$R(A \ldots \ldots \ldots)$ $S(B \ldots \ldots \ldots)$

Retrieve A values of R those are more than some B value of S.

every

$\ltimes$ ✓

$\ltimes_c$ ✓

$\times$ ✓

$$\pi_A\left(R \ltimes_{R.A > S.B} S\right)$$

R(A ......)   S(B.......)

Retrieve 'A' values of 'R' those are more than every B value of S.

every → Complementation

$X \equiv$ A values of R > every B value of S

$\bar{X} \equiv \sim$(A values of R > every B values of S)

$\equiv$ (A values of R $\leq$ Some B values of S

Some → $\bowtie$

$\equiv$ (A

$(\sim X)$ ✓

$X = AU - \bar{X} =$ (All possible values of A) $-$ (A value $\leq$ some B values)

$$\checkmark\ \pi_A(R) - \underbrace{\pi_A\left(R \underset{R.A \leq S.B}{\bowtie} S\right)}$$ ✓

Q. Emp(eid, dno, sal)

Retrieve eids whose salary is more than every emp sal of dept 5.

$$(\text{All employees}) - \sim(\text{sal} > \text{every sal of dep } 5)$$

$$(\text{sal} \le \text{some sal of dep } 5)$$

$$= (\text{All employees}) - (\text{sal} \le \text{some sal of dep } 5)$$

$$= \pi_{eid}(emp) - \pi_{eid}\left(Emp \bowtie_{Sal \le S} \rho_{I,D,S}\left(\sigma_{dno=5}(emp)\right) \right)$$

Set difference.

$$U - \overline{X} = X \quad (\sigma - X)$$

Emp(eid, Sal, gen)

Retrieve eids of female employees whose sal more than every Salary of male employees.

all female emp − ~(fem sal > every male salary)

all female emp − (fem sal ≤ Some male salary)

Some → $\bowtie$

one instance

each other instance.

$$\pi_{eid}\left(\sigma_{gen=female}(Emp)\right) - \pi_{eid}\left(\sigma_{gen=female}(Emp) \bowtie_{Sal \le S} \rho_{ISG}\left(\sigma_{gen=male}\, Emp\right)\right)$$

Emp(eid, sal)

max

Retrieve eids who get maximum salary

maximum value is the value which is $\geq$ every other value.

eid who sal $\geq$ every employees salary

$\cong$ universal set $-$ ~(eid whose salary $\geq$ every sal of emp)

$\cong$ universal set $-$ (emp sal $<$ some salary of emp)

$$\pi_{eid}\, emp \;-\; \pi_{eid}\left(Emp \bowtie_{sal < S} \rho_{I\,S}\, Emp \right)$$

$U - \overline{X} = X$

max $\geq$ all

10

20

30

40 $\geq$ $\geq$ $<$

$>$

5 min break ✓

$R(A\ldots\ldots)$ max A

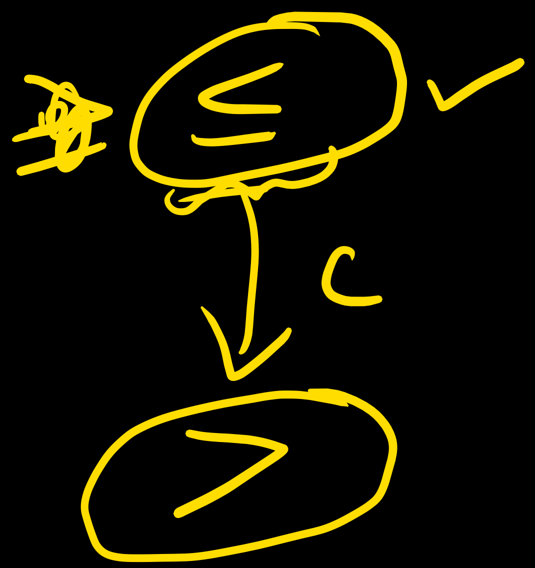
{ A value of R which $\geq$ every A value of R }

{ All A values of R } $-$ { A value of R which are $<$ some A value R }

$$\left(\pi_A(R) - \pi_A\left(R \bowtie_{A<A1} \rho_{A \to A1} R\right)\right)$$

$\checkmark$

minimal



$\left\{\begin{array}{l}\text{eid whose sal} \\ \leq \text{every emp sal}\end{array}\right\} = \left(\begin{array}{l}\text{all eid} \\ \text{of emp}\end{array}\right) - \left\{\begin{array}{l}\text{eid who sal} \\ > \text{some emp sal}\end{array}\right\}$ $\leq$

$$\equiv \pi_{eid}(\text{emp}) - \pi_{eid}\left(\text{Emp} \bowtie_{sal > S} \rho_{IS}(\text{Emp})\right)$$

universal set of Eids

Query for minimum

minimum

↓

Smallest

unique

minimal

↓

Cannot be

reduced

further

↓

not unique

Emp(eid, sal, dno)

Eids ~~that~~ who gets maximum sal for each department.

$>$ $<$ ✓ $\geq \Rightarrow <$ ✓

U

$e_1\ e_2\ e_3\ e_4\ e_5$

$-$

$e_1\ e_3\ e_4$

X

Eid	sal	dno
e_1	40	2
e_2	60	2
e_3	30	2
e_4	30	3
e_5	40	3

Eid	sal	dno
e_1	40	2
e_2	60	2
e_3	30	2
e_4	30	3
e_5	40	3

$X = e_2, e_5$

$e_2 \downarrow 2$, $e_5 \downarrow 3$

$X = \{$ eid whose sal $\geq$ every emp sal of ~~some~~ same dept $\}$

$=$ Universal set of eid's $- \sim \{$ " " $\}$

$=$ all eids $- \{$ eid whose sal $<$ some emp sal of same dept $\}$

$= \pi_{eid}(emp) - \pi_{eid}\left(Emp \bowtie_{Sal<S \cap Dno=D} \rho_{ISD}\, Emp\right)$

and

family (Parent child child DOB)

Parent	child	child DOB
A	B	1995
A	C	✓1998
A	D	1996
E	F	1990
E	G	✓1996

✓ ⟹ youngest child.

Retrieve set of all childs where DOB $\geq$ every child DOB of same parent.

X

Complement

(all child ID's) − ~ (~~Childs~~ child whose DOB ≥ every child DOB of same parent)

= (all child ID's − (child whose DOB < Some ~~every~~ child DOB of same parent)

Condition

Condition

<u>Simple:</u>

→ Two tables.

→ Conditional join on all conditions

→ Rename a table if only one table

→ Subtract from universal ~~table~~ values.

$$\pi_{Child}\ family \;-\; \pi_{Child}\underbrace{\left(family \bowtie_{\substack{Child\,DOB < D \\ \cap\ Parent = P}} \rho_{PCD}\ family \right)}_{\text{Cannot be max.}}$$

Cannot be max.

vvvv imp:

Division (/ ÷ %)

$A\cancel{B} / \cancel{B}$

Enroll

Sid	Cid
S_1	C_1
S_1	C_2
S_1	C_3
S_2	C_1
S_2	C_3
S_3	C_1

$\times C_2$

$C_2\ C_3$

Course

Cid
C_1
C_2
C_3

$\pi_{Sid,\,Cid}(Enroll) \,/\, \pi_{Cid}\, Course$

A

$Sid\ \cancel{Cid} / \cancel{Cid}$

Sid
S_1

attributes in the result are attributes in <u>numerator</u> but not in denominator.

$AB\cancel{CD} \,/\, \cancel{CD}$ AB.

Explanation of / :

$\pi_{sid, cid}(E) \,/\, \pi_{cid}(C) \Rightarrow$ Sids enrolled with every course.

'hint for division

Step I : Sid's not enrolled

E

sid	cid
1	1
1	2
1	3
2	1
2	3
3	1
3	2

~~Course~~ C

cid
1
2
3

$$\pi_{sid\,cid}(E) \,/\, \pi_{cid}(C) = \begin{array}{|c|} \text{sid} \\ \hline 1 \end{array}$$

=

Set of all students who enrolled for every course

$$\pi_{sid\ cid}(E) \;/\; \pi_{cid}(C)$$

Step I: Sids not enrolled for every course. (or) sids enrolled in proper subset of all courses.

$$\underbrace{\pi_{sid}(E) \times \pi_{cid}(C)}_{\text{all possible enrollments of students into the courses}} - \underbrace{\pi_{sid\ cid}(E)}_{\text{students not enrolled in a given course}}$$

$\Downarrow \pi_{sid}$

Students not enrolled in all courses

Step 2:

$$\text{Sids enrolled in every course} = \underbrace{\left(\text{Sid enrolled in some course}\right)}_{\text{universal set}} - \underbrace{\left\{\text{Sid not enrolled for every course}\right\}}_{\text{Step 1}}$$

E

sid	cid
s_1	c_1
s_1	c_2
s_1	c_3
s_2	c_1
s_2	c_2
s_3	c_1

$\pi_{sid}(E) \quad \pi_{cid}(C)$

$$\begin{matrix} s_1 \\ s_2 \\ s_3 \end{matrix} \times \begin{matrix} c_1 \\ c_2 \\ c_3 \end{matrix} =$$

sid	cid
~~s_1~~	~~c_1~~
~~s_1~~	~~c_2~~
~~s_1~~	~~c_3~~
~~s_2~~	~~c_1~~
~~s_2~~	~~c_2~~
s_2	c_3
~~s_3~~	~~c_1~~
s_3	c_2
s_3	c_3

all possible enrollments.

sid	cid
s_2	c_3
s_3	c_2
s_3	c_3

→ students who did not enroll in these course.

sid
s_2
s_3

→ Students who didn't Register in all courses

$$\begin{vmatrix} s_1 \\ s_2 \\ s_3 \end{vmatrix} - \begin{vmatrix} s_2 \\ s_3 \end{vmatrix} = \boxed{s_1} \checkmark$$