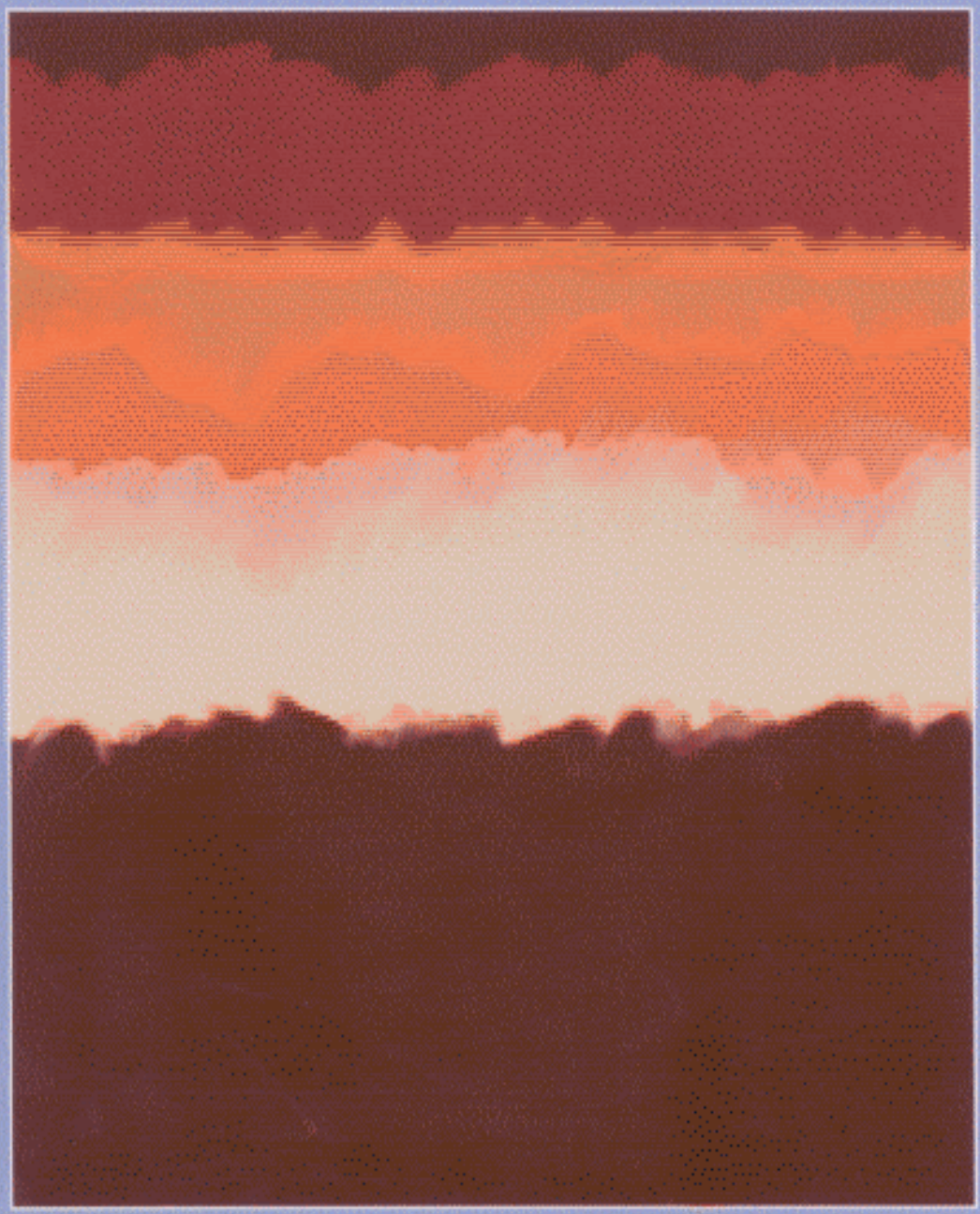
MODERN SYSTEMS ANALYSIS & DESIGN

THIRD EDITION



JEFFREY A. HOFFER
JOEY F. GEORGE
JOSEPH S. VALACICH

INTERNATIONAL EDITION

Contents

Preface xxv

Part Foundations for Systems Development

AN OVERVIEW OF PART I 2

1 The Systems Development Environment 4

Learning Objectives 4

Introduction 4

A Modern Approach to Systems Analysis and Design 6
- Separating Data and Processes That Handle Data 8
- Separating Databases and Applications 10

Your Role and Other Organizational Responsibilities in Systems Development 11
- IS Managers in Systems Development 12
- Systems Analysts in Systems Development 13
- Programmers in Systems Development 13
- Business Managers in Systems Development 14
- Other IS Managers/Technicians in Systems Development 15

Types of Information Systems and Systems Development 15
- Transaction Processing Systems 15
- Management Information Systems 16
- Decision Support Systems 16
- Expert Systems 17
- Summary of Information System Types 17

Developing Information Systems and the Systems Development Life Cycle 18
- The Traditional SDLC 24
- Structured Analysis and Structured Design 24
- Object-Oriented Analysis and Design 25

Different Approaches to Improving Development 25
- Prototyping 25
- Joint Application Design 26

Improving IS Development Productivity 27

Summary 27

Key Terms 28

Review Questions 29

Problems and Exercises 29
Field Exercises 29
References 30

2 Succeeding as a Systems Analyst 31

Learning Objectives 31
Introduction 31
Analytical Skills for Systems Analysts 32
- Systems Thinking: A Review 32
  - Definitions of a System and Its Parts 32
  - Important System Concepts 35
  - Benefiting from Systems Thinking 37
  - Applying Systems Thinking to Information Systems 38
- Organizational Knowledge 40
- Problem Identification 40
- Problem Analyzing and Solving 41

Technical Skills 42
Management Skills 43
- Resource Management 43
- Project Management 44
- Risk Management 44
- Change Management 45

Interpersonal Skills 45
- Communication Skills 45
  - Interviewing, Listening, and Questionnaires 45
  - Written and Oral Presentations 46
- Working Alone and with a Team 47
- Facilitating Groups 48
- Managing Expectations 48

Systems Analysis as a Profession 49
- Standards of Practice 49
- Ethics 50
- Career Paths 53

Summary 55
Key Terms 55
Review Questions 56
Problems and Exercises 56
Field Exercises 57
References 57

3 Managing the Information Systems Project 59

Learning Objectives 59
Introduction 59
Pine Valley Furniture Company Background 60
Managing the Information Systems Project 62
- Initiating a Project 66
- Planning the Project 68
- Executing the Project 74

Closing Down the Project 76
Representing and Scheduling Project Plans 78
Representing Project Plans 80
Constructing a Gantt Chart and PERT Chart at Pine Valley Furniture 80
Using Project Management Software 84
Establishing a Project Starting Date 85
Entering Tasks and Assigning Task Relationships 86
Selecting a Scheduling Method to Review Project Reports 86
Summary 88
Key Terms 88
Review Questions 89
Problems and Exercises 89
Field Exercises 91
References 92

4 Automated Tools for Systems Development 93

Learning Objectives 93
Introduction 93
The Use of CASE in Organizations 94
CASE and System Quality 95
The Cost of CASE 96
The Outlook for CASE 96
Driving and Resisting Forces for CASE 98
Components of CASE 99
CASE Diagramming Tools 102
CASE Form and Report Generator Tools 104
CASE Analysis Tools 104
CASE Repository 106
CASE Repository and the SDLC 109
Additional Advantages of a CASE Repository 109
CASE without a Common Repository 109
CASE Documentation Generator Tools 110
CASE Code Generation Tools 111
Visual and Emerging Development Tools 111
Object-Oriented Development Tools 111
Visual Development Tools 113
Evolution and Future of Development Tools 117
Summary 119
Key Terms 119
Review Questions 120
Problems and Exercises 120
Field Exercises 121
References 121

BROADWAY ENTERTAINMENT COMPANY, INC.: COMPANY BACKGROUND
Case Introduction 123
The Company 123
Company History 124
Company Organization 124
Development of Information Systems 125

Information Systems at BEC Today 125
In-Store Systems 126
Corporate Systems 127
Status of Systems 127
Case Summary 128
Case Questions 129

Part Making the Business Case

AN OVERVIEW OF PART II 132

5 Identifying and Selecting Systems Development Projects 134

Learning Objectives 134
Introduction 134
Identifying and Selecting Systems Development Projects 135
The Process of Identifying and Selecting IS Development Projects 136
Deliverables and Outcomes 140
Corporate and Information Systems Planning 141
Corporate Strategic Planning 142
Information Systems Planning 144
Electronic Commerce Application: Identifying and Selecting Systems Development Projects 152
Internet Basics 152
Pine Valley Furniture WebStore 153
Summary 154
Key Terms 154
Review Questions 155
Problems and Exercises 155
Field Exercises 156
References 156

BROADWAY ENTERTAINMENT COMPANY, INC.: IDENTIFYING AND SELECTING THE CUSTOMER RELATIONSHIP MANAGEMENT SYSTEM 158
Case Introduction 158
The Idea for a New System 158
Formalizing a Project Proposal 159
Case Summary 162
Case Questions 162

6 Initiating and Planning Systems Development Projects 163

Learning Objectives 163
Introduction 163
Initiating and Planning Systems Development Projects 164
The Process of Initiating and Planning IS Development Projects 165
Deliverables and Outcomes 166

Assessing Project Feasibility 168
Assessing Economic Feasibility 168
Determining Project Benefits 170
Determining Project Costs 171
The Time Value of Money 174
Assessing Technical Feasibility 177
Assessing Other Feasibility Concerns 180
Building the Baseline Project Plan 181
Reviewing the Baseline Project Plan 185
Electronic Commerce Application: Initiating and Planning Systems Development Projects 189
Initiating and Planning Systems Development Projects for Pine Valley Furniture's WebStore 190
Initiating and Planning PVF's E-Commerce System 190
WebStore Project Walkthrough 190
Summary 191
Key Terms 192
Review Questions 192
Problems and Exercises 193
Field Exercises 193
References 194
BROADWAY ENTERTAINMENT COMPANY, INC.: INITIATING AND PLANNING THE CUSTOMER RELATIONSHIP MANAGEMENT SYSTEM 195
Case Introduction 195
Initiating and Planning the Project 195
Developing the Baseline Project Plan 197
Case Summary 198
Case Questions 198

Part Analysis

AN OVERVIEW OF PART III 200

7 Determining System Requirements 202

Learning Objectives 202
Introduction 202
Performing Requirements Determination 203
The Process of Determining Requirements 204
Deliverables and Outcomes 204
Traditional Methods for Determining Requirements 205
Interviewing and Listening 206
Choosing Interview Questions 208
Interview Guidelines 209
Administering Questionnaires 210
Choosing Questionnaire Respondents 210
Designing Questionnaires 210

Choosing Between Interviews and Questionnaires 212
Interviewing Groups 213
Nominal Group Technique 213
Directly Observing Users 214
Analyzing Procedures and Other Documents 215
Modern Methods for Determining System Requirements 220
Joint Application Design 221
Taking Part in a JAD 223
CASE Tools During JAD 223
Supporting JAD with GSS 224
Using Prototyping During Requirements Determination 225
Radical Methods for Determining System Requirements 226
Identifying Processes to Reengineer 227
Disruptive Technologies 228
Internet Development: Determining System Requirements 229
Determining System Requirements for Pine Valley Furniture's WebStore 229
System Layout and Navigation Characteristics 229
WebStore and Site Management System Capabilities 230
Customer and Inventory Information 230
System Prototype Evolution 231
Summary 232
Key Terms 232
Review Questions 233
Problems and Exercises 233
Field Exercises 234
References 234
BROADWAY ENTERTAINMENT COMPANY, INC.: DETERMINING REQUIREMENTS FOR THE WEB-BASED CUSTOMER RELATIONSHIP MANAGEMENT SYSTEM
Case Introduction 235
Getting Started on Requirements Determination 235
Conducting Requirements Determination 235
Case Summary 236
Case Questions 237
8 Structuring System Requirements: Process Modeling 238
Learning Objectives 238
Introduction 238
Process Modeling 239
Modeling a System's Process 239
Deliverables and Outcomes 239
Data Flow Diagramming Mechanics 241
Definitions and Symbols 241
Developing DFDs: An Example 243
Data Flow Diagramming Rules 246
Decomposition of DFDs 247
Balancing DFDs 251
Four Different Types of DFDs 253
Using Data Flow Diagramming in the Analysis Process 257
Guidelines for Drawing DFDs 258
Completeness 258
Consistency 262

Timing 262
Iterative Development 262
Primitive DFDs 263
Using DFDs as Analysis Tools 263
Using DFDs in Business Process Reengineering 264
Oracle's Process Modeler and Functional Hierarchy Diagrams 266
Internet Development: Process Modeling 269
Process Modeling for Pine Valley Furniture's WebStore 270
Summary 271
Key Terms 272
Review Questions 272
Problems and Exercises 272
Field Exercises 277
References 277

BROADWAY ENTERTAINMENT COMPANY, INC.: STRUCTURING SYSTEM REQUIREMENTS: PROCESS MODELING FOR THE WEB-BASED CUSTOMER RELATIONSHIP MANAGEMENT SYSTEM
Case Introduction 278
Structuring the High-Level Process Findings from Requirements Determination 278
Inventory and Rental Extension Request 278
Favorite Picks 279
New Product Request 279
New Comment on a Product 279
Inventory Review 280
Comments on Products 280
Rental Status 280
Child Purchase/Rental History 280
Case Summary 280
Case Questions 281

9 Structuring System Requirements: Logic Modeling 282
Learning Objectives 282
Introduction 282
Logic Modeling 283
Modeling a System's Logic 283
Deliverables and Outcomes 283
Modeling Logic with Structured English 285
Modeling Logic with Decision Tables 288
Modeling Logic with Decision Trees 292
Deciding Among Structured English, Decision Tables, and Decision Trees 293
Electronic Commerce Application: Logic Modeling 295
Logic Modeling for Pine Valley Furniture's WebStore 295
Summary 297
Key Terms 297
Review Questions 298
Problems and Exercises 298
Field Exercises 300
References 300

BROADWAY ENTERTAINMENT COMPANY, INC.: STRUCTURING SYSTEM REQUIREMENTS: LOGIC MODELING FOR THE WEB-BASED CUSTOMER RELATIONSHIP MANAGEMENT SYSTEM
Case Introduction 301
The Logic of Information Processes 301
Process 5: Process New Comment 301
Process 6: Display Comment on Product 301
Process 7: New Product Request 303
Case Summary 303
Case Questions 303

10 Structuring System Requirements: Conceptual Data Modeling 304

Learning Objectives 304
Introduction 304
Conceptual Data Modeling 306
The Process of Conceptual Data Modeling 306
Deliverables and Outcomes 308
Gathering Information for Conceptual Data Modeling 309
Introduction to E-R Modeling 311
Entities 311
Naming and Defining Entity Types 313
Attributes 314
Naming and Defining Attributes 314
Candidate Keys and Identifiers 315
Multivalued Attributes 316
Relationships 317
Conceptual Data Modeling and the E-R Model 318
Degree of a Relationship 318
Unary Relationship 318
Binary Relationship 319
Ternary Relationship 320
Cardinalities in Relationships 320
Minimum and Maximum Cardinalities 321
Naming and Defining Relationships 322
Associative Entities 323
Summary of Conceptual Data Modeling with E-R Diagrams 326
Representing Supertypes and Subtypes 326
Business Rules 328
Domains 329
Triggering Operations 329
The Role of CASE in Conceptual Data Modeling 330
An Example of Conceptual Data Modeling at Hoosier Burger 331
Internet Development: Conceptual Data Modeling 335
Conceptual Data Modeling for Pine Valley Furniture's WebStore 335
Summary 339
Key Terms 339
Review Questions 340
Problems and Exercises 340
Field Exercises 344
References 344

BROADWAY ENTERTAINMENT COMPANY, INC.: STRUCTURING SYSTEM REQUIREMENTS: CONCEPTUAL DATA MODELING FOR THE WEB-BASED CUSTOMER RELATIONSHIP MANAGEMENT SYSTEM
Case Introduction 345
Structuring the High-Level Data Modeling Findings from Requirements Determination 345
Case Summary 346
Case Questions 346

11 Selecting the Best Alternative Design Strategy 348

Learning Objectives 348

Introduction 348

Selecting the Best Alternative Design Strategy 349
- The Process of Selecting the Best Alternative Design Strategy 350
- Deliverables and Outcomes 351

Generating Alternative Design Strategies 351

Issues to Consider in Generating Alternatives 353
- Outsourcing 353
- Sources of Software 354
  - Hardware Manufacturers 354
  - Packaged Software Producers 354
  - Custom Software Producers 356
  - Enterprise Solutions Software 356
  - Application Service Providers 357
  - In-House Development 358
- Choosing Off-the-Shelf Software 359
  - Validating Purchased Software Information 361
- Hardware and Systems Software Issues 361
- Implementation Issues 362
- Organizational Issues 362

Developing Design Strategies for Hoosier Burger's New Inventory Control System 363

Selecting the Most Likely Alternative 366

Updating the Baseline Project Plan 367
- Before and After Baseline Project Plans for Hoosier Burger 369

Internet Development: Selecting the Best Alternative Design Strategy 373
- Selecting the Best Alternative Design Strategy for Pine Valley Furniture's WebStore 373

Summary 375

Key Terms 376

Review Questions 377

Problems and Exercises 377

Field Exercises 378

References 378

BROADWAY ENTERTAINMENT COMPANY, INC.: FORMULATING A DESIGN STRATEGY FOR THE WEB-BASED CUSTOMER RELATIONSHIP MANAGEMENT SYSTEM
Case Introduction 379
Determining the System Functionality 379
Determining the System Platform 380
Determining the System Acquisition Methodology 380
Case Summary 381
Case Questions 381

12 Designing Databases 386

Learning Objectives 386

Introduction 386

Database Design 387
- The Process of Database Design 388
- Deliverables and Outcomes 389

Relational Database Model 393
- Well-Structured Relations 394

Normalization 394
- Rules of Normalization 395
- Functional Dependence and Primary Keys 395
- Second Normal Form 396
- Third Normal Form 397

Transforming E-R Diagrams into Relations 398
- Represent Entities 399
- Represent Relationships 399
  - Binary 1:*N* and 1:1 Relationships 399
  - Binary and Higher-Degree *M*:*N* Relationships 401
  - Unary Relationships 402
- Summary of Transforming E-R Diagrams to Relations 404

Merging Relations 404
- An Example of Merging Relations 404
- View Integration Problems 405
  - Synonyms 405
  - Homonyms 405
  - Dependencies Between Nonkeys 406
  - Class/Subclass 406

Logical Database Design for Hoosier Burger 406

Physical File and Database Design 409

Designing Fields 409
- Choosing Data Types 410
  - Calculated Fields 411
  - Coding and Compression Techniques 411
- Controlling Data Integrity 411

Designing Physical Tables 412
- Arranging Table Rows 416
  - Sequential File Organizations 416
  - Indexed File Organizations 416
  - Hashed File Organizations 419
  - Summary of File Organizations 419
- Designing Controls for Files 419

Physical Database Design for Hoosier Burger 420

Electronic Commerce Application: Designing Databases 421
- Designing Databases for Pine Valley Furniture's WebStore 422

Summary 424

Key Terms 425
Review Questions 426
Problems and Exercises 426
Field Exercises 427
References 428

BROADWAY ENTERTAINMENT COMPANY, INC.: DESIGNING THE RELATIONAL DATABASE FOR THE CUSTOMER RELATIONSHIP MANAGEMENT SYSTEM
Case Introduction 429
Identifying Relations 429
Designing the Physical Database 429
Case Summary 430
Case Questions 430

13 Designing Forms and Reports 432

Learning Objectives 432
Introduction 432
Designing Forms and Reports 433
The Process of Designing Forms and Reports 434
Deliverables and Outcomes 436
Formatting Forms and Reports 438
General Formatting Guidelines 439
Highlighting Information 440
Color versus No-Color 442
Displaying Text 443
Designing Tables and Lists 445
Paper versus Electronic Reports 448
Assessing Usability 449
Usability Success Factors 449
Measures of Usability 450

Electronic Commerce Application: Designing Forms and Reports for Pine Valley Furniture's WebStore 451
General Guidelines 451
Designing Forms and Reports at Pine Valley Furniture 451
Lightweight Graphics 452
Forms and Data Integrity Rules 452
Template-Based HTML 453
Summary 453
Key Terms 454
Review Questions 454
Problems and Exercises 454
Field Exercises 455
References 456

BROADWAY ENTERTAINMENT COMPANY, INC.: DESIGNING FORMS AND REPORTS FOR THE CUSTOMER RELATIONSHIP MANAGEMENT SYSTEM 457
Case Introduction 457
Identifying the Forms and Reports 457
Designing Forms and Reports for MyBroadway 457
Case Summary 459
Case Questions 459

14 Designing Interfaces and Dialogues 460

Learning Objectives 460

Introduction 460

Designing Interfaces and Dialogues 461
- The Process of Designing Interfaces and Dialogues 461
- Deliverables and Outcomes 462

Interaction Methods and Devices 462
- Methods of Interacting 462
  - Command Language Interaction 463
  - Menu Interaction 463
  - Form Interaction 468
  - Object-Based Interaction 470
  - Natural Language Interaction 470
- Hardware Options for System Interaction 471

Designing Interfaces 473
- Designing Layouts 473
- Structuring Data Entry 475
- Controlling Data Input 478
- Providing Feedback 480
  - Status Information 480
  - Prompting Cues 480
  - Errors and Warning Messages 480
- Providing Help 481

Designing Dialogues 484
- Designing the Dialogue Sequence 485
- Building Prototypes and Assessing Usability 486
- Designing Interfaces and Dialogues in Graphical Environments 488
  - Graphical Interface Design Issues 488
  - Dialogue Design Issues in a Graphical Environment 490

Electronic Commerce Application: Designing Interfaces and Dialogues for Pine Valley Furniture's WebStore 490
- General Guidelines 490
- Designing Interfaces and Dialogues at Pine Valley Furniture 492
- Menu-Driven Navigation with Cookie Crumbs 492

Summary 493

Key Terms 493

Review Questions 494

Problems and Exercises 494

Field Exercises 495

References 495

BROADWAY ENTERTAINMENT COMPANY, INC.: DESIGNING THE HUMAN INTERFACE FOR THE CUSTOMER RELATIONSHIP MANAGEMENT SYSTEM

Case Introduction 496

Designing the Dialogue Between MyBroadway and Users 496

Case Summary 497

Case Questions 498

15 Finalizing Design Specifications 499

Learning Objectives 499

Introduction 499

Finalizing Design Specifications 500
The Process of Finalizing Design Specifications 500
Deliverables and Outcomes 502
Traditional Method 503
Specification Documents 503
Structure Charts 503
Prototyping 510
Evolutionary Prototyping 510
Throwaway Prototyping 511
An Example: Oracle 511
Transforming and Generating the Database 512
Transforming and Generating Software Modules 514
Radical Methods 518
eXtreme Programming 518
RAD 520

Electronic Commerce Application: Finalizing Design Specifications for Pine Valley Furniture's WebStore 520
Finalizing Design Specifications for Pine Valley Furniture's WebStore 520
Summary 523
Key Terms 523
Review Questions 523
Problems and Exercises 524
Field Exercises 524
References 524

BROADWAY ENTERTAINMENT COMPANY, INC.: FINALIZING DESIGN SPECIFICATIONS FOR THE CUSTOMER RELATIONSHIP MANAGEMENT SYSTEM
Case Introduction 525
Using Throwaway Prototyping for Documenting System Specifications 525
Case Summary 525
Case Questions 525
16 Designing Distributed and Internet Systems 527
Learning Objectives 527
Introduction 527
Designing Distributed and Internet Systems 528
The Process of Designing Distributed and Internet Systems 528
Deliverables and Outcomes 528
Designing Distributed Systems 530
Designing Systems for Local Area Networks 530
File Servers 530
Limitations of File Servers 531
Designing Systems for Client/Server Architecture 532
Client/Server Advantages and Cautions 533
Alternative Designs for Distributed Systems 534
Choosing Between File Server and Client/Server Architectures 534
Advanced Forms of Client/Server Architectures 535
Designing Internet Systems 538
Internet Design Fundamentals 539
Standards Drive the Internet 539
Separating Content and Display 539
Future Evolution 540

Site Consistency 541
Cascading Style Sheets 542
Extensible Style Language (XSL) 542
Other Site Consistency Issues 543
Design Issues Related to Site Management 544
Customer Loyalty and Trustworthiness 545
Web Pages Must Live Forever 546
System Security 547
Managing On-Line Data 547
Context Development 548
On-Line Transaction Processing (OLTP) 549
On-Line Analytical Processing (OLAP) 550
Merging Transaction and Analytical Processing 550
Data Warehousing 551

Electronic Commerce Application: Designing a Distributed Advertisement Server for Pine Valley Furniture's WebStore 555
Advertising for Pine Valley Furniture's WebStore 555
Designing the Advertising Component 555
Designing the Management Reporting Component 556

Summary 557

Key Terms 558

Review Questions 559

Problems and Exercises 559

Field Exercises 560

References 561

BROADWAY ENTERTAINMENT COMPANY, INC.: DESIGNING INTERNET FEATURES INTO THE CUSTOMER RELATIONSHIP MANAGEMENT SYSTEM
Case Introduction 562
Establishing Website Design Principles for MyBroadway 562
Case Summary 562
Case Questions 562

Part Implementation and Maintenance

AN OVERVIEW OF PART V 568

17 System Implementation 570

Learning Objectives 570

Introduction 570

System Implementation 571
The Processes of Coding, Testing, and Installation 572
Deliverables and Outcomes from Coding, Testing, and Installation 572
The Processes of Documenting the System, Training Users, and Supporting Users 573
Deliverables and Outcomes from Documenting the System, Training Users, and Supporting Users 574

Software Application Testing 575
Seven Different Types of Tests 576
The Testing Process 579

Radically Combining Coding and Testing 582
Acceptance Testing by Users 582
Installation 583
Direct Installation 583
Parallel Installation 585
Single Location Installation 585
Phased Installation 586
Planning Installation 586
Documenting the System 587
User Documentation 588
Preparing User Documentation 591
Training and Supporting Users 593
Training Information Systems Users 593
Supporting Information Systems Users 596
Automating Support 597
Providing Support Through a Help Desk 598
Support Issues for the Analyst to Consider 599
Organizational Issues in Systems Implementation 599
Why Implementation Sometimes Fails 599
Factor Models of Implementation Success 601
Political Implementation Models 602

Electronic Commerce Application: System Implementation and Operation for Pine Valley Furniture's WebStore 604
Developing Test Cases for the WebStore 604
Bug Tracking and System Evolution 605
Alpha and Beta Testing the WebStore 605
WebStore Installation 606
Project Close-Down 606
Summary 607
Key Terms 608
Review Questions 609
Problems and Exercises 609
Field Exercises 610
References 610

BROADWAY ENTERTAINMENT COMPANY, INC.: DESIGNING A TESTING PLAN FOR THE CUSTOMER RELATIONSHIP MANAGEMENT SYSTEM
Case Introduction 612
Preparing the Testing Plan 612
Preparing a Test Case 613
Case Summary 614
Case Questions 614
18 Maintaining Information Systems 615
Learning Objectives 615
Introduction 615
Maintaining Information Systems 616
The Process of Maintaining Information Systems 616
Deliverables and Outcomes 619

Conducting Systems Maintenance 619
Types of Maintenance 620
The Cost of Maintenance 621
Managing Maintenance 623
Managing Maintenance Personnel 623
Measuring Maintenance Effectiveness 624
Controlling Maintenance Requests 625
Configuration Management 627
Role of CASE and Automated Development Tools in Maintenance 628
Website Maintenance 629

Electronic Commerce Application: Maintaining an Information System for Pine Valley Furniture's WebStore 629
Mantaining Pine Valley Furniture's WebStore 630
Summary 631
Key Terms 632
Review Questions 632
Problems and Exercises 633
Field Exercises 633
References 634

BROADWAY ENTERTAINMENT COMPANY, INC.: DESIGNING A MAINTENANCE PLAN FOR THE CUSTOMER RELATIONSHIP MANAGEMENT SYSTEM
Case Introduction 635
Preparing the Maintenance Plan 635
Case Summary 636
Case Questions 636
Part Advanced Analysis and Design Methods
AN OVERVIEW OF PART VI 640
19 Rapid Application Development 642
Learning Objectives 642
Introduction 642
Rapid Application Development 643
The Process of Developing an Application Rapidly 643
Deliverables and Outcomes 644
Components of RAD 645
Approaches to RAD 645
Software Tools for RAD 644
Martin's RAD Life Cycle 648
RAD Success Stories 649
RAD Success with Inprise/Borland's Delphi 650
U.S. Navy Fleet Modernization 650
First National Bank of Chicago 650
RAD Success with VisualAge for Java 650
Advantages and Disadvantages of RAD 651

Summary 653
Key Terms 653
Review Questions 654
Problems and Exercises 654
Field Exercises 654
References 655

20 Object-Oriented Analysis and Design 656

Learning Objectives 656
Introduction 656
Object-Oriented Development Life Cycle 657
The Process of Object-Oriented Analysis and Design 657
Deliverables and Outcomes 659
The Unified Modeling Language 660
Use-Case Modeling 660
Developing Use-Case Diagrams 661
Relationships Between Use Cases 662
An Example of Use-Case Diagramming 664
Object Modeling: Class Diagrams 666
Representing Objects and Classes 666
Types of Operations 668
Representing Associations 668
Representing Association Classes 672
Representing Derived Attributes, Derived Associations, and Derived Roles 674
Representing Generalization 674
Interpreting Inheritance and Overriding 679
Representing Multiple Inheritance 680
Representing Aggregation 680
Business Rules 682
Dynamic Modeling: State Diagrams 683
Modeling States and State Transitions 684
Diagramming Substates and Decomposing Events 685
A State Transition Diagram for Hoosier Burger 687
Summary of State Transition Diagramming 688
Dynamic Modeling: Sequence Diagrams 688
Components of a Sequence Diagram 689
Designing a Use Case with a Sequence Diagram 691
A Sequence Diagram for Hoosier Burger 694
Summary of Sequence Diagrams 695
Process Modeling: Activity Diagrams 696
Analysis versus Design 696
Summary 700
Key Terms 700
Review Questions 701
Problems and Exercises 702
Field Exercises 705
References 705

Glossary of Terms 707

Glossary of Acronyms 719

Index 721

Credits 731