Lab 3: Relational Algebra

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Part 1 – Joins

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

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

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

T1.A	Q	R	T2.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. $T1 \bowtie_{T1.A=T2.A \wedge T1.R=T2.C} T2$

A	Q	R	B	C
20	a	5	b	5

Part 2: Chess Queries

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

$$\pi_{Name}(\sigma_{Elo \geq 2850}(Players))$$

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

$$\pi_{Name}(Players \bowtie_{Players.pID=Games.wpID} Games)$$

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

$$\pi_{Name}(Players \bowtie_{Players.pID=Games.wpID} (\sigma_{Result='1-0'}(Games)))$$

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

$$\Pi_{\text{Name}}((\text{Players} \bowtie_{\text{Players.pID=Games.wpID}} (\text{Games} \bowtie_{\text{Games.eID=Events.eID}} (\text{Events}))) \cup (\text{Players} \bowtie_{\text{Players.pID=Games.bpID}} (\text{Games} \bowtie_{\text{Games.eID=Events.eID}} (\sigma_{\text{Year=2018}}(\text{Events})))))$$

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

$$\pi_{Name,Year}((\sigma_{wpID=1 \wedge Result='0-1'}(Games) \bowtie Events) \cup (\sigma_{bpID=1 \wedge Result='1-0'}(Games) \bowtie Events))$$

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.

$$\Pi_{\text{Name}}(\sigma_{\text{pID=MCWhiteOppID}}(\text{Players}) \cup \sigma_{\text{pID=MCBlackOppID}}(\text{Players}))$$

Part 3: LMS Queries

Part 3.1

a) Provide the relation that is the result of the following query. Your relation should be in the form of a table, and should include the schema.

- $\rho(C, \pi_{sid}(\sigma_{Grd=C}(Enrolled)))$
- $\pi_{Name}((\pi_{sid}(Enrolled) - C) \bowtie Students)$

Name VARCGAR(255)
Hermione
Harry

b) Provide a simple English description of what the query is searching for. Your description should be in general terms (remember that the original LMS instance data may change).

This query finds the names of the students who have never received grade C.

Part 3.2

a) Provide the relation that is the result of the following query. Your relation should be in the form of a table, and should include the schema.

- $\rho(S1, Students)$
- $\rho(S2, Students)$
- $\pi_{S2.Name}(\sigma_{S1.Name==Ron \wedge S1.DOB==S2.DOB \wedge S2.name!=Ron}(S1 \times S2))$

S2.Name VARCHAR(255)
Hermione

b) Provide a simple English description of what the query is searching for. Your description should be in general terms (remember that the original LMS instance data may change).

This query finds the names of the student who have the same DOB as Ron

Part 3.3

a) Provide the relation that is the result of the following query. Your relation should be in the form of a table, and should include the schema.

- $\pi_{cName}((\pi_{cID,sID}(Enroll)/\pi_{sID}(Students)) \bowtie Courses)$

Courses.Name VARCHAR(255)

b) Provide a simple English description of what the query is searching for. Your description should be in general terms (remember that the original LMS instance data may change).

This query finds the names of the courses that had every student enrolled in it.

Part 4

Provide a relational algebra query that uses the divide operator to find the names of all students who are taking all of the 3xxx-level classes.

$$\sigma(Level3kCourses, (\sigma_{cID \geq 3000 \wedge cID < 4000}(Courses)))$$

$$\sigma(Level3kSIDs, \Pi_{cID,sID}(Courses/Level3kCourses))$$

$$\Pi_{Name}(\sigma_{Level3kSIDs.sID=Students.sID}(Level3kSIDsXStudents))$$