago. A researcher suspects that the mean monthly cell phone bill is different today. The null hypothesis is not rejected.

Choose the correct answer below.

○ A. There is sufficient evidence to conclude that the mean monthly cell phone bill is higher than its level three years ago of $48.41.

☑ B. There is not sufficient evidence to conclude that the mean monthly cell phone bill is different from its level three years ago of $48.41.

9) State the conclusion based on the results of the test.

According to the Federal Housing Finance Board, the mean price of a single-family home two years ago was $299,000. A real estate broker believes that because of the recent credit crunch, the mean price has decreased since then. The null hypothesis is rejected.

Choose the correct answer below.

☑ A. There is sufficient evidence to conclude that the mean price of a single-family home has decreased from its level two years ago of $299,000.

10) According to a food website, the mean consumption of popcorn annually by Americans is 63 quarts. The marketing division of the food website unleashes an aggressive campaign designed to get Americans to consume even more popcorn. Complete parts (a) through (c) below.

(a) Determine the null and alternative hypotheses that would be used to test the effectiveness of the marketing campaign.

H_0: μ = 63

H_1: μ > 63

(Type integers or decimals. Do not round.)

(b) A sample of 888 Americans provides enough evidence to conclude that marketing campaign was effective. Provide a statement that should be put out by the marketing department.

○ A. There is not sufficient evidence to conclude that the mean consumption of popcorn has risen.

✔ B. There is sufficient evidence to conclude that the mean consumption of popcorn has risen.

(c) Suppose, in fact, the mean annual consumption of popcorn after the marketing campaign is 63 quarts. Has a Type I or Type II error been made by the marketing department? If we tested this hypothesis at the $\alpha = 0.01$ level of significance, what is the probability of committing this error? Select the correct choice below and fill in the answer box within your choice.
(Type an integer or a decimal. Do not round.)

✔ B. The marketing department committed a Type I error because the marketing department rejected the null hypothesis when it was true. The probability of making a Type I error is
.01 .

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11) According to the Centers for Disease Control and Prevention, 9.8% of high school students currently use electronic cigarettes. A high school counselor is concerned the use of e-cigs at her school is higher. Complete parts (a) through (c) below.

(a) Determine the null and alternative hypotheses.

H_0:   p   =   .098

H_1:   p   >   .098

(Type integers or decimals. Do not round.)

(b) If the sample data indicate that the null hypothesis should not be rejected, state the conclusion of the high school counselor.

✔ A. There is not sufficient evidence to conclude that the proportion of high school students exceeds 0.098 at this counselor's high school.

(c) Suppose, in fact, that the proportion of students at the counselor's high school who use electronic cigarettes is 0.241. Was a type I or type II error committed?

○ A. A Type I error was committed because the sample evidence led the counselor to conclude the proportion of e-cig users was 0.241, when, in fact, the proportion is lower.

✔ B. A Type II error was committed because the sample evidence led the counselor to conclude the proportion of e-cig users was 0.098, when, in fact, the proportion is higher.

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12) The _____ _____ is a statement we are trying to find evidence to support.

The alternative hypothesis is a statement we are trying to find evidence to support.

The _____ _____ is a statement of no change, no effect, or no difference.

The null hypothesis is a statement of no change, no effect, or no difference.

14) Determine whether the following statement is true or false.

Sample evidence can prove that a null hypothesis is true.

Choose the correct answer below.

✔ False

○ True