System Analysis & Design

An Object-Oriented Approach with UML

Fifth Edition

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PREFACE

PURPOSE OF THIS BOOK

Systems Analysis and Design (SAD) is an exciting, active field in which analysts continually learn new techniques and approaches to develop systems more effectively and efficiently. However, there is a core set of skills that all analysts need to know—no matter what approach or methodology is used. All information systems projects move through the four phases of planning, analysis, design, and implementation; all projects require analysts to gather requirements, model the business needs, and create blueprints for how the system should be built; and all projects require an understanding of organizational behavior concepts like change management and team building. Today, the cost of developing modern software is composed primarily of the cost associated with the developers themselves and not the computers. As such, object-oriented approaches to developing information systems hold much promise in controlling these costs.

Today, the most exciting change to systems analysis and design is the move to object-oriented techniques, which view a system as a collection of self-contained objects that have both data and processes. This change has been accelerated through the creation of the Unified Modeling Language (UML). UML provides a common vocabulary of object-oriented terms and diagramming techniques that is rich enough to model any systems development project from analysis through implementation.

This book captures the dynamic aspects of the field by keeping students focused on doing SAD while presenting the core set of skills that we feel every systems analyst needs to know today and in the future. This book builds on our professional experience as systems analysts and on our experience in teaching SAD in the classroom.

This book will be of particular interest to instructors who have students do a major project as part of their course. Each chapter describes one part of the process, provides clear explanations on how to do it, gives a detailed example, and then has exercises for the students to practice. In this way, students can leave the course with experience that will form a rich foundation for further work as a systems analyst.

OUTSTANDING FEATURES

A Focus on Doing SAD

The goal of this book is to enable students to do SAD—not just read about it, but understand the issues so that they can actually analyze and design systems. The book introduces each major technique, explains what it is, explains how to do it, presents an example, and provides **Your Turn** opportunities with each chapter for students to practice each new technique before they do it for real in a project. The **Your Turn** boxes are posted online at www.wiley.com/college/dennis. After reading each chapter, the student will be able to perform that step in the system development process.

Rich Examples of Success and Failure

This book has a running online case study (accessible from www.wiley.com/go/dennis/casestudy) about a fictitious health care company called Patterson Superstore. Each chapter of the case study shows how the concepts are applied in situations at Patterson Superstore. In this way, the running case serves as a template that students can apply to their own work. Each chapter also includes numerous **Concepts in Action** boxes, which are posted online at www.wiley.com/college/dennis. These boxes describe how real companies succeeded—and failed—in performing the activities in the chapter. Many of these examples are drawn from our own experiences as systems analysts.

Real World Focus

The skills that students learn in a systems analysis and design course should mirror the work that they ultimately will do in real organizations. We have tried to make this book as "real" as possible by building extensively on our experience as professional systems analysts for organizations, such as Arthur Andersen, IBM, the U.S. Department of Defense, and the Australian Army. We have also worked with a diverse industry advisory board of IS professionals and consultants in developing the book and have incorporated their stories, feedback, and advice throughout. Many students who use this book will eventually use the skills on the job in a business environment, and we believe they will have a competitive edge in understanding what successful practitioners feel is relevant in the real world.

Project Approach

We have presented the topics in this book in the order in which an analyst encounters them in a typical project. Although the presentation is necessarily linear (because students have to learn concepts in the way in which they build on each other), we emphasize the iterative, complex nature of SAD as the book unfolds. The presentation of the material should align well with courses that encourage students to work on projects because it presents topics as students need to apply them.

WHAT'S NEW IN THIS EDITION

- A completely new, expanded case study on an integrated health clinic delivery system has been written to accompany the fifth edition. The entire case study is posted online. At the end of each chapter in the text, a short synopsis of the case is provided.
- The text has been streamlined to focus on the essentials and therefore, to enhance student understanding. Selected materials like the "Your Turn" and "Concepts in Action" boxes have been moved online and can be accessed at www.wiley.com/college/dennis.
- Throughout the book, there is a greater emphasis on verifying, validating, and testing, as well as the incremental and iterative development of systems.
- In Chapter 2, there is more content on Agile techniques, including scrum meetings, product backlog, and sprints.
- In Chapter 3, we have increased focus on software quality and user stories.
- We have added new examples throughout the book and clarified explanations to help students learn some of the more difficult concepts.

- Chapter 10 includes more coverage of mobile computing, including specifics on navigation, input, and output. This chapter also has a new section on games, multidimensional information visualization, augmented reality, and virtual reality.
- Chapter 11 includes new material on ubiquitous computing and the Internet of Things.
- Testing has been expanded in Chapter 12.

ORGANIZATION OF THIS BOOK

This book is loosely organized around the phases and workflows of the enhanced Unified Process. Each chapter has been written to teach students specific tasks that analysts need to accomplish over the course of a project, and the deliverables that will be produced from the tasks. As students complete the chapters, they will realize the iterative and incremental nature of the tasks in object-oriented systems development.

Chapter 1 introduces the SDLC, systems development methodologies, roles and skills needed for a systems analyst, the basic characteristics of object-oriented systems, object-oriented systems analysis, the Unified Process, and the UML. Chapter 2 presents topics related to the project management workflow of the Unified Process, including project identification, system request, feasibility analysis, project selection, traditional project management tools (including work breakdown structures, network diagrams, and PERT analysis), project effort estimation using use-case points, evolutionary work breakdown structures, iterative workplans, scope management, timeboxing, risk management, and staffing the project. Chapter 2 also addresses issues related to the Environment and Infrastructure management workflows of the Unified Process.

Part One focuses on creating analysis models. Chapter 3 introduces students to an assortment of requirements analysis strategies a variety of requirements-gathering techniques that are used to determine the functional and nonfunctional requirements of the system, and to a system proposal. Chapter 4 focuses on constructing business process and functional models using use-case diagrams, activity diagrams, and use-case descriptions. Chapter 5 addresses producing structural models using CRC cards, class diagrams, and object diagrams. Chapter 6 tackles creating behavioral models using sequence diagrams, communication diagrams, behavioral state machines, and CRUDE analysis and matrices. Chapters 4 through 6 also cover the verification and validation of the models described in each chapter.

Part Two addresses design modeling. In Chapter 7, students learn how to verify and validate the analysis models created during analysis modeling and to evolve the analysis models into design models via the use of factoring, partitions, and layers. The students also learn to create an alternative matrix that can be used to compare custom, packaged, and outsourcing alternatives. Chapter 8 concentrates on designing the individual classes and their respective methods through the use of contracts and method specifications. Chapter 9 presents the issues involved in designing persistence for objects. These issues include the different storage formats that can be used for object persistence, how to map an object-oriented design into the chosen storage format, and how to design a set of data access and manipulation classes that act as a translator between the classes in the application and the object persistence. This chapter also focuses on the nonfunctional requirements that impact the data management layer. Chapter 10 presents the design of the human–computer interaction layer, where students learn how to design user interfaces using use scenarios, windows navigation diagrams, storyboards, windows layout diagrams, user interface prototypes, real use cases, interface standards, and user interface templates; to perform user interface evaluations using heuristic evaluation, walkthrough evaluation, interactive evaluation, and formal usability testing; and to address nonfunctional requirements such

as user interface layout, content awareness, aesthetics, user experience, and consistency. This chapter also addresses issues related to mobile computing, social media, games, multidimensional information visualizations, immersive environments, and international and cultural issues with regard to user interface design. Chapter 11 focuses on the physical architecture and infrastructure design, which includes deployment diagrams and hardware/software specification. In today's world, this also includes issues related to cloud computing, ubiquitous computing, the Internet of things, and green IT. This chapter, like the previous design chapters, covers the impact that nonfunctional requirements can have on the physical architecture layer.

Part Three provides material that is related to the construction, installation, and operations of the system. Chapter 12 focuses on system construction, where students learn how to build, test, and document the system. Installation and operations are covered in Chapter 13, where students learn about the conversion plan, change management plan, support plan, and project assessment. Additionally, these chapters address the issues related to developing systems in a flat world, where developers and users are distributed throughout the world.

SUPPLEMENTS www.wiley.com/college/dennis

Instructor Book Companion Website

- **PowerPoint slides:** Instructors can tailor the slides to their classroom needs. Students can use them to guide their reading and studying activities.
- **Test Bank:** Includes a variety of questions ranging from multiple-choice, true/false, and short answer questions. A computerized, **Respondus** version of the Test Bank is also available.
- **Instructor's Manual:** Provides resources to support the instructor both inside and out of the classroom. The manual includes short experiential exercises that instructors can use to help students experience and understand key topics in each chapter. Short stories have been provided by people working in both corporate and consulting environments for instructors to insert into lectures to make concepts more colorful and real. Additional minicases for every chapter allow students to perform some of the key concepts that were learned in the chapter. Solutions to end of chapter questions and exercises are provided.

Student Book Companion Website

- A collection of **templates** and worksheets consisting of electronic versions of selected figures from the book.
- A completely new, expanded **case study** on an integrated health clinic delivery system has been written to accompany the fifth edition. This case study is online only. It can be accessed at www.wiley.com/go/dennis/casestudy.
- "Your Turn" and "Concepts in Action" boxes from the fourth edition have been moved online and can be accessed from the student companion site.

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Project Management Software

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