

Determining the Sample Size: One Sample

OVERVIEW

In this lab, you will be determining the sample size for population means and population proportions. This lab is intended to help you understand the importance of determining appropriate sample sizes in order to accurately estimate average population scores.

OBJECTIVES

By the end of the laboratory, you will be able to:

- Determine sample size for $(1-\alpha)100\%$ Confidence Intervals for the **population mean**.
- Determine sample sizes for $(1-\alpha)100\%$ Confidence Intervals for **population proportion**.
- Determine when to use the formula for means and when to use the formula for proportions.

EQUIPMENT

- Scientific calculator
- Standard Normal (Z) Table

BACKGROUND MATERIAL

Statistical Terms and Topics

- Sample Size (n)
- Chosen significance level (α)
- Population mean (μ)
- Population and sample variance (σ^2 and s^2 , respectively)
- Population and sample standard deviation (σ and s , respectively)
- Population proportion of success (p)
- Population proportion of failure (q : $q=1-p$)
- Z -value from table
- Confidence interval
- Bound, B : margin of error

- Sample size formulas

Determining Sample Size for $(1-\alpha)100\%$ CI for the Population Mean

To estimate the population mean, μ , within a bound (B) with $(1-\alpha)100\%$ confidence, the required sample size is found by solving the following formula for n : $z_{\frac{\alpha}{2}}\left(\frac{\sigma}{\sqrt{n}}\right) = B$.

FORMULA FOR SAMPLE SIZE (MEANS)

$$n = \frac{\left(z_{\frac{\alpha}{2}}\right)^2 \sigma^2}{B^2}$$

Determining Sample Size for $(1-\alpha)100\%$ CI for Population Proportion

To estimate a binomial probability, p , within a bound, B , within $(1-\alpha)100\%$ confidence, solving the following equation for n is required: $z_{\frac{\alpha}{2}}\sqrt{\frac{pq}{n}} = B$

FORMULA FOR SAMPLE SIZE (PROPORTIONS)

$$n = \frac{\left(z_{\frac{\alpha}{2}}\right)^2 (pq)}{B^2}$$

Scenario for 100 (1-alpha)% CI for Population Means

Suppose you wish to estimate a **population mean** on a perfectionism scale to within a bound $B = .15$ using a 95% CI. You know from a prior sample of data that the standard deviation of scores is approximately equal to 7.4. How many subjects would have to be in this sample in order to estimate the average population score on the perfectionism scale? The step-by-step Instructions below will help you answer this question.



Exercise

INSTRUCTIONS

1. Identify the type of problem and the formula that will need to be used.

Type of problem (mean or proportion): _____

Formula: _____

2. Identify the values needed for the formula based on the scenario.

$$z_{\frac{\alpha}{2}} = \underline{\hspace{2cm}}$$

$$\sigma = \underline{\hspace{2cm}}$$

$$B = \underline{\hspace{2cm}}$$

3. Enter values into formula and evaluate:

Formula: _____

Answer: _____ *Hint: Don't forget to round to the nearest whole number since the sample size is in whole units, for example people.*

4. Write the conclusion in terms of the problem:

Scenario for 100 (1-alpha)% CI for Population Proportions

Suppose you want to estimate the **population proportion** of all college students who exhibit clinically high levels of anxiety to within a bound $B = .2$. In a previous application of the Generalized Anxiety Scale $\approx 90\%$ of the college students exhibited high levels of anxiety. You know the standard deviation of scores on the "Generalized Anxiety Scale" is approximately equal to 8.5. What sample size is needed to produce the desired accuracy at this estimate?

Note: If the confidence level is not given, then the confidence level is assumed to be 95%.



Exercise

INSTRUCTIONS

1. Identify the type of problem and the formula that will need to be used.

Type of problem (mean or proportion): _____

Formula: _____

2. Identify the values needed for the formula based on the second scenario.

$$z_{\frac{\alpha}{2}} = \underline{\hspace{2cm}}$$

$$p = \underline{\hspace{2cm}}$$

$$q = \underline{\hspace{2cm}}$$

