**Chapter 4 Logical Database Design and the Relational Model**

# Chapter Overview

The purpose of this chapter is to describe in depth the major steps in logical database design, with emphasis on the relational model. Logical database design is the process of transforming the conceptual data model (described in Chapters 2 and 3) into a logical data model. First, we provide a concise description of the relational data model, including the properties of relations. Next, we describe and illustrate the various types of integrity constraints associated with the relational model. This section introduces SQL table definitions and the concept of well-structured relations. We then provide a detailed description of the process of transforming EER diagrams into relations. Next, we define normalization and describe the steps in normalizing relations. The chapter concludes with a discussion of merging relations and techniques for dealing with typical issues that arise during this process.

# Chapter Objectives

1. Show students the position of logical database design within the overall database development process. This is a key chapter in the textbook because students will begin to see the connection between conceptual modeling and the implementation of a functioning database.
2. Provide students with a solid understanding of the relational data model including the general properties of relations, integrity constraints, and the characteristics of well-structured relations.
3. Discuss the principles and detailed steps involved in mapping EER diagrams to relations. Computer-assisted techniques are often used to speed up this process, but students should still understand the principles underlying the process.
4. Provide students with a firm grasp on the principles of functional dependencies, determinants, and related concepts of normalization.
5. Emphasize why normalization is important to stable database design with the relational model, and then present a concise description of the various normal forms and the normalization process.
6. Discuss some of the anomalies that arise when merging relations, and discuss how to apply the principles we have learned to address these anomalies.

**Key Terms**

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| Alias | Functional dependency | Relation |
| Anomaly | Homonym | Second normal form (2NF) |
| Candidate key | Normal form | Surrogate primary key |
| Composite key | Normalization | Synonyms |
| Determinant | Null | Third normal form (3NF) |
| Enterprise key | Partial functional dependency | Transitive dependency |
| Entity integrity rule | Primary key | Well-structured relation |
| First normal form (1NF) | Recursive foreign key |  |
| Foreign key | Referential integrity constraint |  |

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