Topics: Confidence Intervals

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

   A) 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 sample size of a survey does not need to be a fixed percentage of the population size in order to produce representative results.
The sample size of a survey should be chosen based on the desired level of precision and the margin of error that is acceptable for the estimate

   B) 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 refers to a list of an item which responds to questions. and not the ones which do not respond to the questions.

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

Ans:

True: Larger surveys involve large sample size which reduces the chances off 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

Ans: All of the readers of PC Magazine

   B) The parameter of interest

Ans:

Sample size of the readers who participated in the survey.
The average rating of Kodak digital camera among all of the readers of PC Magazine who participated in the survey

   C) The sampling frame

Ans:

The sampling frame for this survey is total 9000 readers of PC Magazine Who participated in the survey.

   D) The sample size

Ans: Sample Size is 225 which is no of readers who rated the kodac compact digital camera

   E) The sampling design

Ans:

The sampling design for this survey could be a stratified sampling or systematic sampling

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

Ans:

Potential sources of bias or other problems with the survey or sample include:

Self- selection bias: The survey may be subject to self-selection bias because it relies on voluntary participation. which means that only readers who are interested in the topic or who have strong opinions about the products may be more likely to respond. This can lead to a sample that is not representative of the entire population of readers.

Response bias: The survey may be subject to response bias if some readers are more likely to respond than others, or if the way in which the survey is administered.

Sampling bias: The sample may be subject to sampling bias if the readers who participated in the survey are not representative of the entire population of readers likely to respond than others.

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

A) 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. The confidence interval represents the range of values that are likely to include the true population mean, based on the sample data and the level of the confidence desired. A value falls within the confidence interval is considered plausible for the population mean.

B) 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. If the 95% CI for the no of moviegoers who purchase concessions is 30%-45% means there is 95% chance that the true population proportion of moviegoers who purchase concessions is between 30% and 45%. it does not necessarily mean that fever than half of all moviegoers purchase concessions.

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

Ans:

True. The 95% CI for the population mean, μ can be calculated for any sample data, regardless of whether the data are nearly normally distributed. The CI

is based on the sample mean depends on the sample size and the population characteristics, but it is not necessary for the sample data to be normally distributed in order to calculate the CI.

4) What a re the chances that $\bar{x} > u$?

A) ¼
B) ½
C) ¾
D) 1

Ans:

B) 1/2 there is 50% chance that the sample mean is greater than the 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.

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

B) 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?

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

Ans:

A) To determine whether micro soft can conclude that Mozilla has a less than 5% share of the market based on the sample of 2,000 users, we need to consider the margin of error associated with the sample. The margin of error is a measure of precision of an estimate, and it is typically expressed as a percentage of the estimate. The margin off error is determined by the sample size and the level of confidence will result in a smaller margin of error.

To determine the margin of error for the sample of 2,000 users.

margin of error=$(z*s)/\sqrt{n}$

where
z=z score for the confidence level=1.96 for 95%
s= standard error of the estimate=0.046
n= sample size=2000

margin of error=$(1.96*0.046)/\sqrt{2000}$
=0.0091

The margin of error for the sample of 2,000 users is approx 0.91%

This means that the sample estimate of 4.6% is accurate within plus or minus 0.91% at a 95% confidence level.

Since the sample estimate of 4.6% is less than 5% and the margin of error 0.91%, microsoft conclude that mozilla has a less than 5% share of the market based on the sample of 2000 users.

B) If the sample used by WebSideStory includes all daily internet users, then the sample estimate of 4.6% would be the true population proportion of internet users using the mozilla firefox browser

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:

The 95% CI for the size of the shipment is 250 ± 45 books, which means that the interval extends from 250-45=205 books to 250 +45=295 books. This interval can be interpreted as follows:

A) All shipment are between 205 and 295 books. This interpretation is incorrect.
The confidence interval represents a range of values that are likely to include the true population mean, but it is not a guarantee that all shipments fall within this range.

B) 95% of shipments are between 205 and 295 books. This interpretation is also incorrect.
The CI represents a range of values that are likely to include the true population mean, but it des not specify the percentage of shipments that fall within the range.

C) The procedure that produced this interval generates ranges that hold the population mean for 95% of samples. This interpretation is correct. The confidence interval represent a range of values that are likely to include the true population mean for 95% of samples, based on the procedure used to calculate the 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. This interpretation is incorrect. The confidence interval represents a range of values that are likely to include the true population mean for the current sample, but it does not apply to future samples.

E) We can be 95% CI that the range 160-340 holds the population mean. This interpretation is incorrect. The CI is 250 ± 45 books, not 160-340 books

Ans:
C) The procedure that produced this interval generates range that hold the population mean for 95% of samples.

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 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:

The minimum no of employees that must contacted in order to guarantee a margin of error of no more than 4% at 95% CI.

n= (z^2 * p * (1 - p)) / e^2

where

n min sample size
z is the z-score for the CI (196 for 95% confidence)
p is the estimated proportion employers that meet the desired characteristic

n= (1.96 ^2 * 0.5 * (1-0.5)) / (0.04 ^ 2)

n=1.9208/0.0016

n = 1195.5

The minimum no of employees that must be contacted in order to guarantee a margin of error of no more than 4% at 95% CI approx 1196

The correct ans is D) 1000

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:

To determine the minimum sample size needed to achieve a margin of error of no more than 4% at 98 % CI.

n= (z^2 * p * (1-p)) / e^2

where:

n is the minimum sample size
z is the z-score for the confidence level(2.33 for 98% CI)
p is the estimated proportion of employees that meet the desired characteristics

n= (2.33^2*(1-0.5)) / (0.04^2)

= 2.71445/0.0016

n = 1696.5

The minimum sample size needed to achieve a margin of error of no more than 4% at 98% CI is approx 1697

The correct ans is A: 1000