

Student Name: _____

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In-class Exercise 03 Relational Algebra

Suppose we have the following relations:

Sailors (sid, sname, age)

Boats (bid, bname, color)

Reserves (sid, bid, date)

Note: the primary key fields are underlined.

Please complete the following query by using relational algebra.

Query 1: Find the names of sailors who have reserved boat with bid = 100.

Solution:

$\rho(S, \text{Sailors}), \rho(R, \text{Reserves}), \rho(B, \text{Boats})$

$\pi_{sname}(S \bowtie_{R.bid=100} R) \rightarrow \text{Natural join}$

OR $\pi_{sname}(S \bowtie_{R.bid=100, s.sid=R.bid} R) \rightarrow \text{Cartesian product}$

Query 2: Find the sid of sailors who have reserved at least a green boat.

Solution:

$P(S, \text{sailors}), P(R, \text{reserves}), P(B, \text{boats})$

$\Pi_{S.sname} ((S \bowtie_{B.color = 'green'} B) \bowtie R \bowtie S)$

OR $\Pi_{S.sname} (S \bowtie_{B.color = 'green', B.bid = R.bid, S.sid = R.sid} (B \times R \times S))$

Query 3: Find the names and age of sailors who have reserved at least a red or a green boats.

Solution:

$P(S, \text{sailors}), P(R, \text{reserves}), P(B, \text{boats})$

$\Pi_{S.sname, S.age} ((S \bowtie_{B.color = 'red' \vee B.color = 'green'} B) \bowtie R \bowtie S)$

Query 4: Find the names, sid and age of sailors who have reserved at least a red boat and at least a green boat.

Solution:

$P(S, \text{sailors}), P(R, \text{reserves}), P(B, \text{boats})$

$P(\text{temp1}, ((S \bowtie_{B.color = 'red'} B) \bowtie R)), P(\text{temp2}, ((S \bowtie_{B.color = 'green'} B) \bowtie R))$

$\Pi_{S.sname, S.sid, S.age} (\text{temp1} \cap \text{temp2} \bowtie S)$

Query 5: Find the names and age of sailors who have reserved all green boats.

Solution:

$P(S, \text{Sailors}), P(R, \text{Reserves}), P(B, \text{Boats})$

$P(\text{temp1}, (\pi_{R.\text{sid}, R.\text{bid}} R) / (\pi_{B.\text{bid}} (S_{B.\text{color} = 'green'} B)))$

$\pi_{S.\text{name}, S.\text{age}} (\text{temp1} \bowtie S)$

Query 6: Find the names and age of sailors who have reserved all green boats and all red boats.

Solution:

$P(S, \text{Sailors}), P(R, \text{Reserves}), P(B, \text{Boats})$

$P(\text{temp1}, (\pi_{R.\text{sid}, R.\text{bid}} R) / (\pi_{B.\text{bid}} (S_{B.\text{color} = 'green'} B)))$

$P(\text{temp2}, (\pi_{R.\text{sid}, R.\text{bid}} R) / (\pi_{B.\text{bid}} (S_{B.\text{color} = 'red'} B)))$

$\pi_{S.\text{name}, S.\text{age}} ((\text{temp1} \cap \text{temp2}) \bowtie S)$

Query 7: Find the names of the oldest sailors.

Solution:

$\rho(S_1, \text{sailors}), \rho(S_2, \text{sailors})$

$\rho(S_3, \pi_{S_1}(\sigma_{S_1.\text{age} < S_2.\text{age}}(S_1 \times S_2)))$

$\rho(S_4, S_1 - S_3)$

$\pi_{\text{name}}(S_4 \bowtie \text{sailors})$

Query 8: Find the names of sailors who have reserved the first boat in the database.

Solution:

$\rho(R_1, \text{reserves}), \rho(R_2, \text{reserves})$

$\rho(R_3, \pi_{R_1}(\sigma_{R_1.\text{date} > R_2.\text{date}}(R_1 \times R_2)))$

$\rho(R_4, R_1 - R_3)$

$\pi_{\text{name}}(R_4 \bowtie \text{reserves})$

