

Relational Algebra Examples

Selection, Projection Examples

r :

A	B	C	D	E

$\sigma_{\text{„rainbow colors“}}(r)$:

A	B	C	D	E

$\Pi_{A,C,D}(r)$:

A	C	D

Examples for Selection and Projection

EMP (Name, Office, Dept, Rank)

Name	Office	Dept	Rank
Smith	400	CS	Assistant
Jones	220	Econ	Adjunct
Green	160	Econ	Assistant
Brown	420	CS	Associate
Smith	500	Fin	Associate

Project only the names and departments of the employees:

$\Pi_{\text{name, dept}}(\text{EMP})$

Select only those Employees in the CS department:

$\sigma_{\text{Dept} = \text{'CS'}}(\text{EMP})$

Name	Office	Dept	Rank
Smith	400	CS	Assistant
Brown	420	CS	Associate

Name	Dept
Smith	CS
Jones	Econ
Green	Econ
Brown	CS
Smith	Fin

Cartesian Product - Example

r:

A	B

s:

B	C	D

Example:

$r \times s$:

A	r.B	s.B	C	D

$s \times r$:

s.B	C	D	A	r.B

\neq

Non commutative

cartesian Product – Example 2

Do it on your own!

R

First	Last	Age
Bill	Smith	22
Mary	Keen	23
Tony	Jones	32

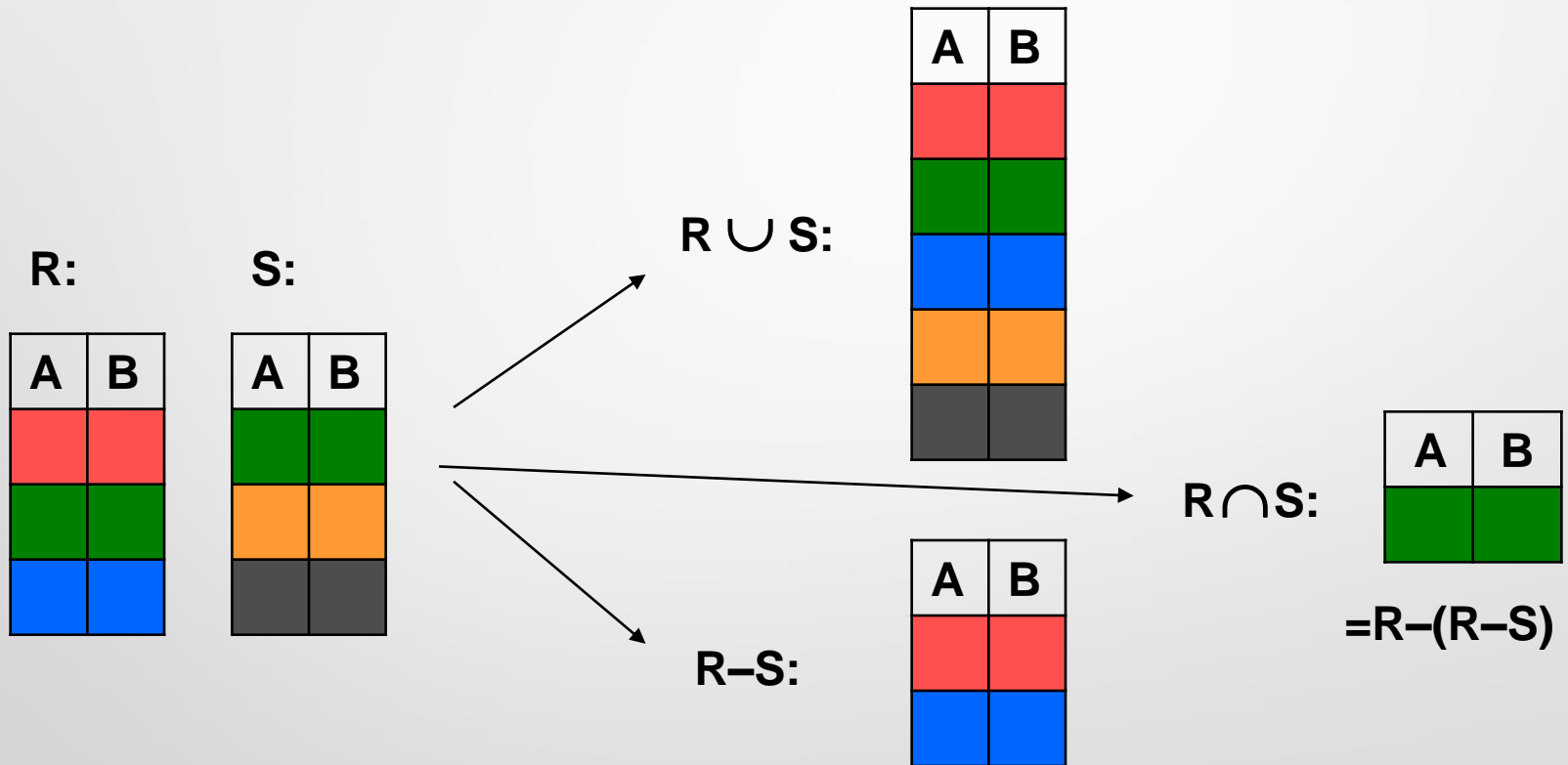
S

Dinner	Dessert
Steak	Ice Cream
Lobster	Cheesecake

R x S

First	Last	Age	Dinner	Dessert
Bill	Smith	22	Steak	Ice Cream
Bill	Smith	22	Lobster	Cheesecake
Mary	Keen	23	Steak	Ice Cream
Mary	Keen	23	Lobster	Cheesecake
Tony	Jones	32	Steak	Ice Cream
Tony	Jones	32	Lobster	Cheesecake

Union, Difference, Intersection Examples



Union, Difference, Intersection

Examples 2 – Do it on your own!

R

First	Last	Age
Bill	Smith	22
Sally	Green	28
Mary	Keen	23
Tony	Jones	32

S

First	Last	Age
Forrest	Gump	36
Sally	Green	28
DonJuan	DeMarco	27

1. List all people in the DB!

$R \cup S$:

First	Last	Age
Bill	Smith	22
Sally	Green	28
Mary	Keen	23
Tony	Jones	32
Forrest	Gump	36
DonJuan	DeMarco	27

3. List those who are in R and in S too!

$R \cap S$:

First	Last	Age
Sally	Green	28

2. List those who are in R but not in S.

$R - S$:

First	Last	Age
Bill	Smith	22
Mary	Keen	23
Tony	Jones	32

4. Check Intersection if $R - (R - S) = R \cap S$ is true!!

Natural Join Example

r:

B	C	D
2	3	4
2	3	5
7	8	10

s:

A	B	C
1	2	3
6	7	9
9	7	8

$r \bowtie_{B,C} s$

$$\sim \Pi_{A,B,C,D}(\sigma_{r.B=s.B \text{ AND } r.C=s.C}(r \times s))$$

A	B	C	D
1	2	3	4
1	2	3	5
9	7	8	10

Natural Join Example 2

Do it on your own!

EMP (Name, Office, Dept, Rank)

Name	Office	Dept	Rank
Smith	400	CS	Assistant
Jones	220	Econ	Adjunct
Green	160	Econ	Assistant
Brown	420	CS	Associate
Smith	500	Fin	Associate

We want to query each worker's telephone number!

EMP ⋈ DEPART?

DEPART(Dept, MainOffice, Phone)

Dept	MainOffice	Phone
CS	404	555-1212
Econ	200	555-1234
Fin	501	555-4321
Hist	100	555-9876

Natural Join Example 2 - solution

Results:

Name	Office	Dept	Salary	MainOffice	Phone
Smith	400	CS	45000	404	555-1212
Jones	220	Econ	35000	200	555-1234
Green	160	Econ	50000	200	555-1234
Brown	420	CS	65000	404	555-1212
Smith	500	Fin	60000	501	555-4321

Problem 1.

Consider the following schema:

- **Suppliers** (sid, sname, address)
- **Parts** (pid, pname, color)
- **Catalog** (sid, pid, cost)

Write the following queries in relational algebra:

1. Find the names of suppliers who supply some red part.
2. Find the sids of suppliers who supply some red or green part.
3. Find the sids of suppliers who supply some red part or are at 221 Parker Ave.
4. Find the sids of suppliers who supply some red part and some green part.

Problem 2.

Our Database Schema is the following:

- **Product** (pid, name, price, category, maker-cid)
- **Purchase** (buyer-ssn, seller-ssn, store, pid)
- **Company** (cid, name, stock price, country)
- **Person** (ssn, name, phone number, city)

Draw the E/R diagram!

1. List the those persons who bought any phones.
2. Find the name of persons, who bought any products made in the USA.
3. List the name of the persons who live in Boston and did not buy anything made in France.
4. List the name of the persons who bought anything from Tom or bought anything directly from the company who made the product and payed more than \$50.

Problem 3.

Find the result of the following relational algebraic expressions, using tables given as:

r:

A	B	C
1	2	3
1	4	5
2	4	5

s:

A	D	E
1	2	3

q:

A	F	C
1	2	3
1	0	10

1. $\sigma_{(A=1)}(r)$

2. $\sigma_{(A < B)}(r)$

3. $\sigma_{(B > C)}(r)$

4. $\sigma_{(A=1 \vee B < C)}(r)$

5. $\sigma_{(A=1 \wedge \neg(B < C))}(r)$

6. $r \cup s$

7. $\pi_{(A, B)}(q)$

8. $\pi_{(A, B)}(q) \cup \pi_{(A, B)}(s)$

9. $\pi_{(A, B)}(\sigma_{(A=1)}(r)) \cup \pi_{(A, B)}(s)$

10. $s \setminus q$

11. $q \setminus s$

12. $q \cap r$

13. $q \setminus (q \setminus r)$

14. $s \times q$

15. $r \times q$

16. $\sigma_{(r.A = q.A)}(r \times q)$

17. $r \bowtie q$

18. $r \bowtie s$