

Computer Science & IT

Database Management System



Query Languages

Lecture No. 12



By- Vishal Sir



Recap of Previous Lecture

✓
Topic

Relational calculus

✓
Topic

Tuple relational calculus (TRC)

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



Topics to be Covered



Topic

Unsafe TRC



Topic

Practice questions {GATE PYQ}



Topic

Domain relational calculus (DRC)





Topic : Unsafe TRC query



$\{t \mid t \notin \text{Relation}\}$

or $\{t \mid \neg(t \in \text{Relation})\}$

We are trying to select the tuples which does not belong to the relation

- * Unsafe TRC query may produce infinite number of tuples.
- * We can not write an equivalent Relational Algebra query corresponding to an Unsafe TRC query.
- * For every safe TRC query we can write an equivalent R.A. query

Power of TRC \neq Power of Relational Algebra
query
{ Safe + Unsafe }

Power of Safe TRC \equiv Power of
query Relational Algebra

#Q. Which of the following relational calculus expressions is not safe?

MCQ



Not At least one tuple s belonging to R_2

A. $\{t | \exists u \in R_1 (t[A] = u[A]) \wedge \neg \exists s \in R_2 (t[A] = s[A])\}$

B. $\{t | \forall u \in R_1 (u[A] = "x" \Rightarrow \exists s \in R_2 (t[A] = s[A] \wedge s[A] = u[A]))\}$

☒ C. $\{t | \neg(t \in R_1)\}$

D. $\{t | \exists u \in R_1 (t[A] = u[A]) \wedge \exists s \in R_2 (t[A] = s[A])\}$

#Q.

Consider the relation employee (name, sex, supervisorName) with name as the key. Supervisor Name gives the name of the supervisor of the employee under consideration. What does the following Tuple Relational Calculus query produce?

t.name

{e.name |

$e \in \text{Employee}$
employee(e)

$\wedge (\forall x) [\neg \text{employee}(x) \vee x.\text{supervisorName} \neq e.\text{name} \vee x.\text{sex} = \text{"male"}]$

Permanently false

- ☒ A. Names of employees with a male supervisor.
- ☒ B. Names of employees with no immediate male subordinates
- ☒ C. Names of employees with no immediate female subordinates
- ☒ D. Names of employees with a female supervisor.

Emp

Name	Sex	Sup.name
A	M	B
B	F	NULL
C	F	NULL
D	F	NULL
E	F	NULL
F	F	NULL



o/p = {A, C, B, F}

#Q.

$$\forall x \{P(x)\} \equiv \sim \exists x \{ \sim P(x) \}$$

Consider the relation employee (name, sex, supervisorName) with name as the key. Supervisor Name gives the name of the supervisor of the employee under consideration. What does the following Tuple Relational Calculus query produce?

A M B (B) F D

{e.name | employee(e)

$\wedge (\forall x) [\sim \text{employee}(x) \vee x.\text{supervisorName} \neq e.\text{name} \vee x.\text{sex} = \text{"male"}]$

$\sim \exists x \{ \sim [\sim \text{employee}(x) \vee x.\text{supervisorName} \neq e.\text{name} \vee x.\text{sex} = \text{"male"}] \}$ — Emp

A. Names of employees with a male supervisor.

$\sim \exists x \{ \text{employee}(x) \wedge x.\text{supervisor} = e.\text{name} \wedge x.\text{sex} = \text{"Female"} \}$

B. Names of employees with no immediate male subordinates

C. Names of employees with no immediate female subordinates

D. Names of employees with a female supervisor.

Name	Sex	Sup. name
A	M	B
B	F	NULL
C	F	NULL
D	F	NULL

#Q. Which of the following tuple relational calculus expression(s) is/are equivalent to $\forall t \in r(P(t))$?

~~I~~ $\neg \exists t \in r(P(t))$

~~II~~ $\exists t \notin r(P(t))$

III $\neg \exists t \in r(\neg P(t))$

~~IV~~ $\neg \exists t \notin r(\neg P(t))$

$\forall t \in R \{P(t)\}$

for all tuples predicate 'P' must be true

$\forall t \in R(P(t))$

Not at least one tuple for which predicate P is false

A. I only

B. II only

C. III only

D. III and IV only

$\sim \exists t \in R(\sim P(t))$

$\forall t \in R(\sim(\sim P(t)))$

$\forall t \in R(P(t))$

#Q.

Consider The Following Relational Scheme

Student (school-id, sch-roll-no, sname, saddress)

School (school-id, sch-name, sch-address, sch-phone)

Enrolment (school-id, sch-roll-no, erollno, examname)

ExamResult (erollno, examname, marks)

Consider the following tuple relational calculus query

$\{ t \mid \exists E \in \text{Enrolment } t = E.\text{school-id} \wedge (\exists B \in \text{ExamResult } B.\text{erollno} = x.\text{erollno} \wedge B.\text{examname} = x.\text{examname} \wedge B.\text{marks} > 35) \mid \{ x \mid x \in \text{Enrolment} \wedge x.\text{school-id} = t \} \mid * 100 > 35 \}$

True This 'AND' Condⁿ is evaluated

$\{ x \mid x \in \text{Enrolment} \wedge x.\text{school-id} = t \wedge (\exists B \in \text{ExamResult } B.\text{erollno} = x.\text{erollno} \wedge$

$B.\text{examname} = x.\text{examname} \wedge B.\text{marks} > 35) \mid \div$

$\{ x \mid x \in \text{Enrolment} \wedge x.\text{school-id} = t \} \mid * 100 > 35 \}$

If a student needs to score more than 35 marks to pass an exam what does the query return?

it will return true or false on the basis of this o/p

No. of tuples in the o/p of inner TRC query

#Q.



A. The empty set

B. schools with more than 35% of its students enrolled in some exam or the other

✓ C. schools with a pass percentage above 35% over all exams taken together

D. schools with a pass percentage above 35% over each exam

#Q.

Consider a database that has the relation schemas
EMP(EmpId, EmpName, DeptId) and
DEPT(DeptName, DeptId).

Note that the DeptId can be permitted to a NULL in the relation EMP. Consider the following queries on the database expressed in tuple relational calculus.

I. $\{t \mid \exists u \in \text{EMP} (t[\text{EMPName}] = u[\text{EmpName}]) \wedge \forall v \in \text{DEPT} (t[\text{DeptId}] \neq \text{DeptId})\}$

II. $\{t \mid \exists u \in \text{EMP} (t[\text{EMPName}] = u[\text{EmpName}]) \wedge \exists v \in \text{DEPT} (t[\text{DeptId}] \neq \text{DeptId})\}$

III. $\{t \mid \exists u \in \text{EMP} (t[\text{EMPName}] = u[\text{EmpName}]) \wedge \exists v \in \text{DEPT} (t[\text{DeptId}] = \text{DeptId})\}$

Which of the above queries are safe?

- A. I and II only
- B. I and III only
- C. II and III only
- D. I, II and III

Every query will produce finite number of EMPName from EMP table

i. All are safe



2 mins Summary



Topic

Unsafe TRC ✓

Topic

Practice questions ✓

Topic

Domain relational calculus (TRC)

THANK - YOU