

# Database Systems 10127

## Lab 5

### Relational Algebra Exercise

Given the following relations

<b>S</b> (sid, sname, age)	this is a table of sailors
<b>B</b> (bid, bname, color)	this is a table of boats
<b>R</b> (sid, bid, date)	this is a table of reservations

Write relational algebra statements for each problem

- 0) Find the color of boat number 103  
 $\pi_{\text{color}} (\sigma_{\text{bid} = 103} (B))$
- 1) Find IDs of sailors who reserved boat number 103  
 $\pi_{\text{sid}} (\sigma_{\text{bid} = 103} (R))$
- 2) Find all reservations of boat number 103  
 $\sigma_{\text{bid}=103} (R)$
- 3) Find names of sailors who reserved boat number 103  
 $\pi_{\text{sname}} (S \bowtie (\sigma_{\text{bid}=103} (R)))$
- 4) Find the IDs of boats reserved by Harry  
 $\pi_{\text{bid}} (R \bowtie \pi_{\text{sid}} (\sigma_{\text{sname} = \text{"Harry"}} (S)))$
- 5) Find the colors of boats reserved by Harry  
 $\pi_{\text{color}} \{B \bowtie [\pi_{\text{bid}} (R \bowtie \pi_{\text{sid}} (\sigma_{\text{sname} = \text{"Harry"}} (S)))]\}$
- 6) Find names of sailors who reserved a red boat  
 $\pi_{\text{sname}} (S \bowtie \{ \pi_{\text{sid}} (R \bowtie [\pi_{\text{bid}} (\sigma_{\text{color} = \text{red}} (B))]) \})$
- 7) Find names of sailors who reserved a red **or** a green boat  
 $\pi_{\text{sname}} (S \bowtie \{ \pi_{\text{sid}} (R \bowtie [\pi_{\text{bid}} (\sigma_{\text{color} = \text{red OR green}} (B))]) \})$

- 8) Find names of sailors who reserved a red **and** a green boat

$$\text{Red\_sids} = \pi_{\text{sids}} \{R \bowtie [\pi_{\text{bid}} (\sigma_{\text{color} = \text{red}} (B))]\}$$

$$\text{Green\_sids} = \pi_{\text{sids}} \{R \bowtie [\pi_{\text{bid}} (\sigma_{\text{color} = \text{green}} (B))]\}$$

$$\pi_{\text{sname}} (S \bowtie \{ \text{Red\_sids} \cap \text{Green\_sids} \})$$

- 9) Find IDs of sailors over age 20 who reserved a red boat

$$\text{Red\_sids} = \pi_{\text{sids}} \{R \bowtie [\pi_{\text{bid}} (\sigma_{\text{color} = \text{red}} (B))]\}$$

$$(\pi_{\text{sids}} [\sigma_{\text{age} > 20} (S)]) \cap \text{Red\_sids}$$

- 10) Find IDs of sailors over age 20 who did not reserve a red boat

$$\text{Red\_sids} = \pi_{\text{sids}} \{R \bowtie [\pi_{\text{bid}} (\sigma_{\text{color} = \text{red}} (B))]\}$$

$$(\pi_{\text{sids}} [\sigma_{\text{age} > 20} (S)]) - \text{Red\_sids}$$

- 11) Find the IDs of the oldest sailors

$$\pi_{\text{sids}} (S) - (\pi_{\text{s1.sids}} \{ \sigma_{\text{s1.age} < \text{s2.age}} [\rho_{\text{s1}} (S) \times \rho_{\text{s2}} (S)] \})$$

- 12) Find the name and age of the oldest sailors

$$O = \pi_{\text{sids}} (S) - (\pi_{\text{s1.sids}} \{ \sigma_{\text{s1.age} < \text{s2.age}} [\rho_{\text{s1}} (S) \times \rho_{\text{s2}} (S)] \})$$

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