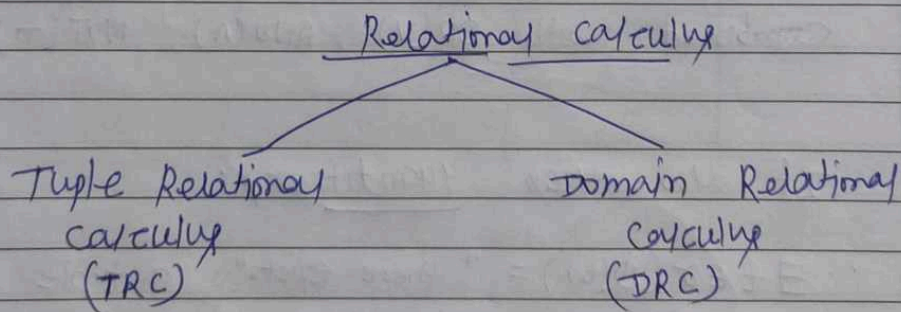## Relational calculus

→ Relational calculus is a non-procedural query language.

→ It is also known as Declarative language.

→ It uses mathematical pridicate (Condition/rules) calculus instead of algebra.

→ Relational calculus tells what to do but never explain how to do.

→ Relational calculus provides description about the query to get the result where as relational algebra gives the method to get the result.

Types:

Relational calculus

Tuple Relational calculus (TRC)   Domain Relational calculus (DRC)

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Tuple Relational calculus (TRC):

→ Tuple Relational calculus is used to selecting those tuples that satisfying the given condition

Syntax:

$$\{ t \mid p(t) \}$$

Here t = resulting tuple

$$p(t) = predicate / condition$$

Table: Student

First_Name	Last_Name	Age
Ajeet	pal	30
Rohit	Sharma	31
Virat	Kohli	27
Mohit	Sain	28

⇒ Query to display last name of those students where Age is greater than 30.

$$\{ t.last\text{-}Name \mid Student(t) \wedge t.age > 30 \}$$

TRC :

→ Tuple Relational calculus is a non-procedural query language unlike relational algebra.

→ In tuple calculus, a query is expressed as

$$\{ t \mid p(t) \}$$

where   t = resulting tuples,

   p(t) = known as predicate (rule/condition)

operations:

→ p(t) may have various conditions logically combined with OR($\lor$), AND($\land$), NOT($\lnot$).

→ It also uses quantifiers:

· $\exists t \in r \, (Q(t))$ = "there exists" a tuple in t in relation r such that predicate Q(t) is true.

· $\forall t \in r \, (Q(t))$ = Q(t) is true "for all" tuples in relation r.

Result of the query:

Last Name
Sharma

→ write a query to display all the details of Students where Age is greater 27

$$\{ t \mid Student(t) \land t.Age > 27 \}$$

Output :

First Name	Last Name	Age
Ajeet	Pal	30
Rohit	Sharma	31
Mohit	Sain	28

Unsafe expression

- $\{ s.name \mid \neg \text{Supplier (s)}$

→ Both TRC and RA (Relational Algebra) have same expressive powers.

Domain Relational Calculus (DRC) :-

→ DRC is a non-procedural query language.

→ Domain Relational calculus uses the same operators as tuple calculus.

→ Query by ~~Language~~ Example (QBE) is a query language related to domain relational calculus.

Formal definition of DRC:

$$\{ <x_1, x_2, \ldots, x_n> \mid p(x_1, x_2, \ldots, x_n) \}$$

→ In DRC, the records are filtered based on the Column.

Example:

Student

First-Name	Last-Name	Age
Ajeet	pal	30
Rohit	Sharma	31
Virat	Kohli	27
Mohit	Sain	28

Write a Query to find first-name and Age of Students where student Age is greater 27.

$\{ < First\text{-}Name, Age > \mid \in Student \wedge Age > 27 \}$ **or**

$\{ < First\text{-}Name, Age > \mid < First\text{-}Name, Age > \in Student \wedge Age > 27 \}$

output:

First-Name	Age
Ajeet	30
Rohit	31
Mohit	28

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diff b/w Relational Algebra and Relational calculus

Relational Algebra	Relational calculus
→ It is procedural query language.	→ It is non-procedural query language.
→ Relational Algebra targets how to obtain result.	→ Relational calculus targets what result to obtain.
→ Relational Algebra is related to programming language concept.	→ Relational calculus is not related to programming language concept.
→ Relational Algebra specifies the order in which operations are to be performed	→ Relational calculus not specifies the order in which operations are to be performs.