EECS 3421 M

ASSIGNMENT #01

Team members:

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Grace days used : 0

Part 1

1. Cannot be expressed.

2. $\pi_{dateIssued,\ timeIssued}(Ticket) \subseteq \pi_{date,\ time}(Match)$

3. $\pi_{TID}(Ticket) \subseteq \pi_{capacity}(Stadium)$

4. $\rho_{T1}(Team) \bowtie_{(T1.country = T2.country \wedge T1.coach \neq T2.coach)} \rho_{T2}(Team))$

5. Cannot be expressed.

Note: for part 2, some of the assignment statements have names constituting underscores (_) between two words since names have been chosen in accordance to their assignments.

// lines are comments in the answers below

Part 2

1.

// A is cross-product of every stadium and country.

1) A := $\pi_{country}$(Team) × π_{SID}(Stadium)

// making country1 and MID pairs.

2) C1 := $\rho_{country1 \text{ —> } country,\ MID}$($\pi_{country1,\ MID}$(competes))

// making country2 and MID pairs.

3) C2 := $\rho_{country2 \text{ —> } country,\ MID}$($\pi_{country2,\ MID}$(competes))

// all_countries_who_played is union of all opponents in the competes relation

4) all_countries_who_played := C1 U C2

// schema is :- all_countries_who_played(country, MID)

5) stadium_country_played :=

$\pi_{country,\ SID}$(all_countries_who_played ⋈ Match)

// stadium_country_played consists of stadium-country pairs that played.

6) countries_not_all_stadium :=

A — (stadium_country_played)

// countries_all_stadium is list of all countries who have played in every stadium

7) countries_all_stadium :=

$\pi_{country}(A) — \pi_{country}(countries\_not\_all\_stadium)$

2. Cannot be expressed.

3.

1) A := $\pi_{country}(Team) - \pi_{country1 \text{ —>} country}(competes)$

2) B := $\pi_{country}(Team) - \pi_{country2 \text{—>} country}(competes)$

// C is countries that didn't play in any matches.

3) C := $\pi_{country}(Team) - (A \cup B)$

// Players_no_match represents players that didn't play any match

4) Players_no_match := $\pi_{PID}(Player \bowtie C)$

4.

1) A := $\pi_{SID,MID}$(Stadium ⋈ Match)

   // A will confirm that A.SID represents the SID of stadium where at least one match took place.

   // B and C are used for cross-product below.

2) B := $\rho_{SID,MID \rightarrow SID1,MID1}$(A)

3) C := $\rho_{SID,MID \rightarrow SID2,MID2}$(A)

   // D lists all stadiums with more than one match.

4) D := $\sigma_{SID1 = SID2 \wedge MID1 \neq MID2}$(B × C)

5) stadium_exactly_one_match :=

   π_{SID}(Stadium) – $\rho_{SID1 \rightarrow SID}(\pi_{SID1}$(D))

5.

Cannot be expressed.

6.

1) list_of_players := $\pi_{fname,\ lname,\ position,\ goals}$(Team ⋈ Player)

   //schema is :- list_of_players(fname, lname, position, goals)

2) D_position_players :=

   $\pi_{fname,\ lname,\ goals}(\sigma_{position\ =\ \text{“D”}}$(list_of_players))

   // schema is :- D_position(fname, lname, goals)

3) D1 := $\rho_{fname,\ lname,\ goals\ \text{—>}\ f1,\ l1,\ g1}$(D_position)

4) D2 := $\rho_{fname,\ lname,\ goals\ \text{—>}\ f2,\ l2,\ g2}$(D_position)

5) all_except_max_goals :=

   $\rho_{f1,\ l1\ \text{—>}\ fname,\ lname}(\pi_{f1,\ l1}(\sigma_{g1\ <\ g2}$(D1 × D2)))

6) max_goal_player :=

   $\pi_{fname,\ lname}$(player) — all_except_max_goals

7.

Part 7.1: getting the first-ticket

1) $T := \pi_{TID,\ dateIssued,\ MID}(Ticket)$

2) $T1 := \rho_{TID,\ dateIssued,\ MID \text{ —> } TID1,\ d1,\ MID1}(T)$

// schema is T1(TID1,d1,MID1)

3) $T2 := \rho_{TID,\ dateIssued,\ MID \text{ —> } TID2,\ d2,\ MID2}(T)$

// schema is T2(TID2,d2,MID2)

4) $T3 := \pi_{TID1,\ d1,\ MID1}(\sigma_{d1 > d2}(T1 \times T2))$

5) $first\_ticket := T - \rho_{TID1,\ d1,\ MID1 \text{ —> } TID,\ dateIssued,\ MID}(T3)$

Part 7. 2 : computing winner of match of first ticket

1) opponents :=

$\pi_{country1,\ country2,\ goals1,\ goals2}(competes \bowtie first\_ticket)$

// winner_country will have union meaning either of two

2) winner_country :=

$(\rho_{country1 \text{ —> } country}(\pi_{country1}(\sigma_{goals1 > goals2}(opponent)) \cup$

$(\rho_{country2 \text{ —> } country}(\pi_{country2}(\sigma_{goals2 > goals1}(opponent))$

8.

1) Players_Spain := $\pi_{fname,\ lname,\ goals}$(Player $\bowtie_{country = \text{“Spain”}}$ Team)

// schema is :- Players_Spain(fname, lname, goals)

2) P1 := $\rho_{fname,\ lname,\ goals \text{ —> } f1,\ l1,\ g1}$(Players_Spain)

3) P2 := $\rho_{fname,\ lname,\ goals \text{ —>} f2,\ l2,\ g2}$(Players_Spain)

4) Players_Spain_except_highest := $\rho_{f1,\ l1,\ g1 \text{ —> } fname,\ lname,\ goals}(\pi_{f1,\ l1,\ g1}(\sigma_{g1 < g2}(P1 \times P2)))$

5) P3 := $\rho_{fname,\ lname,\ goals \text{ —> } f1,\ l1,\ g1}$(Players_Spain_except_highest)

6) P4 := $\rho_{fname,\ lname,\ goals \text{ —> } f2,\ l2,\ g2}$(Players_Spain_except_highest)

7) P5 := $\pi_{f1,\ l1,\ g1}(\sigma_{g1 < g2}(P3 \text{ X } P4))$

8) Players_Spain_second_highest :=

$\pi_{fname,\ lname}$ (Players_Spain_except_highest —

$\rho_{f1,\ l1,\ g1 \text{ —> } fname,\ lname,\ goals}$(P5))

9.

1) $A := \pi_{MID,\ date}(Match)$

2) $B := \pi_{TID,\ dateIssued,\ MID}(Ticket)$

3) $Ticket\_sold\_date\_match := \pi_{MID,\ TID}(\sigma_{date\ =\ dateIssued}(A \bowtie B))$

4) $T1 := \rho_{MID,\ TID\ \text{—>}\ MID1,\ TID1}(Ticket\_sold\_date\_match)$

5) $T2 := \rho_{MID,\ TID\ \text{—>}\ MID2,\ TID2}(Ticket\_sold\_date\_match)$

6) $at\_least\_two\_tickets :=$

$$\rho_{MID1\text{—>}\ MID}(\pi_{MID1}(\sigma_{MID1\ =\ MID2\ \wedge\ TID1\ \neq TID2}(T1 \times T2)))$$

10.

Part 10.1 : all teams who have won at least one match

1) countries_list := $\pi_{country}$(Team)

// schema is :- countries_list (country)

2) opponent_1 := $\rho_{country \rightarrow C1}$(countries_list)

3) opponent_2 := $\rho_{country \rightarrow C2}$(countries_list)

4) country_pairs := opponent_1 X opponent_2

//schema is :- country_pairs (C1, C2)

5) Match_list := $\pi_{country1,\ country2,\ goals1,\ goals2}$(competes)

//schema is :- Match_list (country1, country2, goals1, goals2)

6) Countries_who_played :=

country_pairs $\bowtie_{c1 = country1\ \wedge\ c2 = country2}$ (competes)

// schema is :- countries_who_played(c1, c2, country1, country2, goals1, goals2)

7) country_lost_all := $\pi_{country1}(\sigma_{goals1 < goals2}$(countries_who_played)

// schema is :- coutnry_lost_all (country1)

8) countries_win_at_least_one_match :=

$\pi_{country}$(Team) — $\rho_{country1 \text{ —> } country}$(country_lost_all)

// schema is :- countries_won_at_least_one_match (country)

Part 10.2:

1) winning_team_players :=

$\pi_{PID, position, goals, country}$(players ⋈

countries_win_at_least_one_match)

2) W1 :=

$\rho_{PID, position, goals, country \text{ —> } PID1, P1, G1, C1}$(winning_team_players)

3) W2 :=

$\rho_{PID, position, goals, country \text{ —> } PID2, P2, G2, C2}$(winning_team_players)

4) players_without_highest :=

$(\sigma_{G1 < G2}(\sigma_{C1 = C2 \text{ ^ } PID1 \neq PID2}$(W1 × W2)))

//schema is :- players_without_highest (PID1, P1, G1, C1, PID2, P2, G2, C2)

5) highest_goal_players :=

$$\pi_{country,\ position,\ goals}\ (\ winning\_team\_players\ -$$

$$\rho_{PID1,\ P1,\ G1,\ C1\ \rightarrow\ PID,\ position,\ goals,\ country}(\pi_{PID1,\ P1,\ G1,\ C1}$$

(Players_without_highest)))