

Assignment Project Exam Help

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Relational Algebra
Practice Queries

CS430/630
Lecture 3

Relational Algebra

► Basic operations:

- Selection σ Selects a subset of rows from relation
- Projection π Derives invariant columns from relation
- Cross-product \times Allows us to combine several relations
- Join \bowtie Combines several relations using conditions
- Division \div A bit more complex, will cover later on
- Set-difference $-$ Union \cup Intersection \cap
- Renaming ρ Helper operator, does not derive new result, just renames relations and fields

$$\rho(R(F), E)$$

- F contains *oldname* \rightarrow *newname* pairs



Operator Precedence

► In decreasing order of priority:

1. Selection σ Projection π

2. Cross-product \times Join \bowtie Assignment \leftarrow Project ρ Exam Help

3. Set-difference $-$ Intersection \cap
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4. Union \cup

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Example Schema

Sailors

<u>sid</u>	sname	rating	age
22	dustin	7	45.0
31	lubber	8	55.5
58	rusty	10	35.0

Boats

<u>bid</u>	name	color
101	interlake	red
103	clipper	green

Reserves

<u>sid</u>	<u>bid</u>	<u>day</u>
22	101	10/10/96
58	103	11/12/96



Sample Query 1

Sailors

<u>sid</u>	sname	rating	age
------------	-------	--------	-----

Boats

<u>bid</u>	name	color
------------	------	-------

Reserves

<u>sid</u>	<u>bid</u>	<u>day</u>
------------	------------	------------

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- Find names of sailors who've reserved boat #103

$\pi_{sname}((\sigma_{bid=103} \text{Reserves}) \bowtie \text{Sailors})$

$\pi_{sname}(\sigma_{bid=103}(\text{Reserves} \bowtie \text{Sailors}))$

Example Schema

Sailors

<u>sid</u>	sname	rating	age
22	dustin	7	45.0
31	lubber	8	55.5
58	rusty	10	35.0

Boats

<u>bid</u>	name	color
101	interlake	red
103	clipper	green

Reserves

<u>sid</u>	<u>bid</u>	<u>day</u>
22	101	10/10/96
58	103	11/12/96



Sample Query 2

Sailors

<u>sid</u>	sname	rating	age
------------	-------	--------	-----

Boats

<u>bid</u>	name	color
------------	------	-------

Reserves

<u>sid</u>	<u>bid</u>	<u>day</u>
------------	------------	------------

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- Find names of sailors who've reserved a red boat

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$\pi_{sname}(\pi_{sid}((\pi_{bid}(\sigma_{color='red'} Boats)) \bowtie Res) \bowtie Sailors)$

$\pi_{sname}((\sigma_{color='red'} Boats) \bowtie Reserves \bowtie Sailors)$



Example Schema

Sailors

<u>sid</u>	sname	rating	age
22	dustin	7	45.0
31	lubber	8	55.5
58	rusty	10	35.0

Boats

<u>bid</u>	name	color
101	interlake	red
103	clipper	green

Reserves

<u>sid</u>	<u>bid</u>	<u>day</u>
22	101	10/10/96
58	103	11/12/96



Sample Query 3

Sailors

<u>sid</u>	sname	rating	age
------------	-------	--------	-----

Boats

<u>bid</u>	name	color
------------	------	-------

Reserves

<u>sid</u>	<u>bid</u>	<u>day</u>
------------	------------	------------

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- Find names of sailors who've reserved a red or a green boat

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ρ (*Tempboats*, ($\sigma_{color='red' \vee color='green'}$ *Boats*))

$\pi_{sname}(\textit{Tempboats} \bowtie \textit{Reserves} \bowtie \textit{Sailors})$

Example Schema

Sailors

<u>sid</u>	sname	rating	age
22	dustin	7	45.0
31	lubber	8	55.5
58	rusty	10	35.0

Boats

<u>bid</u>	name	color
101	interlake	red
103	clipper	green

Reserves

<u>sid</u>	<u>bid</u>	<u>day</u>
22	101	10/10/96
58	103	11/12/96



Sample Query 4

Sailors

<u>sid</u>	sname	rating	age
------------	-------	--------	-----

Boats

<u>bid</u>	name	color
------------	------	-------

Reserves

<u>sid</u>	<u>bid</u>	<u>day</u>
------------	------------	------------

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- Find names of sailors who've reserved a red and a green boat

ρ (Tempred, $\pi_{sid}((\sigma_{color='red'} Boats) \bowtie Reserves)$)

ρ (Tempgreen, $\pi_{sid}((\sigma_{color='green'} Boats) \bowtie Reserves)$)

$\pi_{sname}((Tempred \cap Tempgreen) \bowtie Sailors)$

Example Schema

Sailors

<u>sid</u>	sname	rating	age
22	dustin	7	45.0
31	lubber	8	55.5
58	rusty	10	35.0

Boats

<u>bid</u>	name	color
101	interlake	red
103	clipper	green

Reserves

<u>sid</u>	<u>bid</u>	<u>day</u>
22	101	10/10/96
58	103	11/12/96



Sample Query 5

Sailors

<u>sid</u>	sname	rating	age
------------	-------	--------	-----

Boats

<u>bid</u>	name	color
------------	------	-------

Reserves

<u>sid</u>	<u>bid</u>	<u>day</u>
------------	------------	------------

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- Find names of sailors who've reserved only red boats

$$\rho(\text{Tempred}, \pi_{sid}((\sigma_{color='red'} \text{Boats}) \bowtie \text{Reserves}))$$

$$\rho(\text{Tempothers}, \pi_{sid}((\sigma_{color \neq 'red'} \text{Boats}) \bowtie \text{Reserves}))$$

$$\pi_{sname}((\text{Tempred} - \text{Tempothers}) \bowtie \text{Sailors})$$

An Example of Self-Joins

Sailors

<u>sid</u>	sname	rating	age
22	dustin	7	45.0
31	lubber	8	55.5
58	rusty	10	35.0

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- Find sailors with maximum age



An Example of Self-Joins

<u>sid</u>	sname	rating	age	<u>sid</u>	sname	rating	age
22	dustin	7	45.0	22	dustin	7	45.0
22	dustin	7	45.0	31	lubber	8	55.5
22	dustin	7	45.0	58	rusty	10	35.0
31	lubber	8	55.5	22	dustin	7	45.0
31	lubber	8	55.5	31	lubber	8	55.5
31	lubber	8	55.5	58	rusty	10	35.0
58	rusty	10	35.0	22	dustin	7	45.0
58	rusty	10	35.0	31	lubber	8	55.5
58	rusty	10	35.0	58	rusty	10	35.0

► Join condition: “left” age smaller than “right” age



An Example of Self-Joins

$\rho(S1, Sailors)$

$\rho(S2, Sailors)$

$\rho(TempJoin(1 \rightarrow f1, 2 \rightarrow f2, 3 \rightarrow f3, 4 \rightarrow f4),$
 $S1 \bowtie_{S1.age < S2.age} S2)$

$\rho(LeftHalf, \pi_{f1, f2, f3, f4}(TempJoin))$

- ▶ Finally, subtract the resulting left hand side from the initial relation, and you get sailors with maximum ages
- ▶ Final result is

$Sailors - LeftHalf$
