Exercises

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5. Relational Algebra and SQL

1. Write Queries in Relational Algebra

Consider the database of a sailing club with the following three tables:

Sailor(sid: `integer`, name: `string`, rating: `integer`, age: `integer`)

Boat(bid: `integer`, name: `string`, colour: `string`)

Reservation(sid: `integer`, bid: `integer`, day: `date`)

The relation Sailor stores the sailors of the club and the key of that relation is sid. The relation Boat stores boats and bid is the key of that relation. Finally, Reservation stores which sailor has reserved which boat for which day. The key is the combination of the three attributes sid, bid, and day.

Write the following queries in relational algebra:

1. Find the names of sailors with a rating greater 5 and an age between 20 and 30.
2. Find the rating and the age of the sailors who reserved a red boat.
3. Find the IDs of those sailors who either reserved the boat 'Clipper' or who reserved a green boat.
4. Find the IDs of those sailors who reserved the boat 'Clipper' and who reserved a green boat.
5. Find the names of those sailors who reserved two different boats on the same day.
6. Find the IDs of those sailors who never reserved a red boat.
7. Find the names of those sailors who never reserved a read boat.
8. List the IDs of those sailors who made a reservation for every red boat.

2. Write Queries in SQL

Try to express as many of the queries above in SQL, using the constructs that have been introduced in the lecture.

3. Identities in Relational Algebra

For each of the following identities, find out

(i) whether they hold or not, and

(ii) whether they hold under suitable assumptions on the sets of attributes involved.

If an identity does not hold, provide counterexample that shows this. Otherwise, provide an argument why it holds.
We assume that R, S are relations, X is a set of attributes, C, D are conditions, A is an attribute, and α is an aggregation function.

1. $\pi_X(R \cap S) = \pi_X(R) \cap \pi_X(S)$
2. $\pi_X(R \cup S) = \pi_X(R) \cup \pi_X(S)$
3. $\sigma_C(R \cap S) = \sigma_C(R) \cap S$
4. $\sigma_C(R \cup S) = \sigma_C(R) \cup S$
5. $\pi_X(R \bowtie_D S) = \pi_X(R) \bowtie_D S$
6. $\sigma_C(R \bowtie_D S) = \sigma_C(R) \bowtie_D S$
7. $\sigma_C(\gamma_{X,\alpha(A)}(R)) = \gamma_{X,\alpha(A)}(\sigma_C(R))$