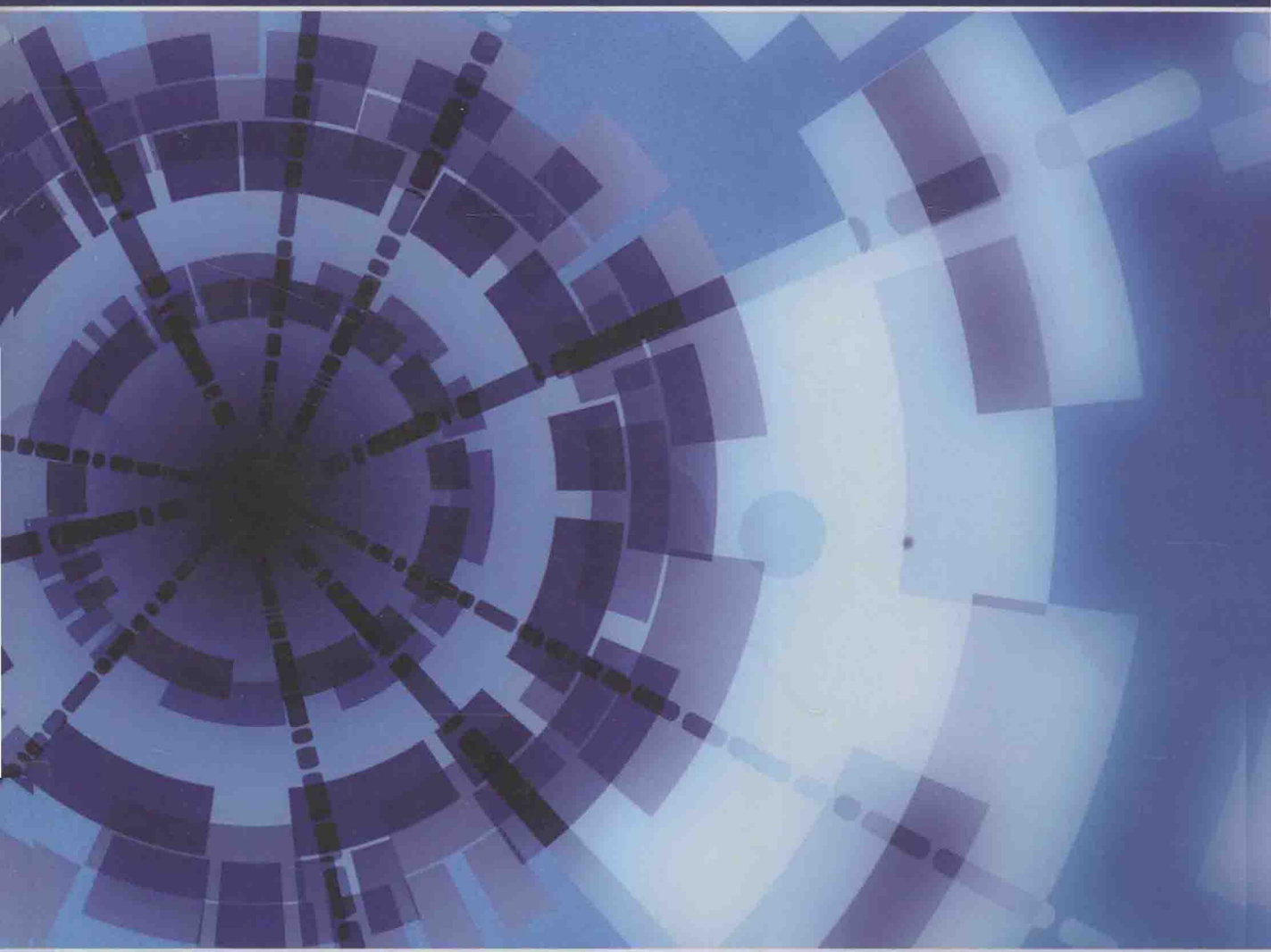
STATISTICS, DATA ANALYSIS, AND DECISION MODELING

FOURTH EDITION



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JAMES R. EVANS

Statistics, Data Analysis, and Decision Modeling

FOURTH EDITION

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To Beverly, Kristin, and Lauren, for all their love and understanding.

—James R. Evans

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Useful Statistical Functions in Excel	*Description*
AVERAGE(*data range*)	Computes the average value (arithmetic mean) of a set of data.
BETADIST(*x, alpha, beta, A, B*)	Returns the cumulative beta density function.
BINOMDIST(*number_s, trials, probability_s, cumulative*)	Returns the individual term binomial distribution.
CHITEST(*actual_range, expected_range*)	Returns the test for independence; the value of the chi-square distribution and the appropriate degrees of freedom.
CONFIDENCE(*alpha, standard_dev, size*)	Returns the confidence interval for a population mean.
CORREL(*arrayl, array2*)	Computes the correlation coefficient between two data sets.
EXPONDIST(*x, lambda, cumulative*)	Returns the exponential distribution.
FORECAST(*x, known_y's, known_x's*)	Calculates a future value along a linear trend.
GAMMADIST(*x, alpha, beta, cumulative*)	Returns the gamma distribution.
GROWTH(*known_y's, known_x's, new_x's, constant*)	Calculates predicted exponential growth.
LINEST(*known_y's, known_x's, new_x's, constant, stats*)	Returns an array that describes a straight line that best fits the data.
LOGNORMDIST(*x, mean, standard_deviation*)	Returns the cumulative lognormal distribution of x, where $\ln(x)$ is normally distributed with parameters mean and standard deviation.
MEDIAN(*data range*)	Computes the median (middle value) of a set of data.
MODE(*data range*)	Computes the mode (most frequently occurring) of a set of data.
NORMDIST(*x, mean, standard_deviation, cumulative*)	Returns the normal cumulative distribution for the specified mean and standard deviation.
NORMSDIST(*z*)	Returns the standard normal cumulative distribution (mean = 0, standard deviation = 1).
PERCENTILE(*array, k*)	Computes the kth percentile of data in a range.
POISSON(*x, mean, cumulative*)	Returns the Poisson distribution.
QUARTILE(*array, quart*)	Computes the quartile of a distribution.
SKEW(*data range*)	Computes the skewness, a measure of the degree to which a distribution is not symmetric around its mean.
STANDARDIZE(*x, mean, standard_deviation*)	Returns a normalized value for a distribution characterized by a mean and standard deviation.
STDEV(*data range*)	Computes the standard deviation of a set of data, assumed to be a sample.
STDEVP(*data range*)	Computes the standard deviation of a set of data, assumed to be an entire population.
TREND(*known_y's, known_x's, new_x's, constant*)	Returns values along a linear trend line.
TTEST(*arrayl, array2, tails, type*)	Returns the probability associated with a *t*-test.
VAR(*data range*)	Computes the variance of a set of data, assumed to be a sample.
VARP(*data range*)	Computes the variance of a set of data, assumed to be an entire population.
WEIBULL(*x, alpha, beta, cumulative*)	Returns the Weibull distribution.
ZTEST(*array, x, sigma*)	Returns the two-tailed *p*-value of a *z*-test.

PREFACE

INTENDED AUDIENCE

Statistics, Data Analysis, and Decision Modeling was written to meet the need for an introductory text that provides a basic introduction to business statistics and decision models/optimization, focusing on practical applications of data analysis and decision modeling, all presented in a simple and straightforward fashion.

The text consists of 14 chapters in two distinct parts. The first eight chapters deal with statistical and data analysis topics, while the remaining chapters deal with decision models and applications. Thus, the text may be used for:

- MBA or undergraduate business programs that combine topics in business statistics and management science into a single, brief, quantitative methods course.
- Business programs that teach statistics and management science in short, modular courses.
- Executive MBA programs.
- Graduate refresher courses for business statistics and management science.

SUBSTANCE

The danger in using quantitative methods does not generally lie in the inability to perform the requisite calculations, but rather in the lack of a fundamental understanding of why to use a procedure, how to use it correctly, and how to properly interpret results. The principal focus of this text is conceptual understanding using simple and practical examples rather than a plug-and-chug or point-and-click mentality, as are often done in other texts, supplemented by appropriate theory. On the other hand, the text does not attempt to be an encyclopedia of detailed quantitative procedures, but focuses in on useful concepts and tools for today's managers.

To support the presentation of topics in business statistics and decision modeling, this text integrates fundamental theory and practical applications in a spreadsheet environment using *Microsoft Excel 2007* and various spreadsheet add-ins, specifically:

- *PHStat*, a collection of statistical tools that enhance the capabilities of Excel; published by Pearson Education.
- A time limited professional version of *Crystal Ball* (including *CBPredictor* for forecasting and *OptQuest* for optimization), the most popular commercial package for risk analysis.
- *TreePlan*, a decision analysis add-in.
- *SimQuick*, an Excel-based application for process simulation, published by Pearson Education.
- *Premium Solver*, a more powerful version of Excel's Solver.

These tools have been integrated throughout the text to simplify the presentations and implement tools and calculations so that more focus can be placed on interpretation

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and understanding the managerial implications of results. However, as not to disrupt the flow of the text discussion and distract from conceptual understanding, we have placed boxed "Notes" for Excel, *PHStat*, and other add-ins that provide procedural details of using specific functions, tools, or techniques where appropriate.

New to This Edition

The fourth edition of this text has been substantially re-written to improve clarity and pedagogical features. Many significant changes have been made in this edition. These changes include the following.

1. Spreadsheet-based tools and applications are now compatible with *Microsoft Excel 2007*, which is used throughout this edition.
2. Every chapter has been carefully revised to improve clarity of the material. Many explanations of critical concepts have been enhanced using new business examples and data sets.
3. Key decision modeling chapters in Part 2 of this book have been significantly revised and reorganized. These are Chapter 9–*Building and Using Decision Models*, Chapter 13–*Linear Optimization*, and Chapter 14–*Integer and Nonlinear Optimization*.
4. Theory and extensive computational formulas have been relegated to end of chapter Appendixes to provide better flexibility for instructors, and not impede learning essential concepts and skills.
5. End-of-chapter material has been enhanced and reorganized to include *Basic Concepts Review Questions* that focus on the understanding of fundamental terms concepts; *Skill-Building Exercises* that facilitate experiential learning and Excel-based skills, and *Problems and Applications*, which provide a wide variety of numerical exercises and practical applications to real and/or realistic data sets or problem scenarios. New cases are introduced in most chapters.

To the Students

The CD-ROM accompanying this text contains all the data and model files used throughout the text in examples, problems, and exercises. These are also available on the text's Web site, www.pearsonhighered.com/evans. Versions of a variety of software packages, including *PHStat, SimQuick, Crystal Ball*, and *Premium Solver*, are also available in connection with this text. For complete information on these, please also visit www.pearsonhighered.com/evans.

To the Instructors

To access instructor solutions files please visit pearsonhighered.com/evans and choose the instructor resources option. A variety of instructor resources are available for instructors who register for our secure environment. The files for each chapter, including PowerPoint presentations, are available for download.

As a registered faculty member, you can login directly to download resource files, and receive immediate access and instructions for installing Course Management content to your campus server.

Need help? Our dedicated Technical Support team is ready to assist instructors with questions about the media supplements that accompany this text. Visit: http://247.pearsoned.com/ for answers to frequently asked questions and toll-free user support phone numbers.

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I would like to thank the following individuals who have provided reviews and insightful suggestions for this edition:

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In addition, I thank the many students over the years who provided numerous suggestions, data sets and problem ideas, and insights into how to better present the material. Finally, appreciation goes to my editor Mark Pfaltzgraff, Ann Pulido, Susie Abraham, and the entire production staff at Pearson Education, for their dedication in developing and producing this text. If you have any suggestions or corrections, please contact me via email at james.evans@uc.edu.

James R. Evans
University of Cincinnati

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