Learning Outcome

By the end of this lecture, you will be able to:

Determine the required sample size to estimate a single population mean within a specified margin of error
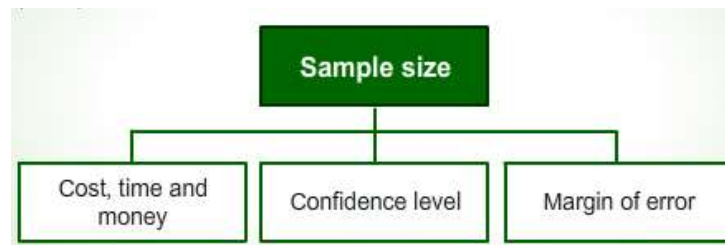
Introduction

The required sample size can be found to reach a desired margin of error (e) and level of confidence (1 - α).

In this lecture, we will study how to determine the sample size in detail.

Sample Size

The required sample size can be found to reach a desired margin of error (*e*) and level of confidence (1 - *α*)

Sample size

Determining The Required Sample Size

Let us now look at determining the required sample size. Required sample size, sigma known then n is:

Required sample size, σ known:

$$n = \frac{z_{\alpha/2}^2 \sigma^2}{e^2} = \left(\frac{z_{\alpha/2}\,\sigma}{e}\right)^2 \qquad (1)$$

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STAT 211: Business Statistics
M8: Estimating two population parameters
L2: Sample Size Determination for Estimating the Mean

Required sample size, σ unknown:

If unknown, σ can be estimated when using the required sample size formula by;
- Using a value for σ that is expected to be at least as large as the true σ.
- Selecting a *pilot* sample and estimating σ by the sample standard deviation, *s*.

Then:

$$n = \frac{z_{\alpha/2}^2 s^2}{e^2} = \left(\frac{z_{\alpha/2}\, s}{e}\right)^2 \qquad\qquad (2)$$

Example

If σ = 45, what sample size is needed, for estimating μ, to be 90% confident of being correct within ± 5 units?

Solution:

$$n = \frac{z_{\alpha/2}^2 \sigma^2}{e^2}$$

$$= \left(\frac{z_{0.1/2}\ 45}{5}\right)^2$$

$$= \left(\frac{(1.645)45}{5}\right)^2$$

$$= 219.188 \approx 220$$

Example

Given here is another example on determining the confidence interval estimate, based on the pilot sample given.

A decision maker is interested in estimating the mean of a population based on a random sample. He wants the confidence level to be 98% and the margin error to be ± 0.3. He does not know what the population standard deviation is, so he has selected the given pilot sample:

8.8	4.89	10.98	15.11	14.79
6.93	1.27	9.06	14.38	5.65
7.24	3.24	2.61	6.09	6.91

Based on the pilot sample, how many more items must be sampled so that the decision maker can make the desired confidence interval estimate?

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STAT 211: Business Statistics
M8: Estimating two population parameters
L2: Sample Size Determination for Estimating the Mean

Recap

In this lecture, you have learned that:

- The required sample size can be found to reach a desired margin of error and level of confidence
- The sample size depends on the cost, time and money; confidence level, and the margin of error

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