

Essentials of Business Statistics

First Canadian Edition

KEN BLACK

University of Houston–Clear Lake

IGNACIO CASTILLO

Wilfrid Laurier University

AMY GOLDLIST

British Columbia Institute of Technology

TIMOTHY EDMUNDS

British Columbia Institute of Technology

WILEY

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About the Authors

KEN BLACK is currently professor of decision sciences in the School of Business at the University of Houston–Clear Lake. Born in Cambridge, Massachusetts, and raised in Missouri, he earned a bachelor’s degree in mathematics from Graceland University, a master’s degree in math education from the University of Texas at El Paso, a Ph.D. in business administration in management science, and a Ph.D. in educational research from the University of North Texas.

Since joining the faculty of UHCL in 1979, Professor Black has taught all levels of statistics courses, forecasting, management science, market research, and production/operations management. In 2005, he was awarded the President’s Distinguished Teaching Award for the university. He has published over 20 journal articles and 20 professional papers, as well as two textbooks: *Business Statistics: An Introductory Course* and *Business Statistics for Contemporary Decision Making*. Professor Black has consulted for many different companies, including Aetna, the city of Houston, NYLCare, AT&T, Johnson Space Center, Southwest Information Resources, Connect Corporation, and Eagle Engineering.

Ken Black and his wife, Carolyn, have two daughters, Caycee and Wendi. His hobbies include playing the guitar, reading, travelling, and running.

IGNACIO CASTILLO is professor of operations and decision sciences at the Lazaridis School of Business & Economics, Wilfrid Laurier University. He received a Ph.D. in industrial engineering from Texas A&M University in 2001, an M.S.E. in industrial engineering from Arizona State University in 1998, and a B.S. (magna cum laude) in applied sciences from Universidad San Francisco de Quito, Ecuador, in 1995.

His research and teaching interests include business statistics, facility location, facility layout and material handling systems, manufacturing and service operations and logistics, and sustainable and closed-loop supply chain management. Dr. Castillo has consulted for several public and private organizations,

has supervised over 15 graduate theses or projects, and has produced over 20 articles that have appeared in prestigious academic journals. His research has been mainly supported by the Natural Sciences and Engineering Research Council of Canada (NSERC).

Dr. Castillo has served as adjunct faculty at the University of Alberta and the University of Waterloo and is a member of the Alpha Pi Mu Industrial Engineering Honor Society, The Honor Society of Phi Kappa Phi, and the Pinnacle Honor Society, and is a Glenn Carroll Teaching Fellow.

AMY GOLDLIST is a faculty member in the Operations Management department in the School of Business at the British Columbia Institute of Technology. She has an M.Sc. in mathematics from the University of British Columbia and a B.Sc. (Honours) from Dalhousie University and the University of King’s College.

Prior to entering academia, Amy worked as an analyst at Goldfarb Intelligence Research, a market research company specializing in qualitative and quantitative research, branding, and strategy.

Amy is currently completing a master’s of data science at the University of British Columbia. She lives in Vancouver, British Columbia, with her husband, Warren, and her children, Sam and Charlie.

TIMOTHY EDMUNDS is an instructor in the Operations Management department of the British Columbia Institute of Technology School of Business. He holds a Ph.D. in Computer Science from Rutgers University and a B.Sc. in Computer Science and Physics from the University of British Columbia. After completing a Postdoctoral Fellowship at UBC, he joined the BCIT faculty, where he currently teaches Business Mathematics and Business Statistics.

Timothy lives in Vancouver with his wife, Bethany, and their children, Tristan and Carter.

Preface

Our world is becoming increasingly reliant on data. We are surrounded by information, but as data become more and more available, it takes a firm grasp of quantitative reasoning to be able to understand what it all means. In order to make a clear story out of the mountains of data we now have available, we need to use statistics as an important method of understanding and acting on information.

We hope that by the end of this course, you will agree that the study of business statistics is important, valuable, and interesting. However, because it involves a new language of terms, symbols, logic, and mathematics, it can be daunting. For many of you, this text will be your first and only introduction to business statistics, which instructors often teach as a survey course. That is, you will be presented with an overview of the subject, including many techniques, concepts, and formulas. It can be overwhelming! One of the main difficulties in studying any topic in this way is being able to see the forest for the trees, that is, to sort out the many topics so they make sense. With this in mind, we have organized the content into four units, with each unit containing chapters that present similar material.

Unit I is titled “Introduction” because the first five chapters (1–5) introduce the study of business statistics. In Chapter 1, you will learn the many meanings of the word *statistics*, the concepts of descriptive and inferential statistics, and the types of data. In Chapter 2, you will use techniques to better organize and visualize different types of data. In Chapter 3, you will learn various measures to summarize data. In Chapter 4, you will explore how data are properly gathered, and in Chapter 5, you will learn the basic laws of probability. The notion of probability underlies virtually every statistics topic, distribution, and technique, thereby making it important to appreciate and understand the subject. In Unit I, the first five chapters, we will develop building blocks that will enable you to understand and apply statistical concepts so you can analyze data to make better decisions.

In Unit II (Chapters 6–9), we introduce the concept of statistical distributions. A statistical distribution is a numerical or graphical representation of frequency counts or probabilities for the possible values of a variable that can occur. Distributions are important because most of the analyses done in business statistics are based on the characteristics of a particular distribution. In Unit II, you will study nine distributions: seven population distributions and two sampling distributions.

In Chapter 6, we will begin the discussion of a probability distribution. We will motivate the study of probability distributions by introducing the concept of expected values, showing how they assist in making simple business decisions.

Seven probability distributions are presented in Chapters 7 and 8. These probability distributions can be categorized as discrete distributions or continuous distributions. Discrete distributions are introduced in Chapter 7, and they include

the discrete uniform distribution, the binomial distribution, the hypergeometric distribution, the Poisson distribution, and the geometric distribution. Continuous distributions are presented in Chapter 8, and they include the continuous uniform distribution and the normal distribution. Information about sampling is discussed in Chapter 9 along with two sampling distributions: the sampling distribution of the mean and the sampling distribution of the sample proportion. Three more population distributions are introduced later in the text in Unit III. These include the t distribution in Chapter 10, the F distribution in Chapter 13, and the χ^2 distribution in Chapter 15.

Unit III, from Chapter 10 through Chapter 12, contains a collection of estimation and hypothesis-testing techniques organized by the situations in which they can be applied. In Chapter 10, we present confidence interval techniques for the estimation of parameters. In Chapter 11, we introduce the concept of hypothesis testing and present one-sample hypothesis tests. Chapter 12 contains hypothesis tests for two samples.

Finally, in Unit IV (Chapters 13–15), we cover a variety of two-variable problems. Chapter 13 deals with problems with both a quantitative and a categorical variable using analysis of variation (ANOVA). Chapter 14 deals with purely categorical data using simple linear regression and correlation. Finally, Chapter 15 looks at purely categorical data that can be analyzed with the χ^2 goodness-of-fit test or the χ^2 test of independence.

Hallmarks of *A Brief Introduction to Business Statistics*

Multimedia and Interactive Content

This book integrates text with interactive and multimedia content, online tools and resources, and video tutorials to provide a contemporary and appealing learning experience. The complete program in *WileyPLUS* along with a stand-alone eText and practical printed text options offers the flexibility to suit any course format, whether it be a face-to-face, a hybrid/blended learning environment, or an online class.

Among its many features, this online learning interface allows students to study and practise using the digital textbook, quizzes, and algorithmic exercises. The immediate feedback helps students understand where they need to focus their study efforts.

In *WileyPLUS*, students will find various helpful tools, such as the student study manual, applets, Decision Dilemma and Decision Dilemma Solved animations, learning activities,

flash cards for key terms, demonstration problems, databases in Excel, case data in Excel, and problem data in Excel.

- **Ebook.** The complete text is available on *WileyPLUS*, with learning links to various features and tools to assist students in their learning.
- **Videos.** There are 21 videos explaining concepts and demonstrating how to work problems for some of the more difficult topics.
- **Office Hours Videos.** These are worked video examples of selected problems from the text.
- **Applets.** Statistical applets are available, affording students the opportunity to learn concepts by iteratively experimenting with various values of statistics and parameters and observing the outcomes.
- **Learning Activities.** There are numerous learning activities to help students better understand concepts and key terms. These activities have been developed to make learning fun, enjoyable, and challenging.
- **Data Sets.** Many problems from the text, along with the case problems and the databases, are available to students in Excel format.
- **Multimedia Resources.** To aid students in understanding complex interactions, the Decision Dilemma and Decision Dilemma Solved features have been animated. Students can view these animated activities to improve their understanding of these features.
- **Kaddstat.** Kaddstat is an easy-to-use add-in to Excel that makes it easier to run complex statistical tests in Excel.
- **Flash Cards.** Key terms will be available to students in a flash card format along with their definition.
- **Student Study Guide.** The study guide contains complete answers to all odd-numbered questions.
- **Demonstration Problems.** Step-by-step solved problems are given for each chapter.
- **Career Center.** This special guide to building a student portfolio is complete with professional resumé and competency documentations as well as Career Coach videos. Through Career Center, students also get access to Career-Shift, a leading job search tool.
- **Demonstration Problems** contain both an example problem and its solution and are used as an additional pedagogical tool to supplement explanations and examples.
- **Section Problems** at the end of almost every section use real data gathered from a plethora of sources. Here are two brief excerpts from some of the real-life problems in the text: “The Canada Beef Export Federation reports that the top six destinations for Canada beef in a recent year were the U.S. with \$1,697 million, Mexico with \$269 million, Japan with \$171 million, South Korea with \$28 million, Taiwan with \$16 million, and China with \$4 million.” “Data accumulated by Environment Canada show that the average wind speed in kilometres per hour for Victoria International Airport, located on the Saanich Peninsula in British Columbia, is 9.3.”
- **Concept Checks** are conceptual questions aimed to reinforce the conceptual understanding of the material presented in each section. These questions do not require students to use calculations.
- **Points of Interest** appear throughout the chapters to provide helpful tips and further explanation regarding key concepts.
- **Statistics in Business Today** focus boxes contain an interesting application of how techniques from that particular chapter are used in the business world today. They are usually based on real companies, surveys, or published research.
- **Decision Dilemma Solved** addresses the managerial and statistical questions raised in the Decision Dilemma. Data given in the Decision Dilemma are analyzed computationally and by computer using techniques presented in the chapter. Answers to the Managerial and Statistical Questions raised in the Decision Dilemma are arrived at by applying chapter concepts, thus bringing closure to the chapter.
- **Key Considerations** is a timely feature given that many users of statistics are unaware of the traps that await the unwary. With the abundance of statistical data and analysis, there is also considerable potential for the misuse of statistics in business dealings. The important Key Considerations feature underscores this potential misuse by discussing such topics as lying with statistics, failing to meet statistical assumptions, and failing to include pertinent information for decision makers. Through this feature, instructors can begin to integrate the topic of ethics with applications of business statistics. Here is an excerpt from a Key Considerations feature: “Hypothesis testing through random sampling opens up many possible inappropriate situations that can occur in sampling, such as identifying a frame that is favourable to the outcome we are seeking or using nonrandom sampling techniques to test hypotheses. In addition, we should be careful to use the proper test statistic for tests of a population mean, particularly when σ is unknown. If the mean is being tested, we should be careful to apply the techniques only when it can be shown with some confidence that the sampling distribution of the mean is normally distributed (i.e., that the central limit theorem applies). The incorrect use of this technique occurs when we do not carefully check the sample size and population distribution shape for compliance with this assumption. Failure to do so can easily result in the reporting of spurious conclusions.”

Content Walkthrough

The following pedagogical features guide the user through the content. The Using the Computer sections have been integrated throughout the text and focus on Microsoft Excel 2016.

- **Learning Objectives** give the reader a list of key topics that will be discussed and the goals to be achieved from studying the material.
- **Decision Dilemma** is a short case that describes a real company or business situation in which managerial and statistical questions are raised. In most Decision Dilemmas, actual data are given and students are asked to consider how the data can be analyzed to answer the questions.

- **Why Statistics Is Relevant** discusses how the material discussed in that chapter is related to real-life decision-making.
- **Summaries** provide an overview of the important concepts, ideas, and techniques. This feature can serve as a preview of the material as well as a review.
- **Key Terms** appear in colour, and their definitions, where possible, are italicized as they are discussed. A separate list of key terms is also presented. In addition, these terms appear with their definitions in a separate glossary.
- **Formulas** are highlighted to make it easy for students to locate them. Formulas are numbered for ease of reference and clarity and are listed at the end of most chapters as a handy reference.
- **Supplementary Problems** are an extensive set of additional problems. The Supplementary Problems are divided into three groups: *Calculating the Statistics*, which are strictly computational problems; *Testing Your Understanding*, which are problems for application and understanding; and *Interpreting the Output*, which are problems that require the interpretation and analysis of software output.
- **Analyzing the Databases** use six major databases located on the student companion website that accompanies the book. The Analyzing the Databases section contains several questions/problems that require the application of techniques from the chapter to data in the variables of the databases. It is assumed that most of these questions/problems will be solved using a computer.
- **Cases** are based on a real company, and many feature Canadian businesses. These cases give students an opportunity to use statistical concepts and techniques presented in the chapter to solve a business dilemma. Some cases feature very large companies, such as Burger King, McCain Foods Limited, and Shell Oil. Others pertain to smaller businesses, such as Delta Wire and Ceapro, that have overcome obstacles to survive and thrive. Most cases include raw data for analysis and questions that encourage students to use several of the techniques presented in the chapter. In many cases, students must analyze software output in order to reach conclusions or make decisions.
- **Using the Computer.** The Using the Computer sections are integrated throughout and contain directions for producing the Excel 2016 software output presented in the material. It is assumed that students have a general understanding of a Microsoft environment. Directions include specifics about menu bars, drop-down menus, and dialogue boxes. Dialogue boxes are not discussed in detail; the intent is to provide enough information for students to produce the same statistical output analyzed and discussed in the chapter.

Student Video Support

With the advent of online business statistics courses, increasingly large class sizes, and the number of commuter students

who have very limited access to educational resources on business statistics, it is often difficult for students to get the learning assistance that they need to bridge the gap between theory and application on their own. Two innovative features of the package to address this issue are described next.

Video Tutorials by Ken Black

An exciting feature of the package that will enhance the effectiveness of student learning in business statistics and significantly enhance the presentation of course material is the series of video tutorials by Ken Black.

There are several high-quality video tutorial sessions that explain difficult key topics and demonstrate how to work problems from challenging sections of the text.

- Chapter 3: Computing Variance and Standard Deviation
- Chapter 5: Constructing and Solving Probability Matrices
- Chapter 5: Solving Probability Word Problems
- Chapter 7: Solving Binomial Distribution Problems, Part I
- Chapter 8: Solving Problems Using the Normal Curve
- Chapter 9: Solving for Probabilities of Sample Means Using the z Statistic
- Chapter 10: Confidence Intervals
- Chapter 10: Determining which Inferential Technique to Use, Part I: Confidence Intervals
- Chapter 11: Establishing Hypotheses
- Chapter 11: Determining which Inferential Technique to Use, Part II: Hypothesis Tests
- Chapter 11: Hypothesis Testing Using the z Statistic
- Chapter 11: Understanding p Values
- Chapter 12: Determining which Inferential Technique to Use, Part II: Hypothesis Tests
- Chapter 12: t Test for Two Samples
- Chapter 13: Computing and Interpreting a One-Way ANOVA
- Chapter 14: Testing the Regression Model I: Predicted Values, Residuals, and Sum of Squares of Error
- Chapter 14: Testing the Regression Model II: Standard Error of the Estimate and r^2

Office Hours Videos by Ignacio Castillo

Office Hours Videos are problem-solving video tutorials based on chapter problems prepared by Canadian author Ignacio Castillo that walk students through the process of solving problems.

The videos by Ken Black and Ignacio Castillo are available for adopters on *WileyPLUS* and can be used to augment lectures and enrich classroom presentations. Each video is around 10 minutes in length.

The Complete Program

Bringing together the text, multimedia resources, video tutorials, self-paced and assignable practice activities, and a variety of teaching, learning, and assessment resources, *WileyPLUS* offers the most complete learning experience and integrates seamlessly with popular learning management systems such as Canvas, Blackboard, Moodle, and D2L.

eText or Loose-Leaf Print Companion Text

A downloadable alternative to a traditional, printed textbook, the eText is a popular option with students who want to be able to access the text on their computer or mobile devices even when not online. A loose-leaf printed companion text is also available and can be packaged with either *WileyPLUS* or the eText. *WileyPLUS* with the printed companion text is the ideal option for face-to-face classes.

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—TIM

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