**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.

Sol: FALSE

Explanation: An adequate sample size is necessary to produce representative results. Hence, the sample size must be a predetermined proportion of the survey's overall population.

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

Sol: FALSE

Explanation: The sampling frame should not include the ones which do not respond to the questions.

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

Sol: TRUE

Explanation: The larger surveys always produce a more accurate impressions than smaller surveys

1. *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:
2. The population : All the readers of PC Magazine
3. The parameter of interest : Average rating
4. The sampling frame: 9000
5. The sample size: 225
6. The sampling design: Random sampling
7. Any potential sources of bias or other problems with the survey or sample: No
8. For each of the following statements, indicate whether it is True/False. If false, explain why.
9. 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.

Sol: TRUE

Explanation: As the $100 falls in the range of $50 to $110 with 95% CI, so it is a plausible value for the population mean at this level of confidence.

1. 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.

Sol: TRUE

Explanation: As the range for 95% CI given 30% to 45% is less than 50%, so this means that fewer than half of all moviegoers purchase concessions.

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

Sol: FALSE

Explanation: A 95% confidence interval indicates that if we compute a 95% confidence interval for each of 100 independent samples, then about 95 of the 100 confidence intervals will include the true mean value. However, in actuality, we choose one random sample and produce one confidence interval, which may or may not include the true mean. For normal distribution the mean is zero hence it applies.

1. What are the chances that ?
2. ¼
3. ½
4. ¾
5. 1

Sol: D

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?

Sol :

Null hypothesis H0 < 5%

If P< 0.05: Reject H0 : it means, If P>0.05: Accept H0

Find P?

The test statistic for  One-sample z-test for proportions is :

Z=(P1-P0)/sqrt(P0(1-P0)/n)

* n = Sample size
* P0= Null hypothesized value
* P1 = Observed proportion

Here P1=4.6=0.46 ,P0=5%=0.05 , n=2000

Z = (0.046-0.05)/(np.sqrt((0.05\*(1-0.05))/2000))

Z=-0.82

Find Probability assuming null hyposthesis, so as to compare with Type-1 error α = 0.05

P=1-stats.norm.cdf(abs(z\_scores))

P=0.205

Hence P>0.05, Accept H0, it means Microsoft cannot conclude that Mozilla has a less than 5% share of the market

1. 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?

Sol: 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.

1. 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?
2. All shipments are between 205 and 295 books.: **INCORRECT**
3. 95% of shipments are between 205 and 295 books.: **INCORRECT**
4. The procedure that produced this interval generates ranges that hold the population mean for 95% of samples. : **CORRECT**
5. If we get another sample, then we can be 95% sure that the mean of this second sample is between 205 and 295.: **INCORRECT**
6. We can be 95% confident that the range 160 to 340 holds the population mean.: IN**CORRECT**
7. Which is shorter: a 95% *z*-interval or a 95% *t*-interval for *μ* if we know that σ =s?
8. The z-interval is shorter
9. The t-interval is shorter
10. Both are equal
11. We cannot say

Sol: 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

Sol:

The margin of error for a confidence interval with confidence level CI for an unknown population proportion p is

Margin of error Me = Z \* sqrt(pl (1- pl)/n),

where z is the z-score, the sample proportion pl is used to estimate the unknown population proportion p

Given Me=5%=0.04

As we don not the proportion consider pl=0.5

Α=0.05

p=1- α/2= 1-0.05/2 = 0.975

Z= stats.norm.ppf(0.975)= 1.95

Me = Z \* sqrt(pl (1- pl)/n), Find n=?

0.04=1.95\*sqrt(0.5(1-0.5)/n)

n~594

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

Sol: 0.04=2.32\*sqrt(0.5(1-0.5)/n)

n~827