CHAPTER 7

ESTIMATION

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ESTIMATION: AN INTRODUCTION

Definition

- The assignment of value(s) to a population parameter based on a value of the corresponding sample statistic is called ***estimation***.
- The value(s) assigned to a population parameter based on the value of a sample statistic is called an ***estimate***.
- The sample statistic used to estimate a population parameter is called an ***estimator***.

i. A Point Estimate

Definition

- The value of a sample statistic that is used to estimate a population parameter is called a ***point estimate***.
- Usually, whenever we use point estimation, we calculate the margin of error associated with that point estimation.
- The margin of error is calculated as follows:

$$\textbf{Margin of error} = \pm \mathbf{1.96}\sigma_{\bar{x}} \quad \textbf{or} \quad \pm \mathbf{1.96 s}_{\bar{x}}$$

ii. An Interval Estimation

Definition

In ***interval estimation***, an interval is constructed around the point estimate, and it is stated that this interval is likely to contain the corresponding population parameter.

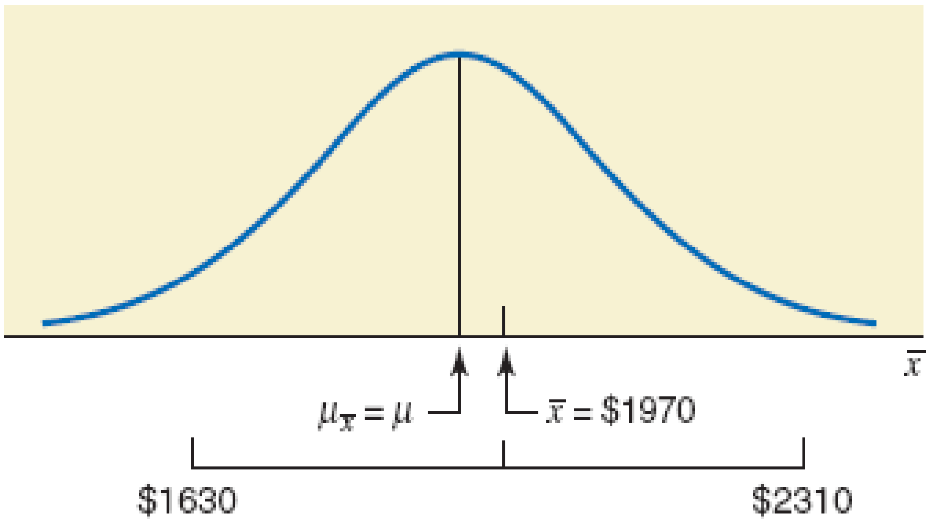


Figure Interval estimation.

iii. Confidence Level and Confidence Interval

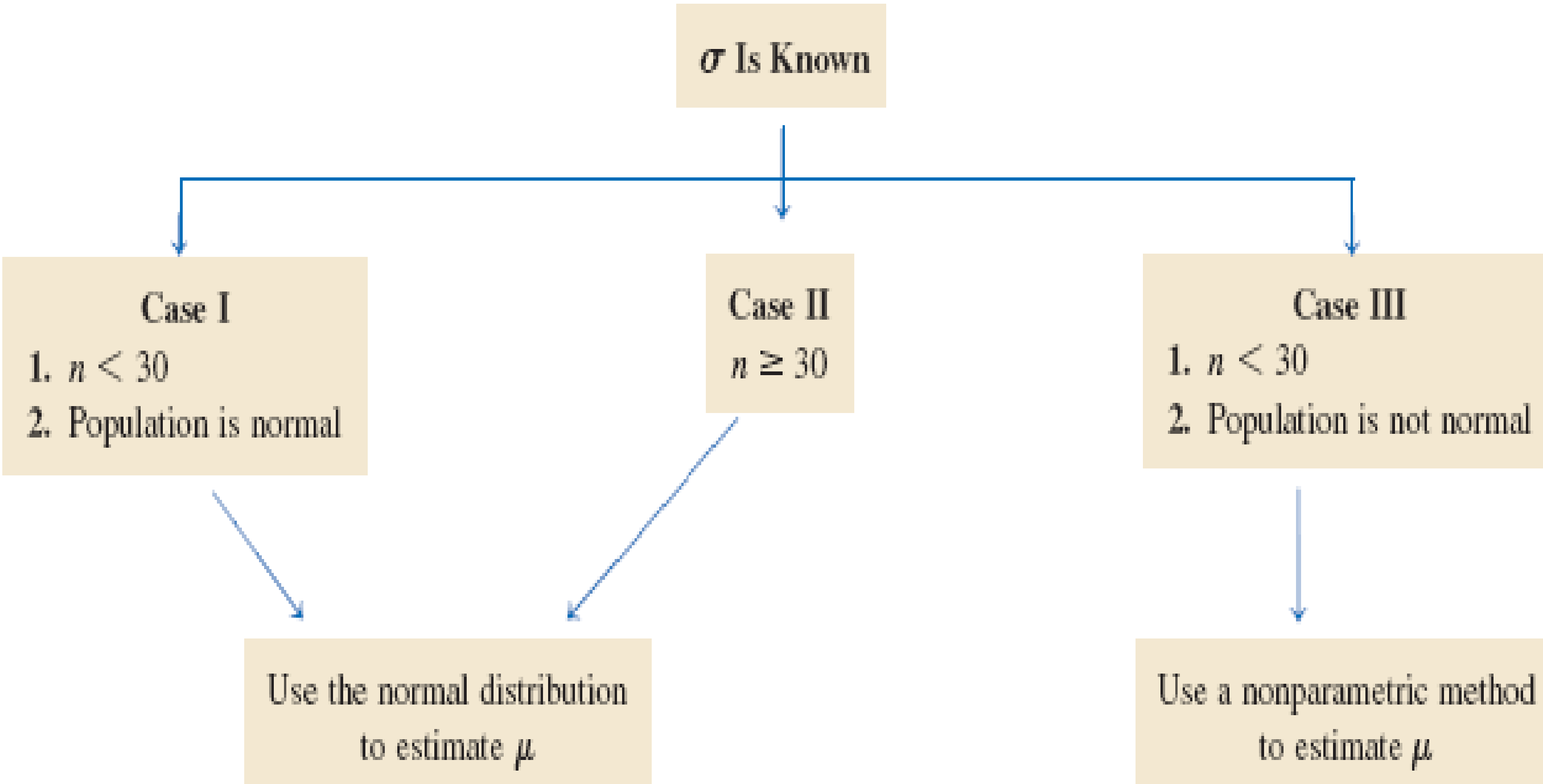
Definition

Each interval is constructed with regard to a given ***confidence level*** and is called a ***confidence interval***. The confidence level is given as

Point estimate ± Margin of error

The confidence less associated with a confidence interval states how much confidence we have that this interval contains the true population parameter. The confidence level is denoted by $(1 - \alpha)100\%$.

ESTIMATION OF A POPULATION MEAN: σ KNOWN



Confidence Interval for μ

- The $(1 - \alpha)100\%$ ***confidence interval for μ*** under Cases I and II is

$$\boxed{\begin{array}{l} \qquad\qquad \bar{x} \pm z\sigma_{\bar{x}} \\ \text{where} \quad \sigma_{\bar{x}} = \sigma / \sqrt{n} \end{array}}$$

- The value of z used here is obtained from the standard normal distribution table (Table IV of Appendix C) for the given confidence level.
- The ***margin of error for the estimate for μ***, denoted by E, is the quantity that is subtracted from and added to the value of x to obtain a confidence interval for μ. Thus,

$$\boxed{E = z\sigma_{\bar{x}}}$$

- The Sample Size for the Estimation of Mean

$$\boxed{n = \frac{z^2\sigma^2}{E^2}}$$

EXAMPLE

A publishing company has just published a new college textbook. Before the company decides the price at which to sell this textbook, it wants to know the average price of all such textbooks in the market. The research department at the company took a sample of 25 comparable textbooks and collected information on their prices. This information produces a mean price of $145 for this sample. It is known that the standard deviation of the prices of all such textbooks is $35 and the population of such prices is normal.

(a) What is the point estimate of the mean price of all such textbooks?

(b) Construct a 90% confidence interval for the mean price of all such college textbooks.

SOLUTION: