

CHAPTER 27



Formal-Relational Query Languages

The tuple relational calculus and the domain relational calculus are declarative relational query languages based on mathematical logic.

Datalog is a language whose syntax modeled after the Prolog language. Although not used commercially at present, Datalog has been used in several research database systems.

Bibliographical Notes

The original definition of tuple relational calculus is in [Codd (1972)]. A formal proof of the equivalence of tuple relational calculus and relational algebra is in [Codd (1972)]. Several extensions to the relational calculus have been proposed. [Klug (1982)] and [Escobar-Molano et al. (1993)] describe extensions to scalar aggregate functions.

Extensions to the relational model and discussions of incorporation of null values in the relational algebra (the RM/T model), as well as outer joins, are in [Codd (1979)]. [Codd (1990)] is a compendium of E. F. Codd's papers on the relational model. Outer joins are also discussed in [Date (1983)].

Datalog programs that have both recursion and negation can be assigned a simple semantics if the negation is "stratified"—that is, if there is no recursion through negation. [Chandra and Harel (1982)] and [Apt and Pugin (1987)] discuss stratified negation. An important extension, called the *modular-stratification semantics*, which handles a class of recursive programs with negative literals, is discussed in [Ross (1990)]; an evaluation technique for such programs is described by [Ramakrishnan et al. (1992)].

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