1. Consider two sets of samples drawn from the same population that are randomly selected. Set X has a sample size = 10, and set Y has a sample size = 100. Which of the following statements is accurate about the confidence interval for the mean of the samples?

   ⦿ The confidence interval for set X is **larger** than the confidence interval for set Y.

   ◯ The confidence interval for set X is **smaller** than the confidence interval for set Y.

   ◯ The confidence interval for set X **equals** the confidence interval for set Y.

   ◯ There isn't enough information to answer the question.

2. Suppose you have a sample of 100 heights of individuals from a specific population. Assume the **population standard deviation** is 1 cm, and the **sample mean** is 175cm from a **random sample** of 100 individuals. What expression describes the margin of error for a confidence level of 99%?

   ◯ $z_{0.01} \cdot \frac{1}{10}$

   ◯ $z_{0.005} \cdot \frac{1}{100}$

   ⦿ $z_{0.005} \cdot \frac{1}{10}$

   ◯ $z_{0.1} \cdot \frac{1}{100}$

3. To calculate a confidence interval for the **mean** of a population, what assumptions must be made? **Select all that apply.**

   ☑ The sample is a random sample.

   ☐ The population must follow a normal distribution.

   ☑ The sample size must be big enough (usually over 30).

   ☐ The sample must have a mean = 0 and a standard deviation = 1.

4. 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** $s = 10$. A confidence interval of 95% of confidence level is given by:

   Hint: $t_{0.975} = 2.093$

   ◯ $(48.95, 51.05)$

   ⦿ $(45.32, 54.68)$

   ◯ $(45.2, 54.8)$

   ◯ $(48.9, 51.1)$

5. A manufacturing company takes a sample of 100 items in its product warehouse and determines that 22% of the sample contains a defect. Calculate the **proportion margin of error** with a 95% confidence interval.

   Hint: $z_{\alpha/2} = 1.96$

   ◯ 0.0336

   ⦿ 0.0812

   ◯ 0.0919

   ◯ 0.3363

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

   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, 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.

   ● Assuming a fixed confidence level, larger samples result 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%?

   ○ $t_{0.05} \cdot \frac{50}{\sqrt{20}}$

   ○ $z_{0.025} \cdot \frac{50}{\sqrt{20}}$

   ● $t_{0.025} \cdot \frac{10}{\sqrt{20}}$

   ○ $z_{0.05} \cdot \frac{10}{\sqrt{20}}$

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.

   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

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

○ 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.

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.

● 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 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.

○ 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.

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

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.

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?

- ⦿ -5.27
- ◯ -2.73
- ◯ 2.73
- ◯ 5.27

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?

- ◯ 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.

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?

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

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

- ☐ Analyzing the average response time of individuals in a driving simulation before and after they undergo distraction training.

- ☑ 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.

- ☐ Investigating the impact of a new workout routine on participants' weight by measuring their weights before and after the routine.

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

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