



EECS3421, Section: M, Winter 2019

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Grace Days Used: 1

1. No team can play against itself.

Ans: $\sigma_{\text{country1}=\text{country2}}(\text{Competes}) = \emptyset$

2. All tickets for a match have to be purchased before the time of the match.

Ans: $\sigma_{(\text{dateIssued}>\text{date}) \vee ((\text{dateIssued}=\text{time}) \wedge (\text{timeIssued}>\text{time}))}(\text{Match} \bowtie \text{Ticket}) = \emptyset$

3. The number of tickets purchased for a match should not exceed the capacity of the stadium where the match takes place.

Ans: "Cannot be Expressed"

4. A coach can only coach one team.

Ans: $\rho_{c1}(\text{Team}) \bowtie_{(c1.coach=c2.coach \wedge c1.country \neq c2.country)} \rho_{c2}(\text{Team}) = \emptyset$

5. A player's position should be one of 'G', 'D', 'M' or 'S' representing a goalkeeper, defender, midfielder or striker, respectively.

Ans: $\sigma_{\text{position} \notin \{'G','D','M','S'\}}(\text{Player}) = \emptyset$

Part 2

// represents a comment

QUESTION 1

A := $\pi_{\text{country}}(\text{Team}) \times \pi_{\text{SID}}(\text{Stadium})$ // all possible pairs of team and stadium

B := $\pi_{\text{country}, \text{SID}}((\text{Match} \bowtie \text{Competes}) \bowtie \text{country1}=\text{country} \vee \text{country2}=\text{country}(\text{Team}))$

//all teams that have played joined with stadium venues

C := $\pi_{\text{country}, \text{SID}}(\text{B} \bowtie \text{Stadium})$ // pair of teams and stadiums, that occurred

D := $\pi_{\text{country}}(\text{A} - \text{B})$ // failures, these countries have not played in all stadiums

Final = $\pi_{\text{country}}(\text{Team}) - \text{D}$ // these countries have played in all the stadiums

QUESTION 2

"Cannot be Expressed"

QUESTION 3

A := $\text{Competes} \bowtie \text{Match}$ // all the countries that have played a match

//players of the countries (teams) that have played

B := $\text{A} \bowtie \text{country1}=\text{country} \vee \text{country2}=\text{country}(\text{Player})$

// subtracting above from all the players gives player that have not played in any match

Final = $\pi_{\text{PID}}(\text{Player}) - \pi_{\text{PID}}(\text{B})$

QUESTION 4

M1 := $\rho_{\text{MID1} \leftarrow \text{MID}, \text{date1} \leftarrow \text{date}, \text{time1} \leftarrow \text{time}}(\text{Match})$

M2 := $\rho_{\text{MID2} \leftarrow \text{MID}, \text{date2} \leftarrow \text{date}, \text{time2} \leftarrow \text{time}}(\text{Match})$

A := $(\text{M2}) \bowtie (\text{M1})$

B := $\sigma_{\text{MID1} \neq \text{MID2}}(\text{A})$ // stadium where at least two matches took place

M := $\text{Match} \bowtie \text{Stadium}$ // stadiums where at least one match took place

$$\text{Final} = \pi_{\text{SID}} (\text{M}) - \pi_{\text{SID}} (\text{B})$$

QUESTION 5

// this problem is approached as in finding max, the max here is represented by the following condition:

// goals11-goals22 > goals1-goals2 \vee goals22-goals11 > goals1-goals2

$$\text{A} := \rho_{\text{MID1} \leftarrow \text{MID}, \text{country11} \leftarrow \text{country1}, \text{country22} \leftarrow \text{country2}, \text{goals11} \leftarrow \text{goals1}, \text{goals22} \leftarrow \text{goals2}} (\text{Competes})$$

$$\text{B} := \pi_{\text{MID}} (\sigma_{\text{goals11-goals22} > \text{goals1-goals2} \vee \text{goals22-goals11} > \text{goals1-goals2}} (\text{A} \times \text{Competes}))$$

$$\text{C} := \pi_{\text{MID}} (\text{Match}) - \text{B} \quad // \text{C is desired match}$$

$$\text{D} := \text{C} \bowtie \text{Competes}$$

$$\text{E} := \text{D} \bowtie_{\text{country1=country}} \text{Team} \quad // \text{E is first country that played in our desired match}$$

$$\text{F} := \text{D} \bowtie_{\text{country2=country}} \text{Team} \quad // \text{E is other country that played in our desired match}$$

$$\text{Final} = \pi_{\text{coach}} (\text{E}) \cup \pi_{\text{coach}} (\text{F}) \quad // \text{coaches of the above countries (teams)}$$

QUESTION 6

$$\text{A} := \sigma_{\text{position}='D'} (\text{Player}) \quad // \text{players at position D}$$

$$\text{M} := \rho_{\text{goals1} \leftarrow \text{goals}, \text{PID1} \leftarrow \text{PID}, \text{fname1} \leftarrow \text{fname}, \text{lname1} \leftarrow \text{lname}, \text{position1} \leftarrow \text{position}, \text{goals1} \leftarrow \text{goals}, \text{country1} \leftarrow \text{country}} (\text{A})$$

$$\text{B} := \sigma_{\text{goals1} > \text{goals}} (\text{A} \bowtie \text{M})$$

$$\text{C} := \text{Player} \bowtie (\pi_{\text{PID}} (\text{A}) - \pi_{\text{PID}} (\text{B})) \quad // \text{player at position D with maximum goals}$$

$$\text{Final} = \pi_{\text{fname}, \text{lname}} (\text{C})$$

QUESTION 7

// First, very first ticket was founded, approached by finding the ticket with the minimum date (oldest ticket)

$\text{Ticket1} := \rho_{\text{TID1} \leftarrow \text{TID}, \text{dateIssued1} \leftarrow \text{dateIssued}, \text{timeIssued1} \leftarrow \text{timeIssued}, \text{MID1} \leftarrow \text{MID}} (\text{Ticket})$

$\text{A} := \pi_{\text{TID}} (\sigma_{\text{dateIssued1} < \text{dateIssued} \vee (\text{dateIssued1} = \text{dateIssued} \wedge \text{timeIssued1} < \text{timeIssued})} (\text{Ticket} \times \text{Ticket1}))$

$\text{B} := \pi_{\text{TID}} (\text{Ticket}) - \text{A}$ // Very first ticket

$\text{C} := \pi_{\text{MID}} (\text{Ticket} \bowtie \text{B})$ // Match (desired) for very first ticket

$\text{D} := \text{Competes} \bowtie \text{C}$

// the queries below find the winning country for the desired match

$\text{E} := \rho_{\text{country} \leftarrow \text{country1}} (\pi_{\text{country1}} (\sigma_{\text{goals1} > \text{goals2}} (\text{D})))$ // country1 won if goals1 > goals2

$\text{F} := \rho_{\text{country} \leftarrow \text{country2}} (\pi_{\text{country2}} (\sigma_{\text{goals2} > \text{goals1}} (\text{D})))$ // country2 won if goals2 > goals1

// the union of E and F would give the winning country as one would be empty set and the other would
// contain winning country

$\text{Final} = \text{E} \cup \text{F}$

QUESTION 8

// first we find the player of Spain with maximum goals

$\text{A} := \sigma_{\text{country} = \text{'Spain'}} (\text{Player})$ // Spanish team

$\text{B} := \rho_{\text{goals1} \leftarrow \text{goals}, \text{PID1} \leftarrow \text{PID}, \text{fname1} \leftarrow \text{fname}, \text{lname1} \leftarrow \text{lname}, \text{position1} \leftarrow \text{position}, \text{goals1} \leftarrow \text{goals}, \text{country1} \leftarrow \text{country}} (\text{Player})$

$\text{C} := \sigma_{\text{country1} = \text{'Spain'}} (\text{B})$

$\text{D} := \text{A} \bowtie \text{C}$

$\text{E} := \sigma_{\text{goals1} > \text{goals}} (\text{D})$

$\text{G} := \pi_{\text{PID}, \text{fname}, \text{lname}, \text{position}, \text{goals}, \text{country}} (\text{E})$

$\text{F} := \text{A} - \text{G}$ // F has Spanish top scorer

$\text{H} := \text{A} - \text{F}$ // H is Spanish team without the top scorer

// now again we find the top scorer which now would be the second top scorer

$I := \rho_{\text{goals2} \leftarrow \text{goals}, \text{PID2} \leftarrow \text{PID}, \text{fname2} \leftarrow \text{fname}, \text{lname2} \leftarrow \text{lname}, \text{position2} \leftarrow \text{position}, \text{goals2} \leftarrow \text{goals}, \text{country2} \leftarrow \text{country}} (\mathbf{H})$

$J := I \bowtie H$

$K := \sigma_{\text{goals2} > \text{goals}} (J)$

$L := \pi_{\text{PID}, \text{fname}, \text{lname}, \text{position}, \text{goals}, \text{country}} (\mathbf{K})$

$M := H - L$ // Top (second) scorer

$\text{Final} := \pi_{\text{fname}, \text{lname}} (\mathbf{M})$

QUESTION 9

$\text{Ticket1} := \rho_{\text{TID1} \leftarrow \text{TID}, \text{dateIssued1} \leftarrow \text{dateIssued}, \text{timeIssued1} \leftarrow \text{timeIssued}} (\mathbf{Ticket})$

$\text{Ticket2} := \rho_{\text{TID2} \leftarrow \text{TID}, \text{dateIssued2} \leftarrow \text{dateIssued}, \text{timeIssued2} \leftarrow \text{timeIssued}} (\mathbf{Ticket})$

$A := \mathbf{Ticket1} \bowtie \mathbf{Match} \bowtie \mathbf{Ticket2}$

$B := \sigma_{\text{TID1} \neq \text{TID2}} (A)$ // two different tickets for the same match (represents at least two)

$C := \sigma_{\text{dateIssued1} = \text{date} \wedge \text{dateIssued2} = \text{date}} (B)$ // tickets were bought on the same date as of match

$\text{Final} = \pi_{\text{MID}} (C)$

QUESTION 10

// to solve this problem, first we need to find the teams that won at least once. We use competes dataset for that to find the team that won at least once.

$A := \rho_{\text{country} \leftarrow \text{country1}} ((\pi_{\text{country1}} (\sigma_{\text{goals1} > \text{goals2}} (\mathbf{Competes}))))$

$B := \rho_{\text{country} \leftarrow \text{country2}} ((\pi_{\text{country2}} (\sigma_{\text{goals2} > \text{goals1}} (\mathbf{Competes}))))$

$C := A \cup B$ // all teams that won at least once

// now we find the top scorers of all these teams

$D := \pi_{\text{country}, \text{goals}, \text{position}, \text{PID}} (C \bowtie \mathbf{Player})$ // players in teams that won at least once

$E := \pi_{\text{country1}, \text{PID1}, \text{goals1}, \text{position1}} (\rho_{\text{country1} \leftarrow \text{country}, \text{PID1} \leftarrow \text{PID}, \text{position1} \leftarrow \text{position}, \text{goals1} \leftarrow \text{goals}} (D)) (\mathbf{Player})$

// this query below returns the players that are not top scorers of the desired teams

$F := \pi_{PID} (\sigma_{goals1 > goals} (\sigma_{country1 = country} (D \times E)))$

$G := \pi_{PID} (Player) - F$ // top (scorers) players of desired teams

// getting our info by joining our desired players from G with Player dataset, and then joining with
// the teams

$H := (Player \bowtie G) \bowtie C$

$Final = \pi_{country, position, goals} (H)$

