Homework 4 - *Relational Algebra*

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Part 1 -

T1

A	Q	R
20	a	5
25	b	8
35	a	6

T2

A	B	C
20	b	6
45	c	3
20	b	5

1.

$T1 \bowtie_{T1.A = T2.A} T2$

T1.A	Q	R	T2.A	B	C
20	a	5	20	b	6
20	a	5	20	b	5

2.

$T1 \bowtie_{T1.Q = T2.B} T2$

A	Q	R	A	B	C
25	b	8	20	b	6
25	b	8	20	b	5

3.

$T1 \bowtie T2$

A	Q	R	B	C
20	a	5	b	6
20	a	5	b	5

4.

$T1 \bowtie_{T1.A = T2.A \,\&\&\, T1.R = T2.C} T2$

T1.A	Q	R	T2.A	B	C
20	a	5	20	b	5

Part 2 -

5 basic relational algebra operators: π, σ, ×, −, ∪

T1

X

T2

X	y

T3

X	y	z

1.

T2⋈T3

Ans: $\sigma_{T2.x = T3.x \wedge T2.y = T3.y}(T2 \times T3)$

2.

$\pi_x(T2) \cap T1$

Ans: $\pi_x(T2) - (\pi_x(T2) - T1)$

3.

$\pi_z(T3 \bowtie_{T3.y == T2.y} T2)$

Ans: $\pi_z(\sigma_{T3.y == T2.y}(T3 \times T2))$

4.

T2 / T1

Ans:
π_y T2 - π_y ((π_y T2) × T1) – T2)

Part 3 -

1. Find the names of any player with an Elo rating of 2850 or higher.

Answer:

$\pi_{\text{Name}} (\sigma_{\text{Elo >= 2850}} (\text{Players}))$

2. Find the names of any player who has ever played a game as white.

Answer:

$\pi_{\text{Players.Name}} (\sigma_{\text{Games.wpID = Players.pID}}(\text{Games} \times \text{Players}))$

3. Find the names of any player who has ever *won* a game as white.

Answer:

$\pi_{\text{Players.Name}} (\sigma_{\text{Games.wpID = Players.pID ^ Games.wpID = "W"}}(\text{Games} \times \text{Players}))$

4. Find the names of any player who played any games in 2018.

Answer:

$\pi_{\text{Players.Name}} (\sigma_{\text{Games.wpID = Players.pID} \vee \text{Games.bpID} = \text{Players.pID}} (\text{Players} \times (\sigma_{\text{Year = 2018}} (\text{Games} \bowtie \text{Events}))))$

5. Find the names and dates of any event in which Magnus Carlsen lost a game.

Answer:

$\pi_{\text{Events.Name, Events.Year}}((\sigma_{\text{Players.Name = "Magnus Carlsen" ^ Games.wpID = Players.pID ^ Games.Result = "B"}}((\text{Games} \bowtie \text{Events}) \times \text{Players}))$

$\cup$

$(\sigma_{\text{Players.Name = "Magnus Carlsen" ^ Games.bpID = Players.pID ^ Games.Result = "W"}}((\text{Games} \bowtie \text{Events}) \times \text{Players})))$

6. Find the names of all opponents of Magnus Carlsen. An opponent is someone who he has played a game against. **Hint**: Both Magnus and his opponents could play as white or black.

Answer:

$\pi_{\text{Players.Name}}(\text{Players} \bowtie ($

$\rho\,(\text{Opponents}_{\text{pId/Games.wpID}}, (\sigma_{\text{Players.Name = "Magnus Carlsen" ^ Games.bpID = Players.pID}}(\text{Games} \times \text{Players})))$

$\cup$

$\rho\,(\text{Opponents}_{\text{pId/Games.bpID}}, (\sigma_{\text{Players.Name = "Magnus Carlsen" ^ Games.wpID = Players.pID}}(\text{Games} \times \text{Players})))$

$))$

7. Find the names of all players who have never lost a game (a draw is not considered a loss).

Answer:

$$\pi_{Players.Name}(Players) - \pi_{Players.Name}($$

$$\sigma_{Games.wpID = Players.pID \wedge Games.Result = "B"}(Players \times Games)$$

$$\cup$$

$$\sigma_{Games.bpID = Players.pID \wedge Games.Result = "W"}(Players \times Games)$$

$$)$$

Part 4 –

1. A)

Name
Jon
Abby

1. B)

We are searching for names of the students who are enrolled in a course and have received a grade other than "C".

2. A)

S2

Name

2. B)

Names of all the students of the same date of birth as Maria except Maria.

3. A)

cName

3. B)

Names of the courses enrolled by all students with the given set of student ID’s.

4.)

ρ (cID_3000_courses, $\pi_{\text{Courses.cId}}(\sigma_{\text{Courses.cID >= 3000 ^ Courses.cID < 4000}}$ (Courses)))

$\pi_{\text{Students.Name}}$ (($\pi_{\text{Enroll.cId, Enroll.sID}}$ (Enroll) / cID_3000_courses) $\bowtie$ Students)

5.)

ρ (steve_courses, $\pi_{\text{Enroll.cId}}(\sigma_{\text{Student.Name == "Steve"}}$ (Students $\bowtie$ Enroll)))

$\pi_{\text{Students.Name}}$ (σ Students.Name != "Steve" (($\pi_{\text{Enroll.cId, Enroll.sID}}$ (Enroll) / steve_courses) $\bowtie$ Students))