EECS 3421 M
Assignment-1

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Integrity constraints

- Player[country] ⊆ Team[country]
- Match[SID] ⊆ Stadium[SID]
- Ticket[MID] ⊆ Match[MID]
- Competes[MID] ⊆ Match[MID]
- Competes[country1] ⊆ Team[country]
- Competes[country2] ⊆ Team[country]

Part-1

1. No team can play against itself

Ans: Can't be expressed

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

Ans: Ticket[TID] ⊆ Match[time]

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

Ans: Ticket[TID] ⊆ Stadium[Capacity]

4. A coach can only coach one team

Ans: Team[Country] ⊆ Team[Coach]

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

Ans:

Can't be expressed

Can be specified like this:

Player[position] ⊆ G
Player[position] ⊆ D
Player[position] ⊆ M
Player[position] ⊆ S

Part-2

1. Report the country of the team that has played in every stadium. If there are ties report all of them.

   $\pi_{country}$ (Team) × stadium
   ($\pi_{country}$ (Team) × stadium) - (Team)
   ($\pi_{country}$ (($\pi_{country}$ (Team) × stadium) - (Team)))
   ($\pi_{country}$ (Team) - ($\pi_{country}$ ((($\pi_{country}$ (Team) × stadium) - (Team)))) [ANS]

2. Report the MID of the match for which the highest number of tickets was purchased. If there are ties report all of them.

ANS: Cannot be expressed.
In this problem we need count the highest number of tickets, which requires an arithmetic operation, which can't be expressed in relational algebra because there is no operator to count. It can however be expressed in SQL but in relational algebra it cannot be expressed.

3. Report the PID(s) of the player(s) of the team(s) that didn't play in any match.

   $D := \pi_{country}(\rho_{country2 \rightarrow country}(Competes))$
   $F := \pi_{country}(\rho_{country1 \rightarrow country}(Competes))$
   $E := \pi_{country}(Team)$
   $F := E - (D \cup F)$

   $\pi_{PID}(F \bowtie \sigma_{(country=F)}\ Players)$. [ANS]

4. Report the SID(s) of the stadium(s) where exactly one match took place.

ANS: Cannot be expressed.
Inexpressible because in order to write the relational algebra for this query we need to count the total amount of matches that were in each stadium and this is not possible in relational algebra. However it is very much possible in SQL using the count operator.

5. Report the coaches of the teams with the highest difference in the number of goals when competed with each other at a match. If there are ties, report all of them.

ANS: Cannot be expressed.

In this problem we need to count the highest difference of goals which requires an arithmetic operation, which can't be expressed in relational algebra because there is no operator to count. It can however be expressed in SQL but in relational algebra it cannot be expressed.

6. Report the fname and lname of the players whose position is 'D' and have scored the largest number of goals among all players (in any team) who play at the same position.

$A := (\sigma_{(position="D")}(Player))$

$B := (\pi_{goals} A) - \pi_{goals} (\sigma_{(goals1>goals)}(Player * \rho_{PID \rightarrow Pid1,\ fname \rightarrow fname1, lname \rightarrow lname1, position \rightarrow position1, goals \rightarrow goals1, country \rightarrow county1} A)))$

$\pi_{fname,\ lname,\ goals}(A \bowtie B)$ [Answer]

7. Find the winner country of the match for which the very first ticket out of all the tickets in the database was purchased. If there was a tie in the match, report nothing.

Π_{TID} (Ticket)

$\sigma_{Country}(\pi_{MID,date}(Match) \bowtie_{MID,\ date} = (\sigma_{goals1>goals2}(\pi_{MID}(Competes) \bowtie \pi_{MID}(Ticket)))$

8. Report the fname and lname of the player of the country 'Spain' with the second largest number of goals among players of that country.

$A := (\sigma_{(country="Spain")}(Player))$

$C := (\pi_{goals} A) - \pi_{goals} (\sigma_{(goals1>goals)}(Player * \rho_{PID \rightarrow pid1, fname \rightarrow fname1, lname \rightarrow lname1, position \rightarrow position1, goals \rightarrow goals1, country \rightarrow county1} A)))$

$D := Player \bowtie C$

$B := A - D$

$Z = (\pi_{goals} B) - \pi_{goals} (\sigma_{(goals1>goals)}(Player * \rho_{PID \rightarrow Pid1, fname \rightarrow fname1, lname \rightarrow lname1, position \rightarrow position1, goals \rightarrow goals1, country \rightarrow county1} B)))$

$\pi_{fname,\ lname}(A \bowtie Z)$ [Answer]

9. Report the MID(s) of the matches for which at least two tickets were bought on the date of the match.

ANS: Cannot be expressed.

In this problem we need to count the number of tickets which requires an arithmetic operation, which can't be expressed in relational algebra because there is no operator to count. It can however be expressed in SQL but in relational algebra it cannot be expressed.

10. Consider all teams that have won at least one match. For each of these teams, report its country, the position of its player with the largest number of goals and the number of goal she/she has scored

$\pi_{country}(Team) \bowtie_{country} \pi_{position}(Player) \bowtie (\pi_{goals>goals1}(\sigma_{goals1>goals2} \cup goals2 > goals1 (Competes) \bowtie_{playerA=playerB} (\sigma_{goals1>goals2 \cup goals2>goals1}(Competes))))$.

[ANS]