

What is Relational Algebra

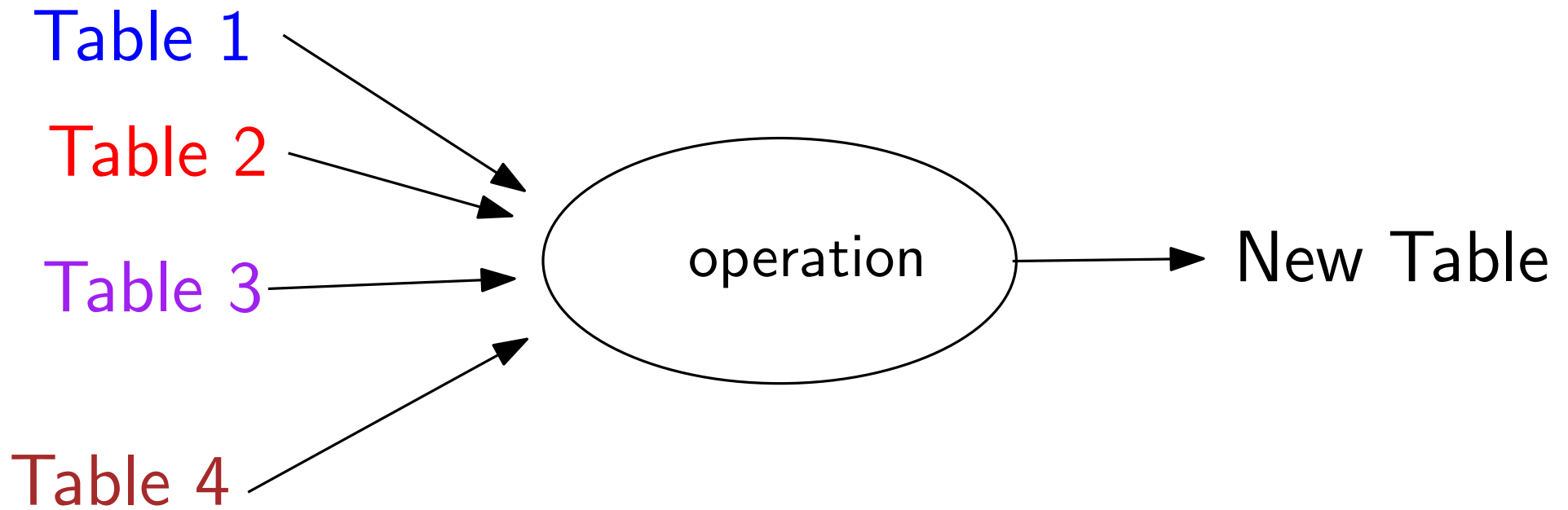


Table \equiv Set of tuples

Why do we use Relational Algebra?

The operation we will see:

Basic operators

1. Select σ
2. Projection Π
3. Product \times
4. Set operations (Union, difference)
5. Rename ρ

Additional operators

1. Natural Join \bowtie
2. Theta Join \bowtie_{θ}

Relational Algebra

First operator: **Select** $\sigma_{Condition} Table$

University		
Name	City	capacity

Condition
→

University		
Name	City	capacity

Relational Algebra

First operator: **Select** $\sigma_{Condition} Table$

Applied to one table to give rows (tuples)

1. Find the movies tuples before 1980
2. Find rating tuples with 5 stars

Relational Algebra

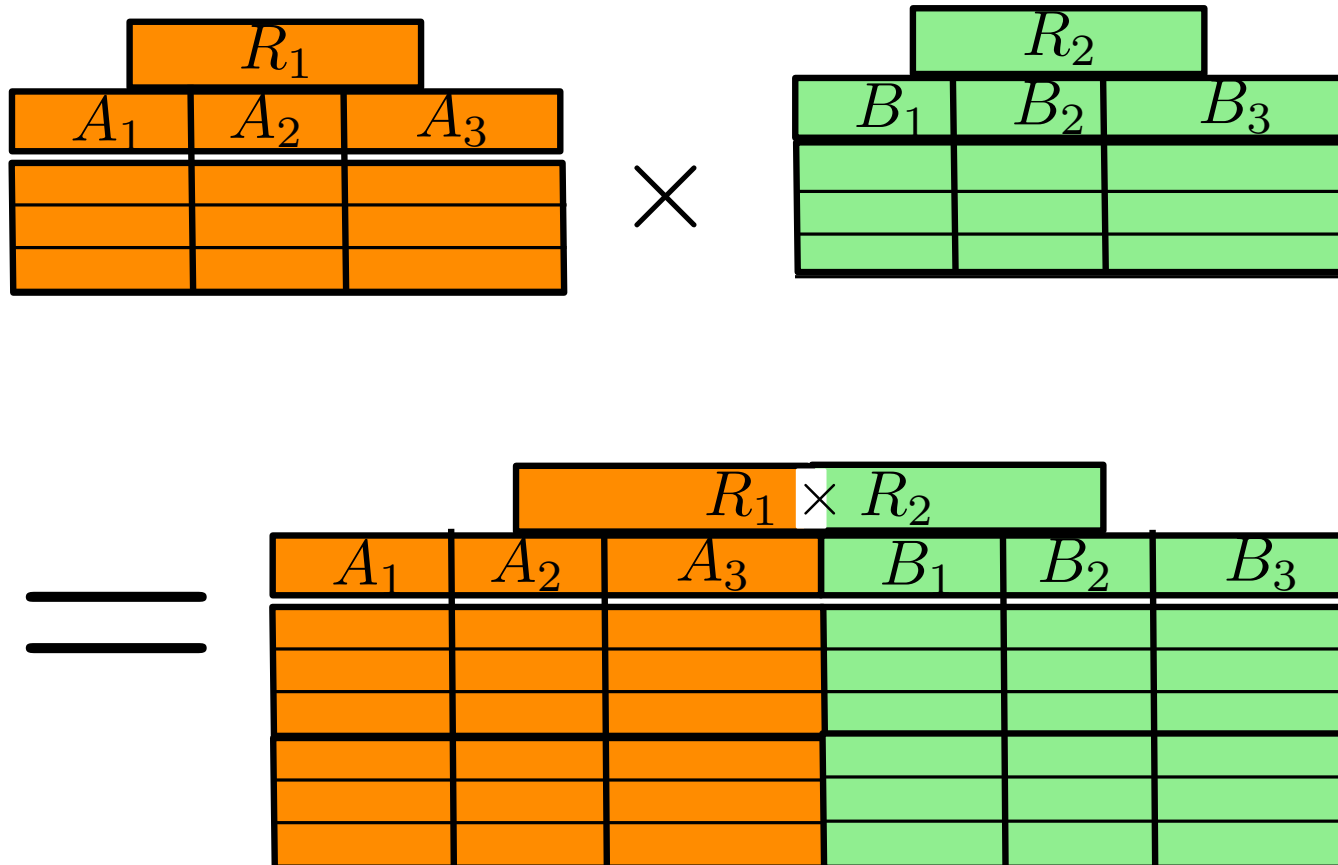
Second operator: **Projection $\Pi_{A_1 \dots A_k}$ Table**

Applied to one table to give columns (tuples)

1. Find the movies names before 1980
2. Find movies IDs with 5 stars with the date of rating

Relational Algebra

3rd operator: Product \times



Relational Algebra

3rd operator: **Product** $Table_1 \times Table_2$

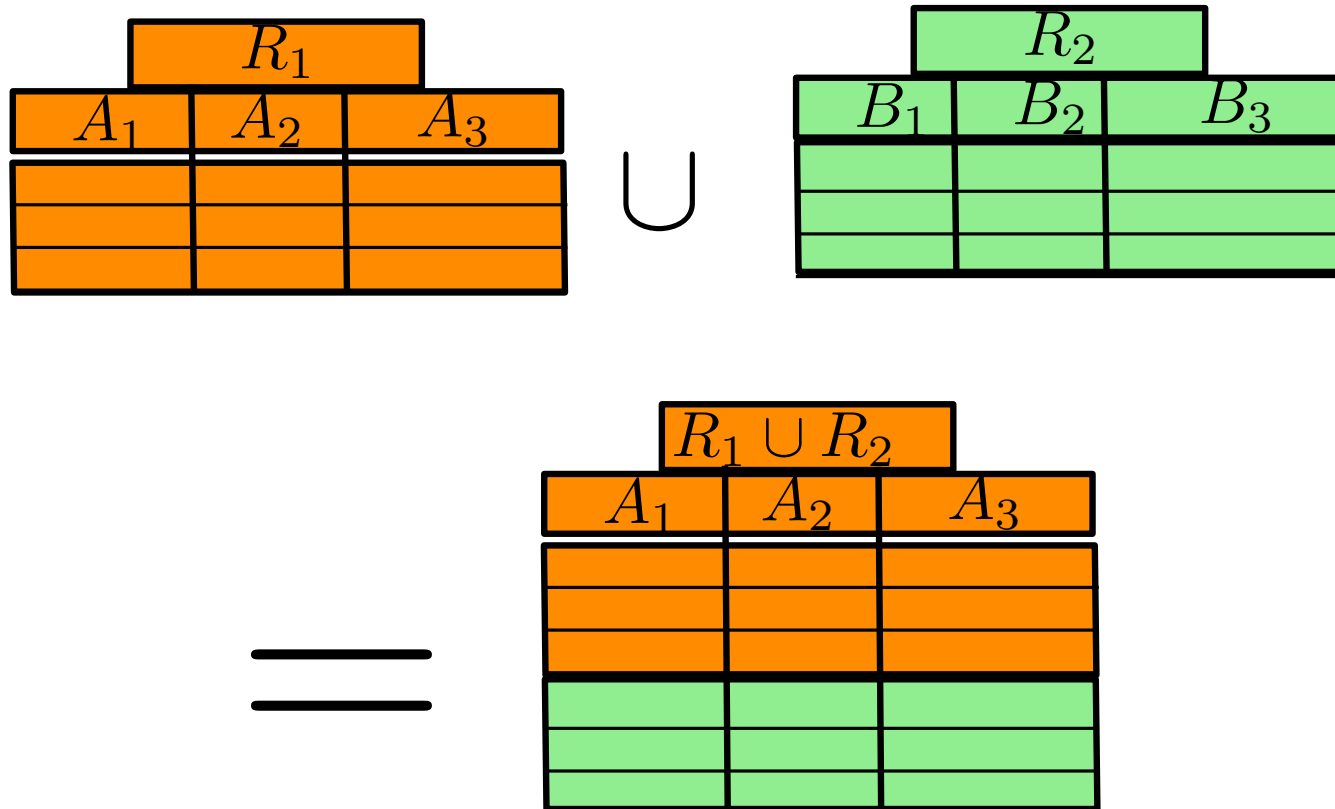
Applied to one table to give columns (tuples)

1. Find all years that have a movie that received a rating of 4 or 5
2. Find the titles of all movies not reviewed by Chris Jackson.

Relational Algebra

4rd operator: Union \cup

Condition: $\#columns R_1 = \#columns R_2$



Relational Algebra

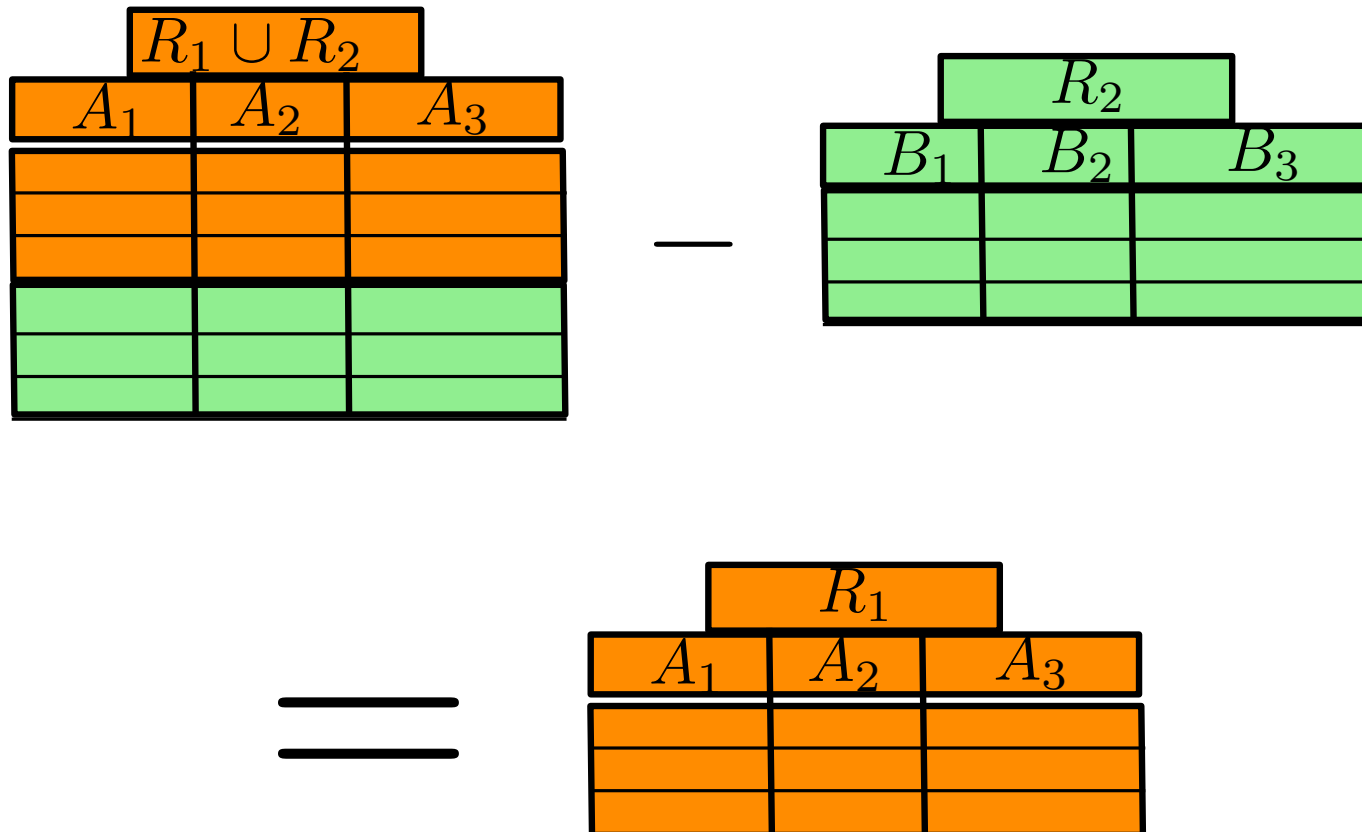
4th operator: Union $Table_1 \cup Table_2$

1. Find the list of directors union reviewers.
2. Find the list of rIDs union mIDs

Relational Algebra

5th operator: Difference —

Condition: $\#columns R_1 = \#columns R_2$



Relational Algebra

5th operator: Difference $Table_1 - Table_2$

1. Find the list movies not rated by Sarah Martinez

Intersection ?? $Table_1 \cap Table_2$

Relational Algebra

Natural join \bowtie

1. A list shcu that, for each rating, the name of reviewers with the names of the movie and the number of stars.

Relational Algebra

Theta join \bowtie_{θ}

1. List of rIDs and mIDs that have at least two different ratings

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Exercise:

A	B	C
1	2	5
33	4	1
3	1	0
1	10	12

D	B
12	15
0	1
4	1
11	10

Find:

1. $R_1 \bowtie R_2$
2. $R_1 \bowtie_{R_1.C=R_2.D} R_2$

Designing Database

UML Data Modeling

How to represent data for application

1. Relational model (tables)
2. XML
3. Graphes
 - (a) Entity-Relationship Model (E/R)
 - (b) Unified Modeling Language (UML)

Both can be translated to relations
automatically (or semi-automatically)

Unified Modeling Language (UML)

1. Classes
2. Associations
3. Association Classes
4. Subclasses
5. Composition & Aggregation

Classes

Name, attributes, methods

For data modeling: add primary key, delete methods

Unified Modeling Language (UML)

1. Classes
2. Associations
3. Association Classes
4. Subclasses
5. Composition & Aggregation

Associations

Relationships between objects of two classes

Multiplicity of Associations

Each object of class C_1 is related to at least m and at most n objects of class C_2

special

$m \dots *$

$0 \dots *$

$1 \dots 1$ (default)

Unified Modeling Language (UML)

1. Classes
2. Associations
3. Association Classes
4. Subclasses
5. Composition & Aggregation

UML Data Modeling: Association Classes

Relationships between objects of two classes, with attributes on relationships