

SYSTEMS ANALYSIS AND DESIGN WITH UML VERSION 2.0

An Object-Oriented Approach
Second Edition



WILEY
INTERNATIONAL
EDITION

RESTRICTED!
Not for sale in
North America

Alan Dennis • Barbara Haley Wixom • David Tegarden

CONTENTS

PREFACE XIII

Chapter 1

Introduction to Systems Analysis and Design 1

INTRODUCTION 1

THE SYSTEMS DEVELOPMENT LIFE CYCLE 3

Planning 4

Analysis 4

Design 5

Implementation 5

SYSTEMS DEVELOPMENT METHODOLOGIES 6

Structured Design 8

Rapid Application Development (RAD) 9

Agile Development 13

Selecting the Appropriate

Development Methodology 15

PROJECT TEAM ROLES AND SKILLS 17

Business Analyst 18

Systems Analyst 19

Infrastructure Analyst 19

Change Management Analyst 19

Project Manager 19

Summary 20 Key Terms 21

Questions 21 Exercises 21

Minicases 22

Chapter 2

Introduction to Object-Oriented Systems Analysis and Design with the Unified Modeling Language, Version 2.0 23

INTRODUCTION 24

BASIC CHARACTERISTICS OF

OBJECT-ORIENTED SYSTEMS 24

Classes and Objects 24

Methods and Messages 25

Encapsulation and Information Hiding 25

Inheritance 26

Polymorphism and Dynamic Binding 28

THE UNIFIED MODELING LANGUAGE,

VERSION 2.0 29

Structure Diagrams 30

Behavior Diagrams 33

Extension Mechanisms 35

OBJECT-ORIENTED SYSTEMS ANALYSIS

AND DESIGN 35

Use-Case Driven 36

Architecture Centric 36

Iterative and Incremental 37

The Unified Process 37

A MINIMALIST APPROACH TO OBJECT-

ORIENTED SYSTEMS ANALYSIS AND

DESIGN WITH UML 2.0 42

Benefits of Object-Oriented Systems

Analysis and Design 42

Extensions to the Unified Process 42

The Minimalist Object-Oriented Systems

Analysis and Design Approach 46

Summary 48 Key Terms 52

Questions 53 Exercises 53

Minicases 54

■ PART ONE: PLANNING PHASE 55

Chapter 3

Project Initiation 57

INTRODUCTION 57

PROJECT IDENTIFICATION 59

System Request 60

Applying the Concepts at CD Selections	60
FEASIBILITY ANALYSIS	63
Technical Feasibility	65
Economic Feasibility	65
Organizational Feasibility	73
Applying the Concepts at CD Selections	74
PROJECT SELECTION	78
Applying the Concepts at CD Selections	78
Summary	79
Key Terms	81
Questions	82
Exercises	82
Minicases	82

Chapter 4 Project Management 84

INTRODUCTION	85
IDENTIFYING PROJECT SIZE	86
Function Point Approach	87
CREATING AND MANAGING THE WORKPLAN	92
Identify Tasks	93
The Project Workplan	94
Gantt Chart	94
PERT Chart	96
Refining Estimates	97
Scope Management	98
Timeboxing	100
Evolutionary Work Breakdown Structures and Iterative Workplans	101
STAFFING THE PROJECT	102
Staffing Plan	103
Motivation	106
Handling Conflict	106
COORDINATING PROJECT ACTIVITIES	107
CASE Tools	108
Standards	109
Documentation	109
Managing Risk	110
APPLYING THE CONCEPTS AT CD SELECTIONS	112
Staffing the Project	115
Coordinating Project Activities	116

Summary	117	Key Terms	118
Questions	119	Exercises	119
Minicases	120		

■ PART TWO: ANALYSIS PHASE 121

Chapter 5 Requirements Determination 123

INTRODUCTION	123
REQUIREMENTS DETERMINATION	124
What is a Requirement?	124
Requirements Definition	127
Determining Requirements	128
Creating the Requirements Definition	129
REQUIREMENTS ANALYSIS TECHNIQUES	129
Business Process Automation	130
Business Process Improvement	132
Business Process Reengineering	134
Selecting the Appropriate Technique	135
REQUIREMENTS-GATHERING TECHNIQUES	137
Interviews	137
Joint Application Development(JAD)	144
Questionnaires	147
Document Analysis	150
Observation	150
Selecting the Appropriate Techniques	152
APPLYING THE CONCEPTS AT CD SELECTIONS	154
Requirements Analysis Techniques	154
Requirements-Gathering Techniques	155
Requirements Definition	155
System Proposal	155
Summary	156
Key Terms	159
Questions	159
Exercises	160
Minicases	161

Chapter 6 Functional Modeling 163

INTRODUCTION	164
BUSINESS PROCESS MODELING WITH ACTIVITY DIAGRAMS	165

Elements of an Activity Diagram	165
Guidelines for Creating Activity Diagrams	169
USE CASE DESCRIPTIONS	171
Types of Use Case	172
Elements of a Use Case Description	173
Guidelines for Creating Use Case Descriptions	176
USE CASE DIAGRAMS	178
Actor	178
Association	178
Use Case	181
Subject Boundary	182
CREATING USE CASE DESCRIPTIONS AND USE CASE DIAGRAMS	182
Identify the Major Use Cases	183
Expand the Major Use Cases	184
Confirm the Major Use Cases	185
Create the Use Case Diagram	186
REFINING PROJECT SIZE AND EFFORT ESTIMATION USING USE CASE POINTS	186
APPLYING THE CONCEPTS AT CD SELECTIONS	190
Business Process Modeling with Activity Diagrams	191
Identify the Major Use Cases	191
Expanding the Major Use Cases	194
Confirming the Major Use Cases	196
Creating the Use Case Diagram	201
Refine Project Size and Effort Estimation Using Use Case Points	202
<i>Summary</i>	203
<i>Key Terms</i>	205
<i>Questions</i>	206
<i>Exercises</i>	206
<i>Minicases</i>	208

Chapter 7

Structural Modeling 210

INTRODUCTION	210
STRUCTURAL MODELS	211
Classes, Attributes, and Operations	211
Relationships	212
CLASS-RESPONSIBILITY-COLLABORATION CARDS	213
Responsibilities and Collaborations	214

Elements of a CRC Card	214
CLASS DIAGRAMS	216
Elements of a Class Diagram	216
Simplifying Class Diagrams	220
Object Diagrams	220

CREATING CRC CARDS AND CLASS DIAGRAMS	221
Object Identification	221
Building CRC Cards and Class Diagrams	223
Applying the Concepts at CD Selections	226
<i>Summary</i>	232
<i>Key Terms</i>	233
<i>Questions</i>	233
<i>Exercises</i>	234
<i>Minicases</i>	235

Chapter 8

Behavioral Modeling 236

INTRODUCTION	236
BEHAVIORAL MODELS	237
INTERACTION DIAGRAMS	237
Objects, Operations, and Messages	238
Sequence Diagrams	238
Communication Diagrams	243
BEHAVIORAL STATE MACHINES	249
States, Events, Transitions, Actions, and Activities	250
Elements of a Behavioral State Machine	250
Building a Behavioral State Machine	251
Applying the Concepts at CD Selections	253
<i>Summary</i>	255
<i>Key Terms</i>	256
<i>Questions</i>	256
<i>Exercises</i>	257
<i>Minicases</i>	258

PART THREE: DESIGN PHASE 259

Chapter 9

Moving on to Design 261

INTRODUCTION	261
EVOLVING THE ANALYSIS MODELS INTO DESIGN MODELS	262

Factoring	263
Partitions and Collaborations	264
Layers	265
PACKAGES AND PACKAGE DIAGRAMS	267
Identifying Packages and Creating Package Diagrams	269
Applying Concepts at CD Selections	272
DESIGN STRATEGIES	275
Custom Development	275
Packaged Software	275
Outsourcing	277
Selecting a Design Strategy	279
DEVELOPING THE ACTUAL DESIGN	281
Alternative Matrix	281
Applying the Concepts at CD Selections	282
<i>Summary</i>	283
<i>Key Terms</i>	285
<i>Questions</i>	286
<i>Exercises</i>	286
<i>Minicases</i>	287

Chapter 10

Class and Method Design 288

INTRODUCTION	288
REVISITING THE BASIC CHARACTERISTICS OF OBJECT-ORIENTATION	290
Classes, Objects, Methods, and Messages	290
Encapsulation and Information Hiding	290
Polymorphism and Dynamic Binding	290
Inheritance	291
DESIGN CRITERIA	294
Coupling	294
Cohesion	296
Connascence	298
OBJECT DESIGN ACTIVITIES	298
Additional Specification	299
Identifying Opportunities for Reuse	300
Restructuring the Design	302
Optimizing the Design	303
Mapping Problem Domain Classes to Implementation Languages	304
CONSTRAINTS AND CONTRACTS	308

Types of Constraints	308
Elements of a Contract	310
METHOD SPECIFICATION	312
General Information	312
Events	313
Message Passing	314
Algorithm Specification	314
APPLYING THE CONCEPTS AT CD SELECTIONS	316
<i>Summary</i>	316
<i>Key Terms</i>	321
<i>Questions</i>	322
<i>Exercises</i>	322
<i>Minicases</i>	323

Chapter 11

Data Management Layer Design 325

INTRODUCTION	326
OBJECT-PERSISTENCE FORMATS	326
Sequential and Random Access Files	327
Relational Databases	330
Object-Relational Databases	330
Object-Oriented Databases	332
Selecting an Object-Persistence Format	333
MAPPING PROBLEM DOMAIN OBJECTS TO OBJECT-PERSISTENCE FORMATS	336
Mapping Problem Domain Objects to an OODBMS Format	336
Mapping Problem Domain Objects to an ORDBMS Format	340
Mapping Problem Domain Objects to an RDBMS Format	343
OPTIMIZING RDBMS-BASED OBJECT STORAGE	345
Optimizing Storage Efficiency	346
Optimizing Data Access Speed	350
Estimating Data Storage Size	356
DESIGNING DATA ACCESS AND MANIPULATION CLASSES	357
APPLYING THE CONCEPTS AT CD SELECTIONS	359
Select Object-Persistence Format	359

Map Problem Domain Objects to Object-Persistence Format	361
Optimize Object Persistence and Estimate its Size	362
Data Access and Manipulation Class Design	365
<i>Summary</i>	367
<i>Key Terms</i>	368
<i>Questions</i>	369
<i>Exercises</i>	370
<i>Minicases</i>	371

Chapter 12

Human Computer Interaction Layer Design 372

INTRODUCTION 373

PRINCIPLES FOR USER

INTERFACE DESIGN 373

Layout	374
Content Awareness	376
Aesthetics	376
User Experience	379
Consistency	380
Minimize User Effort	381

USER INTERFACE DESIGN PROCESS 381

Use Scenario Development	381
Interface Structure Design	383
Interface Standards Design	385
Interface Design Prototyping	387
Interface Evaluation	388

NAVIGATION DESIGN 390

Basic Principles	391
Types of Navigation Controls	391
Messages	395
Navigation Design Documentation	396

INPUT DESIGN 397

Basic Principles	398
Types of Inputs	400
Input Validation	400

OUTPUT DESIGN 401

Basic Principles	403
Types of Outputs	405
Media	407

APPLYING THE CONCEPTS AT

CD SELECTIONS 407

Use Scenario Development	408
Interface Structure Design	408
Interface Standards Design	412
Interface Template Design	412
Design Prototyping	412
Interface Evaluation	413
Navigation Design Documentation	413
<i>Summary</i>	415
<i>Key Terms</i>	417
<i>Questions</i>	418
<i>Exercises</i>	419
<i>Minicases</i>	419

Chapter 13

Physical Architecture Layer Design 423

INTRODUCTION 423

ELEMENTS OF THE PHYSICAL ARCHITECTURE

LAYER 424

Architectural Components	424
Server-Based Architectures	425
Client-Based Architectures	426
Client-Server Architectures	426
Client-Server Tiers	428
Distributed Objects Computing	429
Selecting a Physical Architecture	431
INFRASTRUCTURE DESIGN	433
Deployment Diagram	433
The Network Model	435

NONFUNCTIONAL REQUIREMENTS AND PHYSICAL ARCHITECTURE

LAYER DESIGN 440

Operational Requirements	440
Performance Requirements	442
Security Requirements	443
Cultural and Political Requirements	447
Synopsis	449

HARDWARE AND SOFTWARE

SPECIFICATION 451

APPLYING THE CONCEPTS AT

CD SELECTIONS 452

<i>Summary</i>	455
<i>Key Terms</i>	458
<i>Questions</i>	458
<i>Exercises</i>	459
<i>Minicases</i>	460

PART FOUR:
IMPLEMENTATION PHASE 461

Chapter 14

Construction 463

INTRODUCTION 463

MANAGING PROGRAMMING 464

Assigning Programmers 464

Coordinating Activities 465

Managing the Schedule 466

DESIGNING TESTS 467

Testing and Object-Orientation 468

Test Planning 470

Unit Tests 472

Integration Tests 472

System Tests 474

Acceptance Tests 475

DEVELOPING DOCUMENTATION 475

Types of Documentation 476

Designing Documentation Structure 476

Writing Documentation Topics 478

Identifying Navigation Terms 479

APPLYING THE CONCEPTS AT

CD SELECTIONS 481

Managing Programming 481

Testing 481

Developing User Documentation 483

Summary 483 *Key Terms* 484

Questions 485 *Exercises* 485

Minicases 485

Chapter 15

Installation and Operations 487

INTRODUCTION 487

CONVERSION 489

Conversion Style 491

Conversion Location 491

Conversion Modules 492

Selecting the Appropriate Conversion
Strategy 493

CHANGE MANAGEMENT 495

Understanding Resistance to Change 496

Revising Management Policies 497

Assessing Costs and Benefits 498

Motivating Adoption 500

Enabling Adoption: Training 502

POST-IMPLEMENTATION ACTIVITIES 504

System Support 504

System Maintenance 506

Project Assessment 508

APPLYING THE CONCEPTS AT

CD SELECTIONS 509

Conversion 510

Change Management 510

Post-Implementation Activities 510

Summary 511 *Key Terms* 512

Questions 512 *Exercises* 513

Minicases 513

INDEX 515

Available online at
www.wiley.com/college/dennis

Appendix A

Appendix B