

Computer Science & IT

Database Management System



Query Languages

Lecture No. 10



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Recap



Topic

Practice questions

Topic

Tuple relational calculus (TRC)



Topics to be Covered



Topic

Practice questions on TRC

Topic

Domain relational calculus (DRC)



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

H.W.

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

$$\sim(\sim A) \equiv A$$

$$\sim \sim \left(\forall t \in r (P(t)) \right) \\ \sim \left[\exists t \in r (\sim P(t)) \right]$$

A. I only

B. II only

C. III only

D. III and IV only

$$\sim(t \in R) \equiv t \notin R$$

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

It will be true when for tuples of 'r' predicate 'P' is true

Not for all tuples of 'r' predicate 'P' is true \equiv for at least one tuple of 'r' predicate 'P' is false

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

"MCQ" 

H.W

- ~~A.~~ $\{t | \exists u \in R1 (t[A] = u[A]) \wedge \neg \exists s \in R2 (t[A] = s[A])\}$ assignment Comparison
- ~~B.~~ $\{t | \forall u \in R1 (u[A] = "x" \Rightarrow \exists s \in R2 (t[A] = s[A] \wedge s[A] = u[A]))\}$ $\forall s \in R2 (t[A] \neq s[A])$
- ~~C.~~ $\{t | \neg(t \in R1)\}$ False — No need to check True — then check
- ~~D.~~ $\{t | \exists u \in R1 (t[A] = u[A]) \wedge \exists s \in R2 (t[A] = s[A])\}$ $t.A$
 x
- o/p = ?

$P \rightarrow Q = T$
 $F \rightarrow ?$

#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?

$\{e.name \mid employee(e)\}$

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

$\sim [\exists x (Employee(x) \wedge x.supervisorName = e.name \wedge x.sex = 'female')]$

A. Names of employees with a male supervisor.

Not at least one tuple x in such that in that tuple x

B. Names of employees with no immediate male subordinates

name of Employee is same as name of Employee in tuple e and sex of Employee in tuple x is Female

C. Names of employees with no immediate female subordinates

D. Names of employees with a female supervisor.

#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

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

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

$t = E.\text{school-id} = 01$

Enrolment

School-id	Sch-roll-no	Erollno	examname
01	01	01	(pass)
01	01	01	(fail)
02	02	02	x
01	01	01	(pass)
03	03	03	

Examresult

Erollno	Examname	Marks
01	01	01
01	01	01
02	02	02
01	01	01
03	03	03



#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.

H.W.

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

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

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

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

EMP

EmpID	EmpName	DeptID
E ₁	—	D ₁
E ₂	—	D ₂
E ₃	—	D ₁
E ₄	—	NULL

Dept

DeptName	DeptID
—	D ₁ ✓
—	D ₂ ✓
—	D ₃ ✓

Domain Relational Calculus

↓
"Column"



Topic : Syntax of DRC

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



- Each query is an expression of the form
 $\{ \langle x_1, x_2, \dots, x_n \rangle \mid P(x_1, x_2, \dots, x_n) \}$
- Where x_1, x_2, \dots, x_n represent output domain variables.
- $P(x_1, x_2, \dots, x_n)$ is the predicate formula.

In the output we will get the value from Column
 x_1, x_2, \dots, x_n , for which Predicate formula $P(x_1, x_2, \dots, x_n)$ is true

Consider the following relation

Emp (Eid, Ename, Salary)

Retrieve all records of the Emp table

TRC $\{ t \mid t \in \text{Emp} \}$

DRC: $\{ \langle E, N, S \rangle \mid \langle E, N, S \rangle \in \text{Emp} \}$

it is the
Name assigned
to 1st
Column
of Emp

it is the
Name assigned
to 2nd
Column
of Emp

it is the
Name assigned
to 3rd
Column
of Emp

Consider the following relation

Emp (Eid, Ename, Salary)

Retrieve Ename of all Employee

TRC { t.Ename | t ∈ Emp }

DRC: { <N> | <E, N, S> ∈ Emp }

Consider the following relation

Emp (Eid, Fname, Salary)

Retrieve Eid of all Employee

TRC $\{ t.Eid \mid t \in \text{Emp} \}$

DRC: $\{ \langle E \rangle \mid \langle E, N, S \rangle \in \text{Emp} \}$

#Q. Consider the following relational schemas
Employee(EmpId, EmpName, salary)

Select distinct EmpName from Employee table where salary > 2000

TRC: $\{ t.\text{EmpName} \mid t \in \text{Employee} \wedge t.\text{Salary} > 2000 \}$

DRC: $\{ \langle N \rangle \mid \langle E, N, S \rangle \in \text{Employee} \wedge \langle S \rangle > 2000 \}$

#Q. Consider the following relational schemas
Student(Rollno, name, marks)

Select distinct name and marks of the student from Student table where
Rollno = 10

$$\text{TRC: } \{t.\text{name}, t.\text{marks} \mid t \in \text{Student} \wedge t.\text{Rollno} = 10\}$$

$$\text{DRC: } \{ \langle N, M \rangle \mid \langle R, N, M \rangle \in \text{Student} \wedge \langle R \rangle = 10 \}$$

|||

$$\{ \langle N, M \rangle \mid \langle 10, N, M \rangle \in \text{Student} \}$$



#Q. Consider the following relational schema.

Students(rollno: integer, sname: string)

Courses(courseno: integer, cname: string)

Registration(rollno: integer, courseno: integer, percent: real)

Which of the following queries are equivalent to this query in English?

“Find the distinct names of all students who score more than 90% in the course numbered 107”

I. SELECT DISTINCT S.sname FROM Students as S, Registration as R WHERE
R.rollno=S.rollno AND R.courseno=107 AND R.percent >90

II. $\Pi_{\text{sname}}(\sigma_{\text{courseno}=107 \wedge \text{percent} > 90}(\text{Registration} \bowtie \text{Students}))$

III. $\{T \mid \exists S \in \text{Students}, \exists R \in \text{Registration} (S.\text{rollno}=R.\text{rollno} \wedge R.\text{courseno}=107 \wedge R.\text{percent} > 90 \wedge T.\text{sname}=S.\text{sname})\}$

IV. $\{ \langle S_N \rangle \mid \exists S_R \exists R_P (\langle S_R, S_N \rangle \in \text{Students} \wedge \langle S_R, 107, R_P \rangle \in \text{Registration} \wedge R_P > 90) \}$

~~A. I, II, III and IV~~

B. I, II and III only

C. I, II and IV only

D. II, III and IV only

$\{ \langle N \rangle \mid \langle R, N \rangle \in \text{Student} \wedge \langle R, N, 107, P \rangle \in \text{Registration} \wedge \langle P \rangle > 90 \}$



2 mins Summary



✓ **Topic**

Practice questions on TRC

✓ **Topic**

Domain relational calculus (DRC)

THANK - YOU