

11ed Chapter 2

Data Models

Discussion Focus

Although all of the topics covered in this chapter are important, our students have given us consistent feedback: *If you can write precise business rules from a description of operations, database design is not that difficult.* Therefore, once data modeling (Sections 2.1, "Data Modeling and Data Models", Section 2.2 "The Importance of Data Models," and 2.3, "Data Model Basic Building Blocks,") has been examined in detail, Section 2.4, "Business Rules," should receive a lot of class time and attention. Perhaps it is useful to argue that the answers to questions 2 and 3 in the **Review Questions** section are the key to successful design. That's why we have found it particularly important to focus on business rules and their impact on the database design process.

What are business rules, what is their source, and why are they crucial?

Business rules are precisely written and unambiguous statements that are derived from a detailed description of an organization's operations. *When written properly*, business rules define one or more of the following modeling components:

- entities
- relationships
- attributes
- connectivities
- cardinalities – these will be examined in detail in Chapter 3, "The Relational Database Model." Basically, the cardinalities yield the minimum and maximum number of entity occurrences in an entity. For example, the relationship described by "a professor teaches one or more classes" means that the PROFESSOR entity is referenced at least once and no more than four times in the CLASS entity.
- constraints

Because the business rules form the basis of the data modeling process, their precise statement is crucial to the success of the database design. And, because the business rules are derived from a precise description of operations, much of the design's success depends on the accuracy of the description of operations.

Examples of business rules are:

- An invoice contains one or more invoice lines.
- Each invoice line is associated with a single invoice.
- A store employs many employees.
- Each employee is employed by only one store.
- A college has many departments.
- Each department belongs to a single college. (This business rule reflects a university that

has multiple colleges such as Business, Liberal Arts, Education, Engineering, etc.)

- A driver may be assigned to drive many different vehicles.
- Each vehicle can be driven by many drivers. (Note: Keep in mind that this business rule reflects the assignment of drivers during some period of time.)
- A client may sign many contracts.
- Each contract is signed by only one client.
- A sales representative may write many contracts.
- Each contract is written by one sales representative.

Note that each relationship definition requires the definition of two business rules. For example, the relationship between the INVOICE and (invoice) LINE entities is defined by the first two business rules in the bulleted list. This two-way requirement exists because there is always a two-way relationship between any two related entities. (This two-way relationship description also reflects the implementation by many of the available database design tools.)

Keep in mind that the ER diagrams cannot always reflect all of the business rules. For example, examine the following business rule:

A customer cannot be given a credit line over \$10,000 unless that customer has maintained a satisfactory credit history (as determined by the credit manager) during the past two years.

This business rule describes a constraint that cannot be shown in the ER diagram. The business rule reflected in this constraint would be handled at the applications software level through the use of a trigger or a stored procedure. (Your students will learn about triggers and stored procedures in Chapter 8, “Advanced SQL.”)

Given their importance to successful design, we cannot overstate the importance of business rules and their derivation from properly written description of operations. It is not too early to start asking students to write business rules for simple descriptions of operations. Begin by using familiar operational scenarios, such as buying a book at the book store, registering for a class, paying a parking ticket, or renting a DVD.

Also, try reversing the process: Give the students a chance to write the business rules from a basic data model such as the one represented by the text’s Figure 2.1 and 2.2. Ask your students to write the business rules that are the foundation of the relational diagram in Figure 2.2 and then point their attention to the relational tables in Figure 2.1 to indicate that an AGENT occurrence can occur multiple times in the CUSTOMER entity, thus illustrating the implementation impact of the business rules

An agent can serve many customers.

Each customer is served by one agent.