Chapter IV

FuzzyEER: Main Characteristics of a Fuzzy Conceptual Modeling Tool

In this chapter we present the FuzzyEER Model, which is an extension of the EER Model with fuzzy semantics and notations. The Entity-Relationship Model was introduced by Chen (1976). Since then, numerous modifications and extensions of its modeling capabilities have been suggested. We will mainly use the approach by Elmasri and Navathe (2000) because it is very popular, general, and has an international scope.

With regard to the fuzzy attributes, the following aspects will be defined in the FuzzyEER Model: imprecise attributes, fuzzy attributes associated to one or more attributes or with an independent meaning, as well as degrees of fuzzy membership to the model itself. Furthermore, the following concepts will also be defined: fuzzy aggregation, fuzzy entity, weak fuzzy entity, fuzzy relationship, and defined specialization with fuzzy degrees. Fuzzy constraints are very important, and we review them in this chapter as well.
Finally, we also include a table to compare FuzzyEER and the modeling tools for the currently most important published fuzzy databases. Appendix A summarizes the conventions for FuzzyEER diagrams.

**A Brief Introduction to the ER/EER Model**

The ER Model graphically represents data as entities, relationships, and attributes. Entities are objects that exist in the real world and are represented in the model by rectangles. Relationships relate different entities to each other and are represented with diamond shapes. Both entities and relationships can have different attributes, which identify or characterize them.

The EER Model allows us to extend the description of the entities with new types (superclasses, subclasses, and categories). A subclass is a specialization of a superclass, so that each member of a subclass must be a member of the superclass. A superclass is a generalization of one or several subclasses. A specialization to which the superclass and all its subclasses are connected is represented with a circle. Subclasses are marked with the inclusion symbol (Ì) in the connecting line. A shared subclass is a subclass with various superclasses so that every member (or instance) of the subclass must belong to all the superclasses. Naturally, a subclass inherits every attribute of all its superclasses. On the other hand, a category (union type) is similar to a shared subclass, in which every member of the subclass must belong to only one of the superclasses, inheriting only the attributes of that superclass.

**Fuzzy Values: Fuzzy Attributes and Fuzzy Degrees**

In this section we refer to the fact that the attributes of an entity may be fuzzy values, and it is possible to operate with these values. The imprecision may be expressed in some ways, and we have classified it in two basic types. The first one we will properly call fuzzy attributes, and the second one we will call fuzzy degrees. As you will see, we based our work on works by many