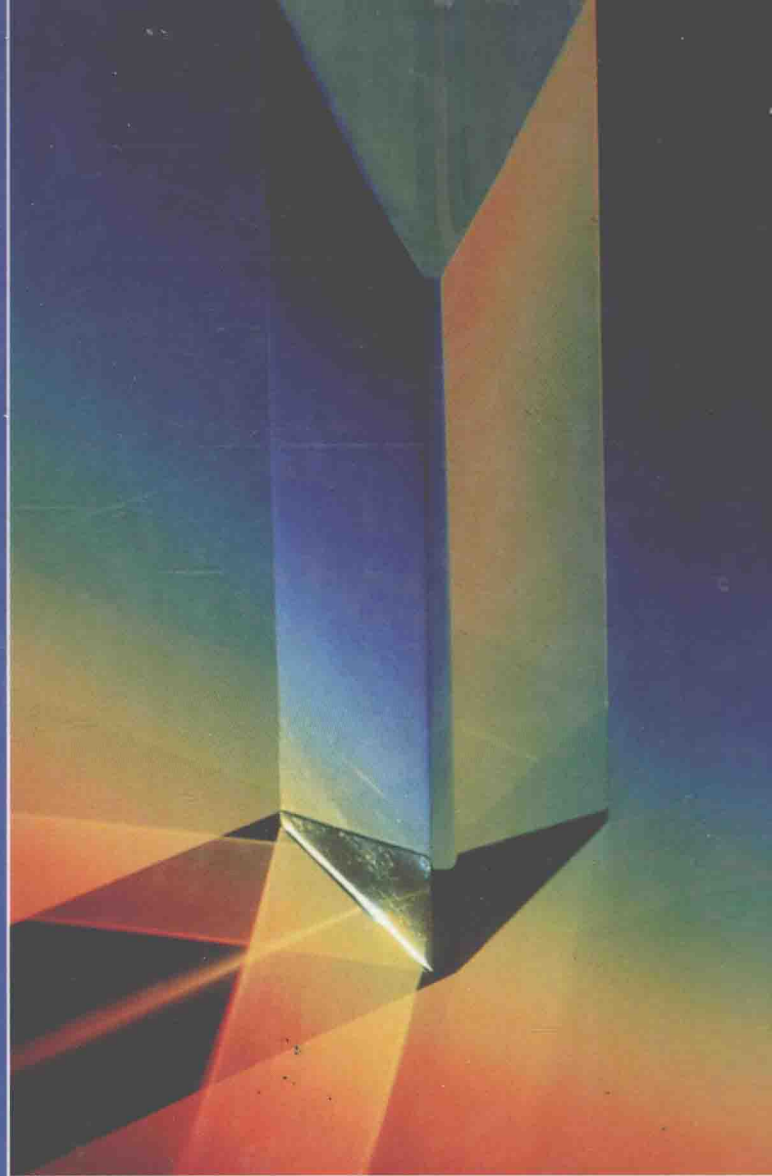


INTRODUCTION TO

# STATISTICS

CONCEPTS AND APPLICATIONS



THIRD EDITION

ANDERSON  
SWEENEY  
WILLIAMS



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**INTRODUCTION TO**  
**STATISTICS**  
**CONCEPTS AND APPLICATIONS**

**THIRD EDITION**

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INTRODUCTION TO  
**STATISTICS**  
CONCEPTS AND APPLICATIONS

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# PREFACE

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The purpose of this book is to provide a comprehensive treatment of introductory statistics for students from a wide variety of academic backgrounds. The text is applications oriented and has been written with the needs of the nonmathematician in mind. The mathematical prerequisite is a course in college algebra.



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## APPLICATIONS AND METHODOLOGY INTEGRATED

Applications of the statistical methodology are an integral part of the organization and presentation of the material. Each chapter begins by motivating the student with a general interest writeup involving statistics in practice that demonstrates a use of the statistical procedures that will be introduced in the chapter. Statistical techniques are then introduced using examples where the techniques have been successfully applied. The discussion and development of each technique is centered around an application setting, with the statistical results providing information helpful in solving the underlying problem.

In addition, we have taken care to provide a sound methodological development. Throughout the text we have utilized notation that is generally accepted for the topic being covered. Students will thus find that the text provides good preparation for the study of more advanced statistical material. A bibliography that should prove useful as a guide to further study has been included as an appendix.



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## CHANGES IN THE THIRD EDITION

In making modifications for this new edition, we have maintained the presentation style of the previous edition. However, this edition includes a more complete and detailed topical coverage than the previous editions, including the addition of counting rules for combinations and permutations and expanded binomial probability tables. We have also extended our treatment of experimental design, revised the three-chapter sequence on regression analysis, and included a new chapter on sample survey methods. The more significant changes in the third edition are summarized below.

### MORE EXAMPLES AND PROBLEMS BASED ON REAL DATA

We have continued our emphasis on helping students understand the wide range of statistical applications by expanding the number of examples and problems based on real statistical studies. Sources such as *The New York Times*, *USA Today*, *Psychology Today*, *New England Journal of Medicine*, and *The Wall Street Journal* provide referenced



applications and problems that demonstrate wide-ranging uses of statistics. The use of real data means that students not only learn about the statistical methodology but also learn about the content of applications encountered in practice. Approximately 300 new problems have been added in this edition.

## **METHODS EXERCISES AND APPLICATIONS EXERCISES**

The end-of-section exercises have been split into two parts. With the Methods exercises, students are required to make sure they can handle the formulas and make the necessary computations. In the Applications exercises, students are given problems that require using the chapter material in real-world situations. With this approach, students first focus on the computational “nuts and bolts,” then move on to the subtleties of statistical application and interpretation.

## **SELF-TEST EXERCISES**

Certain exercises are identified as self-test exercises. Completely worked-out solutions for these exercises are provided in an appendix at the end of the text. Students can attempt the self-test exercises and immediately check the solution to evaluate their understanding of the concepts presented in the chapter.

## **COMPUTER CASES**

Many chapters have computer cases, which contain problem scenarios accompanied by modest-sized data sets. Computer solution by Minitab, The Data Analyst, or another statistical software package is required. Each case outlines a report that the student prepares to summarize statistical results as well as present interpretations and recommendations. The data sets for all computer cases are available on data disks formatted for Minitab, The Data Analyst, or MYSTAT.

## **A NEW CHAPTER ON SAMPLING AND SURVEY METHODOLOGY**

Chapter 18 treats sampling and survey methodology. A discussion of issues involved in designing and conducting survey research is presented. The probability sampling methods of simple random sampling, stratified simple random sampling, cluster sampling, and systematic sampling are covered. The nature and control of sampling and nonsampling error are treated.

## **ANALYSIS OF VARIANCE AND EXPERIMENTAL DESIGN**

The presentation of analysis of variance and experimental design (Chapter 12) has been revised with a new *Statistics in Practice* used to introduce students to the concepts. The chapter begins with analysis of variance and its use in testing for the equality of means with three or more populations. Procedures for making multiple comparisons have been expanded and now appear immediately following the material on testing for the equality of means. Experimental design concepts are presented after the introduction to analysis of variance. Completely randomized, randomized block, and factorial experimental designs complete the coverage. Formulas for the analysis of variance computations appear in the chapter appendix.



## REGRESSION ANALYSIS

The three-chapter sequence on regression analysis (Chapters 13, 14, and 15) has been enhanced with an expanded discussion of the use and interpretation of dummy variables and interaction terms. The best-subset selection technique and the use of normal probability plots are now included, and the discussion of residual analysis has been expanded.



## FEATURES

We have continued many of the features that appeared in earlier editions. Some of the more important ones include the following.

## LEARNING OBJECTIVES

Each chapter begins with a statement of learning objectives which falls under the heading of “What You Will Learn in This Chapter.” This list contains the concepts that the student will be expected to master and should help guide the student’s study of the material.

## STATISTICS IN PRACTICE

Each chapter opens with a general interest news article that demonstrates a use of the statistical procedures about to be introduced. These *Statistics in Practice* applications are based on actual articles appearing in journals, magazines, and newspapers such as *The New England Journal of Medicine*, *Time*, *USA Today*, *The New York Times*, and so on. The *Statistics in Practice* is a condensed version of the original article and specifically focuses on the use of statistics as reported in the publication. Topical selections include the cost of a college education, marriage statistics, pay differentials for men and women, and professional sports; these selections should capture the student’s interest and show them that the statistical procedures that he or she is about to learn have some interesting applications.

## CHAPTER PEDAGOGY

Each chapter introduces statistical methodology in the context of examples that demonstrate the use of the methodology in a wide variety of general interest applications. Problems are provided after each section to enable the student to check his or her progress. Answers to the even-numbered exercises and self-test exercises are provided at the back of the book. Each chapter concludes with a review of key concepts and topics introduced therein. A glossary of statistical terms found in the chapter follows, and a key formula section itemizes the important equations that the student should know how to apply. A review quiz is then included to reinforce the key concepts presented. Supplementary exercises, based on the material throughout the chapter, then provide additional opportunities to practice applying the methodology presented. Where appropriate, computer printouts are included; these print-outs demonstrate how computer packages can be used in statistical computation and summaries.



## REVIEW QUIZZES

The review quizzes consist of true-false and multiple choice questions. Each review quiz provides the student with an opportunity to evaluate his or her progress after the chapter material has been covered. Answers for the review quiz questions are included at the back of the book.

## NOTES AND COMMENTS

At the end of many sections, we have provided *Notes and Comments* designed to give the student additional insights about the statistical methodology presented in the section. They include warnings and/or limitations about the methodology, recommendations for application, brief descriptions of additional technical considerations, and so on. It is hoped that this feature will expand the students' understanding of statistics and their ability to use the material.

## COMPUTER SOFTWARE

The text contains numerous examples and discussions of the important role statistical software packages play in the computation and presentation of statistical results. More examples and problems based on the Minitab statistical package have been added. Use and interpretation of the information provided by Minitab printouts are emphasized. Available to adopters is The Data Analyst version 2.0, an IBM-compatible microcomputer software package developed by the authors. The Data Analyst or MYSTAT may be ordered shrink-wrapped with the text. The Data Analyst, MYSTAT, Minitab, or other statistical packages can be used to solve problems and computer cases appearing in the text.

## DATA DISK

Data sets for text examples, problems, and computer cases are available on special Data Disks, that can be ordered with the text. The Data Disks contain the data sets in a format acceptable to Minitab, MYSTAT, or The Data Analyst software packages.

## ANCILLARIES

Accompanying the text is a complete package of support materials. A solutions manual, prepared by the authors, contains complete solutions to all exercises in the text. A test bank contains multiple choice questions followed by problems, and WESTTEST Computerized Testing also accompanies the package. Transparency masters display worked-out demonstration problems, and a student workbook (prepared by Meredith Many and Charlotte Lewis, University of New Orleans) provides chapter summaries and glossaries, formula references, and additional practice problems with solutions. The Data Analyst microcomputer software package, developed by the authors, is available free to adopters, and students may purchase the software shrinkwrapped with the text for a small additional charge. In addition, the MYSTAT statistical software package may also be purchased shrinkwrapped with the text for a small additional charge.





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*David R. Anderson*

*Dennis J. Sweeney*

*Thomas A. Williams*



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