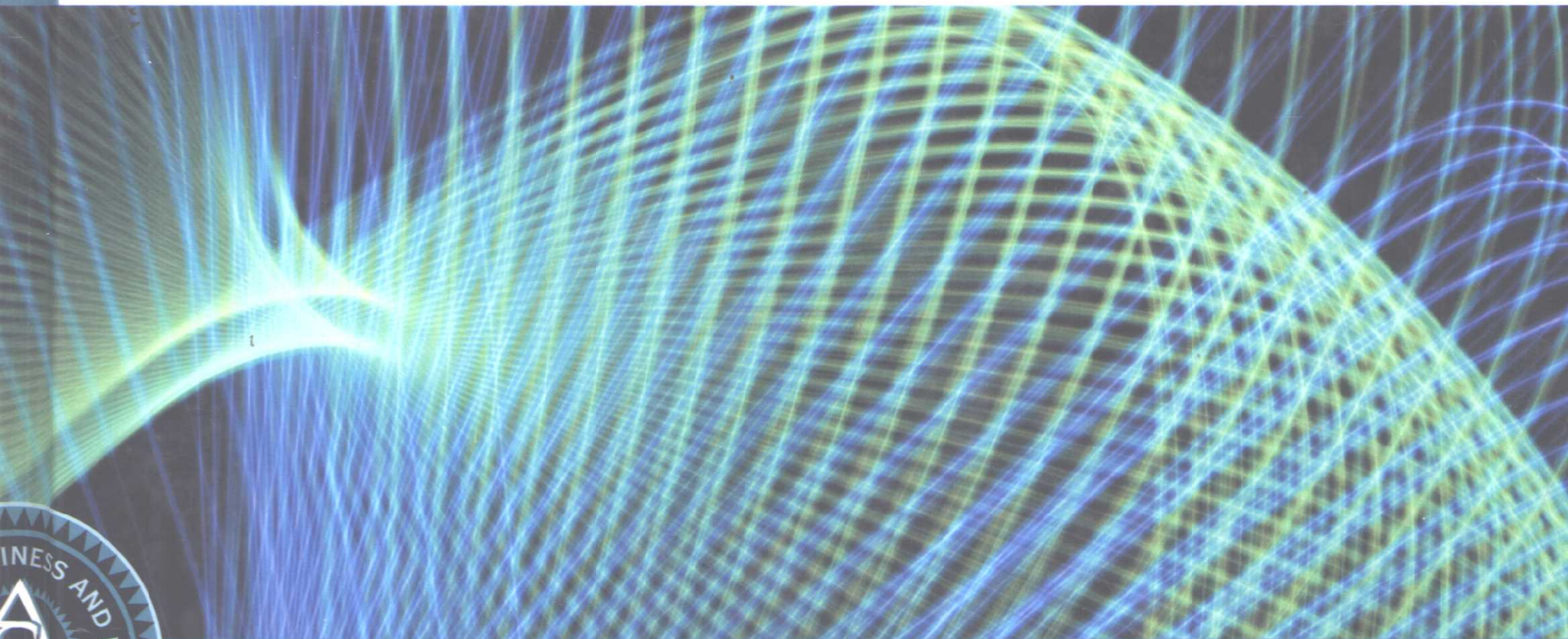


STATISTICS FOR BUSINESS AND ECONOMICS



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STATISTICS FOR BUSINESS AND ECONOMICS 8e

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Preface

The purpose of *STATISTICS FOR BUSINESS AND ECONOMICS* is to give students, primarily those in the fields of business administration and economics, a conceptual introduction to the field of statistics and its many applications. The text is applications oriented and written with the needs of the non-mathematician in mind; the mathematical prerequisite is knowledge of algebra.

Applications of data analysis and statistical methodology are an integral part of the organization and presentation of the text material. The discussion and development of each technique is presented in an application setting, with the statistical results providing insights to decisions and solution to problems.

Although the book is applications oriented, we have taken care to provide sound methodological development and to use notation that is generally accepted for the topic being covered. Hence, students will find that this text provides good preparation for the study of more advanced statistical material. A revised and updated bibliography to guide further study is included as an appendix.

CHANGES IN THE EIGHTH EDITION

We appreciate the acceptance and positive response to the previous editions of *STATISTICS FOR BUSINESS AND ECONOMICS*. Accordingly, in making modifications for this new edition, we have maintained the presentation style and readability of those editions. The significant changes in the new edition are summarized here.

Content Revisions

The following list summarizes selected content revisions for this edition.

- A discussion of levels of measurement for data (Chapter 1)
- More material on graphical and tabular descriptive statistics (Chapter 2)
- The use of Microsoft® Excel for random sampling (Chapter 7)
- An earlier discussion of the term *margin of error* and additional information on when to use z and when to use t for interval estimation
- More emphasis on computing and interpreting p -values (Chapters 9 through 12)
- Formulas for regression computations have been modified to emphasize intuition and deemphasize computational issues (Chapter 14)
- Updated index numbers including the CPI and DJIA (Chapter 17)

New Examples and Exercises Based on Real Data

We have added approximately 200 new examples and exercises based on real data and recent reference sources of statistical information. Using *The Wall Street Journal*, *USA Today*, *Fortune*, *Barron's*, various websites, and a variety of other sources, we have drawn upon actual studies to develop explanations and to create exercises that demonstrate many uses of statistics in business and economics. We believe that the use of real data helps generate more student interest in the material and enables the student to learn about both the statistical methodology and its application. The eighth edition of the text contains approximately 350 examples and exercises based on real data.

New Case Problems

We have added four new case problems to this edition, bringing the total number of case problems in the text to twenty-six. The new case problems, which are based on referenced data sets, appear in the chapters on internal estimation and regression. These case problems provide students with the opportunity to analyze somewhat larger data sets and prepare managerial reports based on the results of the analysis.

New Statistics in Practice

Each chapter begins with a statistics in practice article that describes an application of the statistical methodology to be covered in the chapter. Statistics in practice have been provided by practitioners at companies such as Procter & Gamble, Mead, Dollar General, Colgate-Palmolive, Polaroid, Monsanto, and others. This edition includes two new statistics in practice: Small Fry Design (Chapter 3) and Citigroup (Chapter 5).

MINITAB and Excel Appendices

MINITAB and Excel Spreadsheet appendices appear at the end of most chapters. These appendices provide step-by-step procedures that make it easy for the student to use MINITAB or Excel to conduct the statistical analysis presented in the chapter. All appendices have been updated for the latest versions of MINITAB and Excel. The Excel appendix for descriptive statistics (Chapter 2) now includes the use of the function wizard, the chart wizard, and the pivot table report. These procedures expose the student to the extensive capabilities of Excel for creating graphical presentations and for developing crosstabulations. A total of ten new and/or revised appendices appear at the end of the chapters on descriptive statistics, sampling, interval estimation, hypothesis testing, and tests of independence.

FEATURES AND PEDAGOGY

We have continued many of the features that appeared in previous editions. Some of the important ones are noted here.

Methods Exercises and Applications Exercises

The end-of-section exercises are split into two parts, Methods and Applications. The Methods exercises require students to use the formulas and make the necessary computations. The Applications exercises require students to use the chapter material in real-world situations. Thus, 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 those exercises are provided in Appendix E at the back of the book. Students can attempt the self-test exercises and immediately check the solution to evaluate their understanding of the concepts presented in the chapter.

Notes and Comments

At the end of many sections, we provide Notes and Comments designed to give the student additional insights about the statistical methodology and its application. Notes and Comments include warnings about or limitations of the methodology, recommendations for application, brief descriptions of additional technical considerations, and other matters.

Data Sets Accompany the Text

Over 100 data sets are now available on the CD-rom that is packaged with the text. The data sets are available in both MINITAB and Excel formats. Data set logos are used in the text to identify the data sets that are available on the CD. Data sets for all case problems as well as data sets for larger exercises are included on the CD.

ANCILLARY TEACHING AND LEARNING MATERIALS

WebTutor™, a brand new electronic ancillary, is available with the new edition of *STATISTICS FOR BUSINESS AND ECONOMICS*. There are two main formats for this product:

- WebTutor is used by an entire class under the directions of the instructor. It provides Web-based learning resources to students as well as powerful communication and other course management tools including course calendar, chat, and e-mail for instructors. WebTutor is available on WebCT and Blackboard. See <http://webtutor.thomsonlearning.com> for more information.
- Personal WebTutor provides the learning resources for individual students to purchase and use for study and review. See <http://pwt.swcollege.com> for more information about this product.

Three print ancillaries are available to students either through their bookstore or for direct purchase through the on-line catalog at www.swcollege.com.

- Prepared by Mohammad Ahmadi of the University of Tennessee-Chattanooga, the **Work Book** (ISBN: 0-324-06676-7) will provide the student with significant supplementary study materials. It contains an outline, review, and list of formulas each text chapter, sample exercises with step-by-step solutions, exercises with answers, and a series of self-testing questions with answers.
- Another student ancillary is the **Microsoft® Excel Companion for Business Statistics** (ISBN: 0-324-06898-0) by David Eldredge of Murray State College. This manual provides step-by-step instructions for using Excel to solve many of the problems included in introductory business statistics. Directions for Excel 2000 and Excel 97 are included.
- **Solutions Manual** At the request of the instructor, a print version of the Solutions Manual can be packaged with the text for student purchase.

The following instructor support materials are available to adopters from the Thomson Learning™ Academic Resource Center at 800-423-0563 or through www.swcollege.com:

- **Instructor's Resource CD** (ISBN: 0-324-06674-0)—All instructor ancillaries are provided on a single CD-rom. Included in this convenient format are:
 - **Solutions Manual**—The Solutions Manual, prepared by the authors, includes solutions for all problems in the text.
 - **Instructor's Manual**—The Instructor's Manual, also prepared by the authors, contains solutions to all case problems presented in the text.
 - **PowerPoint™ Presentation Slides**—Prepared by John Loucks of St. Edward's University, the presentation slides contain a teaching outline that incorporates graphics to help instructors create even more stimulating lectures. The PowerPoint 97 slides may be adapted using PowerPoint software to facilitate classroom use.
 - **Test Bank and ExamView™**—Prepared also by Mohammad Ahmadi, the Test Bank includes true/false, multiple choice, short answer questions, and problems for each chapter. ExamView computerized testing software allows instructors to create, edit, store, and print exams.

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David R. Anderson
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Thomas A. Williams

About the Authors

David R. Anderson. David R. Anderson is Professor of Quantitative Analysis in the College of Business Administration at the University of Cincinnati. Born in Grand Forks, North Dakota, he earned his B.S., M.S., and Ph.D. degrees from Purdue University. Professor Anderson has served as Head of the Department of Quantitative Analysis and Operations Management and as Associate Dean of the College of Business Administration. In addition, he was the coordinator of the College's first Executive Program.

At the University of Cincinnati, Professor Anderson has taught introductory statistics for business students as well as graduate-level courses in regression analysis, multivariate analysis, and management science. He has also taught statistical courses at the Department of Labor in Washington, D.C. He has been honored with nominations and awards for excellence in teaching and excellence in service to student organizations.

Professor Anderson has coauthored nine textbooks in the areas of statistics, management science, linear programming, and production and operations management. He is an active consultant in the field of sampling and statistical methods.

Dennis J. Sweeney. Dennis J. Sweeney is Professor of Quantitative Analysis and Director of the Center for Productivity Improvement at the University of Cincinnati. Born in Des Moines, Iowa, he earned a B.S.B.A. degree from Drake University and his M.B.A. and D.B.A. degrees from Indiana University where he was an NDEA Fellow. During 1978-79, Professor Sweeney worked in the management science group at Procter & Gamble; during 1981-82, he was a visiting professor at Duke University. Professor Sweeney served as Head of the Department of Quantitative Analysis and as Associate Dean of the College of Business Administration at the University of Cincinnati.

Professor Sweeney has published more than 30 articles and monographs in the area of management science and statistics. The National Science Foundation, IBM, Procter & Gamble, Federated Department Stores, Kroger, and Cincinnati Gas & Electric have funded his research, which has been published in *Management Science*, *Operations Research*, *Mathematical Programming*, *Decision Sciences*, and other journals.

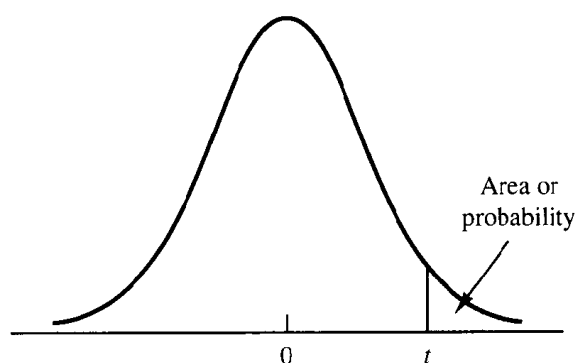
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Before joining the College of Business at RIT, Professor Williams served for seven years as a faculty member in the College of Business Administration at the University of Cincinnati, where he developed the undergraduate program in Information Systems and then served as its coordinator. At RIT he was the first chairman of the Decision Sciences Department. He teaches courses in management science and statistics, as well as graduate courses in regression and decision analysis.

Professor Williams is the coauthor of ten textbooks in the areas of management science, statistics, production and operations management, and mathematics. He has been a consultant for numerous *Fortune* 500 companies and has worked on projects ranging from the use of data analysis to the development of large-scale regression models.

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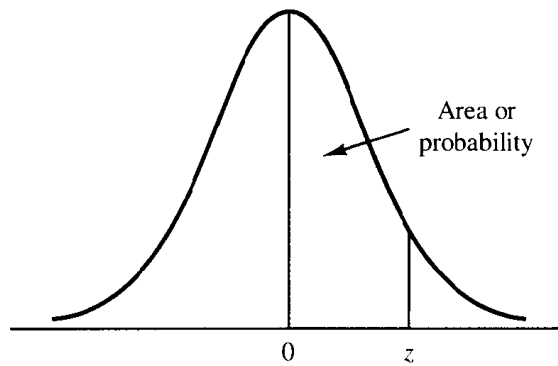


Entries in the table give *t* values for an area or probability in the upper tail of the *t* distribution. For example, with 10 degrees of freedom and a .05 area in the upper tail, $t_{.05} = 1.812$.

Degrees of Freedom	Area in Upper Tail				
	.10	.05	.025	.01	.005
1	3.078	6.314	12.706	31.821	63.657
2	1.886	2.920	4.303	6.965	9.925
3	1.638	2.353	3.182	4.541	5.841
4	1.533	2.132	2.776	3.747	4.604
5	1.476	2.015	2.571	3.365	4.032
6	1.440	1.943	2.447	3.143	3.707
7	1.415	1.895	2.365	2.998	3.499
8	1.397	1.860	2.306	2.896	3.355
9	1.383	1.833	2.262	2.821	3.250
10	1.372	1.812	2.228	2.764	3.169
11	1.363	1.796	2.201	2.718	3.106
12	1.356	1.782	2.179	2.681	3.055
13	1.350	1.771	2.160	2.650	3.012
14	1.345	1.761	2.145	2.624	2.977
15	1.341	1.753	2.131	2.602	2.947
16	1.337	1.746	2.120	2.583	2.921
17	1.333	1.740	2.110	2.567	2.898
18	1.330	1.734	2.101	2.552	2.878
19	1.328	1.729	2.093	2.539	2.861
20	1.325	1.725	2.086	2.528	2.845
21	1.323	1.721	2.080	2.518	2.831
22	1.321	1.717	2.074	2.508	2.819
23	1.319	1.714	2.069	2.500	2.807
24	1.318	1.711	2.064	2.492	2.797
25	1.316	1.708	2.060	2.485	2.787
26	1.315	1.706	2.056	2.479	2.779
27	1.314	1.703	2.052	2.473	2.771
28	1.313	1.701	2.048	2.467	2.763
29	1.311	1.699	2.045	2.462	2.756
30	1.310	1.697	2.042	2.457	2.750
40	1.303	1.684	2.021	2.423	2.704
60	1.296	1.671	2.000	2.390	2.660
120	1.289	1.658	1.980	2.358	2.617
∞	1.282	1.645	1.960	2.326	2.576

area 1.06

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Entries in the table give the area under the curve between the mean and z standard deviations above the mean. For example, for $z = 1.25$ the area under the curve between the mean and z is .3944.

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
.0	.0000	.0040	.0080	.0120	.0160	.0199	.0239	.0279	.0319	.0359
.1	.0398	.0438	.0478	.0517	.0557	.0596	.0636	.0675	.0714	.0753
.2	.0793	.0832	.0871	.0910	.0948	.0987	.1026	.1064	.1103	.1141
.3	.1179	.1217	.1255	.1293	.1331	.1368	.1406	.1443	.1480	.1517
.4	.1554	.1591	.1628	.1664	.1700	.1736	.1772	.1808	.1844	.1879
.5	.1915	.1950	.1985	.2019	.2054	.2088	.2123	.2157	.2190	.2224
.6	.2257	.2291	.2324	.2357	.2389	.2422	.2454	.2486	.2518	.2549
.7	.2580	.2612	.2642	.2673	.2704	.2734	.2764	.2794	.2823	.2852
.8	.2881	.2910	.2939	.2967	.2995	.3023	.3051	.3078	.3106	.3133
.9	.3159	.3186	.3212	.3238	.3264	.3289	.3315	.3340	.3365	.3389
1.0	.3413	.3438	.3461	.3485	.3508	.3531	.3554	.3577	.3599	.3621
1.1	.3643	.3665	.3686	.3708	.3729	.3749	.3770	.3790	.3810	.3830
1.2	.3849	.3869	.3888	.3907	.3925	.3944	.3962	.3980	.3997	.4015
1.3	.4032	.4049	.4066	.4082	.4099	.4115	.4131	.4147	.4162	.4177
1.4	.4192	.4207	.4222	.4236	.4251	.4265	.4279	.4292	.4306	.4319
1.5	.4332	.4345	.4357	.4370	.4382	.4394	.4406	.4418	.4429	.4441
1.6	.4452	.4463	.4474	.4484	.4495	.4505	.4515	.4525	.4535	.4545
1.7	.4554	.4564	.4573	.4582	.4591	.4599	.4608	.4616	.4625	.4633
1.8	.4641	.4649	.4656	.4664	.4671	.4678	.4686	.4693	.4699	.4706
1.9	.4713	.4719	.4726	.4732	.4738	.4744	.4750	.4756	.4761	.4767
2.0	.4772	.4778	.4783	.4788	.4793	.4798	.4803	.4808	.4812	.4817
2.1	.4821	.4826	.4830	.4834	.4838	.4842	.4846	.4850	.4854	.4857
2.2	.4861	.4864	.4868	.4871	.4875	.4878	.4881	.4884	.4887	.4890
2.3	.4893	.4896	.4898	.4901	.4904	.4906	.4909	.4911	.4913	.4916
2.4	.4918	.4920	.4922	.4925	.4927	.4929	.4931	.4932	.4934	.4936
2.5	.4938	.4940	.4941	.4943	.4945	.4946	.4948	.4949	.4951	.4952
2.6	.4953	.4955	.4956	.4957	.4959	.4960	.4961	.4962	.4963	.4964
2.7	.4965	.4966	.4967	.4968	.4969	.4970	.4971	.4972	.4973	.4974
2.8	.4974	.4975	.4976	.4977	.4977	.4978	.4979	.4979	.4980	.4981
2.9	.4981	.4982	.4982	.4983	.4984	.4984	.4985	.4985	.4986	.4986
3.0	.4986	.4987	.4987	.4988	.4988	.4989	.4989	.4989	.4990	.4990

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