Course Id: IT60113 Advanced Database Systems (Mid Sem Exam)

Date: September 15, 2010   **Total Time: 2 Hours**
Max. Marks: 60

Instructions: Answer all questions. You may answer the questions in any order. However, all parts of the same question must be answered together. Clearly state any reasonable assumption you make.

1. FIFA wants to maintain data about various teams and matches played in the World Cup Soccer tournament. Each team is identified by the country name, which is unique. Other attributes of a team are jersey color and current FIFA ranking, which is also unique. Each team has a number of players one of whom is the captain. For each player, a player id has to be maintained which is unique. Consider another two attributes of player as you feel appropriate, one of which should be multi-valued. It is also required to maintain the details of the coach of each team like his name (which is unique across all teams), date of birth, and salary in dollars. For each match, the date of the match, names of the teams and the team that won the match should be maintained (Assume each match has a decisive score, i.e., no match is drawn) along with the final score (like 2-1, 1-0, etc.). For each player, we have to maintain the number of goals scored in different matches

    (a) Draw an E-R diagram to represent the E-R model for the above situation. Clearly identify primary and candidate keys of entity sets, cardinality and participation.
    (b) Draw the corresponding relational model clearly identifying primary and foreign keys. The number of relations should be minimum
    (c) Based on the above schema, express the following queries using SQL.
        (i)   Name of each player and the number of goals he scored in the tournament
        (ii)   Names of the teams who have scored more than 20 goals in the tournament
    (d) Represent the following queries as relational algebra expressions
        (i)   Names of countries whose coaches earn more than $100,000
        (ii)   Names of countries with FIFA ranking < 5 who have defeated Brazil.
                                                                        [5+2+[2+2]+[2+2]=15]

2. Consider two tables: Team (Team_id, Team_Goals_Scored) and Player (Player_id, Team_id, Player_Goals_Scored). Whenever there is any insert or update in the Player table, the column Team_Goals_Scored in the Team table should be updated for the team to which the player belongs. On the other hand, whenever there is any update in the Team_Goals_Scored column of the Team table, we need to see if the updated value matches with the total number of goals from the Player table for that country. If the two do not match, the transaction should be rolled back.
    (a) Write appropriate STARBURST active rules to handle the above requirement. You may assume that the Team table initially contains one row for each team with Team_Goals_Scored column value set to zero.
    (b) Justify whether the set of rules will achieve termination.
                                                                        [12+3=15]

3. Consider a temporal database table be defined as follows.

    CREATE TABLE Employee (Name CHAR(30), Salary INTEGER, Designation CHAR(30))
    AS VALID STATE DAY AND TRANSACTION

    (a) Assume that the table is initially empty and today (i.e., 15/09/2010) you are inserting tuples in the table. Write an INSERT statement to insert information about Samir whose salary is 5000 and designation is Lecturer. Similarly, consider that you also inserted data for Manish with salary 5000, designation Lecturer, Anup with salary 4000 designation Reader and Priya with salary 6000, designation Lecturer. (You do not need to write insert statements for the last three. Assume you used the same insert statement as used for Samir and only changed the data values).
    (b) What would be the output of the Temporal SQL query "SELECT * FROM Employee" if
        (i) it is executed today after you inserted the rows and
        (ii) it is executed on 18/09/2010
    (c) On 19/09/2010, you come to know that Samir's salary will become 6000 from 21/09/2010.
        (i) What Temporal SQL statement would you write to put this information in the database on 19/09/2010?
        (ii) What would be the output if you execute the Temporal SQL query "SELECT salary, count(*) FROM Employee GROUP BY salary" on 22/09/2010?

    [3+[3+3]+[3+3]=15]

4. Consider three Datalog base predicates: student (Name, Dept, Program), registration (Name, Course, Grade) and core_course (Dept, Course).
    (a) Write Datalog rule(s) to derive the names of students who have registered for all the core courses of the it department and got grades greater than 6.0 in each of them.
    (b) Justify why your Datalog program is safe.
    (c) Write corresponding relational algebra expression(s).

    [9+2+4=15]