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TRC & DRC

Complete Course on Database Management System

Vishvadeep Gothi • Lesson 21 • July 14, 2023

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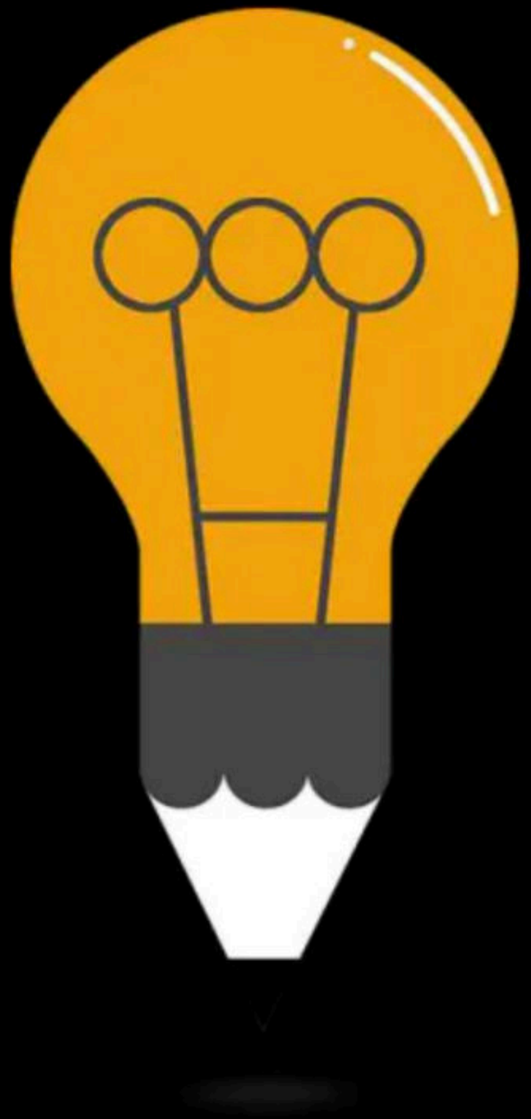

DBMS

Tuple Relational & Domain Relational Calculus

attribute

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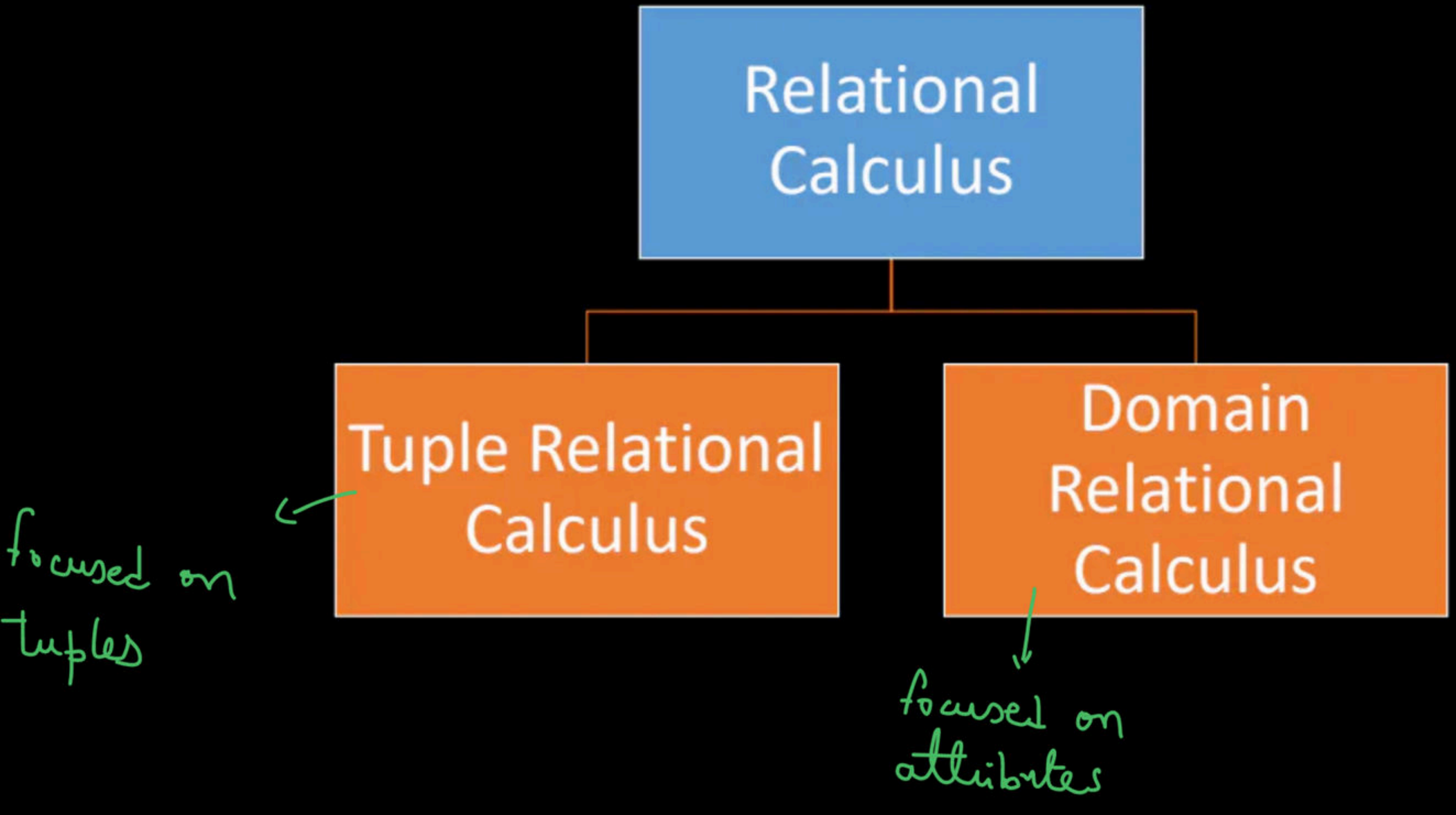
Relational Calculus



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Tuple Relational Calculus

Tuple Relational Calculus is a non-procedural query language

TRC, DRC are more powerful than relational algebra & SQL

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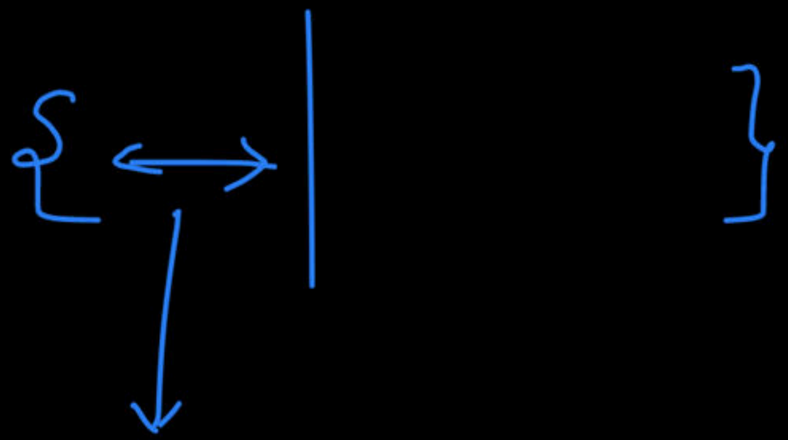
Tuple Relational Calculus

Tuple Relational Calculus is a non-procedural query language

{t| P(t)}

tuple variable

Predicate



{ t| P(t)} ⇒ fetch all tuples t which are satisfying predicate P(t)

ex:-

student(rno, name, dob, marks)

select * from student

$\{t \mid t \in student\}$

Tuple Relational Calculus

t[Attribute1] => tuple t of an attribute Attribute1

{t| P(t)}

fetch name of all students

{ t [name] | t ∈ student }

or

{ t.name | t ∈ student }

find name, marks of all students

{ t.name, t.marks | t ∈ student }

select of SQL

from, where

$$\{ t[\text{name}], t[\text{marks}] \mid t \in \text{student} \}$$

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Tuple Relational Calculus

Shopkeeper(Firstname, Lastname, Rating)

{t | t ∈ Shopkeeper}

{t | t ∈ Shopkeeper ∧ t.rating > 8}

select * from shopkeeper
where rating > 8

Find firstname of all shopkeepers who are having rating b/w 7 to 10?

$$\{ t.\text{firstname} \mid t \in \text{shopkeeper} \wedge t.\text{rating} \geq 7 \wedge t.\text{rating} \leq 10 \}$$

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Tuple Relational Calculus

TRC eliminates duplicate

And ⇒ $\wedge$

or ⇒ $\vee$

Not ⇒ $\sim$ $\neg$

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Tuple Relational Calculus

{t.Firstname, t.Lastname | t ∈ Shopkeeper AND t.rating > 8 }

{t[Firstname], t[Lastname] | t ∈ Shopkeeper AND t[rating] > 8 }

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Tuple Relational Calculus

Select fname, Lname from students where gender='Male' and marks<20

students (RNo, fname, lname, gendere, marks)

$\{ t.fname, t.lname \mid t \in students \wedge t.gendere = 'male' \wedge t.marks < 20$

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Tuple Relational Calculus

Students (Fname, Lname, DOB, Marks, Gender)

Find all such students who's marks are greater than 40

$$\{ t \mid t \in students \wedge t.marks > 40 \}$$

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Tuple Relational Calculus

Students (Fname, Lname, DOB, Marks, Gender)

{t[age] | t ∈ Students ^ t[Marks] > 30 } => Empty set because there is no any attribute age in relation students

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Quantifiers

Existential: $\exists t \in r\ (P(t))$ => There exists a tuple t, which belongs to relation r and satisfies predicate p.

Universal: $\forall\ t \in r\ (P(t))$

↓

for all

Tuple Relational Calculus

Students (Fname, Lname, DOB, Marks, Gender, Dno)

Department (Dno, Dname, HOD)

Find all such female students who studies in CS department

$$\{t \mid t \in students \wedge t.Gender = 'Female' \wedge \exists s \{s \in department \wedge s.Dname = 'CS' \wedge s.Dno = t.Dno\}\}$$

Tuple Relational Calculus

Students (Fname, Lname, DOB, Marks, Gender, Dno)

Department (Dno, Dname, HOD)

Find all such female students who studies in CS department

$\{t[Fname] \mid t \in Students \wedge t[Gender] \text{ 'Female'} \wedge \exists s \{s \in Department \wedge s[Dname]=\text{'CS'} \wedge s[Dno]=t[Dno]\}\}$

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Tuple Relational Calculus

Students (Fname, Lname, DOB, Marks, Gender, Dno)

Department (Dno, Dname, HOD)

Find all such department names where there is no any male student?

$$\{t.dname \mid t \in department \wedge \neg \exists s \{s \in students \wedge s.gender = 'male' \wedge s.Dno = t.Dno\}\}$$

$$\{t.dname \mid t \in department \wedge \forall s \{s \in students \wedge s.gender \neq 'male' \wedge s.Dno = t.Dno\}\}$$

Tuple Relational Calculus

Drivers (did, dname, rating)

Cars (cid, cmodel, ccolor)

Drives (Did, cid, dateofRace)

Find the models of cars driven by 'Michael'?

$$\{t.cmodel \mid t \in cars \wedge \exists d \{d \in drives \wedge d.cid = t.cid \wedge$$

$$\exists s \{s \in drivers \wedge s.did = d.did \wedge$$

$$s.dname = 'michael'\}\}\}$$

$$\{ t.\text{model} \mid t \in \text{cars} \wedge \exists d \exists s \{ d \in \text{drivers} \wedge s \in \text{drivers} \wedge s.\text{dname} = \text{'Michael'} \wedge t.\text{cid} = d.\text{cid} \wedge d.\text{did} = s.\text{did} \} \}$$

student(rno, sname, dob)

courses(cno, cname, fee)

enrolled(rno, cno, duration)

name of all such students who have enrolled for a course 'DBMS' during 2023.

$$\{t.sname \mid t \in student \wedge \exists e \exists c\{e \in enrolled \wedge c \in courses \wedge t.rno = e.rno \wedge e.cno = c.cno \wedge c.cname = \text{'DBMS'} \wedge e.duration = 2023\}\}$$

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Tuple Variable

1. Bound ⇒ used with Quantifier
2. Free ⇒ not Quantified

Domain Relational Calculus

{<c1, c2, ….., cn>| P(c1, c2, ….., cn)}

c1, c2, ….., cn are domain variables

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Domain Relational Calculus

$\{<r, f, l, m> \mid <r, f, l, m> \in \text{Students}\}$

students(rno, fname, lname, marks)

⇓

select * from students

---

first name of all students

$(<f> \mid <r, f, l, m> \in \text{students})$

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Domain Relational Calculus

{<f> | <r, f, l, m> ∈ Students ^ <~~m>90~~}

<m> > 90 }

Drivers (did, dname, rating, dob)

name of all such drivers who are having rating > 8 and dob = '27-10-1988'

{<n> | <i, n, r, d> ∈ Drivers ∧ <r> > 8 ∧ <d> = '27-10-1988' }

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Domain Relational Calculus

Select name and marks of student with rollno 5

student (rno, fname, lname, mark

$$\{ \langle f, m \rangle \mid \langle r, f, l, m \rangle \in student \wedge \langle r \rangle = 5 \}$$

Domain Relational Calculus

Select name and marks of student with rollno 5

{<f, m> | <r, f, l, m> ∈ Students ^ <r>=5}

{<f, m> | <5, f, l, m> ∈ Students}

---

find name of students who score 90 marks.

{ <f> | <r, f, l, 90> ∈ students }

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Domain Relational Calculus

Select roll number and name of students with whos last name is ‘Kumar’ and marks>50

$$\{ \langle f \rangle \mid \langle r, f, l, m \rangle \in \text{students} \wedge \langle l \rangle = \text{'kumar'} \wedge \langle m \rangle > 50 \}$$

or

$$\{ \langle f \rangle \mid \langle r, f, \text{'kumar'}, m \rangle \in \text{students} \wedge \langle m \rangle > 50 \}$$

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Domain Relational Calculus

Accounts(acno, custID, Amount)

Find all the customerIDs whos bank balace is more than 50000

$$\{ \langle c \rangle \mid \langle a, c, am \rangle \in Accounts \wedge \langle am \rangle > 50000 \}$$

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Happy Learning.!