Notes 1

Thursday, February 8, 2024 1:11 PM

Division

Compute all x values in A which are disqualified then remove ~~them~~ from A

An x value is disqualified if we attaching a y value from B, we obtain a tuple $\langle x,y \rangle$ ~~that~~ is not in A

compute disqualified tuples

$\pi_x((\pi_x(A) \times B) - A)$

compute non disqualified x values

$\underbrace{\pi_x(A)}_{x \text{ col projected}} - \underbrace{\pi_x((\pi_x(A) \times B) - A)}_{\text{get x values / column projected}}$

example

$\pi_x(A) \times B$

s1 × p2 → s1 p2
s2 → s2 p2 → call C
s3 → s3 p2
s4 → s4 p4

$C - A = \{0\}$ empty relation

$\pi_x(A) - (\text{no x values}) = \underbrace{\pi_x(A)}_{\text{all x values in A}}$

example 2

$\pi_x(\pi_x(A) \times B) - A)$

$\pi_x(A) \times B$

s1	p2
s2	p4
s3	
s4	

⟹

s1	p2
s1	p4
s2	p2
s2	p4
s3	p2
s3	p4
s4	p2
s4	p4

Subtract A ⟹

s2	p4
s3	p4

call D

now do $\pi_x(A) - \pi_x(D) \Rightarrow$ s1 s2 s3 s4 − s2 s3 ⟹ $\boxed{s1, s4}$

example 3

$\pi_x(A) - \pi_x((\pi_x(A) \times B) - A)$

$\pi_x(A) \times B$

s1, s2, s3, s4 × p1, p2, p4 →

s1	p1
s1	p2
s1	p4
s2	p1
s2	p2
s2	p4
s3	p1
s3	p2
s3	p4
s4	p1
s4	p2
s4	p4

−A →

s2	p4
s3	p1
s3	p4
s4	p1

Call E

do $\pi_x(A) - \pi_x(E)$

s1 s2 s3 s4 − s2 s3 s4 → $\boxed{s1}$ Answer

Q1 a) get list of all sid where bid is 103 from Reserves

$\pi_{\cancel{sid}\ sname}((\sigma_{bid=103}(\text{Reserves})) \bowtie \text{Sailors})$

or

$\pi_{sname}(\sigma_{sid\ is\ same}(\pi_{sid}(\sigma_{bid=103}\text{Reserves}) \bowtie \text{Sailors}))$

Q2 don't ~~try to~~ do a join on full ~~tables as that~~ is an expensive action
~~try to~~ do selection on tables to make them smaller

$\pi_{\cancel{sid}\ sname}((\sigma_{color='Red'}\text{Boats}) \bowtie \text{Reserves} \bowtie \text{Sailors})$

Method 2

$\pi_{\cancel{sid}\ sname}(\underbrace{\pi_{sid}(\underbrace{(\pi_{bid}\sigma_{color='Red'}\text{Boats})}_{\text{project bid to check with reserves}} \bowtie \text{Reserves})}_{\text{project sid to check with sailors}} \bowtie \text{Sailors})$

Q3 select ~~boa~~ lubber from Sailors → project sid A
↓
natural join with Reserves → project bid B

natural join with Boats → project bname C
output (C)

$$\underbrace{\pi_{bname}\Big(\underbrace{\pi_{bid}\big(\underbrace{(\pi_{sid}\,\sigma_{sname='Lubber'}\,Sailors)\bowtie Reserves}_{A}\big)}_{B}\bowtie Boats\Big)}_{C}$$

Q4 natural join of Sailors & Reserves leaves only those tuples which are true in the fields for both the relations & relations match
So ~~do~~ do $\pi_{sname}(Sailors \bowtie Reserves)$

Q5 names of (Red or green)
$\rho(Temp, (\sigma_{color='Red'}\,Boats) \cup (\sigma_{color='green'}\,Boats))$
~~Row~~ Temp contains ~~those~~ tuples (with no projections) which have Red or green boats
Now project out of result of Temp
$\pi_{sname}(Temp \bowtie Reserves \bowtie Sailors)$

Method 2
$\rho(Temp, (\sigma_{color='red' \vee color='green'}\,Boats))$

$\pi_{sname}(Temp \bowtie Reserves \bowtie Sailors)$

Q6 AND
$\rho(Temp, (\sigma_{color='red' \wedge color='green'}\,Boats))$
$\pi_{sname}(Temp \bowtie Reserves \bowtie Sailors)$

Correct
$\rho(Temp1, \pi_{sid}((\sigma_{color='red'}\,Boats) \bowtie Reserves))$
$\rho(Temp2, \pi_{sid}((\sigma_{color='green'}\,Boats) \bowtie Reserves))$
$\pi_{sname}((Temp1 \cap Temp2) \bowtie Sailors)$

Q8 division → get [all x from A whose every y in B is covered in those x]

A: x | y B: y
all y covered → all x we get

2 columns from Reserves → one col from Boat
↓
get only one column from Reserves
hence we have all sid which has collection of all bid
return all sid → only the first col

then we get sid → then we get sname after doing a natural join

Q9 first select all interlakes in relation B
A: x, y ← get all (x) — B: y
Compute not all y in B but only specific y

Relational Calculus

Relational algebra : ~~non~~ procedural
Relational Calculus: nonprocedural / declarative
Allows us to describe the set of answers without being explicit about how they should be computed
Tuple Relational Calculus used in SQL
Domain Relational Calculus used in QBE
Query by language → a database query language

Tuple Relational Calculus
A tuple variable takes on tuples of a relation as its values

$\{T \mid p(T)\}$ query form

(1) $\{S \mid S \in Sailors \wedge S.rating > 7\}$

(2) $\{P \mid \exists S \in Sailors(S.rating > 7 \wedge P.name = S.name$

$\wedge\ P.age = S.age)$

(3) $\{P \mid \exists R \in Reserves\ \exists S \in Sailors(R.sid = S.sid \wedge P.name = S.name \wedge P.day = R.day \wedge P.bid = R.bid\}$

Domain Relational Calculus

A domain variable takes on/ranges over the values in the domain of some attribute

DRC query form

$\{\langle x1, x_2 \cdots x_n\rangle \mid P(\langle x1, x_2 \cdots x_n\rangle)\}$

(1) $\{\langle I N T A\rangle \mid \langle I N T A\rangle \in Sailors \wedge T > 7\}$

(2) $\{\langle N\rangle \mid \exists\ I T A(\langle I N T A\rangle \in Sailors \wedge \exists\ Ir\ Br\ D(\langle Ir\ Br\ D\rangle \in Reserves \wedge Ir = I \wedge Br = 103))\}$

$\{\langle N\rangle \mid \exists I, T, A(\langle I, N, T, A\rangle \in Sailors \wedge \exists(Ir\ Br\ D\rangle \in Reserves(Ir = I \wedge Br = 103))\}$

$\{\langle N\rangle \mid \exists I, T, A(\langle I N T A\rangle \in Sailors \wedge \exists D(\langle I\ 103\ D\rangle \in Reserves))\}$

(3) $\{P \mid \exists S \in Sailors\ \exists R \in Reserves(R.sid = S.sid \wedge R.bid = 103 \wedge P.sname = S.sname)\}$

(4) $\{P \mid \exists S \in Sailors\ \exists R \in Reserves(R.sid = S.sid \wedge P.sname = S.sname) \wedge \exists B \in Boats(B.bid = R.bid \wedge B.color = 'red'))\}$

(4) $\{\langle N\rangle \mid \exists I T A(\langle I N T A\rangle \in Sailors \wedge \exists \langle Ir\ Br\ D\rangle \in Reserves \wedge \exists \langle Br\ BN\ 'red'\rangle \in Boats\}$

(5) $\{P \mid \exists S \in Sailors\ \exists R_1 \in Reserves\ \exists R_2 \in Reserves(S.sid = R1.sid \wedge R1.sid = R2.sid \wedge R1.bid \neq R2.bid \wedge P.sname = S.sname\}$

(5) $\{\langle N\rangle \mid \exists I T A(\langle I N T A\rangle \in Sailors \wedge \exists Br1\ Br_2\ D_1 D_2(\langle I\ Br1\ D1\rangle \in Reserves \wedge \langle I\ Br_2\ D_2\rangle \in Reserves \wedge Br1 \neq Br2)\}$

(6) $\{P \mid \exists S \in Sailors\ \forall B \in Boats(\exists R \in Reserves(S.sid = R.sid \wedge R.bid = B.bid \wedge P.sname = S.sname))\}$

(6) $\{\langle N\rangle \mid \exists I T A(\langle I N T A\rangle \in Sailors \wedge \forall B, BN, C(\neg(\langle B, BN, C\rangle \in Boats) \vee (\exists \langle Ir\ Br\ D\rangle \in Reserves(I = Ir \wedge Br = B)))))\}$