**Topics: Confidence Intervals**

1. For each of the following statements, indicate whether it is True/False. If false, explain why.
2. The sample size of the survey should at least be a fixed percentage of the population size in order to produce representative results.
3. The sampling frame is a list of every item that appears in a survey sample, including those that did not respond to questions.
4. Larger surveys convey a more accurate impression of the population than smaller surveys.

Ans: -

1. False. There is no fixed limit for sample size of a population but it is generally preferred to take a larger sample for better results.
2. True.
3. True.
4. *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:
5. The population
6. The parameter of interest
7. The sampling frame
8. The sample size
9. The sampling design
10. Any potential sources of bias or other problems with the survey or sample

Ans: -

1. All of its readers
2. Average rating of satisfaction
3. Sampling frame is 9000 readers
4. Sample size is 225 readers
5. Sample design is Survey response rating
6. In this survey, the population consists of only people who read PC Magazine but there may be many others who don’t read PC Magazine yet they use these different electronic items. Also not all readers of the magazine gave a rating in this survey so there is some nonresponsive bias.
7. For each of the following statements, indicate whether it is True/False. If false, explain why.
8. 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.
9. 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.
10. The 95% Confidence-Interval for *μ* only applies if the sample data are nearly normally distributed.

Ans: -

1. True
2. False. The given statement only determines that we are 95% confident that the true proportion of moviegoers who purchase concessions lies within 30% to 45%. We can’t make a definitive statement without further knowledge.
3. False. If the data is normally distributed, it is easier to understand but that doesn’t mean it only applies for that scenario. When we take a large sample size the mean of the data appears to be normally distributed. We can use Central limit theorem to make a normal approximation of data.
4. What are the chances that ?
5. ¼
6. ½
7. ¾
8. 1

Ans: -

If we assume a normal distribution, then the probability for a random variable to be greater than mean is 0.5 and we can assume that it also true for the sample mean since the sample mean is from the same normal distribution. So, the chances would be ½.

1. 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.
2. If the sample were based on 2,000 users, could Microsoft conclude that Mozilla has a less than 5% share of the market?
3. 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. No. We can use hypothesis testing to determine whether the result of Null Hypothesis (>=5% share) is greater than the α value (0.05 for type-1 error).

We can find the z-score with the formula



See Set\_3.ipynb for solution

1. Yes. Because now the sample size is the population size.
2. 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?
3. All shipments are between 205 and 295 books.
4. 95% of shipments are between 205 and 295 books.
5. The procedure that produced this interval generates ranges that hold the population mean for 95% of samples.
6. If we get another sample, then we can be 95% sure that the mean of this second sample is between 205 and 295.
7. We can be 95% confident that the range 160 to 340 holds the population mean.

Ans: -

1. False. The given value is only correct 95% of the time. So there may be books greater than 295 or less than 205.
2. True.
3. True.
4. True.
5. False. We cannot be 95% confident that the population mean will be in range 160 to 340 since the provided interval is only for the 95% confidence interval of a sample.
6. Which is shorter: a 95% *z*-interval or a 95% *t*-interval for *μ* if we know that σ =s?
7. The z-interval is shorter
8. The t-interval is shorter
9. Both are equal
10. We cannot say

Ans: -

The 95% z-interval is shorter than 95% t-interval because the critical value of t-interval cannot be smaller than z-interval critical value. If we reduce the degrees of freedom the value of t-interval increases. Hence, 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.

1. 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)?
2. 600
3. 400
4. 550
5. 1000

Ans: - A. See Set\_3.ipynb for solution.

1. Suppose we want the above margin of error to be based on a 98% confidence level. What sample size (minimum) must we now use?
2. 1000
3. 757
4. 848
5. 543

Ans: - C. See Set\_3.ipynb for solution.