Lecture SQL03
Relational Algebra
Examples

Unless otherwise noted, lecture notes are derived from
Visual Quickstart Guide: SQL, Third Edition, by Chris Fehily

UAH
CPE 353

Relational Algebra Operators

- Selection $\sigma_{condition}(R)$
- Projection $\Pi_{attribute1,...,attributek}(R)$
- Rename $\rho_{New \leftarrow Old}(R)$
- Cartesian Product $R \times S$
- Difference $R - S$
- Intersection $R(X) \cap S(X)$
- Union $R(X) \cup S(X)$
- Theta/Equi Join $R \bowtie_{condition} S$
- Natural Join $R \bowtie S$

Relations

customers

UID	Last Name	First Name
128	Smith	John
324	Doe	John
245	Jones	Mark
756	Smith	Jane
459	Moore	Sara
721	Parks	Ralph

pets

UID	Pet Name	Type
128	Spot	Dog
324	Rex	Dog
756	Tiger	Cat
756	Fluffy	Cat
459	Tweety	Bird
721	Yippy	Dog
128	Rover	Dog
245	Stripes	Cat
324	Cupcake	Dog
459	Chewy	Dog

vets

UID
324
245

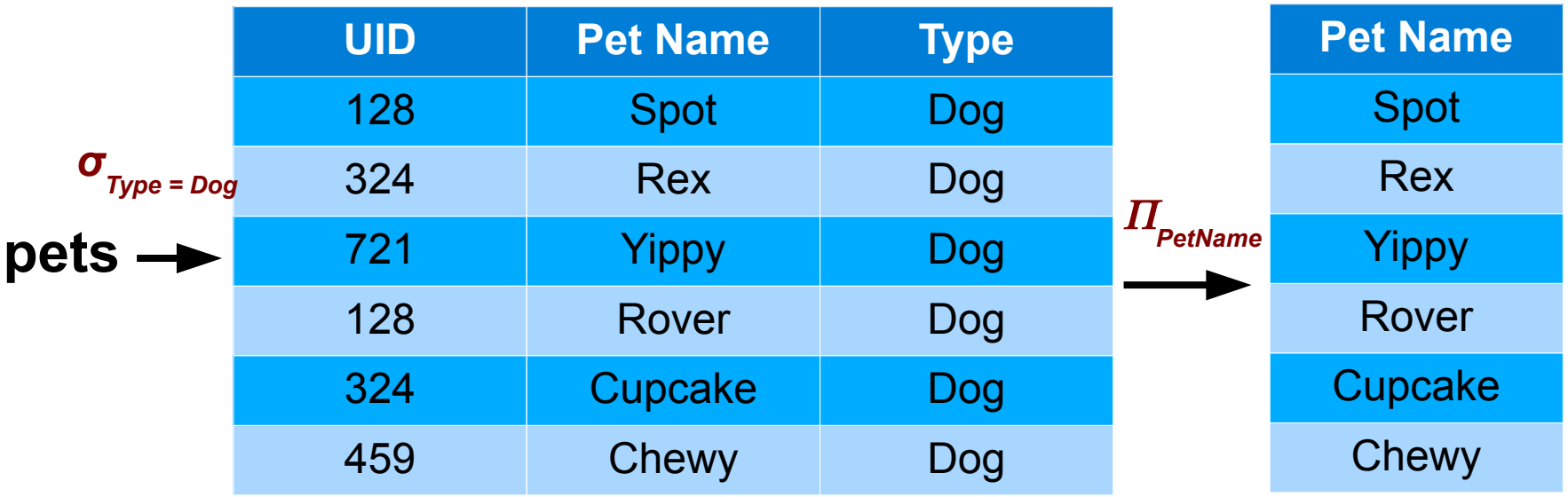
accounts

UID	Balance
128	0
756	45
459	0
721	10

Examples - 1

- Find the names of all dogs at the vet clinic.

$$\Pi_{PetName}(\sigma_{Type = Dog}(pets))$$



UID	Pet Name	Type
128	Spot	Dog
324	Rex	Dog
721	Yippy	Dog
128	Rover	Dog
324	Cupcake	Dog
459	Chewy	Dog

Pet Name
Spot
Rex
Yippy
Rover
Cupcake
Chewy

Examples - 2

- Find the UIDs of all customers that owe money to the clinic.

$$\Pi_{UID}(\sigma_{Balance > 0}(accounts))$$

accounts

UID	Balance
128	0
756	45
459	0
721	10

$\sigma_{Balance > 0}$ →

UID	Balance
756	45
721	10

Π_{UID} →

UID
756
721

Examples - 3

- Find the names of all customers that owe money to the clinic.

$$\Pi_{LastName,FirstName}(customers \bowtie \boxed{\Pi_{UID}(\sigma_{Balance > 0}(accounts))})$$

customers

UID	Last Name	First Name
128	Smith	John
324	Doe	John
245	Jones	Mark
756	Smith	Jane
459	Moore	Sara
721	Parks	Ralph

$\bowtie$

UID
756
721

From previous query

Examples – 3 continued

UID	Last Name	First Name	UID
128	Smith	John	756
128	Smith	John	721
324	Doe	John	756
324	Doe	John	721
245	Jones	Mark	756
245	Jones	Mark	721
756	Smith	Jane	756
756	Smith	Jane	721
459	Moore	Sara	756
459	Moore	Sara	721
721	Parks	Ralph	756
721	Parks	Ralph	721

Compute natural join

UID	Last Name	First Name
756	Smith	Jane
721	Parks	Ralph

Examples – 3 continued

$$\Pi_{LastName,FirstName}(customers \bowtie \Pi_{UID}(\sigma_{Balance > 0}(accounts)))$$

UID	Last Name	First Name
756	Smith	Jane
721	Parks	Ralph

$\Pi_{LastName,FirstName}$ →

Last Name	First Name
Smith	Jane
Parks	Ralph

Examples - 3

- Find the names of all customers that owe money to the clinic.

- Alternative solution. Better or worse?

$$\Pi_{FirstName,LastName}(\sigma_{Balance > 0} \; (\Pi_{LastName,FirstName,Balance}(customers \bowtie accounts)))$$

Relations

customers

UID	Last Name	First Name
128	Smith	John
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756	Smith	Jane
459	Moore	Sara
721	Parks	Ralph

vets

UID
324
245

accounts

UID	Balance
128	0
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721	10

pets

UID	Pet Name	Type
128	Spot	Dog
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128	Rover	Dog
245	Stripes	Cat
324	Cupcake	Dog
459	Chewy	Dog

Examples - 4

- Find the names of all pets owned by Jane Smith.

$$\Pi_{PetNames}(pets \bowtie \Pi_{UID}(\sigma_{FN = Jane\ AND\ LN = Smith}(customers)))$$

What may go wrong here?