GENERALIZED DIVISION FOR RELATIONAL ALGEBRAIC LANGUAGE*

R. DEMOLOMBE
ONERA-CERT, B.P. 40.25, 31055 Toulouse Cedex, France

Received 13 May 1981; revised version received 24 February 1982

Keywords: Database, relational model, algebraic language

1. Introduction

In [1] Codd has defined a set of algebraic operators on a set of tuples (i.e., relations). These operators when they are composed allow us to define a query language which is called "Relational Algebraic Language". In this language we can define a set of operators which would just guarantee the completeness of the language. However, some queries may be very difficult to express if we only use these basic operators. So it is useful to add some other operators which could be defined as functions of the previous ones, and which would facilitate the expression of some of the queries.

So Codd has defined the division operator which corresponds, more or less, to the universal quantifier, combined with implication, in Predicate Calculus language. In this paper we are going to give the definition of a generalized division operator which will permit us to express easily some queries which are unpracticable even if we have the Codd's division operator. Moreover, we will give the corresponding meaning of this operator in Relational Calculus (see [1]) and Predicate Calculus language (see [3,5]).

2. Definition of the generalized division

We will use the following notation:
- R and S are relation names.
- A, A (resp. B, B) is a partition of the set of attributes of the relation R (resp. S) and we shall write R(A, A) (resp. S(B, B)).
- R[A] is the projection of the relation R on the attribute A; let p be a tuple of R. We note that p[A] will represent the components of p corresponding to the attributes of A. gR(r[A]) = {r[A] | r ∈ R} is the image set of r[A] under R.

First we recall the definition of the division operator given by Codd.

Definition 0 (Codd). If A and B are union-compatible 1, the division of R by S on the attributes A and B is defined as follows:

R[A + B]S = {r[A] | r ∈ R ∧ S[B] ⊆ gR(r[A])}.

If we detail the definition of S[B] ⊆ gR(r[A]), we have

R[A + B]S = {r[A] | r ∈ R ∧ ∀s' ∈ S ∃r' ∈ R

r'[A] = r[A] ∧ r'[A] = s'[B]}.

We will now define the degeneralized division.

Definition 1. If A and B are union-compatible, the degeneralized division of R and S on the attributes A

1 Two sets of attributes are union-compatible if they have the same cardinality, and if the attributes which have the same rank are defined on the same domain.