Exercises relational algebra

August 6, 2024

Exercise 1

We have the following schema for the information system of a bus company.

Driver (dno, name, address)
Bus (bno, type, cap)
Route ($rtid$, length, duration, nr-of-stops)
Schedule ($rtid, date, time$, bno, dno)

Each driver has a unique number. Every bus has a type (one letter) and a capacity (= maximum number of passengers).
Furthermore, we have a table that contains the scheduling of buses and drivers on the several routes. All routes start at the central bus station. The attribute 'time' indicates the time of leaving.
Formulate the following queries in the RA.
Q_1: Give the numbers and names of the drivers who will be driving today
Q_2: Give the numbers and names of the drivers who are scheduled today on a bus with a capacity of more than 60.
Q_3: Give the numbers and names of the drivers who have not been scheduled on a bus of type A
Q_4: Give the numbers and names of the drivers who drive buses of type A exclusively
Q_5: Give the numbers and names of the drivers who have been scheduled on all routes with more than 10 stops.
Q_7: Give the numbers of the drivers who are scheduled on at least two different routes today.

Exercise 2

(i) Give a RA-expression that expresses the intersection using only
    $\sigma, \pi, \times, \cup, -$.

(ii) Give a RA-expression that expresses the division using only
    $\sigma, \pi, \times, \cup, -$.

Exercise 3

(i) We are allowed to use the logical connectives AND, OR and NOT in the predicates of selections. Are these connectives essential for the expressiveness of the relational algebra?

(ii) Reflecting on the answer of (i), why do we allow them?

(iii) Who do we not allow more complex predicates using quantifiers?