**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 to produce representative results.

ANS :

**Sample Size Determination:** Calculating the appropriate sample size involves considerations such as the desired level of confidence (usually expressed as a confidence level, e.g., 95%), the margin of error (how much variability is acceptable), and the size of the population. There are statistical formulas and calculators available to help determine the necessary sample size based on these factors.

**Margin of Error:** The margin of error, often denoted as a percentage, represents the range within which the true population parameter is likely to fall. A smaller margin of error requires a larger sample size.

Confidence Level: The confidence level reflects the likelihood that the true population parameter falls within the calculated confidence interval.

1. 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 sample should contain only those items that have responded because the items with no response adds no value the analysis and just increases the size of data.

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

ANS: True More the size of sample, it captures maximum patterns that helps to build an accurate model

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:

ANS:

1. The population : The population in this case would be all the consumers who purchased and used Kodak compact digital cameras.
2. The parameter of interest: - The parameter of interest is the average rating of all Kodak compact digital cameras in the population.
3. The sampling frame: - The sampling frame could be a list of all customers who purchased Kodak compact digital cameras.
4. The sample size: - The sample size is 225 readers who participated in the survey
5. The sampling design: - The sampling design is not specified in the problem, but it could be a simple random sample of the population of Kodak compact digital camera owners.
6. Any potential sources of bias or other problems with the survey or sample

There could be potential sources of bias in the survey if the sample is not representative of the population, or if the readers who participated in the survey had different characteristics or opinions than those who did not participate. Additionally, the wording of the survey question or the way in which the respondents were selected or contacted could also introduce bias.

1. For each of the following statements, indicate whether it is True/False. If false, explain why.
2. 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 is constructed in such a way that the true population mean is expected to fall within it with a 95% probability. Therefore, $100 falls within the interval, and 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.

ANS: False. The confidence interval gives a range of plausible values for the true proportion of moviegoers who purchase concessions, not an estimate of the actual proportion. Since the interval includes 45%, it is possible that the true proportion of moviegoers who purchase concessions is 45%, which is more than half of all moviegoers.

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

Ans: False. The 95% confidence interval for μ (population mean) can be constructed using the sample data, regardless of the distribution of the sample mean, as long as the sample size is large enough (typically, n ≥ 30) due to the Central Limit Theorem. However, if the sample size is small and the population distribution is non-normal, a confidence interval based on the t-distribution may be more appropriate.

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

Ans: B. 1/2

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?

Ans : Sample proportion (p̂) = 4.6% = 0.046

Sample size (n) = 2,000

Assuming a significance level (α) of 0.05, here's how you can perform the hypothesis test:

Calculate the standard error (SE) of the sample proportion:

SE = √[(p̂ \* (1 - p̂)) / n]

SE = √[(0.046 \* (1 - 0.046)) / 2000]

SE ≈ √[(0.046 \* 0.954) / 2000]

SE ≈ √(0.043924 / 2000)

SE ≈ √0.000021962

SE ≈ 0.004684

Calculate the z-score:

The z-score measures how many standard errors the sample proportion is away from the population proportion under the null hypothesis.

z = (p̂ - P) / SE

Where P is the assumed population proportion under the null hypothesis, which is 5% = 0.05.

z = (0.046 - 0.05) / 0.004684

z ≈ (-0.004) / 0.004684

z ≈ -0.853

Calculate the critical z-value for a one-tailed test at a 5% significance level (α = 0.05). You can find this value using a standard normal distribution table or calculator. For α = 0.05, the critical z-value is approximately -1.645.

Compare the calculated z-score to the critical z-value:

-0.853 < -1.645

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?

Ans: We are given that Web Side Story claims that its sample includes all the daily Internet users. This means that the 4.6% share of the market represents the whole population. 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.
3. 95% of shipments are between 205 and 295 books.
4. The procedure that produced this interval generates ranges that hold the population mean for 95% of samples.
5. If we get another sample, then we can be 95% sure that the mean of this second sample is between 205 and 295.
6. We can be 95% confident that the range 160 to 340 holds the population mean.

Ans : The correct interpretation of the given 95% confidence interval for the size of shipments of textbooks is: C. The procedure that produced this interval generates ranges that hold the population mean for 95% of samples.

1. Which is shorter: a 95% *z*-interval or a 95% *t*-interval for *μ* if we know that σ =s?
2. The z-interval is shorter
3. The t-interval is shorter
4. Both are equal
5. We cannot say

Ans: A. The z-interval is shorter Because, z 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.

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: To determine the minimum number of randomly selected employers required to guarantee a margin of error of no more than 4% at 95% confidence,

we can use the following formula: n = (z\*σ / E) ^2

Where: z = 1.96 (the z-value corresponding to 95% confidence)

σ = 0.5 (since we do not know the true proportion, we assume a conservative estimate of 0.5) E = 0.04 (the desired margin of error)

Plugging in the values, we get n = (1.96 \* 0.5 / 0.04) ^2 n = 600.25 Rounding up to the nearest integer, we get the minimum number of employees to contact is 601, which is option A. Therefore, the answer is A.

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: Z= 2.576 0.04 = 2.326 \* sqrt ( ( 0.5 \* 0.5 ) / n)

n = ( 2.326^2 \* 0.5 \* 0.5 ) / ( 0.04 )^2

= 1.3525 / 0.0016

= 845.35 ≈ 848 Option C is correct