Ch-6

21.05.2017

Relational Algebra: The relational algebra is a theoritical language with operations that work on one or more relations to define another relation without changing the original relation. It is used to manipulate relations to obtain a ~~disere~~ desired result.

Relational Algebra Operation:
Union, ~~inse~~ intersection, difference, devision, ~~rem~~ renaming, selection, projection, cartesian product, join, etc.

* Unary operation: Operate with one relation.

E.g: selection, projection, etc

Binary operation: Operate on two relations

Eg: Union, Intersection, Join etc

N-ary operations:

Selection operation:

Syntax:

$\sigma_{predicate}(R)$

σ = selection (sigma)

predicate = condition

R = Relation

Symbols:

$<$ $>$ or $\neq$

$>, <, \geq, \leq, =$

$\wedge$, $\vee$, $\neg$

↓ AND ↓ OR ↓ NOT

Example:

Student

Roll	Name	GCPA
01	Rupa	4.5
02	Rimi	3.5
03	Shovo	2.5
04	Sumi	3.2
05	Poly	2.7
06	Keya	2.9

Employee

Name	Age	Sallary
Mark	25	9000
Lucky	40	3000
Mark	36	4500
John	42	3900

Find the students whose GCPA > 3.0

$\sigma_{GCPA>3.0}(Student)$

Roll	name	GPA
01	Rupa	4.5
02	Rim	3.5
04	Sumi	3.2

(3) Find those employees whose age below 30 or salary more than 4000

Ans.) $\sigma_{age<30 \vee salary>4000}$

~~whose~~ GCPA > 3.0

1. Find those Employee whose salary is more that 4000

Ans: $\sigma_{salary>4000}(Employee)$

2. Find those Employee whose age is less than 30 years

Ans: $\sigma_{age<30}(Employee)$

Projection operation:

Syntax:

$$\Pi_{a_1, a_2, \ldots a_n}(R)$$

Π = Projection (pie)

$a_1, \ldots a_n$ = attributes

Stuff

name	Gender	Date of Birth	salary
Rony	M	01/05/86	20,000
Tony	M	05/07/80	30,000
Jony	M	07/02/95	40,000
Rupa	F	03/09/96	35,000

Projection operation is used to show the descrebe colums of a relation.

Select *
From table_name
where condition

14 marks → 1 set from here

selection operation specefic Row তের উপর কাজ করে।

4. Find those Employees whose age below 30 and salary 4000.

Ans: $\sigma_{age<30 \wedge salary=4000}(Employees)$

5. Find the Employee whose name is 'lucky'

$\sigma_{name=lucky}(Employee)$

Select Column-name

projection operation

একটা Table থেকে কোন কোন column নিতে চাই,

Show the names of staff relation

Π_{name} (staff)

Show the name, Date of birth.

$\Pi_{name, Date\ of\ birth}$ (staff)

Find the staff, whose salary is greater than 30,000 and Gender is 'F'.

Π_{name} ($\sigma_{salary>30000 \wedge Gender='F'}$ (staff))

22.05.2015

Customer

Name	Street	City	Phone	Age
Ruchi	abc	Dhaka	123	16
Adnan	def	Khulna	456	18
Upoma	ghi	Rajshahi	289	20
Sazzad	JKl	Dhaka	135	17

Find the names of customers who lives in dhaka

Π_{name} ($\sigma_{city=Dhaka}$ (customer))

Find the customer who's age is more than 16 and live dhaka where his/her phone number starts with '1'

Π_{name} ($\sigma_{age>16 \wedge city='Dhaka' \wedge Phone='1\%'}$ (custom

Binary Operation Capability: To perform union, intersection and difference relations should be union compatible 2 relations are union compatible if they have some number of attributes and belong to same domain.

→ ~~Con~~ Column no number need to be same.

→ Domains need to be same

Suppose we have 2 relations

R

A	B
α	1
α	2
β	1

S

A	B
α	2
β	3

R

A	B

S

A	B

not compatible

R

A	B

S

A	B

compatible

Union Operation

R ∪ S is

A	B
α	1
α	2
β	1
β	2

Intersection Operation

R ∩ S is

A	B
α	2

~~Diffi~~ Difference Operation:

R − S is

A	B
α	1
β	1

S − R is

A	B
β	3

Rename Operation:

- To rename a table: $\rho_{A}(B)$ (B → old name, A → new name)
- To rename attribute

$\rho_{\text{oldname} \rightarrow \text{new name}}(R)$

Example:

Employes (name, branch, salary)

After,

$\rho_{\text{Branch, salary} \rightarrow \text{location, pay}}(\text{Employee})$

old → new

we will get,

Employee (name, location, pay)

Division Operation:

R

A	B
a_1	b_1
a_1	b_2
a_2	b_1
a_3	b_2

S

B
b_1
b_2

So, R/S =

A
a_1

Cartesian Product operation

R

A
a
b

S

B
1
2
3

R x S is

A	B
a	1
b	2
a	3
b	1
b	2
b	3

Division operation

A

Sno	Pno
S_1	P_1
S_1	P_2
S_1	P_3
S_1	P_4
S_2	P_1
S_2	P_2
S_3	P_2
S_4	P_2
S_4	P_4

B_1

Sno
P_2

B_2

Pno
P_4

i) $A/B_1 = ?$

ii) $A/B_2 =$

iii)

Sno
S_1
S_2
S_3
S_4

iv)

Sno
S_1
S_4

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Example:

Borrower

Name	Loan NO
Kamal	L-17
Jamal	L-23

Loan LOAN

Loan NO	Branch	Amount
L-14	Kakhrail	10000
L-23	Motijheel	25000

Find the names of customers who have a loan loan at motijheel Branch?

$\Pi_{name}(\sigma_{loan}$

* cartesian product
* Rename

Borrower X Loan

Name	Borrow. Loan no	Branch	Loan. Loan no	amount
Kamal	L-17	L-14	Kakrail	10000
kamal	L-17	L-23	Motijhil	15000
Jamal	L-23	L-14	Kakrail	10000
Jamal	L-23	L-23	motihil	1500

Branch = " motijheel

Borrow. loan no = Loan. loan no

$\Pi_{name}(\sigma_{Branch = "motijheel"}$ and Borrow

loan no = Loan . loan no (Borrower × Loan))

Name	Loan. no	Branch	Amount

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Natural Join. (⋈)

Say,

Name	Department
Smith	CSE
John	EEE
Paul	EEE

Department	Head
EEE	Brown
CSE	Alen

RMS

Name	Department	head
Smith	CSE	Alen
John	EEE	Brown
Paul	EEE	Brown

Find the tables of last classes

Borrower (Name, Loan NO)

Loan (LoanNO, Branch Amount)

- Find the customer who have a loan at MOTIJHEEL Branch using natural join.

Name	Loanno	Branch	Amount
Jamal	L-23	Mothijheel	25000

$\Pi_{name}(\sigma_{Branch='mothijheel'}(Borrower \bowtie loan))$

Theta join

Syntax ($R \bowtie_{condition} S$)

Or,

$\sigma_{condition}(R \bowtie S)$

Say, Depositore (customer NO, Name, Account no)

Account (Account NO, Branch, Balance)

* Find the customere name who have an account in the bank and having Balance greater than 5000?

$\Pi_{name}(\sigma_{balance>5000}(Dipositore \bowtie Account_{no}))$

Semi Join

Notation:

$R \ltimes_F S$, F is the condition

Half

R

E.NO	E. Name	Designation
E_1	Rupa	Programmere
E_2	Nipa	Analyst
E_3	Jhuma	DB admin
E_4	Sadat	consultant

Designation	Salary
Programer	25000
Consultant	50000
Managere	25000

$R \ltimes_{R.designation = S.designation} S$

~~R. account no = S. account no~~

E.NO	E.Name	Designation
E1	Rupa	Programmere
E_4	Sadat	Consultant

outer join

1) Left outer join (⟕)
2) Right outer join (⟖)
3) Full outer join (⟗)

Example:

R_1

Name	Department
Smith	Sales
Black	Production
white	production

R_2

Department	head
Production	Mary
Purchasing	Brown

[Natural join করলে অযথা কোন Row যদি lost/ delete হয়ে যায়, তাহলে Data ঝুলানোর Dangling tuple]

i) R_1 ⟕ R_2

Name	Department	Head
Smith	Sales	Null
Black	Production	mary
White	Production	mary

ii) R_1 ⟖ R_2

Name	Department	head
Black	Production	Mary
White	Production	Mary
Null	purchasing	Brown

iii) R_1 ⟗ R_2

Name	Department	Head
Smith	sales	Null
Black	Production	mary
white	production	mary
Null	Purchasing	Brown

29.05.2017

Aggregation: Aggregate Function take a collection (column) of values (domain) and return a single value as result.

notation:

$$G\ \mathcal{G}_{F(A)}(R)$$

Here,

$\mathcal{G}$ → aggregate symbol

F → Functions

A → Attribute

R → Relation

G → Group By

Functions can be:

- Max
- MIN
- SUM
- Count
- count-distinct
- Average

Example:

Instructor

ID	Name	Department	Salary
01	Alen	CSE	20,000
21	Brown	EEE	25,000
51	Cook	EEE	35,000
22	Dowson	ME	20,000
43	Erdy	CE	15,000
56	Frank	CSE	40,000
65	Grimson	ME	30,000

1 →

Find the total salary of the Instructors?

$$\mathcal{G}_{sum(salary)}(Instructor)$$

Find the average salary of Instructor according to their department:

$_{Department}\mathcal{G}_{average\ (salary)}$ (Instructore)

Find the number of departments in the instructor relation

$\mathcal{G}_{count-distinct\ (department)}$ (Instructor)

ID	Name	Department	salary
48	Enly	CE	15,000
01	Alem	CSE	20,000
56	Frank	CSE	40,000
21	Brown	EEE	25,000
51	Cook	EEE	35,000
22	Dowson	ME	20,000
65	Grimson	ME	30,000

→ 2

Department	Avg salary
CE	15000
CSE	30,000
→ EEE	30,000
ME	25,000