Preface

Welcome to the exciting world of statistics! We have written this text to make statistics accessible to everyone, including those with a limited mathematics background. Statistics affects all aspects of our lives. Whether we are testing new medical devices or determining what will entertain us, applications of statistics are so numerous that, in a sense, we are limited only by our own imagination in discovering new uses for statistics.

Overview

The fourth edition of *Understanding Basic Statistics* continues to emphasize concepts of statistics. Statistical methods are carefully presented with a focus on understanding both the *suitability of the method* and the *meaning of the result*. Statistical methods and measurements are developed in the context of applications.

We have retained and expanded features that made the first three editions of the text very readable. New definition boxes highlight important terms. New procedure displays summarize steps for analyzing data. Examples, exercises, and problems touch on applications appropriate to a broad range of interests.

Technology-based components give both students and professors additional resources. The HM statSpace™ CD-ROM contains data sets (in Microsoft Excel, Minitab, SPSS, and TI-84Plus/TI-83Plus and ASCII file formats), as well as interactive tutorial exercises and quizzes for each chapter section. The web site for the text provides a wealth of material including digital lessons, a glossary, statistical tables, and links to other relevant web sites. In addition, a new component, Eduspace®, provides students with interactive lessons including audio, streaming video, animation, and computer simulations along with interactive tutorial activities. Instructional videos and DVDs covering every section of the text provide even more learning support.

Major Content Changes in the Fourth Edition

With each new edition, the authors reevaluate the scope, appropriateness, and effectiveness of the text's presentation and reflect on extensive user feedback. Revisions have been made throughout the text to clarify explanations of important concepts and to update problems.

Introduction of Hypothesis Testing Using *P*-Values

Chapter 9, Hypothesis Testing, has been reorganized. In keeping with the use of computer technology and standard practice in research, hypothesis testing is now introduced using *P*-values. The critical region method is still supported, but not given primary emphasis.

Use of Student's t Distribution in Confidence Intervals and Testing of Means

If the normal distribution is used in confidence intervals and testing of means, then the *population standard deviation must be known.* If the population standard deviation is not known, then under conditions described in the text, the Student's t distribution is used. This is the most commonly used procedure in statistical research. It is also used in statistical software packages such as Microsoft Excel, Minitab, SPSS, and TI-84Plus/TI-83Plus calculators.

Confidence Intervals and Hypothesis Tests of Difference of Means

If the normal distribution is used, then both population standard deviations must be known. When this is not the case, the Student's t distribution incorporates an approximation for t, with a commonly used conservative choice for the degrees of freedom. Satterthwaite's approximation for the degrees of freedom as used in computer software is also discussed. The pooled standard deviation is presented for appropriate applications ($\sigma_1 \approx \sigma_2$).

Organization of Other Sections and Chapters

In Chapter 2, Organizing Data, frequency distributions and histograms are now presented in Section 2.1 while other graphs such as bar graphs, circle graphs, and time-series graphs are presented in Section 2.2.

In Chapter 4, Correlation and Regression, scatter diagrams and the sample correlation coefficient are presented in Section 4.1. The equation of the least-squares line is presented in Section 4.2. In both sections, the computation formulas have been streamlined.

All inferences regarding correlation and regression are included in Section 11.4, Inferences for Correlation and Regression. This section is carefully divided into subsections so that some or all of the inferential topics may be included, depending on a particular syllabus.

The third edition's Chapter 7, Normal Distributions, and Chapter 8, Introduction to Sampling Distributions, have been combined into a single chapter, Chapter 7, Normal Curves and Sampling Distributions. Material in this new chapter has been streamlined, allowing more rapid progress through the normal distribution and sampling distributions.

Features in the Fourth Edition

Chapter and Section Lead-ins

- *Preview Questions* at the beginning of each chapter are keyed to the sections.
- *Focus Problems* at the beginning of each chapter demonstrate types of questions students can answer once they master the concepts and skills presented in the chapter.
- *Focus Points* at the beginning of each section describe the primary learning objectives of the section.

Carefully Developed Pedagogy

- *Examples* show students how to select and use appropriate procedures.
- *Guided Exercises* within the sections give students an opportunity to work with a new concept. Completely worked-out solutions appear beside each exercise to give immediate reinforcement.

- NEW! *Definition boxes* highlight important definitions throughout the text.
- NEW! *Procedure displays* summarize key strategies for carrying out statistical procedures and methods.
- *Labels* for each example or guided exercise highlight the technique, concept, or process illustrated by the example or guided exercise. In addition, labels for section and chapter problems describe the field of application and show the wide variety of subjects in which statistics is used.
- *Section and chapter problems* require the student to use all the new concepts mastered in the section or chapter. Problem sets include a variety of real-world applications with data or settings from identifiable sources. Key steps and solutions to odd-numbered problems appear at the end of the book.

- NEW! *Expand Your Knowledge problems* present enrichment topics for applications of probability and statistics.

- NEW! *Problems incorporating real-world data available on a CD-ROM or text web site* alert students to data available electronically.
- NEW! *Cumulative review problem sets* occur after every third chapter and include key topics from previous chapters. Answers to *all* cumulative review problems are given at the end of the book.
- *Data Highlights and Linking Concepts* provide group projects and writing projects.
- *Viewpoints* are brief essays presenting diverse situations in which statistics is used.
- *Design and photos* are appealing and enhance readability.

Technology within the Text

- *Tech Notes* within sections provide brief point-of-use instructions for the TI-84Plus and TI-83Plus calculators, Microsoft Excel, and Minitab.
- *Using Technology* sections have been revised to show the use of SPSS as well as the TI-84Plus and TI-83Plus calculators, Microsoft Excel, and Minitab.

Supplements for Students

- *Student Solutions Manual.* This manual provides solutions to the odd-numbered section and chapter exercises and to all the Cumulative Review exercises in the student textbook.
- *Technology Guide.* This guide contains information and examples for the TI-84Plus and TI-83Plus graphing calculators, Minitab software, Microsoft Excel, and SPSS software.
- *Eduspace®.* Powerful, customizable, and interactive, Eduspace, powered by Blackboard®, is Houghton Mifflin's online learning tool for instructors and students. Eduspace is a text-specific, web-based learning environment that your instructor can use to offer students a combination of practice exercises, multimedia tutorials, video explanations, online algorithmic homework, and more. Specific content is available 24 hours a day to help students succeed in the course.
- *HM statSpace™ Student Tutorial CD-ROM.* For students who prefer the portability of a CD-ROM, this tutorial provides opportunities for self-paced review

and practice with algorithmically generated exercises and step-by-step solutions. The CD-ROM also includes:
  — Data sets for additional experimentation with Minitab, Microsoft Excel, SPSS, and the TI-84Plus/TI-83Plus calculators.
  — Links to online resources, including additional data sets and an online graphing calculator.
- *Houghton Mifflin Instructional DVDs.* Hosted by Dana Mosely and professionally produced, these text-specific DVDs are ideal for promoting individual study and review. These comprehensive DVDs also support students in online courses and students who have missed a lecture.
- *SMARTHINKING®.* Houghton Mifflin's unique partnership with SMARTHINKING brings students real-time, online tutorial support when they need it most. This partnership offers students a range of tutorial services exclusively for students using Houghton Mifflin texts. Using state-of-the-art whiteboard technology and feedback tools, students interact and communicate with "e-structors." These specially trained tutors guide students through the learning and problem-solving process without providing answers or rewriting students' work. SMARTHINKING offers three levels of service:*
  — *Live Tutorial Help* provides real-time, one-on-one instruction.
  — *Questions Any Time* allows students to e-mail questions to a tutor outside of the scheduled tutorial sessions and receive a reply, usually within 24 hours.
  — *Independent Study Resources* connects students around-the-clock to additional educational resources, ranging from interactive web sites to Frequently Asked Questions.

  Visit **smarthinking.com** for more information.
- *Online Study Center.* Access the Online Study Center for this text by visiting **college.hmco.com/pic/braseUBS4e**. Resources include flashcards, glossary, data sets, ACE quizzes with step-by-step tutorial help, technology guide, statistical tables, frequently used formulas, digital lessons, digital art, and web links.
- *Student Version of MINITAB or SPSS.* These statistical software packages manipulate and interpret data to produce textual, graphical, and tabular results. MINITAB and/or SPSS may be packaged with the textbook. Please visit the Houghton Mifflin web site or contact your Houghton Mifflin sales representative.

Supplements for Instructors

- Online *Instructor Solutions.* This supplement provides complete solutions to *all* exercises in the text.
- *Eduspace®.* Powerful, customizable, and interactive, Eduspace, powered by Blackboard®, is Houghton Mifflin's online learning tool. Eduspace provides instructors with online courses and content. By pairing the widely recognized tools of Blackboard with quality, text-specific content from Houghton Mifflin Company (HMCo), Eduspace makes it easy for instructors to create all or part of a course online. Homework exercises, quizzes, tests, tutorials, and supplemental study materials all come ready-to-use. Instructors can choose to use the content as is

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or modify it, and they can even add their own content. Visit **www.eduspace.com** for more information.

- *HM ClassPrep™ with HM Testing (powered by Diploma™).* *HM Class Prep* offers a combination of two class-management tools including supplements and text-specific resources for the instructor. *HM Testing* (powered by *Diploma*) offers instructors a flexible and powerful tool for test generation and test management. Now supported by the Brownstone Research Group's market-leading *Diploma* software, this new version of *HM Testing* significantly improves on functionality and ease-of-use by offering all the tools needed to create, author, deliver, and customize multiple types of tests—including authoring and editing algorithmic questions. *Diploma* is currently in use at thousands of college and university campuses throughout the United States and Canada.
- *Online Teaching Center.* Access the Online Teaching Center for this text by visiting **college.hmco.com/pic/braseUBS4e.** In addition to the student resources (see previous description for Online Study Center), online *Instructor Solutions* are also available.

Alternate Routes Through the Text

Understanding Basic Statistics, Fourth Edition, is designed to be flexible. It offers the professor a choice of teaching possibilities. In most one-semester courses, it is not practical to cover all the material in depth. However, depending on the emphasis of the course, the professor may choose to cover various topics. For help in topic selection, refer to the *Table of Prerequisite Material* on page 1.

- *Linear Regression.* Chapter 4, Correlation and Regression, may be delayed until after Chapter 9. The descriptive topics of linear regression may then be followed immediately by the inferential topics of linear regression presented in Chapter 11.
- *Probability.* For courses requiring minimal probability, Section 5.1, What Is Probability? and the first part of Section 5.2, Some Probability Rules—Compound Events, will be sufficient.

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Table of Prerequisite Material

Chapter		Prerequisite Sections
1	Getting Started	None
2	Organizing Data	1.1, 1.2
3	Averages and Variation	1.1, 1.2, 2.1
4	Correlation and Regression	1.1, 1.2, 3.1, 3.2
5	Elementary Probability Theory	1.1, 1.2, 2.1
6	The Binomial Probability Distribution and Related Topics	1.1, 1.2, 2.1, 3.1, 3.2, 5.1, 5.2 5.3 useful but not essential
7	Normal Curves and Sampling Distributions	
	(omit 7.6)	1.1, 1.2, 2.1, 3.1, 3.2, 5.1, 5.2, 6.1
	(include 7.6)	also 6.2, 6.3
8	Estimation	
	(omit 8.3)	1.1, 1.2, 2.1, 3.1, 3.2, 5.1, 5.2, 6.1, 7.1, 7.2, 7.3, 7.4, 7.5
	(include 8.3)	also 6.2, 6.3, 7.6
9	Hypothesis Testing	
	(omit 9.3)	1.1, 1.2, 2.1, 3.1, 3.2, 5.1, 5.2, 6.1, 7.1, 7.2, 7.3, 7.4, 7.5
	(include 9.3)	also 6.2, 6.3, 7.6
10	Inferences About Differences	
	(omit 10.3)	1.1, 1.2, 2.1, 3.1, 3.2, 5.1, 5.2, 6.1, 7.1, 7.2, 7.3, 7.4, 7.5, 8.1, 8.2, 9.1, 9.2
	(include 10.3)	also 6.2, 6.3, 7.6, 9.3
11	Additional Topics Using Inference	
	(Part I: 11.1, 11.2, 11.3)	1.1, 1.2, 2.1, 3.1, 3.2, 5.1, 5.2, 6.1, 7.1, 7.2, 7.3, 7.4, 7.5, 9.1
	(Part II: 11.4)	Chapter 4, 8.1, 8.2 also