

This International Student Edition is for use outside of the U.S.



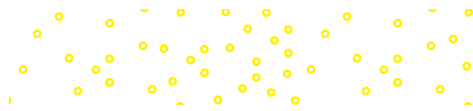
# ACCOUNTING INFORMATION SYSTEMS

Richardson | Chang | Smith

FOURTH EDITION

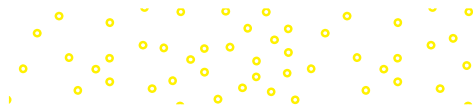


**Mc  
Graw  
Hill**

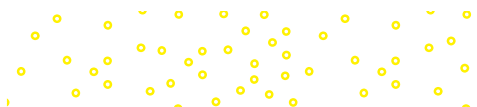


# Accounting Information Systems

FOURTH EDITION







# Accounting Information Systems

FOURTH EDITION

Vernon J. Richardson

*University of Arkansas*

*Baruch College*

C. Janie Chang

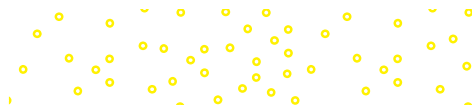
*University of California, Davis*

Rodney Smith

*California State University, Long Beach*

**Mc  
Graw  
Hill**





## ACCOUNTING INFORMATION SYSTEMS

Published by McGraw Hill LLC, 1325 Avenue of the Americas, New York, NY 10019. Copyright ©2024 by McGraw Hill LLC. All rights reserved. Printed in the United States of America. No part of this publication may be reproduced or distributed in any form or by any means, or stored in a database or retrieval system, without the prior written consent of McGraw Hill LLC, including, but not limited to, in any network or other electronic storage or transmission, or broadcast for distance learning.

Some ancillaries, including electronic and print components, may not be available to customers outside the United States.

This book is printed on acid-free paper.

1 2 3 4 5 6 7 8 9 LWI 28 27 26 25 24 23

ISBN 978-1-266-18835-0

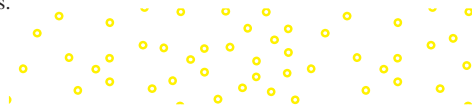
MHID 1-266-18835-5

Cover Image: *Andreas Schindl/123RF; stockcreations/Shutterstock*

All credits appearing on page or at the end of the book are considered to be an extension of the copyright page.

The Internet addresses listed in the text were accurate at the time of publication. The inclusion of a website does not indicate an endorsement by the authors or McGraw Hill LLC, and McGraw Hill LLC does not guarantee the accuracy of the information presented at these sites.

[mheducation.com/highered](http://mheducation.com/highered)





# About the Authors

## **Vernon J. Richardson** *University of Arkansas; Baruch College*

Vernon J. Richardson is a Distinguished Professor of Accounting and the G. William Glezen Chair in the Sam M. Walton College of Business at the University of Arkansas and a visiting professor at Baruch College. He received his BS, Master's of Accountancy, and MBA from Brigham Young University and a PhD in accounting from the University of Illinois at Urbana–Champaign. He has taught students at the University of Arkansas, University of Illinois, Brigham Young University, and University of Kansas and internationally at Chinese University of Hong Kong Shenzhen, Aarhus University, the China Europe International Business School (Shanghai), Xi'an Jiaotong Liverpool University, and the University of Technology Sydney.

Dr. Richardson is a member of the American Accounting Association. He has served as president of the American Accounting Association Information Systems section. He previously served as an editor of *The Accounting Review* and is currently an editor at *Accounting Horizons*. He has published articles in *The Accounting Review*, *Journal of Information Systems*, *Journal of Accounting and Economics*, *Contemporary Accounting Research*, *MIS Quarterly*, *International Journal of Accounting Information Systems*, *Journal of Management Information Systems*, *Journal of Operations Management*, and *Journal of Marketing*. Dr. Richardson is also a co-author of McGraw-Hill's *Introduction to Data Analytics for Accounting*, *Data Analytics for Accounting* and *Introduction to Business Analytics* textbooks.



## **C. Janie Chang** *University of California, Davis*

C. Janie Chang is the Academic Executive Director of the Master of Professional Accountancy program at University of California, Davis. She received her PhD from the University of California–Irvine. Before joining UC Davis in 2023, Dr. Chang was the Vern Odmark Professor at San Diego State University (SDSU). At SDSU, she established the graduate Accounting Information Systems (AIS) program. She also taught students at University of California–Irvine, San Jose State University, and California State University–San Marcos. Dr. Chang's teaching interests in AIS include information systems audit, data modeling, issues in e-business, and business networks and controls.

Dr. Chang is a member of the American Accounting Association and Information Systems Audit and Control Association (ISACA). Dr. Chang has studied issues in auditing, accounting, and information systems to investigate information processing of experts in addition to cross-cultural issues related to professional judgments and decisions. Her studies have been published in *Abacus*, *Auditing: A Journal of Practice and Theory*, *Behavioral Research in Accounting*, *Data Base*, *International Journal of Accounting*, *International Journal of Accounting Information Systems*, *Journal of Accounting Literature*, *Journal of Accounting and Public Policy*, and *Journal of Emerging Technologies in Accounting*, among others.





**Rod Smith** *California State University–Long Beach*

Rod Smith is Professor of Accountancy at California State University–Long Beach and Director of the MS in Accountancy program. He received his BS in mathematics from the University of Oregon; MS in financial management from the Naval Postgraduate School, Monterey, California; and PhD in management (accounting) from University of California–Irvine. He previously taught at the University of Arkansas, University of California–Irvine, and University of Alaska.

Dr. Smith has published research in the *Accounting Review*, *Journal of Information Systems*, *Journal of Management Accounting Research*, *Journal of Accounting and Public Policy*, and *International Journal of Accounting Information Systems*. He is a certified public accountant (retired), certified management accountant, chartered global management accountant, and retired captain in the U.S. Coast Guard.

His research interests include use of financial and nonfinancial measures to assess organizational performance; accounting information systems, enterprise systems, business processes, and business value; design science; and systems dynamics and business process simulation.

## Dedications

**To my wonderful daughter, Bethany. You are a treasure and joy to mom and me.**

—Vern Richardson

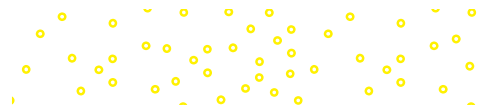
**To my students and my family who have inspired and supported me.**

—Janie Chang

**To my wife, Gayla.**

—Rod Smith

# Preface

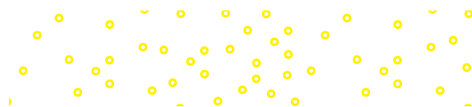


Whether working in public accounting or in industry, accountants use a variety of technology tools. The International Federation of Accountants (IFAC) describes four roles for accountants with respect to information technology: (1) *users* of technology and information systems, (2) *managers* of users of technology and related information systems, (3) *designers* of information systems, and (4) *evaluators* of information systems. As users, managers, designers, and evaluators of technology and technology-driven business processes, accountants must understand the organization and how organizational processes generate information important to management. Accountants must be business analysts to ensure that process and systems are well documented and continuously improved.

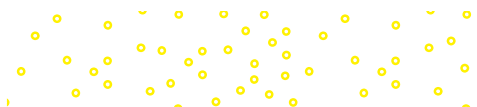
This text aims to provide students with a variety of technology and business analysis concepts and skills most relevant to business operations and decision making. It is intended for use in the first Accounting Information Systems course at both the undergraduate and graduate levels. Ongoing changes in business technology—such as the move to Internet-based systems, data analytics, software as a service, mobile access to enterprise information, as well as increased security and control requirements—make technological skills more important than ever for accounting graduates. This text also aims to show how changes in accounting affect each of these roles. For example, Extensible Business Reporting Language (XBRL) changes system requirements and affects how companies develop and report financial information. We also consider the role of data analytics and how it is used in financial accounting, managerial accounting, and auditing. Additionally, we consider both the COBIT and COSO frameworks to describe how organizations deal with risk management. In their roles as managers, designers, and evaluators, accountants must know how those frameworks affect their accounting and related information systems.

The core competencies of the American Institute of Certified Public Accountants (AICPA) emphasize accounting skills over content. This text emphasizes examples, problems, and projects through which students can develop the technological skills they need for their accounting careers. It uses real-world companies such as **Starbucks**, **Walmart**, **Google**, and **Amazon** that students can relate to. It takes a broad view of accounting information systems that emphasizes the accountants' roles in the use, management, design, and evaluation of the systems and the management information that they produce. To assist accounting students in experiencing the benefit of learning information technology/information services (IT/IS) concepts and using IT/IS skills in accounting, we focus on business processes, business requirements, how information technology supports those requirements, and how accountants contribute. In particular, this text helps students

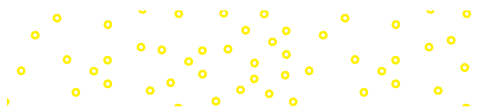
- **Apply Data Analytics and understand the basic concepts of blockchain and artificial intelligence.** This includes using three different data analytics tools: Excel, Tableau, and Power BI. The use of technology is rapidly changing the accounting profession. The CPA exam now includes material on Data Analytics. Interest in, and use of, blockchain is exploding. Increased computing power and availability of data is driving advances in artificial intelligence. Today's accountant must be familiar with all these topics and able to use prominent tools.
- **Design business processes and represent them with standard documentation tools.** The role of the accounting function has evolved from stewardship and reporting to full partnership, supporting management decisions throughout the







organization. As business analysts, accountants must be able to document business processes, identify potential improvements, and design and implement new business processes. Thus, this text helps develop business process modeling skills.

- **Design and implement well-structured databases to enable business processes.** Accountants must also understand how business processes generate data and how such data are structured, interrelated, and stored in a database system. To ensure that business processes and the database systems are documented and to help make improvements to processes and systems, accountants must understand and be able to model such systems. Thus, this text helps develop data modeling and database implementation skills.
  - **Query databases to provide insights about the performance of business operations.** Most organizational information resides in databases. To support management decisions throughout the organization, accountants must understand how those data are structured and how to retrieve information to support business management decisions. Thus, this text develops skills on the use of Microsoft Access and databases in general. This text also develops Data Analytics tools through the use of Microsoft Excel and Tableau.
  - **Evaluate internal control systems and apply business rules to implement controls and mitigate information systems risks.** Federal legislation—for example, the Sarbanes–Oxley Act of 2002 and COSO and COBIT guidance—emphasizes the importance of risk mitigation in modern organizations. Internal control systems must constantly evolve to meet a changing risk environment. Accountants are often the internal control experts and must, therefore, understand how internal controls should be implemented in business processes as part of the organization’s overall risk mitigation and governance framework. Thus, this text presents specific material on internal control and accounting information systems, as well as general information about computer fraud and security. It also describes how to monitor and audit accounting information systems.
- 

# Main Features

*Accounting Information Systems*, 4th Edition, focuses on the accountant’s role as business analyst in solving business problems by database modeling, database design, and business process modeling.

## Chapter Maps

Chapter Maps provide a handy guide at the start of every chapter. These remind students what they have learned in previous chapters, what they can expect to learn in the current chapter, and how the topics will build on each other in chapters to come. This allows them to stay more focused and organized along the way.

## Chapter Two

### Data Analytics: Addressing Accounting Questions with Data

#### A Look at This Chapter

With data plentiful and technology tools increasingly available to assist, accountants address a variety of accounting questions using data and analytics. We introduce a framework to facilitate the data analytics process, suggesting the AMPS model (i.e., Ask the question, Master the data, Perform the analysis, Share the story). We illustrate the AMPS model specifically by highlighting the types of questions asked; the types of data that are available; and four analytics types, namely descriptive, diagnostic, predictive, and prescriptive analytics. We then demonstrate the AMPS process by illustrating hands-on examples of each of these four analytics types using Excel.

#### A Look Back

Chapter 1 discussed the importance of accounting information systems and the role accountants play in those systems. It further described how investments in information technology might improve the ability to manage business processes and potentially create value for the firm.

#### A Look Ahead


Chapter 3 discusses the use of accounting visualizations in data analytics using software tools like Excel, Tableau, and Power BI to help with reporting and visualizations.

## Chapter-Opening Vignettes

Do your students sometimes wonder how the course connects with their future? Each chapter opens with a vignette, which sets the stage for the rest of the chapter and encourages students to think of concepts in a business context.

**“I like how it relates many of the concepts to real companies, like Starbucks.”**

—*Linda Wallace, Virginia Tech*



**Developing an analytics mindset**

**EY** argues that accountants, including its own accounting professionals (including CPAs) and its new hires, need an analytics mindset.

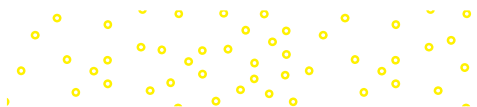
So, what is an analytics mindset?

An analytics mindset is the ability to

- Ask the right questions.
- Extract, transform, and load relevant data.
- Apply appropriate data analytics techniques.
- Interpret and share the results with stakeholders.

In this text, we focus on learning appropriate data analytics techniques that can be used to analyze data. While we formalize this as being the AMPS model, the analytics mindset serves as a way to see how the data analytics process can help you think through the various components of questions that can be addressed and answered with data. As you continue in your college studies, you will increasingly learn other components of developing the critical analytics mindset that will serve you throughout your professional career.

Source: [https://assets.ey.com/content/dam/ey-sites/ey-com/en\\_us/home-index/ey-eyarc-brochure.pdf](https://assets.ey.com/content/dam/ey-sites/ey-com/en_us/home-index/ey-eyarc-brochure.pdf)



# Chapter Outline

Each chapter opens with an Outline that provides direction to the students about the topics they can expect to learn throughout the chapter.

# Learning Objectives

Learning Objectives are featured at the beginning of each chapter. The objectives provide students with an overview of the concepts they should understand after reading the chapter. These Learning Objectives are repeated in the margin of the text where they apply.

CHAPTER OUTLINE	LEARNING OBJECTIVES
Introduction The Impact of Data Analytics on Business and Accounting (2-1) Impact of Data Analytics on Business Impact of Data Analytics on Accounting The Diversity of Accounting Data Enhances Accounting Analytics (2-2) The Data Analytics Process: The AMPS Model (2-3) The Cyclical, Recursive Nature of the AMPS Model Illustration of the AMPS Analytics Model: Predicting Inventory Needs The AMPS Model: Ask the Question (2-4) The AMPS Model: Master the Data (2-5) The AMPS Model: Perform the Analysis (2-6) The AMPS Model: Share the Story Demonstration Labs (Illustrating the AMPS Model) (2-7) Demonstration Lab 1: Descriptive Data Analytics: Accounts Receivable Aging Demonstration Lab 2: Diagnostic Data Analytics: Segregation of Duties Demonstration Lab 3: Predictive Data Analysis: Predicting Bankruptcy Demonstration Lab 4: Prescriptive Data Analytics: Estimating the Breakeven Point	After reading this chapter, you should be able to: <b>2-1</b> Understand the impact of data analytics on business and accounting. <b>2-2</b> Characterize the diversity of accounting data available to address accounting questions. <b>2-3</b> Explain how the AMPS model describes the data analytics process. <b>2-4</b> Describe the first stage of the AMPS model—asking appropriate questions. <b>2-5</b> Describe the second stage of the AMPS model—mastering the data. <b>2-6</b> Define and demonstrate the third stage of the AMPS model—performing the analysis—using different analytics types. <b>2-7</b> Demonstrate each of the four analytics types using the AMPS model.

“Well-written with great examples. Students should like reading this book.”

—*Marcia Watson, Mississippi State University*

# Integrated Project

Projects can generate classroom discussion, foster good teamwork, and prepare students for their accounting careers. Chapter 10 provides guidance to students on how to approach a systems project; related material provides information and data for the projects. There are now three different projects, so instructors can select the project level of difficulty to match the time available or the sophistication of their students. The two main integrated projects require students to apply the different techniques they have learned in Chapters 7, 8, and 9 to a realistic situation. One project focuses on inventory management in a small business with multiple retail stores and a central warehouse. The second project also involves a small wholesale distribution business with multiple stores but without inventory management complications. Students use Microsoft Access to implement their data models and prepare financial reports in both projects. Students also apply data analytics concepts from Chapters 1, 2, and 3.

**LO 10-3**  
Develop an integrated UML class diagram for a business.

**EXHIBIT 10.6**  
Prepare Structure Diagram Subprocess

**Prepare Structure Diagram**  
Exhibit 10.6 outlines the tasks to prepare structure diagrams. Using the information gained from discovering the business requirements, the project team then prepares an integrated UML class diagram that shows the data requirements for the organization. The class diagram should articulate with the BPMN activity diagrams. In other words, the class diagram must include resources, events, and agents that capture information reflected by each data object in the activity diagrams. Material in Chapters 5, 6, and 7 of this text provides standard patterns that can be the basis for the integrated diagram.

This example starts with a UML class diagram based on the generic REA framework for the sales process as shown in Exhibit 10.7. Remember this involves six classes, two resources (*Inventory* and *Cash*), two events (*Sales* and *Cash Receipts*), and two agents (*Customers* and *Employees*). The second step is to determine the associations, starting with the basic associations from the generic sales model and then refining to address specific business requirements. Third, process requirements define appropriate multiplicities. This diagram implements the data structures to support the interactions between Customers and Your Company shown in Exhibit 10.3.

store#	Inventory#	Sale_month	Oct2024	Oct2023	Oct2022	Oct2021	Oct2020	Sale Amt2024	Sale Amt2023	Sale Amt2022
F0001	F0001	1	357	331	314	296	279	51,071	5993	5993
F0001	F0001	2	627	577	546	515	485	53,886	51,711	51,711
F0001	F0001	3	905	783	268	323	238	59,915	58,649	58,649
F0001	F0002	1	85	83	82	81	81	5383	5374	5374
F0001	F0002	2	624	612	606	599	593	52,688	52,754	52,754
F0001	F0002	3	182	178	176	175	173	5819	5801	5801
F0001	F0003	1	877	877	880	883	886	51,885	51,885	51,787
F0001	F0003	2	124	124	125	126	127	5020	5020	5020
F0001	F0003	3	445	445	449	453	456	52,225	52,225	52,225
F0001	F0004	1	413	388	357	351	335	52,478	52,328	52,328
F0001	F0004	2	471	463	419	401	383	52,026	52,658	52,658
F0001	F0004	3	343	332	305	292	279	52,058	51,932	51,932
F0001	F0005	1	463	448	448	448	448	52,719	52,689	52,689
F0001	F0005	2	482	442	442	442	442	52,682	52,682	52,682

store#	Inventory#	Location											
		Austin TX	Boston	Miami	New Orleans	New York	Philadelphia	Phoenix	Portland	San Diego	San Francisco	Seattle	Washington DC
F0001	Flores	549	1,098	955	543	108	972	648	901	609	581	1,215	1,300
F0001	Baby's Breath	-485	-295	-305	-425	-190	-275	355	455	-815	-900	-125	485
F0001	Carnations Pink	780	8,814	2,388	152	774	640	570	2,256	2,188	864	1,704	2,248
F0001	Carnations White	-402	-54	-48	942	-24	-72	336	815	-336	-606	222	306
F0001	Chrysanthemum	-1,683	-1,710	-1,782	-1,791	-1,350	-1,044	-513	210	-2,106	-2,196	-837	-54
F0001	Delphinium	-1,107	-522	-432	-1,728	-324	-261	486	837	-473	-2,169	210	936
F0001	Hydrangeas	-516	-60	-60	816	-320	-84	2,090	554	-3,728	-1,296	684	2,688
F0001	Hypericum	616	1,177	1,078	-986	957	990	1,617	187	495	1,210	2,070	1,524
F0001	Iris	552	444	1,376	-180	1,058	576	1,776	1,836	156	-264	1,788	1,524
F0001	Lilies Asiatic	-663	-156	-104	962	-52	-91	1,552	1,445	-450	-1,590	540	1,820
F0001	Lilies Colored Calla	0	105	636	826	435	360	1,365	1,396	626	1,260	1,895	1,701
F0001	Lilies Oriental	-240	-108	-156	-1,380	-72	-60	1,140	1,920	-1,320	-1,416	912	2,352
F0001	Lisianthus	2,080	5,170	3,500	6,360	2,800	2,660	2,970	1,820	3,460	4,240	3,150	4,200
F0001	Orchids	1,185	1,626	1,313	1,568	2,610	1,493	3,090	1,765	525	743	2,865	2,688
F0001	Peonies	0	150	384	432	182	392	938	1,644	-210	1,296	492	812
F0001	Roses Mixed	1,070	1,130	540	340	620	900	3,300	1,890	820	200	1,860	3,300
F0001	Roses Pink	473	352	1,221	-154	800	1,331	1,937	1,892	165	-275	1,615	1,518
F0001	Roses Red	1,840	3,171	1,573	2,202	2,618	1,711	3,274	3,116	3,374	2,902	574	3,052
F0001	Roses Yellow	600	1,152	1,290	-180	720	480	3,654	1,396	216	192	1,752	1,398
F0001	Snopdragons	-1,284	-420	-628	-1,728	-732	-528	492	875	-2,004	-1,308	144	1,494
F0001	Sunflowers	-1,572	-1,122	-1,672	-1,668	-1,902	-984	-262	-78	-1,802	-4,122	-546	-342
F0001	Tulips	888	3,040	2,490	-428	716	1,482	3,636	1,390	66	-402	715	3,786

## Data Analytics

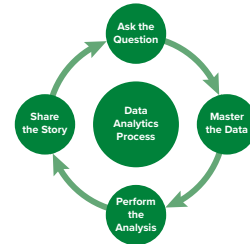
Due to its importance and popularity, we expanded coverage on Data Analytics and moved it forward in the text. Chapter 2 introduces the importance and impact of Data Analytics in the business world, specifically in the accounting profession. It introduces a framework to facilitate the Data Analytics process, suggesting the AMPS model (i.e., ask the question, master the data, perform the analysis, share the story). We illustrate the AMPS model specifically by highlighting the types of questions asked; the types of data that are available; and four types of analyses, including descriptive, diagnostic, predictive, and prescriptive analysis. Chapter 3 continues the discussion and introduces students to using tools such as Excel, Tableau, and Power BI to help with reporting and visualizations.

Step-by-step instructions and videos associated with the data analytics labs are provided in Connect.

### The Cyclical, Recursive Nature of the AMPS Model

After completing all stages of the AMPS model, oftentimes the decision maker is now more knowledgeable and better able to ask another deeper, more refined question, which suggests the AMPS model should best be viewed as recursive in nature. Data analytics might be viewed as successively peeling the layer of an onion. By peeling the first layer of the onion, you now are able to see the next layer and evaluate it and remove it to get to the third layer, and so on. Oftentimes, the AMPS model must be performed multiple times, refining the question (ask the question), possibly considering different types of data (master the data), performing additional analysis (perform the analysis), and retelling the story in each iteration (sharing the story) before the issue/problem/challenge can be finally addressed with some confidence as shown in Exhibit 2.4.

**EXHIBIT 2.4**  
The Recursive Nature  
of the Data Analytics  
Process Using the  
AMPS Model



136 Chapter 3 Data Analytics: Data Visualizations

### LABS ASSOCIATED WITH CHAPTER 3



- LAB 3-1 EXCEL** Creating Column Charts, Line Charts and Pie Charts for Tesla Sales and Earnings
- LAB 3-2 POWER BI** Creating a Word Cloud
- LAB 3-3 EXCEL** Using Scatterplots and Regression to Understand the Relationship between Advertising Expenditures
- LAB 3-4 EXCEL** Time Series Analysis of IBM Sales and Earnings
- LAB 3-5 TABLEAU** Time Series Analysis of IBM Sales and Earnings
- LAB 3-6 POWER BI** Time Series Analysis of IBM Sales and Earnings
- LAB 3-5 EXCEL** Create a Dashboard Using PivotTables and Slicers

The multiple choice assessment questions for each lab are assignable via Connect. Materials are also available for courses not utilizing Connect via the Solutions Manual.

## Progress Checks

These self-test questions and problems in the body of the chapter enable the student to determine whether he or she has understood the preceding material and to reinforce that understanding before reading further. Detailed solutions to these questions are found at the end of each chapter.

**“I really like the Progress Check box. It is a great tool for students’ self-assessment.”**

—*Chih-Chen Lee, Northern Illinois University*

### ✓ PROGRESS CHECK

1. A database is an organized collection of data for various uses. Name three uses for a sales database at **Walmart**.
2. Relational data models allow changes to the data model as information needs change. How does the use of a data model help database designers and database users to understand the business processes?

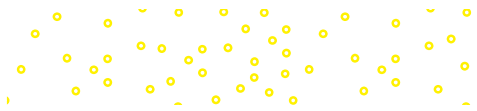
#### LO 6-2

Explain basic relational database principles.

### FUNDAMENTALS OF RELATIONAL DATABASES

#### Entities and Attributes

First, it is important to describe entities and attributes of a relational database. As introduced in Chapter 5, a class (also called an entity) in the relational database model could be a person, place, thing, transaction, or event about which information is stored. Customers, sales, products, and employees are all examples of classes. Classes could be grouped into resources (R), events (E), and agents (A) in data modeling.<sup>1</sup> *Resources* are those things that have economic value to a firm, such as cash and products. *Events* are the various business activities conducted in a firm’s daily operations, such as sales and purchases. *Agents* are the people who participate in business events, such as customers and employees.



## Data Modeling and Microsoft Access

Chapter 5 describes how data modeling supports the design, implementation, and operation of database systems. Basic modeling tools are used throughout the rest of the text.

**“This textbook would be good when using the database approach. It provides the information needed to develop and use a database without getting into the details of transaction processing (activities, documents, and internal control).”**

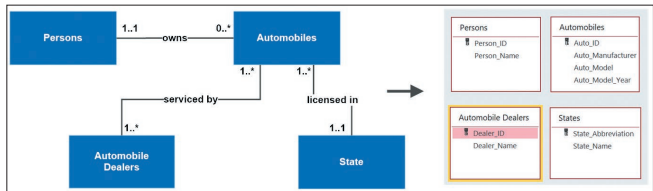
—*Janice Benson, University of Wyoming*

# Chapter Five

## Data Modeling

**A Look at This Chapter**

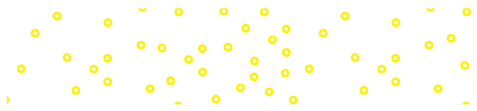
Today's accountants must understand how business processes generate data and how those data are structured, inter-related, and stored in a database system. To ensure that business processes and the database systems are documented and to participate in improvements to processes and systems, accountants must understand and be able to model such systems. This chapter describes data modeling. It explains how data models support database-driven systems. It introduces basic data modeling tools to guide the student's development of modeling skills. Finally, it discusses business rules and how the identification of relevant business rules supports both process and data modeling.



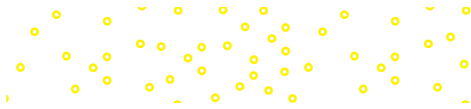
## Connect Accounting for Accounting Information Systems

The 4th Edition of Accounting Information Systems has a full Connect package, with the following features available for instructors and students.

- **SmartBook 2.0®** A personalized and adaptive learning tool used to maximize the learning experience by helping students study more efficiently and effectively. Smartbook 2.0 highlights where in the chapter to focus, asks review questions on the materials covered and tracks the most challenging content for later review recharge.
- **Multiple Choice Questions.** The multiple choice questions from the end-of-chapter materials are assignable in Connect, providing students with instant feedback on their answers.
- **Problems.** Select problems from the text are available for assignment in Connect to ensure students are building an analytical skill set.

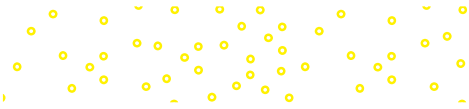




- 
- **Comprehensive Review Exercises and Integrated Project.** The setup information for the Comprehensive Review Exercises for Chapters 7, 8, and 9 and the Integrated Project in Chapter 10 have been added to Connect, along with the ability for students to upload their submission files for their instructors to grade.
  - **Lecture Videos:** Video-based walk-throughs are available for each chapter to reinforce select concepts.
  - **Test Bank:** The Test Bank for each chapter has been updated and expanded to stay current with new and revised chapter material, with all questions available for assignment through Connect. Instructors can also create tests and quizzes from the Test Bank through our Test Builder software.

Available within McGraw Hill Connect<sup>®</sup>, Test Builder is a cloud-based tool that enables instructors to format tests that can be printed, administered within a Learning Management System, or exported as a Word document. Test Builder offers a modern, streamlined interface for easy content configuration that matches course needs, without requiring a download.

Test Builder allows you to:

- access all test bank content from a particular title.
  - easily pinpoint the most relevant content through robust filtering options.
  - manipulate the order of questions or scramble questions and/or answers.
  - pin questions to a specific location within a test.
  - determine your preferred treatment of algorithmic questions.
  - choose the layout and spacing.
  - add instructions and configure default settings.
- The Instructor and Student Resources have been updated for the 4th edition and are available in the Connect Instructor Resources page. Available resources include Solutions Manuals, Comprehensive Exercise and Integrated Project setup and solutions files, PowerPoint presentations, and other ancillary materials. All applicable Student Resources including databases and data files, will be available in a convenient file that can be distributed to students for classes either directly, through Connect, or via courseware.
- 

# AIS 4e Content Updates

## General Updates for the 4th Edition

---

- Now in full color!
- Expanded and relocated coverage of data analytics to chapter 1-3 to demonstrate how data analytics is performed and creates value.
- Added more Tableau and Power BI Labs for data analysis.
- Added Alteryx and UiPath labs for process automation.
- Added end-of-chapter multiple-choice questions and problems throughout the text.
- Significantly revised many end-of-chapter problems for availability and auto-grading within Connect.
- Revised and added many new discussion questions in most chapters.
- Updated integrated projects to apply data analytics concepts.
- Added a new integrated project that emulates accounting software to complete the accounting process for a store.
- Updated Lecture Videos in Connect.

## Chapter-by-Chapter Updates

---

### *Chapter 1*

---

- Added explanation of a cost accounting system in relation to the various enterprise system components.
- Added two data analytics labs to demonstrate what value can be derived from an accounting information system.

### *Chapter 2*

---

- Updated discussion on the impact of data analytics on various areas of accounting.
- Added four new demonstration data analytics labs focusing on the different analytics types.

### *Chapter 3*

---

- Rewrote chapter to emphasize importance of data visualizations.
- Added four new data analytics labs focusing on the different data visualization techniques.

### *Chapter 4*

---

- Updated introduction to Business Process Modeling and Notation (BPMN).
- Added information about how to develop BPMN models.

### *Chapter 5*

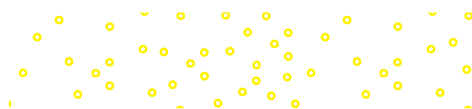
---

- Updated introduction to Uniform Modeling Language (UML) class diagrams.
- Added information about using business models and business rules to implement internal controls over business processes.
- Added a review exercise for more guided hands-on experience.

### *Chapter 6*

---

- Updated discussion of relational databases, structured query language (SQL), and Microsoft Access.
- Added hands-on activities.





## ***Chapter 7***

---

- Updated description of sales and collection processes.
- Added new information about planning and implementing internal controls over sales and collections.
- Updated the review exercise to provide more guided hands-on experience.

## ***Chapter 8***

---

- Updated description of the purchases and payments process.
- Added new information about planning and implementing internal controls over purchases and payments.
- Updated the review exercise to provide more guided hands-on experience.

## ***Chapter 9***

---

- Updated description of the conversion (manufacturing) process.
- Added new information about planning and implementing internal controls over the conversion process.
- Added a new review exercise to provide more guided hands-on experience.

## ***Chapter 10***

---

- Substantially updated the two integrated projects to include both process modeling and data analytics components.
- Created a new step-by-step version of the Y Not Flowers project that can be used as students progress through the chapters.
- Created a new project that emulates a small business accounting system such as Quickbooks, and review summary information to complete the accounting process for this store.

## ***Chapter 11***

---

- Added new information about internal controls over financial reporting consistent with new changes to the CPA exam.

## ***Chapter 12***

---

- Updated information about cybersecurity and System and Organization Controls (SOC) examinations to address new changes to the CPA exam and increasing importance of cybersecurity.

## ***Chapter 13***

---

- Updated information on information technology and systems auditing to address new changes to the CPA exam.

## ***Chapter 14***

---

- Updated information about eXtensible Business Reporting Language (XBRL) and inline XBRL.

## ***Chapter 15***

---

- Updated descriptions of Blockchain technology.
- Updated description of AI, machine learning, and robotic process automation.
- Added hands-on labs using Alteryx and UiPath.

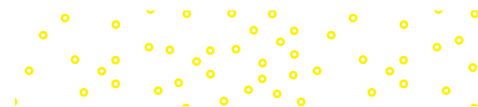
## ***Chapter 16***

---

- Updated discussion of the business value of information technology.

## ***Chapter 17***

---

- Updated discussion of planning and implementing IT initiatives.
  - Introduced the waterfall and the agile methodologies for systems development.
- 

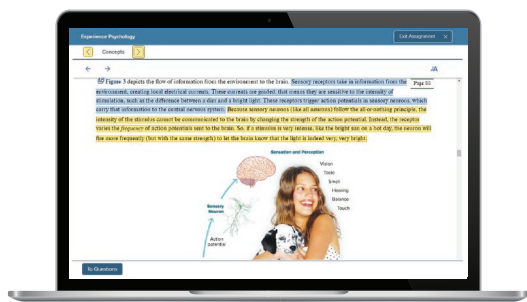
# Instructors

## The Power of Connections

### A complete course platform

Connect enables you to build deeper connections with your students through cohesive digital content and tools, creating engaging learning experiences. We are committed to providing you with the right resources and tools to support all your students along their personal learning journeys.

**65%**  
Less Time  
Grading



Laptop: Getty Images; Woman/dog: George Doyle/Getty Images

### Every learner is unique

In Connect, instructors can assign an adaptive reading experience with SmartBook<sup>®</sup> 2.0. Rooted in advanced learning science principles, SmartBook 2.0 delivers each student a personalized experience, focusing students on their learning gaps, ensuring that the time they spend studying is time well-spent.

[mheducation.com/highered/connect/smartbook](http://mheducation.com/highered/connect/smartbook)

### Affordable solutions, added value

Make technology work for you with LMS integration for single sign-on access, mobile access to the digital textbook, and reports to quickly show you how each of your students is doing. And with our Inclusive Access program, you can provide all these tools at the lowest available market price to your students. Ask your McGraw Hill representative for more information.

### Solutions for your challenges

A product isn't a solution. Real solutions are affordable, reliable, and come with training and ongoing support when you need it and how you want it. Visit [supportateverystep.com](http://supportateverystep.com) for videos and resources both you and your students can use throughout the term.



**SUPPORT** <sup>AT</sup>  
*every step*

## Students

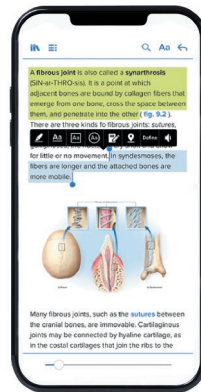
### Get Learning that Fits You

#### Effective tools for efficient studying

Connect is designed to help you be more productive with simple, flexible, intuitive tools that maximize your study time and meet your individual learning needs. Get learning that works for you with Connect.

#### Study anytime, anywhere

Download the free ReadAnywhere® app and access your online eBook, SmartBook® 2.0, or Adaptive Learning Assignments when it's convenient, even if you're offline. And since the app automatically syncs with your Connect account, all of your work is available every time you open it. Find out more at [mheducation.com/readanywhere](http://mheducation.com/readanywhere)



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

- Jordan Cunningham,  
Eastern Washington University

iPhone: Getty Images

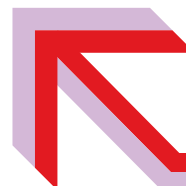


#### Everything you need in one place

Your Connect course has everything you need—whether reading your digital eBook or completing assignments for class—Connect makes it easy to get your work done.

#### Learning for everyone

McGraw Hill works directly with Accessibility Services Departments and faculty to meet the learning needs of all students. Please contact your Accessibility Services Office and ask them to email [accessibility@mheducation.com](mailto:accessibility@mheducation.com), or visit [mheducation.com/about/accessibility](http://mheducation.com/about/accessibility) for more information.





# Acknowledgments

Special thanks go to Deniz Appelbaum, Montclair State University; Katherine Boswell, University of Louisiana - Monroe; and Kevin Brennan, University of Akron who were a tremendous help offering suggestions during their accuracy reviews of the text and Connect.

Throughout the development of this book, we were privileged to have the candid and valuable advice of our contributors, reviewers, and survey and focus group participants. These instructors provided us with priceless suggestions, feedback, and constructive criticism. The depth and sincerity of their reviews indicate that they are a devoted group of teacher-scholars. The content of the book over various versions and editions was greatly enhanced because of their efforts.

T. S. Amer <i>Northern Arizona University</i>	<i>Nova Southeastern University</i>	Jennifer Grennan <i>Queens University</i>
Deniz Appelbaum <i>Montclair State University</i>	Shifei Chung <i>Rowan University</i>	Michael Griffin <i>UMASS Dartmouth</i>
Victoria Badura <i>Chadron State College</i>	Kim Church <i>Oklahoma State University</i>	Deborah L. Habel <i>Wayne State University</i>
Jon A. Baumunk <i>San Diego State University</i>	Ronald Clark <i>Auburn University</i>	Rebekah Heath <i>St. Ambrose University</i>
James Bay <i>University of Utah</i>	Curtis Clements <i>Abilene Christian University</i>	William Heninger <i>Brigham Young University</i>
Ryan Baxter <i>Boise State University</i>	Donna Free <i>Oakland University</i>	Kenneth Henry <i>Florida International University</i>
Tanya Benford <i>Florida Gulf Coast University</i>	Graham Gal <i>University of Massachusetts, Amherst</i>	Sarah Hill <i>Northcentral Technical College</i>
Janice Benson <i>University of Wyoming</i>	Andy Garcia <i>Bowling Green State University</i>	Rani Hoitash <i>Bentley University</i>
Jennifer Blaskovich <i>University of Nebraska, Omaha</i>	David Gelb <i>Seton Hall University</i>	Diane Janvrin <i>Iowa State University</i>
Faye Borthick <i>Georgia State University</i>	Jeremy Germann <i>Centralia College</i>	Jason Jio <i>Bradley University</i>
Daniel Boylan <i>University of North Georgia</i>	Jan Gillespie <i>University of Texas</i>	Steven Johnson <i>Minnesota State University, Mankato</i>
Kristine Brands <i>Regis University</i>	Terry Glandon <i>University of Texas, El Paso</i>	Nancy Jones <i>San Diego State University</i>
Linda Bressler <i>University of Houston</i>	Severin Grabski <i>Michigan State University</i>	Grover Kearns <i>University of South Florida, St. Petersburg</i>
Kimberly Brickler-Ulrich <i>Lindenwood University</i>	Marina Grau <i>Houston Community College</i>	Andrea Seaton Kelton <i>Middle Tennessee State University</i>
Sandra Cereola <i>James Madison University</i>	Gerry Grant <i>California State University, Fullerton</i>	Kevin Kobelsky <i>University of Michigan, Dearborn</i>
Siew Chan		

Joseph Komar  
*University of St. Thomas*  
 Don Kovacic  
*California State*  
*University, San Marcos*  
 Sabrina Landa  
*California State*  
*University, Long Beach*  
 Brenda Lauer  
*Davenport University*  
 Mark Lawrence  
*University of North*  
*Alabama*  
 Yvette Lazdowski  
*Plymouth State*  
*University*  
 Maria Leach  
*Auburn University*  
 Chih-Chen Lee  
*Northern Illinois*  
*University*  
 Picheng Lee  
*Pace University*  
 Adena LeJeune  
*Louisiana College*  
 Chan Li  
*University of Pittsburg*  
 Robert Lin  
*California State*  
*University, East Bay*  
 Qi Liu  
*University of Rhode Island*  
 Tina Loraas  
*Auburn University*  
 Sakthi Mahenthiran  
*Butler University*  
 Lois Mahoney  
*Eastern Michigan*  
*University*  
 Kevin J. McFarlane  
*Regis University*  
 Britton McKay  
*Georgia Southern*  
*University*  
 James Mensching  
*California State*  
*University, Chico*  
 Mike Metzcar  
*Indiana Wesleyan*  
*University*

Pam Meyer  
*University of Louisiana*  
*at Lafayette*  
 Bonnie Morris  
*West Virginia University*  
 Johnna Murray  
*University of Missouri,*  
*St. Louis*  
 Bruce Neumann  
*University of Colorado,*  
*Denver*  
 Colin Onita  
*San Jose State University*  
 Oluwakemi  
 Onwuchekwa  
*University of Central*  
*Florida*  
 Debra Petrizzo  
*Franklin University*  
 Theresa Phinney  
*Texas A&M University*  
 Ronald Premuroso  
*University of Montana*  
 Helen Pruitt  
*University of Maryland*  
 Jeffrey Pullen  
*University of Maryland*  
 Austin Reitenga  
*University of Alabama*  
 Jennifer Riley  
*University of Nebraska*  
*Omaha*  
 Juan Roman  
*American Public*  
*University System*  
 Silvia Romero  
*Montclair State*  
*University*  
 Mohd Rujob  
*Eastern Connecticut*  
*State University*  
 Juan Manuel Sanchez  
*Texas Tech University*  
 Paul San Miguel  
*Western Michigan*  
*University*  
 Arline Savage  
*Cal Poly, San Luis*  
*Obispo*  
 Lloyd Seaton

*University of Northern*  
*Colorado*  
 George Schmelzle  
*Missouri State University*  
 Dmitriy Shaltayev  
*Christopher Newport*  
*University*  
 Lewis Shaw  
*Suffolk University*  
 Robert Slater  
*University of North*  
*Florida*  
 Gary Smith  
*Georgia State University*  
 Kathleen Sobieralski  
*University of Maryland*  
 Eileen Taylor  
*North Carolina State*  
*University*  
 Ryan Teeter  
*University of Pittsburgh*  
 Katie Terrell  
*University of Arkansas*  
 Barbara Uliss  
*Metropolitan State*  
*University of Denver*  
 Linda Wallace  
*Virginia Tech*  
 Ting Wang  
*Governors State*  
*University*  
 Marcia Watson  
*Mississippi State*  
*University*  
 Andy Welchel  
*Furman University*  
 Mitchell Wenger  
*The University of*  
*Mississippi*  
 Veronda Willis  
*The University of Texas*  
*at Tyler*  
 Darryl Woolley  
*University of Idaho*  
 Al Chen Yuang-Sung  
*North Carolina State*  
*University*  
 David Zhu  
*California State*  
*University, Stanislaus*

# Brief Contents

**About the Authors v**

**Dedications vi**

**Preface vii**

**Main Features ix**

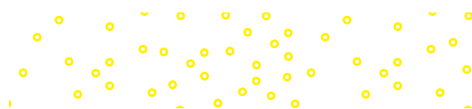
**AIS 4e Content Updates xiv**

**Acknowledgments xviii**

Chapter 1	Accounting Information Systems and Firm Value	2
Chapter 2	Data Analytics: Addressing Accounting Questions with Data	42
Chapter 3	Data Analytics: Data Visualizations	108
Chapter 4	Accountants as Business Analysts	174
Chapter 5	Data Modeling	210
Chapter 6	Relational Databases and Enterprise Systems	236
Chapter 7	Sales and Collections Business Process	282
Chapter 8	Purchases and Payments Business Process	322
Chapter 9	Conversion Business Process	350
Chapter 10	Integrated Project	376
Chapter 11	Accounting Information Systems and Internal Controls	386
Chapter 12	Cybersecurity and Computer Fraud	420
Chapter 13	Monitoring and Auditing AIS	450
Chapter 14	Reporting Processes and eXtensible Business Reporting Language (XBRL)	470
Chapter 15	Emerging Technologies: Blockchain and AI Automation	492
Chapter 16	The Balanced Scorecard, Business Model Canvas, and Business Value of Information Technology	526
Chapter 17	Justifying and Planning IT Initiatives Using Project Management Techniques	550

**GLOSSARY OF MODELS 586**

**INDEX I-1**



# Contents

## Chapter 1

### Accounting Information Systems and Firm Value 2

- Introduction 4
- Accountants as Business Analysts 4
- Definition of Accounting Information Systems 5
  - A Simple Information System* 6
  - Attributes of Useful Information* 6
  - Data versus Information* 7
  - Discretionary versus Mandatory Information* 8
- Role of Accountants in Accounting Information Systems 9
  - Specific Accounting Roles* 10
  - Certifications in Accounting Information Systems* 11
- The Value Chain and Accounting Information Systems 12
- AIS and Internal Business Processes 15
  - Financial Reporting System* 15
  - Human Resource Management System* 16
- AIS and External Business Processes 16
  - The Supply Chain* 16
  - Customer Relationship Management* 18
- Using AIS to Create a Cost Accounting System: An Example 19
- AIS and Value Creation 21
  - AIS and Firm Profitability* 21
- Summary 22
- Key Words 23
- Answers to Progress Checks 24
- Multiple Choice Questions 26
- Discussion Questions 28
- Problems 29

## Chapter 2

### Data Analytics: Addressing Accounting Questions with Data 42

- The Impact of Data Analytics on business and Accounting 44
  - Impact of Data Analytics on Business* 44
  - Impact of Data Analytics on Accounting* 44
- The Diversity of Accounting Data Enhances Accounting Analytics 47
- The Data Analytics Process: The AMPS Model 49
  - The Cyclical, Recursive Nature of the AMPS Model* 49
  - Illustration of the AMPS Analytics Model: Predicting Inventory Needs* 50

- The AMPS Model: Ask the Question* 51
- The AMPS Model: Master the Data* 52
- The AMPS Model: Perform the Analysis* 56
- The AMPS Model: Share the Story* 60

### Demonstration Labs (Illustrating the AMPS Model) 60

- Demonstration Lab 1: Descriptive Data Analytics: Accounts Receivable Aging* 61
- Demonstration Lab 2: Diagnostic Data Analytics: Segregation of Duties* 67
- Demonstration Lab 3: Predictive Data Analysis: Predicting Bankruptcy* 72
- Demonstration Lab 4: Prescriptive Data Analytics: Estimating the Breakeven Point* 80

### Summary 85

### Key Words 86

### Answers to Progress Checks 86

### Multiple Choice Questions 88

### Discussion Questions 89

### Problems 89

## Chapter 3

### Data Analytics: Data Visualizations 108

### Data Visualizations 110

### Exploratory and Explanatory Data Visualizations 110

#### *Exploratory Data Visualizations* 111

#### *Explanatory Data Visualizations* 113

### Data Visualization Concepts 113

### Appropriate Visualizations for Categorical Data 115

#### *Charts Appropriate for Categorical Data* 116

### Determining Appropriate Visualizations for Numerical Data 119

#### *Charts Appropriate for Numerical (Quantitative) Data* 119

#### *Bar Charts and Line Charts to Visualize Numerical Data* 120

#### *Visualizations Often Depend on User Preference* 123

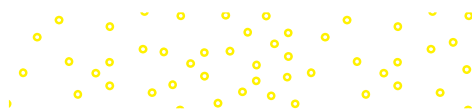
### Share the Story: Storytelling with Visualizations and Written Reports 125

#### *Executive Summary* 126

#### *Full Report* 126

### Summary 126

### Key Words 127



Appendix A: A Review of Sample Charts and their Uses 128  
 Answers to Progress Checks 130  
 Multiple Choice Questions 130  
 Discussion Questions 132  
 Problems 132

## Chapter 4

### Accountants as Business Analysts 174

Changing Roles of Accountants in Business 176  
*IMA Competency Framework* 176  
*CGMA Competency Framework* 177  
*IFAC Accountant Roles* 178  
*AICPA and NASBA CPA Evolution* 178  
 Business Process Documentation 178  
*Definitions* 178  
*Purposes of Documentation* 179  
*Value of Business Models* 180  
 Types of Business Models 181  
 Activity Models 181  
*Business Process Modeling Notation* 182  
*Basic Building Blocks for BPMN Diagrams* 182  
*Example of a Business Process Diagram* 183  
*Identifying Participants in Business Process Diagrams* 184  
*Messages in BPMN* 185  
*Extended Building Blocks for BPMN Diagrams and Modeling Concepts* 186  
*Subprocesses and Repeating Activities* 189  
*Data Objects, Datastores, and Associations* 190  
*Rules for Connecting Symbols with Sequence Flows and Message Flows* 192  
*Steps to Prepare Business Process Models* 193  
*Review Exercise: Preparing a Basic BPMN Diagram* 193  
 Summary 194  
 Key Words 195  
 Appendix A: Flowcharting 196  
 Appendix B: Data Flow Diagrams 200  
 Answers to Progress Checks 202  
 Multiple Choice Questions 203  
 Discussion Questions 206  
 Problems 207

## Chapter 5

### Data Modeling 210

Structure Models 212  
*Unified Modeling Language Class Diagrams* 212  
*Building Blocks for UML Class Diagrams* 212  
*Best Practices in Preparing Class Diagrams* 216

UML Class Models for Relational Database Design 217  
*Review Exercise: Preparing and Implementing a UML Class Diagram* 220  
 Decision Requirements and Business Rules 220  
*Business Rules and Decision Tables* 221  
 Using Business Process Models and Business Rules to Implement Internal Controls 222  
 Summary 225  
 Key Words 226  
 Appendix A: Entity-Relationship Diagrams 227  
 Answers to Progress Checks 229  
 Multiple Choice Questions 230  
 Discussion Questions 234  
 Problems 235

## Chapter 6

### Relational Databases and Enterprise Systems 236

Introduction 238  
*Definitions for Databases* 238  
 Fundamentals of Relational Databases 239  
*Entities and Attributes* 239  
*Keys and Relationships* 239  
*Basic Requirements of Tables* 241  
 Using Microsoft Access to Implement a Relational Database 241  
*Introduction to Microsoft Access* 241  
*Steve's Stylin' Sunglasses* 242  
*A Data Model and Attributes for Steve's Stylin' Sunglasses' Sales Process* 242  
*Multiplicities in Steve's Stylin' Sunglasses' Data Model* 243  
*Demonstration Lab 1: Using Access to Implement a Simple Database for Steve's Stylin' Sunglasses* 245  
*Demonstration Lab 2: Creating a Form for Data Entry and Display* 253  
 Structured Query Language (SQL) 261  
 Enterprise Systems 267  
*Challenges of Enterprise System Implementation* 269  
*Enterprise Systems Computing in the Cloud* 270  
 Summary 271  
 Key Words 271  
 Answers to Progress Checks 272  
 Multiple Choice Questions 272  
 Discussion Questions 275  
 Problems 276



**Chapter 7****Sales and Collections Business Process 282**

- Sales and Collection Process 284
- Sunset Graphics Example 284
  - Company Overview* 284
  - Sunset Graphics' Sales and Collection Process Description* 285
- Sunset Graphics' Activity Models 285
  - Basic Sales Activity Model* 285
  - Refining the Model to Show Collaboration* 286
  - Refining the Model to Consider Exceptions* 287
  - Basic Internet Sales Activity Model* 288
- Planning and Implementing Sales and Collection Process Controls 290
  - Application Controls* 292
- Sunset Graphics' Structure Models 296
  - UML Class Model for Quotes* 296
  - UML Class Model for Adding Orders* 297
  - UML Class Model for Adding Cash Receipts* 297
  - UML Class Model for Adding Categorical Information* 298
  - UML Class Model for Supporting Relational Database Planning* 299
- Sunset Graphics' Relational Database 301
  - Relational Database Planning for Attributes* 301
  - Create the Database and Define Tables* 303
  - Set Relationships* 305
  - Review Exercise: Baer Belly Bikinis' Sales to Retailers* 306
- Summary 309
- Key Words 309
- Appendix A: Generic REA Model with Multiplicities for the Sales and Collection Process 310
- Answers to Progress Checks 312
- Multiple Choice Questions 312
- Discussion Questions 317
- Problems 318

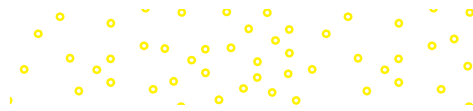
**Chapter 8****Purchases and Payments Business Process 322**

- Purchases and Payments Process 324
- Sunset Graphics Example 324
  - Company Overview* 324
  - Sunset Graphics' Purchases and Payments Process Description* 324
- Sunset Graphics' Activity Models 325
  - Basic Purchases Activity Model* 325
  - Refining the Model to Show Collaboration* 325
  - Refining the Model for Credit Card Payments* 327

- Planning and Implementing Purchases and Payments Process Controls 328
- Sunset Graphics' Structure Models 330
  - Basic UML Class Diagram for Purchases and Payments* 330
  - Refining the UML Class Diagram for Purchases and Payments* 331
- Sunset Graphics' Relational Database 332
  - Relational Database Planning for Attributes* 332
  - Creating the Database and Defining the Tables* 334
  - Review Exercise: Baer Belly Bikinis' Purchases* 334
- Summary 336
- Key Words 337
- Appendix A: Generic REA Model with Multiplicities for the Purchases and Payments Process 338
- Answers to Progress Checks 339
- Multiple Choice Questions 340
- Discussion Questions 344
- Problems 345

**Chapter 9****Conversion Business Process 350**

- Conversion Process 352
- Sunset Graphics Example 353
  - Company Overview* 353
  - Sunset Graphics' Conversion Process Description* 353
- Sunset Graphics' Activity Models 353
  - Basic Conversion Activity Model* 353
  - Refining the Model* 354
- Sunset Graphics' Conversion Process Controls 357
- Sunset Graphics' Structure Models 358
  - Basic UML Class Diagram for Conversion* 358
  - Refining the UML Class Diagram for Sunset's Conversion Process* 359
- Sunset Graphics' Relational Database 360
  - Relational Database Planning for Attributes* 361
  - Creating the Database and Defining the Tables* 363
  - Review Exercise: Baer Belly Bikinis' Swimwear Production* 363
- Summary 365
- Key Words 366
- Answers to Progress Checks 366
- Multiple Choice Questions 367
- Discussion Questions 371
- Problems 372



## Chapter 10

### Integrated Project 376

- Integrated Project Options 378
- Project Planning 378
  - Determine Business Requirements* 379
  - Prepare Activity Models Using BPMN* 379
  - Prepare Structure Diagram* 382
  - Import Data into Access, Create Efficient Tables, and Set Relationships* 383
  - Use Queries to Develop Financial Statement Information* 384
- Summary 385

## Chapter 11

### Accounting Information Systems and Internal Controls 386

- Introduction 388
- Ethics, The Sarbanes–Oxley Act of 2002, and Corporate Governance 388
  - The Need for a Code of Ethics* 388
  - Corporate Governance as Addressed by Sarbanes–Oxley* 388
- Control and Governance Frameworks 390
  - Overview of Control Concepts* 390
  - Commonly Used Frameworks* 391
  - COSO Internal Control Framework* 392
  - COSO ERM Framework* 394
  - COBIT Framework* 403
  - Information Technology Infrastructure Library* 405
  - ISO 27000 Series* 406
- Comparing Control/Governance Frameworks 408
- Summary 408
- Key Words 409
- Answers to Progress Checks 410
- Appendix: ERP Architecture and Control Issues 410
- Multiple Choice Questions 412
- Discussion Questions 415
- Problems 415

## Chapter 12

### Cybersecurity and Computer Fraud 420

- Introduction 422
- Information Security and Systems Integrity 422
  - Information Security Risks and Attacks* 422
  - Encryption and Authentication* 423
  - Cybersecurity Risk Management Framework by AICPA* 427
- Computer Fraud and Abuse 427
  - Computer Fraud Risk Assessment* 429
  - Computer Fraud Schemes* 429

- Computer Fraud Prevention and Detection* 431
- General Data Protection Regulation* 432
- Vulnerability Assessment and Management 432
  - Types of Vulnerabilities* 433
  - An Overall Framework for Vulnerability Assessment and Management* 434
- System Availability 435
- System and Organization Controls (SOC) Examinations 436
- Disaster Recovery Planning and Business Continuity Management 438
- Summary 439
- Key Words 440
- Answers to Progress Checks 441
- Multiple Choice Questions 442
- Discussion Questions 446
- Problems 447

## Chapter 13

### Monitoring and Auditing AIS 450

- Introduction 452
- Computer Hardware and Software 452
  - The Operating System* 452
  - Database Systems* 453
  - LANs and WANs* 454
  - Wireless Networks* 456
- Computer-Assisted Audit Techniques 458
- Continuous Monitoring and Continuous Auditing 460
- Summary 463
- Key Words 463
- Answers to Progress Checks 464
- Multiple Choice Questions 464
- Discussion Questions 467
- Problems 467

## Chapter 14

### Reporting Processes and eXtensible Business Reporting Language (XBRL) 470

- Introduction 472
- Data Warehouses and Data Marts 472
- Business Intelligence 474
- Digital Dashboards 476
- Financial Reporting and XBRL 477
  - How XBRL Works* 479
  - Using XBRL Tags to Display Financial Statements* 480
  - XBRL Assurance* 480
  - XBRL GL* 481
- Summary 482
- Key Words 483

Answers to Progress Checks 483  
 Multiple Choice Questions 484  
 Discussion Questions 486  
 Problems 486

## Chapter 15

### Emerging Technologies: Blockchain and AI Automation 492

Blockchain 494  
*A Brief History of Blockchain* 494  
*What Is Blockchain?* 495  
*When Is Blockchain Useful?* 496  
*How Does Blockchain Work?* 497  
*Popular Cryptocurrency Applications* 499  
*Types of Blockchain* 501  
*Platforms Using Blockchain Technology* 502  
 Blockchain Applications 504  
*Blockchain Use Cases* 505  
*Current Challenges with Adopting Blockchain Technology* 506  
*The Impact of Blockchain on Audit and Assurance* 507  
*Getting Started with Blockchain* 508  
 Artificial Intelligence 508  
*Introduction to Artificial Intelligence* 508  
*Assessing Performance* 514  
 AI Applications Important to Accounting 515  
*Natural Language Processing* 515  
*Robotic Process Automation* 515  
 Summary 516  
 Key Words 517  
 Answers to Progress Checks 518  
 Multiple Choice Questions 519  
 Discussion Questions 523

## Chapter 16

### The Balanced Scorecard, Business Model Canvas, and Business Value of Information Technology 526

Balanced Scorecard Framework 528  
*Learning and Growth Perspective* 529  
*Process Perspective* 529  
*Customer Perspective* 530  
*Financial Perspective* 530  
 Framework Integrating Strategy, Operations, and IT Investment 530  
 Role of AIS/IT in a Balanced Scorecard Framework 531  
 Using a Balanced Scorecard Management Process 533  
 Role of AIS/IT in the Balanced Scorecard Management Process 534  
 IT Governance Institute Val IT Framework 535  
 Implementing Val IT Governance 536

Business Model Canvas 537  
*Elements of the Business Model Canvas* 537  
*Impact of Information Technology* 540  
*Similarities with Strategy Maps* 540  
 Summary 541  
 Key Words 542  
 Answers to Progress Checks 543  
 Multiple Choice Questions 543  
 Discussion Questions 548  
 Problems 548

## Chapter 17

### Justifying and Planning IT Initiatives Using Project Management Techniques 550

Large IT Projects Require Economic Justification 552  
 The Business Case for IT Initiatives 552  
*Assessing Business Requirements for IT Initiatives* 553  
 Estimating Benefits 554  
 Estimating Costs 555  
*Acquisition Costs* 556  
*Operating Costs* 556  
 Assessing Risks 557  
 Developing the Value Proposition 558  
*Test the Sensitivity of Estimates to Changes in Assumptions* 560  
*Prepare the Value Proposition* 560  
 The Systems Development Life Cycle 561  
*The Waterfall Model and the Agile Model of Systems Development* 563  
 Effective Information Technology Planning 563  
 Projects, Project Management, and Project Sponsors 565  
 Challenges of IT Project Management 566  
 Constraining Factors of IT Projects 567  
*Scope* 567  
*Cost* 568  
*Time* 568  
*The 15-15 Rule* 568  
 Project Management Tools 569  
 Summary 571  
 Key Words 572  
 Answers to Progress Checks 573  
 Multiple Choice Questions 574  
 Discussion Questions 577  
 Problems 578

## GLOSSARY OF MODELS 586

## INDEX I-1

# Chapter One

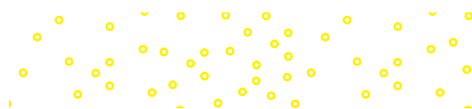
## Accounting Information Systems and Firm Value

### **A Look at This Chapter**

Information plays a crucial role in today's information age. In this chapter, we discuss the importance of data and information in accounting information systems and the role accountants play in those systems to create value for the company. In this chapter, we also describe investments in information systems to manage internal and external business processes and how they create value for the firm.

### **A Look Ahead**

Chapter 2 examines the role of accountants as business analysts. The chapter defines business process modeling and describes how it supports the business analyst role of accountants. It explains the potential value of business process modeling and introduces basic modeling tools to guide the accountant's development of modeling skills.





Sorbis/Shutterstock

Walking in to **Starbucks** to order a latte, you notice the atmosphere and the quality and variety of its coffees and related offerings. What you may not immediately notice is the accounting information system that supports the recordkeeping, replenishment, financing, and so on. To be sure, Starbucks has invested immense resources into planning, designing, and developing a number of accounting information systems to track information needed to run an effective business and to report to its shareholders and regulators (e.g., Internal Revenue Service and Securities and Exchange Commission) on its performance. This accounting information system tracks information as diverse as the number of hours worked each day by each of its 383,000 employees throughout the world to the amount of sales taxes to be paid and remitted to local, state, and national tax authorities at its 33,833 stores in 80 countries.

And customers are increasingly using mobile apps to order and pay for their Starbucks transactions. The Starbucks app is the second most used mobile payment app for point-of-sale transactions in the U.S., right after Apple Pay, and is used by over 30 million Americans!

Even Starbucks' Clover coffee machines use technology! By tracking customer preferences and tracking the expiration dates of milk, Starbucks is always collecting information and making it accessible from headquarters as well as each individual store for decision making. Many increasingly view Starbucks as a technology company. Do you? This chapter focuses on the role accounting information systems play in creating value for a firm such as Starbucks.

Source: *CNN Business Profile*, <https://money.cnn.com/quote/profile/profile.xhtml?symb=SBUX>, *Insider Intelligence*, <https://www.insiderintelligence.com/content/how-starbucks-app-energizing-mobile-payment-use> (Accessed August 2022).

## CHAPTER OUTLINE

Introduction  
 Accountants as Business Analysts  
 Definition of Accounting Information Systems  
*A Simple Information System*  
*Attributes of Useful Information*  
*Data versus Information*  
*Discretionary versus Mandatory Information*  
 Role of Accountants in Accounting Information Systems  
*Specific Accounting Roles*  
*Certifications in Accounting Information Systems*  
 The Value Chain and Accounting Information Systems  
 AIS and Internal Business Processes  
*Financial Reporting System*  
*Human Resource Management System*  
 AIS and External Business Processes  
*The Supply Chain*  
*Customer Relationship Management*  
 Using AIS to create a cost accounting system:  
 An Example  
 AIS and Value Creation  
*AIS and Firm Profitability*

## LEARNING OBJECTIVES

After reading this chapter, you should be able to:

- 1-1** Define an accounting information system, and explain characteristics of useful information.
- 1-2** Distinguish among data, information, and an information system.
- 1-3** Distinguish the roles of accountants in providing information, and explain certifications related to accounting information systems.
- 1-4** Describe how business processes affect the firm's value chain.
- 1-5** Explain how AIS affects firm value.
- 1-6** Describe how AIS assists the firm in its internal business processes.
- 1-7** Assess how AIS facilitates the firm's external business processes.
- 1-8** Explain how an AIS is used to create a cost accounting system.
- 1-9** Assess the impact of AIS on firm profitability and stock prices.
- Lab 1-1** Excel: Descriptive Analytics: Determining the Most Profitable Products (SKU) and Customers
- Lab 1-2** Excel: Descriptive Analytics: Calculating Descriptive Statistics

## INTRODUCTION

Data on business facts, numbers, customer preferences, and other useful indicators for business purposes are all around us. When a company combines this data with the appropriate context and uses data analytics to analyze it, it becomes a strategic asset for developing a competitive advantage to run the business better than its competitors.

**Starbucks**, for example, uses information about its customers, suppliers, and competitors to predict how much coffee it will sell and how much coffee it will need to purchase. If the company predicts more sales to customers than it actually has, it will have excess coffee and likely incur extra carrying costs of its inventory. If Starbucks underestimates the demand for its products, the store could potentially run out of coffee and miss out on profitable sales that will go to competitors. Information is a strategic asset if the firm (1) knows what information it needs; (2) develops systems to collect, store, and process that information; and (3) uses that information (often via data analytics) to make critical decisions that will ultimately affect performance and profitability.

### LO 1-1

Define an accounting information system, and explain characteristics of useful information.

## ACCOUNTANTS AS BUSINESS ANALYSTS

There are data all around us of every type. In fact, 1.7 megabytes of new information will be soon be created every second for every human being on the planet. With an incredible 2.5 quintillion bytes of data being created every day, 90 percent of the world's data has been created in the last two years alone.<sup>1</sup>

Firms have access to a tremendous amount of data—for instance, transactional data produced from point-of-sale terminals or bank deposits, consumer behavior data on customer preferences and purchases, product availability and costs, and operational statistics generated throughout a supply chain—that can contain valuable insights to enable decision making. With such data, firms can more easily compare and contrast results with relevant benchmarks. In that way, firms can determine the most effective way to allocate resources such as human resource (HR) talent, capital (e.g., equipment and buildings), and budgets (e.g., marketing, advertising, and research and development).<sup>2</sup>

At the same time, however, surveys suggest that 28 percent of senior financial executives say they have little or no information to predict the performance of their firms. Another 54 percent said they had only half the information needed to provide visibility into performance.<sup>3</sup>

Therefore, even with information all around us, it often lacks the needed relevance, clarity, and accuracy. To be sure, as you've learned in your classes to date, accountants keep financial records, prepare financial reports, and perform audits of those financial reports. Because the role of the accountant is to access and attest to the quality of information, accountants may increasingly be considered to be in the best position to serve as a business analyst in looking at the organization as a whole and helping determine how best to optimize overall company performance.

Specifically, as the business analyst, the accountant might be able to use their knowledge of available data from *Accounting Information Systems (AIS)* to provide management with data-driven insights to:

- Address business opportunities like *whether to outsource a portion of the manufacturing function* to Sri Lanka.
- Promote one streaming product over another *based on expected profit margins*.

<sup>1</sup>B. Marr, "How Much Data Is Produced Every Day 2021?," <https://www.the-next-tech.com/>, Accessed November 2022.

<sup>2</sup>B. McCarthy, "A Manual for the Data-Driven Finance Chief," *CFO.com*, November 6, 2015.

<sup>3</sup>J. Hagel, "Why Accountants Should Own Big Data," *Journal of Accountancy*, November 2013.



- Structure its research and development projects to take advantage of research and development (*R&D tax credits*) in such a way as to minimize current or future taxes.
- Evaluate characteristics of the *journal entries* based on risk scoring (who recorded them, at what amount, who authorized them, rare account combinations, etc.) to find *errors or fraud* in the journal entries.
- Consider how the *product reviews* on **Best Buy**'s website can help predict which inventory items will be sold and which ones won't be sold to determine if the inventory will become obsolete and if the inventory is appropriately valued.
- Predict the *right level of the Allowance for Doubtful Accounts* by classifying which customers will be able to pay their debts based on all the things the company knows about them.
- Give auditors the needed information *to evaluate and verify* account balances to identify potential material misstatements.
- Predict when goodwill is or soon will be impaired using *social media, macroeconomic conditions, the business press, or recent accounting performance*.
- Estimate a product's fixed and variable cost behavior to help *predict the level of sales* required to break even.
- Address the GAAP requirement for the firm *to predict the level of future sales returns* (items returned, refunds, etc.) in order to match it with the current period sales amounts<sup>4</sup> with information from the AIS.

To address such critical, but diverse, business opportunities, accountants need to decide what information is needed or potentially useful for addressing important business questions, then build an information system to gather and access the necessary information, and finally, analyze and communicate this information for use in critical business decision making.<sup>5</sup>

## DEFINITION OF ACCOUNTING INFORMATION SYSTEMS

Of the many information systems that are used in a firm, one type of information system is used in every firm: an **accounting information system (AIS)**. An AIS is a system that records, processes, summarizes, reports, and communicates the results of business transactions to provide financial and nonfinancial information to facilitate decision making. An AIS is also designed to ensure appropriate levels of internal controls (important security measures to protect the integrity and privacy of sensitive data) for those transactions.

This is the focus of this book. Some might call an AIS just a financial reporting system (FRS). Others might include in their AIS a much broader set of data that includes nonfinancial information such as customer sales data, sales transactions, and marketing activities or the results of research and development investment. Viewed broadly, an AIS collects, processes, and reports information deemed useful in decision making.

The study of AIS lies at the nexus of two traditional disciplines: information systems and accounting. In this book, we will highlight knowledge from both of these disciplines to more fully understand an AIS. While an AIS could take the form of a paper-and-pencil manual bookkeeping system, we will view an AIS as having all of the capabilities of a computerized system.

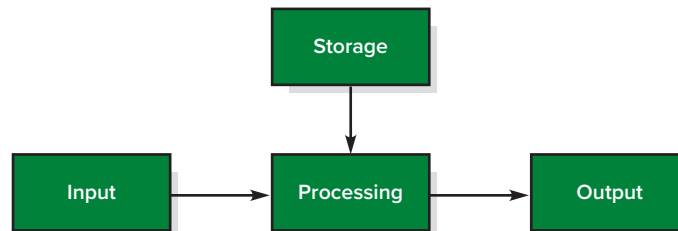
<sup>4</sup>FASB, ASU 2014-09.

<sup>5</sup>F. Borthick, "Helping Accountants Learn to Get the Information Managers Want: The Role of the Accounting Information Systems Course," *Journal of Information Systems* 10, no. 2 (1996), pp. 75–85.

## A Simple Information System

An AIS, just like any system, can be explained using a general systems approach (as in Exhibit 1.1) with input, storage, processing, and output activities. We cover these activities in subsequent chapters, but the input may come in the form of sales recorded on a **Starbucks** cash register or point-of-sale terminal. Processing those data may take the form of getting the input into storage (such as a database or a data table). Processing might involve querying that database (e.g., using SQL or other queries) to produce the output in the form of a report for management use. As an example, Starbucks may query its sales database to report how much coffee it sells around Christmas to see if additional sales incentives need to be made to increase sales around Christmas in the future. Whether this report has information that is ultimately useful to management for their decision making is covered in the next section.

**EXHIBIT 1.1**  
A Simple Information System



## Attributes of Useful Information

To be most useful for decision makers, information from an AIS must both have relevance and give faithful representation of what occurred by having these attributes:

### 1. Relevance

- a. Confirmatory, or feedback, value (corrects or confirms what had been predicted in the past).
- b. Predictive value (helps with forecasting the future).
- c. Materiality (is above a threshold where missing or inaccurate information would impact decisions).

### 2. Faithful representation

- a. Complete (includes all monetary transactions; not missing any).
- b. Neutrality (not biased one way or the other).
- c. Free from error (contains no mistakes or inaccuracies).

## Relevance

To be useful, information must be relevant to the decision maker, capable of influencing the decisions of users. In other words, information is relevant when it helps users evaluate how past decisions actually worked out (feedback value) or predict what will happen in the future (predictive value). It is also relevant if the information is material in size, big enough to influence the decisions of its users.

## Faithful Representation

Information exhibits faithful representation if the information is complete (i.e., includes all applicable transactions), is neutral (i.e., free from bias), and is free from error. Faithful representation information represents the substance of the underlying economic transaction. If **Amazon** sells Steph Curry athletic shoes for \$300, it should be recorded and subsequently reported in its sales revenue account as \$300. Accounting information should not be

designed to lead users to accept or reject any specific decision alternative, but rather to offer information from transactions that report in essence what happened, free of error or bias.

AISs and accountants exist to provide useful information to decision makers. Considering the attributes of useful information helps AIS designers and users construct a system that delivers useful information to decision makers.

### LO 1-2

Distinguish among data, information, and an information system.

## Data versus Information

Hal Varian, **Google**'s chief economist, explains that while data are widely available, "what is scarce is the ability to extract wisdom from them." In that short statement, we learn that data and the information actually needed to make decisions may well have different definitions. **Data** are simply raw facts that describe the characteristics of an event that, in isolation, have little meaning.

**Walmart** has an information system called Retail Link. Retail Link is an Internet-based tool allowing Walmart employees and Walmart suppliers to access the point-of-sale data. Retail Link provides sales and inventory data, by item, store, and day (and time) to its suppliers. That is, it contains a record of every sale of every individual item at every Walmart store for the last 2 years, including time and date of sale, bar code number, price, and quantity purchased. However, to be most useful to Walmart, these data must be processed in a meaningful way to provide information most pertinent for Walmart management. To illustrate, consider the following example:

At what price should Walmart offer its bananas?

Bananas are the best selling item at Walmart, selling more than 1 billion pounds per year (32 pounds every second of every day). Sometimes Walmart will put bananas at the back of the produce section to get customers to walk through other products before picking up the bananas!<sup>6</sup>

To determine price, Walmart management would like the information to potentially address such questions as:

- How many pounds of bananas does Walmart sell on August 1 at its Lawrence, Kansas, store location this year versus last year? How many bananas were available for sale on August 1? How many bananas went bad on August 1 and had to be thrown away (or donated to charity)?
- What is the right price to charge for bananas to maximize Walmart's profits, or that will consistently bring customers in to buy their bananas and other Walmart products?
- What was the trade-off between prices for organic and nonorganic bananas at its locations in Tempe, Arizona; Stamford, Connecticut; and Champaign, Illinois? Does the relative difference in organic and nonorganic bananas depend on location, time of year, size of the price difference, or something else?
- Which other additional items sell best when bananas are bought by our customers? Which items should be set next to the bananas to enhance their chance of being sold?

**Information** is defined as data organized in a way meaningful to the user. Thus, data are often processed (aggregated, calculated, sorted, manipulated, etc.) and then combined with the appropriate context (year or location, etc.) to turn it into information.

<sup>6</sup>A. Lutz, "Why Bananas Are the Best-Selling Item at Walmart," *Business Insider*, September 27, 2013, <https://www.businessinsider.com/bananas-the-best-selling-item-at-walmart-2013-9>; A. Swerdloff, "Walmart Is Exploiting Our Love of Bananas to Lure Us through Its Stores," *Munchies*, February 20, 2016, [https://munchies.vice.com/en\\_us/article/bm3adz/walmart-is-exploiting-our-love-of-bananas-to-lure-us-through-its-stores](https://munchies.vice.com/en_us/article/bm3adz/walmart-is-exploiting-our-love-of-bananas-to-lure-us-through-its-stores).

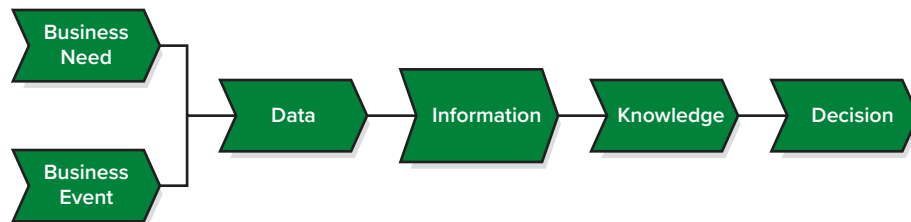
Decision makers typically require useful information to make decisions. As an example, while the sales price of a particular toy might be just considered data, subtracting the cost of goods sold from the sales price to compute the net profit would be considered information if the data help a retailer decide whether to carry that particular toy in its inventory, or even where to place it on its shelf to maximize customer exposure. To the extent that computers can assist in processing and organizing data in a way that is helpful to the decision maker, it is possible that there may be so much information available to actually cause **information overload**, which is the difficulty a person faces in understanding a problem and making a decision when faced with too much information. Therefore, an AIS must be carefully designed to provide the most important and useful information without overwhelming the user.

Data are considered to be an input, whereas information is considered to be the output.

The overall transformation from a business need and business event (like each individual transaction including bananas) to the collection of data and information to an ultimate decision is called the **information value chain** and is reflected in Exhibit 1.2. If Walmart needs to know how many bananas it should have at each location (i.e., business need), it will collect transactions involving banana sales (i.e., business event). Then it can take those data and turn them into information that might be used to make decisions on banana supply levels at each store. Certainly, the transformation from data to information is a key part of that value chain. Information that is useful (i.e., exhibiting characteristics of relevance or faithful representation) may get to the point of being knowledge and, ultimately, may be helpful in forming the basis for a decision.

### EXHIBIT 1.2 Information Value Chain

Source: Statements on Management Accounting, Institute of Management Accountants, 2008.



## Discretionary versus Mandatory Information

Because you have already taken a few accounting classes, you understand the types of information that are recorded, processed, and subsequently reported for different purposes, including managerial, financial, or tax purposes. Managerial accounting information is generally produced for internal information purposes and would usually be considered to be **discretionary information** because there is no law requiring that it be provided to management. Management simply decides what information it needs to track and builds an information system to track it. For example, management may want an activity-based costing (ABC) system to figure out which cost drivers should be used to allocate overhead costs at **Tesla** to different products (like Tesla's Model 3, Model X, and Model S). The value of information equals the difference between the benefits realized from using that information and the costs of producing it. Because discretionary information is not required, management must determine if the benefits of receiving that information are greater than the costs of producing it.

As early as 1989, **Starbucks** installed a costly computer network and hired a specialist in information technology from **McDonald's** Corporation to design a point-of-sale (cash register) system for store managers to use. Every night, stores passed their sales information to the Seattle headquarters, which allowed managers to highlight regional buying trends almost instantly. Because this information is not required by regulators, this would be considered to be an example of discretionary information.



**An AIS is used to support the mandatory information required by tax returns.**

Digital Vision/Getty Images

In contrast, much of the financial and tax accounting information is produced by the company for external information purposes such as for investors, banks, financial analysts, bondholders, and the Internal Revenue Service (IRS) in the form of tax returns or audited financial statements. This financial and tax accounting information would generally be considered to be **mandatory information**.

While discretionary information should be produced if the value of the information it provides to management is worth more than the cost to produce it, mandatory information is usually produced at the lowest possible cost of compliance with the laws or regulations from such entities as the Securities and Exchange Commission, IRS, state banking commission, and state tax commission.



### PROGRESS CHECK

1. Propose useful information that is relevant to a college football coach. Also, propose useful information that exhibits qualities of faithful representation to a college football coach.
2. Give an example of data versus information at a **T-Mobile** store.
3. Provide two types of discretionary information and two types of mandatory information that might come from an accounting information system for **Samsung**.

#### LO 1-3

Distinguish the roles of accountants in providing information, and explain certifications related to accounting information systems.

## ROLE OF ACCOUNTANTS IN ACCOUNTING INFORMATION SYSTEMS

In today's age, technology is a key tool in creating information systems for businesses. As a result, accounting and information technology are now more closely linked than ever. As information technology (IT) has gained operational and strategic importance in the business world, the role of accountants, understandably, must adjust as well. The International Federation of Accountants (IFAC) notes:

IT has grown (and will continue to grow) in importance at such a rapid pace and with such far reaching effects that it can no longer be considered a discipline peripheral to accounting. Rather, professional accounting has merged and developed with IT to such an extent that one can hardly conceive of accounting independent from IT.<sup>7</sup>

<sup>7</sup>"Information Technology Competencies in the Accounting Profession: AICPA Implementation Strategies for IFAC International Education Guideline No. 11," American Institute of Certified Public Accountants, 1996.