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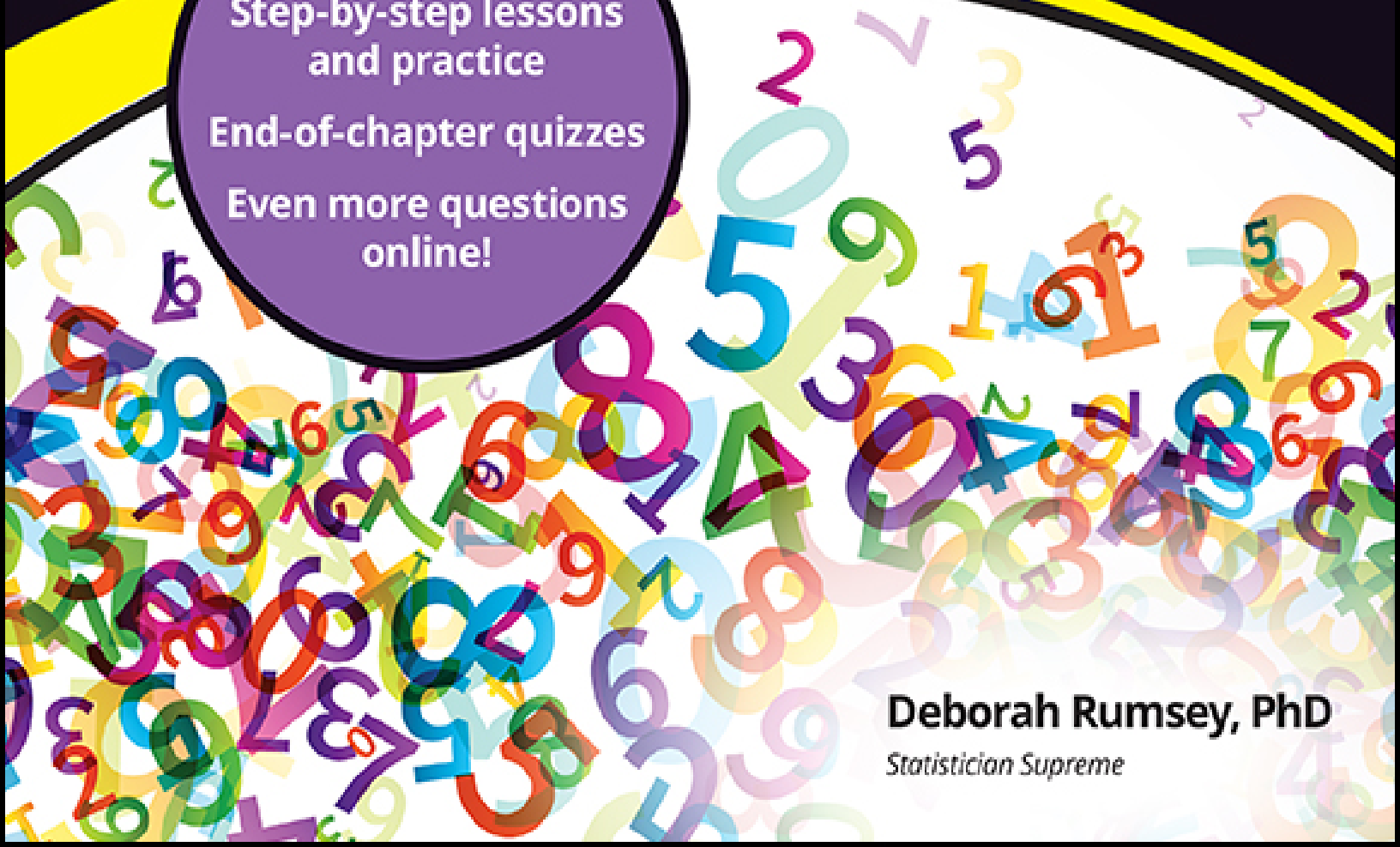

Deborah Rumsey, PhD

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by Deborah J. Rumsey, PhD

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Published by: **John Wiley & Sons, Inc.,** 111 River Street, Hoboken, NJ 07030-5774, www.wiley.com

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Library of Congress Control Number: 2022945239

ISBN 978-1-119-90256-0 (pbk); ISBN 978-1-119-90257-7 (ebk); ISBN 978-1-119-90258-4 (ebk)

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Introduction

You get hit with an incredible amount of statistical information on a daily basis. You know what I'm talking about: charts, graphs, tables, and headlines that talk about the results of the latest poll, survey, experiment, or other scientific study. The purpose of this book is to develop and sharpen your skills in sorting through, analyzing, and evaluating all that info, and to do so in a clear, fun, and pain-free way with tons of opportunities to practice. You also gain the ability to decipher and make important decisions about statistical results (for example, the results of the latest medical studies), while being ever aware of the ways that people can mislead you with statistics. And you see how to do it right when it's your turn to design the study, collect the data, crunch the numbers, and/or draw the conclusions.

This book is also designed to help those of you who are looking to get a solid foundation in introductory statistics or those taking a statistics class and wanting some backup. You'll gain a working knowledge of the big ideas of statistics and gather a boatload of tools and tricks of the trade that'll help you get ahead of the curve, especially for taking exams.

This book is chock-full of real examples from real sources that are relevant to your everyday life — from the latest medical breakthroughs, crime studies, and population trends to the latest U.S. government reports. I even address a survey on the worst cars of the millennium! By reading this book, you'll understand how to collect, display, and analyze data correctly and effectively, and you'll be ready to critically examine and make informed decisions about the latest polls, surveys, experiments,

and reports that bombard you every day. You will even find out how to use crickets to gauge temperature!

You will also get to climb inside the minds of statisticians to see what's worth taking seriously and what isn't to be taken so seriously. After all, with the right skills and knowledge, you don't have to be a professional statistician to understand introductory statistics. You can be a data guru in your own right.

About This Book

This book departs from traditional statistics texts, references, supplemental books, and study guides in the following ways:

- It includes practical and intuitive explanations of statistical concepts, ideas, techniques, formulas, and calculations found in an introductory statistics course.
- It shows you clear and concise step-by-step procedures that explain how you can intuitively work through statistics problems.
- It features interesting real-world examples relating to your everyday life and workplace.
- It contains plenty of excellent practice problems crafted in a straightforward manner to lead you down the path of success.
- It offers not only answers, but also clear, complete explanations of the answers. Explanations help you know exactly how to approach a problem, what information you need to solve it, and common problems you need to avoid.
- It includes tips, strategies, and warnings based on my vast experience with students of all backgrounds and

learning styles.

- It gives you upfront and honest answers to your questions like, “What does this really mean?” and “When and how will I ever use this?”

As you work your way through the lessons and problems in this book, you should be aware of four conventions that I’ve used.

- **Dual use of the word *statistics:*** In some situations, I refer to statistics as a subject of study or as a field of research, so the word is a singular noun. For example, “Statistics is really quite an interesting subject.” In other situations, I refer to statistics as the plural of *statistic,* in a numerical sense. For example, “The most commonly used statistics are the mean and the standard deviation.”
- **Use of the word *data:*** You’re probably unaware of the debate raging among statisticians about whether the word *data* should be singular (“data is ”) or plural (“data are ”). It got so bad that one group of statisticians had to develop two versions of a statistics T-shirt: “Messy Data Happens” and “Messy Data Happen.” I go with the plural version of the word *data* in this book.
- **Use of the term *standard deviation:*** When I use the term *standard deviation,* I mean *s,* the sample standard deviation. (When I refer to the population standard deviation, I let you know.)
- **Use of *italics:*** I use *italics* to let you know a new statistical term is appearing on the scene. Look for a definition accompanying its first appearance.

Foolish Assumptions

I don’t assume that you’ve had any previous experience with statistics, other than the fact that you’re a member of the general public who gets bombarded every day with statistics in the form of numbers, percents, charts, graphs, “statistically significant” results, “scientific” studies, polls, surveys, experiments, and so on.

What I do assume is that you can do some of the basic mathematical operations and understand some of the basic notation used in algebra, such as the variables x and y, summation signs ($\sum$), taking the square root, squaring a number, and so on. If you need to brush up on your algebra skills, check out *U Can Algebra I For Dummies* by Mary Jane Sterling (Wiley).

I don’t want to mislead you: You do encounter formulas in this book, because statistics does involve a bit of number crunching. But don’t let that worry you. I take you slowly and carefully through each step of any calculations you need to do, explaining things both with notation and without. I also provide practice questions for you to work so you can become familiar and comfortable with the calculations and make them your own.

Icons Used in This Book

You’ll see the following five icons throughout the book:

EXAMPLE Each example is a stat question based on the discussion and explanation, followed by a solution. Work through these examples, and then refer to them to help you solve the practice problems that follow them as well as the quiz questions at the end of the chapter.

REMEMBER This icon points out important information that you need to focus on. Make sure you understand this information fully before moving on. You can skim through these icons when reading a chapter to make sure you remember the highlights.

TIP Tips are hints that can help speed you along when answering a question. See whether you find them useful when working on practice problems.

WARNING This icon flags common mistakes that students make if they're not careful. Take note and proceed with caution!

YOUR TURN When you see this icon, it's time to put on your thinking cap and work out a few practice problems on your own. The answers and detailed solutions are available so you can feel confident about your progress.

Beyond the Book

In addition to the material in the print or e-book you're reading right now, this book also comes with a handy online Cheat Sheet. Use it when you need a quick refresher on a formula or the next step in conducting a hypothesis test. To get this Cheat Sheet, simply go to

www.dummies.com and type **Statistics All in One For Dummies Cheat Sheet** in the Search box.

You'll also have access to online quizzes related to each chapter, beginning with Unit 2, Chapter 4. These quizzes provide a whole new set of problems for practice and confidence-building. To access the quizzes, follow these simple steps:

1. **Register your book or ebook at Dummies.com to get your PIN. Go to www.dummies.com/go/getaccess.**
2. **Select your product from the drop-down list on that page.**
3. **Follow the prompts to validate your product, and then check your email for a confirmation message that includes your PIN and instructions for logging in.**

If you do not receive this email within two hours, please check your spam folder before contacting us through our Technical Support website at http://support.wiley.com or by phone at 877-762-2974.

Now you're ready to go! You can come back to the practice material as often as you want — simply log on with the username and password you created during your initial login. No need to enter the access code a second time.

Your registration is good for one year from the day you activate your PIN.

Where to Go from Here

This book is written in such a way that you can start anywhere and still be able to understand what's going on. So you can take a peek at the table of contents or the

index, look up the information that interests you, and flip to the page listed. However, if you have a specific topic in mind and are eager to dive into it, here are some directions:

- To work on interpreting graphs, charts, means or medians, and the like, head to Unit 2.
- To find info on the normal, *Z*-, *t*-, or binomial distributions or the Central Limit Theorem, see Unit 3.
- To focus on confidence intervals and hypothesis tests of all shapes and sizes, flip to Unit 4.
- To delve into surveys, experiments, regression, and two-way tables, see Unit 5.

Or if you aren't sure where you want to start, start with Chapter 1 for the big picture and then plow your way through the rest of the book. Ready, set, go!

Unit 1

Getting Started with Statistics

In This Unit ...

Chapter 1: The Statistics of Everyday Life

- Statistics and the Media: More Questions than Answers?
- Using Statistics at Work

Chapter 2: Taking Control: So Many Numbers, So Little Time

- Detecting Errors, Exaggerations, and Just Plain Lies
- Feeling the Impact of Misleading Statistics

Chapter 3: Tools of the Trade

- Thriving in a Statistical World
- Statistics: More than Just Numbers
- Designing Appropriate Studies
- Collecting Quality Data
- Grabbing Some Basic Statistical Jargon
- Drawing Credible Conclusions
- Becoming a Sleuth, Not a Skeptic

Chapter 1

The Statistics of Everyday Life

IN THIS CHAPTER

- **Raising questions about statistics you see in everyday life**
- **Encountering statistics in the workplace**

Today's society is completely taken over by numbers. Numbers are everywhere you look, from billboards showing the on-time statistics for a particular airline, to sports shows discussing the Las Vegas odds for upcoming football games. The evening news is filled with stories focusing on crime rates, the expected life span of junk-food junkies, and the president's approval rating. On a normal day, you can run into 5, 10, or even 20 different statistics (with many more on election night). Just by reading a Sunday newspaper all the way through, you come across literally hundreds of statistics in reports, advertisements, and articles covering everything from soup (how much does an average person consume per year?) to nuts (almonds are known to have positive health effects — what about other types of nuts?).

In this chapter we discuss the statistics that often appear in your life and work, and talk about how statistics are presented to the general public. After reading this chapter, you'll realize just how often the media hits you with numbers and how important it is to be able to unravel the meaning of those numbers. Like it or not,

statistics are a big part of your life. So, if you can't beat 'em, join 'em. And if you don't want to join 'em, at least try to understand 'em.

Statistics and the Media: More Questions than Answers?

Open a newspaper and start looking for examples of articles and stories involving numbers. It doesn't take long before those numbers begin to pile up. Readers are inundated with results of studies, announcements of breakthroughs, statistical reports, forecasts, projections, charts, graphs, and summaries. The extent to which statistics occur in the media is mind-boggling. You may not even be aware of how many times you're hit with numbers nowadays.

This section looks at just a few examples from one Sunday paper's worth of news that I read the other day. When you see how frequently statistics are reported in the news without providing all the information you need, you may find yourself getting nervous, wondering what you can and can't believe anymore. Relax! That's what this book is for — to help you sort out the good information from the bad (the chapters in Unit 2 give you a great start on that).

Probing popcorn problems

The first article I came across that dealt with numbers was "Popcorn plant faces health probe," with the subheading: "Sick workers say flavoring chemicals caused lung problems." The article describes how the Centers for Disease Control (CDC) expressed concern

about a possible link between exposure to chemicals in microwave popcorn flavorings and some cases of fixed obstructive lung disease. Eight people from one popcorn factory alone contracted this lung disease, and four of them were awaiting lung transplants.

According to the article, similar cases were reported at other popcorn factories. Now, you may be wondering, what about the folks who eat microwave popcorn? According to the article, the CDC found “no reason to believe that people who eat microwave popcorn have anything to fear.” (Stay tuned.) The next step is to evaluate employees in more depth, including conducting surveys to determine health and possible exposures to the flavoring chemicals, checks of lung capacity, and detailed air samples. The question here is: How many cases of this lung disease constitute a real pattern, compared to mere chance or a statistical anomaly? (You find out more about this in Chapter 15.)

Venturing into viruses

A second article discussed a recent cyber attack: A wormlike virus made its way through the Internet, slowing down web browsing and email delivery around the world. How many computers were affected? The experts quoted in the article said that 39,000 computers were infected, and they in turn affected hundreds of thousands of other systems.

Questions: How did the experts get that number? Did they check each computer out there to see whether it was affected? The fact that the article was written less than 24 hours after the attack suggests the number is a guess. Then why say 39,000 and not 40,000 — to make it seem less like a guess? To find out more on how to guesstimate with confidence (and how to evaluate someone else’s numbers), see Chapter 14.