

Relational Algebra

November 12, 2019

Chapter 4

p 100-116

Queries

- How do we implement a query?
- How do we optimize a query?
- How to we talk about a query?

- We will use this lecture plus the Indexes/Storage engine lecture to understand Query Planning and Optimization

Algebra vs Calculus

- Relational Algebra
 - queries are composed of operators
 - step by step procedure for solving the query
 - relationally complete
- Relational Calculus (p 116-126)
 - describe result of query without specifying how to compute
- Expressiveness: Algebra vs Calculus (section 4.4)

Queries: Defined

- Input and output are *relations*
- Queries work on *instances* of relations
- May refer to columns/fields by name or position
 - may need to rename columns/fields to avoid conflict

Queries

- Composed of operators
- Operators:
 - accept one to two relation instances
 - produce a relation instance
- *Can compose queries*
- Relational algebra expression
 - relation (produced by some operator(s))

Example Data

- From your book, 102

<i>sid</i>	<i>sname</i>	<i>rating</i>	<i>age</i>
22	Dustin	7	45.0
31	Lubber	8	55.5
58	Rusty	10	35.0

Figure 4.1 Instance *S1* of Sailors

<i>sid</i>	<i>sname</i>	<i>rating</i>	<i>age</i>
28	yuppy	9	35.0
31	Lubber	8	55.5
44	guppy	5	35.0
58	Rusty	10	35.0

Figure 4.2 Instance *S2* of Sailors

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

Figure 4.3 Instance *R1* of Reserves

Basic Operators

- Selection
- Projection
- Union/Intersection
- Cross-product
- Difference

Joins

- Conditional Joins
- Equijoin
- Natural Join

Others

- Division
- Renaming

Division Example

A

sno	pno
s1	p1
s1	p2
s1	p3
s1	p4
s2	p1
s2	p2
s3	p2
s4	p2
s4	p4

B1

pno
p2

B2

pno
p2
p4

B3

pno
p1
p2
p4

A/B1 A/B2 A/B3

Examples: from the book

- Find the snames
 - who have reserved boat 103.
 - who have reserved any boat.
 - who have reserved a red boat.
 - who have reserved a red or green boat.
 - who have reserved a red and green boat.
 - who have reserved exactly 2 boats.
 - who have reserved at least 2 boats.
 - with age over 20 who have not reserved a red boat.
 - who reserved all boats.
- Find the colors of the boats reserved by Lubber.