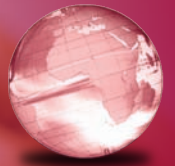


GLOBAL
EDITION



Accounting Information Systems

THIRTEENTH EDITION

Marshall B. Romney • Paul John Steinbart

ALWAYS LEARNING

PEARSON



Accounting Information Systems



This page is intentionally left blank.



Accounting Information Systems

THIRTEENTH EDITION
GLOBAL EDITION

Marshall B. Romney
Brigham Young University

Paul John Steinbart
Arizona State University



PEARSON

Boston Columbus Indianapolis New York San Francisco Upper Saddle River
Amsterdam CapeTown Dubai London Madrid Milan Munich Paris Montréal Toronto
Delhi Mexico City São Paulo Sydney Hong Kong Seoul Singapore Taipei Tokyo

Editor in Chief: Donna Battista
Acquisitions Editor: Ellen Geary
Editorial Assistant: Christine Donovan
Head of Learning Asset Acquisition, Global Edition: Laura Dent
Director of Marketing: Maggie Moylan Leen
Marketing Manager: Alison Haskins
Team Lead, Project Management: Jeff Holcomb
Senior Production Project Manager: Liz Napolitano
Associate Editor, Global Edition: Toril Cooper

Associate Project Editor, Global Edition: Uttaran Das Gupta
Manager, Rights & Permissions Manager: Michael Joyce
Rights & Permissions Coordinator: Samantha Graham
Senior Manufacturing Controller, Production, Global Edition:
Trudy Kimber
Senior Manufacturing Buyer: Carol Melville
Interior Designer: Liz Harasymcuk
Cover Designer: PreMediaGlobal
Cover Art: © abdrahimmahfar/Shutterstock

Credits and acknowledgments borrowed from other sources and reproduced, with permission, in this textbook appear on the appropriate page within text.

Photo Credits: Laptop icon, throughout book: Zentilia/Shutterstock; Blue eye icon, throughout book: Sam D. Cruz/Shutterstock; pp. 1, 3 (top), 27, 29, 51, 75, 109: Ian Dagnall/Alamy; pp. 1, 3 (bottom), 147, 149, 177, 215, 255, 287, 313, 337: ViewApart/Fotolia; pp. 363, 365, 405, 441, 469, 497: Image Source/Getty Images; pp. 613, 615, 649, 677: Radius Images/Alamy.

Microsoft and/or its respective suppliers make no representations about the suitability of the information contained in the documents and related graphics published as part of the services for any purpose. All such documents and related graphics are provided “as is” without warranty of any kind. Microsoft and/or its respective suppliers hereby disclaim all warranties and conditions with regard to this information, including all warranties and conditions of merchantability, whether express, implied or statutory, fitness for a particular purpose, title and non-infringement. In no event shall Microsoft and/or its respective suppliers be liable for any special, indirect or consequential damages or any damages whatsoever resulting from loss of use, data or profits, whether in an action of contract, negligence or other tortious action, arising out of or in connection with the use or performance of information available from the services.

The documents and related graphics contained herein could include technical inaccuracies or typographical errors. Changes are periodically added to the information herein. Microsoft and/or its respective suppliers may make improvements and/or changes in the product(s) and/or the program(s) described herein at any time. Partial screen shots may be viewed in full within the software version specified.

Microsoft® and Windows® are registered trademarks of the Microsoft Corporation in the U.S.A. and other countries. This book is not sponsored or endorsed by or affiliated with the Microsoft Corporation.

Pearson Education Limited
Edinburgh Gate
Harlow
Essex CM 20 2JE
England

and Associated Companies throughout the world

Visit us on the World Wide Web at:
www.pearsonglobaleditions.com

© Pearson Education Limited 2015

The rights of Marshall B. Romney and Paul John Steinbart to be identified as the authors of this work have been asserted by them in accordance with the Copyright, Designs and Patents Act 1988.

Authorized adaptation from the United States edition, entitled Accounting Information Systems, 13th edition, ISBN 978-0-133-42853-7, by Marshall B. Romney and Paul John Steinbart, published by Pearson Education © 2015.

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, photocopying, recording or otherwise, without either the prior written permission of the publisher or a license permitting restricted copying in the United Kingdom issued by the Copyright Licensing Agency Ltd, Saffron House, 6–10 Kirby Street, London EC1N 8TS.

All trademarks used herein are the property of their respective owners. The use of any trademark in this text does not vest in the author or publisher any trademark ownership rights in such trademarks, nor does the use of such trademarks imply any affiliation with or endorsement of this book by such owners.

ISBN 10: 1-292-06052-2
ISBN 13: 978-1-292-06052-1 (Print)
ISBN 13: 978-1-292-06108-5 (PDF)

British Library Cataloguing-in-Publication Data
A catalogue record for this book is available from the British Library

10 9 8 7 6 5 4 3 2 1
14 13 12 11

Typeset by PreMediaGlobal in Minion Pro Regular 10/12 pt.
Printed and bound by Courier Kendallville in The United States of America.

Brief Contents

Preface 19

PART I Conceptual Foundations of Accounting Information Systems 27

CHAPTER 1 Accounting Information Systems: An Overview 28

CHAPTER 2 Overview of Transaction Processing and Enterprise Resource Planning Systems 50

CHAPTER 3 Systems Documentation Techniques 74

CHAPTER 4 Relational Databases 108

PART II Control and Audit of Accounting Information Systems 147

CHAPTER 5 Computer Fraud 148

CHAPTER 6 Computer Fraud and Abuse Techniques 176

CHAPTER 7 Control and Accounting Information Systems 214

CHAPTER 8 Controls for Information Security 254

CHAPTER 9 Confidentiality and Privacy Controls 286

CHAPTER 10 Processing Integrity and Availability Controls 312

CHAPTER 11 Auditing Computer-Based Information Systems 336

PART III Accounting Information Systems Applications 363

CHAPTER 12 The Revenue Cycle: Sales to Cash Collections 364

CHAPTER 13 The Expenditure Cycle: Purchasing to Cash Disbursements 404

CHAPTER 14 The Production Cycle 440

CHAPTER 15 The Human Resources Management and Payroll Cycle 468

CHAPTER 16 General Ledger and Reporting System 496

PART IV The REA Data Model 527**CHAPTER 17** Database Design Using the REA Data Model 528**CHAPTER 18** Implementing an REA Model in a Relational Database 560**CHAPTER 19** Special Topics in REA Modeling 582**PART V** The Systems Development Process 613**CHAPTER 20** Introduction to Systems Development and Systems Analysis 614**CHAPTER 21** AIS Development Strategies 648**CHAPTER 22** Systems Design, Implementation, and Operation 676*Glossary* 702*Index* 723

Contents

Preface 19

PART I Conceptual Foundations of Accounting Information Systems 27

CHAPTER 1 Accounting Information Systems: An Overview 28

Introduction 29

Information Needs and Business Processes 31

Information Needs 31

Business Processes 32

Accounting Information Systems 36

How an AIS Can Add Value to an Organization 37

The AIS and Corporate Strategy 38

The Role of the AIS in the Value Chain 40

Summary and Case Conclusion 41 ■ Key Terms 42

AIS IN ACTION: Chapter Quiz 42 ■ Discussion Questions 43 ■ Problems 44

CASE 1-1 Ackoff's Management Misinformation Systems 47

AIS IN ACTION SOLUTIONS: Quiz Key 48

CHAPTER 2 Overview of Transaction Processing and Enterprise Resource Planning Systems 50

Introduction 51

Transaction Processing: The Data Processing Cycle 52

Data Input 52

Data Storage 53

Data Processing 59

Information Output 59

Enterprise Resource Planning (ERP) Systems 61

Summary and Case Conclusion 64 ■ Key Terms 64

AIS IN ACTION: Chapter Quiz 64 ■ Discussion Questions 65 ■ Problems 66

CASE 2-1 Bar Harbor Blueberry Farm 70

AIS IN ACTION SOLUTIONS: Quiz Key 71

CHAPTER 3 Systems Documentation Techniques 74

Introduction 75

Data Flow Diagrams 76

Subdividing the DFD 78

Flowcharts 82

Types of Flowcharts 83

Program Flowcharts 86

Business Process Diagrams 86

Summary and Case Conclusion 90 ■ Key Terms 90

 AIS IN ACTION: Chapter Quiz 90 ■ Comprehensive Problem 91 ■

Discussion Questions 92 ■ Problems 92

CASE 3-1 Dub 5 99 **AIS IN ACTION SOLUTIONS:** Quiz Key 100 ■ Comprehensive Problem Solution 102**CHAPTER 4 Relational Databases 108****Introduction 108**

Files Versus Databases 109

Using Data Warehouses for Business Intelligence 110

The Advantages of Database Systems 111

The Importance of Good Data 111

Database Systems 112

Logical and Physical Views of Data 112

Schemas 112

The Data Dictionary 114

DBMS Languages 114

Relational Databases 114

Types of Attributes 114

Designing a Relational Database for S&S, Inc. 116

Basic Requirements of a Relational Database 118

Two Approaches to Database Design 119

Creating Relational Database Queries 119

Query 1 121

Query 2 123

Query 3 124

Query 4 124

Query 5 126

Database Systems and the Future of Accounting 126

Summary and Case Conclusion 127 ■ Key Terms 128

 AIS IN ACTION: Chapter Quiz 128 ■ Comprehensive Problem 129 ■

Discussion Questions 130 ■ Problems 130

CASE 4-1 Research Project 136 **AIS IN ACTION SOLUTIONS:** Quiz Key 136 ■ Comprehensive Problem Solution 138 ■

Appendix: Data Normalization 140 ■ Summary 143 ■ Second Normalization Example 143

PART II**Control and Audit of Accounting Information Systems 147****CHAPTER 5 Computer Fraud 148****Introduction 149****AIS Threats 150****Introduction to Fraud 152**

Misappropriation of Assets 153

Fraudulent Financial Reporting 154

SAS No. 99: The Auditor's Responsibility to Detect Fraud 154

Who Perpetrates Fraud and Why 155

The Fraud Triangle 155

Computer Fraud 160

The Rise in Computer Fraud 160

Computer Fraud Classifications 162

Preventing and Detecting Fraud and Abuse 164

Summary and Case Conclusion 165 ■ Key Terms 166

 AIS IN ACTION: Chapter Quiz 166 ■ Discussion Questions 167 ■ Problems 168 **CASE 5-1** David L. Miller: Portrait of a White-Collar Criminal 170 **CASE 5-2** Heirloom Photo Plans 171 **AIS IN ACTION SOLUTIONS:** Quiz Key 173**CHAPTER 6 Computer Fraud and Abuse Techniques 176****Introduction 176****Computer Attacks and Abuse 177****Social Engineering 185****Malware 190**

Summary and Case Conclusion 199 ■ Key Terms 200

 AIS IN ACTION: Chapter Quiz 201 ■ Discussion Questions 202 ■ Problems 202 **CASE 6-1** Shadowcrew 210 **AIS IN ACTION SOLUTIONS:** Quiz Key 211**CHAPTER 7 Control and Accounting Information Systems 214****Introduction 215**

Why Threats to Accounting Information Systems are Increasing 215

Overview of Control Concepts 216

The Foreign Corrupt Practices and Sarbanes–Oxley Acts 217

Control Frameworks 218

COBIT Framework 218

COSO's Internal Control Framework 220

COSO's Enterprise Risk Management Framework 220

The Enterprise Risk Management Framework Versus the Internal Control Framework 222

The Internal Environment 222

Management's Philosophy, Operating Style, and Risk Appetite 223

Commitment to Integrity, Ethical Values, and Competence 223

Internal Control Oversight by the Board of Directors 224

Organizational Structure 224

Methods of Assigning Authority and Responsibility 224

Human Resources Standards that Attract, Develop, and Retain Competent Individuals 224

External Influences 226

Objective Setting 226**Event Identification 227****Risk Assessment and Risk Response 227**

Estimate Likelihood and Impact 228

Identify Controls 229

Estimate Costs and Benefits 229

Determine Cost/Benefit Effectiveness 229

Implement Control or Accept, Share, or Avoid the Risk 229

Control Activities 230

Proper Authorization of Transactions and Activities 230

Segregation of Duties 231

Project Development and Acquisition Controls 233

Change Management Controls 234

- Design and Use of Documents and Records 234
- Safeguard Assets, Records, and Data 234
- Independent Checks on Performance 235

Information and Communication 236

Monitoring 236

- Perform Internal Control Evaluations 236
- Implement Effective Supervision 236
- Use Responsibility Accounting Systems 236
- Monitor System Activities 237
- Track Purchased Software and Mobile Devices 237
- Conduct Periodic Audits 237
- Employ a Computer Security Officer and a Chief Compliance Officer 238
- Engage Forensic Specialists 238
- Install Fraud Detection Software 238
- Implement a Fraud Hotline 239

Summary and Case Conclusion 239 ■ Key Terms 240

AIS IN ACTION: Chapter Quiz 240 ■ Discussion Questions 242 ■ Problems 242

CASE 7-1 The Greater Providence Deposit & Trust Embezzlement 250

AIS IN ACTION SOLUTIONS: Quiz Key 251

CHAPTER 8 Controls for Information Security 254

Introduction 254

Two Fundamental Information Security Concepts 256

- Security is a Management Issue, Not Just a Technology Issue 256
- Defense-in-Depth and the Time-Based Model of Information Security 257

Understanding Targeted Attacks 258

Preventive Controls 259

- People: Creation of a “Security-Conscious” Culture 259
- People: Training 260
- Process: User Access Controls 261
- It Solutions: Antimalware Controls 264
- It Solutions: Network Access Controls 264
- It Solutions: Device and Software Hardening Controls 269
- It Solutions: Encryption 270
- Physical Security: Access Controls 271
- Change Controls and Change Management 272

Detective Controls 273

- Log Analysis 273
- Intrusion Detection Systems 274
- Penetration Testing 274
- Continuous Monitoring 274

Corrective Controls 274

- Computer Incident Response Team (CIRT) 275
- Chief Information Security Officer (CISO) 275
- Patch Management 276

Security Implications of Virtualization and the Cloud 276

Summary and Case Conclusion 277 ■ Key Terms 278

AIS IN ACTION: Chapter Quiz 278 ■ Discussion Questions 279 ■ Problems 280

CASE 8-1 Assessing Change Control and Change Management 283

CASE 8-2 Role-Play: Designing an Effective Information Security Program 283

AIS IN ACTION SOLUTIONS: Quiz Key 284

CHAPTER 9 Confidentiality and Privacy Controls	286
Introduction	286
Preserving Confidentiality	287
Identify and Classify Information to be Protected	287
Protecting Confidentiality With Encryption	288
Controlling Access to Sensitive Information	288
Training	290
Privacy	290
Privacy Controls	290
Privacy Concerns	291
Privacy Regulations and Generally Accepted Privacy Principles	293
Encryption	294
Factors that Influence Encryption Strength	295
Types of Encryption Systems	296
Hashing	298
Digital Signatures	298
Digital Certificates and Public Key Infrastructure	300
Virtual Private Networks (VPNS)	301
Summary and Case Conclusion	302 ■ Key Terms 302
AIS IN ACTION: Chapter Quiz	303 ■ Discussion Questions 304 ■ Problems 304
CASE 9-1 Confidentiality of Examination Question Papers	308
CASE 9-2 Generally Accepted Privacy Principles	308
AIS IN ACTION SOLUTIONS: Quiz Key	309
CHAPTER 10 Processing Integrity and Availability Controls	312
Introduction	312
Processing Integrity	312
Input Controls	313
Processing Controls	315
Output Controls	316
Illustrative Example: Credit Sales Processing	317
Processing Integrity Controls in Spreadsheets	318
Availability	319
Minimizing Risk of System Downtime	319
Recovery and Resumption of Normal Operations	320
Summary and Case Conclusion	324 ■ Key Terms 325
AIS IN ACTION: Chapter Quiz	325 ■ Discussion Questions 326 ■ Problems 327
CASE 10-1 Ensuring Systems Availability	332
CASE 10-2 Ensuring Process Integrity in Spreadsheets	333
AIS IN ACTION SOLUTIONS: Quiz Key	334
CHAPTER 11 Auditing Computer-Based Information Systems	336
Introduction	337
The Nature of Auditing	338
Overview of the Audit Process	338
The Risk-Based Audit Approach	340
Information Systems Audits	341
Objective 1: Overall Security	341
Objective 2: Program Development and Acquisition	343
Objective 3: Program Modification	344
Objective 4: Computer Processing	345
Objective 5: Source Data	348
Objective 6: Data Files	349

Audit Software 350**Operational Audits of an AIS 352**

Summary and Case Conclusion 352 ■ Key Terms 353

AIS IN ACTION: Chapter Quiz 353 ■ Discussion Questions 354 ■ Problems 355**CASE 11-1** Preston Manufacturing 359**AIS IN ACTION SOLUTIONS:** Quiz Key 359**PART III Accounting Information Systems Applications 363****CHAPTER 12 The Revenue Cycle: Sales to Cash Collections 364****Introduction 366****Revenue Cycle Information System 367**

Process 367

Threats and Controls 368

Sales Order Entry 370

Taking Customer Orders 371

Credit Approval 373

Checking Inventory Availability 375

Responding to Customer Inquiries 377

Shipping 378

Pick and Pack the Order 378

Ship the Order 380

Billing 383

Invoicing 383

Maintain Accounts Receivable 385

Cash Collections 388

Process 388

Threats and Controls 389

Summary and Case Conclusion 391 ■ Key Terms 392

AIS IN ACTION: Chapter Quiz 392 ■ Discussion Questions 393 ■ Problems 393**CASE 12-1** Research Project: How CPA Firms Are Leveraging New Developments in IT 401**AIS IN ACTION SOLUTIONS:** Quiz Key 401**CHAPTER 13 The Expenditure Cycle: Purchasing to Cash Disbursements 404****Introduction 405****Expenditure Cycle Information System 407**

Process 407

Threats and Controls 409

Ordering Materials, Supplies, and Services 412

Identifying What, When, and How Much to Purchase 412

Choosing Suppliers 415

Receiving 419

Process 419

Threats and Controls 420

Approving Supplier Invoices 421

Process 421

Threats and Controls 423

Cash Disbursements 425

Process 425

Threats and Controls 425

Summary and Case Conclusion 427 ■ Key Terms 428

AIS IN ACTION: Chapter Quiz 428 ■ Discussion Questions 429 ■ Problems 430

CASE 13-1 Research Project: Impact of Information Technology on Expenditure Cycle Activities, Threats, and Controls 437

AIS IN ACTION SOLUTIONS: Quiz Key 438

CHAPTER 14 The Production Cycle 440

Introduction 441

Production Cycle Information System 443

Process 444

Threats and Controls 444

Product Design 445

Process 445

Threats and Controls 447

Planning and Scheduling 447

Production Planning Methods 447

Key Documents and Forms 447

Threats and Controls 450

Production Operations 452

Threats and Controls 452

Cost Accounting 454

Process 454

Threats and Controls 455

Summary and Case Conclusion 460 ■ Key Terms 461

AIS IN ACTION: Chapter Quiz 461 ■ Discussion Questions 462 ■ Problems 462

CASE 14-1 The Accountant and CIM 465

AIS IN ACTION SOLUTIONS: Quiz Key 466

CHAPTER 15 The Human Resources Management and Payroll Cycle 468

Introduction 469

HRM/Payroll Cycle Information System 470

Overview of HRM Process and Information Needs 470

Threats and Controls 473

Payroll Cycle Activities 475

Update Payroll Master Database 475

Validate Time and Attendance Data 477

Prepare Payroll 479

Disburse Payroll 483

Calculate and Disburse Employer-Paid Benefits Taxes and Voluntary Employee Deductions 484

Outsourcing Options: Payroll Service Bureaus and Professional Employer Organizations 485

Summary and Case Conclusion 486 ■ Key Terms 487

AIS IN ACTION: Chapter Quiz 487 ■ Discussion Questions 488 ■ Problems 488

CASE 15-1 Research Report: HRM/Payroll Opportunities for CPAs 493

AIS IN ACTION SOLUTIONS: Quiz Key 494

CHAPTER 16 General Ledger and Reporting System 496

Introduction 497

General Ledger and Reporting System 498

Process 498

Threats and Controls 499

Update General Ledger 501

Process 501

Threats and Controls 501

Post Adjusting Entries 504

Process 505

Threats and Controls 505

Prepare Financial Statements 506

Process 506

Threats and Controls 510

Produce Managerial Reports 512

Process 512

Threats and Controls 512

Summary and Case Conclusion 516 ■ Key Terms 517

AIS IN ACTION: Chapter Quiz 517 ■ Discussion Questions 518 ■ Problems 519**CASE 16-1** Exploring XBRL Tools 523**CASE 16-2** Evaluating a General Ledger Package 523**CASE 16-3** Visualization tools for Big Data 523**AIS IN ACTION SOLUTIONS:** Quiz Key 524**PART IV The REA Data Model 527****CHAPTER 17 Database Design Using the REA Data Model 528****Introduction 528****Database Design Process 529****Entity-Relationship Diagrams 530****The REA Data Model 531**

Three Basic Types of Entities 532

Structuring Relationships: The Basic REA Template 532

Developing an REA Diagram 535

Step 1: Identify Relevant Events 535

Step 2: Identify Resources and Agents 537

Step 3: Determine Cardinalities of Relationships 538

Summary and Case Conclusion 544 ■ Key Terms 545

AIS IN ACTION: Chapter Quiz 545 ■ Comprehensive Problem 548 ■

Discussion Questions 548 ■ Problems 549

CASE 17-1 REA Data Modeling Extension 552**AIS IN ACTION SOLUTIONS:** Quiz Key 552 ■ Comprehensive Problem Solution 556**CHAPTER 18 Implementing an REA Model in a Relational Database 560****Introduction 561****Integrating REA Diagrams Across Cycles 561****Rules for Combining REA Diagrams 564**

Merging Redundant Resource Entities 564

Merging Redundant Event Entities 565

Validating the Accuracy of Integrated REA Diagrams 566

Implementing an REA Diagram in a Relational Database 566

Step 1: Create Tables for Each Distinct Entity and M:N Relationship 566

Step 2: Assign Attributes to Each Table 568

Step 3: Use Foreign Keys to Implement 1:1 and 1:N Relationships 569

Completeness Check 570

Using REA Diagrams to Retrieve Information from a Database 571

Creating Journals and Ledgers 571

Generating Financial Statements	572
Creating Managerial Reports	573
Summary and Case Conclusion	573 ■ Key Term 574
AIS IN ACTION: Chapter Quiz	574 ■ Comprehensive Problem 575 ■
Discussion Questions	575 ■ Problems 576
CASE 18-1 Practical Database Design	577
AIS IN ACTION SOLUTIONS: Quiz Key	577 ■ Comprehensive Problem Solution 579

CHAPTER 19 Special Topics in REA Modeling 582

Introduction 583

Additional Revenue and Expenditure Cycle Modeling Topics 583

Additional Revenue Cycle Events and Attribute Placement	583
Additional Expenditure Cycle Events and Attribute Placement	585
Sale of Services	588
Acquisition of Intangible Services	588
Digital Assets	589
Rental Transactions	589

Additional REA Features 591

Employee Roles	591
M:N Agent–Event Relationships	591
Locations	591
Relationships Between Resources and Agents	591

Production Cycle REA Model 592

Additional Entities—Intellectual Property	592
Production Cycle Events	594
New REA Feature	594

Combined HR/Payroll Data Model 595

HR Cycle Entities	595
Tracking Employees' Time	596

Financing Activities Data Model 597

Summary and Case Conclusion	598
AIS IN ACTION: Chapter Quiz	601 ■ Discussion Questions 602 ■ Problems 603
CASE 19-1 Practical Database Assignment	607
AIS IN ACTION SOLUTIONS: Quiz Key	607 ■ Appendix: Extending the REA Model to Include Information About Policies 611

PART V The Systems Development Process 613

CHAPTER 20 Introduction to Systems Development and Systems Analysis 614

Introduction 615

Systems Development 617

The Systems Development Life Cycle	617
The Players	618

Planning Systems Development 619

Planning Techniques	620
---------------------	-----

Feasibility Analysis 621

Capital Budgeting: Calculating Economic Feasibility	622
---	-----

Behavioral Aspects of Change 624

Why Behavioral Problems Occur	624
How People Resist Change	624
Preventing Behavioral Problems	625

Systems Analysis 626

- Initial Investigation 626
- Systems Survey 627
- Feasibility Study 629
- Information Needs and Systems Requirements 629
- Systems Analysis Report 631

Summary and Case Conclusion 632 ■ Key Terms 633

AIS IN ACTION: Chapter Quiz 634 ■ Comprehensive Problem 635 ■ Discussion Questions 635 ■ Problems 636

CASE 20-1 Audio Visual Corporation 643

AIS IN ACTION SOLUTIONS: Quiz Key 644 ■ Comprehensive Problem Solution 646

CHAPTER 21 AIS Development Strategies 648**Introduction 649****Purchasing Software 649**

- Selecting a Vendor 650
- Acquiring Hardware and Software 650
- Evaluating Proposals and Selecting a System 651

Development by In-House Information Systems Departments 653

- End-User-Developed Software 653
- Advantages and Disadvantages of End-User Computing 654
- Managing and Controlling End-User Computing 655

Outsourcing the System 656

- Advantages and Disadvantages of Outsourcing 656

Business Process Management 657

- Internal Controls in a Business Process Management System 658

Prototyping 659

- When to Use Prototyping 660
- Advantages of Prototyping 660
- Disadvantages of Prototyping 661

Computer-Aided Software Engineering 661

Summary and Case Conclusion 662 ■ Key Terms 663

AIS IN ACTION: Chapter Quiz 663 ■ Comprehensive Problem Freedom from Telemarketers—the do Not Call List 664 ■ Discussion Questions 664 ■ Problems 665

CASE 21-1 Professional Salon Concepts 670

AIS IN ACTION SOLUTIONS: Quiz Key 672 ■ Comprehensive Problem Solution 675

CHAPTER 22 Systems Design, Implementation, and Operation 676**Introduction 677****Conceptual Systems Design 677**

- Evaluate Design Alternatives 677
- Prepare Design Specifications and Reports 679

Physical Systems Design 679

- Output Design 680
- File and Database Design 680
- Input Design 681
- Program Design 682
- Procedures and Controls Design 683

Systems Implementation 684

- Implementation Planning and Site Preparation 684
- Selecting and Training Personnel 685
- Complete Documentation 686
- Testing the System 686

Systems Conversion 687**Operation and Maintenance 688**

Summary and Case Conclusion 689 ■ Key Terms 690

AIS IN ACTION: Chapter Quiz 690 ■ Comprehensive Problem Hershey's Big Bang ERP 691 ■

Discussion Questions 692 ■ Problems 693

CASE 22-1 Citizen's Gas Company 698**AIS IN ACTION SOLUTIONS:** Quiz Key 699 ■ Comprehensive Problem Solution 701

Glossary 702

Index 723

This page is intentionally left blank.

Preface

To the Instructor

This book is intended for use in a one-semester course in accounting information systems at either the undergraduate or graduate level. Introductory financial and managerial accounting courses are suggested prerequisites, and an introductory information systems course that covers a computer language or software package is helpful, but not necessary.

The book can also be used as the main text in graduate or advanced undergraduate management information systems courses.

The topics covered in this text provide information systems students with a solid understanding of transaction processing systems that they can then build on as they pursue more in-depth study of specific topics such as databases, data warehouses and data mining, networks, systems analysis and design, computer security, and information system controls.

ENHANCEMENTS IN THE THIRTEENTH EDITION

Perhaps the most noticeable change in the thirteenth edition is the change from a two-color design to a full-color design. This improves the readability of figures and diagrams, making it easier for students to understand relationships among concepts. We also made extensive revisions to the content of the material to incorporate recent developments, while retaining the features that have made prior editions easy to use. Every chapter has been updated to include up-to-date examples of important concepts. Specific changes include:

1. Introduction of business process diagrams in Chapter 3 and their use in the five chapters of Part III to provide an easy-to-understand method for showing the sequential flow of activities within business processes.
2. More detailed discussion of internal control frameworks: COSO, COSO-ERM, and COBIT. In particular, we discuss the new revision to the COSO framework and have updated the discussion of IT controls to reflect the new distinction between governance and management that was introduced in COBIT 5.
3. Updated discussion of information security countermeasures, including the security and control implications associated with virtualization and cloud computing. We also moved the material on change management from Chapter 10 to Chapter 8 to reflect its importance as one of the key layers of defense.
4. Annotation of the data flow diagrams in the five chapters of Part III to include information about when and where major internal control threats exist within each business process. In addition, in each chapter the discussion of controls to mitigate the various threats has also been revised to explicitly reference the summary table of threats and countermeasures found in each chapter. Each chapter also explicitly discusses how to properly configure ERP systems to enforce proper segregation of duties.

5. Many new end-of-chapter discussion questions and problems, including additional Excel exercises that are based on articles from the *Journal of Accountancy* so that students can develop the specific skills used by practitioners.
6. Many new computer fraud and abuse techniques have been added to help students understand the way systems are attacked.
7. The database chapter has been updated with all new tables and figures so that the Microsoft Access screen shots reflect the latest version of that product. At the request of some of our loyal adopters, an Appendix to Chapter 4 is included with this edition of the text that discusses database normalization.

CUSTOMIZING THIS TEXT

Pearson Custom Library can help you customize this textbook to fit how you teach the course. You can select just the chapters from this text that you plan to cover and arrange them in the sequence you desire. You even have the option to add your own material or third party content. In addition, you may choose an alternate version of the REA material presented in Chapters 17–19 that uses the Batini style notation instead of the crows feet notation featured in this book.

To explore how to create a customized version of the book you can contact your Pearson representative.

SUPPLEMENTAL RESOURCES

As with prior editions, our objective in preparing this thirteenth edition has been to simplify the teaching of AIS by enabling you to concentrate on classroom presentation and discussion, rather than on locating, assembling, and distributing teaching materials. To assist you in this process, the following supplementary materials are available to adopters of the text:

- *Solutions Manual* prepared by Marshall Romney at Brigham Young University and Paul John Steinbart at Arizona State University
- *Instructors Manual* prepared by Robyn Raschke at University of Nevada–Las Vegas
- *Test Item File* prepared by Robert Marley at Georgia Southern University
- *TestGen testing software*, a computerized test item file
- *PowerPoint Presentation* slides developed by Robyn Raschke at University of Nevada–Las Vegas

The thirteenth edition includes an entirely new set of PowerPoint slides that make extensive use of high-quality graphics to illustrate key concepts. The slides do not merely consist of bullet points taken verbatim from the text, but instead are designed to help students notice and understand important relationships among concepts. The large number of slides provides instructors a great deal of flexibility in choosing which topics they wish to emphasize in class.

In addition, you can access all these supplements from the protected instructor area of www.pearsonglobaleditions.com/Romney.

We recognize that you may also wish to use specific software packages when teaching the AIS course. Contact your Pearson representative to learn about options for bundling this text (or a customized version) with software packages or other texts such as *Peachtree Computerized Practice Set: Comprehensive Assurance and Systems Tool (CAST)*; *Manual AIS Practice Set: Comprehensive Assurance and Systems Tool (CAST)*; or *CAST: Auditing Simulation*, all written by Laura R. Ingraham and J. Gregory Jenkins, both at North Carolina State University.

To the Student

As did previous editions, the thirteenth edition of *Accounting Information Systems* is designed to prepare you for a successful accounting career whether you enter public practice, industry, or government. All of you will be users of accounting information systems. In addition to being users, some of you will become managers. Others will become internal and external auditors,

and some of you will become consultants. Regardless of your role, you will need to understand how accounting information systems work in order to effectively measure how cost-effectively they perform, to assess their reliability and that of the information produced, or to lead the redesign and implementation of new and better systems. Mastering the material presented in this text will give you the foundational knowledge you need in order to excel at all those tasks.

This text discusses important new IT developments, such as virtualization and the move to cloud computing, because such developments affect business processes and often cause organizations to redesign their accounting systems to take advantage of new capabilities. The focus, however, is not on IT for the sake of IT, but on how IT affects business processes and controls. Indeed, new IT developments not only bring new capabilities, but also often create new threats and affect the overall level of risk. This text will help you understand these issues so that you can properly determine how to modify accounting systems controls to effectively address those new threats and accurately assess the adequacy of controls in those redesigned systems. We also discuss the effect of recent regulatory developments, such as the SEC mandate to use XBRL and the pending switch from GAAP to IFRS, on the design and operation of accounting systems.

In addition to technology- and regulatory-driven changes, companies are responding to the increasingly competitive business environment by reexamining every internal activity in an effort to reap the most value at the least cost. As a result, accountants are being asked to do more than simply report the results of past activities. They must take a more proactive role in both providing and interpreting financial and nonfinancial information about the organization's activities. Therefore, throughout this text we discuss how accountants can improve the design and functioning of the accounting information system (AIS) so that it truly adds value to the organization by providing management with the information needed to effectively run an organization.

Key Learning Objectives

When you finish reading this text, you should understand the following key concepts:

- The basic activities performed in the major business cycles
- What data needs to be collected to enable managers to plan, evaluate, and control the business activities in which an organization engages
- How IT developments can improve the efficiency and effectiveness of business processes
- How to design an AIS to provide the information needed to make key decisions in each business cycle
- The risk of fraud and the motives and techniques used to perpetrate fraud
- The COSO and COSO-ERM models for internal control and risk management, as well as the specific controls used to achieve those objectives
- The Control Objectives for Information and Related Technology (COBIT) Framework for the effective governance and control of information systems and how IT affects the implementation of internal controls
- The AICPA's Trust Services framework for ensuring systems reliability by developing procedures to protect the confidentiality of proprietary information, maintain the privacy of personally identifying information collected from customers, assure the availability of information resources, and provide for information processing integrity
- Fundamentals of information security
- Goals, objectives, and methods for auditing information systems
- Fundamental concepts of database technology and data modeling and their effect on an AIS
- The tools for documenting AIS work, such as REA diagrams, data flow diagrams, business processing diagrams, and flowcharts
- The basic steps in the system development process to design and improve an AIS

Features to Facilitate Learning

To help you understand these concepts the text includes the following features:

1. **Each chapter begins with an integrated case that introduces that chapter's key concepts and topics and identifies several key issues or problems that you should be able to solve after mastering the material presented in that chapter.** The case is referenced throughout the chapter and the chapter summary presents solutions to the problems and issues raised in the case.
2. **Focus Boxes and real-world examples** to help you understand how companies are using the latest IT developments to improve their AIS.
3. **Hands-on Excel exercises in many chapters** to help you hone your computer skills. Many of these exercises are based on “how-to” tutorials that appeared in recent issues of the *Journal of Accountancy*.
4. **Numerous problems in every chapter** provide additional opportunities for you to demonstrate your mastery of key concepts. Many problems were developed from reports in current periodicals. Other problems were selected from the various professional examinations, including the CPA, CMA, CIA, and SMAC exams. **Each chapter also has one or more cases** that require more extensive exploration of specific topics.
5. **Chapter quizzes** at the end of each chapter enable you to self-assess your understanding of the material. We also provide detailed explanations about the correct answer to each quiz question.
6. **Extensive use of Full-Color Graphics.** The text contains hundreds of figures, diagrams, flowcharts, and tables that illustrate the concepts taught in the chapters. Color is used to highlight key points.
7. Definitions of key terms are repeated in the **glossary margins** in each chapter. In addition, a **comprehensive glossary** located at the back of the book makes it easy to look up the definition of the various technical terms used in the text.
8. **Extensive on-line support** at Pearson's content-rich, text-supported Companion Website at www.pearsonhighered.com/romney/.

Excel Homework Problems

Accountants need to become proficient with Excel because it is a useful tool for tasks related to every business process. That is why each of the chapters in the business process section contains several homework problems that are designed to teach you new Excel skills in a context related to one of the business processes discussed in the chapter.

As with any software, Microsoft regularly releases updates to Microsoft Office, but not everyone always immediately switches. Eventually, however, during your career you will periodically move to a newer version of Excel. When you do, you will find that sometimes you need make only minor changes to existing spreadsheets, but other times you may have to make more significant changes because the newer version of Excel now incorporates different features and functions.

So how do you keep abreast of changes? And how can you learn new Excel skills “on the job” to simplify tasks that you now find yourself doing repeatedly? You could pay to take a course, but that can be costly, time-consuming and may not always be timely. Alternatively, you can develop life-long learning skills to continuously update your knowledge. One important way to do this is to begin now to save copies of two types of articles that regularly appear in the *Journal of Accountancy*. The first is the monthly column titled “Technology Q&A,” which often contains answers to questions about how do you do something in a newer version of Excel that you know how to do in an older version. The second type of article is a complete tutorial about a powerful way to use one or more Excel functions to automate a recurring task. Often, this second type of article has an online spreadsheet file that you can download and use to follow along with the example and thereby teach yourself a new skill.

The *Journal of Accountancy* web site maintains an archive of these articles that you can search to see if there is one that addresses a task that is new for you. Even if the article explains how to do something (such as create a pivot table) in an older version of Excel, in most cases you will find that many of the steps have not changed. For those that have, if you read the old way to do it as described in the article, you can then use Excel's built-in help feature to see how to do the same task in the newer version that you are now using.

The Excel homework problems in the five business process chapters in this textbook let you practice using *Journal of Accountancy* articles to help you develop new skills with Excel. Many of the problems reference a *Journal of Accountancy* tutorial article. Some are written for the version of Excel that you currently use, in which case it will be straightforward to follow the article to solve the problem. Others, however, were written for earlier versions of Excel, which gives you an opportunity to practice learning how to use Excel's help functions to update the steps in the tutorial.

Content and Organization

This text is divided into five parts, each focused on a major theme.

PART I: CONCEPTUAL FOUNDATIONS OF ACCOUNTING INFORMATION SYSTEMS

Part I consists of four chapters which present the underlying concepts fundamental to an understanding of AIS. Chapter 1 introduces basic terminology and provides an overview of AIS topics. It discusses how an AIS can add value to an organization and how it can be used to help organizations implement corporate strategy. It also discusses the types of information companies need to successfully operate and introduces the basic business processes that produce that information. It concludes by describing the role of the AIS in an organization's value chain.

Chapter 2 introduces transaction processing in automated systems, presenting basic information input/output, processing, and data storage concepts. You will see the wide range of data that must be collected by the AIS. This information helps you to understand what an AIS does; as you read the remainder of the book, you will see how advances in IT affect the manner in which those functions are performed. Chapter 2 also introduces you to Enterprise Resource Planning (ERP) systems and discusses their importance and uses in modern business.

Chapter 3 covers three of the most important tools and techniques used to understand, evaluate, design, and document information systems: data flow diagrams, business process diagrams, and flowcharts. You will learn how to read, critique, and create systems documentation using these tools.

Chapter 4 introduces the topic of databases, with a particular emphasis on the relational data model and creating queries in Microsoft Access. The chapter also introduces the concept of business intelligence.

PART II: CONTROL AND AUDIT OF ACCOUNTING INFORMATION SYSTEMS

The seven chapters in Part II focus on threats to the reliability of AIS and applicable controls for addressing and mitigating the risks associated with those threats. Chapter 5 introduces students to the different kinds of threats faced by information systems, primarily focusing on the threat of fraud. The chapter describes the different types of fraud and explains how fraud is perpetrated, who perpetrates it, and why it occurs.

Chapter 6 discusses computer fraud and abuse techniques. Three major types of computer fraud are discussed: computer attacks and abuse, social engineering, and malware. The chapter explains the dozens of ways computer fraud and abuse can be perpetrated.

Chapter 7 uses the COSO framework, including the expanded enterprise risk management (COSO-ERM) model, to discuss the basic concepts of internal control. It also introduces the COBIT framework which applies those concepts to IT, thereby providing a foundation for effective governance and control of information systems.

Chapter 8 focuses on information security. It introduces the fundamental concepts of defense-in-depth and the time-based approach to security. The chapter provides a broad survey of a variety of security topics including access controls, firewalls, encryption, and incident detection and response.

Chapter 9 discusses the many specific computer controls used in business organizations to achieve the objectives of ensuring privacy and confidentiality, and includes a detailed explanation of encryption.

Chapter 10 addresses the controls necessary to achieve the objectives of accurate processing of information and ensuring that information is available to managers whenever and wherever they need it.

Chapter 11 describes principles and techniques for the audit and evaluation of internal control in a computer-based AIS and introduces the topic of computer-assisted auditing.

PART III: ACCOUNTING INFORMATION SYSTEMS APPLICATIONS

Part III focuses on how a company's AIS provides critical support for its fundamental business processes. Most large and many medium-sized organizations use enterprise resource planning (ERP) systems to collect, process, and store data about their business processes, as well as to provide information reports designed to enable managers and external parties to assess the organization's efficiency and effectiveness. To make it easier to understand how an ERP system functions, Part III consists of five chapters, each focusing on a particular business process.

Chapter 12 covers the revenue cycle, describing all the activities involved in taking customer orders, fulfilling those orders, and collecting cash.

Chapter 13 covers the expenditure cycle, describing all the activities involved in ordering, receiving, and paying for merchandise, supplies, and services.

Chapter 14 covers the production cycle, with a special focus on the implications of recent cost accounting developments, such as activity-based costing, for the design of the production cycle information system.

Chapter 15 covers the human resources management/payroll cycle, focusing primarily on the activities involved in processing payroll.

Chapter 16 covers the general ledger and reporting activities in an organization, discussing topics such as XBRL, the balanced scorecard, the switch from GAAP to IFRS, and the proper design of graphs to support managerial decision making.

Each of these five chapters explains the three basic functions performed by the AIS: efficient transaction processing, provision of adequate internal controls to safeguard assets (including data), and preparation of information useful for effective decision making.

PART IV: THE REA DATA MODEL

Part IV consists of three chapters that focus on the REA data model, which provides a conceptual tool for designing and understanding the database underlying an AIS. Chapter 17 introduces the REA data model and how it can be used to design an AIS database. The chapter focuses on modeling the revenue and expenditure cycles. It also demonstrates how the REA model can be used to develop an AIS that can not only generate traditional financial statements and reports but can also more fully meet the information needs of management.

Chapter 18 explains how to implement an REA data model in a relational database system. It also shows how to query a relational database in order to produce various financial statements and management reports.

Chapter 19 explains how to develop REA data models of the production, HR/payroll, and financing cycles. It also discusses a number of advanced modeling issues, such as the acquisition and sale of intangible products and services and rental transactions.

PART V: THE SYSTEMS DEVELOPMENT PROCESS

Part V consists of three chapters that cover various aspects of the systems development process. Chapter 20 introduces the systems development life cycle and discusses the introductory steps of this process (systems analysis, feasibility, and planning). Particular emphasis is placed on the behavioral ramifications of change.

Chapter 21 discusses an organization's many options for acquiring or developing an AIS (e.g., purchasing software, writing software, end-user-developed software, and outsourcing) and for speeding up or improving the development process (business process reengineering, prototyping, and computer-assisted software engineering).

Chapter 22 covers the remaining stages of the systems development life cycle (conceptual design, physical design, implementation, and operation and maintenance) and emphasizes the interrelationships among the phases.

Acknowledgments

We wish to express our appreciation to all supplements authors for preparing the various supplements that accompany this edition. We thank Martha M. Eining of the University of Utah and Carol F. Venable of San Diego State University for preparing the comprehensive cases included on our Web site. We are also grateful to Iris Vessey for her contributions to the problem material. We thank Bill Heninger of Brigham Young University for allowing us to use portions of his database normalization tutorial to create the Appendix to Chapter 4.

Perhaps most importantly, we are indebted to the numerous faculty members throughout the world who have adopted the earlier editions of this book and who have been generous with their suggestions for improvement. We are especially grateful to the following faculty who participated in reviewing the thirteenth edition throughout various stages of the revision process:

Dr. Linda Bressler, *University of Houston–Downtown*
Elizabeth Carlson, *University of Southern Florida–Sarasota/Manatee*
Gregory J. Gerard, *Florida State University*
Lois S. Mahoney, *Eastern Michigan University*
Robert Marley, *Georgia Southern University*

We are grateful for permission received from four professional accounting organizations to use problems and unofficial solutions from their past professional examinations in this book. Thanks are extended to the American Institute of Certified Public Accountants for use of the CPA Examination materials, to the Institute of Certified Management Accountants for use of CMA Examination materials, to the Institute of Internal Auditors for use of CIA Examination materials, and to the Society of Management Accountants of Canada for use of SMAC Examination materials. We also wish to thank Netsuite, Inc., for providing permission to use screenshots of their software throughout the text.

Of course, any errors in this book remain our responsibility. We welcome your comments and suggestions for further improvement.

Finally, we want to thank our wives and families for their love, support, and encouragement. We also want to thank God for giving us the ability to start and complete this book.

— Marshall B. Romney
Provo, Utah
— Paul John Steinbart
Tempe, Arizona

Pearson would like to thank and acknowledge the following persons for their contribution to the Global Edition:

Contributors:

Simon Lee, *The Chinese University of Hong Kong*

Erik Rutkens, *University of Groningen*

Reviewers:

Mohammad El Hajj, *Lebanese University, University Institute of Technology*

Chris Cheng, *Hang Seng Management College*

Mohamad Hisyam Selamat, *SEGi University, Kota Damansara, Malaysia*

Raymond Kin Ho Wong, *The Chinese University of Hong Kong*

Conceptual Foundations of Accounting Information Systems

PART

I



CHAPTER 1

Accounting Information
Systems: An Overview

CHAPTER 2

Overview of Transaction
Processing and Enterprise
Resource Planning (ERP)

CHAPTER 3

Systems Documentation
Techniques

CHAPTER 4

Relational Databases

Accounting Information Systems: An Overview

LEARNING OBJECTIVES

After studying this chapter, you should be able to:

1. Distinguish data from information, discuss the characteristics of useful information, and explain how to determine the value of information.
2. Explain the decisions an organization makes and the information needed to make them.
3. Identify the information that passes between internal and external parties and an accounting information system (AIS).
4. Describe the major business processes present in most companies.
5. Explain what an AIS is and describe its basic functions.
6. Discuss how an AIS can add value to an organization.
7. Explain how an AIS and corporate strategy affect each other.
8. Explain the role an AIS plays in a company's value chain.

INTEGRATIVE CASE

S&S

After working for years as a regional manager for a retail organization, Scott Parry opened his own business with Susan Gonzalez, one of his district managers, as his partner. They formed S&S to sell appliances and consumer electronics. Scott and Susan pursued a “clicks and bricks” strategy by renting a building in a busy part of town and adding an electronic storefront.

Scott and Susan invested enough money to see them through the first six months. They will hire 15 employees within the next two weeks—3 to stock the shelves, 4 sales representatives, 6 checkout clerks, and 2 to develop and maintain the electronic storefront.

Scott and Susan will host S&S's grand opening in five weeks. To meet that deadline, they have to address the following important issues:

1. What decisions do they need to make to be successful and profitable? For example:
 - a. How should they price products to be competitive yet earn a profit?



- b. Should they extend credit, and, if so, on what terms? How can they accurately track what customers owe and pay?
 - c. How should they hire, train, and supervise employees? What compensation and benefits package should they offer? How should they process payroll?
 - d. How can they track cash inflows and outflows to avoid a cash squeeze?
 - e. What is the appropriate product mix? What inventory quantities should they carry, given their limited showroom space?
2. What information do Scott and Susan need to make those decisions?
 - a. What information do the external entities they interact with need?
 - b. What information do management and other employees need?
 - c. How can they gather, store, and disseminate that information?
 3. What business processes are needed, and how should they be carried out?
 4. What functionality should be provided on the website?

Although Scott and Susan could use an educated guess or “gut feeling” to make these decisions, they know they can make better decisions if they obtain additional information. A well-designed AIS can solve these issues and provide the information they need to make any remaining decisions.

Introduction

We begin this chapter by explaining important terms and discussing the kinds of information that organizations need and the business processes used to produce that information. We continue with an exploration of what an accounting information system (AIS) is, how an AIS adds value to an organization, how an AIS and corporate strategy affect each other, and the role of the AIS in the value chain.

A **system** is a set of two or more interrelated components that interact to achieve a goal. Most systems are composed of smaller subsystems that support the larger system. For example, a college of business is a system composed of various departments, each of which is a subsystem. Moreover, the college itself is a subsystem of the university.

Each subsystem is designed to achieve one or more organizational goals. Changes in subsystems cannot be made without considering the effect on other subsystems and on the system as a whole. **Goal conflict** occurs when a subsystem’s goals are inconsistent with the goals of another subsystem or with the system as a whole. **Goal congruence** occurs when a subsystem achieves its goals while contributing to the organization’s overall goal. The larger the organization and the more complicated the system, the more difficult it is to achieve goal congruence.

system - Two or more interrelated components that interact to achieve a goal, often composed of subsystems that support the larger system.

goal conflict - When a subsystem’s goals are inconsistent with the goals of another subsystem or the system as a whole.

goal congruence - When a subsystem achieves its goals while contributing to the organization’s overall goal.