Preface

The *Advanced Topics in Database Research* book series has been recognized as an outstanding academic book series in the fields of database, software engineering, as well as systems analysis and design. The goal of the book series is to provide researchers and practitioners easy access to excellent chapters which address the latest research issues in the field of database (the term "database" is used here broadly).

This is the third volume of the *Advanced Topics in Database Research* book series. This book consists of 16 excellent chapters ranging from theoretical database issues to practical applications of database techniques. In terms of research methodology, the chapters vary from meta-modeling to empirical case studies. Although the topics are broad, the book provides a sample of some of the best research work done in the database area. The contributing authors represent almost every part of the globe. We have authors from the USA, Canada, The Netherlands, Spain, Chile, Hungary, Israel, Lebanon, Korea, and China.

The book is divided into three sections: (I) Analysis of Development Methodologies; (II) Database Design and Development: Issues and Solutions; and (III) Database Design and Development: Applications. In the following, we briefly describe each chapter:

Section I: Analysis of Development Methodologies consists of three chapters.

Chapter I, "Agile Development Methods and Component-Orientation: A Review and Analysis," presents and analyzes the state-of-the-art agile methods used in the agile development process. Different conceptual foundations and practical uses of these methods, as well as their limitations, are listed and discussed. Service-based component concepts applied at the level of modeling, architectural design, and development are proposed to ensure and strengthen agile development principles and practices. The paper also introduces necessary agility to more traditional development.

Chapter II, "Comparing Metamodels for ER, ORM and UML Data Models," gives a concrete metamodel analysis of the three main database modeling techniques used in the industry — Entity Relationship (ER), Object Role Modeling (ORM), and Unified Modeling Language (UML). ORM is used as the metamodeling language because of its great expressibility and clarity. Discussions based on the metamodel analysis are detailed in the chapter.

Chapter III, "An Evaluation Framework for Component-Based and Service-Oriented System Development Methodologies," presents an evaluation framework that highlights the extent to which a particular method is component-based and service-oriented. The framework is then applied to evaluate a few popular Component-Based Development (CBD) methods. Based on the evaluation, improvements to these methods are proposed to provide a consistent, systematic, and integrated CBD and Web-Service (WS) methodology support throughout the system life cycle.

Section II: Database Design and Development: Issues and Solutions consists of seven chapters.

Chapter IV, "Improving the Understandability of Dynamic Semantics: An Enhanced Metamodel for UML State Machines," introduces an approach to improve the understandability of the dynamic semantics of languages involved in the representation of behavior. Using a two-layer architecture as the starting point, a metamodel of UML State Machines is proposed.

Chapter V, "Metrics for Workflow Design: How an Information Processing View on Business Processes Helps to Make Good Designs," introduces a cohesion metric for the identification of weakly cohesive activities in a workflow design. A heuristic method based on the cohesion metric is presented to decide between various workflow design alternatives. Both theoretical and empirical evaluations positively support the soundness of the metric.

Chapter VI, "Fuzzy Aggregations and Fuzzy Specializations in Eindhoven Fuzzy EER Model," uses fuzzy quantifiers and fuzzy degrees in the context of fuzzy sets and fuzzy query systems for understanding semantic aspects in database concepts. The study is aimed to relax some constraints and other aspects that have not been studied in previous works. The study also extends the Enhanced Entity-Relationship (EER) model with fuzzy capabilities.

Chapter VII, "Normalization of Relations with Nulls in Candidate Keys: Traditional and Domain Key Normal Forms," discusses normalization of relations when the candidate keys of a relation have missing information represented by nulls. The related limitations of Boyce-Codd Normal Form (BCNF) and Domain Key Normal Form (DKNF) can be solved by incorporating the concept of entity integrity rule into the respective definitions.

Chapter VIII, "Regression Test Selection for Database Applications," discusses the difficulties caused by some database applications' features during maintenance activities, especially for regression testing that follows modification to database applications. The chapter proposes a two-phase regression testing methodology for selecting regression tests and for further reduction in the number of these tests.

Chapter IX, "An Attempt to Establish a Correspondence between Development Methods and Problem Domains," discusses the issue of development method adaptation. Then it introduces a new approach to calculate the fitness of methods to specific problems.

Chapter X, "Toward an Extended Framework for Human Factors Research on Data Modeling," summarizes the past human factors research on conceptual data modeling. In addition to analyzing the variables used in earlier studies and summarizing the results of this stream of research, the authors propose a new framework to help both scholars and practitioners in this area.

Section III: Database Design and Development: Applications consists of six chapters.

Chapter XI, "Using DEMO and ORM in Concert: A Case Study," examines the role of Demo Engineering Methodology for Organizations (DEMO) and Object-Role Modeling (ORM) in conceptually modeling business processes. An exploratory case study of applying the two methods in concert is provided.

Chapter XII, "Revisiting Workflow Modeling with Statecharts," proposes the use of Harel's statecharts in business workflows modeling. The authors developed algorithms that link desirable properties of active database system—non-termination, non-confluence, and not-observable determinism—to problems in workflow management systems.

Chapter XIII, "Framework for the Rapid Development of Modeling Environments," presents Generic Modeling Environment (GME) as a framework for rapid development of modeling environments. The chapter also compares GME with other tools in terms of metamodeling, constraint management, visualization, and extensibility.

Chapter XIV, "Federated Process Framework for Transparent Process Monitoring in Business Process Outsourcing," proposes a federated process framework and its system architecture. The architecture provides a conceptual design for effective implementation of process information sharing that supports the autonomy and agility of insourcing companies. The framework was developed using an object-oriented database and Extensible Markup Language.

Chapter XV, "Online Analytical Mining for Web Access Patterns," offers an architecture to store the derived web user access paths in a data warehouse and to facilitate its view maintainability by use of a metadata. The architecture of online analytical mining uses the frame model metadata to study the user surfing behavior. Performance studies were done to demonstrate the effectiveness and efficiency of the proposed architecture.

Chapter XVI, "Modeling Motion: Building Blocks of a Motion Database," introduces a binary-based model for the representation and storage of motion data. The model enables the communication, storage, and analysis of patterns of motion. The comparison with a standard motion system that is based on key frames indicates a significant advantage of the proposed model.

These 16 chapters provide a sample of the state-of-the-art research in the field of database. We hope that both scholars and practitioners will find the book a useful reference for their work.

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