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Meta-Level Control for Deductive Database Systems

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Preface

The development of database technology has currently reached the stage of deductive database systems which use Horn clauses for defining relations. After a long period in which the top-down approach used by SLD-resolution was favored for implementing deductive database systems, the bottom-up approach for computing the answer of a query to a deductive database is now becoming more and more attractive. Characteristic of the bottom-up approach is that the query and the rules of the deductive database are translated into a relational algebra expression. This expression is then evaluated on a relational database system.

Besides increased efficiency, another advantage of the bottom-up approach is that all procedural features are eliminated. For example, the sequence of the rules in a deductive database and the sequence of the atoms in the premise of a rule are totally irrelevant. The lack of procedural features results in a really declarative system where logic and control are clearly separated and where the programmer need not have procedural knowledge about the deduction process.

On the other hand, the fact that the deduction process can hardly be controlled by the programmer sometimes decreases the efficiency and the range of application of such a system. To eliminate this deficiency, this book presents a so-called *expert deductive database system* that allows explicit control of the deduction process. This system consists of an *object-level* describing the logical aspects of a problem and of a *meta-level* that contains application-specific control information affecting the object-level deduction process. More precisely, with a meta-level deductive database the programmer can explicitly specify application-specific control information that then affects the deduction process for the object-level deductive database. For example, object-level rules can be disregarded, and some tuples deduced at the object-level can be preferred to other tuples.

This book is organized as follows: After a brief introduction, Chapter 2 describes a standard deductive database system, which was the starting point of this thesis. Then Chapter 3 introduces the expert deductive database system. In detail, this chapter first gives some motivating remarks on why the programmer should be able to communicate control information to the deductive database system and why the solution of using a meta-level for controlling the object-level deduction process has been chosen. Then the architecture of the expert deductive database system is presented. Finally, an overview of the possibilities for controlling the object-level deduction process is given. These possibilities are then described in Chapters 4 to 8. Finally, Chapter 9 contains a summary and an outlook. In the appendix, two sloppy delta-iteration schemes are given that are used in the expert deductive database system to implement deduction control efficiently.

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Helmut Schmidt

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