BOSTON UNIVERSITY

Relational Algebra

CS460: Introduction to Database Systems

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Basics

Relational Algebra: 5 Basic Operations

Selection (σ) Selects a subset of *rows* from relation (horizontal).

Projection (π) Retains only wanted *columns* from relation (vertical).

Cross-product (×) Allows us to combine two relations.

Set-difference (–) Tuples in R_1, but not in R_2.

Union (U) Tuples in R_1 and/or in R_2.

each operation returns a relation : ***composability*** (Algebra is "closed")

Projection

sid	sname	rating	age
28	yuppy	9	35.0
31	lubber	8	55.5
44	guppy	5	35.0
58	rusty	10	35.0

S_2

sname	rating
yuppy	9
lubber	8
guppy	5
rusty	10

$$\pi_{sname,rating}(S_2)$$

Selection

sid	sname	rating	age
28	yuppy	9	35.0
~~31~~	~~lubber~~	~~8~~	~~55.5~~
~~44~~	~~guppy~~	~~5~~	~~35.0~~
58	rusty	10	35.0

$$\sigma_{rating>8}(S_2)$$

Union

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

S_1

sid	sname	rating	age
28	yuppy	9	35.0
31	lubber	8	55.5
44	guppy	5	35.0
58	rusty	10	35.0

S_2

sid	sname	rating	age
22	dustin	7	45.0
31	lubber	8	55.5
58	rusty	10	35.0
44	guppy	5	35.0
28	yuppy	9	35.0

$S_1 \cup S_2$

Set-Difference

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

S_1

sid	sname	rating	age
28	yuppy	9	35.0
31	lubber	8	55.5
44	guppy	5	35.0
58	rusty	10	35.0

S_2

sid	sname	rating	age
22	dustin	7	45.0

$S_1 - S_2$

sid	sname	rating	age
28	yuppy	9	35.0
44	guppy	5	35.0

$S_2 - S_1$

Cross Product

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

S_1

sid	bid	day
22	101	10/10/16
58	103	11/12/16

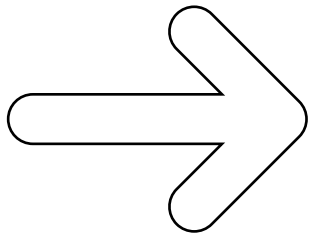
R_1

$S_1 \times R_1 =$

(sid)	sname	rating	age	(sid)	bid	day
22	dustin	7	45.0	22	101	10/10/16
22	dustin	7	45.0	58	103	11/12/16
31	lubber	8	55.5	22	101	10/10/16
31	lubber	8	55.5	58	103	11/12/16
58	rusty	10	35.0	22	101	10/10/16
58	rusty	10	35.0	58	103	11/12/16

Join (Uses the Cross-Product!)

(sid)	sname	rating	age	(sid)	bid	day
22	dustin	7	45.0	22	101	10/10/16
~~22~~	~~dustin~~	~~7~~	~~45.0~~	~~58~~	~~103~~	~~11/12/16~~
~~31~~	~~lubber~~	~~8~~	~~55.5~~	~~22~~	~~101~~	~~10/10/16~~
~~31~~	~~lubber~~	~~8~~	~~55.5~~	~~58~~	~~103~~	~~11/12/16~~
~~58~~	~~rusty~~	~~10~~	~~35.0~~	~~22~~	~~101~~	~~10/10/16~~
58	rusty	10	35.0	58	103	11/12/16



sid	sname	rating	age	bid	day
22	dustin	7	45.0	101	10/10/16
58	rusty	10	35.0	103	11/12/16