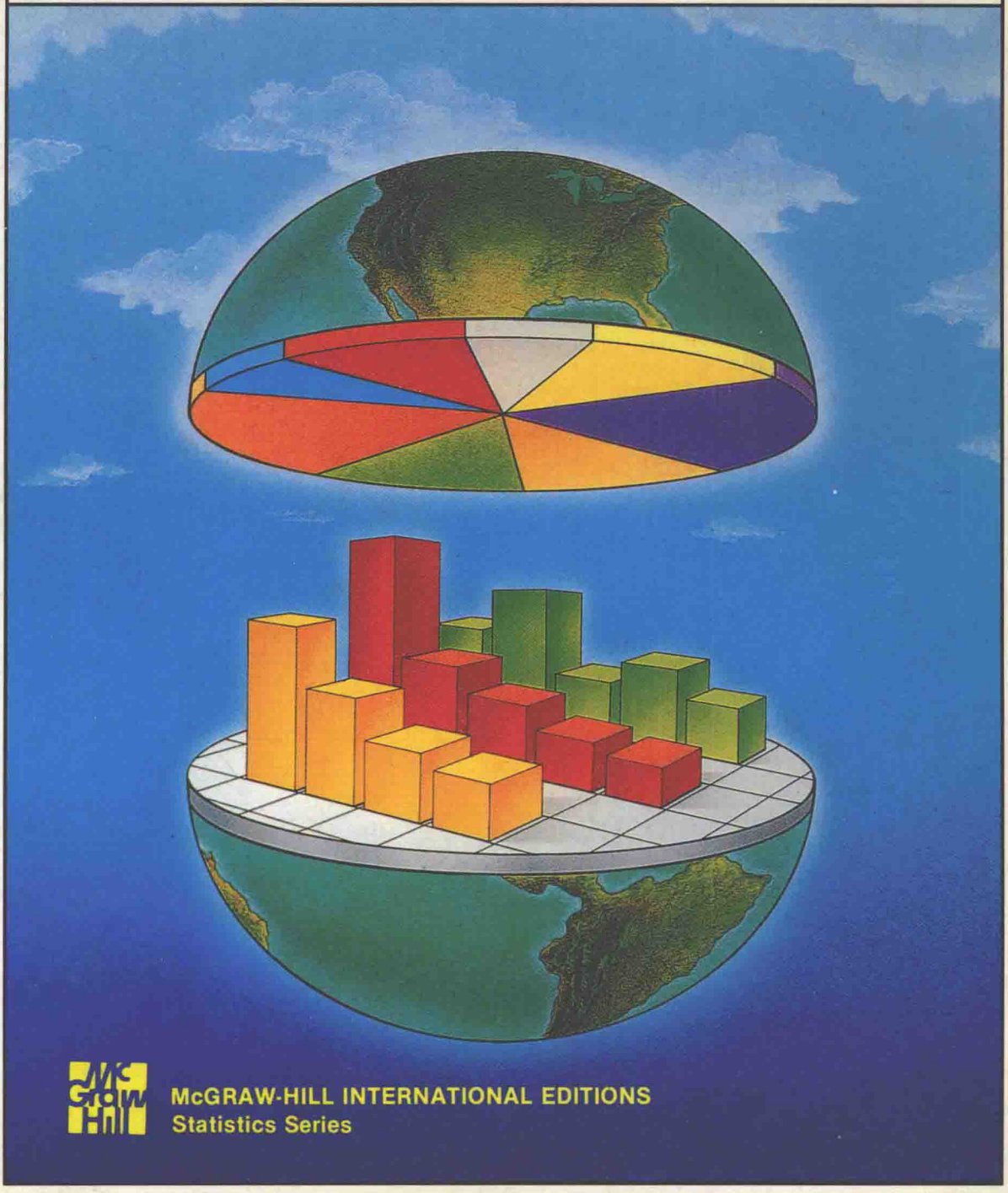
STATISTICS

A Fresh Approach



McGRAW-HILL INTERNATIONAL EDITIONS
Statistics Series

Donald H. Sanders

Fourth Edition

STATISTICS

FOURTH EDITION

A Fresh Approach

Donald H. Sanders
Educational Consultant
Fort Worth, Texas

McGRAW-HILL PUBLISHING COMPANY
New York St. Louis San Francisco Auckland Bogotá
Caracas Hamburg Lisbon London Madrid Mexico
Milan Montreal New Delhi Oklahoma City Paris
San Juan São Paulo Singapore Sydney Tokyo Toronto

Page 99: From THE HOUSE AT POOH CORNER by A. A. Milne, 1928, p. 90. Used by permission of the Canadian Publishers, McClelland and Stewart, Toronto. Reprinted by permission of Methuen Children's Books. Copyright 1928 by E. P. Dutton, renewed 1956 by A. A. Milne. Reprinted by permission of the publisher, E. P. Dutton, a division of Penguin Books USA Inc.

Pages 165 and 214: From WINNIE-THE-POOH by A. A. Milne, 1926, pp. 45 and 100. Used by permission of the Canadian Publishers, McClelland and Stewart, Toronto. Reprinted by permission of Methuen Children's Books. Copyright 1926 by E. P. Dutton, renewed 1954 by A. A. Milne. Reprinted by permission of the publisher, E. P. Dutton, a division of Penguin Books USA Inc.

STATISTICS: A Fresh Approach
INTERNATIONAL EDITION 1990

Exclusive rights by McGraw-Hill Book Co — Singapore for manufacture and export.This book cannot be re-exported from the country to which it is consigned by McGraw-Hill.

Copyright © 1990, 1985, 1980, 1976 by McGraw-Hill, Inc.
All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise without the prior written permission of the publisher.

4 5 6 7 8 9 0 CMO 9 4 3

This book was set in Caledonia by the George Composition Unit in cooperation with Ruttle Shaw & Wetherill, Inc.
The editors were Bonnie Binkert and Larry Goldberg.
The production supervisor was Salvador Gonzales.
The designer was Joan E. O'Connor.
Photo research was done by Elyse Rieder.
Permission research was done by Lynn Mooney.
New drawings were done by Fine Illustrations, Inc.

Library of Congress Cataloging-in-Publication Data

Sanders, Donald H.
Statistics: a fresh approach/Donald H. Sanders.—4th ed.
p. cm.
Includes index.
ISBN 0-07-054881-1 ISBN 0-07-835204-5 (software).
ISBN 0-07-054882-X (instructor's manual).—ISBN 0-07-054883-8 (study guide)
QA276.12.526 1. Statistics. I. Title 89-8077
519.5—dc20 CIP

When ordering this title use ISBN 0-07-100920-5

Printed in Singapore

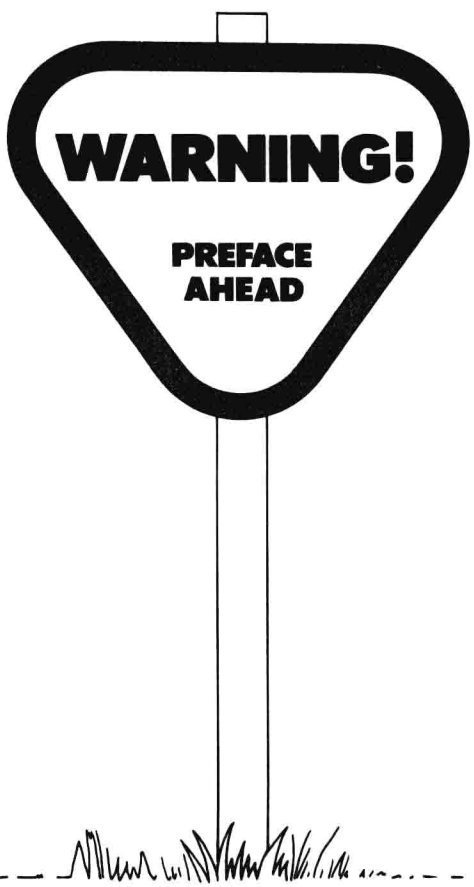
ABOUT THE AUTHOR

Donald H. Sanders is the author of eight books about computers and statistics. Twenty editions of these texts have been published, and over a million copies of these books have been used in college courses and in industry and government training programs.

Dr. Sanders has 20 years of teaching experience. After receiving degrees from Texas A & M University and the University of Arkansas, he was a professor at the University of Texas at Arlington, at Memphis State University, and at Texas Christian University. In addition to his books, Dr. Sanders has contributed articles to journals such as *Data Management, Automation, Banking, Journal of Small Business Management, Journal of Retailing,* and *Advanced Management Journal.* He has also encouraged his graduate students to contribute computer-related articles to national periodicals, and over 70 of these articles have been published. Dr. Sanders chairs the "Computers and Data Processing" Subject Examination Committee, CLEP Program, College Entrance Examination Board, Princeton, N.J.

TO THOSE WHO OPEN
THIS BOOK WITH DISMAY

此为试读,需要完整PDF请访问: www.ertongbook.com


WARNING!
PREFACE
AHEAD

PREFACE

If I had only one day left to live, I would live it in my statistics class—it would seem so much longer.
—Quote in a university student calendar

It's that time again—time to attempt once more to present the subject of statistics in an interesting (and sometimes humorous) way so that a period spent on the subject doesn't seem to students to represent the eternity suggested by the above quote.

Actually, most readers of this book accept the fact that an educated citizen needs an understanding of basic statistical tools to function in a world that's becoming increasingly dependent on quantitative information. But most who read this text have never placed the solving of mathematical problems at the top of their list of favorite things to do. In fact, many probably don't care much for math (may even be terrified of the subject and consider it a foreign language) and have probably heard numerous disturbing rumors about statistics courses.

A motivating force behind the preparation of this text is the distinct possibility that the misgivings and apathy implicit in the introductory quote are related in some way to the unfortunate fact that many existing statistics books are rigorously written, mathematically profound, precisely detailed—and excruciatingly dull!

THE PURPOSE OF THIS EDITION

The *main difference between this text and many others* is that an attempt is made here to (1) communicate with students rather than lecture to them,

(2) present material in a rather relaxed and informal way without omitting the more important concepts, (3) show with integrated examples presented throughout the text how computer statistical software packages are used to eliminate computational drudgery and support analysis and decision-making efforts, (4) recapture student attention with occasional quotes, ridiculous names, and unlikely situations of a humorous nature, and (5) utilize an intuitive and/or commonsense approach to develop concepts whenever possible. In short, this book is written for students rather than statisticians, and its intent is to convince readers that the study of statistics can be a lively, interesting, and rewarding experience.

More specifically, the *purpose of this book* is to introduce students at an early stage in a college program to many of the important concepts and procedures they'll need to (1) evaluate such daily inputs as organizational reports, newspaper and magazine articles, and radio and television commentaries, (2) improve their ability to make better decisions over a wide range of topics, and (3) improve their ability to measure and cope with changing conditions both at home and on the job. And since users of this text may frequently be consumers rather than producers of statistical information, the emphasis here is on explaining statistical procedures and interpreting the resulting conclusions. However, the *mathematical demands are modest*—no college-level math background is required or assumed. (The treatment of probability and probability distributions, for example, is limited to the essentials.)

ORGANIZATION AND REVISION FEATURES IN GENERAL

This edition is organized into *four parts*. Each part is introduced by a brief essay that explains the purpose of the part and identifies the chapters included in the part. Each chapter, in turn, is introduced with *opening pages* containing the following features:

- An *opening vignette* that highlights some aspect of the contents of the chapter. These vignettes—many of which are new in this edition—provide statistical applications, cases, and items of interest.
- A *Looking Ahead section* that previews the chapter contents and lists the *Learning Objectives* for each chapter.
- A *Chapter Outline*.

In the *body* of the chapters, you'll find:

- *Boxed inserts*—many newly selected for this edition—that are included to supply additional "real-world" applications and cases. These inserts help maintain student interest and stimulate discussions.
- Important new terms and concepts that are highlighted in **boldface type** and then defined when they appear for the first time in a chapter and in the text.
- Outputs of *statistical software packages*, which are often used to support computing, analysis, and decision-making efforts. Common input data are often supplied to two statistical programs—*Mystat* and *Minitab*. Students can then see that although output formats may differ the results produced are similar. The presentation and integration of this statistical software material draws on the experience I've gained from two decades of writing computer texts. These

books have been translated into German, French, Spanish, and Portuguese versions, and over a million of them have been used in college courses and industry and government training programs.

At the *end of each chapter* you'll find:

- A *Looking Back* section that addresses the chapter learning objectives by summarizing the main points found in the chapter.
- A listing of *Key Terms and Concepts* that includes the page numbers where the boldfaced new terms/concepts and formulas are first mentioned.
- Sections that present *Problems* and *Review and Discussion Topics*. Scores of new problems are added for this edition, and the *solutions to selected problems* are now included in Appendix 12 at the back of the book. Additional problems and questions are presented in the *Self-Testing Review sections* that are included in most chapters.
- A new *Projects/Issues section,* added for this edition. This section suggests topics for student research that are based on chapter material.
- *Answers to Self-Testing Review Questions,* supplied for student feedback. These problems and questions support the learning objectives of the chapter.
- A new *Closer Look Reading* that gives additional optional information to stimulate discussion and provide more in-depth coverage of selected topics.

A brief summary of the four parts of the text, along with some more specific comments about the revisions made in this edition, is presented below.

REVISING THE PARTS

Part One: Descriptive Statistics

The subject of the first four chapters is descriptive statistics. After introductory materials are presented in Chapter 1, the focus in that chapter turns to a new section on the role of computers in statistics. Computer software concepts and categories are discussed, and the methods people use to communicate with prewritten software packages are outlined. Two types of software packages used to analyze statistical data—the electronic spreadsheet and the statistical analysis program—are introduced. Several examples and illustrations give students a feel for the functions performed by spreadsheet and statistical packages. For example, procedures used to enter a data set into the *Mystat* and *Minitab* programs are shown, and some of the results obtained when these programs analyze the data set are presented. *Mystat* and/or *Minitab* operations are then integrated throughout most of the remaining chapters of the book.

Chapter 2 still introduces examples of how statistical methods have been used improperly. However, the proper use of statistical tables, line, bar, and pie charts, and statistical maps is shown with the help of new tables and charts. A new section on computer graphics programs is found in Chapter 2, and the full-color gallery of photographs showing the types of output produced by such graphics packages is also new.

Chapters 3 and 4 deal with measures of *central tendency* and *dispersion*. A new discussion of computer-generated histograms is introduced in Chapter 3,

and new sections on exploratory data analysis are added in Chapters 3 and 4. For example, computer-generated stem-and-leaf displays are presented in Chapter 3, and box-and-whiskers displays are introduced and discussed in Chapter 4. Beginning in Chapter 3, important formulas are numbered and highlighted in boxes for emphasis, and this approach continues throughout the book. The ease with which statistical software packages produce central tendency values (in Chapter 3) and dispersion values (in Chapter 4) is demonstrated and explained.

Part Two: Sampling in Theory and Practice

Statistical inference concepts are considered in the seven chapters of Part 2. The foundation for the material on sampling applications is presented in Chapters 5 and 6. The first of many computer simulation examples (ones that imitate 200 tosses of a coin and 180 rolls of a die by a random process) are presented in Chapter 5. The material on probability computations is reworked and expanded in Chapter 5, and calculations of binomial, Poisson, and normal probabilities by a statistical software package are added. Central Limit Theorem concepts are demonstrated in Chapter 6 with new computer simulations.

Chapter 7 shows how sample data are used to estimate population parameters (new computer simulations help validate important concepts). Chapters 8 through 11 then focus on hypothesis-testing procedures. In Chapter 8, new statistical quality control concepts are introduced, and new examples with computer solutions are presented. The analysis of variance (ANOVA) testing procedure in Chapter 10 is simplified, and a new section on the one-way ANOVA table and the use of computers to ease ANOVA calculation efforts is added. New computer techniques to reduce chi-square testing efforts are also introduced in Chapter 11.

Part Three: Coping with Change

The three chapters in Part 3 focus on the *measurement and prediction of change*. Chapter 12 looks at how index number procedures are used to measure changes in economic conditions. Index number examples are updated to reflect the changes made in the base periods of popular series. Chapters 13 and 14 show how time-series analysis and regression and correlation techniques are used in forecasting. New time-series charts are found in Chapter 13, and new approaches are used to compute regression equation and standard error of estimate values in Chapter 14. A major new section on relationship tests and prediction intervals is now included in Chapter 14. The relationship tests include a t test for slope and an ANOVA test, and prediction intervals are prepared for both large and small samples. The use of *Mystat* and *Minitab* packages to carry out tedious regression and correlation calculations is demonstrated. A lengthy Closer Look reading on multiple linear regression and correlation—complete with example problem and relevant calculations—is now available at the end of Chapter 14 for those wishing to study this technique.

Part Four: Concluding Topics

Several additional quantitative tools available to the decision maker that haven't been considered in the preceding 14 chapters are included in Part 4. For example, Chapter 15 deals with some *nonparametric statistical procedures*, and this chapter now shows how statistical programs can help carry out selected procedures. And Chapter 16 is a brief essay that describes procedures that cannot be considered in any detail. New readings provide a general overview of several of these important tools.

SUPPLEMENTS FOR THIS EDITION

Several supplements have been prepared to make this *Statistics* package a complete teaching and learning tool. They include:

- *Computer Supplement*. A computer supplement is available for those interested in learning how to use a statistical computer package. The components of the computer supplement are: (1) *Mystat diskette:* An educational version of the *Systat* statistical package. The diskette contains the *Mystat* program and disk space for storing data. (2) *Using Mystat:* A complete user manual that teaches the reader how to use the *Mystat* statistical package.
- *The Student Study Guide*. The Study Guide presents problems and exercises to help students develop a better understanding of statistical reasoning and analysis. Each chapter includes (1) an overview of key terms and important formulas presented exactly as found in the textbook, (2) several illustrative problems, with detailed solutions, (3) set of exercises, some of which reinforce basic problem-solving skills while others explore variations on underlying themes, (4) solutions to problems and exercises.
- *The Instructor's Manual*. For each chapter of the text, the Instructor's Manual contains (1) solutions to the end-of-chapter problems that aren't presented at the end of the book, (2) a key to discussion questions, (3) possible true-false test questions, (4) possible multiple-choice test questions, and (5) transparency masters.

USE OF THIS BOOK

This book is written for use in an early one- or two-term course in statistics. As noted earlier, no college-level math background is required or assumed. The organization of this book into four parts permits a certain amount of *modular flexibility*. Although the order of presentation is logical and is used successfully by many instructors, there's no necessary reason why chapters and even parts must be covered in the sequence in which they appear in this volume. Depending on the objectives of the course, some (but certainly not all) of the ways this book might be used are as follows:

此为试读,需要完整PDF请访问: www.ertongbook.com

PART	PART	PART	PART	PART
1	1	1 first	1	1
2 one	2 one	3 term	2 one	Chapter 12
3 term	3 term		Chapter 14 term	2 (selected chapters) one or two terms
4	4	2 second		Chapter 15
		4 term		Chapter 13
				Chapter 14

The chapters in Part 3 are essentially free-standing and may be covered in sequence or independently. Chapter 15 may be included with the material in Part 2, or it may be used in place of some of the material in Part 2.

One inevitable limitation of a book such as this involves the priorities given to the various statistical topics. Some may feel that there's an appalling lack of coverage of topics that should be included. Certainly, many of the subjects briefly discussed in the last chapter—"Where Do We Go from Here?"—could each have been expanded to lengthy chapters with the possible result that the finished product would be twice its present size. And others may feel that too much space is devoted to some area—for example, sampling applications in Part 2. Since this book is written for beginners, though, the preference here is to err in the direction of keeping the size (and cost) of the book down.

ACKNOWLEDGMENTS

It's customary to conclude a preface by acknowledging the help and suggestions received from numerous sources. And certainly the many who have contributed to this edition are deserving of recognition. Useful comments and suggestions were provided by the following colleagues who responded to questions about earlier editions, and who reviewed this text during its development: Ernest A. Beasley, Okaloosa-Walton Junior College; Ronald L. Coccari, Cleveland State University; Joel Feiner, Suny—Old Westbury; Keith Moore, Park College—Missouri; Joseph B. Murray, Philadelphia Community College; Mark J. Ratkus, LaSalle University; Theodore W. Roesler, University of Nebraska—Lincoln; and Larry J. Schuetz, Linn Benton Community College.

I am grateful to the Literary Executor of the late Sir Ronald A. Fisher, F.R.S., to Dr. Frank Yates, F.R.S., and to Longman Group Ltd. London, for permission to reprint an abridgment of Table IV from their book *Statistical Tables for Biological, Agricultural and Medical Research* (6th edition, 1974). Another word of thanks goes to those who furnished the readings and photos reproduced in the text. Their individual contributions are acknowledged in the body of the book. Thanks also to Bob Eng and Frank Murph for their input in earlier editions.

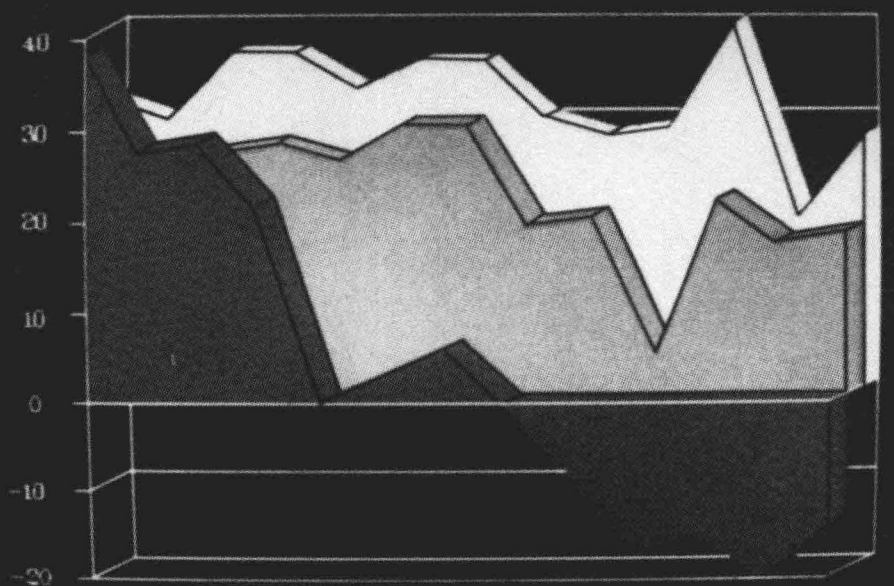
The final tribute and greatest appreciation, though, is reserved for these few: to Bonnie Binkert, Larry Goldberg, Joan O'Connor, Shelly Langman, developer of *User's Manual to Mystat*, and Sal Gonzales, production supervisor; to Dr. Gary D. Sanders, Arizona State University, for his insight and problem contributions; and to Joyce Sanders for her continuing suggestions and encouragement.

Donald H. Sanders

STATISTICS

A Fresh Approach

PART ONE



CONTENTS

PREFACE xix

PART ONE DESCRIPTIVE STATISTICS

1 LET'S GET STARTED 3
Looking Ahead 4
What to Expect 5
Purpose and Organization of the Text 5
Need for Statistics 10
Statistical Problem-Solving Methodology 13
Role of the Computer in Statistics 18
Looking Back 33
Key Terms and Concepts 34
Topics for Review and Discussion 34
Projects/Issues to Consider 35
A Closer Look: Selecting and Buying a Statistical Software Package 36

2 LIARS, #$%*& LIARS, AND A FEW STATISTICIANS 38
Looking Ahead 39
Some Unfavorable Opinions 40
The Bias Obstacle 41
Aggravating Averages 43
Disregarded Dispersions 44

	The Persuasive Artist	46
	The *Post Hoc Ergo Propter Hoc* Trap	61
	Antics with Semantics	62
	The Trend Must Go On!	63
	Follow the Bouncing Base (If You Can)	63
	Spurious (and Curious) Accuracy	65
	Avoiding Pitfalls	67
	Looking Back	68
	Key Terms and Concepts	69
	Topics for Review and Discussion	69
	Projects/Issues to Consider	70
	A Closer Look: The Power of Graphics	72
3	STATISTICAL DESCRIPTION: FREQUENCY DISTRIBUTIONS AND MEASURES OF CENTRAL TENDENCY	77
	Looking Ahead	79
	Introduction to Data Collection and Organization	80
	Frequency Distributions	84
	Graphic Presentations of Frequency Distributions	88
	Summary Measures of Frequency Distributions: An Overview	97
	Computing Measures of Central Tendency	99
	Summarizing Qualitative Data	112
	Looking Back	113
	Key Terms and Concepts	114
	Problems	115
	Topics for Review and Discussion	121
	Projects/Issues to Consider	122
	Answers to Self-Testing Review Questions	123
	A Closer Look: Dotplotting the Slimline Data	125
4	STATISTICAL DESCRIPTION: MEASURES OF DISPERSION AND SKEWNESS	128
	Looking Ahead	129
	Measures of Absolute Dispersion	130
	Computing Measures of Absolute Dispersion for Ungrouped Data	131
	Computing Measures of Absolute Dispersion for Grouped Data	139
	Summary of Comparative Characteristics	148
	Measure of Relative Dispersion	150
	Measure of Skewness	151
	Looking Back	152
	Key Terms and Concepts	154
	Problems	154
	Topics for Review and Discussion	157
	Projects/Issues to Consider	158
	Answers to Self-Testing Review Questions	158
	A Closer Look: Introducing Statistics to Geography Students—The Case for Exploratory Data Analysis	160

PART TWO SAMPLING IN THEORY AND PRACTICE

5	PROBABILITY AND PROBABILITY DISTRIBUTIONS	167
	Looking Ahead	168
	Meaning and Types of Probability	169
	Probability Computations	172
	Expected Value	176
	Probability Distributions	179
	The Binomial Distribution	180
	The Poisson Distribution	188
	The Normal Distribution	191
	Looking Back	201
	Key Terms and Concepts	202
	Problems	202
	Topics for Review and Discussion	207
	Projects/Issues to Consider	207
	Answers to Self-Testing Review Questions	207
	A Closer Look: Misapplications Reviews—Ice Follies	210
6	SAMPLING CONCEPTS	212
	Looking Ahead	213
	Population, Sample, Symbols: A Review	214
	Importance of Sampling	216
	Advantages of Sampling	217
	Sample Selection	219
	Sampling Distribution of Means—A Pattern of Behavior	223
	Sampling Distribution of Percentages	237
	Looking Back	240
	Key Terms and Concepts	242
	Problems	242
	Topics for Review and Discussion	246
	Projects/Issues to Consider	247
	Answers to Self-Testing Review Questions	248
	A Closer Look: Census Bureau Gears up for Countdown to 1990	250
7	ESTIMATING MEANS AND PERCENTAGES	253
	Looking Ahead	255
	Need for Accurate Estimates	256
	Estimator, Estimate, Estimation, et Cetera	257
	Interval Estimation of the Population Mean: Some Basic Concepts	259
	Estimating the Population Mean: σ Known	263
	Estimating the Population Mean: σ Unknown	267
	Interval Estimation of the Population Percentage	278
	Determination of Sample Size	283
	Looking Back	289
	Key Terms and Concepts	291
	Problems	291
	Topics for Review and Discussion	296

此为试读,需要完整PDF请访问: www.ertongbook.com