• Read Sections 6.1, 6.2, 6.3, 6.4 (if you have not done so already) and also sections 3.1 and 3.2 of the textbook.

• Exercise 6.1.5 parts a), c), and d) only; Exercise 6.1.6; Exercise 6.4.6 parts a), b), c), d), and e) only.

• Problem 1: Recall again the beer drinkers database consisting of information about drinkers, beers, and bars telling which drinkers like which beers, which drinkers frequent which bars, and which bars serve which beers and at what prices. In the first previous homework assignment you had to give an appropriate relational database schema for this database.

Give relational calculus expressions and also SQL expressions for the following queries:

1. “List all bars that serve a beer that Joe Mug likes for under $3.25”
2. “List all bars that serve at least two different beers that Joe Mug likes.”

• Problem 2: Recall that the semijoin \( R \bowtie S \) of two relations \( R \) and \( S \) is the relation consisting of all tuples \( t \) in \( R \) such that there is at least one tuple in \( S \) that agrees with \( t \) in all attributes that \( R \) and \( S \) have in common.

Assume now that the attributes of \( R \) are \( A, B, C \) and the attributes of \( S \) are \( B, C, D \). Give a relational calculus expression for \( R \bowtie S \).

• Problem 3. The Computing Research Association (CRA) collects data on salaries of faculty members in Ph.D.-granting computer science departments in North America. CRA maintains a database that includes the following two tables:

\[
\text{SALARIES(id-no, university, title, salary)} \\
\text{RANKING(university, rank)}
\]

The values of id-no are strings encoding names of faculty, while the values of title are “Lecturer”, “Assistant Professor”, “Associate Professor”, “Full Professor”. The values of rank are positive integers denoting the ranking of each university according to the latest survey by the National Research Council.

Express the following queries in SQL:

1. Find the average, maximum and minimum salary paid to each title (“Lecturer”, “Assistant Professor”, “Associate Professor”, “Full Professor”).
2. Find the average, maximum and minimum salary paid to each title in universities ranked 1-12 (included).
3. For each university ranked 1-12 (included), find the average, minimum and maximum salary paid to each title.