

GLOBAL  
EDITION



# Basic Business Statistics

## *Concepts and Applications*

THIRTEENTH EDITION

Berenson • Levine • Szabat

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# BREAKTHROUGH

To improving results

## MyStatLab™ for Business Statistics

MyStatLab is a course management system that provides engaging learning experiences and delivers proven results while helping students succeed. Tools are embedded which make it easy to integrate statistical software into the course. And, MyStatLab comes from an experienced partner with educational expertise and an eye on the future.

### Tutorial Exercises

MyStatLab homework and practice exercises correlated to the exercises in the textbook are generated algorithmically, giving students unlimited opportunity for practice and mastery. MyStatLab grades homework and provides feedback and guidance.

Homework: Homework Ch. 13

Ex. Score: 0 of 1 pt HW Score: 0% (0 of 4 pts) 0 of 4 complete

The value of a sports franchise is directly related to the amount of revenue that a franchise can generate. The accompanying data table gives the value and the annual revenue for 15 major sport teams. Suppose you want to develop a simple linear regression model to predict franchise value based on annual revenue generated. Complete parts (a) through (d) below.

Click the icon to view the table of franchise values and annual revenues.

a. Construct a scatter plot. Choose the correct graph below.

b. Use the least-squares method to determine the regression coefficients  $b_0$  and  $b_1$ .

$b_0 = -486.8837$   
 $b_1 = 4.7062$   
(Round to four decimal places as needed.)

c. Interpret the meaning of  $b_0$  and  $b_1$ . Choose the correct answer below.

A practical interpretation of the Y-intercept,  $b_0$ , is not meaningful because no sports franchise is going to have a revenue of zero. The slope,  $b_1$ , implies that for each increase of 1 million dollars in annual revenue, the franchise value is expected to increase by the value of  $b_1$ , in millions of dollars.

Question is complete.

All parts showing Similar Exercise Save

**Help Me Solve This** breaks the problem into manageable steps. Students enter answers along the way.

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Copy our data sets, from the eText and the MyStatLab questions, into software such as StatCrunch, Minitab, Excel, and more. Students have access to support tools—videos, Study Cards, and manuals for select titles—to learn how to use statistical software.

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	<b>Graphing Calculator Help</b>
	▶ Use the <a href="#">Graphing Calculator Tutorial for Statistics</a> to learn basic TI calculator functions.

## StatCrunch

MyStatLab includes web-based statistical software, StatCrunch, within the online assessment platform so that students can analyze data sets from exercises and the text. In addition, MyStatLab includes access to **www.StatCrunch.com**, the full web-based program where users can access thousands of shared data sets, create and conduct online surveys, perform complex analyses using the powerful statistical software, and generate compelling reports.

## Engaging Video Resources

- **Business Insight Videos** are 10 engaging videos showing managers at top companies using statistics in their everyday work. Assignable questions encourage discussion.
- **StatTalk Videos**, hosted by fun-loving statistician Andrew Vickers, demonstrate important statistical concepts through interesting stories and real-life events. This series of 24 videos includes available assessment questions and an instructor's guide.

## PHStat™ (access code required)

PHStat is a statistics add-in for Microsoft Excel that simplifies the task of operating Excel, creating real Excel worksheets that use in-worksheet calculations. Download PHStat by visiting [www.pearsonhighered.com/phstat](http://www.pearsonhighered.com/phstat) or through a link in MyStatLab's Tools for Success, access code required.

This book features PHStat version 4 which is compatible with all current Microsoft Windows and (Mac) OS X Excel versions.



# A ROADMAP FOR SELECTING A STATISTICAL METHOD

Data Analysis Task	For Numerical Variables	For Categorical Variables
<b>Describing a group or several groups</b>	<p>Ordered array, stem-and-leaf display, frequency distribution, relative frequency distribution, percentage distribution, cumulative percentage distribution, histogram, polygon, cumulative percentage polygon, bullet maps, sparklines, gauges, treemaps <b>(Sections 2.2, 2.4, 17.1)</b></p> <p>Mean, median, mode, geometric mean, quartiles, range, interquartile range, standard deviation, variance, coefficient of variation, skewness, kurtosis, boxplot, normal probability plot <b>(Sections 3.1, 3.2, 3.3, 6.3)</b></p> <p>Index numbers <b>(online Section 16.8)</b></p> <p>Gauges, bullet graphs, and treemaps <b>(Section 17.1)</b></p>	<p>Summary table, bar chart, pie chart, Pareto chart <b>(Sections 2.1 and 2.3)</b></p>
<b>Inference about one group</b>	<p>Confidence interval estimate of the mean <b>(Sections 8.1 and 8.2)</b></p> <p><math>t</math> test for the mean <b>(Section 9.2)</b></p> <p>Chi-square test for a variance or standard deviation <b>(online Section 12.7)</b></p>	<p>Confidence interval estimate of the proportion <b>(Section 8.3)</b></p> <p>Z test for the proportion <b>(Section 9.4)</b></p>
<b>Comparing two groups</b>	<p>Tests for the difference in the means of two independent populations <b>(Section 10.1)</b></p> <p>Wilcoxon rank sum test <b>(Section 12.4)</b></p> <p>Paired <math>t</math> test <b>(Section 10.2)</b></p> <p><math>F</math> test for the difference between two variances <b>(Section 10.4)</b></p> <p>Wilcoxon signed ranks test <b>(online Section 12.8)</b></p>	<p>Z test for the difference between two proportions <b>(Section 10.3)</b></p> <p>Chi-square test for the difference between two proportions <b>(Section 12.1)</b></p> <p>McNemar test for two related samples <b>(online Section 12.6)</b></p>
<b>Comparing more than two groups</b>	<p>One-way analysis of variance for comparing several means <b>(Section 11.1)</b></p> <p>Kruskal-Wallis test <b>(Section 12.5)</b></p> <p>Randomized block design <b>(Section 11.2)</b></p> <p>Two-way analysis of variance <b>(Section 11.3)</b></p> <p>Friedman rank test <b>(online Section 12.9)</b></p>	<p>Chi-square test for differences among more than two proportions <b>(Section 12.2)</b></p>
<b>Analyzing the relationship between two variables</b>	<p>Scatter plot, time series plot <b>(Section 2.5)</b></p> <p>Covariance, coefficient of correlation <b>(Section 3.5)</b></p> <p>Simple linear regression <b>(Chapter 13)</b></p> <p><math>t</math> test of correlation <b>(Section 13.7)</b></p> <p>Time-series forecasting <b>(Chapter 16)</b></p> <p>Sparklines <b>(Section 17.1)</b></p>	<p>Contingency table, side-by-side bar chart, PivotTables <b>(Sections 2.1, 2.3, 2.6)</b></p> <p>Chi-square test of independence <b>(Section 12.3)</b></p>
<b>Analyzing the relationship between two or more variables</b>	<p>Multiple regression <b>(Chapters 14 and 15)</b></p> <p>Regression trees <b>(Section 17.3)</b></p> <p>Neural nets <b>(Section 17.4)</b></p> <p>Cluster analysis <b>(Section 17.5)</b></p> <p>Multidimensional scaling <b>(Section 17.6)</b></p>	<p>Multidimensional contingency tables <b>(Section 2.7)</b></p> <p>Drilldown and slicers <b>(Section 17.1)</b></p> <p>Logistic regression <b>(Section 14.7)</b></p> <p>Classification trees <b>(Section 17.3)</b></p> <p>Neural nets <b>(Section 17.4)</b></p>

# Basic Business Statistics Concepts and Applications

THIRTEENTH EDITION  
GLOBAL EDITION

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Over the years, Berenson has received several awards for teaching and for innovative contributions to statistics education. In 2005, he was the first recipient of the Catherine A. Becker Service for Educational Excellence Award at Montclair State University and, in 2012, he was the recipient of the Khubani/Telebrands Faculty Research Fellowship in the School of Business.

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*To our spouses and children,  
Rhoda, Marilyn, Kathy, Lori, and Sharyn*

---

*and to our parents, in loving memory,  
Nat, Ethel, Lee, Reuben, Mary, and William*



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**THINK ABOUT THIS: Risky Business****USING STATISTICS: Reliable Decision-Making, Revisited**

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# Preface

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Over a generation ago, advances in “data processing” led to new business opportunities as first centralized and then desktop computing proliferated. The Information Age was born. Computer science became much more than just an adjunct to a mathematics curriculum, and whole new fields of studies, such as computer information systems, emerged.

More recently, further advances in information technologies have combined with data analysis techniques to create new opportunities in what is more data *science* than data *processing* or *computer science*. The world of business statistics has grown larger, bumping into other disciplines. And, in a reprise of something that occurred a generation ago, new fields of study, this time with names such as informatics, data analytics, and decision science, have emerged.

This time of change makes what is taught in business statistics and how it is taught all the more critical. These new fields of study all share statistics as a foundation for further learning. We are accustomed to thinking about change, as seeking ways to continuously improve the teaching of business statistics have always guided our efforts. We actively participate in Decision Sciences Institute (DSI), American Statistical Association (ASA), and Making Statistics More Effective in Schools and Business (MSMESB) conferences. We use the ASA’s Guidelines for Assessment and Instruction (GAISE) reports and combine them with our experiences teaching business statistics to a diverse student body at several large universities.

What to teach and how to teach it are particularly significant questions to ask during a time of change. As an author team, we bring a unique collection of experiences that we believe helps us find the proper perspective in balancing the old and the new. Our two lead authors, Mark L. Berenson and David M. Levine, were the first educators to create a business statistics textbook that discussed using statistical software and incorporated “computer output” as illustrations—just the first of many teaching and curricular innovations in their many years of teaching business statistics. Our newest co-author, Kathryn A. Szabat, has provided statistical advice to various business and nonbusiness communities. Her background in statistics and operations research and her experiences interacting with professionals in practice have guided her, as departmental chair, in developing a new, interdisciplinary academic department, Business Systems and Analytics, in response to the technology- and data-driven changes in business today.

All three of us benefit from our many years teaching undergraduate business subjects and the diversity of interests and efforts of our past co-author, Timothy Krehbiel. We are pleased to offer the innovations and new content that are itemized starting on the next page. As in prior editions, we are guided by these key learning principles:

- Help students see the relevance of statistics to their own careers by providing examples drawn from the functional areas in which they may be specializing.
- Emphasize interpretation of statistical results over mathematical computation.
- Give students ample practice in understanding how to apply statistics to business.
- Familiarize students with how to use statistical software to assist business decision making.
- Provide clear instructions to students for using statistical applications.

Read more about these principles on page 27.

## What’s New and Innovative in This Edition?

This thirteenth edition of *Basic Business Statistics* contains both new and innovative features and content, while refining and extending the use of the DCOVA (**D**efine, **C**ollect, **O**rganize, **V**isualize, and **A**nalyze) framework, first introduced in the twelfth edition as an integrated approach for applying statistics to help solve business problems.

## Innovations

**Getting Started: Important Things to Learn First**—In a time of change, you can never know exactly what knowledge and background students bring into an introductory business statistics classroom. Add that to the need to curb the fear factor about learning statistics that so many students begin with, and there’s a lot to cover even before you teach your first statistical concept.

We created “Getting Started: Important Things to Learn First” to meet this challenge. This unit sets the context for explaining what statistics is (not what students may think!) while ensuring that all students share an understanding of the forces that make learning business statistics critically important today. Especially designed for instructors teaching with course management tools, including those teaching hybrid or online courses, “Getting Started” has been developed to be posted online or otherwise distributed before the first class section begins and is available for download as explained in Appendix C.

**Student Tips**—In-margin notes reinforce hard-to-master concepts and provide quick study tips for mastering important details.

**Discussion of Business Analytics**—“Getting Started: Important Things to Learn First” quickly defines *business analytics* and *big data* and notes how these things are changing the face of statistics.

This material serves as an introduction to the new “Business Analytics” chapter (Chapter 17). This new chapter begins with a scenario that uses the management of a theme park to introduce applications of business analytics. The chapter begins by discussing descriptive visualization methods used for general oversight and applies them to issues raised in the scenario. Using other examples, the chapter then discusses the predictive analytics methods classification and regression trees, neural nets, cluster analysis, and multidimensional scaling that are in common use today.

Because standard Microsoft Excel and Minitab offer little or no support for the methods discussed, the chapter uses results created using JMP, the interactive data analysis software from the SAS Institute, and Tableau Public, the Web-based data visualization tool from Tableau Software, where appropriate. For those interested, a special *Software Guide* located at the end of the chapter explains how to use these two programs (and Microsoft Excel) to construct the results shown in the chapter.

**PHStat version 4**—For Microsoft Excel users, this new version of the Pearson Education statistics add-in contains several new and enhanced procedures, simpler set up, and is compatible with both Microsoft Windows and (Mac) OS X Excel versions.

**Chapter Short Takes** Online PDF documents (available for download as explained in Appendix C) that supply additional insights or explanations to important statistical concepts or details about the results presented in this book.

## Revised and Enhanced Content

**New Continuing End-of-Chapter Cases**—This thirteenth edition features several new end-of-chapter cases. New and recurring throughout the book is a case that concerns analysis of sales and marketing data for home fitness equipment (CardioGood Fitness), a case that concerns pricing decisions made by a retailer (Sure Value Convenience Stores), and the More Descriptive Choices Follow-Up case, which extends the use of the retirement funds sample first introduced in Chapter 2. Also recurring is the Clear Mountain State Student Surveys case, which uses data collected from surveys of undergraduate and graduate students to practice and reinforce statistical methods learned in various chapters. This case replaces end-of-chapter questions related to the student survey database in the previous edition. Joining the Mountain States Potato Company regression case of the previous edition are new cases in simple linear regression (Brynne Packaging) and multiple regression (The Craybill Instrumentation Company).

**Many New Applied Examples and Problems**—Many of the applied examples throughout this book use new problems or revised data. Approximately 44% of the problems are new to this edition. The ends-of-section and ends-of-chapter problem sets contain many new problems that use data from *The Wall Street Journal*, *USA Today*, and other sources.

**Revised Using Statistics Scenarios**—There are new or revised Using Statistics scenarios in five chapters.

**Checklist for Preparing to Use Microsoft Excel or Minitab with This Book**—Found in Section GS.4 of “Getting Started: Important Things to Learn First,” this checklist explains for students which skills they will need and where they will find information about those skills in the book.

**Revised Appendices Keyed to the Preparing to Use Microsoft Excel Checklist**—The revised Appendix B discusses the Excel skills that readers need to make best use of the *In-Depth Excel* instructions in this book. Appendix F presents useful Excel knowledge, including a discussion of the new worksheet function names that were introduced in Excel 2010. Appendix G presents FAQs about using Excel and Minitab with this book.

**Configuring Microsoft Excel Appendix**—This revised Appendix D discusses the procedures and practices that will help readers that use Microsoft Excel to avoid common technical problems that might otherwise arise as they learn business statistics with this book.

## Distinctive Features

We have continued many of the traditions of past editions and have highlighted some of these features below.

**Using Statistics Business Scenarios**—Each chapter begins with a Using Statistics example that shows how statistics is used in the functional areas of business—accounting, finance, information systems, management, and marketing. Each scenario is used throughout the chapter to provide an applied context for the concepts. The chapter concludes with a Using Statistics, Revisited section that reinforces the statistical methods and applications discussed in each chapter.

**Emphasis on Data Analysis and Interpretation of Excel and Minitab Results**—We believe that the use of computer software is an integral part of learning statistics. Our focus emphasizes analyzing data by interpreting results while reducing emphasis on doing computations. For example, in the coverage of tables and charts in Chapter 2, the focus is on the interpretation of various charts and on when to use each chart. In our coverage of hypothesis testing in Chapters 9 through 12, and regression and multiple regression in Chapters 13 through 15, extensive computer results have been included so that the  $p$ -value approach can be emphasized.

**Pedagogical Aids**—An active writing style is used, with boxed numbered equations, set-off examples to provide reinforcement for learning concepts, student tips, problems divided into “Learning the Basics” and “Applying the Concepts,” key equations, and key terms.

**Digital Cases**—In the Digital Cases, available for download as explained in Appendix C, learners must examine interactive PDF documents to sift through various claims and information in order to discover the data most relevant to a business case scenario. Learners then determine whether the conclusions and claims are supported by the data. In doing so, learners discover and learn how to identify common misuses of statistical information. (Instructional tips for using the Digital Cases and solutions to the Digital Cases are included in the Instructor’s Solutions Manual.)

**Answers**—Most answers to the even-numbered exercises are included at the end of the book.

**Flexibility Using Excel**—For almost every statistical method discussed, this book presents more than one way of using Excel. Students can use *In-Depth Excel* instructions to directly work with worksheet solution details *or* they can use either the *PHStat* instructions *or* the *Analysis ToolPak* instructions to automate the creation of those worksheet solutions.

**PHStat**—PHStat is the Pearson Education statistics add-in that you use with Microsoft Excel to help build solutions to statistical problems. With PHStat, you fill in simple-to-use dialog boxes and watch as PHStat creates a worksheet solution for you. PHStat allows you to use the Microsoft Excel statistical functions without having to first learn advanced Excel techniques or worrying about building worksheets from scratch. As a student studying statistics, you can focus mainly on learning statistics and not worry about having to fully master Excel as well.

Unlike other programs, PHStat solutions are real worksheets that contain real Excel calculations (called formulas in Excel). You can examine the contents of worksheet solutions to learn the appropriate functions and calculations necessary to apply a particular statistical method. With most of these worksheet solutions, you can change worksheet data and immediately see how those changes affect the results. This book uses PHStat version 4 which includes over 60 procedures that create Excel worksheets and charts for these statistical methods:

Descriptive Statistics: boxplot, descriptive summary, dot scale diagram, frequency distribution, histogram & polygons, Pareto diagram, scatter plot, stem-and-leaf display, one-way tables & charts, and two-way tables & charts

Probability and probability distributions: simple & joint probabilities, normal probability plot, and binomial, exponential, hypergeometric, and Poisson probability distributions

Sampling: sampling distributions simulation

Confidence interval estimation: for the mean, sigma unknown; for the mean, sigma known, for the population variance, for the proportion, and for the total difference

Sample size determination: for the mean and the proportion

One-sample tests:  $Z$  test for the mean, sigma known;  $t$  test for the mean, sigma unknown; chi-square test for the variance; and  $Z$  test for the proportion

Two-sample tests (unsummarized data): pooled-variance  $t$  test, separate-variance  $t$  test, paired  $t$  test,  $F$  test for differences in two variances, and Wilcoxon rank sum test

Two-sample tests (summarized data): pooled-variance  $t$  test, separate-variance  $t$  test, paired  $t$  test,  $Z$  test for the differences in two means,  $F$  test for differences in two variances, chi-square test for differences in two proportions,  $Z$  test for the difference in two proportions, and McNemar test

Multiple-sample tests: chi-square test, Marascuilo procedure Kruskal-Wallis rank test, Levene test, one-way ANOVA, Tukey-Kramer procedure randomized block design, and two-way ANOVA with replication

Regression: simple linear regression, multiple regression, best subsets, stepwise regression, and logistic regression

Control charts:  $p$  chart,  $c$  chart, and  $R$  and  $Xbar$  charts.

Decision-making: covariance and portfolio management, expected monetary value, expected opportunity loss, and opportunity loss

Data preparation: stack and unstack data

See Appendix Section C.4 for more information about PHStat.

**Visual Explorations**—The series of Excel workbooks that allow students to interactively explore important statistical concepts in descriptive statistics, the normal distribution, sampling distributions, and regression analysis. For example, in descriptive statistics, students observe the effect of changes in the data on the mean, median, quartiles, and standard deviation. With the normal distribution, students see the effect of changes in the mean and standard deviation on the areas under the normal curve. In sampling distributions, students use simulation to explore the effect of sample size on a sampling distribution. In regression analysis, students have the opportunity to fit a line and observe how changes in the slope and intercept affect the goodness of fit. The Visual Explorations workbooks are available for download as explained in Appendix C. (See Appendix Section C.4 to learn more about the workbooks that comprise Visual Explorations.)

## Chapter-by-Chapter Changes Made for This Edition

Besides the new and innovative content described in “What’s New and Innovative in This Edition?” the thirteenth edition of *Basic Business Statistics* contains the following specific changes to each chapter. Highlights of the changes to the individual chapters are as follows:

**Getting Started: Important Things to Learn First**—This all-new chapter includes new material on business analytics and introduces the DCOVA framework and a basic vocabulary of statistics, both of which were introduced in Chapter 1 of the twelfth edition.

**Chapter 1**—Collecting data has been relocated to this chapter from Section 2.1. Sampling methods and types of survey errors have been relocated from Sections 7.1 and 7.2. There is a new subsection on data cleaning. The CardioGood Fitness and Clear Mountain State Surveys cases are included.

**Chapter 2**—Section 2.1, “Data Collection,” has been moved to Chapter 1. The chapter uses a new data set that contains a sample of 316 mutual funds and a new set of restaurant cost data. The CardioGood Fitness, The Choice *Is* Yours Follow-up, and Clear Mountain State Surveys cases are included.

**Chapter 3**—For many examples, this chapter uses the new mutual funds data set that is introduced in Chapter 2. There is increased coverage of skewness and kurtosis. There is a new example on



computing descriptive measures from a population using “Dogs of the Dow.” The CardioGood Fitness, More Descriptive Choices Follow-up, and Clear Mountain State Surveys cases are included.

**Chapter 4**—The chapter example has been updated. There are new problems throughout the chapter. The CardioGood Fitness, The Choice *Is* Yours Follow-up, and Clear Mountain State Surveys cases are included.

**Chapter 5**—There is an additional example on applying probability distributions in finance, and there are many new problems throughout the chapter. The notation used has been made more consistent.

**Chapter 6**—This chapter has an updated Using Statistics scenario and some new problems. The CardioGood Fitness, More Descriptive Choices Follow-up, and Clear Mountain State Surveys cases are included.

**Chapter 7**—Sections 7.1 and 7.2 have been moved to Chapter 1. An additional example of sampling distributions from a larger population has been included.

**Chapter 8**—This chapter includes an updated Using Statistics scenario and new examples and exercises throughout the chapter. The Sure Value Convenience Stores, CardioGood Fitness, More Descriptive Choices Follow-up, and Clear Mountain State Surveys cases are included. The section “Applications of Confidence Interval Estimation in Auditing” has been moved online. There is an online section on bootstrapping.

**Chapter 9**—This chapter includes additional coverage of the pitfalls of hypothesis testing. The Sure Value Convenience Stores case is included.

**Chapter 10**—This chapter has an updated Using Statistics scenario, a new example on the paired *t*-test on textbook prices, and a new example on the *Z*-test for the difference between two proportions. The Sure Value Convenience Stores, CardioGood Fitness, More Descriptive Choices Follow-up, and Clear Mountain State Surveys cases are included. There is a new online section on Effect Size.

**Chapter 11**—The chapter has a new Using Statistics scenario that relates to a mobile electronics merchandiser that replaces the Perfect Parachutes scenario. This chapter includes the Sure Value Convenience Stores, CardioGood Fitness, More Descriptive Choices Follow-up, and Clear Mountain State Surveys cases. It now includes an online section on fixed effects, random effects, and mixed effects models.

**Chapter 12**—The chapter includes many new problems. This chapter includes the Sure Value Convenience Stores, CardioGood Fitness, More Descriptive Choices Follow-up, and Clear Mountain State Surveys cases. The McNemar test and the Chi-square test for a standard deviation or variance are now online sections.

**Chapter 13**—The Using Statistics scenario has been updated and changed, with new data used throughout the chapter. This chapter includes the Brynne Packaging case.

**Chapter 14**—The online section on influence analysis has been moved into the text.

**Chapter 15**—This chapter includes the Sure Value Convenience Stores, Craybill Instrumentation, and More Descriptive Choices Follow-up cases.

**Chapter 16**—This chapter includes new data involving movie attendance in Section 16.3 and updated data for The Coca-Cola Company in Sections 16.4 through 16.6 and Wal-Mart Stores, Inc., in Section 16.7. In addition, most of the problems are new or updated.

**Chapter 17**—This is the new business analytics chapter already discussed in *Innovations* on page 24. This chapter has been designed so that the descriptive methods or any of the predictive analytics methods can be taught separately and apart from the rest of the chapter should time not permit coverage of the entire chapter.

**Chapter 18**—This chapter now includes some new problems.

**Chapter 19**—The “Statistical Applications in Quality Management” chapter has been renumbered as Chapter 19 and moved online, where it is available for download as explained in Appendix C.

**Chapter 20**—The “Decision Making” chapter has been renumbered as Chapter 20 and remains available for download as explained in Appendix C.

## About Our Educational Philosophy

In *Our Starting Point* at the beginning of this preface, we stated that we are guided by these key learning principles:

- Help students see the relevance of statistics to their own careers by providing examples drawn from the functional areas in which they may be specializing.
- Emphasize interpretation of statistical results over mathematical computation.
- Give students ample practice in understanding how to apply statistics to business.
- Familiarize students with how to use statistical software to assist business decision making.
- Provide clear instructions to students for using statistical applications.

The following further explains these principles:

1. **Help students see the relevance of statistics to their own careers by providing examples drawn from the functional areas in which they may be specializing.** Students need a frame of reference when learning statistics, especially when statistics is not their major. That frame of reference for business students should be the functional areas of business, such as accounting, finance, information systems, management, and marketing. Each statistics topic needs to be presented in an applied context related to at least one of these functional areas. The focus in teaching each topic should be on its application in business, the interpretation of results, the evaluation of the assumptions, and the discussion of what should be done if the assumptions are violated.
2. **Emphasize interpretation of statistical results over mathematical computation.** Introductory business statistics courses should recognize the growing need to *interpret* statistical results that computerized processes create. This makes the interpretation of results more important than knowing how to execute the tedious hand calculations required to produce them.
3. **Give students ample practice in understanding how to apply statistics to business.** Both classroom examples and homework exercises should involve actual or realistic data as much as possible. Students should work with data sets, both small and large, and be encouraged to look beyond the statistical analysis of data to the interpretation of results in a managerial context.
4. **Familiarize students with how to use statistical software to assist business decision making.** Introductory business statistics courses should recognize that programs with statistical functions are commonly found on a business decision maker's desktop computer. Integrating statistical software into all aspects of an introductory statistics course allows the course to focus on interpretation of results instead of computations (see point 2).
5. **Provide clear instructions to students for using statistical applications.** Books should explain clearly how to use programs such as Microsoft Excel and Minitab with the study of statistics, without having those instructions dominate the book or distract from the learning of statistical concepts.

## Student Resources

**Student Solutions Manual**, by Professor Pin Tian Ng of Northern Arizona University and accuracy checked by Annie Puciloski, provides detailed solutions to virtually all the even-numbered exercises and worked-out solutions to the self-test problems.

**Online resources**—The complete set of online resources are discussed fully in Appendix C, which also explains how to download these resources. These resources include the **Excel and Minitab Data Files** that contain the data used in chapter examples or named in problems and end-of-chapter cases; the **Excel Guide Workbooks** that contain templates or model solutions for applying Excel to a particular statistical method; the **Digital Cases** PDF files that support the end-of-chapter Digital Cases; the **Visual Explorations Workbooks** that interactively demonstrate various key statistical concepts; and the **PHStat** add-in that simplifies the use of Microsoft Windows or OS X Microsoft Excel with this book, as explained in Section EG.1.

The online resources also include the **Chapter Short Takes** and **Online Topic Sections** that expand and extend the discussion of statistical concepts worksheet-based solutions as well as the full text of two additional chapters, “Statistical Applications in Quality Management” and “Decision Making.”

## Instructor Resources

The following supplements are among the resources available to adopting instructors at the Instructor's Resource Center, located at [www.pearsonglobaleditions.com/Berenson](http://www.pearsonglobaleditions.com/Berenson).

- **Instructor's Solutions Manual**, by Professor Pin Tian Ng of Northern Arizona University and accuracy checked by Annie Puciloski, includes solutions for end-of-section and end-of-chapter problems, answers to case questions, where applicable, and teaching tips for each chapter.
- **Lecture PowerPoint Presentations**, by Professor Patrick Schur of Miami University and accuracy checked by David Levine and Kathryn Szabat, are available for each chapter. The PowerPoint slides provide an instructor with individual lecture outlines to accompany the text. The slides include many of the figures and tables from the text. Instructors can use these lecture notes as is or can easily modify the notes to reflect specific presentation needs.
- **Test Bank**, by Professor Pin Tian Ng of Northern Arizona University, contains true/false, multiple-choice, fill-in, and problem-solving questions based on the definitions, concepts, and ideas developed in each chapter of the text.
- **TestGen®** ([www.pearsoned.com/testgen](http://www.pearsoned.com/testgen)) enables instructors to build, edit, print, and administer tests using a computerized bank of questions developed to cover all the objectives of the text. TestGen is algorithmically based, allowing instructors to create multiple but equivalent versions of the same question or test with the click of a button. Instructors can also modify test bank questions or add new questions. The software and test bank are available for download from Pearson Education's online catalog.



**MyStatLab™ Online Course (access code required)** MyStatLab from Pearson is the world's leading online resource for statistics learning, integrating interactive homework, assessment, and media in a flexible, easy to use format. MyStatLab is a course management systems that delivers **proven results** in helping individual students succeed.

- MyStatLab can be successfully implemented in any environment—lab-based, hybrid, fully online, traditional—and demonstrates the quantifiable difference that integrated usage has on student retention, subsequent success, and overall achievement.
- MyStatLab's comprehensive online gradebook automatically tracks students' results on tests, quizzes, and homework and in the study plan. Instructors can use the gradebook to provide positive feedback or intervene if students have trouble. Gradebook data can be easily exported to a variety of spreadsheet programs, such as Microsoft Excel. You can determine which points of data you want to export and then analyze the results to determine success.

MyStatLab provides **engaging experiences** that personalize, stimulate, and measure learning for each student. In addition to the resources below, each course includes a full interactive online version of the accompanying textbook.

- **Tutorial Exercises with Multimedia Learning Aids:** The homework and practice exercises in MyStatLab align with the exercises in the textbook, and they regenerate algorithmically to give students unlimited opportunity for practice and mastery. Exercises offer immediate helpful feedback, guided solutions, sample problems, animations, videos, and eText clips for extra help at the point of use.
- **MyStatLab Accessibility:** MyStatLab is compatible with the JAWS 12/13 screen reader and enables multiple-choice and free-response problem types to be read and interacted with via keyboard controls and math notation input.
- **StatTalk Videos:** Fun-loving statistician Andrew Vickers takes to the streets of Brooklyn, NY to demonstrate important statistical concepts through interesting stories and real-life events. This series of 24 fun and engaging videos will help students actually understand statistical concepts. Available with an instructor's user guide and assessment questions.
- **Business Insight Videos:** Ten engaging videos show managers at top companies using statistics in their everyday work. Assignable question encourage debate and discussion.
- **Additional Question Libraries:** In addition to algorithmically regenerated questions that are aligned with your textbook, the MyStatLab courses come with two additional question libraries:
  - **450 Getting Ready for Statistics** covers the developmental math topics students need for the course. These can be assigned as a prerequisite to other assignments, if desired.
  - **1000 Conceptual Question Library** requires students to apply their statistical understanding.

- **Integration of Statistical Software:** We make it easy to copy our data sets, both from the eText and the MyStatLab questions, into software such as StatCrunch, Minitab, Excel, and more. Students have access to a variety of support tools—Technology Tutorial Videos, Technology Study Cards, and Technology Manuals for select titles—to learn how to effectively use statistical software.
- **StatCrunch®:** MyStatLab integrates the web-based statistical software StatCrunch within the online assessment platform so that students can easily analyze data sets from exercises and the text. In addition, MyStatLab includes access to [www.statcrunch.com](http://www.statcrunch.com), a website where users can access tens of thousands of shared data sets, conduct online surveys, perform complex analyses using the powerful statistical software, and generate compelling reports.

And, MyStatLab comes from an **experienced partner** with educational expertise and an eye on the future.

- Knowing that you are using a Pearson product means knowing that you are using quality content. That means that our eTexts are accurate and our assessment tools work.
- Whether you are just getting started with MyStatLab, or have a question along the way, we're here to help you learn about our technologies and how to incorporate them into your course.

To learn more about how MyStatLab combines proven learning applications with powerful assessment, visit [www.mystatlab.com](http://www.mystatlab.com) or contact your Pearson representative.

**StatCrunch®** is powerful web-based statistical software that allows users to perform complex analyses, share data sets, and generate compelling reports of their data. The vibrant online community offers tens of thousands shared data sets for students to analyze.

Full access to StatCrunch is available with a MyStatLab access kit, and StatCrunch is available by itself to qualified adopters. StatCrunch is now compatible with most mobile devices. To access, visit [www.statcrunch.com/mobile](http://www.statcrunch.com/mobile) from the browser on your smartphone or tablet. For more information, visit our website at [www.statcrunch.com](http://www.statcrunch.com), or contact your Pearson representative.

## Acknowledgments

We are extremely grateful to the RAND Corporation and the American Society for Testing and Materials for their kind permission to publish various tables in Appendix E, and to the American Statistical Association for its permission to publish diagrams from the *American Statistician*.

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Finally, we would like to thank our families for their patience, understanding, love, and assistance in making this book a reality. It is to them that we dedicate this book.

## Concluding Remarks

Please email us at [authors@davidlevinestatistics.com](mailto:authors@davidlevinestatistics.com) if you have a question or require clarification about something discussed in this book. We also invite you to communicate any suggestions you may have for a future edition of this book. And while we have strived to make this book both pedagogically sound and error-free, we encourage you to contact us if you discover an error. When contacting us electronically, please include “BBS edition 13” in the subject line of your message.

You can also visit [davidlevinestatistics.com](http://davidlevinestatistics.com), where you will find an email contact form and links to additional information about this book. For technical assistance using Microsoft Excel or any of the Excel add-ins that you can use with this book including PHStat, review Appendices D and G and follow the technical support links discussed in Appendix Section G.1, if necessary.

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## GETTING STARTED

# Important Things to Learn First

### CONTENTS

- GS.1 Statistics: A Way of Thinking
- GS.2 Data: What Is It?
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“Big Data”  
Statistics: An Important Part of Your Business Education

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### EXCEL GUIDE

- EG.1 Getting Started with Microsoft Excel
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- MG.1 Getting Started with Minitab
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- MG.5 Printing Parts of a Project

### OBJECTIVES

- That the volume of data that exists in the world makes learning about statistics critically important
- That statistics is a way of thinking that can help you make better decisions
- How the DCOVA framework for applying statistics can help you solve business problems
- What business analytics is and how these techniques represent an opportunity for you
- How to make best use of this book
- How to prepare for using Microsoft Excel or Minitab with this book

## USING STATISTICS

### “You Cannot Escape from Data”

Not so long ago, business students were unfamiliar with the word *data* and had little experience handling data. Today, every time you visit a search engine website or “ask” your mobile device a question, you are handling data. And if you “check in” to a location or indicate that you “like” something, you are *creating* data as well.

You accept as almost true the premises of stories in which characters collect “a lot of data” to uncover conspiracies, to foretell disasters, or to catch a criminal. You hear concerns about how the government or business might be able to “spy” on you in some ways or how large social media companies “mine” your personal data for profit.

You hear the word *data* everywhere and may even have a “data plan” for your smartphone. You know, in a general way, that data are facts about the world and that most data seem to be, ultimately, a set of numbers—that 49% of students recently polled dreaded taking a business statistics course, or that 50% of citizens believe the country is headed in the right direction, or that unemployment is down 3%, or that your best friend’s social media account has 835 friends and 202 recent posts.

**You cannot escape from data in this digital world. What, then, should you do?** You could try to ignore data and conduct business by relying on hunches or your “gut feelings.” However, if you only want to use gut feelings, then you probably shouldn’t be reading this book or taking business courses in the first place.

You could note that there is so much data in the world—or just in your own little part of the world—that you couldn’t possibly get a handle on it. You could accept other people’s data summaries and their conclusions without first reviewing the data yourself. That, of course, would expose yourself to fraudulent practices.

**Or, you could do things the proper way and realize that you cannot escape learning the methods of statistics, the subject of this book . . .**



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## GS.1 Statistics: A Way of Thinking

Statistics is a way of thinking that can help you make better decisions. Statistics helps you solve problems that involve decisions that are based on data that have been collected. You may have had some statistics instruction in the past. If you ever created a chart to summarize data or calculated values such as averages to summarize data, you have used statistics. But there's even more to statistics than these commonly taught techniques, as the detailed table of contents shows.

Statistics is undergoing important changes today. There are new ways of visualizing data that either did not exist, were not practical to do, or were not widely known until recently. And, more and more, statistics today is being used to “listen” to what the data might be telling you (the subject of Chapter 17) rather than just being a way to use data to prove something you want to say.

If you associate statistics with doing a lot of mathematical calculations, you will quickly learn that business statistics uses software to perform the calculations for you (and, generally, the software calculates with more precision and efficiency than you could do manually). But while you do not need to be a good manual calculator to apply statistics, because statistics is a way of thinking, you do need to follow a framework, or plan, to minimize possible errors of thinking and analysis. The **DCOVA framework** is one such framework.

### THE DCOVA FRAMEWORK

The DCOVA framework consists of the following tasks:

- **Define** the data that you want to study in order to solve a problem or meet an objective.
- **Collect** the data from appropriate sources.
- **Organize** the data collected by developing tables.
- **Visualize** the data collected by developing charts.
- **Analyze** the data collected to reach conclusions and present those results.

The DCOVA framework uses the five tasks **Define**, **Collect**, **Organize**, **Visualize**, and **Analyze** to help apply statistics to business decision making. Typically, you do the tasks in the order listed. You must always do the first two tasks to have meaningful outcomes, but, in practice, the order of the other three can change or appear inseparable. Certain ways of visualizing data help you to organize your data while performing preliminary analysis as well. In any case, when you apply statistics to decision making, you should be able to identify all five tasks, and you should verify that you have done the first two tasks before the other three.

Using the DCOVA framework helps you to apply statistics to these four broad categories of business activities:

- Summarize and visualize business data
- Reach conclusions from those data
- Make reliable forecasts about business activities
- Improve business processes

Throughout this book, and especially in the Using Statistics scenarios that begin the chapters, you will discover specific examples of how DCOVA helps you apply statistics. For example, in one chapter, you will learn how to demonstrate whether a marketing campaign has increased sales of a product, while in another you will learn how a television station can reduce unnecessary labor expenses.