Topic - Relational Calculus

Relational calculus is a non-procedural query language. In the non-procedural query language, the user is concerned with the details of how to obtain the end results.

Relational calculus is a non-procedural query language that tells the system what data to be retrieved but doesn't tell how to retrieve it.

The relational calculus tells what to do but never explains how to do.

Types of Relational calculus:

1. Tuple Relational Calculus (TRC)

The tuple relational calculus is specified to select the tuples in a relation. In TRC, filtering variable uses the tuples of a relation.

The result of the relation can have one or more tuples.

Notation:

{T | P (T)} or {T | Condition (T)}

Where

T is the resulting tuples

P(T) is the condition used to fetch T.

For example:

{ T.name | Author(T) AND T.article = 'database' }

OUTPUT: This query selects the tuples from the AUTHOR relation. It returns a tuple with 'name' from Author who has written an article on 'database'.

TRC (tuple relation calculus) can be quantified. In TRC, we can use Existential (∃) and Universal Quantifiers (∀).

For example:

{ R| ∃T ∈ Authors(T.article='database' AND R.name=T.name)}

Output: This query will yield the same result as the previous one.

Tuple relational calculus is used for selecting those tuples that satisfy the given condition.

Table: Student

First_Name Last_Name Age

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Ajeet Singh 30

Chaitanya Singh 31

Rajeev Bhatia 27

Carl Pratap 28

Lets write relational calculus queries.

Query to display the last name of those students where age is greater than 30

{ t.Last_Name | Student(t) AND t.age > 30 }

In the above query you can see two parts separated by | symbol. The second part is where we define the condition and in the first part we specify the fields which we want to display for the selected tuples.

The result of the above query would be:

Last_Name

Singh

Query to display all the details of students where Last name is ‘Singh’

{ t | Student(t) AND t.Last_Name = 'Singh' }

Output:

First_Name Last_Name Age

--- --- ---

Ajeet Singh 30

Chaitanya Singh 31

2. Domain Relational Calculus (DRC)

The second form of relation is known as Domain relational calculus. In domain relational calculus, filtering variable uses the domain of attributes.

Domain relational calculus uses the same operators as tuple calculus. It uses logical connectives ∧ (and), ∨ (or) and ┐ (not).

It uses Existential (∃) and Universal Quantifiers (∀) to bind the variable.

Notation:

{ a1, a2, a3, ..., an | P (a1, a2, a3, ... ,an)}

Where

a1, a2 are attributes

P stands for formula built by inner attributes

For example:

{< article, page, subject > | ∈ MCA ∧ subject = 'database'}

Output: This query will yield the article, page, and subject from the relational MCA , where the subject is database.

Again we take the same table to understand how DRC works.

Table: Student

First_Name Last_Name Age

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Ajeet Singh 30

Chaitanya Singh 31

Rajeev Bhatia 27

Carl Pratap 28

Query to find the first name and age of students where student age is greater than 27

{< First_Name, Age > | ∈ Student ∧ Age > 27}

Note:

The symbols used for logical operators are: ∧ for AND, ∨ for OR and ┐ for NOT.

Output:

First_Name Age

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Ajeet 30

Chaitanya 31

Carl 28