

PREFACE

About This Book

We created *Stats in Your World* out of a sense of civic duty. Seriously. We think there's no course that better prepares people for life than Statistics. Everyone is bombarded daily by charts and graphs, by data, by polls, by results of studies, and by assertions and claims made by people wanting to sell us things or convince us of something. The ability to sort out what's dubious (or even pure nonsense) from important and meaningful insights not only enlightens people, it allows them to make good decisions as consumers, as parents, and as citizens. Sure, Statistics is a math course, but it's also a course in critical thinking and civics that will prepare our students for greater success in the Information Age.

This text presents Statistics as a key tool for thinking about the world. By leading with real-world examples, clear graphics, and practical data analysis, we get students “doing Statistics” quickly and “thinking statistically” right from the start. The questions that motivate our hundreds of examples and exercises highlight the wide applicability of Statistics, teach the methods and procedures of proper data analysis, and—most important—emphasize thinking about what the results mean.

We modeled the first edition on *Stats: Modeling the World*, the highly successful AP[®] Statistics book, and have been thrilled by feedback from all sides. Teachers are delighted that students can and do learn from reading the text, and their students say (to their amazement) that they even find the book enjoyable. The book's engaging style, support for underlying math skills, and scaffolded materials that enable success for all students tie all the skills and concepts to the world we live in. In this course and with this textbook, you can say goodbye to that oft-uttered math class question, “When does anyone ever use this stuff?”!

What Stats Course?

So if it were it up to us, we'd make taking a Statistics course a requirement for high school graduation. But what should that course look like? Well, that depends on several factors, among them the math backgrounds of the students and whether it's to be a one-semester or full-year course. By selecting appropriate topics and pacing, teachers can use this textbook for a wide variety of courses. If your course includes . . .

- **Basic data analysis**—choose Chapters 1–7 to cover graphical displays (pie charts, bar graphs, stem-and-leaf plots, boxplots, histograms, and scatterplots), summary statistics (mean, median, range, standard deviation, correlation), lines of best fit, and use of the Normal curve;
- **Curve fitting**—add Chapter 8 to look at exponential and power models;
- **Data collection**—include Chapter 9 (sampling, polls, and surveys), Chapter 10 (observational studies and experiments), and Chapter 11 (simulations);
- **Probability**—choose Chapter 12 (sample spaces and counting strategies) and Chapter 13 (probability basics), perhaps enriching your course with Chapter 14 (probability rules, independence, Venn and tree diagrams) and Chapter 15 (expected value and binomial probability);
- **Inference concepts**—explore inferences about a population proportion with Chapter 16 (confidence intervals) and Chapter 17 (hypothesis tests);
- **More advanced inference**—add Chapter 18 (inference techniques for a population mean), Chapter 19 (inferences for the difference of two proportions or means), and/or Chapter 20 (χ^2 procedures).

We've been guided in the choice and order of topics by several fundamental principles. First, we have tried to ensure that each new topic fits into the growing structure of

understanding that we hope students will build. We have worked to provide scaffolded materials to help each class, in its own way, follow the GAISE project (Guidelines for Assessment and Instruction in Statistics Education) sponsored by the American Statistical Association. That report urges that Statistics education should:

1. emphasize statistical literacy and develop statistical thinking,
2. use real data,
3. stress conceptual understanding rather than mere knowledge of procedures,
4. foster active learning,
5. use technology for developing concepts and analyzing data, and
6. make assessment a part of the learning process.

New to the Third Edition

This new edition of *Stats in Your World* extends the series of innovations pioneered in our books, teaching Statistics and statistical thinking as it is practiced today. We've made some important revisions and additions, each with the goal of making it even easier for students to put the concepts of Statistics together into a coherent whole.



- **More extensive, and more integrated, use of simulations.** Previous editions all included simulations, but in the third edition we've incorporated even more of them, and they're now integrated more fluidly with the text. There's hardly a chapter that doesn't use simulations to motivate a new topic, or to illustrate a concept, or to assist in analyzing data when traditional methods requiring strong assumptions or cumbersome computations are insufficient.
- **Applets.** Margin pointers alert students to an innovative set of applets allowing them to explore important concepts and develop deeper understanding of key ideas. Among these: What does standard deviation mean? How might outliers affect our analyses? What does a correlation reveal about a relationship? How does linear regression work? How large should a sample be? What does the all-important Central Limit Theorem say? What does "95% confident" mean? How does hypothesis testing work, and what is a P-value? The applets are found on the book's resource site (www.pearsonhighered.com/bock).
- **Updated examples, exercises, and data.** We've updated our innovative *Think/Show/Tell Step-by-Step* examples with new contexts and data. We've added new exercises and updated continuing exercises with the most recent data. Whenever possible, we've provided those data on the book's resource site (www.pearsonhighered.com/bock). Most of the examples and exercises are based on recent news stories, research articles, and other real-world sources. We've listed many of those sources so students can explore them further.

Continuing Features

You'll still find the many engaging, innovative and pedagogically effective features underlying the first edition's success.

- **Chapter 1 (and beyond).** Chapter 1 gets down to business immediately, looking at data. Other chapters lead with new, up-to-the-minute, motivating examples and follow through with analyses of the data, and real-world examples provide a basis for sample problems and exercises.

THINK

SHOW

TELL

Do the Math

For Example

Just Checking

Step-by-Step Example

TI TIPS

WHAT CAN GO WRONG?

IN YOUR
WORLD

WHAT HAVE WE LEARNED?

EXERCISES

- **Think, Show, Tell.** We repeat the mantra of *Think*, *Show*, and *Tell* throughout, providing a consistent framework for how to do Statistics. *Think* emphasizes the importance of clearly understanding a Statistics question (What do we know? What do we hope to learn? What procedure should we use? Are the assumptions and conditions satisfied?). The *Show* step contains the mechanics of calculating results and conveys the message that number-crunching is only one part of the process. *Tell* reminds students that interpreting the findings is where the action is: reporting what we have learned about the world.
- **Do the Math.** We often offer explanations and some practice exercises to help students review and master important arithmetic or algebra skills they'll need in order to perform a statistical procedure successfully. Answers are at the end of the chapter's exercise sets so students can easily check themselves.
- **For Example.** In every chapter, you'll find worked examples that illustrate how to apply each new concept and method. As we move through the chapter, each *For Example* further develops a statistical analysis, picking up the story and moving it forward as students learn to do each new step.
- **Just Checking.** After a new skill or concept has been presented, we ask students to pause and think about what they've just learned. The questions are designed to allow a quick check that they understand the material. These answers also appear at the end of the chapter's exercise sets.
- **Step-by-Step Worked Examples.** When students have mastered the individual steps, we present the big picture: a complete statistical analysis following our *Think-Show-Tell* rubric. These *Step-by-Step* examples ask students real-world questions, then guide them through the process by developing answers in a unique and pedagogically effective two-column format: a general explanation of what to do on the left paralleling each worked-out step on the right. The result is better understanding of statistical concepts and procedures, not just number crunching.
- **TI Tips.** We emphasize sound understanding of formulas and methods, but we want students to use technology for actual calculations. Easy-to-read *TI Tips* in the chapters show students how to use TI-84 Plus CE statistics functions. (Help using a TI-Nspire appears in Appendix B.) We do remind students that calculators are just for *Show*—the technology cannot *Think* about what to do nor *Tell* what it all means.
- **What Can Go Wrong?** Each chapter contains innovative *What Can Go Wrong?* alerts highlighting the most common errors people make and the misconceptions they have about Statistics. Our goals are to help students avoid these pitfalls, and to arm them with the tools to detect statistical errors and to debunk misuses of statistics, whether intentional or not.
- **In Your World.** Each chapter closes with a recent news story or magazine article that applies the new Statistics knowledge in an interesting context, amplifying the book's central message that Statistics is about the real world.
- **What Have We Learned?** These chapter-ending summaries are great study guides providing complete overviews that highlight the new concepts, define the new terms, and list the skills that the student should have acquired in the chapter.
- **Exercises.** We've created exercises at three levels of complexity. The **A** exercises offer straightforward practice of individual concepts or skills. The **B** exercises ask students to combine several steps in a more complete analysis. Teachers who are looking for more challenging exercises that enrich student understanding will find them in the **C** sections. Throughout, examples are paired so that each odd-numbered exercise (with an answer in the back of the book) is accompanied by an even-numbered exercise about the same concept. Almost all exercises are based on


NOTATION ALERT
ON THE COMPUTER

TI-Nspire

real-world studies and data sets, the data often included in the exercise or available at the book's website.

- **Notation Alerts.** Throughout this book we emphasize the importance of clear communication, and proper notation is part of the vocabulary of Statistics. We've found that it helps students when we call attention to the letters and symbols statisticians use to mean very specific things.
- **On the Computer.** In the real world Statistics is implemented on computers, so at the end of each chapter we show an annotated example of software output, usually based on StatCrunch[®], a great online stats package that nicely complements this course.
- **TI-Nspire Activities.** We've created many demonstrations and investigations for TI-Nspire handhelds to enhance each chapter. They're on the book's website, <http://pearsonhighered.com/bock>.

Our Goal: Read This Book!

The best text in the world is of little value if students don't read it. Here are some of the ways we have tried to encourage students to actually read *Stats In Your World*:

- **Readability.** You'll see immediately that this book doesn't read like other math texts. The style, both colloquial and informative, entices students to see what it says.
- **Humor.** We know that humor is a great way to promote interest and learning. You'll find quips and wry comments sprinkled through the narrative, margin notes, and footnotes, plus a number of cartoons.
- **Informality.** Don't let our informal diction fool you. It doesn't mean that the subject matter is covered lightly or sloppily. You'll find we've been quite precise and that the narrative offers sound explanations and justifications.
- **Consistency.** We've worked hard to avoid the "do what we say, not what we do" trap. From the very start, we teach the importance of plotting data and checking assumptions and conditions to ensure a statistical method will produce reliable results. We have been careful to model that behavior throughout the book.
- **The benefit of reading.** Most high school students have not yet learned the value of reading a textbook—and especially not a math book! We've worked hard to make the text engaging, and to weave important concepts, definitions, and sample solutions into a narrative that will reward students who do read the book.

Mathematics, Technology, and Data

This book is not concerned with proving theorems about Statistics, nor do we present concocted data sets or ask students to do tedious calculations by hand. To experience the power of Statistics it's best to explore real data sets using modern technology.

- **Technology.** We assume that you will use some form of technology in your Statistics course. That could be a calculator, a spreadsheet, or a statistics package. In each chapter we present easy-to-understand instructions for using a TI-84, and we explain typical computer output. In Appendix B, we offer general guidance (organized by chapter) to help students use StatCrunch, Excel[®], or a TI-Nspire.
- **Data.** Because we use technology for computing, we don't limit ourselves to small, artificial data sets. In addition to including some small data sets, we have built our examples and exercises on real data. Many of these data are included on the book's website, <http://pearsonhighered.com/bock>.