1. Which of the statements about confidence intervals is true?

1 / 1 point

Hint: $\text{margin of error} = z_{\alpha/2} \cdot \frac{\sigma}{\sqrt{n}}$.

- ○ Assuming a fixed margin of error, larger samples result in a larger confidence level.
- ◉ Assuming a fixed confidence level, larger samples result in a smaller margin of error.
- ○ Assuming a fixed confidence level, halving the margin of error requires a sample twice as large.
- ○ Assuming a fixed sample size, higher confidence results in a smaller margin of error.

Correct
Nice Job! A good check is to try plugging in actual values! Since this is a hypothetical situation, choose nice whole numbers such as $n = 25$, $\sigma = 10$, and $z_{\alpha/2} = 2$. Then calculate again where $n = 100$. Can you confirm that this results in a smaller margin of error?

2. You have a sample size of 20 from a population with unknown mean and standard deviation. You measured that the **sample mean** $\overline{X} = 50$ and the **sample standard deviation is** $s = 10$. What expression describes the margin of error for a confidence level of 95%?

1 / 1 point

- ○ $t_{0.05} \cdot \frac{50}{\sqrt{20}}$
- ○ $z_{0.025} \cdot \frac{50}{\sqrt{20}}$
- ◉ $t_{0.025} \cdot \frac{10}{\sqrt{20}}$
- ○ $z_{0.05} \cdot \frac{10}{\sqrt{20}}$

Correct
Nice job! The equation for finding the margin of error when the population mean and standard deviation are unknown is

$$\text{margin of error} = t_{\alpha/2} \cdot \frac{s}{\sqrt{n}}$$

3. Researchers conducted a study and tested a random sample of 200 animals. Their research shows that 40 of the animals test positive for a disease. Calculate the margin of error for a 90% confidence level for the percentage of animals that carry the disease.

1 / 1 point

Hint:

$$\text{margin of error} = z_{\alpha/2} \cdot \sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$$

and $z_{\alpha/2} = 1.645$

- ○ 0.003
- ○ 0.0141
- ◉ 0.0465
- ○ 0.233

Correct
Nice job!

4. In statistical hypothesis testing, which of the following statements correctly defines Type I and Type II errors?

1 / 1 point

- (selected) Type I error occurs when we reject a null hypothesis that is true, while Type II error occurs when we accept a null hypothesis that is false.
- Type I error occurs when we accept a null hypothesis that is true, while Type II error occurs when we reject a null hypothesis that is false.
- Type I error occurs when we reject a null hypothesis that is false, while Type II error occurs when we accept a null hypothesis that is true.
- Type I error occurs when we accept a null hypothesis that is false, while Type II error occurs when we reject a null hypothesis that is true.

Correct
This is the accurate definition of Type I and Type II errors. Type I error refers to rejecting a null hypothesis that is actually true, and Type II error refers to accepting a null hypothesis that is actually false.

5. When conducting a hypothesis test, after defining the null hypothesis (H_0) and the alternative hypothesis (H_1), what are the general steps to decide whether to reject the null hypothesis? Select the correct sequence of steps.

1 / 1 point

- (selected) Set the significance level (α), calculate the test statistic based on sample data, calculate the p-value, compare the p-value with the significance level, and make a decision to reject or fail to reject (H_0)
- Calculate the test statistic, determine the significance level (\alpha), calculate the p-value, compare the p-value with the significance level, and make a decision on the null hypothesis.
- Calculate the p-value based on the test statistic, set the significance level (α), compare the p-value with the significance level, and decide on the null hypothesis.

Correct
You've selected the correct sequence of steps for conducting a hypothesis test. Setting the significance level (α) before collecting data and performing calculations ensures that the test's criteria for making decisions are predefined, which is crucial for the integrity of the test. Calculating the test statistic and the p-value, then comparing the p-value with the significance level, allows for an objective decision to be made about whether to reject or fail to reject (H_0)

6. Suppose you are conducting a hypothesis test to determine whether a new teaching method improves student performance.

   1 / 1 point

   The null hypothesis (H_0) states that the teaching method has no effect, while the alternative hypothesis (H_1) suggests that the teaching method leads to higher student performance. You collect data from a sample of 50 students and calculate a test statistic of 1.98. The critical value at a significance level of 0.05 is 1.96. Should you reject the null hypothesis?

   - ○ No, you do not reject the null hypothesis.
   - ◉ Yes, you reject the null hypothesis.

   ✓ Correct
   Since the test statistics is **greater than** the critical value, it means that, given our significance level, we should reject H_0.

7. A company claims that their new energy drink decreases reaction times. To investigate this claim, a researcher conducts a hypothesis test using a sample of 40 participants. The average reaction time in the sample is 0.95 seconds, with a standard deviation of 0.12 seconds. The company states that the average reaction time without their energy drink is 1.05 seconds. The researcher wants to determine whether sufficient evidence supports the company's claim. Assuming a significance level of 0.05, what is the test statistic for this hypothesis test?

   1 / 1 point

   - ◉ -5.27
   - ○ -2.73
   - ○ 2.73
   - ○ 5.27

   ✓ Correct
   Nice job! In this question, you are given information about the sample standard deviation. Therefore, you calculate the t-test statistic using the formula $\frac{\overline{x}-\mu}{S/\sqrt{n}}$.

8. Based on the scenario in the previous question (question #7), which distribution would you use to find *p*-values for different levels of significance?

   1 / 1 point

   - ○ Standard normal distribution.
   - ○ t-Student distribution with 40 degrees of freedom.
   - ○ Normal distribution with $\mu = 0.95$ and $\sigma = 0.12$.
   - ◉ t-Student distribution with 39 degrees of freedom.

   ✓ Correct
   The problem is a hypothesis test for the mean with an unknown population standard deviation. Therefore the test statistic will follow a t-Student Distribution with $n = 40 - 1 = 39$ degrees of freedom!

9. You notice that your six-sided die seems to favor the outcome six. You state the null hypothesis is that the die is fair, and the alternative hypothesis is that the die favors some outcomes. After conducting a hypothesis test by rolling the die 100 times, you determine that the p-value is 0.03. Which of the following conclusions is a correct interpretation of the p-value?

1 / 1 point

- ○ The probability of rolling the die and getting a six is 97%.
- ○ The chance that the die is fair is 3%.
- ○ The chance that the die is unfair is 3%.
- ◉ The chance of producing the observer results (a fair die) is 3%.

Correct
Excellent! The p-value does not represent the probability of individual outcomes. Instead, the p-value indicates the probability of seeing the observed data.

10. Which of the following scenarios should be analyzed as a two-sample t-test?

1 / 1 point

- [x] Comparing the test scores of two independent groups of students who received different teaching methods.

Correct
Yes! A two-sample t-test is appropriate when comparing two **independent** groups. Since the scenario involves two independent groups of students, it would be suitable to use a two-sample t-test.

- [ ] Analyzing the average response time of individuals in a driving simulation before and after they undergo distraction training.
- [ ] Investigating the impact of a new workout routine on participants' weight by measuring their weights before and after the routine.
- [x] Comparing the click-through rates of two independent groups of participants testing two different versions of a website homepage in an A/B testing environment.

Correct
Yes! A two-sample t-test is appropriate when comparing two **independent** groups. Since the scenario involves two independent groups of participants, it would be suitable to use a two-sample t-test.

- [ ] Testing the effectiveness of a new drug by measuring the blood pressure of the same group of patients before and after treatment.