## CONTENTS

Preface xv

### Section 1: Getting Started  1

**Chapter 1: Why We Model**  3  
- The Importance of Modeling  4  
- Principles of Modeling  7  
- Object-Oriented Modeling  10

**Chapter 2: Introducing the UML**  13  
- An Overview of the UML  14  
- A Conceptual Model of the UML  17  
- Architecture  30  
- Software Development Life Cycle  33

**Chapter 3: Hello, World!**  37  
- Key Abstractions  38  
- Mechanisms  41  
- Components  43

### Section 2: Basic Structural Modeling  45

**Chapter 4: Classes**  47  
- Getting Started  47  
- Terms and Concepts  49  
- Common Modeling Techniques  54  
  - Modeling the Vocabulary of a System  54  
  - Modeling the Distribution of Responsibilities in a System  56  
  - Modeling Nonsoftware Things  57  
  - Modeling Primitive Types  58  
- Hints and Tips  59
Chapter 5: Relationships  61
   Getting Started  62
   Terms and Concepts  63
   Common Modeling Techniques  69
      Modeling Simple Dependencies  69
      Modeling Single Inheritance  70
      Modeling Structural Relationships  72
   Hints and Tips  74

Chapter 6: Common Mechanisms  75
   Getting Started  76
   Terms and Concepts  77
   Common Modeling Techniques  83
      Modeling New Building Blocks  83
      Modeling Comments  85
      Modeling New Semantics  86
      Modeling New Properties  88
   Hints and Tips  89

Chapter 7: Diagrams  91
   Getting Started  92
   Terms and Concepts  93
   Common Modeling Techniques  98
      Modeling Different Views of a System  98
      Modeling Different Levels of Abstraction  100
      Modeling Complex Views  103
   Hints and Tips  103

Chapter 8: Class Diagrams  105
   Getting Started  105
   Terms and Concepts  107
   Common Modeling Techniques  108
      Modeling Simple Collaborations  108
      Modeling a Logical Database Schema  110
      Forward and Reverse Engineering  112
   Hints and Tips  115

Section 3: Advanced Structural Modeling  117

Chapter 9: Advanced Classes  119
   Getting Started  119
   Terms and Concepts  120
   Common Modeling Techniques  132
      Modeling the Semantics of a Class  132
   Hints and Tips  133
Chapter 10: Advanced Relationships  135
   Getting Started  136
   Terms and Concepts  137
   Common Modeling Techniques  151
      Modeling Webs of Relationships  151
   Hints and Tips  152

Chapter 11: Interfaces, Types, and Roles  155
   Getting Started  155
   Terms and Concepts  157
   Common Modeling Techniques  163
      Modeling the Seams in a System  163
      Modeling Static and Dynamic Types  165
   Hints and Tips  166

Chapter 12: Packages  169
   Getting Started  170
   Terms and Concepts  171
   Common Modeling Techniques  177
      Modeling Groups of Elements  177
      Modeling Architectural Views  179
   Hints and Tips  181

Chapter 13: Instances  183
   Getting Started  183
   Terms and Concepts  185
   Common Modeling Techniques  190
      Modeling Concrete Instances  190
      Modeling Prototypical Instances  192
   Hints and Tips  193

Chapter 14: Object Diagrams  195
   Getting Started  195
   Terms and Concepts  197
   Common Modeling Techniques  198
      Modeling Object Structures  198
      Forward and Reverse Engineering  200
   Hints and Tips  201

Section 4: Basic Behavioral Modeling  203

Chapter 15: Interactions  205
   Getting Started  206
   Terms and Concepts  207
   Common Modeling Techniques  216
      Modeling a Flow of Control  216
   Hints and Tips  217
Chapter 16: Use Cases 219
   Getting Started 219
   Terms and Concepts 222
   Common Modeling Techniques 229
      Modeling the Behavior of an Element 229
   Hints and Tips 231

Chapter 17: Use Case Diagrams 233
   Getting Started 233
   Terms and Concepts 234
   Common Modeling Techniques 236
      Modeling the Context of a System 236
      Modeling the Requirements of a System 237
   Forward and Reverse Engineering 239
   Hints and Tips 241

Chapter 18: Interaction Diagrams 243
   Getting Started 244
   Terms and Concepts 245
   Common Modeling Techniques 251
      Modeling Flows of Control by Time Ordering 251
      Modeling Flows of Control by Organization 253
   Forward and Reverse Engineering 255
   Hints and Tips 256

Chapter 19: Activity Diagrams 257
   Getting Started 258
   Terms and Concepts 259
   Common Modeling Techniques 268
      Modeling a Workflow 268
      Modeling an Operation 270
   Forward and Reverse Engineering 272
   Hints and Tips 273

Section 5: Advanced Behavioral Modeling 275

Chapter 20: Events and Signals 277
   Getting Started 277
   Terms and Concepts 278
   Common Modeling Techniques 283
      Modeling a Family of Signals 283
      Modeling Exceptions 284
   Hints and Tips 286
Chapter 26: Deployment 359
   Getting Started 359
   Terms and Concepts 360
   Common Modeling Techniques 364
      Modeling Processors and Devices 364
      Modeling the Distribution of Components 365
   Hints and Tips 367

Chapter 27: Collaborations 369
   Getting Started 369
   Terms and Concepts 371
   Common Modeling Techniques 376
      Modeling the Realization of a Use Case 376
      Modeling the Realization of an Operation 378
      Modeling a Mechanism 379
   Hints and Tips 380

Chapter 28: Patterns and Frameworks 381
   Getting Started 381
   Terms and Concepts 383
   Common Modeling Techniques 387
      Modeling Design Patterns 387
      Modeling Architectural Patterns 389
   Hints and Tips 391

Chapter 29: Component Diagrams 393
   Getting Started 393
   Terms and Concepts 394
   Common Modeling Techniques 396
      Modeling Source Code 396
      Modeling an Executable Release 398
      Modeling a Physical Database 400
      Modeling Adaptable Systems 402
   Forward and Reverse Engineering 403
   Hints and Tips 405

Chapter 30: Deployment Diagrams 407
   Getting Started 407
   Terms and Concepts 409
   Common Modeling Techniques 411
      Modeling an Embedded System 411
      Modeling a Client/Server System 412
      Modeling a Fully Distributed System 414
   Forward and Reverse Engineering 416
   Hints and Tips 417
Chapter 31: Systems and Models  419
  Getting Started  419
  Terms and Concepts  421
  Common Modeling Techniques  424
    Modeling the Architecture of a System  424
    Modeling Systems of Systems  426
  Hints and Tips  426

Section 7: Wrapping Up  429

Chapter 32: Applying the UML  431
  Transitioning to the UML  431
  Where to Go Next  433

Appendix A: UML Notation  435

Appendix B: UML Standard Elements  441

Appendix C: Rational Unified Process  449

Glossary  457

Index  469