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) True If the same size is too low, higher is the chance of being wrong and lower is the value of confidence

    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 A list of all elements in the population from which the sample is drawn.
Frame is needed so that everyone in the population is identified so they will have annual opportunity for selection as subject

    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) p=x/n=225/9000=0.025
    B. The parameter of interest
    Ans) sample size,average,scale
    C. The sampling frame
    Ans)9000
    D. The sample size
    Ans 225
    E. The sampling design
        1. **Define the population. 2. Determine the sampling Frame3. Select Sampling Technique. 4. Determine the sample size 5. Execute the Sampling Process**
    F. Any potential sources of bias or other problems with the survey or sample
    Ans, Marginal error, Confidence Level, Confidence Interval

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
    Reason: The 95% confidence interval for the average purchase of customers at a department store is $50 to $110. Which means that there is a 95% chance that the population mean will fall between $50 and $110. Hence, as $100 falls between $50 and $110, it is a plausible value for the population mean at this confidence level.

    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) True
    The 95% confidence interval for the number of moviegoers who purchase concessions is 30% to 45%, this means that there is a 95% chance that only 30 to 45 % of moviegoers purchase concessions, which is less than 50%. Hence, we can infer that fewer than half of all the moviegoers purchase concessions.
    III. The 95% Confidence-Interval for μ only applies if the sample data are nearly normally distributed.
    Ans) False. With a large enough sample, the central limit theorem implies a normal sampling distribution regardless of the distribution of the data

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

    A. ¼
    B. ½
    C. ¾
    D. 1

Answer: D. 1 (Mean of Sample means is equal to population mean)

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?
    NO

It is given in the question that in the month of January 2005, WebSideStory, an organization which checks internet traffic had reported its sampling revealed which Mozilla Firefox browser had launched in the year 2004 has grabbed a share of 4.6% share of the global market.

(I) Now suppose the population proportion share of market by the Mozilla is = p

Then, Null Hypothesis is $H_0 \text{ is } p \geq 5$ **% {meaning Mozilla has more than 5 percent or equal to 5 percent share of the market}**

Alternate Hypothesis, $H_A \text{ is } p < 5$ **% {meaning Mozilla has a less than five percent share of the market}**

This test statistics which will be used is One-sample z-test for proportions;

$$TS = \frac{\hat{p}-p}{\sqrt{\frac{p(1-p)}{n}}} \sim N(0,1)$$

where, $\hat{p}$ **= is the sample proportion of share of the market that is grabbed by the Mozilla in year 2004 = 4.6%**

n = sample of users = 2,000

So, the test statistics is = $= \frac{0.046-0.05}{\sqrt{\frac{0.05(1-0.05)}{2000}}}$

$= -0.821$

Therefore, z-test statistics is -0.821.

As per question it is not mentioned properly or stated the degree of significance, we can assume that it is 5%. Now, the level of significance at 5 percent, the z table will give the critical value of -1.96 to the left-tailed test.

Now the test statics value is greater than critical value of z, and thus we don't have sufficient evidence to reject the null hypothesis because it will not be placed in the rejection part or region.

So we can conclude that the Mozilla has equal to 5% or more than 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?
YES

Now it is claimed by WebSideStory that their sample contains all the internet users using daily. Thus it means 4.6 percent share of market shows the entire population.

So, we conclude that the Mozilla has a share in the ,market of less than 5 %

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.
    INCORRECT

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

    CORRECT

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

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

    A. 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 : A. 600

n = $\left(\frac{z}{ME}\right)^2 \cdot (p(1-p))$

0.5∗0.5 n 2 1.96 ∗0.5∗0.5 0.9604 ==600.4

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

n = $\left(\frac{z}{ME}\right)^2 \cdot (p(1-p))$

0.5∗0.5 n

2.3262∗0.5∗0.5 1.3525 = = 845.35