

Homework

Basic Relational Algebra

Set Builder Notation

Expand the set builder expressions for the set X into long form sets. You can assume we are working with only non-negative integers. If the answer is an infinite set, show enough of the set to capture the pattern.

Ex: $X = \{x | x \% 3 = 0\}$

Solution: $X = \{0, 3, 6, 9, \dots\}$

$X = \{(x, x + 1)\}$

$X = \{$

$X = \{x | x > 4 \text{ and } x \leq 8 \text{ and } x \neq 5\}$

$X = \{$

Given: $A = \{a | 0 < a < 5\}$ and $B = \{b | b \geq 3 \text{ and } e < 6\}$

$X = \{x | x \in A \text{ and } x \notin B\}$

$X = \{$

Relational Notation To SQL

Generate the CREATE TABLE statements for the following relations. For variatic types (like string types), guess a reasonable value for the size of the type.

Students(id:INT, email:STRING, firstName:STRING, lastName:STRING)

Authors(authorId, authorLastName, authorFirstName, address, city, state, zip)

Dogs(type, cuteness, hugability, weight, height, age, favoriteFood)

Basic Relation Operations

Compute the given operation on the pair of relations and diagram the resulting relation. Make sure to remember to include the names of the attributes.

Union (\cup)

$$\begin{array}{c|c} \mathbf{R:} & \\ \hline \mathbf{A} & \\ \hline 1 & \\ 2 & \\ 3 & \end{array} \cup \begin{array}{c|c} \mathbf{S:} & \\ \hline \mathbf{C} & \\ \hline 3 & \\ 4 & \\ 5 & \end{array} =$$

$$\begin{array}{c|c} \mathbf{R:} & \\ \hline \mathbf{A} & \mathbf{B} \\ \hline 1 & a \\ 2 & b \\ 3 & c \end{array} \cup \begin{array}{c|c} \mathbf{S:} & \\ \hline \mathbf{C} & \\ \hline a & \\ b & \\ c & \end{array} =$$

Difference ($-$)

$$\begin{array}{c|c} \mathbf{R:} & \\ \hline \mathbf{A} & \\ \hline 1 & \\ 2 & \\ 3 & \end{array} - \begin{array}{c|c} \mathbf{S:} & \\ \hline \mathbf{C} & \\ \hline 3 & \\ 4 & \\ 5 & \end{array} =$$

$$\begin{array}{c|c} \mathbf{R:} & \\ \hline \mathbf{A} & \\ \hline 3 & \\ 4 & \\ 5 & \end{array} - \begin{array}{c|c} \mathbf{S:} & \\ \hline \mathbf{C} & \\ \hline 1 & \\ 2 & \\ 3 & \end{array} =$$

Cartesian Product (\times)

$$\begin{array}{c|c} \mathbf{R:} & \\ \hline \mathbf{A} & \\ \hline 1 & \\ 2 & \\ 3 & \end{array} \times \begin{array}{c|c} \mathbf{S:} & \\ \hline \mathbf{A} & \\ \hline \mathbf{Z} & \\ \mathbf{X} & \\ \mathbf{Y} & \end{array} =$$

$$\begin{array}{c|c} \mathbf{R:} & \\ \hline \mathbf{A} & \mathbf{B} \\ \hline 1 & a \\ 2 & b \\ 3 & c \end{array} \times \begin{array}{c|c} \mathbf{S:} & \\ \hline \mathbf{A} & \\ \hline \mathbf{Z} & \\ \mathbf{X} & \\ \mathbf{Y} & \end{array} =$$

Students

Consider the following table of students:

Students:

id	lastName	firstName	unitsCompleted	quartersCompleted	gpa
1	Anderson	Alex	50	5	3.2
2	Cooper	John	180	15	3.9
3	Smith	Jane	140	10	2.2
4	Doe	Aldrin	80	5	1.2
5	Williams	Kim	20	1	2.9

Write the relational algebra statement for each operation.

Rename (ρ)

- Rename the Students relation to “CSCStudents”.
- Keep the relation called “Students”, but rename the attributes so that they are all caps with underscores separating the words.

Projection (π)

- Project Students so that only the name (first, last) is left.

Selection (σ)

- Find all the students that have completed more than five quarters.
- Find all the students with even id numbers.
- Find all the students that have complete an average of at least 16 units a quarter.
- Find the last name of the student with the highest gpa.
- Find the first and last names of all the students who have either completed more than 100 units and have less than a 3.0 gpa, or have completed less than 100 units with less than a 2.0 gpa.