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?

   - (●) $H_0 : \mu = 1,800$
     $H_A : \mu > 1,800$
   - ( ) $H_0 : \mu = 1,800$
     $H_A : \mu > 1,950$
   - ( ) $H_0 : \bar{x} = 1,800$
     $H_A : \bar{x} > 1,800$
   - ( ) $H_0 : \mu = 1,950$
     $H_A : \mu > 1,800$

2. Which of the following is the correct definition of the p-value?

   - ( ) P(H_0 true | observed sample statistic)
   - ( ) P(H_0 true | H_A false)
   - ( ) P(observed sample statistic | H_0 true)
   - (●) P(observed or more extreme sample statistic | H_0 true)

✓ **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)

3. A researcher found a 2006 - 2010 survey showing that the average age of women at first marriage is 23.44. Suppose a researcher believes that this value may have increased more recently, but as a good scientist he also wants to consider the possibility that the average age may have decreased. The researcher has set up his hypothesis test; which of the following states the appropriate H_A correctly?

- ○ $H_A : \mu < 23.44$ years old.
- ○ $H_A : \mu > 23.44$ years old.
- ○ $H_A : \mu = 23.44$ years old.
- ◉ $H_A : \mu \neq 23.44$ years old.

✓ **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.

Because the researcher is interested in both an increase or a decrease, H_A should be two-sided.

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

- ○ rejected when it is false
- ○ not rejected when it is true
- ○ not 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.

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. 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.
   - (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.

   ✓ **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.

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?

- 392
- 393
- 553
- 554
- 13,830

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.

7. The significance level in hypothesis testing is the probability of

- rejecting a null hypothesis
- failing to reject a true null hypothesis
- rejecting an alternative hypothesis
- rejecting a true null hypothesis
- failing to reject a false null hypothesis

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.

Note that the probability of making a Type 1 error is equivalent to the significance level when the null hypothesis is true.

8. The nutrition label on a bag of potato chips says that a one ounce (28 gram) serving of potato chips has 130 calories and contains ten grams of fat, with three grams of saturated fat. A random sample of 35 bags yielded a sample mean of 134 calories with a standard deviation of 17 calories. We are evaluating whether these data provide convincing evidence that the nutrition label does not provide an accurate measure of calories in the bags of potato chips at the 10% significance level. Which of the following is correct?

- (●) The p-value is approximately 16%, which means we should fail to reject the null hypothesis and determine that these data **do not** provide convincing evidence the nutrition label does not provide an accurate measure of calories in the bags of potato chips.
- ( ) The p-value is approximately 16%, which means we should reject the null hypothesis and determine that these data provide convincing evidence the nutrition label does not provide an accurate measure of calories in the bags of potato chips.
- ( ) The p-value is approximately 8%, which means we should reject the null hypothesis and determine that these data provide convincing evidence the nutrition label does not provide an accurate measure of calories in the bags of potato chips.
- ( ) The p-value is approximately 8%, which means we should fail to reject the null hypothesis and determine that these data **do not** provide convincing evidence the nutrition label does not provide an accurate measure of calories in the bags of potato chips.