

Lind / Marchal / Wathen

Statistical Techniques in Business and Economics

Fourteenth Edition

**This
International
Student Edition
is for use
outside of
the U.S.**

McGraw-Hill International Edition



Statistical Techniques in Business & Economics

Fourteenth Edition

Douglas A. Lind

Coastal Carolina University and The University of Toledo

William G. Marchal

The University of Toledo

Samuel A. Wathen

Coastal Carolina University



McGraw-Hill
Irwin

Số hóa bởi Trung tâm Học liệu – ĐHTN <http://www.lrc-tnu.edu.vn>
Boston Burr Ridge, IL Dubuque, IA Madison, WI New York San Francisco St. Louis
Bangkok Bogota Caracas Kuala Lumpur Lisbon London Madrid Mexico City
Milan Montreal New Delhi Santiago Seoul Singapore Sydney Taipei Toronto

**STATISTICAL TECHNIQUES IN BUSINESS AND ECONOMICS**

Published by McGraw-Hill/Irwin, a business unit of The McGraw-Hill Companies, Inc., 1221 Avenue of the Americas, New York, NY, 10020. Copyright © 2010, 2008, 2005, 2002, 1999, 1996, 1993, 1990, 1986, 1982, 1978, 1974, 1970, 1967 by The McGraw-Hill Companies, Inc. All rights reserved. No part of this publication may be reproduced or distributed in any form or by any means, or stored in a database or retrieval system, without the prior written consent of The McGraw-Hill Companies, Inc., including, but not limited to, in any network or other electronic storage or transmission, or broadcast for distance learning.

Some ancillaries, including electronic and print components, may not be available to customers outside the United States.

This book is printed on acid-free paper.

1 2 3 4 5 6 7 8 9 0 WCK/WCK 0 9

ISBN 978-0-07-017220-3
MHID 0-07-017220-X

The McGraw-Hill/Irwin Series Operations and Decision Sciences

Business Statistics

Aczel and Sounderpandian
Complete Business Statistics
Seventh Edition

ALEKS Corporation
ALEKS for Business Statistics
First Edition

Alwan
Statistical Process Analysis
First Edition

Bowerman, O'Connell, and Murphree
Business Statistics in Practice
Fifth Edition

Bowerman, O'Connell,
Orris, and Murphree
Essentials of Business Statistics
Third Edition

Bryant and Smith
**Practical Data Analysis: Case
Studies in Business Statistics,
Volumes I, II, and III***

Cooper and Schindler
Business Research Methods
Tenth Edition

Doane, Mathieson, and Tracy
Visual Statistics
Second Edition, 2.0

Doane and Seward
**Applied Statistics in Business
and Economics**
Second Edition

Doane and Seward
**Essential Statistics in Business
and Economics**
Second Edition

Gitlow, Oppenheim, Oppenheim,
and Levine
Quality Management
Third Edition

Kutner, Nachtsheim, Neter and Li
Applied Linear Statistical Models
Fifth Edition

Kutner, Nachtsheim, and Neter
Applied Linear Regression Models
Fourth Edition

Lind, Marchal, and Wathen
**Basic Statistics for Business and
Economics**
Sixth Edition

Lind, Marchal, and Wathen
**Statistical Techniques in Business
and Economics**
Fourteenth Edition

Merchant, Goffinet, and Koehler
**Basic Statistics Using Excel for
Office XP**
Fourth Edition

Olson and Shi
**Introduction to Business
Data Mining**
First Edition

Orris
**Basic Statistics Using Excel
and MegaStat**
First Edition

Siegel
Practical Business Statistics
Fifth Edition

Wilson, Keating, and John Galt
Solutions, Inc.
Business Forecasting
Fifth Edition

Zagorsky
Business Information
First Edition

Quantitative Methods and Management Science

Hillier and Hillier
**Introduction to Management
Science**
Third Edition

Stevenson and Ozgur
**Introduction to Management
Science with Spreadsheets**
First Edition

Kros
**Spreadsheet Modeling for
Business Decisions**
First Edition

*Available only through McGraw-Hill's PRIMIS Online Assets Library.

Over the years, we have received many compliments on this text and have been told it's a favorite among students. We accept that as the highest compliment and continue to work very hard to maintain that status.

The objective of *Statistical Techniques in Business and Economics* is to provide students majoring in management, marketing, finance, accounting, economics, and other fields of business administration with an introductory survey of the many applications of descriptive and inferential statistics. While we focus on business applications, we also use many exercises and examples that are student oriented and do not require previous courses.

In this text we show beginning students every step needed to be successful in a basic statistics course. This step-by-step approach enhances performance, accelerates preparedness, and significantly improves motivation. Understanding the concepts, seeing and doing plenty of examples and exercises, and comprehending the application of statistical methods in business and economics are the focus of this book.

The first edition of this text was published in 1967. At that time locating relevant business data was difficult. That has changed! Today locating data is not a problem. The number of items you purchase at the grocery store is automatically recorded at the checkout counter. Phone companies track the time of our calls, the length of calls, and the number of the person called. Credit card companies maintain information on the number, time and date, and amount of our purchases. Medical devices automatically monitor our heart rate, blood pressure, and temperature. A large amount of business information is recorded and reported almost instantly. CNN, *USA Today*, and MSNBC, for example, all have websites where you can track stock prices with a delay of less than 20 minutes.

Today, skills are needed to deal with a large volume of numerical information. First, we need to be critical consumers of information presented by others. Second, we need to be able to reduce large amounts of information into a concise and meaningful form to enable us to make effective interpretations, judgments, and decisions.

All students have calculators and most have either personal computers or access to personal computers in a campus lab. Statistical software, such as Microsoft Excel and MINITAB, is available on these computers. The commands necessary to achieve the software results are available in a special section at the end of each chapter. We use screen captures within the chapters, so the student becomes familiar with the nature of the software output. Because of the availability of computers and software it is no longer necessary to dwell on calculations. We have replaced many of the calculation examples with interpretative ones, to assist the student in understanding and interpreting the statistical results. In addition we now place more emphasis on the conceptual nature of the statistical topics. While making these changes, we still continue to present, as best we can, the key concepts, along with supporting examples.

What's New in This Fourteenth Edition?

We have made several changes to this edition that we think you and your students will find useful.

- New exercises and examples using Excel 2007 screenshots and the latest version of MINITAB. We have also increased the size and clarity of these screenshots.

the Authors

- There are also new Excel 2007 software commands and updated MINITAB commands at the ends of chapters.
- At the end of each Section Review, we have added a Practice Test. We think this will give the student an idea of what might appear on a test and how the test might be structured. Hopefully, this will reduce test anxiety. The test includes a section on vocabulary and a section of problems.
- We have carefully reviewed the Exercises within the chapters, those at the ends of chapters, and in the Review Section. We have revised or replaced those that were outdated. You can still find and assign your favorites that have worked well, or you can introduce fresh examples.
- There is new content on nominal-level data and its properties in Chapter 1.
- There are many new photos throughout with updated exercises in the chapter openers.
- Much of the relevant data and statistics within the text and exercises have been updated.

Dedication

To Jane, my wife and best friend, and our sons, their wives, and our grandchildren: Mike and Sue (Steve and Courtney), Steve and Kathryn (Kennedy and Jake), and Mark and Sarah (Jared, Drew, and Nate).

Douglas A. Lind

To Elizabeth and William, the most recent additions to our family.

William G. Marchal

To my wonderful family: Isaac, Hannah, and Barb.

How Are Chapters Organized to

Chapter Goals

Each chapter begins with a set of goals, or learning objectives, designed to provide focus for the chapter and motivate student learning. These objectives indicate what the student should be able to do after completing the chapter.

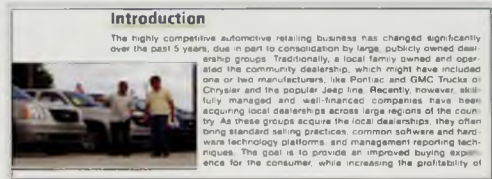
Chapter Opening Exercise

A representative exercise opens the chapter and shows how the chapter content can be applied to a real world situation.



Introduction to the Topic

Each chapter starts with a review of the important concepts of the previous chapter and provides a link to the material in the current chapter. This step-by-step approach increases comprehension by providing continuity across the concepts.



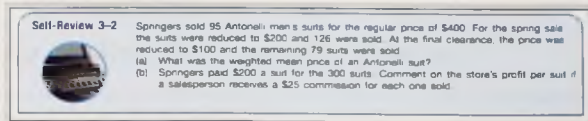
Example/Solution

After important concepts are introduced, a solved example is given to provide a how-to illustration for students and to show a relevant business or economics-based application that helps answer the question, "What will I use this for?" All examples provide a realistic scenario or application and make the math size and scale reasonable for introductory students.



Self-Reviews

Self-Reviews are interspersed throughout each chapter and closely patterned after the preceding Examples. They help students monitor their progress and provide immediate reinforcement for that particular technique.



BY CHAPTER

Chapter Summary

Each chapter contains a brief summary of the chapter material, including the vocabulary and the critical formulas.

Chapter Summary

- I. A frequency table is a grouping of qualitative data into mutually exclusive classes showing the number of observations in each class.
- II. A relative frequency table shows the fraction of the number of frequencies in each class.
- III. A bar chart is a graphic representation of a frequency table.
- IV. A pie chart shows the proportion each distinct class represents of the total number of observations.

Pronunciation Key

This tool lists the mathematical symbol, its meaning, and how to pronounce it. We believe this will help the student retain the meaning of the symbol and generally enhance course communications.

Pronunciation Key

SYMBOL	MEANING	PRONUNCIATION
\bar{x}	Population mean	mu
$+$	Operation of adding	sigma
Σ	Adding a group of values	sigma X
s	Sample mean	X bar

Chapter Exercises

Generally, the end of chapter exercises are the most challenging and integrate the chapter concepts. The answers and worked-out solutions for all odd-numbered exercises appear at the end of the text. For exercises with more than 20 observations, the data can be found on the Student CD and on the text's Web site. These files are in Excel and MINITAB formats.

Chapter Exercises

23 Describe the similarities and differences of qualitative and quantitative variables. Be sure to include:

- a. What level of measurement is required for each variable type?
- b. Can both types be used to describe both samples and populations?

Data Set Exercises

The last several exercises at the end of each chapter are based on four large data sets. These data sets are printed in Appendix A in the text and are also on the Student CD and on the text's Web site. These data sets present the students with real-world and more complex applications.

Data Set Exercises

46 Refer to the Rice Cakes data, which report information on the calories sold in the Denver, Colorado, area last year.

- a. Construct the mean and the standard deviation of the distribution of the selling prices for the business. Assume first to be the population. Develop a histogram of the data. Would a normal distribution best describe the distribution of the population of selling prices? Explain the reasoning.
- b. Let's assume a normal population. Select a sample of 50 boxes. Compute the mean and the standard deviation of the sample. Determine the likelihood of finding a sample mean that is larger than the population.
- c. Repeat the data set, and report demographic and economic information on all about 100. Select a random sample of 75 countries. For this sample, calculate the mean and standard deviation of the six variables.
- d. Once in this mean and standard deviation compare with the mean and standard deviation of the original "population" of all countries.
- e. Verify a histogram of the six means and discuss whether the distribution is normal.
- f. Suppose the population distribution is normal. For the first sample mean, do you consider, determine the likelihood of finding a sample mean that is larger or larger than the population.

Software Commands

Software examples using Excel, MegaStat[®], and MINITAB are included throughout the text. But, the explanations of the computer input commands for each program are placed at the end of the chapter. This allows students to focus on the statistical techniques rather than how to input data.

Software Commands

1. The Excel commands to select a simple random sample on page 261 are:

- a. Select the **Data** tab on the top of the menu. Then on the far right select **Data Analysis**, then **Sampling and Inv.**
- b. For **Input Range** insert B1:B31. Since the column is named, click the **Labels** box. Select **Random**, and enter the sample size for the **Number of Samples**, in this case 5. Click on **Output Range** and indicate the place on the spreadsheet you want the sample information. Note that your sample results will differ from those in the text. Also recall that Excel samples with replacement, so it is possible for a population value to appear more than once in the sample.

