BASIC STATISTICS for BUSINESS & ECONOMICS

10E

Douglas A. Lind
William G. Marchal
Samuel A. Wathen

McGraw Hill

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Basic Statistics for
BUSINESS & ECONOMICS

TENTH EDITION

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BASIC STATISTICS FOR BUSINESS AND ECONOMICS

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DEDICATION

To Jane, my wife and best friend, and our sons, their wives, and our grandchildren: Mike and Sue (Steve and Courtney), Steve and Kathryn (Kennedy, Jake, and Brady), and Mark and Sarah (Jared, Drew, and Nate).

Douglas A. Lind

To Margaret Marchal Nicholson and Andrea.

William G. Marchal

To my wonderful family: Barb, Hannah, and Isaac.

Samuel A. Wathen

A NOTE FROM THE AUTHORS

Over the years, we received many compliments on this text and understand that it's a favorite among students. We accept that as the highest compliment and continue to work very hard to maintain that status.

The objective of *Basic Statistics for Business & Economics* is to provide students majoring in management, marketing, finance, accounting, economics, and other fields of business administration with an introductory survey of descriptive and inferential statistics. To illustrate the application of statistics, we use many examples and exercises that focus on business applications, but also relate to the current world of the college student. A previous course in statistics is not necessary, and the mathematical requirement is first-year algebra.

In this text, we show beginning students every step needed to be successful in a basic statistics course. This step-by-step approach enhances performance, accelerates preparedness, and significantly improves motivation. Understanding the concepts, seeing and doing plenty of examples and exercises, and comprehending the application of statistical methods in business and economics are the focus of this book.

The first edition of this text was published in 1967. At that time, locating relevant business data was difficult. That has changed! Today, locating data is not a problem. The number of items you purchase at the grocery store is automatically recorded at the checkout counter. Phone companies track the time of our calls, the length of calls, and the identity of the person called. Credit card companies maintain information on the number, time and date, and amount of our purchases. Medical devices automatically monitor our heart rate, blood pressure, and temperature from remote locations. A large amount of business information is recorded and reported almost instantly. CNN, *USA Today,* and MSNBC, for example, all have websites that track stock prices in real time.

Today, the practice of data analytics is widely applied to "big data." The practice of data analytics requires skills and knowledge in several areas. Computer skills are needed to process large volumes of information. Analytical skills are needed to evaluate, summarize, organize, and analyze the information. Critical thinking skills are needed to interpret and communicate the results of processing the information.

Our text supports the development of basic data analytical skills. At the end of each chapter, you will find a section called Data Analytics. This section provides the instructor and student with opportunities to apply statistical knowledge and statistical software to explore several business environments. Interpretation of the analytical results is an integral part of these exercises.

A variety of statistical software is available to complement our text. Microsoft Excel includes an add-in with many statistical analyses. MegaStat is an add-in available for Microsoft Excel. Minitab and JMP are stand-alone statistical software packages available to download for either PC or Mac computers. In our text, Microsoft Excel, Minitab, and MegaStat are used to illustrate statistical software analyses. The text now includes references or links to Excel tutorials in Connect. These provide users with clear demonstrations using statistical software to create graphical and descriptive statistics and statistical analyses to test hypotheses. We use screen captures within the chapters, so the student becomes familiar with the nature of the software output.

Because of the availability of computers and software, it is no longer necessary to dwell on calculations. We have replaced many of the calculation examples with interpretative ones, to assist the student in understanding and interpreting the statistical results. In addition, we place more emphasis on the conceptual nature of the statistical topics. While making these changes, we still continue to present, as best we can, the key concepts, along with supporting interesting and relevant examples.

WHAT'S NEW IN THE TENTH EDITION?

We made several significant improvements to our text.

First, the text now uses an excellent set of Excel tutorials to demonstrate how to use Excel to perform the statistical analyses in the text. Rather than referring to a set of written procedures, users will be able to view well-organized presentations that clearly demonstrate how to use the various statistical tools, functions, and analyses in Excel. The references to the tutorials are indicated by a unique icon placed in the left margin and aligned with the procedure or analysis in the text. In the eBook, these

icons will be directly linked to the tutorials. Textbook users will access the tutorials through Connect.

Second, Chapter 8 now starts with a brief discussion of the research process to establish a context for sampling and data collection. It also includes comments on ethics and biased sampling. After the description of sampling methods, a new section, "Sample Mean as a Random Variable," demonstrates the effect of random sampling on the sample mean followed by the section, "Sampling Distribution of the Sample Mean." The standard error of the sampling distribution is now featured in a new section. The "sampling error" concept continues to be a key item in the chapter's discussion.

Third, starting in Chapter 9, many exercises have been restructured with multi-item responses. Reformulating these exercises will provide users with more direction to understanding the details of a particular statistical technique. As an example, compare Chapter 11, Exercise 20 before, on the left, and after, on the right.

20. FILE The federal government recently granted funds for a special program designed to reduce crime in high-crime areas. A study of the results of the program in eight high-crime areas of Miami, Florida, yielded the following results.

		Number of Crimes by Area						
	A	B	C	D	E	F	G	H
Before	14	7	4	5	17	12	8	9
After	2	7	3	6	8	13	3	5

Has there been a decrease in the number of crimes since the inauguration of the program? Use the .01 significance level.

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Before	14	7	4	5	17	12	8	9
After	2	7	3	6	8	13	3	5

Has there been a decrease in the number of crimes since the inauguration of the program? Use the .01 significance level.
a. State the null and alternate hypotheses.
b. What is the p-value?
c. Is the null hypothesis rejected?
d. What is the conclusion indicated by the analysis?

HOW ARE CHAPTERS ORGANIZED TO ENGAGE STUDENTS AND PROMOTE LEARNING?

Chapter Learning Objectives

Each chapter begins with a set of learning objectives designed to provide focus for the chapter and motivate student learning. These objectives, located in the margins next to the topic, indicate what the student should be able to do after completing each section in the chapter.

Chapter Opening Exercise

A representative exercise opens the chapter and shows how the chapter content can be applied to a real-world situation.

▲ **MERRILL LYNCH** recently completed a study of online investment portfolios for a sample of clients. For the 70 participants in the study, organize these data into a frequency distribution. (See Exercise 43 and **LO2-3.**)

LEARNING OBJECTIVES

When you have completed this chapter, you will be able to:

LO2-1   Summarize qualitative variables with frequency and relative frequency tables.

LO2-2   Display a frequency table using a bar or pie chart.

LO2-3   Summarize quantitative variables with frequency and relative frequency distributions.

LO2-4   Display a frequency distribution using a histogram or frequency polygon.

Introduction to the Topic

Each chapter starts with a review of the important concepts of the previous chapter and provides a link to the material in the current chapter. This step-by-step approach increases comprehension by providing continuity across the concepts.

INTRODUCTION

The United States automobile retailing industry is highly competitive. It is dominated by megadealerships that own and operate 50 or more franchises, employ over 10,000 people, and generate several billion dollars in annual sales. Many of the top dealerships are publicly owned with shares traded on the New York Stock Exchange or NASDAQ. Based on 2018 new-vehicle retail sales, the largest megadealership was AutoNation (ticker symbol AN), followed by Penske Auto Group (PAG), Group 1 Automotive Inc. (ticker symbol GPI), and Lithia Motors Inc. (LAD). (www.autonews.com/dealers/check-out-top-150-us-dealership-groups)

These large corporations use statistics and analytics to summarize and analyze data and information to support their decisions. As an example, we will look at the Applewood Auto Group. It owns four dealerships and sells a wide range of vehicles. These include the popular Korean brands Kia and Hyundai, BMW and Volvo sedans and luxury SUVs, and a full line of Ford and Chevrolet cars and trucks.

Ms. Kathryn Ball is a member of the senior management team at Applewood Auto Group, which has its corporate offices adjacent to Kane Motors. She is responsible for tracking and analyzing vehicle sales and the profitability of those vehicles. Kathryn would like to summarize the profit

Justin Sullivan/Getty Images

Example/Solution

After important concepts are introduced, a solved example is given. This example provides a how-to illustration and shows a relevant business application that helps students answer the question, "How can I apply this concept?"

► EXAMPLE

The service departments at Tionesta Ford Lincoln and Sheffield Motors Inc., two of the four Applewood Auto Group dealerships, were both open 24 days last month. Listed below is the number of vehicles serviced last month at the two dealerships. Construct dot plots and report summary statistics to compare the two dealerships.

Tionesta Ford Lincoln					
Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
23	33	27	28	39	26
30	32	28	33	35	32
29	25	36	31	32	27
35	32	35	37	36	30

Self-Reviews

Self-Reviews are interspersed throughout each chapter and follow Example/Solution sections. They help students monitor their progress and provide immediate reinforcement for that particular technique. Answers are in Appendix D.

Statistics in Action

Statistics in Action articles are scattered throughout the text, usually about two per chapter. They provide unique, interesting applications and historical insights in the field of statistics.

STATISTICS IN ACTION

If you wish to get some attention at the next gathering you attend, announce that you believe that at least two people present were born on the same date—that is, the same day of the year but not necessarily the same year. If there are 30 people in the room, the probability of a duplicate is .706. If there are 60

Definitions

Definitions of new terms or terms unique to the study of statistics are set apart from the text and highlighted for easy reference and review. They also appear in the Glossary at the end of the book.

JOINT PROBABILITY A probability that measures the likelihood two or more events will happen concurrently.

Formulas

Formulas that are used for the first time are boxed and numbered for reference. In addition, a formula card is listed in the back of the text that lists all the key formulas.

SPECIAL RULE OF MULTIPLICATION	$P(A \text{ and } B) = P(A)P(B)$	(5–5)

Exercises

Exercises are included after sections within the chapter and at the end of the chapter. Section exercises cover the material studied in the section. Many exercises have data files available to import into statistical software. They are indicated with the FILE icon. Answers to the odd-numbered exercises are in Appendix C.

EXERCISES

For Exercises 39–44, do the following:

   a. Compute the sample variance.
   b. Determine the sample standard deviation.

39. Consider these values a sample: 7, 2, 6, 2, and 3.
40. The following five values are a sample: 11, 6, 10, 6, and 7.
41. **FILE** Dave's Automatic Door, referred to in Exercise 29, installs automatic garage door openers. Based on a sample, following are the times, in minutes, required to install 10 door openers: 28, 32, 24, 46, 44, 40, 54, 38, 32, and 42.
42. **FILE** The sample of eight companies in the aerospace industry, referred to in Exercise 30, was surveyed as to their return on investment last year. The results are 10.6, 12.6, 14.8, 18.2, 12.0, 14.8, 12.2, and 15.6.

Computer Output

The text includes many software examples, using Excel, MegaStat®, and Minitab. The software results are illustrated in the chapters. Instructions for the software examples are referenced in online tutorials in Connect.

APPLEWOOD AUTO GROUP

	A	B	C	D	E	F	G	H
1	Age	Profit	Location	Vehicle-Type	Previous		Profit	
2	21	$1,387	Tionesta	Sedan	0			
3	23	$1,754	Sheffield	SUV	1		Mean	1843.17
4	24	$1,817	Sheffield	Hybrid	1		Standard Error	47.97
5	25	$1,040	Sheffield	Compact	0		Median	1882.50
6	26	$1,273	Kane	Sedan	1		Mode	1915.00
7	27	$1,529	Sheffield	Sedan	1		Standard Deviation	643.63
8	27	$3,082	Kane	Truck	0		Sample Variance	414256.61
9	28	$1,951	Kane	SUV	1		Kurtosis	-0.22
10	28	$2,692	Tionesta	Compact	0		Skewness	-0.24
11	29	$1,342	Kane	Sedan	2		Range	2998
12	29	$1,206	Sheffield	Sedan	0		Minimum	294
13	30	$443	Kane	Sedan	3		Maximum	3292
14	30	$1,621	Sheffield	Truck	1		Sum	331770
15	30	$754	Olean	Sedan	2		Count	180

Source: Microsoft Excel

HOW DOES THIS TEXT REINFORCE STUDENT LEARNING?

BY CHAPTER

Chapter Summary

Each chapter contains a brief summary of the chapter material, including vocabulary, definitions, and critical formulas.

CHAPTER SUMMARY

I. A random variable is a numerical value determined by the outcome of an experiment.
II. A probability distribution is a listing of all possible outcomes of an experiment and the probability associated with each outcome.
  A. A discrete probability distribution can assume only certain values. The main features are:
    1. The sum of the probabilities is 1.00.
    2. The probability of a particular outcome is between 0.00 and 1.00.
    3. The outcomes are mutually exclusive.
  B. A continuous distribution can assume an infinite number of values within a specific range.
III. The mean and variance of a discrete probability distribution are computed as follows.
  A. The mean is equal to:

$$\mu = \Sigma[xP(x)] \tag{6-1}$$

  B. The variance is equal to:

$$\sigma^2 = \Sigma[(x - \mu)^2 P(x)] \tag{6-2}$$

Pronunciation Key

This section lists the mathematical symbol, its meaning, and how to pronounce it. We believe this will help the student retain the meaning of the symbol and generally enhance course communications.

PRONUNCIATION KEY

SYMBOL	MEANING	PRONUNCIATION
$P(A)$	Probability of A	P of A
$P(\sim A)$	Probability of not A	P of not A
$P(A \text{ and } B)$	Probability of A and B	P of A and B
$P(A \text{ or } B)$	Probability of A or B	P of A or B
$P(A \mid B)$	Probability of A given B has happened	P of A given B
$_nP_r$	Permutation of n items selected r at a time	Pnr
$_nC_r$	Combination of n items selected r at a time	Cnr

Chapter Exercises

Generally, the end-of-chapter exercises are the most challenging and integrate the chapter concepts. The answers and worked-out solutions for all odd-numbered exercises are in Appendix C. Many exercises are noted with a data file icon. For these exercises, there are data files in Excel format located

on the text's website, **www.mhhe.com/Lind10e**. These files help students use statistical software to solve the exercises.

CHAPTER EXERCISES

21. According to the local union president, the mean gross income of plumbers in the Salt Lake City area follows the normal probability distribution with a mean of $45,000 and a population standard deviation of $3,000. A recent investigative reporter for KYAK TV found, for a sample of 120 plumbers, the mean gross income was $45,500. At the .10 significance level, is it reasonable to conclude that the mean income is not equal to $45,000? Determine the p-value.

22. **FILE** Rutter Nursery Company packages its pine bark mulch in 50-pound bags. From a long history, management knows that the distribution of bag weights is normally distributed with a population standard deviation of 3 pounds per bag. At the end of each day, Jeff Rutter, the production manager, weighs 10 bags and computes the mean weight of the sample. Following are the weights of 10 bags from today's production.

45.6	47.7	47.6	46.3	46.2	47.4	49.2	55.8	47.5	48.5

   a. Can Mr. Rutter conclude that the mean weight of the bags is less than 50 pounds? Use the .01 significance level.
   b. In a brief report, tell why Mr. Rutter can use the z-distribution as the test statistic.
   c. Compute the p-value.

23. A new weight-watching company, Weight Reducers International, advertises that those who join will lose an average of 10 pounds after the first 2 weeks. The population standard deviation is 2.8 pounds. A random sample of 50 people who joined the weight reduction program revealed a mean loss of 9 pounds. At the .05 level of significance,

Data Analytics

The goal of the Data Analytics sections is to develop analytical skills. The exercises present a real-world context with supporting data. The data sets are printed in Appendix A and available to download from the text's website **www.mhhe.com/Lind10e**. Statistical software is required to analyze the data and respond to the exercises. Each data set is used to explore questions and discover findings that relate to a real-world context. For each business context, a story is uncovered as students progress from Chapters 1 to 15.

DATA ANALYTICS

(The data for these exercises are available at the text website: www.mhhe.com/lind10e.)

52. Refer to the North Valley Real Estate data, which report information on homes sold during the last year.
   a. The mean selling price (in $ thousands) of the homes was computed earlier to be $357.0, with a standard deviation of $160.7. Use the normal distribution to estimate the percentage of homes selling for more than $500.000. Compare this to the actual results. Is price normally distributed? Try another test. If price is normally distributed, how many homes should have a price greater than the mean? Compare this to the actual number of homes. Construct a frequency distribution of price. What do you observe?
   b. The mean days on the market is 30 with a standard deviation of 10 days. Use the normal distribution to estimate the number of homes on the market more than 24 days.

Software Tutorials

References to tutorials demonstrating how to use Excel to compute various statistics and perform statistical analyses are included throughout the text. See an example of the icon to the right.

Answers to Self-Review

The worked-out solutions to the Self-Reviews are provided in Appendix D.

6–1 a.

Number of Spots	Probability
1	$\frac{1}{6}$
2	$\frac{1}{6}$
3	$\frac{1}{6}$
4	$\frac{1}{6}$
5	$\frac{1}{6}$
6	$\frac{1}{6}$
Total	$\frac{6}{6} = 1.00$

Practice Test

The Practice Test is intended to give students an idea of content that might appear on a test and how the test might be structured. The Practice Test includes both objective questions and problems covering the material studied in the material studied in the section.

PRACTICE TEST

There is a practice test at the end of each chapter. The tests are in two parts. The first part includes 10 to 15 objective questions, usually in a fill-in-the-blank format. The second part includes problems. In most cases, it should take 30 to 45 minutes to complete the test. The problems will require a calculator. Check your answers against those provided in Appendix C in the back of the book.

Part 1—Objective

1. The science of collecting, organizing, presenting, analyzing, and interpreting data to assist in making more effective decisions is referred to as _____ .
2. Methods of organizing, summarizing, and presenting data in an enlightening way are called _____ .

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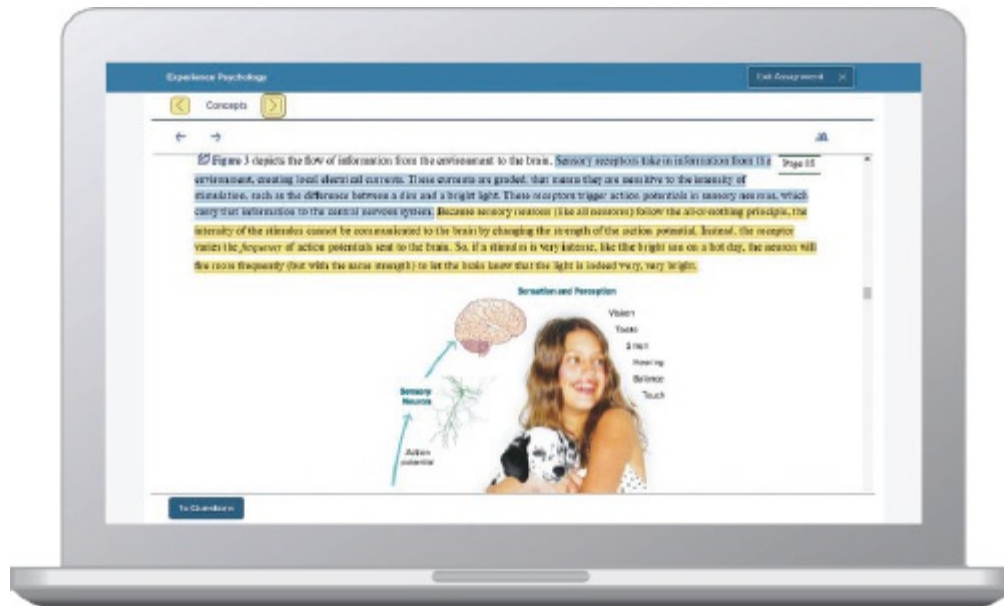
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"I really liked this app—it made it easy to study when you don't have your textbook in front of you."

- Jordan Cunningham, Eastern Washington University

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ADDITIONAL RESOURCES

INSTRUCTOR LIBRARY

The Connect® Instructor Library is your repository for additional resources to improve student engagement in and out of class. You can select and use any asset that enhances your lecture, including:

- **Solutions Manual** The Solutions Manual, carefully revised by the authors, contains solutions to all basic, intermediate, and challenge problems found at the end of each chapter.
- **Test Bank** The Test Bank, revised by Wendy Bailey of Troy University, contains hundreds of true/false, multiple choice and short-answer/discussions, updated based on the revisions of the authors. The level of difficulty varies, as indicated by the easy, medium, and difficult labels.
- **PowerPoint Presentations** Prepared by Stephanie Campbell of Mineral Area College, the presentations contain exhibits, tables, key points, and summaries in a visually stimulating collection of slides.
- **Excel Templates** There are templates for various end-of-chapter problems that have been set as Excel spreadsheets—all denoted by an icon. Students can easily download the files, save them, and use the data to solve end-of-chapter problems.

MEGASTAT® FOR MICROSOFT EXCEL®

MegaStat® by J. B. Orris of Butler University is a full-featured Excel statistical analysis add-in that is available on the MegaStat website at **www.mhhe.com/megastat** (for purchase). MegaStat works with recent versions of Microsoft Excel® (Windows and Mac OS X). See the website for details on supported versions.

Once installed, MegaStat will always be available on the Excel add-ins ribbon with no expiration date or data limitations. MegaStat performs statistical analyses within an Excel workbook. When a MegaStat menu item is selected, a dialog box pops up for data selection and options. Since MegaStat is an easy-to-use extension of Excel, students can focus on learning statistics without being distracted by the software. Ease-of-use features include Auto Expand for quick data selection and Auto Label detect.

MegaStat does most calculations found in introductory statistics textbooks, such as computing descriptive statistics, creating frequency distributions, and computing probabilities as well as hypothesis testing, ANOVA, chi-square analysis, and regression analysis (simple and multiple). MegaStat output is carefully formatted and appended to an output worksheet.

Video tutorials are included that provide a walkthrough using MegaStat for typical business statistics topics. A context-sensitive help system is built into MegaStat and a User's Guide is included in PDF format.
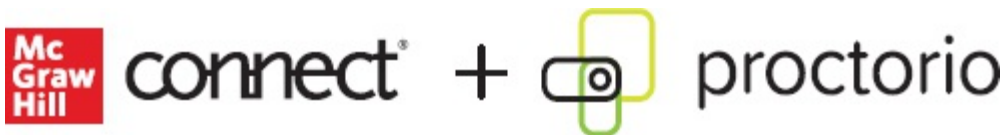
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Minitab®, Minitab® Express, SPSS®, and JMP® Student Edition are software products that are available to help students solve the exercises with data files. Each software product can be packaged with any McGraw Hill business statistics text.
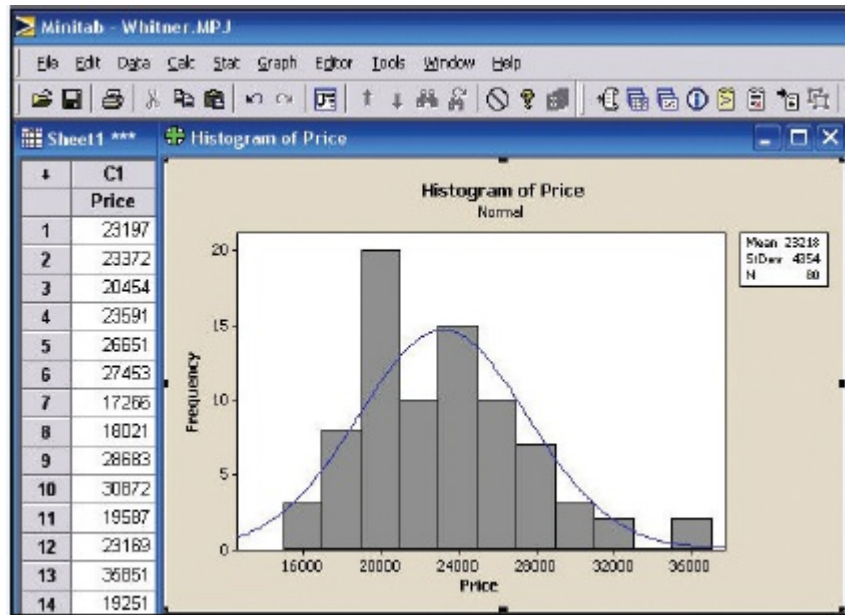
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Instant and detailed reporting gives instructors an at-a-glance view of potential academic integrity concerns, thereby avoiding personal bias and supporting evidence-based claims.

ACKNOWLEDGMENTS

This edition of *Basic Statistics for Business & Economics* is the product of many people: students, colleagues, reviewers, and the staff at McGraw Hill Education. We thank them all. We wish to express our sincere gratitude to the reviewers:

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Zhiwei Zhu
University of Louisiana–Lafayette

Their suggestions and thorough reviews of the previous edition and the manuscript of this edition make this a better text.

ENHANCEMENTS TO *BASIC STATISTICS FOR BUSINESS & ECONOMICS*, 10E

CHAPTER 1 What Is Statistics?

- Updated graphic on data analytics.
- Updated examples.
- Newly revised Ethics and Statistics section.
- New exercise 17 requiring statistical software.
- Updated exercise 19.

CHAPTER 2 Describing Data: Frequency Tables, Frequency Distributions, and Graphic Presentation

- Updated examples.
- Updated exercises 33, 38, 47, 48.
- New exercise 44 using extensive data from the pizza industry requiring statistical software.

CHAPTER 3 Describing Data: Numerical Measures

- Updated examples.
- Revised example/solution showing the calculation of the sample mean.
- Revised example/solution showing the calculation of the sample standard deviation.
- Updated Statistics in Action with most recent Major League Baseball data.
- The section of the relative positions of the mean, median, and mode as well as the concept of skewness have been rewritten with new illustrations.
- Updated exercises 21, 23, 25, 61, 64.

CHAPTER 4 Describing Data: Displaying and Exploring Data

- Updated examples.
- Revised section on computing quartiles.
- Box plots are generated with Excel with accompanying Connect tutorial.
- Updated exercise 16 with Washington Nationals salary data.
- Updated Self-Review 4–5 to include data.
- A new section on the correlation coefficient added to the major section, "Describing the Relationship between Two Variables."

- Exercises 17, 18, and 32 provide data and ask the user to produce scatter plots with statistical software.
- New exercise 24.

CHAPTER 5 A Survey of Probability Concepts

- Updated examples.
- New exercises 80, 83.
- Updated exercises 9, 10, 52.
- Revised example/solution showing the calculation of empirical probability.
- New "Principles of Counting" example/solution based on blood type.

CHAPTER 6 Discrete Probability Distributions

- Updated examples.
- New exercises 9, 10, 17, 18, 24, 43, 54, 55, 56, 57.
- Updated exercises 5, 7, 8, 24.
- New example/solution using the binomial distribution to predict purchase behavior with debit and credit cards.

CHAPTER 7 Continuous Probability Distributions

- New opening page and exercise.
- Revised example/solution demonstrating the uniform probability distribution.
- For all uniform distribution examples and exercises, users are asked to compute the mean and standard deviation.
- Updated and revised exercises 1, 2, 5, 7, 8, 11, 12, 28.
- New exercises 15, 19, 20, 31, 32, 37, 39, 43, 51, 53.
- Added emphasis on defining the probability of a particular value of a continuous random variable to be zero.

CHAPTER 8 Sampling, Sampling Methods, and the Central Limit Theorem

- New chapter title: "Sampling, Sampling Methods, and the Central Limit Theorem."
- New section titled: "Research and Sampling." This section now introduces the idea of sampling by discussing the research process (i.e., posing a research question, collecting data, processing the data, and making data-based inferences and conclusions). The section also discusses ethical guidelines for selecting representative samples from populations.
- Revised Self-Review 8–1.
- Revised Statistics in Action about biased sampling.
- New section: "Sample Mean as a Random Variable."
- Revised example/solution demonstrating sampling, the sample mean as a random variable, and the meaning and interpretation of sampling error.
- New section: "Standard Error of the Mean."
- New Exercises 14, 15, 16.

- Updated exercises 12, 13, 18, 19, 20, 21, 25, 26, 31, 32, 36.

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CHAPTER 9   Estimation and Confidence Intervals

- Introduction now connects Chapter 8 to Chapter 9 by discussing how sample data are used to estimate population parameters.
- More emphasis placed on the margin of error in the calculation and interpretation of a confidence interval.
- Revised example/solution demonstrating the calculation and interpretation of a confidence interval estimating a population mean.
- Revised example/solution demonstrating the calculation and interpretation of a confidence interval estimating a population proportion.
- Revised example/solution demonstrating the margin of error in computing a sample size.
- New exercises 17, 37, 38, 39, 40, 41, 42.
- Updated exercises 5, 11, 12, 19, 22, 25, 28, 29, 31, 33, 37, 38, 39, 40, 41, 42, 43, 46, 47, 50, 53.

CHAPTER 10   One-Sample Tests of Hypothesis

- The chapter now relies on statistical software to compute p-values.
- Revised example/solution demonstrating the hypothesis-testing procedure with added emphasis on the significance level and the Type I error probability.
- Revised Self-Review 10–1.
- Revised section titled "p-Value in Hypothesis Testing."
- Revised Self-Review 10–2.
- Revised example/solutions demonstrating hypothesis testing with the t-statistic.
- New exercises 29, 30.

CHAPTER 11   Two-Sample Tests of Hypothesis

- Revised explanation comparing independent and dependent sampling.
- Updated exercises 4, 9.
- Exercises 17–46 are now structured with multi-item responses providing users with directed questions.

CHAPTER 12   Analysis of Variance

- Revised Self-Review 12–2.
- Revised Self-Review 12–3.
- Updated exercises 1–6, 9, 10, 13, 14, 21, 22, 23, 24, 26, 27, 28, 31.
- New Statistics in Action illustrating ANOVA.

CHAPTER 13   Correlation and Linear Regression

- Chapter encourages users to compute p-Values with statistical software including online p-Value

calculators.
- New exercises 17, 35, 41, 43.
- Updated exercises 36, 47, 48, 49, 51, 52, 57, 58, 59.

CHAPTER 14 Multiple Regression Analysis

- New Statistics in Action describing spurious correlation.
- Updated exercises 1, 2, 24, 25, 26, 28.

CHAPTER 15 Nonparametric Methods: Nominal Level Hypothesis Tests

- Revised chapter opening page.
- Revised example/solution testing two population proportions.
- New exercises 24, 44.
- Updated exercise 29.

BRIEF CONTENTS

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