

Statistics for Business and Economics

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**To my mother,
Margaret Olson,
and the memory of my father,
Stan Olson**

—D.O.

**To Karen, Kristen, and Robbie,
Hope it was all worth it.**

—J.L.

Preface

The title of this text, though simple, completely describes its intended purpose—to introduce the concepts of statistics to students planning to enter the world of business and economics. It has been our experience that students have difficulty mastering the very parts of statistics that will be most beneficial to them in their professional lives, namely:

1. understanding the basic underlying concepts of statistics;
2. selecting the appropriate statistical tests and procedures; and
3. applying test results to real-life business situations.

This book addresses these problems.

To the Instructor

The material contained in this text can easily be adapted to accommodate either a one- or two-semester course. Once the core material, Chapters 1–3 and 5–8, have been completed, the basic ideas of descriptive and inferential methods have been introduced and a number of paths may then be followed. Chapter 4, Probability, can be covered in sequence or relegated to the appendix depending on time constraints and its importance in the eyes of the professor. Any of the remaining topics—analysis of variance, regression and time series, index numbers, decision theory, chi-square, or nonparametrics—may then be tackled.

Many of the following features of this text are not emphasized in other works, but we have found them to minimize frustration, speed the student along the learning curve, challenge the curious, and address the three problems listed in the introductory paragraph:

- *An abundance of intuitive arguments and explanations that emphasize the understanding of ideas that “make sense” of statistics.* Rather than relying on rote memorization or a cookbook approach, we encourage the students to tackle both the “how” and “why” of statistical methods.
- *Emphasis on assumptions.* Assumptions underlying each test are presented as the test is introduced. Many of these discussions span an entire

section. In addition, each “test capsule” contains an assumption box that lists the assumptions. Hence, assumptions are offered in both fully descriptive and concise form to better aid the student in selecting the appropriate statistical tool.

- *Data analysis.* Students are encouraged to examine and analyze data in light of required distributional assumptions before selecting and performing hypothesis tests.
- *Hypothesis-test capsules.* Each major hypothesis test is first discussed in detail. This discussion is followed by a capsulized form of the test that emphasizes only the critical points, thus allowing the student to “zero in” on the crucial aspects of the test.
- *Highlighted examples set in business situations and presented with complete solutions and thorough interpretations.* Implications of various decisions are emphasized. The conclusion of nearly every example is analyzed in light of its impact on the company or business involved.
- *Timely topics and case studies.* In addition to classical statistical ideas, popular subjects such as control charts, box plots, and stem-and-leaf displays are given ample treatment. Case studies address recent developments in the business world and explore the conditions leading to and implications resulting from recent decisions.
- *Exercises at various levels of difficulty.* The text contains over 1200 end-of-section and end-of-chapter exercises. They range in difficulty from “plugging values into formulas” to synthesizing information and drawing conclusions. Many exercises are designed to be completed using a hand-held calculator, while others require the use of computer software. In addition, approximately 100 questions appearing in sections titled “On the Computer” are intended solely for use with a computer.
- *End-of-chapter summaries.* This section contains the usual list of formulas and symbols, but more importantly, it contains a section headed “Key Points.” Each point is a short statement regarding an important idea expanded on in the chapter. Together these points concisely summarize all chapter topics.
- *Computer emphasis.* Although this text can be used for classes in which computers are not available, ample opportunity is provided to experience the added power software provides. Actual computer output is integrated throughout the text as all major topics are introduced. Many of the exercises call for computer analysis; others encourage it. These exercises are identified in the text by a diskette symbol (■) beneath the exercise number. In addition, six sets of actual data are provided for analysis throughout the course of study. Students are guided through this analysis with questions in the section “On the Computer.” The six sets of data as well as the data from more than 125 end-of-chapter exercises are available on disk in both MINITAB and ASCII format.



To the Student

As you read your many business texts and explore the numerous business and economics magazines, newspapers, and journals in your library, you will

discover an increased emphasis on the use of statistical methodology in making business decisions. This emphasis becomes evident in most publications dating from the 1980s on. Much of this emphasis can be directly attributed to the implementation of statistics in the workplace by our international competitors, particularly the Japanese.

We view statistics as a field that allows us to collect, monitor, and analyze important information about any facet of an organization. Whether you work in accounting, economics, finance, information systems, management, marketing, production, or any other business division, you can help in the decision-making process by providing the best information possible. With this in mind, we have adopted a three-step approach in developing this text.

First, we have concentrated on understanding basic statistical ideas and the role they play in the analytical side of problem solving. Even a very small mistake in analysis can have a major and drastic impact on a final decision. Most of the calculations in this text can be easily completed with a standard hand-held calculator. We also offer you ample opportunity to apply computer power to statistical analysis. Most companies of the 1990s will have computer workstations in each office module, and statistics will play an important part in such an environment. Throughout the text we have made a point of illustrating how computers help us analyze problems. But the user who relies solely on the computer for analysis is foolish. Only a professional who understands the basic ideas behind the analyses can use them properly. We have chosen the MINITAB software package for most of our illustrations because of its popularity in the business and educational communities. If you have either a statistical package (MINITAB, SAS, SPSS, STATA, to name but a few) or a good spreadsheet package (LOTUS, SuperCalc, or EXCEL are a few examples), you will be able to complete most of the text exercises using computer assistance, and we urge you to do so.

Second, we have emphasized that the choice of the appropriate statistical procedure is a critical part of the decision-making process. The failure to use the appropriate statistical tool can result in poor decisions, false hopes, and major financial problems.

Third, we have stressed interpreting results in such a way that even a manager who is not statistically literate can understand the consequences of various actions. During our years in the classroom we have observed that most college students are good problem solvers. However, the best statistical analysis will be worthless if you fail to draw proper conclusions. Misinterpreted results or poorly drawn conclusions can be fatal for any company.

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Although the path to writing this text and meeting all our objectives has not been simple—it has been long and arduous—along the way many people helped us to produce this final product. To thank them all would be impossible, but a few stand out in our minds. The hours of editing and proofreading by the late Lynn Nichols will be remembered, along with his love of the language. The ORU word-processing department, especially Elaine Drain and Marcella Rodgers, was invaluable in preparing the manuscript during

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As authors we’ve learned a lot about working together. We started as business partners, but ended up friends.

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To all who contributed and to those who are about to join us, we hope you enjoy the journey as much as we have.

*Debra Olson Oltman
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