Short Question

Question 1. [10 marks]

Define $R \otimes S$ (R XOR S) as the relation which contains tuples that belong to either R or S but to both R and S. Assume that both R and S have the same schema, (A, B) and they are "XOR compatible", wherever applicable:

(a) Can you express $R \otimes S$ in terms of the basic relational operations? If yes, then show your expressions. If no, explain why and what is missing.

(b) Can you express $R \otimes S$ in SQL? If yes, then show your SQL. If no, explain why and what is missing.

Schema for Relational Algebra and SQL queries:

Consider following schema for *sailors-boats-reserves.*

The database stores the information about sailors who have reserved boats.

The database has following three relations with primary keys underlined and attribute domain listed besides the attribute name:

sailors (sid: integer, sname: string, rating: real, age: real)
boats (bid: integer, bname: string, color: string)
reserves (sid: integer, bid: string, day: date)

Relational Algebra

Answer the following queries in Relational Algebra. If the query cannot be expressed in Relational Algebra, briefly explain the reason for it.

Question 2. [5 marks] Find the id of the sailors whose rating is better than some sailor called 'Bob'.

Question 3. [5 marks] Find the names of the sailors who have reserved all boats called ‘BigBoat’.

Question 4. [3 marks] Find the ids of the sailors who have reserved the highest number of green boats.

Question 5. [7 marks] Find the names of the sailors
who have reserved every boat reserved by those with a lower rating.

Question 6. [5 marks] Find the name and age of the oldest sailor.

SQL

Answer the following queries in SQL.

Question 7. [3 marks] Find the names of sailors who have reserved a red boat, and list in the descending order of age.

Question 8. [5 marks] Find the names of sailors who have reserved all the boats.

Question 9. [5 marks] For each boat which was reserved by at least 5 distinct sailors, find the boat id and the average age of sailors who reserved it. **For this question only, Do Not use subquery**.

Question 10. [7 marks] Create a view named `RatingDiffrence`. In this view, store the difference between the average rating of sailors who reserved red boat and the average rating of all sailors (including ones who reserved red boat). Using this view, find the ***name and rating of all the sailors*** who have ***not*** reserved a boat whose name includes string "thunder" and whose rating is more than `RatingDiffrence`.

Space for scratch work. Anything written on this page will not be marked.