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.

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

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

ANS:

1) **True,**
   The representation of the survey results should have a sample size. The sample size must be a fixed percentage of the total population size of the survey
2) **False,**
   The sampling frame refers to a list of an item which responds to the question and not the ones which do not respond to the questions.
3) **True,**

   The larger conveys a more accurate impression of the population as larger surveys involve large sample size which reduces the chances of error.

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
    B. The parameter of interest
    C. The sampling frame
    D. The sample size
    E. The sampling design
    F. Any potential sources of bias or other problems with the survey or sample

ANS:

A) **9000 Readers**
B) **Mean=7.5**
C) **Total Readers**
D) **225 Readers**
E) **Kodak compact digital camera**
F) **PC Magazine**

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.

   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.

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

   ANS:
   1. True

   2. False
   The 95% confident that the true proportion of moviegoers who purchase concessions falls within the range of 30% to 45%.
   It does not imply that fewer than half of all moviegoers purchase concessions. The interval includes values greater than 45%, and the true proportion could be anywhere within that range. It's a statement about the precision of the estimate, not a statement about a specific point within the interval being more likely than others.

   3. True

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

   A. ¼
   B. ½
   C. ¾
   D. 1
   ANS: d)
   1 (Mean of the sample 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?
ANS:

```
# Apply one sample one tail test
z_scores=(0.046-0.05)/(np.sqrt((0.05*(1-0.05))/2000))
z_scores
```

```
-0.820782681668124
```

```
# Find Probability assuming null hyposthesis, so as to compare with Type-1 error α = 0.05
p_value=1-stats.norm.cdf(abs(z_scores))
p_value
```

```
0.20588503245107104
```

As (p_value = 0.2058) > (α = 0.05)
Accept Null Hypothesis i.e Mozilla market share > 5%.
Thus, Microsoft cannot conclude that Mozilla has a less 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?
ANS:

We are given that WebSideStory claims that its sample includes all the daily Internet users.

This means that the 4.6% is the population percentage.

Comparing it with Microsoft's claim that Mozilla has a less than 5% share of the whole market is True.

Hence, we can conclude that Mozilla has a less than 5% share of the market.

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:
False
The correct interpretation of a 95% confidence interval is not that all individual shipments are within the interval.

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

The correct interpretation of a 95% confidence interval is not that a certain percentage of individual observations fall within the interval

C. The procedure that produced this interval generates ranges that hold the population mean for 95% of samples.
ANS:
True
The procedure that produced this interval generates ranges that hold the population mean for 95% of samples" is a correct interpretation of a 95% confidence interval

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:
False
The confidence interval is about our level of confidence in estimating the true population parameter, not about making predictions for individual future samples

E. We can be 95% confident that the range 160 to 340 holds the population mean.
ANS:
False
The correct interpretation of the 95% confidence interval (250 ± 45 books) is that we can be 95% confident that the true population mean falls within the range of 205 to 295 books, not 160 to 340. The provided confidence interval specifically pertains to the interval (250 ± 45).

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

Because it tell us difference between mean of distribution and data points in standard deviation

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

Margins of error estimate is 1/ sqrt (n)
if 0.04=1/25 is Margin of error
then n=25^2 or 625.
Choose 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:

B) 1000