Topics: Confidence Intervals

1. For each of the following statements, indicate whether it is True/False. If false, explain why.

    I. The sample size of the survey should at least be a fixed percentage of the population size in order to produce representative results.

    ANS- The statement is incorrect; the suitable sample size for a survey doesn't have to be a fixed percentage of the population size. It depends on factors like precision, population variability, and confidence level, rather than adhering strictly to a set percentage.

    II. The sampling frame is a list of every item that appears in a survey sample, including those that did not respond to questions.

    ANS-The statement is incorrect because the sampling frame excludes items that did not respond to questions or are not available for sampling. In other words, the sampling frame only consists of the elements that are eligible and accessible for inclusion in the survey or study.

    III. Larger surveys convey a more accurate impression of the population than smaller surveys.

    ANS- True

2. *PC Magazine* asked all of its readers to participate in a survey of their satisfaction with different brands of electronics. In the 2004 survey, which was included in an issue of the magazine that year, more than 9000 readers rated the products on a scale from 1 to 10. The magazine reported that the average rating assigned by 225 readers to a Kodak compact digital camera was 7.5. For this product, identify the following:

    A. The population

    ANS- 9000

    B. The parameter of interest

    ANS- The parameter of interest in this scenario is the population mean satisfaction rating of the camera, which is specified as 7.5

    C. The sampling frame

    ANS- The sampling frame encompasses all PC Magazine readers who received the survey. It represents the defined group from which the sample for the survey was drawn.

    D. The sample size

    ANS- 225

    E. The sampling design

ANS- The sampling design determines how samples are chosen for a survey, specifically for Kodak compact digital cameras.

F. Any potential sources of bias or other problems with the survey or sample

ANS- It's possible that only those who were exceptionally pleased or dissatisfied with the product participated in the survey, potentially making the results unreliable.

3. For each of the following statements, indicate whether it is True/False. If false, explain why.

I. If the 95% confidence interval for the average purchase of customers at a department store is $50 to $110, then $100 is a plausible value for the population mean at this level of confidence.

ANS- TRUE.

II. If the 95% confidence interval for the number of moviegoers who purchase concessions is 30% to 45%, this means that fewer than half of all moviegoers purchase concessions.

ANS- False.

We have suggestive evidence, but cannot confirm with 100% certainty based on this data alone. Considering values beyond the 95% confidence interval is essential.

III. The 95% Confidence-Interval for μ only applies if the sample data are nearly normally distributed.

ANS- False.

A moderately large sample, typically exceeding 30 in many cases, is recommended. The central limit theorem ensures that the sampling distribution becomes approximately normal, irrespective of the original data distribution.

4. What are the chances that $\overline{X} > \mu$?

A. ¼
B. ½
C. ¾
D. 1

ANS-B.

This is a baseless assumption. In reality, there is a 50% chance that the sample mean (X) is greater than the population mean (μ).

5. In January 2005, a company that monitors Internet traffic (WebSideStory) reported that its sampling revealed that the Mozilla Firefox browser launched in 2004 had grabbed a 4.6% share of the market.

   I. If the sample were based on 2,000 users, could Microsoft conclude that Mozilla has a less than 5% share of the market?

   ANS- As the p-value (0.2058) is greater than the significance level (alpha = 0.05), we accept the Null Hypothesis. Therefore, Mozilla's market share is greater than 5%. Microsoft cannot conclude that Mozilla has less than a 5% share of the market.

   II. WebSideStory claims that its sample includes all the daily Internet users. If that's the case, then can Microsoft conclude that Mozilla has a less than 5% share of the market?

   ANS- With a population percentage of 4.6%, Microsoft's claim that Mozilla has less than a 5% share of the entire market is accurate.

6. A book publisher monitors the size of shipments of its textbooks to university bookstores. For a sample of texts used at various schools, the 95% confidence interval for the size of the shipment was 250 ± 45 books. Which, if any, of the following interpretations of this interval are correct?

   A. All shipments are between 205 and 295 books.
   ANS- Incorrect.

   B. 95% of shipments are between 205 and 295 books.
   ANS- Incorrect.

   C. The procedure that produced this interval generates ranges that hold the population mean for 95% of samples.
   ANS- Correct.

   D. If we get another sample, then we can be 95% sure that the mean of this second sample is between 205 and 295.
   ANS- Incorrect.

   E. We can be 95% confident that the range 160 to 340 holds the population mean.
   ANS- Incorrect

7. Which is shorter: a 95% *z*-interval or a 95% *t*-interval for μ if we know that σ =s?

   A. The z-interval is shorter
   B. The t-interval is shorter
   C. Both are equal
   D. We cannot say

ANS- The z-interval is shorter.

Questions 8 and 9 are based on the following: To prepare a report on the economy, analysts need to estimate the percentage of businesses that plan to hire additional employees in the next 60 days.

8. How many randomly selected employers (minimum number) must we contact in order to guarantee a margin of error of no more than 4% (at 95% confidence)?

   A. 600
   B. 400
   C. 550
   D. 1000

ANS-600 randomly selected employers must be contacted in order to guarantee a margin of error of no more than 4%,(OPTION A).

$0.04 = 1.96*\sqrt{0.5*0.5/n}$

$n = 1.96^2*0.5*0.5/0.04^2$

$= 0.9604/0.0016$

$= 600$

9. Suppose we want the above margin of error to be based on a 98% confidence level. What sample size (minimum) must we now use?

   A. 1000
   B. 757
   C. 848
   D. 543

ANS- The sample size must be taken is 848 (OPTION C).

$Z = 2.326^2 * \sqrt{0.5*0.5/n}$

$n = 2.326^2*0.5*0.5/0.04^2$

$= 1.3525/0.0016$

$= 845.35$