RAINER • PRINCE • WATSON

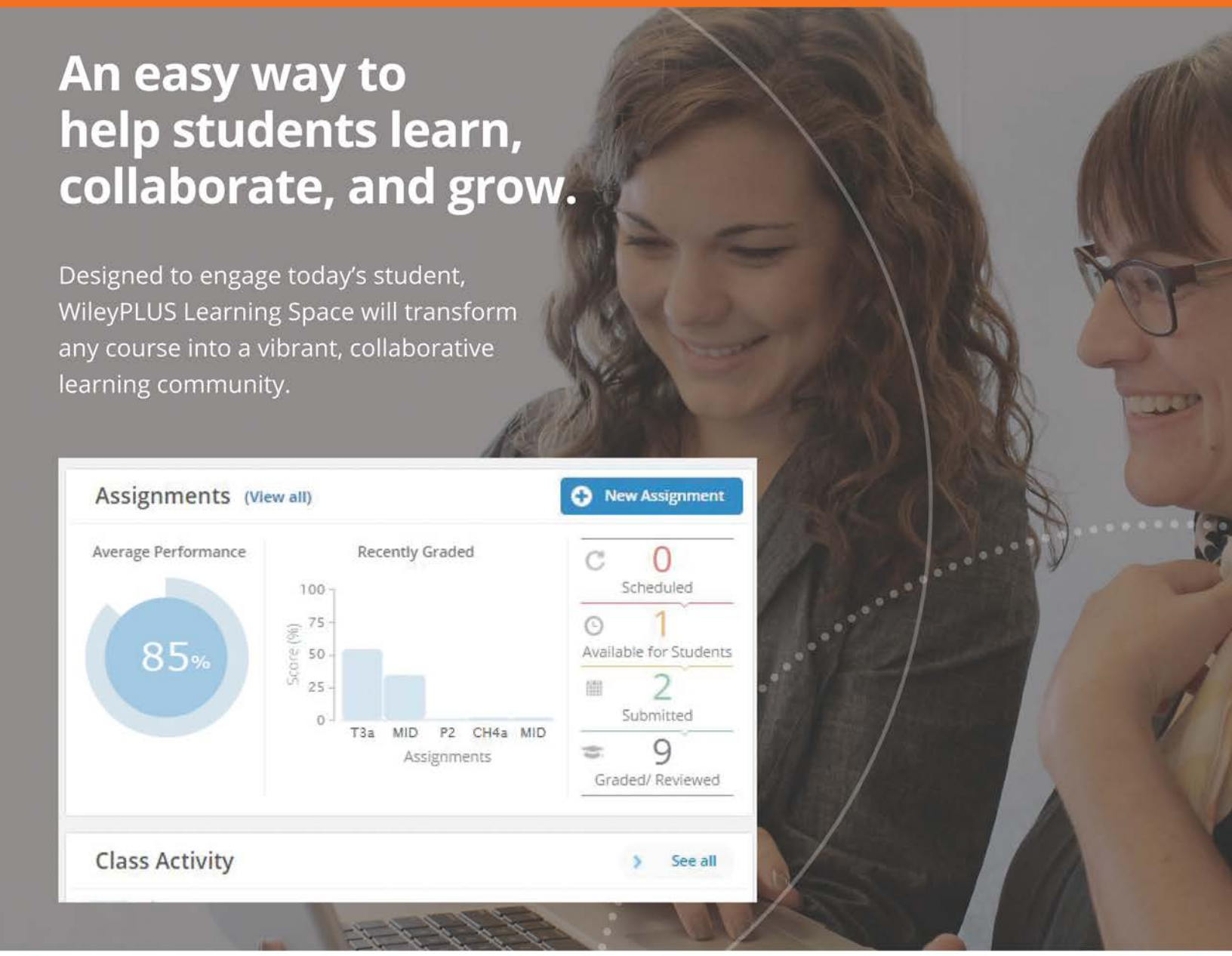
Management Information Systems

Moving Business Forward

4th EDITION

WILEY

WileyPLUS Learning Space



An easy way to help students learn, collaborate, and grow.

Designed to engage today's student, WileyPLUS Learning Space will transform any course into a vibrant, collaborative learning community.

Identify which students are struggling early in the semester.

Educators assess the real-time engagement and performance of each student to inform teaching decisions. Students always know what they need to work on.

Facilitate student engagement both in and outside of class.

Educators can quickly organize learning activities, manage student collaboration, and customize their course.

Measure outcomes to promote continuous improvement.

With visual reports, it's easy for both students and educators to gauge problem areas and act on what's most important.

www.wileypluslearningspace.com

WILEY

Management Information Systems

Moving Business Forward

Fourth Edition

KELLY RAINER

BRAD PRINCE

HUGH WATSON

with contributions by
Alina M. Chircu, Bentley University
Marco Marabelli, Bentley University

WILEY

VICE PRESIDENT AND DIRECTOR	George Hoffman
DIRECTOR	Veronica Visentin
EXECUTIVE EDITOR	Darren Lalonde
ASSISTANT DEVELOPMENT EDITOR	Emma Townsend-Merino
SENIOR CONTENT MANAGER	Dorothy Sinclair
SENIOR PRODUCTION EDITOR	Jane Lee Kaddu
SENIOR MARKETING MANAGER	Chris DeJohn
ASSOCIATE PRODUCT DESIGNER	Wendy Ashenberg
SENIOR DESIGNER	Maureen Eide
SENIOR PHOTO EDITOR	Billy Ray
COVER DESIGNER	Maureen Eide
PRODUCTION MANAGEMENT SERVICES	Thomson Digital
COVER CREDIT	Aleksandarvelasevic © Getty Images

This book was set in Source Sans Pro 9.5/12.5 by Thomson Digital and printed and bound by Courier/Kendallville.

This book is printed on acid free paper.

Founded in 1807, John Wiley & Sons, Inc., has been a valued source of knowledge and understanding for more than 200 years, helping people around the world meet their needs and fulfill their aspirations. Our company is built on a foundation of principles that include responsibility to the communities we serve and where we live and work. In 2008, we launched a Corporate Citizenship Initiative, a global effort to address the environmental, social, economic, and ethical challenges we face in our business. Among the issues we are addressing are carbon impact, paper specifications and procurement, ethical conduct within our business and among our vendors, and community and charitable support. For more information, please visit our Web site: www.wiley.com/go/citizenship.

Copyright © 2017 John Wiley & Sons, Inc. All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, photocopying, recording, scanning or otherwise, except as permitted under Sections 107 or 108 of the 1976 United States Copyright Act, without either the prior written permission of the Publisher, or authorization through payment of the appropriate per-copy fee to the Copyright Clearance Center, Inc., 222 Rosewood Drive, Danvers, MA 01923 (Web site: www.copyright.com). Requests to the Publisher for permission should be addressed to the Permissions Department, John Wiley & Sons, Inc., 111 River Street, Hoboken, NJ 07030-5774, (201) 748-6011, fax (201) 748-6008, or online at: www.wiley.com/go/permissions.

ISBN-13: 978-1-119-32109-5

The inside back cover will contain printing identification and country of origin if omitted from this page. In addition, if the ISBN on the back cover differs from the ISBN on this page, the one on the back cover is correct.

Library of Congress Cataloging-in-Publication Data
Names: Rainer, R. Kelly, Jr., 1949-
Title: Management information systems / R. Kelly Rainer, Jr., Brad Prince, Hugh Watson.
Description: Fourth edition. | Hoboken, NJ : John Wiley & Sons, Inc., 2017. | Includes bibliographical references and index.
Identifiers: LCCN 2016034800 (print) | LCCN 2016035388 (ebook) | ISBN 9781118890486 (paperback : acid-free paper) | ISBN 9781118890431 (pdf) | ISBN 9781119321095 (epub)
Subjects: LCSH: Management information systems.
Classification: LCC HD30.213 .R35 2017 (print) | LCC HD30.213 (ebook) | DDC 658.4/038011--dc23
LC record available at https://lccn.loc.gov/2016034800

Printed in the United States of America.

10 9 8 7 6 5 4 3 2 1

To The Student

Dear Student,

Why are you here? We are not asking you a philosophical question—that is a different course. We are asking, "Why are you about to spend an entire term learning about information systems? Why are you—an accounting major, or a marketing or management major—being required to study this topic?" You may be asking, "What's in IT for me?" The short answer is that "IT's About Business," and the longer answer is the goal of this book.

Information systems are making the world a very small place and are contributing to rapidly increasing global competition. As a result, organizations are constantly trying to find ways to gain a competitive advantage—by achieving operational excellence, developing new products and services, developing new business models, providing superb customer service, improving decision making, and so on. It should be obvious, then, that an introductory course in information systems is critically important for success in your chosen career.

Rapid advances in information systems mean that, as business students, change will be the only constant you will encounter in today's dynamic digital business environment. We wrote this book for business students of all majors who will soon become business professionals. We have three goals in mind:

1. To help you be immediately successful when you join your organization
2. To help you understand the importance of information systems for individuals, organizations, and society as a whole
3. To enable you to become informed users of your organization's information systems

To accomplish these goals, we have tried to provide the essential, relevant knowledge that you need to understand to effectively use information systems in your careers.

The way we propose to do this is by keeping you *actively involved* in the material. Every section of the chapters has an activity that asks you to do something beyond just reading the textbook that will help you see why the content is useful for your future business career.

We hope you will enjoy this active approach and successfully complete the course with a richer understanding of what's in IT for you.

KELLY RAINER, BRAD PRINCE, AND HUGH WATSON

To The Instructor

Dear Instructor,

We are like you. All of us who teach the introductory course in information systems realize that it is difficult for students to understand the importance and relevance of the topics in the course. As a result, students often memorize the content just before the exam, and then forget it as soon as the exam is over. We all want to engage students at a much deeper level. We know that the best way to accomplish this objective is through *hands-on active learning,* leading to *increased student engagement* in our course content.

Accordingly, active learning and student engagement are key principles of our new book. We recognize the need to actively involve students in problem solving, creative thinking, and capitalizing on opportunities. Every section of every chapter includes extensive hands-on exercises, activities, and mini-cases. End-of-chapter material also includes exercises that require students to use software application tools. Through these activities, we enable students to understand how to *do* something with the concepts they learn, such as meet business goals using information systems, configure products, and use spreadsheets and databases to facilitate problem solving.

The preface on the next page further outlines the goals, features, and support material provided with our new text. We hope you will enjoy teaching with this approach!

KELLY RAINER, BRAD PRINCE, AND HUGH WATSON

Preface

Chapter Organization

Each chapter contains the following elements:

- **Chapter Outline:** Lists the major concepts covered in each chapter.
- **Learning Objectives:** Provide an overview of the key learning goals that students should achieve after reading the chapter.
- **Chapter-Opening Case:** A short case that focuses on a small or start-up company that is using information systems to solve a business problem. Cases in introductory information systems textbooks typically involve very large organizations. In contrast, our chapter-opening cases demonstrate that small and start-up companies also have business problems that they address using information systems. Students will see that small firms usually have to be quite creative in building and implementing IS solutions, because they do not have MIS departments or large budgets. These small-business cases also add an entrepreneurial flavor to each chapter for students who are planning to start their own businesses.
- **Apply the Concept Activities:** This book's unique pedagogical structure is designed to keep students actively engaged with the course material. Reading material in each chapter subsection is immediately followed by an "Apply the Concept" activity that is directly related to a chapter objective. These activities include links to online videos and articles and other hands-on activities that require students to immediately apply what they have learned. Via WileyPLUS, instructors can assign a section of text along with an Apply the Concept activity. Each Apply the Concept has the following elements:
  - Background (places the activity in the context of relevant reading material)
  - Activity (a hands-on activity that students carry out)
  - Deliverable (various tasks for students to complete as they perform the activity)
- **IT's About Business:** Short cases that demonstrate real-world applications of IT to business. Each case is accompanied by questions relating the case to concepts covered in the chapter. Icons relate these boxes to the specific functional areas.
- **IT's Personal:** Sprinkled throughout the chapters, these short vignettes explain the relevance of MIS concepts to students' daily lives.
- **Before You Go On:** End-of-section reviews prompt students to pause and test their understanding of concepts before moving on to the next section.
- **Examples:** Interspersed throughout the text, these highlight the use (and misuse) of information systems by real-world organizations, thereby illustrating the concepts discussed in the chapter.
- **What's in IT for Me?:** A unique end-of-chapter summary that demonstrates the relevance of each key chapter topic to different functional areas, including accounting, finance, marketing, production/operations management, human resources management, and management information systems. This cross-functional focus makes the book accessible for students from any major.
- **Summary:** Keyed to the Learning Objectives listed at the beginning of the chapter, the summary enables students to review major concepts covered.
- **Discussion Questions and Problem-Solving Activities:** Provide practice through active learning. These exercises are hands-on opportunities to apply the concepts discussed in the chapter.
- **Collaboration Exercises:** Team exercises that require students to take on different functional roles and collaborate to solve business problems using Google Drive. These exercises allow students to get first-hand experience solving business problems using Cloud-based tools while also experiencing an authentic business team dynamic.
- **Closing Cases:** Each chapter concludes with two cases about business problems faced by actual companies and how they used IS to solve those issues. The cases are broken down into three parts: a description of the problem, an overview of the IS solution implemented, and a presentation of the results of the implementation. Each case is followed by discussion questions, so that students can further explore the concepts presented in the case.
- **Spreadsheet Activity:** Every chapter includes a hands-on spreadsheet project that requires students to practice their Excel skills within the context of the chapter material. WileyPLUS Learning Space includes an Excel Lab Manual for students who need introductory coverage or review.
- **Database Activity:** Every chapter includes a hands-on database project that requires students to practice their Access skills while using concepts learned in the chapter. WileyPLUS Learning Space includes an Access Lab Manual for students who need introductory coverage or review.
- **Internship Activity:** Every chapter includes an Internship Activity which presents a business problem found in one of four recurring industries (healthcare, banking, manufacturing, and retail.) STUDENTS are directed to various software demos that provide useful tools for addressing the business problem. Then the students must act as interns and apply

the concepts they learned in the chapter to provide a solution to the business problem.

- **Glossary:** A study tool that highlights vocabulary within the chapters and facilitates studying.

Key Features

Student Engagement As discussed in the note addressed to instructors at the beginning of this preface, one of the chief goals of this text is to engage students at a level beyond recognition of key terms. We believe the best way to achieve this goal is through hands-on, active learning that will lead to increased student engagement with the course and its content.

Accordingly, every section of every chapter provides resources that actively involve students in problem solving, creative thinking, and capitalizing on opportunities. Every chapter includes extensive hands-on exercises, activities, and mini-cases, including exercises that require students to solve business problems using Excel and Access.

Cross-Functional Approach We emphasize the importance of information systems by calling attention in every chapter to how that chapter's topic relates to each business major. Icons guide students to relevant issues for their specific functional area—accounting (ACC), fi nance (FIN), marketing (MKT), production operations management (POM), human resources management (HRM), and management information systems (MIS). Chapters conclude with a detailed summary (entitled "What's in IT for Me?") of how key concepts in the chapter relate to each functional area.

ACCT FIN MKT POM HRM MIS

Diversified and Unique Examples from Different Industries Extensive use of vivid examples from large corporations, small businesses, and government and not-for-profit organizations enlivens the concepts from the chapter. Th e examples illustrate everything from the capabilities of information systems, to their cost and justification and the innovative ways that corporations are using IS in their operations. Small businesses have been included in recognition of the fact that many students will work for small-to mid-sized companies, and some will even start their own small business. In fact, some students may already be working at local businesses, and the concepts they are learning in class can be readily observed or put into practice in their part-time jobs. Each chapter constantly highlights the integral connection between business and IS. This connection is especially evident in the chapter-opening and closing cases, the "IT's About Business" boxes, and the highlighted examples.

Successes and Failures Many textbooks present examples of the successful implementation of information systems, and our book is no exception. However, we go one step beyond by also providing numerous examples of IS failures, in the context of lessons that can be learned from such failures. Misuse of information systems can be very expensive.

Global Focus An understanding of global competition, partnerships, and trading is essential to success in a modern business environment. Therefore, we provide a broad selection of international cases and examples. We discuss the role of information systems in facilitating export and import, the management of international companies, and electronic trading around the globe.

Innovation and Creativity In today's rapidly changing business environment, creativity and innovation are necessary for a business to operate effectively and profitably. Throughout our book, we demonstrate how information systems facilitate these processes.

Focus on Ethics With corporate scandals appearing in the headlines almost daily, ethics and ethical questions have come to the forefront of business people's minds. In addition to devoting an entire chapter to ethics and privacy (Chapter 6), we have included examples and cases throughout the text that focus on business ethics.

A Guide to Icons in This Book

As you read this book, you will notice a variety of icons interspersed throughout the chapters.

These icons highlight material relating to different functional areas. MIS concepts are relevant to all business careers, not just careers in IT. The functional area icons help students of different majors quickly pick out concepts and examples of particular relevance to them. Below is a quick reference of these icons.

ACCT **For the Accounting Major** highlights content relevant to the functional area of accounting.

FIN **For the Finance Major** highlights content relevant to the functional area of finance.

MKT **For the Marketing Major** highlights content relevant to the functional area of marketing.

POM **For the Production/Operations Management Major** highlights content relevant to the functional area of production/operations management.

HRM **For the Human Resources Major** highlights content relevant to the functional area of human resources.

MIS **For the MIS Major** highlights content relevant to the functional area of MIS.

What's New in the Fourth Edition?

Content changes include:

- Chapter 5: Completely rewritten chapter on Business Analytics. Chapter provides a visual overview of the Analytics process (Figure 5.3), and extensive coverage of descriptive analytics, predictive analytics, and prescriptive analytics.
- Plug IT In 5: Completely rewritten Plug IT In on Artificial Intelligence. This Plug In differentiates between weak AI and strong AI and then addresses AI technologies such as expert systems, machine learning, deep learning, and neural networks. The Plug In continues with a discussion of AI applications, including machine vision, natural language processing, robotics, speech recognition, and intelligent agents.
- Chapter 3 contains expanded coverage of Big Data.
- Plug IT In 1 provides expanded coverage of business processes.
- All new or updated IT's About Business, chapter-opening and closing cases, and examples.
- Pedagogical changes include:
  - Revised and streamlined "Apply the Concept" activities now relate directly to chapter objectives.
  - New "Internship Activities" replace the Ruby's Club activities from previous editions. Each Internship Activity includes a software demo that requires students to apply new tools to business problems.
  - Revised "Collaboration Exercises" now each require use of Google Drive.
  - Revised and streamlined database and spreadsheet exercises for every chapter. These include references to lessons in the WileyPLUS lab manual for students who need instruction or review.

Online Resources

www.wiley.com/college/rainer

Our book also facilitates the teaching of an Introduction to Information Systems course by providing extensive support materials for instructors and students. Visit www.wiley.com/college/rainer to access the Student and Instructor Companion Sites.

Instructor's Manual The *Instructor's Manual* includes a chapter overview, teaching tips and strategies, answers to all end-of-chapter questions, supplemental mini-cases with essay questions and answers, and experiential exercises that relate to particular topics. It also includes answers and solutions to all spreadsheet and database activities, along with a guide to teaching these exercises, and links to the separate Excel and Access starter and solutions files.

Test Bank The test bank is a comprehensive resource for test questions. Each chapter contains multiple choice, true/false, short answer, and essay questions. In addition, each chapter includes "Apply Your Knowledge" questions that require more creative thought to answer. Each multiple choice and true/false question is labeled to indicate its level of difficulty: easy, medium, or hard.

The test bank is available for use in Respondus' easy-to-use software. Respondus® is a powerful tool for creating and managing exams that can be printed or published directly to Blackboard, WebCT, Desire2Learn, eCollege, ANGEL, and other learning systems. For more information on Respondus® and the Respondus Test Bank Network, please visit www.respondus.com.

Reading Quizzes These multiple choice conceptual questions can be used by instructors to evaluate a student's understanding of the reading. They are available in Respondus, the WileyPLUS course, and the Book Companion Site.

PowerPoint Presentations The *PowerPoint Presentations* consist of a series of slides for each chapter. The slides are designed around each chapter's content, incorporating key points from the chapter and chapter illustrations as appropriate, as well as real-life examples from the Web.

Image Library All textbook figures are available for download from the Web site. These figures can easily be added to PowerPoint presentations.

Weekly Updates (http://wileyinformationsystemsupdates.com)
Weekly updates, harvested from around the Internet by David Firth of the University of Montana, provide you with the latest IT news and issues. These are posted every Monday morning throughout the year at http://wileyinformationsystemsupdates.com/. They include links to current articles and videos as well as discussion questions to assign or use in class.

OfficeGrader Office Grader™ is an Access-Based VBA Macro that enables automatic grading of Office assignments. The macros compare Office files and grade them against a master file. OfficeGrader™ is available for Word, Access, Excel, and PowerPoint for Office 2010 and 2013. For more information, contact your Wiley sales representative or visit http://www.wiley.com/college/sc/office2013/officegrader.html.

WileyPLUS Learning Space

WileyPLUS Learning Space is an easy way for students to learn, collaborate, and grow. With WileyPLUS Learning Space, students create a personalized study plan, assess progress along the way, and make deeper connections as they interact with the course material and each other. Through a combination of dynamic course materials and visual reports, this collaborative learning environment gives you and your students immediate

insight into strengths and problem areas in order to act on what's most important.

- This online teaching and learning environment integrates the entire digital textbook with the most effective instructor and student resources to accommodate every learning style.
- Students achieve concept mastery in a rich, structured environment that is available 24/7.
- Instructors personalize and manage their course more effectively with assessment, assignments, grade tracking, and more. You can even add your own materials to your WileyPLUS course
- With WileyPLUS Learning Space you can identify students who are falling behind and intervene accordingly, without having to wait for them to come to office hours.
- WileyPLUS Learning Space can complement the textbook or replace the printed textbook altogether.

WileyPLUS Learning Space for Rainer MIS 3e includes the following resources to support teaching and learning:

- New author lecture videos for every section of every chapter will facilitate switch to "flipped classrooms" and/or will provide additional learning support for students.
- Orion, an adaptive, personal learning experience that helps students highlight their strengths and problems areas and navigate through their studies to get optimal results in the most efficient amount of time. (See more information below.).
- Group chat function facilitates student discussion about activities and cases.
- Complete eText allows searching across all chapters, note-taking, highlighting, and the ability to copy and paste or print key sections.
- Lab Manual for Microsoft Office 2010 and Office 2013.
- Automatically graded practice questions
- Vocabulary flash cards and quizzes
- Library of additional "IT's About Business" cases.

For more information and a demo, visit here: http://www.wiley.com/college/sc/wpls/

ORION Included in WileyPLUS Learning Space, ORION helps gauge students' strengths and weaknesses so that instructors can tailor instruction accordingly. Instructor reports track aggregate and individual student proficiency at the objective or chapter level, to show exactly where students excel as well as the areas that need reinforcement.

Based on cognitive science, WileyPLUS with ORION is a personalized, adaptive learning experience that helps students build proficiency on topics while using their study time most effectively.

For more information and a demo, visit here: http://www.wiley.com/college/sc/ oriondemo/.

WILEY Flex

In addition to WileyPLUS Learning Space, Wiley provides a wide variety of printed and electronic formats that provide many choices to your students at a wide range of price points. Contact your Wiley sales representative for more details on any of the below.

Wiley E-Text Powered by VitalSource Wiley E-Texts are complete digital versions of the text that help students study more efficiently. Students can access content online and offline on their desktops, laptops, and mobile devices; search across the entire book content, take notes and highlight, and copy and paste or print key sections.

Wiley Binder Version A three-hole-punched, loose-leaf version allows students to carry only the content they need, insert class notes and hand-outs, and keep all materials in one place.

Wiley Custom This group's services allows you to adapt existing Wiley content and combine text materials, incorporate and publish your own materials, and collaborate with Wiley's team to ensure your satisfaction.

Wiley Custom Select Wiley Custom Select allows you to build your own course materials using selected chapters of any Wiley text and your own material if desired. For more information, visit http:// customselect.wiley.com.

Acknowledgments

Creating, developing, and producing a text for the introduction to information systems course is a formidable undertaking. Along the way, we were fortunate to receive continuous evaluation, criticism, and direction from many colleagues who regularly teach this course.

Special thanks to the following contributors: Ken Corley for designing the PowerPoint slides, Jennifer Gerow for writing test bank questions, Bob Gehling for working on the Instructor's Manual, and Carole Hollingsworth for designing Wiley PLUS activities.

Special thanks to contributors Dawna Dewire, Joan Lumpkin, Kevin Lertwachara, Roy DeJoie, and Kala Seal for working on the original Apply the Concept activities that appeared in prior editions. Thanks also to Efrem Mallach for creating the original database activities in

the prior editions. Many thanks also to Alina M. Chircu and Marco Marabelli of Bentley University for developing new material that enhances our coverage of business processes and ERP. We are grateful for the dedication and creativity of all these contributors in helping us craft this new text.

We would like to thank the Wiley team: Darren Lalonde, Executive Editor; Emma Townsend-Merino, Assistant Development Editor; Wendy Ashenberg, Associate Product Designer; and Chris DeJohn, Senior Marketing Manager. We also thank the Content Management team, including Dorothy Sinclair, Content Manager; Jane Lee Kaddu, Senior Production Editor; and Abhishek Sarkari of Thomson Digital. And thanks to Maureen Eide, Senior Designer; and Billy Ray, Senior Photo Editor. We would also like to thank Robert Weiss for his skillful and thorough editing of the manuscript.

Finally, we would like to acknowledge the contributions made by the individuals listed below who participated in focus groups, telesessions, surveys, chapter walkthroughs, class tests, user feedback surveys, and reviews.

KELLY RAINER
BRAD PRINCE
HUGH WATSON

Monica Adya, *Marquette University*
Lawrence Andrew, *Western Illinois University, Macomb*
Orakwue (Bay) Arinze, *Drexel University*
Laura Atkins, *James Madison University*
Nick Ball, *Brigham Young University*
Nicholas Barnes, *Nicholls College*
Susan Barzottini, *Manchester Community College*
Kristi Berg, *Minot State University*
Andy Borchers, *Lipscomb University*
David Bouchard, *Metropolitan State University*
Dave Bourgeois, *Biola University*
Mari Buche, *Michigan Tech University*
Richard Burkhard, *San Jose State University*
Ashley Bush, *Florida State University*
Frank Canovatchel, *Champlain College*
Donald Carpenter, *Mesa State College*
Teuta Cata, *Northern Kentucky University*
Wendy Ceccucci, *Quinnipiac University*
Amita Chin, *Virginia Commonwealth University*
Susan Chinn, *University of Southern ME, Portland*
Richard Christensen, *Metropolitan State University*
Dmitriy Chulkov, *Indiana University Kokomo*
Phillip Coleman, *Western Kentucky University*
Emilio Collar, *Western CT State University*
Daniel Connolly, *University of Denver*
Lee Cornell, *Minnesota State University, Mankato*
David Croasdell, *University of Nevada, Reno*
Jakov Crnkovic, *University at Albany, SUNY*
Reet Cronk, *Harding University*
Marcia Daley, *Clark, Atlanta*
Donald Danner, *San Francisco State University*
Roy DeJoie, *Purdue University*
Dawna Dewire, *Babson College*
Kevin Duffy, *Wright State University*
Lauren Eder, *Rider University*
Sean Eom, *Southeast Missouri State University*
Ahmed Eshra, *St. John's University*
Roger Finnegan, *Metropolitan State University*
Thomas Fischer, *Metropolitan State University*
Jerry Flatto, *University of Indianapolis*
Jonathan Frankel, *University of Massachusetts, Boston*
Judith Gebauer, *University of North Carolina, Wilmington*
Jennifer Gerow, *Virginia Military Institute*
Matt Graham, *University of Maine*
Katie Gray, *University of Texas, Austin*
Penelope (Sue) Greenberg, *Widener University*
Naveen Gudigantala, *University of Portland*
Saurabh Gupta, *University of North Florida*
Bernard Han, *Western Michigan University*
Hyo-Joo Han, *Georgia Southern College*
John Hagle, *Texas State Technical College*
Peter Haried, *University of Wisconsin, LaCrosse*
Ranida Harris, *Indiana University Southeast*
Roslin Hauck, *Illinois State University*
Bernd Haupt, *Penn State University*
Jun He, *University of Michigan, Dearborn*
Richard Herschel, *St. Joseph's University*
Bogdan Hoanca, *University of Alaska*
Mary Carole Hollingsworth, *Georgia Perimeter College, Clarkston Campus*
Terri Holly, *Indian River State College*
Derrick Huang, *Florida Atlantic University*
Maggie Hutchison, *Flagler College*
Mark Hwang, *Central Michigan University*
Lynn Isvik, *Upper Iowa University, Fayette*
Curtis Izen, *Baruch College, City University of New York*
Radhika Jain, *Baruch College, City University of New York*
Arpan Jani, *University of Wisconsin, River Falls*
Jonathan Jelen, *St. John's University*
Hong Jiang, *Benedict College*
Nenad Jukic, *Loyola University*
Elene Kent, *Capital University*
Stephen Klein, *Ramapo College*
Brian Kovar, *Kansas State University*
Subodha Kumar, *Texas A&M*
Diane Lending, *James Madison University*
Kevin Lertwachara, *Cal Poly San Luis Obispo*
Terry Letsche, *Wartburg College*
Victor Lipe, *Trident Tech*
Chuck Litecky, *Southern Illinois University, Carbondale*
Joan Lumpkin, *Wright State University*
Nicole Lytle, *Cal State, San Bernardino*
George Mangalaraj, *Western Illinois University*
Parand Mansouri-Rad, *University of Texas, El Paso*
Michael Martel, *Ohio University*
Nancy Martin, *Southern Illinois University, Carbondale*
Richard McMahon, *University of Houston, Downtown*
Tony McRae, *Collin College*
Vishal Midha, *University of Texas, Pan American*
Esmail Mohebbi, *University West Florida*
Luvai Motiwalla, *University Mass Online*
Mahdi Nasereddin, *Penn State, Berks*
Sandra K. Newton, *Sonoma State University*
Ann O'Brien, *University of Wisconsin, Madison*
Sungjune Park, *University of North Carolina, Charlotte*
Yang Park, *Georgia Southwestern State University*
Alan Peace, *West Virginia University*
Jacqueline Pike, *Duquesne University*

Tony Pittarese, *East Tennessee State University*
Jennifer Pitts, *Columbus State University*
Richard Platt, *University of West Florida*
Larisa Preiser, *Cal Poly Pomona*
Michelle Ramim, *Nova Southeastern University*
Alison Rampersad, *Lynn University*
Ralph Reilly, *University of Hartford*
Wes Rhea, *Kennesaw State University*
Julio Rivera, *University of Alabama, Birmingham*
Thomas Roberts, *William Patterson University*
Cynthia Ruppel, *Nova Southeastern University*
James Ryan, *Troy University*
Russell Sabadosa, *Manchester Community College*
Jim Samuel, *Baruch College, City University of New York*
Tom Sandman, *Cal State, Sacramento*
Kala Seal, *Loyola Marymount*
Tod Sedbrook, *University of Northern Colorado*
Elaine Seeman, *East Carolina University*
Richard Segall, *Arkansas State University*
Lee Sellers, *Eastern Oregon University—Mt. Hood Metro Center*
Judy Ann Serwatka, *Purdue University, North Central*
John Seydel, *Arkansas State University*
Jollean Sinclaire, *Arkansas State University*
Vivek Shah, *Texas State University, San Marcos*
Mehrdad Sharbaf, *Loyola Marymount University*
Suengjae Shin, *Mississippi State University, Meridian*
Todd Stabenow, *Hawkeye Community College*
Jo Lynne Stalnaker, *University of Wyoming*
Cynthia Stone, *Indiana University*
Nathan Stout, *University of Oklahoma*
Yi Sun, *Cal State, San Marcos*
Winston Tellis, *Fairfield University*
Doug Francis Tuggle, *Chapman University*
Wendy Urban, *Temple University*
Darlene de Vida, *Lower Columbia College*
James Villars, *Metropolitan State University*
Padmal Vitharana, *Syracuse University*
Haibo Wang, *Texas A&M International University*
Hong Wang, *North Carolina A&T State University*
June Wei, *University of West Florida*
Melody White, *University of North Texas*
Rosemary Wild, *Cal Poly San Luis Obispo*
Tom Wilder, *Cal State, Chico*
Karen Williams, *University of Texas, San Antonio*
Marie Wright, *Western Connecticut State University*
Yaquan Xu, *Virginia State University*
Benjamin Yeo, *Loyola Marymount University*
Bee Yew, *Fayetteville State University*
Jigish Zaveri, *Morgan State University*
Grace Zhang, *Augusta State University*
Wei Zhang, *University of Massachusetts, Boston*
Zuopeng Zhang, *SUNY, Plattsburgh*
Fan Zhao, *Florida Gulf Coast University*
Robert Zwick, *Yeshiva University*

Brief Contents

PREFACE vii

1 Introduction to Information Systems 1

2 Organizational Strategy, Competitive Advantage, and Information Systems 33

3 Data and Knowledge Management 56

4 Telecommunications and Networking 91

5 Business Analytics 127

6 Ethics and Privacy 155

7 Information Security 176

8 Social Computing 209

9 E-Business and E-Commerce 244

10 Wireless, Mobile Computing, and Mobile Commerce 274

11 Information Systems within the Organization 306

12 Customer Relationship Management 331

13 Supply Chain Management 352

14 Acquiring Information Systems and Applications 370

PLUG IT IN 1 Business Processes and Business Process Management 398

PLUG IT IN 2 Hardware and Software 411

PLUG IT IN 3 Fundamentals of Relational Database Operations 431

PLUG IT IN 4 Cloud Computing 441

PLUG IT IN 5 Artificial Intelligence 464

PLUG IT IN 6 Project Management 477

PLUG IT IN 7 Protecting Your Information Assets 488

INDEX 507

Contents

PREFACE vii

1 Introduction to Information Systems 1

Opening Case 1
Introduction 2
1.1 Why Should I Study Information Systems? 3
1.2 Overview of Computer-Based Information Systems 9
1.3 How Does IT Impact Organizations? 17
1.4 Importance of Information Systems to Society 23
Summary 27
Chapter Glossary 28
Discussion Questions 29
Problem-Solving Activities 29
Closing Case 1 30
Closing Case 2 31

2 Organizational Strategy, Competitive Advantage, and Information Systems 33

Opening Case 33
Introduction 34
2.1 Business Pressures, Organizational Responses, and Information Technology Support 35
2.2 Competitive Advantage and Strategic Information Systems 44
Summary 51
Chapter Glossary 52
Discussion Questions 52
Problem-Solving Activities 53
Closing Case 1 53
Closing Case 2 54

3 Data and Knowledge Management 56

Opening Case 56
Introduction 57
3.1 Managing Data 60
3.2 The Database Approach 62
3.3 Big Data 66
3.4 Data Warehouses and Data Marts 75
3.5 Knowledge Management 81
Summary 86
Chapter Glossary 86
Discussion Questions 87
Problem-Solving Activities 87
Closing Case 1 88
Closing Case 2 89

4 Telecommunications and Networking 91

Opening Case 91
Introduction 93
4.1 What Is a Computer Network? 94
4.2 Network Fundamentals 97
4.3 The Internet and the World Wide Web 102
4.4 Network Applications: Discovery 107
4.5 Network Applications: Communication 110
4.6 Network Applications: Collaboration 113
4.7 Network Applications: Educational 117
Summary 120
Chapter Glossary 121
Discussion Questions 123
Problem-Solving Activities 123
Closing Case 1 124
Closing Case 2 125

5 Business Analytics 127

Opening Case 127
Introduction 128
5.1 Managers and Decision Making 129
5.2 The Business Analytics Process 133
5.3 Business Analytics Tools 137
5.4 Business Analytics Models: Descriptive Analytics, Predictive Analytics, and Prescriptive Analytics 141
Summary 150
Chapter Glossary 150
Discussion Questions 151
Closing Case 1 151
Closing Case 2 153

6 Ethics and Privacy 155

Opening Case 155
Introduction 156
6.1 Ethical Issues 157
6.2 Privacy 163
Summary 171
Chapter Glossary 171
Discussion Questions 172

Problem-Solving Activities 172
Closing Case 1 173
Closing Case 2 174

7 Information Security 176

Opening Case 176
Introduction 177
7.1 Introduction to Information Security 178
7.2 Unintentional Threats to Information Systems 180
7.3 Deliberate Threats to Information Systems 183
7.4 What Organizations Are Doing to Protect Information Resources 189
7.5 Information Security Controls 191
Summary 201
Chapter Glossary 202
Discussion Questions 204
Problem-Solving Activities 204
Closing Case 1 205
Closing Case 2 207

8 Social Computing 209

Opening Case 209
Introduction 211
8.1 Web 2.0 212
8.2 Fundamentals of Social Computing in Business 219
8.3 Social Computing in Business: Shopping 225
8.4 Social Computing in Business: Marketing 229
8.5 Social Computing in Business: Customer Relationship Management 232
8.6 Social Computing in Business: Human Resource Management 235
Summary 238
Chapter Glossary 239
Discussion Questions 240
Problem-Solving Activities 240
Closing Case 1 240
Closing Case 2 242

9 E-Business and E-Commerce 244

Opening Case 244
Introduction 245
9.1 Overview of E-Business and E-Commerce 247
9.2 Business-to-Consumer (B2C) Electronic Commerce 254
9.3 Business-to-Business (B2B) Electronic Commerce 261
9.4 Ethical and Legal Issues in E-Business 264
Summary 268
Chapter Glossary 268
Discussion Questions 269
Problem-Solving Activities 270
Closing Case 1 271
Closing Case 2 272

10 Wireless, Mobile Computing, and Mobile Commerce 274

Opening Case 274
Introduction 275
10.1 Wireless Technologies 276
10.2 Wireless Computer Networks and Internet Access 284
10.3 Mobile Computing and Mobile Commerce 291
10.4 The Internet of Things 296
Summary 301
Chapter Glossary 302
Discussion Questions 302
Problem-Solving Activities 303
Closing Case 1 303
Closing Case 2 304

11 Information Systems within the Organization 306

Opening Case 306
Introduction 307
11.1 Transaction Processing Systems 308
11.2 Functional Area Information Systems 309
11.3 Enterprise Resource Planning Systems 316
11.4 ERP Support for Business Processes 322
Summary 327
Chapter Glossary 327
Discussion Questions 328
Problem-Solving Activities 328
Closing Case 1 329
Closing Case 2 329

12 Customer Relationship Management 331

Opening Case 331
Introduction 332
12.1 Defining Customer Relationship Management 333
12.2 Operational Customer Relationship Management Systems 338
12.3 Other Types of Customer Relationship Management Systems 343
Summary 347
Chapter Glossary 347

Discussion Questions 348
Problem-Solving Activities 348
Closing Case 1 349
Closing Case 2 350

13 Supply Chain Management 352

Chapter Opening Case 352
Introduction 353
13.1 Supply Chains 354
13.2 Supply Chain Management 356
13.3 Information Technology Support for Supply Chain Management 361
Summary 365
Chapter Glossary 366
Discussion Questions 366
Problem-Solving Activities 366
Closing Case 1 367
Closing Case 2 368

14 Acquiring Information Systems and Applications 370

Opening Case 370
Introduction 371
14.1 Planning for and Justifying IT Applications 372
14.2 Strategies for Acquiring IT Applications 376
14.3 Traditional Systems Development Life Cycle 381
14.4 Alternative Methods and Tools for Systems Development 387
Summary 392
Chapter Glossary 393
Discussion Questions 394
Problem-Solving Activities 394
Closing Case 1 395
Closing Case 2 396

Plug IT In 1 Business Processes and Business Process Management 398

PI1.1 Business Processes 398
PI1.2 Business Process Improvement, Business Process Reengineering, and Business Process Management 404
Summary 409
Chapter Glossary 410
Discussion Questions 410

Plug IT In 2 Hardware and Software 411

Introduction 411
PI2.1 Introduction to Hardware 411
PI2.2 Introduction to Software 422
Summary 428
Glossary 428
Discussion Questions 430
Problem-Solving Activities 430

Plug IT In 3 Fundamentals of Relational Database Operations 431

Introduction 431
PI3.1 Query Languages 431
PI3.2 Entity–Relationship Modeling 432
PI3.3 Normalization and Joins 435
Summary 440
Glossary 440
Discussion Questions 440

Plug IT In 4 Cloud Computing 441

PI4.1 Introduction 441
PI4.2 What Is Cloud Computing? 443
PI4.3 Different Types of Clouds 447
PI4.4 Cloud Computing Services 449
PI4.5 The Benefits of Cloud Computing 453
PI4.6 Concerns and Risks with Cloud Computing 455
PI4.7 Web Services and Service-Oriented Architecture 459
Summary 462
Glossary 463
Discussion Questions 463
Problem-Solving Activities 463

Plug IT In 5 Artificial Intelligence 464

PI5.1 Introduction to Artificial Intelligence 464
PI5.2 Artificial Intelligence Technologies 466
PI5.3 Artificial Intelligence Applications 470
Summary 475
Chapter Glossary 476
Discussion Questions 476
Problem-Solving Activities 476

Plug IT In 6 Project Management 477

PI6.1 Project Management for Information Systems Projects 477
PI6.2 The Project Management Process 479
PI6.3 The Project Management Body of Knowledge 482
Summary 485
Glossary 485
Discussion Questions 485
Collaboration Exercise PI6.1 486
Problem-Solving Activities 486

Plug IT In 7 Protecting Your Information Assets 488

PI7.1 How to Protect Your Assets: The Basics 488
PI7.2 Behavioral Actions to Protect Your Information Assets 489
PI7.3 Computer-Based Actions to Protect Your Information Assets 492
Summary 504
Discussion Questions 505
Problem-Solving Activities 506

INDEX 507

Management Information Systems

Fourth Edition

CHAPTER 1

STOCK4B-RF/Getty Images

Introduction to Information Systems

CHAPTER OUTLINE

1.1 Why Should I Study Information Systems?

1.2 Overview of Computer-Based Information Systems

1.3 How Does IT Impact Organizations?

1.4 Importance of Information Systems to Society

LEARNING OBJECTIVES

1.1 Identify the reasons why being an informed user of information systems is important in today's world.

1.2 Describe the various types of computer-based information systems in an organization.

1.3 Discuss ways in which information technology can affect managers and nonmanagerial workers.

1.4 Identify positive and negative societal effects of the increased use of information technology.

Opening Case

MKT FanDuel

POM Founded in 2009, FanDuel (www.fanduel.com) operates a Web-based fantasy sports game. It is the largest company in the daily fantasy sports business. In May 2016, FanDuel was legal in 39 states, taking advantage of an exclusion in the 2006 Unlawful Internet Gambling Enforcement Act. This statute bans credit card issuers and banks from working with poker and sports-betting Web sites, effectively preventing U.S. customers from participating in those industries. The law, however, exempts fantasy sports because they are considered a game of skill, not luck. To maintain legal status, the operator of a fantasy sports business must follow four rules: (1) publish prize amounts before the games begin, (2) make prize amounts independent of the number of players in the game, (3) level the playing field by allowing anyone in a league to draft any player they want, and (4) disregard point spreads and game scores.

FanDuel delivers simple and fast fantasy betting. After paying an entry fee, players become eligible to win daily cash payouts based on the statistical performance of athletes in games played

that day. Traditional fantasy sports often frustrate players because the experience lasts for an entire season. If a player drafts a bad team, then he or she is stuck with that team for several months. In addition, serious fantasy league players analyze large amounts of statistics, roster changes, and injury reports. Many casual players do not have time for such analyses. In contrast to these leagues, FanDuel allows customers to play for just a day, a weekend, or a week.

FanDuel lets players participate for free or bet up to $5000 to draft a team of players in the National Football League (NFL), the National Basketball Association (NBA), Major League Baseball (MLB), and the National Hockey League (NHL), plus college football and basketball. Players can compete head-to-head against another individual or in a league with up to 125,000 teams. The winner is the one with the best player statistics, which translate into fantasy points. FanDuel takes an average of 9 percent of each prize.

MIS By May 2016, FanDuel claimed more than 1 million customers and operated in 39 states. However, the company was not yet profitable. It has to spend millions of dollars on computing power from Amazon Web Services to manage, as only one example, the increase in Web traffic just before Sunday's NFL kickoff. At that time, FanDuel must manage 150,000 simultaneous users, who make 250,000 roster changes per hour. The company also provides 15 million live scoring updates per minute during games, meaning that it must manage 6 terabytes of network traffic during game day. (A terabyte equals 1 trillion bytes.)

Professional sports have noted that FanDuel, with its easy-to-use app, appeals to young and mobile sports fans. Further, these fans have money at stake, so they are more inclined to watch games on television than they otherwise would be. An increase in viewers leads to an increase in advertising rates for the teams. In fact, in 2015 FanDuel signed multiyear sponsorship agreements with 15 NFL teams. These deals generally include stadium signage, radio and digital advertising, and other promotions. Interestingly, the NBA owns an equity stake in FanDuel.

Despite continued success, daily fantasy sports companies face a substantive problem. They can operate only as long as the federal government allows them to do so. The government could close the fantasy loophole in the 2006 statute at any time.

Significantly, the federal law does not give daily fantasy sports businesses immunity from state laws. In October 2015, New York Attorney General Eric Schneiderman launched an inquiry into FanDuel and its chief rival DraftKings. Shortly thereafter, he ruled that the two companies were operating illegally and issued a cease and desist order, ordering the two companies to stop taking bets in New York State.

FanDuel, which is based in New York, said that it would check the locations of its users to ensure that they submitted entries from states where it is permitted to do so. Users who attempt to circumvent this decision could see their accounts terminated and FanDuel refuse to pay out any winnings.

On the other hand, DraftKings, which is based in Massachusetts, sent an e-mail to its New York customers assuring them that they could continue submitting entries. DraftKings told its New York customer that their right to play in New York will remain unchanged unless a New York court decides otherwise.

Interestingly, in the spring of 2016, FanDuel suspended contests on college sports in all states as part of a negotiation with the National Collegiate Athletic Association.

And the bottom line? The legal battle continues.

Sources: Compiled from D. Purdum, "DraftKings, FanDuel to Stop Offering College Fantasy Games," *ESPN.com*, March 31, 2016; M. Brown, "FanDuel Lays Off Workers as Legal Pressure Mounts," *Forbes*, January 20, 2016; R. Axon, "Facing Threat from N.Y. Attorney General, FanDuel Suspends Entries in State," *USA Today*, November 17, 2015; L. Baker, "FanDuel, DraftKings Vow to Fight New York's Halt on Bets," *Reuters*, November 12, 2015; D. Alba, "DraftKings and FanDuel Scandal Is a Cautionary Startup Tale," *Wired*, October 9, 2015; D. Roberts, "Are DraftKings and FanDuel Legal?" *Fortune*, September 24, 2015; K. Wagner, "DraftKings and FanDuel Are Battling over Your Favorite Teams," *www.recode.net*, July 17, 2015; R. Sandomir, "FanDuel and DraftKings, Leaders in Daily Fantasy Sports, Are Quickly Gaining Clout," *The New York Times*, July 13, 2015; S. Rodriguez, "Yahoo Enters World of Daily Fantasy Sports, Takes on DraftKings and FanDuel," *International Business Times*, July 8, 2015; B. Schrotenboer, "FanDuel Signs Deals with 15 NFL Teams, Escalating Daily Fantasy Integration," *USA Today*, April 21, 2015; D. Primack, "DraftKings and FanDuel Close in on Massive New Investments," *Fortune*, April 6, 2015; S. Ramachandran and Am Sharma, "Disney to Invest $250 Million in Fantasy Site DraftKings," *The Wall Street Journal*, April 3, 2015; M. Kosoff, "Fantasy Sports Startup FanDuel May Soon Be Worth $1 Billion," *Business Insider*, February 18, 2015; D. Heitner, "DraftKings Reports $304 Million on Entry Fees in 2014," *Forbes*, January 22, 2015; S. Bertoni, "Fantasy Sports, Real Money," *Forbes*, January 19, 2015; B. Schrotenboer, "Fantasy Sports Debate: Gambling or Not Gambling?" *USA Today*, January 12, 2015; "The FanDuel Scam," *The Daily Roto*, December 19, 2014; D. Heitner, "Fantasy Sports Service, FanDuel, Secures $11 Million Investment; Includes Money from Comcast Ventures," *Forbes*, January 30, 2013; www.fanduel.com, www.draftkings.com, accessed July 17, 2015.

Questions

1. Describe how information technology is essential to FanDuel's operations.
2. Discuss the nontechnological problems that FanDuel faces.
3. Describe FanDuel's information technology infrastructure. Now discuss possible technological problems that FanDuel might face.

Introduction

Before we proceed, we need to define information technology and information systems. **Information technology (IT)** refers to any computer-based tool that people use to work with information and to support the information and information-processing needs of an organization. An **information system (IS)** collects, processes, stores, analyzes, and disseminates information for a specific purpose.

IT has far-reaching effects on individuals, organizations, and our planet. Although this text is largely devoted to the many ways in which IT has transformed modern organizations, you will also learn about the significant impacts of IT on individuals and societies, the global economy, and our physical environment. In addition, IT is making our world smaller, enabling more

and more people to communicate, collaborate, and compete, thereby leveling the competitive playing field.

When you graduate, you either will start your own business or you will work for an organization, whether it is public sector, private sector, for-profit, or not-for-profit. Your organization will have to survive and compete in an environment that has been radically transformed by information technology. This environment is global, massively interconnected, intensely competitive, 24/7/365, real-time, rapidly changing, and information-intensive. To compete successfully, your organization must use IT effectively.

As you read this chapter and this text, keep in mind that the information technologies you will learn about are important to businesses of all sizes. No matter what area of business you major in, what industry you work for, or the size of your company, you will benefit from learning about IT. Who knows? Maybe you will use the tools you learn about in this class to make your great idea a reality by becoming an entrepreneur and starting your own business! In fact, as you see in the chapter opening case and in chapter closing case 2, you can use information technology to help you start your own business.

The modern environment is intensely competitive not only for your organization, but for you as well. You must compete with human talent from around the world. Therefore, you will also have to make effective use of IT.

Accordingly, this chapter begins with a discussion of why you should become knowledgeable about IT. It also distinguishes among data, information, and knowledge, and it differentiates computer-based information systems from application programs. Finally, it considers the impacts of information systems on organizations and on society in general.

1.1 Why Should I Study Information Systems?

You are part of the most connected generation in history: You have grown up online; you are, quite literally, never out of touch; you use more information technologies (in the form of digital devices), for more tasks, and are bombarded with more information, than any generation in history. The *MIT Technology Review* refers to you as *Homo conexus*. Information technologies are so deeply embedded in your lives that your daily routines would be almost unrecognizable to a college student just 20 years ago.

Essentially, you practice continuous computing, surrounded by a movable information network. This network is created by constant cooperation between the digital devices you carry (for example, laptops, tablets, and smartphones); the wired and wireless networks that you access as you move about; and Web-based tools for finding information and communicating and collaborating with other people. Your network enables you to pull information about virtually anything from anywhere, at any time, and to push your own ideas back to the Web, from wherever you are, via a mobile device. Think of everything you do online, often with your smart phone: register for classes; take classes (and not just at your university); access class syllabi, information, PowerPoints, and lectures; research class papers and presentations; conduct banking; pay your bills; research, shop, and buy products from companies or other people; sell your "stuff"; search for, and apply for, jobs; make your travel reservations (hotel, airline, rental car); create your own blog and post your own podcasts and videocasts to it; design your own page on Facebook; make and upload videos to YouTube; take, edit, and print your own digital photographs; "burn" your own custom-music CDs and DVDs; use RSS feeds to create your personal electronic newspaper; text and tweet your friends and family throughout your day; send Snaps; and many other activities. (*Note:* If any of these terms are unfamiliar to you, don't worry. You will learn about everything mentioned here in detail later in this text.)

The Informed User—You!

So, the question is: Why you should learn about information systems and information technologies? After all, you can comfortably use a computer (or other electronic devices) to perform

many activities, you have been surfing the Web for years, and you feel confident that you can manage any IT application that your organization's MIS department installs.

The answer lies in you becoming an **informed user**; that is, a person knowledgeable about information systems and information technology. There are several reasons why you should be an informed user.

MIS

In general, informed users tend to get more value from whatever technologies they use. You will enjoy many benefits from being an informed user of IT, including:

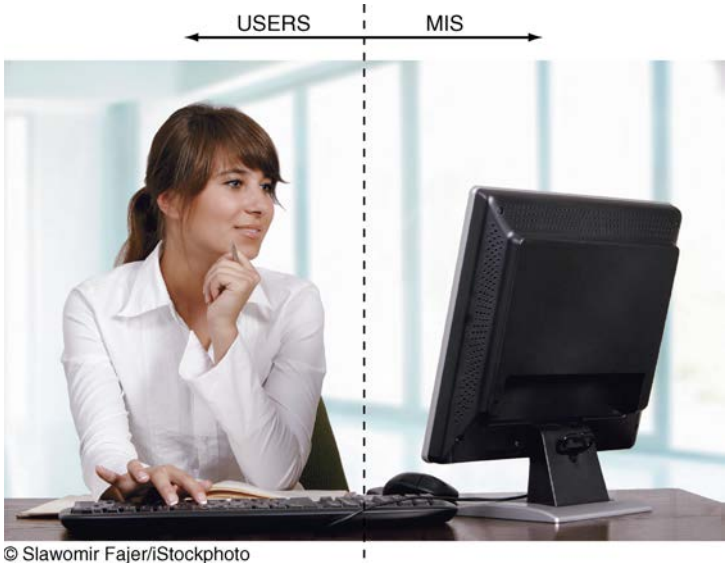
- You will benefit more from your organization's IT applications because you will understand what is "behind" those applications (see **Figure 1.1**). That is, what you see on your computer screen is brought to you by your MIS department, who are operating "behind" your screen.
- You will be in a position to enhance the quality of your organization's IT applications with your input.
- Even as a new graduate, you will quickly be in a position to recommend—and perhaps help select—the IT applications that your organization will use.
- Being an informed user will keep you abreast of both new information technologies and rapid developments in existing technologies. Remaining "on top of things" will help you to anticipate the impacts that "new and improved" technologies will have on your organization and to make recommendations on the adoption and use of these technologies.
- You will understand how using IT can improve your organization's performance and teamwork as well as your own productivity.
- If you have ideas of becoming an entrepreneur, then being an informed user will help you use IT when you start your own business.

Going further, managing the IS function within an organization is no longer the exclusive responsibility of the IS department. Rather, users now play key roles in every step of this process. The overall objective in this text is to provide you with the necessary information to contribute immediately to managing the IS function in your organization. In short, the goal is to help you become a very informed user!

IT Offers Career Opportunities

MIS

Because IT is vital to the operation of modern businesses, it offers many employment opportunities. The demand for traditional IT staff—programmers, business analysts, systems analysts, and designers—is substantial. In addition, many well-paid jobs exist in areas such as the Internet and electronic commerce (e-commerce), mobile commerce (m-commerce), network security, telecommunications, and multimedia design.



© Slawomir Fajer/iStockphoto

FIGURE 1.1 IT skills open many doors because IT is so widely used.

The IS field includes the people in various organizations who design and build information systems, the people who use those systems, and the people responsible for managing those systems. At the top of the list is the chief information officer (CIO).

The CIO is the executive who is in charge of the IS function. In most modern organizations, the CIO works with the chief executive officer (CEO), the chief financial officer (CFO), and other senior executives. Therefore, he or she actively participates in the organization's strategic planning process. In today's digital environment, the IS function has become increasingly strategic within organizations. As a result, although most CIOs still rise from the IS department, a growing number are coming up through the ranks in the business units (e.g., marketing, finance). Regardless of your major, you could become the CIO of your organization one day. This is another reason to be an informed user of information systems!

Table 1.1 provides a list of IT jobs, along with a description of each one. For further details about careers in IT, see www.computerworld.com/careertopics/careers and www.monster.com.

Career opportunities in IS are strong and are projected to remain strong over the next ten years. In fact, the *U.S. News & World Report* listed its "25 best jobs of 2015," *Money* listed its "best jobs in America for 2015," and *Forbes* listed its "10 best jobs" for 2015. Let's take a look at these rankings. (Note that the rankings differ because the magazines used different criteria in their

TABLE 1.1 Information Technology Jobs

Position	Job Description
Chief Information Officer	Highest-ranking IS manager; responsible for all strategic planning in the organization
IS Director	Manages all systems throughout the organization and the day-to-day operations of the entire IS organization
Information Center Manager	Manages IS services such as help desks, hot lines, training, and consulting
Applications Development Manager	Coordinates and manages new systems development projects
Project Manager	Manages a particular new systems development project
Systems Manager	Manages a particular existing system
Operations Manager	Supervises the day-to-day operations of the data and/or computer center
Programming Manager	Coordinates all applications programming efforts
Systems Analyst	Interfaces between users and programmers; determines information requirements and technical specifications for new applications
Business Analyst	Focuses on designing solutions for business problems; interfaces closely with users to demonstrate how IT can be used innovatively
Systems Programmer	Creates the computer code for developing new systems software or maintaining existing systems software
Applications Programmer	Creates the computer code for developing new applications or maintaining existing applications
Emerging Technologies Manager	Forecasts technology trends; evaluates and experiments with new technologies
Network Manager	Coordinates and manages the organization's voice and data networks
Database Administrator	Manages the organization's databases and oversees the use of database-management software
Auditing or Computer Security Manager	Oversees the ethical and legal use of information systems
Webmaster	Manages the organization'sWeb site
Web Designer	Creates Web sites and pages

research.) As you can see, jobs suited for MIS majors rank extremely high in all three lists. The magazines with their job rankings are as follows:

***U.S. News & World Report* (out of 25)**

#3 Software Developer

#7 Computer System Analyst

#8 Information Security Analyst

#11 Web Developer

#21 IT Manager

Money

#1 Software Architect

#2 Video Game Designer

#8 Database Developer

#9 Information Assurance (Security) Analyst

#11 Clinical Applications Specialist (IT in healthcare)

#14 User Experience Designer

#17 IT Program Manager

***Forbes* (out of 10)**

#8 Software Engineer

#10 Computer Systems Analyst

Not only do IS careers offer strong job growth, but the pay is excellent as well. The Bureau of Labor Statistics, an agency within the Department of Labor that is responsible for tracking and analyzing trends relating to the labor market, notes that the median salary in 2015 for "computer and information systems managers" was approximately $130,000, and predicted that the profession would grow by an average of 15 percent per year through 2022.

Managing Information Resources

Managing information systems in modern organizations is a difficult, complex task. Several factors contribute to this complexity. First, information systems have enormous strategic value to organizations. Firms rely on them so heavily that, in some cases, when these systems are not working (even for a short time), the firm cannot function. (This situation is called "being hostage to information systems.") Second, information systems are very expensive to acquire, operate, and maintain.

A third factor contributing to the difficulty in managing information systems is the evolution of the management information systems (MIS) function within the organization. When businesses first began to use computers in the early 1950s, the MIS department "owned" the only computing resource in the organization, the mainframe. At that time, end users did not interact directly with the mainframe.

In contrast, in the modern organization, computers are located in all departments, and almost all employees use computers in their work. This situation, known as *end user computing*, has led to a partnership between the MIS department and the end users. The MIS department now acts as more of a consultant to end users, viewing them as customers. In fact, the main function of the MIS department is to use IT to solve end users' business problems.

MIS

As a result of these developments, the responsibility for managing information resources is now divided between the MIS department and the end users. This arrangement raises several important questions: Which resources are managed by whom? What is the role of the MIS department, its structure, and its place within the organization? What is the appropriate relationship between the MIS department and the end users? Regardless of who is doing what, it is essential that the MIS department and the end users work in close cooperation.

There is no standard way to divide responsibility for developing and maintaining information resources between the MIS department and the end users. Instead, that division depends on several factors: the size and nature of the organization, the amount and type of IT resources, the organization's attitudes toward computing, the attitudes of top management toward computing, the maturity level of the technology, the amount and nature of outsourced IT work, and even the countries in which the company operates. Generally speaking, the MIS department is responsible for corporate-level and shared resources, and the end users are responsible for departmental resources. **Table 1.2** identifies both the traditional functions and various new, consultative functions of the MIS department.

TABLE 1.2 The Changing Role of the Information Systems Department

Traditional Functions of the MIS Department
Managing systems development and systems project management
• As an end user, you will have critical input into the systems development process. You will learn about systems development in Chapter 13.
Managing computer operations, including the computer center
Staffing, training, and developing IS skills
Providing technical services
Infrastructure planning, development, and control
• As an end user, you will provide critical input about the IS infrastructure needs of your department.
New (Consultative) Functions of the MIS Department
Initiating and designing specific strategic information systems
• As an end user, your information needs will often mandate the development of new strategic information systems.
You will decide which strategic systems you need (because you know your business needs better than the MIS department does), and you will provide input into developing these systems.
Incorporating the Internet and electronic commerce into the business
• As an end user, you will be primarily responsible for effectively using the Internet and electronic commerce in your business. You will work with the MIS department to accomplish this task.
Managing system integration including the Internet, intranets, and extranets
• As an end user, your business needs will determine how you want to use the Internet, your corporate intranets, and extranets to accomplish your goals. You will be primarily responsible for advising the MIS department on the most effective use of the Internet, your corporate intranets, and extranets.
Educating the non-MIS managers about IT
• Your department will be primarily responsible for advising the MIS department on how best to educate and train your employees about IT.
Educating the MIS staff about the business
• Communication between the MIS department and the business units is a two-way street. You will be responsible for educating the MIS staff on your business, its needs, and its goals.
Partnering with business-unit executives
• Essentially, you will be in a partnership with the MIS department. You will be responsible for seeing that this partnership is one "between equals" and ensuring its success.

(*Continued*)

Managing outsourcing

- Outsourcing is driven by business needs. Therefore, the outsourcing decision resides largely with the business units (i.e., with you). The MIS department, working closely with you, will advise you on technical issues such as communications bandwidth, security, as well as other issues.

Proactively using business and technical knowledge to seed innovative ideas about IT

- Your business needs often will drive innovative ideas about how to effectively use information systems to accomplish your goals. The best way to bring these innovative uses of IS to life is to partner closely with your MIS department. Such close partnerships have amazing synergies!

Creating business alliances with business partners

- The needs of your business unit will drive these alliances, typically along your supply chain. Again, your MIS department will act as your advisor on various issues, including hardware and software compatibility, implementing extranets, communications, and security.

So, where do the end users come in? Take a close look at Table 1.2. Under the traditional MIS functions, you will see two functions for which you provide vital input: managing systems development and infrastructure planning. Under the consultative MIS functions, in contrast, you exercise the primary responsibility for each function, while the MIS department acts as your advisor.

Before you go on…

1. Rate yourself as an informed user. (Be honest; this isn't a test!)
2. Explain the benefits of being an informed user of information systems.
3. Discuss the various career opportunities offered in the IT field.

Apply the Concept 1.1

LEARNING OBJECTIVE 1.1 Identify the reasons why being an informed user of information systems is important in today's world.

STEP 1: Background (Here is what you are learning.)

Section 1.1 discussed how businesses are utilizing modern technologies to become more productive by connecting to their customers, suppliers, partners, and other parties. Those connections, however, do not exist simply to support the businesses. Do you realize how connected *you* are? Computers and information systems have become an essential feature of our everyday lives. Most of you have a cell phone within reach and have looked at it within the past 5 minutes. No longer is a phone just a phone; rather, it is your connection to family, friends, shopping, driving directions, entertainment (games, movies, music, etc.), and much more.

When you embark on your career, you likely will have to interface with information systems to post transactions and search for or record information. Accomplishing these tasks will require you to work effectively with computers, regardless of the industry you find yourself employed in.

STEP 2: Activity (Here is what you do.)

Visit the Web sites of three local businesses: a bank, a dentist, and a retail shop. Examine their information to see if you can determine what types of information systems they use to support their operations. It is likely that you will find some similarities and differences among the three. Also, see if they have any open positions. If they do, what technical skills do these positions require? Summarize your findings in a paragraph or two.

STEP 3: Assignment (Here is what you turn in.)

Based on your research, identify five reasons why it is important for you to be an informed user of information technology. Reference your summarized findings to support your reasoning. Submit this list to your instructor, but also keep it in mind. You have just looked into the real world (your local world, in fact) and identified a reason for taking this course!

1.2 Overview of Computer-Based Information Systems

Organizations refer to their management information systems functional area by several names, including the MIS Department, the Information Systems (IS) Department, the Information Technology (IT) Department, and the Information Services Department. Regardless of the name, however, this functional area deals with the planning for—and the development, management, and use of—information technology tools to help people perform all the tasks related to information processing and management. Recall that **information technology** relates to any computer-based tool that people use to work with information and to support the information and information-processing needs of an organization.

As previously stated, an **information system** collects, processes, stores, analyzes, and disseminates information for a specific purpose. The purpose of information systems has been defined as getting the right information to the right people, at the right time, in the right amount, and in the right format. Because information systems are intended to supply useful information, we need to differentiate between information and two closely related terms: data and knowledge (see **Figure 1.2**).

Data items refer to an elementary description of things, events, activities, and transactions that are recorded, classified, and stored but are not organized to convey any specific meaning. Data items can be numbers, letters, figures, sounds, and images. Examples of data items are collections of numbers (e.g., 3.11, 2.96, 3.95, 1.99, 2.08) and characters (e.g., B, A, C, A, B, D, F, C).

Information refers to data that have been organized so that they have meaning and value to the recipient. For example, a grade point average (GPA) by itself is data, but a student's name coupled with his or her GPA is information. The recipient interprets the meaning and draws

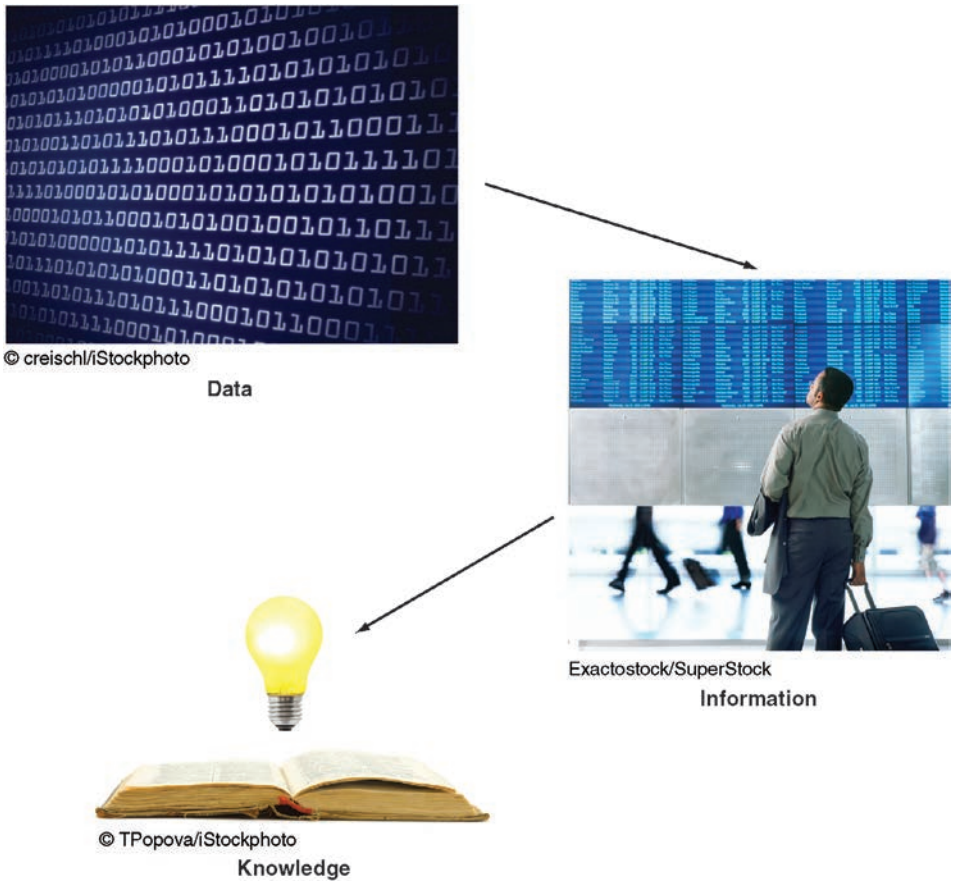


FIGURE 1.2 Data, Information, and Knowledge