



Ppbig/123RF



Stephen VanHorn/Shutterstock



FuzzBones/Shutterstock

Accounting Information Systems

FIFTEENTH EDITION
GLOBAL EDITION

Marshall B. Romney
Professor Emeritus, Brigham Young University

Paul John Steinbart
Professor Emeritus, Arizona State University

Scott L. Summers
Brigham Young University

David A. Wood
Brigham Young University



Pearson

Harlow, England • London • New York • Boston • San Francisco • Toronto • Sydney • Dubai • Singapore • Hong Kong
Tokyo • Seoul • Taipei • New Delhi • Cape Town • Sao Paulo • Mexio City • Madrid • Amsterdam • Munich • Paris • Milan

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 32

Business Processes 33

Accounting Information Systems 36

How an AIS Can Add Value to an Organization 37

An AIS Can Use Artificial Intelligence and Data Analytics
to Improve Decision Making 38

The AIS and Blockchain 40

Cloud Computing, Virtualization, and the Internet of Things 44

The AIS and Corporate Strategy 44

The Role of the AIS in the Value Chain 45

Summary and Case Conclusion 46 ■ Key Terms 47

AIS IN ACTION: Chapter Quiz 47 ■ Discussion Questions 48 ■ Problems 49 ■

AIS IN ACTION SOLUTIONS: Quiz Key 54

CHAPTER 2 Overview of Transaction Processing and Enterprise Resource Planning Systems 56

Introduction 57

Transaction Processing: The Data Processing Cycle 58

Data Input 58

Data Storage 59

Data Processing 65

Information Output 65

Transaction Processing: Blockchain 67

Enterprise Resource Planning (ERP) Systems 68

Summary and Case Conclusion 71 ■ Key Terms 71

AIS IN ACTION: Chapter Quiz 71 ■ Discussion Questions 72 ■ Problems 73

CASE 2-1 Bar Harbor Blueberry Farm 79

CASE 2-2 SDC 80

AIS IN ACTION SOLUTIONS: Quiz Key 81

CHAPTER 3 Systems Documentation Techniques 84**Introduction 85****Business Process Diagrams 86****Flowcharts 89**

Types of Flowcharts 91

Program Flowcharts 94

Data Flow Diagrams 95

Subdividing the DFD 97

Summary and Case Conclusion 100 ■ Key Terms 100

AIS IN ACTION: Chapter Quiz 101 ■ Comprehensive Problem 102 ■

Discussion Questions 102 ■ Problems 102

CASE 3-1 Dub 5 107**AIS IN ACTION SOLUTIONS:** Quiz Key 108 ■ Comprehensive Problem Solution 110**PART II Data Analytics 117****CHAPTER 4 Relational Databases 118****Introduction 118****Databases and Files 119**

Using Data Warehouses for Data Analytics 121

The Advantages of Database Systems 121

The Importance of Good Data 122

Database Systems 122

Logical and Physical Views of Data 122

Schemas 123

The Data Dictionary 124

DBMS Languages 126

Relational Databases 126

Types of Attributes 127

Designing a Relational Database for S&S, Inc. 127

Basic Requirements of a Relational Database 129

Two Approaches to Database Design 131

Creating Relational Database Queries 131

Query 1 131

Query 2 134

Query 3 137

Query 4 137

Query 5 139

Database Systems and the Future of Accounting 140

Summary and Case Conclusion 142 ■ Key Terms 142

AIS IN ACTION: Chapter Quiz 142 ■ Comprehensive Problem 143 ■

Discussion Questions 144 ■ Problems 145

CASE 4-1 Research Project 153**AIS IN ACTION SOLUTIONS:** Quiz Key 154 ■ Comprehensive Problem Solution 155

Appendix: Data Normalization 158 ■ Summary 161

CHAPTER 5 Introduction to Data Analytics in Accounting 162**Introduction 163****Ask the Right Questions 165****Extract, Transform, and Load Relevant Data 165**

Extracting Data 166

Transforming Data 169

Loading Data 170

Apply Appropriate Data Analytic Techniques 171
Interpret and Share the Results with Stakeholders 172

Interpreting Results 172
 Sharing Results 173

Additional Data Analytics Considerations 174

Automation 174
 Data Analytics Is Not Always the Right Tool 176

Summary and Case Conclusion 176 ■ Key Terms 176

AIS IN ACTION: Chapter Quiz 177 ■ Discussion Questions 178 ■ Problems 178

CASE 5-1 Robotic Process Automation—Wood’s Amazing Woods Inc. 183

AIS IN ACTION SOLUTIONS: Quiz Key 185

CHAPTER 6 Transforming Data 188

Introduction 189

Attributes of High-Quality Data 190

Data Structuring 191

Aggregate Data 191
 Data Joining 192
 Data Pivoting 192

Data Standardization 193

Data Parsing and Data Concatenation 193
 Cryptic Data Values 195
 Misfielded Data Values 196
 Data Formatting and Data Consistency 196

Data Cleaning 198

Data De-Duplication 198
 Data Filtering 198
 Data Contradiction Errors 199
 Data Threshold Violations 199
 Violated Attribute Dependencies 200
 Data Entry Errors 200

Data Validation 200

Visual Inspection 201
 Basic Statistical Tests 201
 Audit a Sample 201
 Advanced Testing Techniques 202

Summary and Case Conclusion 202 ■ Key Terms 202

AIS IN ACTION: Chapter Quiz 203 ■ Discussion Questions 204 ■ Problems 204

CASE 6-1 Hotel Data Cleaning Case 209

AIS IN ACTION SOLUTIONS: Quiz Key 210

CHAPTER 7 Data Analysis and Presentation 214

Introduction 215

Data Analysis 215

Descriptive Analytics 215
 Diagnostic Analytics 217
 Predictive Analytics 219
 Prescriptive Analytics 220
 Common Problems with Data Analytics 220

Data Presentation 222

Choosing the Right Visualization 222
 Designing High-Quality Visualizations 225

Summary and Case Conclusion 235 ■ Key Terms 235

AIS IN ACTION: Chapter Quiz	236	■ Discussion Questions	237	■ Problems	237
CASE 7-1 Analyzing Gamified Training	241				
CASE 7-1 Appendix	242				
ANALYTICS MINDSET Gamification	243				
AIS IN ACTION SOLUTIONS: Quiz Key	244				

PART III Control of Accounting Information Systems 247

CHAPTER 8 Fraud and Errors 248

Introduction 249

AIS Threats 249

Natural and Political Disasters 249

Software Errors and Equipment Malfunctions 251

Unintentional Errors 251

Intentional Acts 252

Introduction to Fraud 253

Misappropriation of Assets 254

Fraudulent Financial Reporting 255

SAS No. 99 (AU-C Section 240): The Auditor's Responsibility to Detect Fraud 255

Who Perpetrates Fraud and Why 256

The Fraud Triangle 256

Computer Fraud 261

The Rise in Computer Fraud 261

Computer Fraud Classifications 262

Preventing and Detecting Fraud and Abuse 264

Using Data Analytics to Prevent and Detect Fraud 266

Summary and Case Conclusion 268 ■ Key Terms 269

AIS IN ACTION: Chapter Quiz 269 ■ Discussion Questions 270 ■ Problems 271

CASE 8-1 David L. Miller: Portrait of a White-Collar Criminal 276

CASE 8-2 Heirloom Photo Plans 277

AIS IN ACTION SOLUTIONS: Quiz Key 279

CHAPTER 9 Computer Fraud and Abuse Techniques 282

Introduction 282

Computer Attacks and Abuse 283

Social Engineering 292

Malware 296

Summary and Case Conclusion 305 ■ Key Terms 306

AIS IN ACTION: Chapter Quiz 306 ■ Discussion Questions 307 ■ Problems 308

CASE 9-1 Shadowcrew 318

AIS IN ACTION SOLUTIONS: Quiz Key 319

CHAPTER 10 Control and Accounting Information Systems 322

Introduction 323

Why Threats to Accounting Information Systems Are Increasing 323

Overview of Control Concepts 324

The Foreign Corrupt Practices and Sarbanes–Oxley Acts 325

Control Frameworks 326

COBIT Framework 326

COSO'S Internal Control Framework 328

The Control Environment 330

Management's Philosophy, Operating Style, and Risk Appetite 331

Commitment to Integrity, Ethical Values, and Competence 331

Internal Control Oversight by the Board of Directors 332

Organizational Structure 332
 Methods of Assigning Authority and Responsibility 332
 Human Resources Standards That Attract, Develop, and Retain Competent Individuals 333
 External Influences 334

Risk Assessment and Risk Response 335

Estimate Likelihood and Impact 335
 Identify Controls 335
 Estimate Costs and Benefits 335
 Determine Cost/Benefit Effectiveness 336
 Implement Control or Accept, Share, or Avoid the Risk 337

Control Activities 337

Proper Authorization of Transactions and Activities 337
 Segregation of Duties 338
 Project Development and Acquisition Controls 341
 Change Management Controls 342
 Design and Use of Documents and Records 342
 Safeguard Assets, Records, and Data 342
 Independent Checks on Performance 343

Communicate Information and Monitor Control Processes 344

Information and Communication 344
 Monitoring 345

Summary and Case Conclusion 347 ■ Key Terms 348

AI5 IN ACTION: Chapter Quiz 348 ■ Discussion Questions 350 ■ Problems 350

CASE 10-1 The Greater Providence Deposit & Trust Embezzlement 356

AI5 IN ACTION SOLUTIONS: Quiz Key 357

CHAPTER 11 Controls for Information Security 360

Introduction 361

Three Fundamental Information Security Concepts 362

1. Security Is a Management Issue, Not Just a Technology Issue 362
2. People: The Critical Factor 364
3. The Time-Based Model of Information Security 365

Protecting Information Resources 367

Physical Security: Access Controls 367
 Process: User Access Controls 368
 IT Solutions: Antimalware Controls 372
 IT Solutions: Network Access Controls 372
 IT Solutions: Device and Software Hardening Controls 377
 IT Solutions: Encryption 379

Detecting Attacks 379

Log Analysis 379
 Intrusion Detection Systems 380
 Honeypots 380
 Continuous Monitoring 380

Responding to Attacks 381

Computer Incident Response Team (CIRT) 381
 Chief Information Security Officer (CISO) 381

Monitor and Revise Security Solutions 382

Penetration Testing 382
 Change Controls and Change Management 382

Security Implications of Virtualization, Cloud Computing, and the Internet of Things 383

Summary and Case Conclusion 384 ■ Key Terms 384

AIS IN ACTION: Chapter Quiz 385 ■ Discussion Questions 386 ■ Problems 386

CASE 11-1 Assessing Change Control and Change Management 391

CASE 11-2 Research Project 391

AIS IN ACTION SOLUTIONS: Quiz Key 391

CHAPTER 12 Confidentiality and Privacy Controls 394

Introduction 395

Protecting Confidentiality and Privacy 395

Identify and Classify Information to Be Protected 396

Protecting Sensitive Information with Encryption 396

Controlling Access to Sensitive Information 396

Training 398

Privacy Regulations and Generally Accepted Privacy Principles 398

The EU's GDPR and U.S. Laws 398

Generally Accepted Privacy Principles 399

Encryption 402

Factors That Influence Encryption Strength 403

Types of Encryption Systems 403

Virtual Private Networks (VPNs) 405

Hashing 406

Digital Signatures 407

Digital Certificates and Public Key Infrastructure 408

Blockchain 409

Summary and Case Conclusion 412 ■ Key Terms 412

AIS IN ACTION: Chapter Quiz 412 ■ Discussion Questions 414 ■ Problems 414

CASE 12-1 Protecting Privacy of Tax Returns 418

CASE 12-2 Generally Accepted Privacy Principles 419

AIS IN ACTION SOLUTIONS: Quiz Key 419

CHAPTER 13 Processing Integrity and Availability Controls 422

Introduction 422

Processing Integrity 423

Input Controls 423

Processing Controls 425

Output Controls 426

Illustrative Example: Credit Sales Processing 427

Processing Integrity Controls in Spreadsheets 429

Availability 429

Minimizing Risk of System Downtime 429

Recovery and Resumption of Normal Operations 430

Summary and Case Conclusion 435 ■ Key Terms 436

AIS IN ACTION: Chapter Quiz 436 ■ Discussion Questions 437 ■ Problems 438

CASE 13-1 Ensuring Systems Availability 447

CASE 13-2 Ensuring Process Integrity in Spreadsheets 447

AIS IN ACTION SOLUTIONS: Quiz Key 448

PART IV Accounting Information Systems Applications 451

CHAPTER 14 The Revenue Cycle: Sales to Cash Collections 452

Introduction 454

Revenue Cycle Information System 456

Process 456

Threats and Controls 456

Sales Order Entry 459

- Taking Customer Orders 460
- Credit Approval 462
- Checking Inventory Availability 464
- Responding to Customer Inquiries 465

Shipping 467

- Pick and Pack the Order 467
- Ship the Order 469

Billing 471

- Invoicing 472
- Maintain Accounts Receivable 474

Cash Collections 477

- Process 477
- Threats and Controls 478

Summary and Case Conclusion 480 ■ Key Terms 481

AIS IN ACTION: Chapter Quiz 481 ■ Discussion Questions 482 ■ Problems 482

CASE 14-1 Research Project: The Use of RFID in Retail 491

AIS IN ACTION SOLUTIONS: Quiz Key 491

CHAPTER 15 The Expenditure Cycle: Purchasing to Cash Disbursements 494

Introduction 495**Expenditure Cycle Information System 496**

- Process 496
- Threats and Controls 499

Ordering Materials, Supplies, and Services 503

- Identifying What, When, and How Much to Purchase 503
- Choosing Suppliers 505

Receiving 509

- Process 510
- Threats and Controls 511

Approving Supplier Invoices 512

- Process 512
- Threats and Controls 515

Cash Disbursements 515

- Process 515
- Threats and Controls 515

Summary and Case Conclusion 518 ■ Key Terms 519

AIS IN ACTION: Chapter Quiz 519 ■ Discussion Questions 520 ■ Problems 520

CASE 15-1 Group Case Analysis: School District Expenditure Fraud 529

CASE 15-2 Anatomy of a Multi-Million Dollar Embezzlement at ING Bank 529

AIS IN ACTION SOLUTIONS: Quiz Key 530

CHAPTER 16 The Production Cycle 532

Introduction 533**Production Cycle Information System 535**

- Process 536
- Threats and Controls 536

Product Design 537

- Process 537
- Threats and Controls 539

Planning and Scheduling 539

- Production Planning Methods 539

Key Documents and Forms 539

Threats and Controls 543

Production Operations 544

Threats and Controls 544

Cost Accounting 546

Process 546

Threats and Controls 547

Summary and Case Conclusion 552 ■ Key Terms 553

AIS IN ACTION: Chapter Quiz 553 ■ Discussion Questions 554 ■ Problems 555

CASE 16-1 The Accountant and CIM 559

AIS IN ACTION SOLUTIONS: Quiz Key 559

CHAPTER 17 The Human Resources Management and Payroll Cycle 562

Introduction 563

HRM/Payroll Cycle Information System 564

Overview of HRM Process and Information Needs 564

Threats and Controls 566

Payroll Cycle Activities 569

Update Payroll Master Database 570

Validate Time and Attendance Data 571

Prepare Payroll 573

Disburse Payroll 577

Calculate and Disburse Employer-Paid Benefits, Taxes, and Voluntary Employee Deductions 579

Outsourcing Options: Payroll Service Bureaus and Professional Employer Organizations 579

Summary and Case Conclusion 580 ■ Key Terms 581

AIS IN ACTION: Chapter Quiz 581 ■ Discussion Questions 582 ■ Problems 583

CASE 17-1 Excel Project: Sorting and Grouping Data 589

AIS IN ACTION SOLUTIONS: Quiz Key 589

CHAPTER 18 General Ledger and Reporting System 592

Introduction 593

General Ledger and Reporting System 594

Process 595

Threats and Controls 595

Update General Ledger 597

Process 597

Threats and Controls 598

Post Adjusting Entries 600

Process 601

Threats and Controls 602

Prepare Financial Statements 602

Process 602

Threats and Controls 609

Produce Managerial Reports 610

Process 610

Threats and Controls 610

Summary and Case Conclusion 614 ■ Key Terms 614

AIS IN ACTION: Chapter Quiz 615 ■ Discussion Questions 616 ■ Problems 616

CASE 18-1 Exploring iXBRL Viewers 621

CASE 18-2 Evaluating a General Ledger Package 621

AIS IN ACTION SOLUTIONS: Quiz Key 622

PART V The REA Data Model 625

CHAPTER 19 Database Design Using the REA Data Model 626

Introduction 626

Database Design Process 627

Entity-Relationship Diagrams 628

The REA Data Model 629

Three Basic Types of Entities 630

Structuring Relationships: The Basic REA Template 630

Developing an REA Diagram 633

Step 1: Identify Relevant Events 633

Step 2: Identify Resources and Agents 635

Step 3: Determine Cardinalities of Relationships 636

What an REA Diagram Reveals About an Organization 640

Business Meaning of Cardinalities 640

Uniqueness of REA Diagrams 641

Summary and Case Conclusion 642 ■ Key Terms 643

AIS IN ACTION: Chapter Quiz 643 ■ Comprehensive Problem 646 ■

Discussion Questions 646 ■ Problems 647

CASE 19-1 REA Data Modeling Extension 651

AIS IN ACTION SOLUTIONS: Quiz Key 652 ■ Comprehensive Problem Solution 656

CHAPTER 20 Implementing an REA Model in a Relational Database 660

Introduction 661

Integrating REA Diagrams Across Cycles 661

Merging Redundant Resource Entities 664

Merging Redundant Event Entities 665

Validating the Accuracy of Integrated REA Diagrams 666

Implementing an REA Diagram in a Relational Database 666

Step 1: Create Tables for Each Distinct Entity and M:N Relationship 666

Step 2: Assign Attributes to Each Table 668

Step 3: Use Foreign Keys to Implement 1:1 and 1:N Relationships 669

Completeness Check 670

Using REA Diagrams to Retrieve Information from a Database 671

Creating Journals and Ledgers 671

Generating Financial Statements 672

Creating Managerial Reports 673

Summary and Case Conclusion 673 ■ Key Term 674

AIS IN ACTION: Chapter Quiz 674 ■ Comprehensive Problem 675 ■

Discussion Questions 675 ■ Problems 676

CASE 20-1 Practical Database Design 678

AIS IN ACTION SOLUTIONS: Quiz Key 679 ■ Comprehensive Problem Solution 681

CHAPTER 21 Special Topics in REA Modeling 684

Introduction 685

Additional Revenue and Expenditure Cycle Modeling Topics 685

Additional Revenue Cycle Events and Attribute Placement 685

Additional Expenditure Cycle Events and Attribute Placement 687

Sale of Services 690

Acquisition of Intangible Services 690

Digital Assets 691

Rental Transactions 691

Additional REA Features 693

- Employee Roles 693
- M:N Agent–Event Relationships 693
- Locations 693
- Relationships Between Resources and Agents 693

Production Cycle REA Model 694

- Additional Entities—Intellectual Property 694
- Production Cycle Events 696
- New REA Feature 696

Combined HR/Payroll Data Model 697

- HR Cycle Entities 697
- Tracking Employees' Time 698

Financing Activities Data Model 699

Summary and Case Conclusion 700

AIS IN ACTION: Chapter Quiz 703 ■ Discussion Questions 704 ■ Problems 705

CASE 21-1 Practical Database Assignment 710

AIS IN ACTION SOLUTIONS: Quiz Key 710

Appendix: Extending the REA Model to Include Information About Policies 714

PART VI The Systems Development Process 717

CHAPTER 22 Introduction to Systems Development and Systems Analysis 718

Introduction 719**Systems Development 721**

- The Systems Development Life Cycle 721
- The Players 722

Planning Systems Development 723

- Planning Techniques 725

Feasibility Analysis 725

- Capital Budgeting: Calculating Economic Feasibility 726

Behavioral Aspects of Change 727

- Why Behavioral Problems Occur 728
- How People Resist Change 728
- Preventing Behavioral Problems 729

Systems Analysis 730

- Initial Investigation 730
- Systems Survey 732
- Feasibility Study 733
- Information Needs and Systems Requirements 733
- Systems Analysis Report 735

Summary and Case Conclusion 736 ■ Key Terms 737

AIS IN ACTION: Chapter Quiz 738 ■ Comprehensive Problem 739 ■

Discussion Questions 739 ■ Problems 740

CASE 22-1 Audio Visual Corporation 749

AIS IN ACTION SOLUTIONS: Quiz Key 750 ■ Comprehensive Problem Solution 752

CHAPTER 23 AIS Development Strategies 754

Introduction 755**Purchasing Software 755**

- Selecting a Vendor 756

Acquiring Hardware and Software 756
 Evaluating Proposals and Selecting a System 757

Development by In-House Information Systems Departments 759

End-User-Developed Software 759
 Advantages and Disadvantages of End-User Computing 760
 Managing and Controlling End-User Computing 761

Outsourcing the System 762

Advantages and Disadvantages of Outsourcing 762

Methods for Improving Systems Development 763

Business Process Management 764
 Prototyping 765
 Agile Methodologies 767
 Computer-Aided Software Engineering 770

Summary and Case Conclusion 771 ■ Key Terms 771

AIS IN ACTION: Chapter Quiz 772 ■ Comprehensive Problem 773 ■

Discussion Questions 773 ■ Problems 774

CASE 23-1 Wong Engineering Corp. 778

AIS IN ACTION SOLUTIONS: Quiz Key 779 ■ Comprehensive Problem Solution 782

CHAPTER 24 Systems Design, Implementation, and Operation 784

Introduction 785

Conceptual Systems Design 785

Evaluate Design Alternatives 785
 Prepare Design Specifications and Reports 787

Physical Systems Design 787

Output Design 788
 File and Database Design 788
 Input Design 789
 Program Design 790
 Procedures and Controls Design 791

Systems Implementation 792

Implementation Planning and Site Preparation 792
 Selecting and Training Personnel 793
 Complete Documentation 794
 Testing the System 794

Systems Conversion 795

Operation and Maintenance 796

Summary and Case Conclusion 797 ■ Key Terms 798

AIS IN ACTION: Chapter Quiz 798 ■ Comprehensive Problem 799 ■

Discussion Questions 800 ■ Problems 801

CASE 24-1 Citizen's Gas Company 807

AIS IN ACTION SOLUTIONS: Quiz Key 807 ■ Comprehensive Problem Solution 809

Glossary 812

Index 829