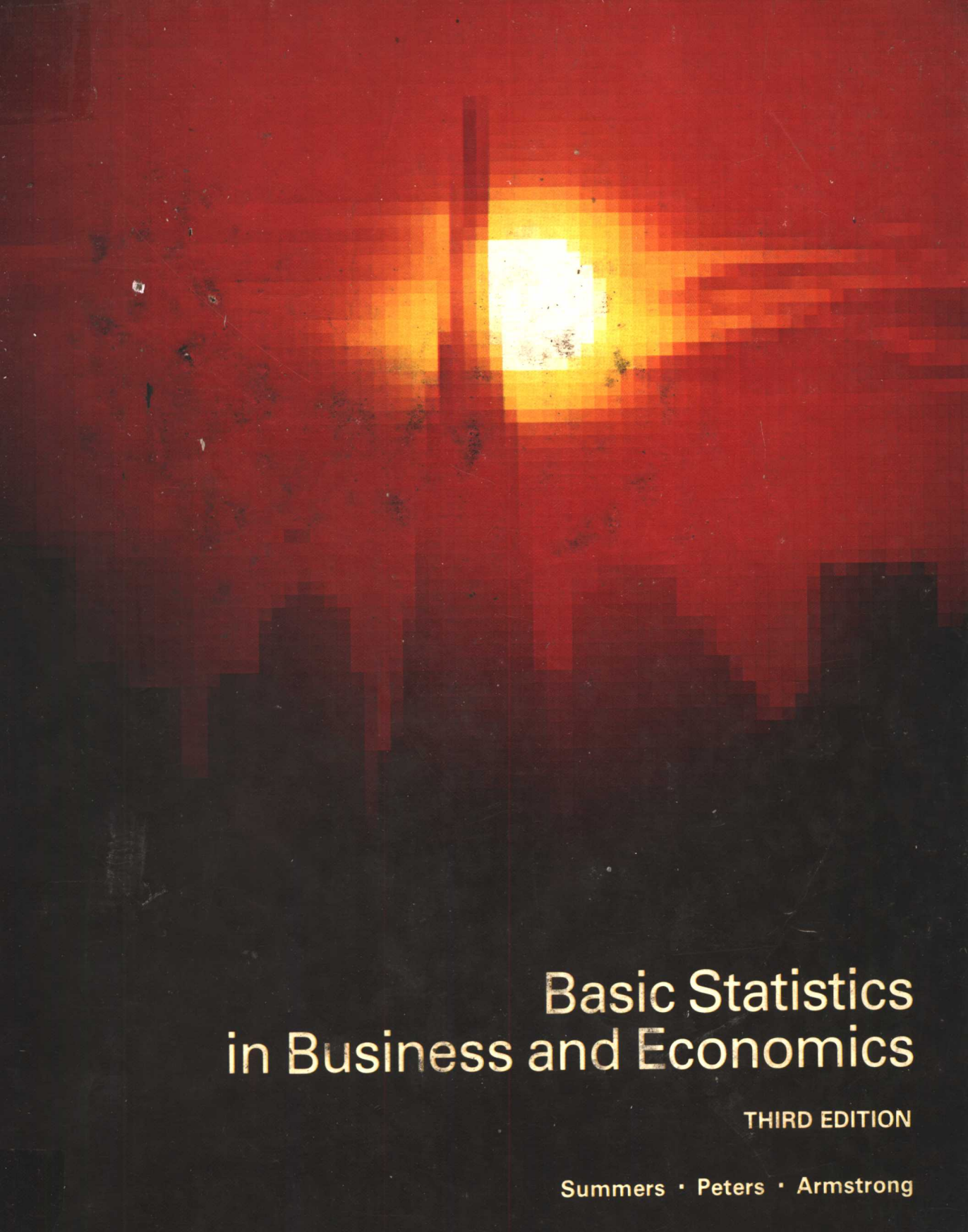

Basic Statistics in Business and Economics

THIRD EDITION

Summers · Peters · Armstrong

Basic Statistics in Business and Economics

THIRD EDITION

George W. Summers
University of Arizona

William S. Peters
University of New Mexico

Charles P. Armstrong
University of Rhode Island

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Students: There is extra help available . . .

This text has been written to make your study of statistics as simple and rewarding as possible. But even so there may be concepts or techniques that will be difficult for you. Or you may want a little "insurance" for success as mid-terms and finals come up. If so, you will want to buy a copy of the *Student Supplement for Basic Statistics in Business and Economics.* It's described in the preface of this book. Your campus bookstore either has it in stock or will order it for you.

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PREFACE

Basic Statistics in Business and Economics, Third Edition, is intended primarily for beginning statistics courses for business students. These courses could be as short as a single quarter or as long as an academic year. Suggested chapter sequences for courses of different lengths are given in the subsequent discussion of the book's organization.

Our major objectives were to present basic statistical concepts in an applied context, to methodically develop the logic underlying statistical techniques with emphasis on verbal explanation and example, and to pay careful attention to necessary assumptions, consequences of violating assumptions, and interpreting results. The book assumes a knowledge of algebra. However, basic statistical concepts and procedures are explained with minimal use of mathematics. We think this approach produces greater appreciation for the concepts and can be accomplished without oversimplification.

Considerable effort has been made to improve both the quality and quantity of exercises in the third edition. Exercises now appear at the ends of most sections to provide immediate practice with procedures and concepts. Supplementary exercises are given at the ends of chapters to provide practice of the concepts developed throughout the chapter. Solutions (rather than answers) to odd-numbered exercises are given at the end of the book to reinforce understanding and correct misconceptions.

The role of the computer in applied statistics is recognized in several ways. Computer applications in descriptive statistics (such as data handling and calculating summary descriptive measures) and in statistical inference (such as multiple regression) are included within certain chapters. Computer exercises that use a data set in Appendix C are given at the ends of relevant chapters. This set contains observations of 100 single-family residence sales with five variables recorded for each sale.

Concrete applications from functional areas of business, industry, and government are used extensively in text examples and exercises. Many such applications are based on actual situations reported by managers of statistical departments at a number of companies, who responded to the authors' extensive search for real-world uses of statistics. Where possible, sources are given for these examples and exercises. A brief list of selected applications follows.

Accounting

Comparison of operating ratios with control group (Exercise 6-14, page 162)

Sampling audit of accounts payable (Exercise 9-22, page 275)

Estimation of the proportion of delinquent charge accounts (Exercise 8-2, page 219)

Advertising

Hardware buying; cooperative regression study of sales results from three media (page 425)

Newspaper readership (page 117)

Response to TV spot ads (Exercise 10-9, page 300)

Media market penetration (Exercise 4-15, page 105)

Economics

Recession and balance of trade assessments (Exercise 4-11, page 104)

Distribution of number of employees per firm (Exercise 3-16, page 65)

Job-related injury and illness fatalities, by industry (page 22)

Relationship of collective bargaining law to movement in wage offers (Exercise 11-10, page 339)

Finance, Insurance, and Real Estate

Selling price, floor area, and age of single-family residences, a regression study (page 405)

Mergers and stock price changes (Exercise 4-18, page 105)

Life insurance premiums and actuarial probabilities (page 129)

Stock portfolio performance (Exercise 4-6, page 97)

General Management

W. R. Grace: major sources of net sales 1950, 1962, 1977 (Figure 2-9, page 29)

Ages of chief executive officers of larger corporations (Exercise 3-11, page 61)

Functional areas of business from which chief executives came (Exercise 2-22, page 49)

Marketing

Connecticut Peak-load Pricing Study: electricity consumption change for large users (page 337)

Packaging effects on sales (Exercise 15-6, page 450)

Cola blind preference taste test (page 195)

Effect of message on telephone sales appointment rate (Exercise 11-14, page 347)

Operations Management

Machine maintenance cost versus age (Exercise 10-17, page 314)

Product development cost ratios (Exercise 3-28, page 82)

Warehouse space control (Exercise 14-1, page 416)

Acceptance sampling of attributes (Exercise 6-16, page 168)

Product spoilage rates for two shifts (Exercise 11-4, page 332)

Personnel

Estimation of employee absenteeism (Exercise 8-26, page 240)

Influence of schooling and manual dexterity on job performance (Exercise 14-4, page 417)

Comparison of sources for professional athletes (Exercise 15-7, page 450)

Public Administration

Stability versus growth as policy of county commissioners (Exercise 11-12, page 339)

Pedestrian fatalities from motor vehicles (Exercise 8-29, page 241)

Probability of arrest versus police response time (Exercise 10-3, page 292)

The book is divided into five parts: Descriptive Statistics, Background for Statistical Inference, Basic Statistical Inference, Further Topics in Statistical Inference, and Additional Topics.

Part I, Descriptive Statistics, includes chapters entitled Statistics and Data, Organizing and Presenting Data, and Summary Descriptive Measures. As compared to the previous edition, this material has been completely revised, and topics have been rearranged. In addition, more emphasis has been placed on the general meaning and uses of statistics and less on calculation.

Part II, Background for Statistical Inference, begins with a chapter on probability, continues with chapters discussing probability distributions for discrete and continuous random variables, and concludes with a chapter on sampling distributions for means and proportions. The first of these chapters does not use the set-theoretic approach to probability, but instead places heavy emphasis on aids for probability calculations. An optional section on the Poisson distribution has been added to the second chapter in this part. The final chapter concludes with a discussion of stratified, cluster, and systematic sampling.

Part III, Basic Statistical Inference, covers point and interval estimation for means and proportions, hypothesis tests for mean and proportions, and simple linear regression. This material has been condensed from four chapters to three by combining pro-

portions with means in the first two chapters and moving chi-square to its own chapter in Part IV. Topics previously discussed in the chapters Inference for Means—Variance Known and Inference for Means—Variance Unknown have been reassigned to the more familiar areas of estimation and hypothesis testing.

Part IV, Further Topics in Statistical Inference, discusses inference from two samples, analysis of frequencies (chi-square), analysis of variance, multiple regression, and nonparametric statistics. An important addition is estimation of means and multiple contrasts in the analysis of variance chapter. The chapter on multiple regression has been completely revised. Topical coverage is much more extensive, and the chapter now is primarily concerned with interpreting computer output.

Part V, Additional Topics, comprises two chapters on time series and two on decision making. Expanding the discussion of decision making to two chapters allows a logical division of the material into a chapter concerned with prior information only and one using a combination of prior and sample information. This division offers instructors the flexibility to include only the first chapter if they desire or need to do so.

The first three parts of the book form a sequence that we consider appropriate for a one-term course. If only a single quarter is available, the essentials in these three sections can be covered by omitting optional topics and possibly some of the material on sampling methods. In courses extending over at least one semester, Inferences from Two Samples (Chapter 11), can be easily inserted between Hypothesis Tests for Means and Proportions (Chapter 9) and Simple Linear Regression and Correlation (Chapter 10). This sequence is, of course, the logical one in view of the statistical models involved. But one-term courses often omit two-sample inference and we chose to follow the prevailing teaching sequence for such cases.

A Student Supplement furnishes additional learning and practice aids, including programmed learning modules, self-correcting exercises with solutions, and practice examinations.

We wish to express our appreciation to the organizations and firms that responded to our requests for real applications of statistical methods. Sources of these materials are acknowledged in footnotes. We want to thank Jon Thompson of Wadsworth Publishing Company and the staff of Phoenix Publishing Services. Our appreciation is also extended to the BSBE Book Club, an informal group of experienced Wadsworth sales representatives who provided insights and suggestions on this revision over a two-year period: Charlie Delmar, Peter Fairchild, Pat Farrant, Myron Flemming, Jim Freel, Rich Giggy, Bill Hoffman, Kevin Howat, Steve Keeble, John Moroney, Mike Needham, Ragu Raghavan, and Herb Smith. We also want to acknowledge the many helpful suggestions made by colleagues, students, and reviewers. The reviewers are: Arthur Dayton, Kansas State University; Manfred W. Hopfe, California State University, Sacramento; Jeffrey Horen, University of Iowa; Ronald S. Koot, Pennsylvania State University; Donald Snyder, California State University, Los Angeles. Finally we want to thank the authors and publishers who gave us permission to reprint figures and tables. Their permissions are acknowledged in footnotes.

George W. Summers
William S. Peters
Charles P. Armstrong

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