

## 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)

- I. False. The sample size of a survey does not need to be a fixed **percentage** of the population size to produce representative results.
  - II. False. The sampling frame is a list of all the elements (individuals or units) in a population from which a sample is drawn. It is used as a basis for selecting the sample. It should ideally include every item in the population to ensure that the sample is representative.
  - III. 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
  - 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. rating of camera(7.5)
  - C. All readers of the issue where the survey was included
  - D. 225 readers
  - E. Voluntary response
  - F. It is possible that only those who were particularly pleased or only who are displeased with the product participated in the survey which can make 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.
- 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  $\mu$  only applies if the sample data are nearly normally distributed.

ANS)

- I. True
  - II. False. we cannot confirm 100% based on this data. We have to consider the values out of this range.
  - III. False. The Central Limit Theorem allows the use of the 95% confidence interval for the population mean ( $\mu$ ) even if the underlying data distribution is not normal, as long as the sample size is sufficiently large
4. What are the chances that  $\bar{X} > \mu$  ?
- A.  $\frac{1}{4}$
  - B.  $\frac{1}{2}$
  - C.  $\frac{3}{4}$
  - D. 1

ANS) D. 1 ( sample mean can be different from 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.
  - I. If the sample were based on 2,000 users, could Microsoft 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) 1.

Alternative hypothesis :  $\mu < 5$

Null hypothesis :  $\mu \geq 5$

where  $\mu$  is Mozilla market share

Applying One-sample One-tail z-test,

$z\_scores = -0.8207$

$p\_value = 0.20588$

comparing the  $p\_value$  with  $\alpha$

As ( $p\_value = 0.2058$ ) > ( $\alpha = 0.05$ ) ; Accept Null Hypothesis

i.e. Mozilla market share  $> 5\%$  Thus, Microsoft can not conclude that Mozilla has a less than  $5\%$  share of the market.

2. Yes, because we are given that WebSideStory claims that its sample includes all the daily internet users.

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  $250 \pm 45$  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)

- A. Incorrect
- B. Correct
- C. Correct
- D. Correct
- E. Incorrect

7. Which is shorter: a  $95\%$   $z$ -interval or a  $95\%$   $t$ -interval for  $\mu$  if we know that  $\sigma = s$ ?

- 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

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)** n= number of employers

Assume  $\hat{p} = 0.5$ ,  $\hat{q} = 0.5$  Margin of error=0.04

For 95% confidence interval, the critical value  $Z=1.96$

$$ME = Z * \sqrt{\frac{\hat{p}\hat{q}}{n}}$$

$$n = \frac{1.96^2 * 0.5 * 0.5}{0.04^2} = \frac{0.9604}{0.0016} = 600$$

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)** For 95% confidence interval, the critical value  $Z= 2.326$

$$n = \frac{2.326^2 * 0.5 * 0.5}{0.04^2} = \frac{1.3525}{0.0016} = 845.35$$