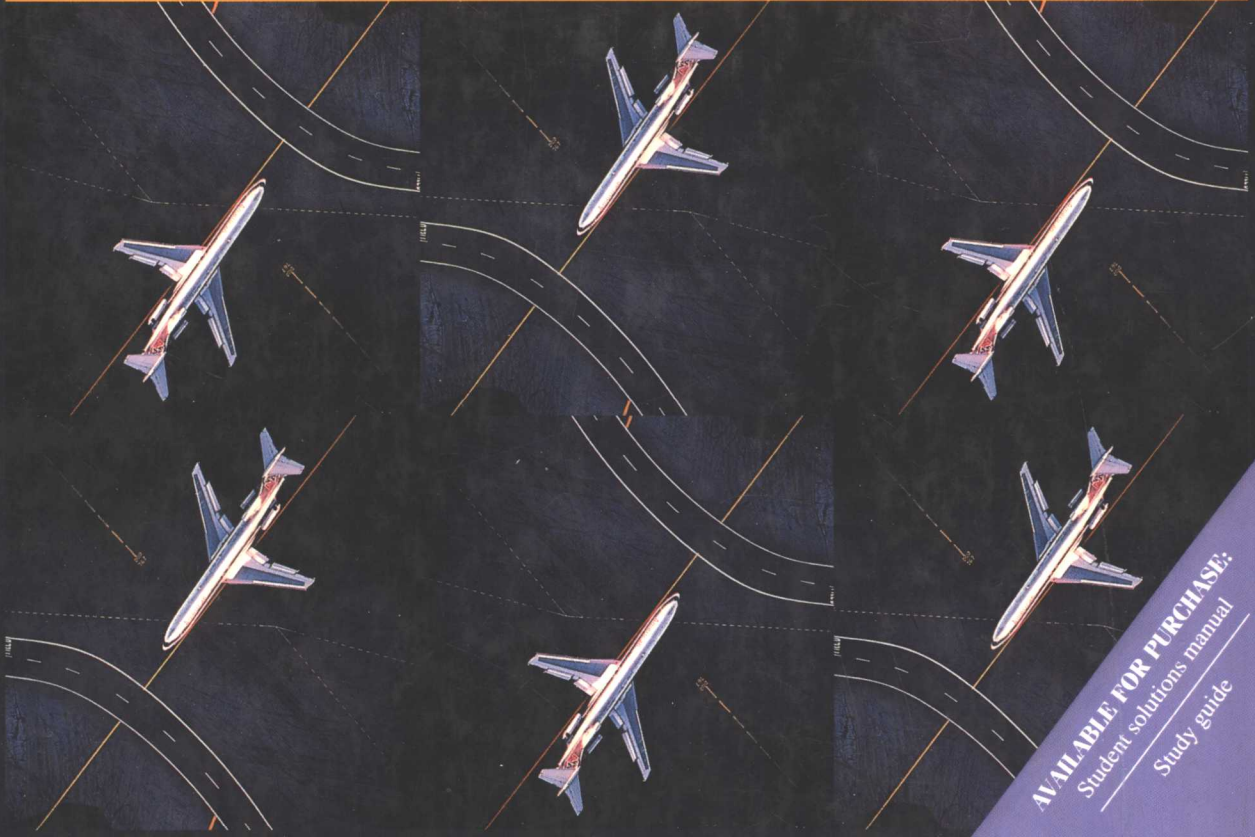


**KELLER
WARRACK
BARTEL**

STATISTICS

FOR MANAGEMENT AND ECONOMICS

THIRD EDITION



AVAILABLE FOR PURCHASE:
Student solutions manual
Study guide

Statistics

for

Management

and

Economics

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Techniques Illustrated by Computer Output

TECHNIQUE	MINITAB	SAS	EXAMPLE	PAGE
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Stem and leaf	✓	✓	—	30
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z-test of μ	✓		7.2, 7.3	260, 264
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Key to Exercise/Case Icons

The exercises and cases illustrate how statistics can be used in a wide range of applications. When appropriate, the areas to which the cases and many of the exercises apply are identified using the following icons:

ICON	APPLICATION
------	-------------



Accounting



Computer Exercises/Cases



Economics



Education



Finance



Management



Marketing



Production/Operations Management



Politics and Government



Real Estate



Retailing



Science/Health



Tourism

Preface

All statistics books describe how statistical techniques are performed. Most show in detail how to compute the statistics needed to make decisions, draw conclusions, or recommend actions. Most books also discuss the fundamental concepts underlying the statistical methods. However, we believe this is not enough. Presenting statistics as a series of unconnected arithmetic procedures produces students who will judge statistics courses boring, difficult, and useless. Showing students how to perform statistical techniques by hand does not prepare them for real-world applications or even the final exam in the course. Students' greatest difficulty is in identifying the correct statistical method to use. If students are taught only how to calculate statistics, they will be capable only of solving problems at the back of sections and chapters, because for those kinds of problems the student knows which technique to use—obviously the one introduced in that section or chapter. In this book we show not only the how and why of statistics but also the when.

Our philosophy in this book can be expressed quite simply: we regard the calculation of the statistical procedure to be the least important element of an application. Computers can more easily produce the results. Far more important is the ability to set up the problem properly, which includes recognizing which technique to use. Equally important is the ability to interpret the results and incorporate the statistics into the larger decision problem. This philosophy is made operational in several ways.

Systematic Approach

In Chapter 7 we introduce our systematic approach by describing the critical factors that determine the appropriate statistical technique. These are the problem objective and the type of data. We teach that all statistical techniques are fundamentally alike in that (except for nonparametric methods) we start by identifying the parameter of interest, the parameter's estimator, the estimator's sampling distribution, which leads to the confidence interval estimator, and the test statistic. Review Chapters 10 and 17, placed at the midpoint and conclusion of statistical inference, allow students to practice recognizing the correct method.

Realistic Applications

Applications of statistics in the real world or even in other courses often require the use of several different techniques. By emphasizing how to identify those techniques, we make it possible for instructors to introduce to their classes more interesting and realistic examples, exercises, and cases. Thus, it becomes easier to show students that statistics can be

as useful as any other course in the curriculum. Students so convinced will be more motivated to learn statistics and less likely to find the course boring and difficult.

Use of the Computer

The availability of low cost computers and software has changed statistics. Because we no longer must demonstrate the arithmetic of statistics, we can spend our classroom time dealing with the concepts, discussing the exercises and cases, and in general motivating students. Even if students don't have access to computers and software, it is still unnecessary to present calculations by hand. Our approach allows instructors to discuss problem recognition and computer output interpretation without having to compute statistics by hand. You will find that most examples in this book present three different ways to solve the problem: we show how the calculations are done by hand (we believe that solving a few problems manually may provide a deeper understanding of the material), and we use the Minitab and SAS computer software systems to produce the statistical results. Thus, instructors may choose which form of solution to use. If they wish, instructors can easily substitute their preferred software output in place of our three methods.

In summary, we have attempted to make teaching and learning statistics a more positive experience. Our goal is to make the job that you do in the statistics classroom closely resemble the kind of work real statisticians do. Just as statisticians begin working on a problem by identifying which techniques to use, getting the computer to produce the results, and then incorporating these results into the decision framework, so too do our students perform the same operations on the examples, exercises, and cases. We've found that our students like this approach: they say it gives them more confidence and makes learning statistics more fun. We hope that all students have the same reaction to this textbook.

Learning Aids

Though we have mentioned several of the book's learning aids above, it may be useful to summarize them here:

Cases

There are 46 cases scattered throughout the book, which have been adapted from real studies. Students are expected to analyze the cases and draw conclusions in the same way as the authors of the studies. Some of the cases require the use of a computer and software. The data for these cases are stored on the disk for this book.

Computer Output

For most of the worked examples, we provide both Minitab and SAS output. This exposes students to how statistics is actually applied in the real world.

Minitab and SAS Instructions and Exercises

In the appendixes at the end of appropriate chapters, we provide instructions and commands for the actual use of these two popular packages. It is not necessary for students to purchase

the Minitab or SAS manuals. We have also included exercises in those appendixes permitting students to practice using the software. The data for these exercises are stored on the data disk for this book.

Review Chapters

There are two review chapters in the text to help students identify the correct technique. Chapter 10 appears midway through our presentation of statistical inference, and Chapter 17 reviews all of the statistical methods covered. Both feature flowcharts that summarize the systematic approach, as well as exercises and cases that require the use of several different statistical procedures.

Exercises

There are 1,362 exercises of varying levels of difficulty in this book:

Learning the Techniques Exercises appear at the end of most sections. These were developed to help students learn the arithmetic involved in a specific procedure.

Applying the Techniques Exercises follow. These stress when and why the technique is used and show how the results assist in the decision-making process.

Supplementary Exercises appear at the end of chapters. Because they cover all the topics presented in a particular chapter, they offer students practice in identifying which techniques to use of those they've encountered in the chapter. The Supplementary Exercises also are more realistic and are somewhat more difficult than the other two types of exercises.

New in This Edition

This third edition features a number of improvements suggested by reviewers and users of the second edition:

1. The introduction to statistical inference has been altered. Chapter 5 in the second edition has been deleted. Chapter 7 now presents the concepts of estimation and hypothesis testing and illustrates them by discussing inference about the population mean when the population variance is known. Much of the material in the old Chapter 5 appears in the new Chapter 7. Chapter 8 describes the techniques used to make inferences about describing a single population. Chapter 9 presents statistical inference about comparing two populations.
2. The terms *nominal*, *ordinal*, and *interval data scales* have been replaced by *qualitative*, *ranked*, and *quantitative data*.
3. A new chapter on **quality management** (Chapter 18) has been created. In this chapter we introduce control charts and show how they are used to achieve and maintain high-quality products.
4. Graphical and numerical descriptive techniques have been separated into two chapters. In Chapter 2 we introduce graphical methods including box plots; Chapter 3 presents numerical techniques.

5. Probability (Chapter 4) has been streamlined, concentrating only on the topics necessary to understand the foundation of statistical inference.
6. Throughout the book we have created new examples, exercises, and cases and deleted some others.

Teaching Aids

To assist professors, we have provided a number of teaching aids. All of these are available from Wadsworth Publishing Company.

An *Instructor's Resource Book* includes the following:

1. Suggestions about teaching statistics with the systematic approach.
2. Transparency Masters keyed to the teaching suggestions.
3. Teaching notes for each case, detailing the goals of the case, assignment questions, analysis and solution, teaching strategy, and (where necessary) Minitab computer instructions.
4. A write-up of supplementary topics that do not appear in the textbook but that some instructors may wish to cover (these have been formatted for easy reproduction and distribution to students):
 - a. Joint probability distributions and covariance
 - b. Hypergeometric distribution
 - c. Continuous probability distributions with calculus
 - d. Deriving the normal equations
5. SPSS instructions, which can be used instead of Minitab and SAS (these too can be copied and distributed).
6. A test bank containing about 800 problems and answers, and a description of our approach to testing, including how we produce examinations that require no calculations for the students to perform. Computerized testing is also available in IBM-PC and Macintosh formats.
7. Solutions to the textbook's odd-numbered exercises.

A separate *Student Solutions Manual* is also available. It furnishes detailed solutions to the textbook's even-numbered exercises.

We have also written a *Study Guide* that contains overviews of each chapter in the text, examples illustrating specific techniques, and exercises and their solutions. There are a total of 134 worked examples and 324 exercises.

Acknowledgments

This book was developed from several courses we've taught in business and economics programs at a total of 10 universities over a combined 55 years of teaching. We are most grateful to our colleagues, our teaching assistants, and especially our students, whose helpful suggestions, comments, and criticisms have benefited this text.

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