Congratulations! You passed!

Next Item

1. An insurance company is reviewing its current policy rates. When originally setting the rates they believed that the average claim amount was $1,800. They are concerned that the true mean is actually higher than this, because they could potentially lose a lot of money. They randomly select 40 claims, which yield a sample mean of $1,950. Which of the following is the correct set of hypotheses for this scenario?

1 / 1 points

- ( ) $H_0: \mu = 1,950$

  $H_A: \mu > 1,800$
- ( ) $H_0: \bar{x} = 1,800$

  $H_A: \bar{x} > 1,800$
- (•) $H_0: \mu = 1,800$

  $H_A: \mu > 1,800$

Correct
This question refers to the following learning objective(s):

- Always construct hypotheses about population parameters (e.g. population mean, μ) and not the sample statistics (e.g. sample mean, $\bar{x}$). Note that the population parameter is unknown while the sample statistic is measured using the observed data and hence there is no point in hypothesizing about it.
- Define the null value as the value the parameter is set to equal in the null hypothesis.
- Note that the alternative hypothesis might be one-sided ($\mu <$ or $>$ the null value) or two-sided ($\mu \neq$ the null value), and the choice depends on the research question.

- ( ) $H_0: \mu = 1,800$

  $H_A: \mu > 1,950$

2. Your friend likes to show off to his coworkers using statistical terminology, but he makes errors so much that you often have to correct him. He just completed the following hypothesis test:

1 / 1 points

$H_0: \mu = 100$; $H_A: \mu \neq 100$

$x = 105$, $s = 10$, $n = 40$

p-value = 0.0016

He claims the definition of this p-value is

"the probability of obtaining a sample mean of 105 from a random sample of $n = 40$ when the true population mean is assumed to be 100."

Which of the following is true? (You may assume his calculations are correct, only focus on his interpretation.)

- (•) Your friend is wrong, the statement should be revised as "the probability of obtaining a sample mean of 105 or more extreme from a random sample of $n = 40$ when the true population mean is assumed to be 100."

Correct
This question refers to the following learning objective(s): Define a p-value as the conditional probability of obtaining a sample statistic at least as extreme as the one observed given that the null hypothesis is true.

p-value = P(observed or more extreme sample statistic | H_0 true)

- ( ) Your friend is wrong, the statement should be revised as "the probability of obtaining a sample mean of 105 from a random sample of $n = 40$ when the true population mean is assumed to be different than 105."
- ( ) Your friend is right.
- ( ) Your friend is wrong, the sample size is irrelevant.

3. Two-sided alternative hypotheses are phrased in terms of:

1 / 1 points

- ( ) ≤ or ≥
- ( ) ≈ or =
- ( ) < or >
- (•) ≠

Correct
This question refers to the following learning objective(s): Note that the alternative hypothesis might be one-sided ($\mu <$ or $>$ the null value) or two-sided ($\mu \neq$ the null value), and the choice depends on the research question.

4. A Type 1 error occurs when the null hypothesis is

1 / 1 points

- ( ) not rejected when it is false
- ( ) rejected when it is false
- (•) rejected when it is true

Correct
This question refers to the following learning objective(s): Note that the conclusion of a hypothesis test might be erroneous regardless of the decision we make.

- Define a Type 1 error as rejecting the null hypothesis when the null hypothesis is actually true.
- Define a Type 2 error as failing to reject the null hypothesis when the alternative hypothesis is actually true.

- ( ) not rejected when it is true

5. A statistician is studying blood pressure levels of Italians in the age range 75-80. The following is some information about her study:

1 / 1 points

1. The data were collected by responses to a survey conducted by email, and no measures were taken to get information from those who did not respond to the initial survey email.
2. The sample observations only make up about 4% of the population.
3. The sample size is 2,047.
4. The distribution of sample observations is skewed - the skew is easy to see, although not very extreme.

The researcher is ready to use the Central Limit Theorem (CLT) in the main part of her analysis. Which aspect of the her study is most likely to prevent her from using the CLT?

- (•) (I), because the sample may not be random and hence observations may not be independent.

Correct
The correct answer is that the data arose as a result of an email survey. This data collection would likely result in a sample which is not a simple random sample of Italians aged 75-80, which would violate the independence of observations condition necessary for the CLT.

- ( ) (II), because she only has data from a small proportion of the whole population.
- ( ) (III), because the sample size is too small compared to all Italians in the age range 75-80.
- ( ) (IV), because there is some skew in the sample distribution.

6. SAT scores are distributed with a mean of 1,500 and a standard deviation of 300. You are interested in estimating the average SAT score of first year students at your college. If you would like to limit the margin of error of your 95% confidence interval to 25 points, at least how many students should you sample?

1 / 1 points

- ( ) 392
- ( ) 393
- ( ) 553
- (•) 554

Correct
This question refers to the following learning objective(s): Calculate the required sample size to obtain a given margin of error at a given confidence level by working backwards from the given margin of error.

$ME = z^\star \frac{s}{\sqrt{n}} \rightarrow 25 = 1.96 \frac{300}{\sqrt{n}} \rightarrow n = \frac{1.96^2 \times 300^2}{25^2} \rightarrow n = 553.1904 \rightarrow$ n should be at least 554, since rounding down would result in a slightly larger margin of error than we desire.

- ( ) 13,830

7. If it's relatively riskier to reject the null hypothesis when it might be true, should a smaller or a larger significance level be used?

1 / 1 points

- ( ) larger
- (•) smaller

Correct
This question refers to the following learning objective(s): Note that the probability of making a Type 1 error is equivalent to the significance level when the null hypothesis is true, and choose a significance level depending on the risks associated with Type 1 and Type 2 errors.

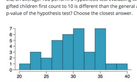
- Use a smaller α if Type 1 error is relatively riskier.
- Use a larger α if Type 2 error is relatively riskier.

If it's relatively riskier to reject the null hypothesis when it might be true, that means it's relatively riskier to make a Type 1 error, therefore we should decrease the probability of making a Type 1 error, which means decreasing the significance level.

8. Researchers investigating characteristics of gifted children collected data from schools in a large city on a random sample of thirty-six children who were identified as gifted children soon after they reached the age of four. The following histogram shows the distribution of the ages (in months) at which these children first counted to 10 successfully. Also provided are some sample statistics.

1 / 1 points

Suppose you read online that children first count to 10 successfully when they are 32 months old, on average. You perform a hypothesis test evaluating whether the average age at which gifted children first count to 10 is different than the general average of 32 months. What is the p-value of the hypothesis test? Choose the closest answer.



n	36
min	21
mean	30.69
sd	4.31
max	39

- ( ) 0.0344
- ( ) 0.9656
- ( ) 0.7183
- ( ) 0.9312
- (•) 0.0688

Correct
This question refers to the following learning objective(s): Calculate a p-value as the area under the normal curve beyond the observed sample mean (either in one tail or both, depending on the alternative hypothesis). Note that in doing so you can use a Z score, where

$$Z = \frac{sample\ statistic - null\ value}{SE} = \frac{\bar{x} - \mu_0}{SE}$$

Always sketch the normal curve when calculating the p-value, and shade the appropriate area(s) depending on whether the alternative hypothesis is one- or two-sided.

$$H_0: \mu = 32, H_A: \mu \neq 32$$

$$\begin{aligned} Z &= \frac{30.69 - 32}{\frac{4.31}{\sqrt{36}}} = -1.82 \\ p - value &= P(\bar{x} < 30.69 \mid \mu = 32) \\ &= P(|z| > 1.82) \\ &= 2 \times 0.0344 = 0.0688 \end{aligned}$$