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:
False. The required sample size for a survey depends on several factors, including the desired level of precision, the variability of the population, and the type of analysis to be performed. In general, larger sample sizes provide more precise estimates, but there is no fixed percentage of the population size that guarantees representative results.

    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:
False. The sampling frame is a list of all the elements in the population from which the sample is drawn. It does not include those who did not respond to questions

    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

The population of interest is all users of Kodak compact digital cameras.

    B. The parameter of interest

The parameter of interest is the average satisfaction rating of all Kodak compact digital camera users.

    C. The sampling frame

The sampling frame is the list of all PC Magazine readers who received the survey.

    D. The sample size

The sample size is 225.

    E. The sampling design

The sampling design is a self-selected sample.

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

Some problems associated are:
1) self-selected sample bias
2) Survey questions bias
3) Small sample problem
4) Sampling frame is limited to PC magazine only.

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.
While the confidence interval suggests that the proportion of moviegoers who purchase concessions is likely between 30% and 45%, it does not prove that fewer than half of all moviegoers purchase concessions. The true proportion could be anywhere within the confidence interval.

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

ANS: True.

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

   A. ¼
   B. ½
   C. ¾
   D. 1

ANS: B. 50%

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: If the sample were based on 2,000 users, we would need to calculate the confidence interval for the proportion of Mozilla Firefox users. Assuming a 95% confidence level, the confidence interval would be approximately 3.68% to 5.52%. Since this interval includes 5%, Microsoft cannot definitively conclude that Mozilla has a less than 5% share of the market based on this sample.
Calculated the CI using formula= sample proportion ± margin of error

   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: If WebSideStory's claim that its sample includes all daily Internet users is true, then the observed proportion of 4.6% would represent the true population proportion. In this case, Microsoft could conclude that Mozilla has a less than 5% share of the market, as the observed proportion is below the 5% threshold.

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.

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

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

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

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

ANS: Out of the given interpretations, only the following statement is correct:
C. The procedure that produced this interval generates ranges that hold the population mean for 95% of samples.
This statement accurately reflects the meaning of a 95% confidence interval. It implies that if we were to repeatedly take samples from the population and construct confidence intervals, 95% of those intervals would contain the true population mean.

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: A. The z-interval is shorter.
When the population standard deviation (σ) is known and equal to the sample standard deviation (s), the 95% z-interval will always be shorter than the 95% t-interval for the population mean (μ).
This is because the z-distribution, which is used for the z-interval, is more concentrated around its mean compared to the t-distribution, which is used for the t-interval.

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: A. 600
Sample size = (z^2 * p * (1-p)) / (e^2)
Sample size= (1.96^2 * 0.5 * (1-0.5)) / (0.04^2) =600.25

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:
C. 848
Using the same formula used above,
n = (2.33^2 * 0.5 * (1-0.5)) / (0.04^2) =848.26