

DataBase I

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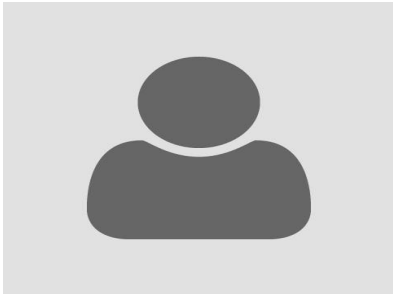
GitHub link: <https://github.com/gkrait/Courses/tree/master/Database>



Data

What is DATABASE?

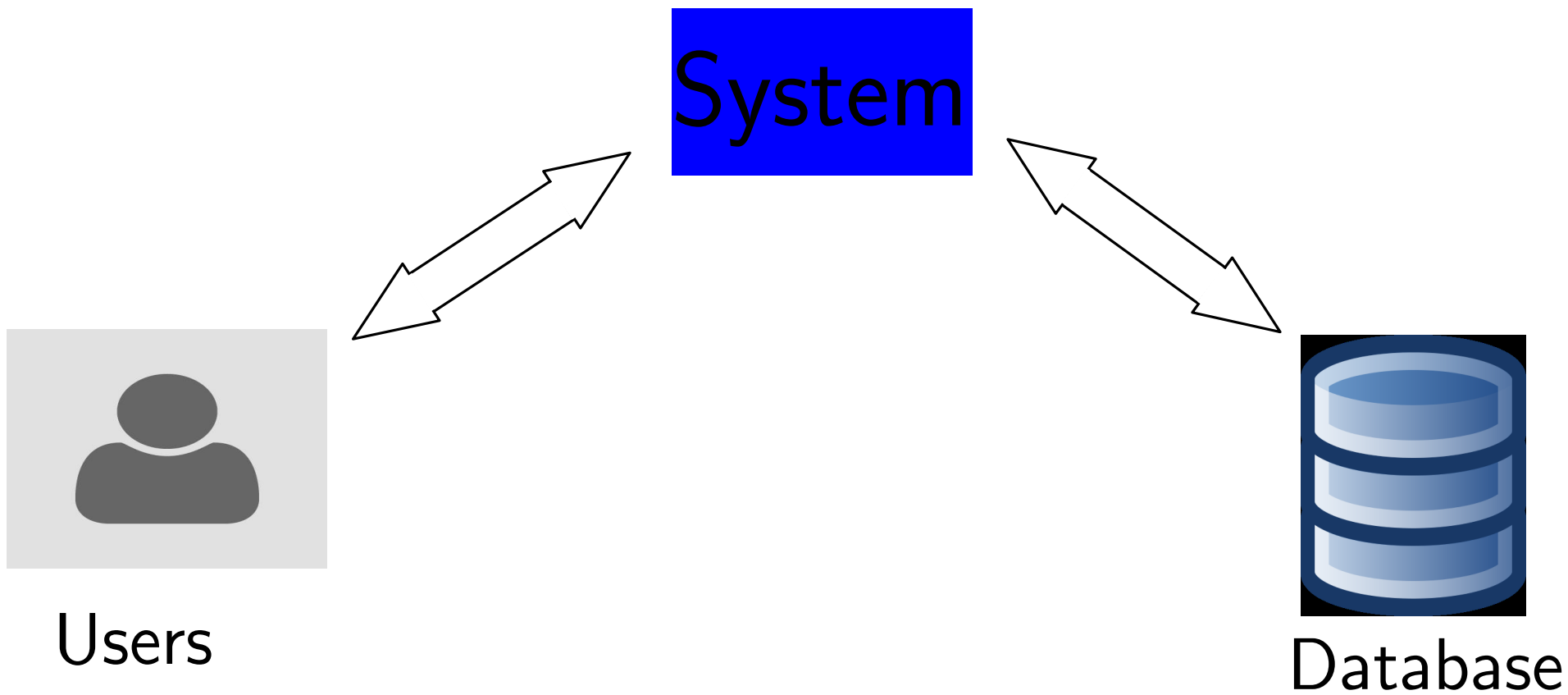
A database is an organized collection of data, stored and accessed electronically from a computer system.

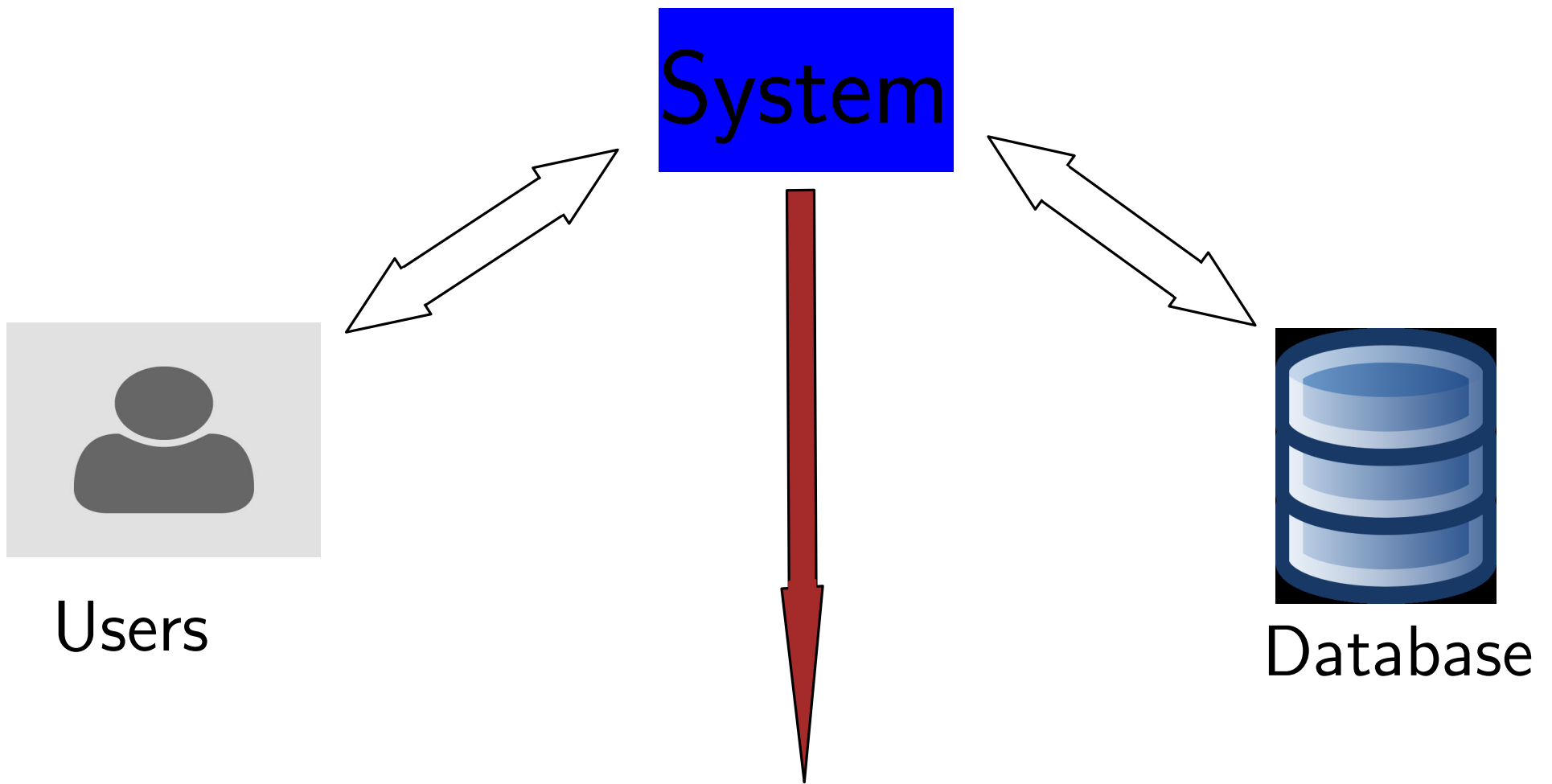


Users



Database





The main focus of this course

System



Database management system (DBMS)

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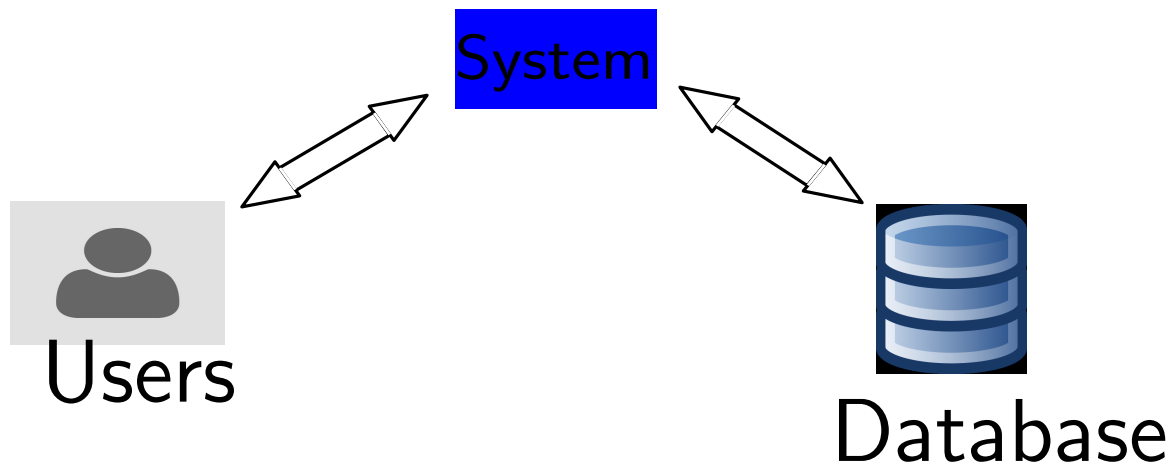
Definition:

software system that enables users to define, create, maintain and control access to the database

Database management system (DBMS)

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Database management system (DBMS)
provides

efficient, reliable, convenient, and safe multi-user
storage of and access to massive amounts of
persistent data.

- Massive
- Persistent
- Safe
- Multi-user
- Convenient
- Efficient
- Reliable

Key concepts:

- Data model
- Schema versus data
- Data definition language (DDL)
- Data manipulation or query language (DML)

Example: Database at Polytech

- For every student, we store ID number , name , adress , and date of birth .
- For every course, we store ID number , name , start and end dates and a short description .

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What is the best way to store those infos?

Example: Database at Polytech

- For every student, we store ID number, name, adress, and date of birth.
- For every course, we store ID number, name, start and end dates and a short description.

What is the best way to store those infos?

- files?, many problems... difficult to find and modify information
- Excel? better, but has limited options and storage

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- For every student, we store ID number , name , adress , and date of birth .
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Students			
ID	Name	Adress	Birth

Courses			
ID	Name	Date	Description

Example: Database at Polytech

- For every student, we store ID number , name , adress , and date of birth .
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- Every student attends some courses

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Students			
ID	Name	Adress	Birth

Student S
takes course C

Courses			
ID	Name	Date	Description

Example: Database at Polytech

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ID	Name	Adress	Birth

Courses			
ID	Name	Date	Description

Student S
takes course C

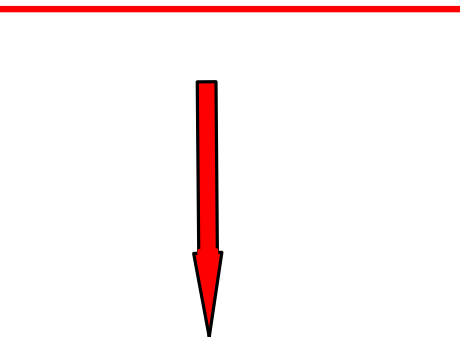


Study Plane		
Student ID	Course ID	Grades

Example: Database at Polytech

Students			
ID	Name	Adress	Birth

Courses			
ID	Name	Date	Description




Study Plane		
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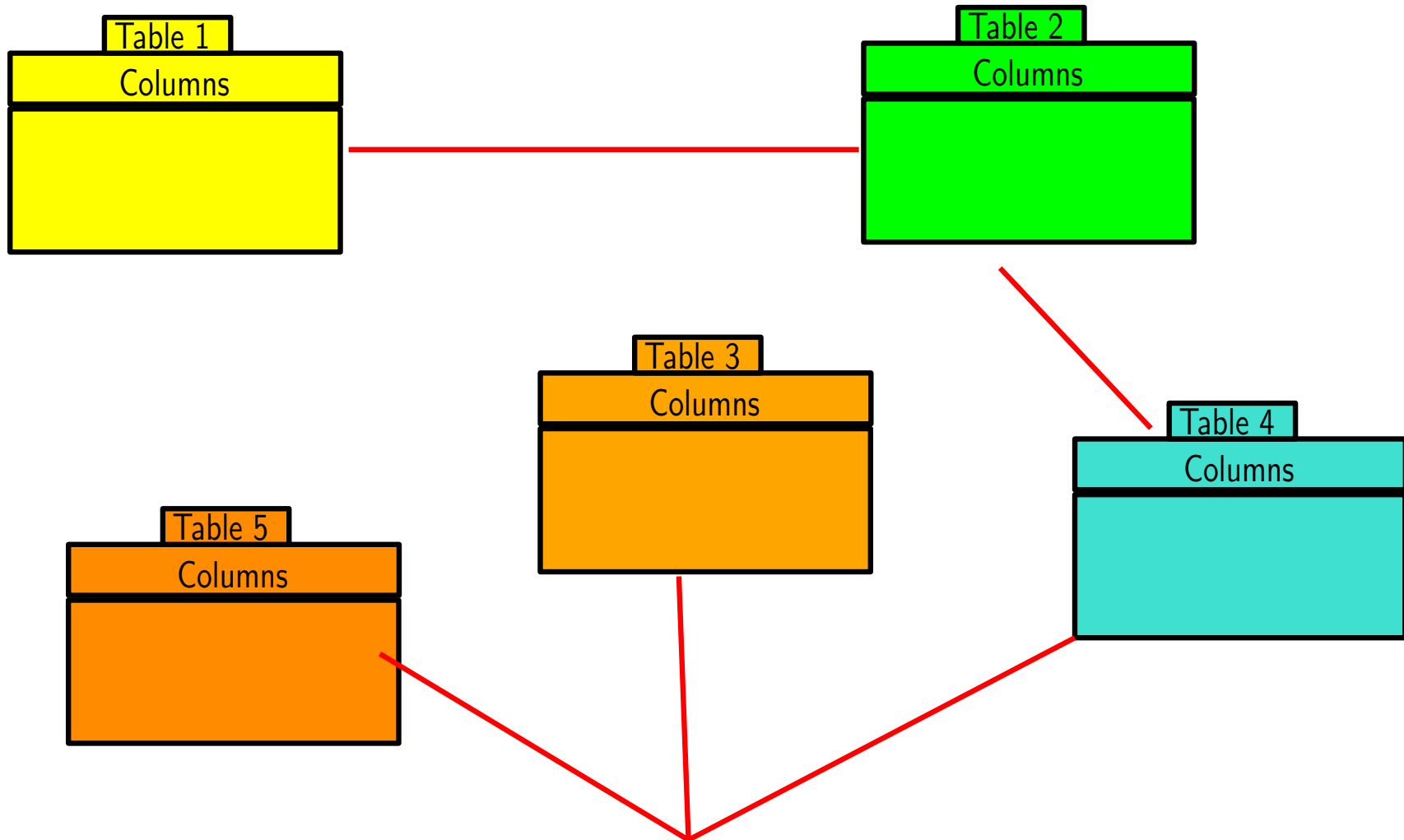
What will we learn here:

- Dealing with Rational Database:
 - Creating
 - Querying
 - Updating
 - Deleting
- Designing Databases (creating efficient DB)
- Rational Algebra (for querying even complex)

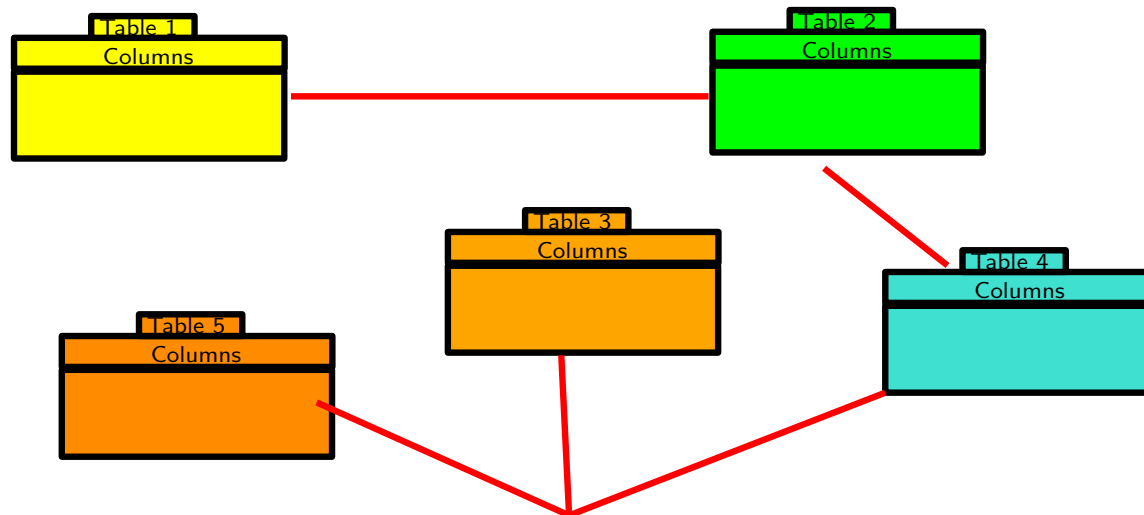
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 - Rational Algebra (for querying even complex)
- SQL
- MySql
Workbench

More general: Relational model



More general: Relational model of Database



Rational model: This model organizes data into one or more tables (or "relations") of columns and rows, with a unique key identifying each row.

Schema = structural description of relations in database

Students			
ID	Name	Adress	Birth

Courses			
ID	Name	Date	Description

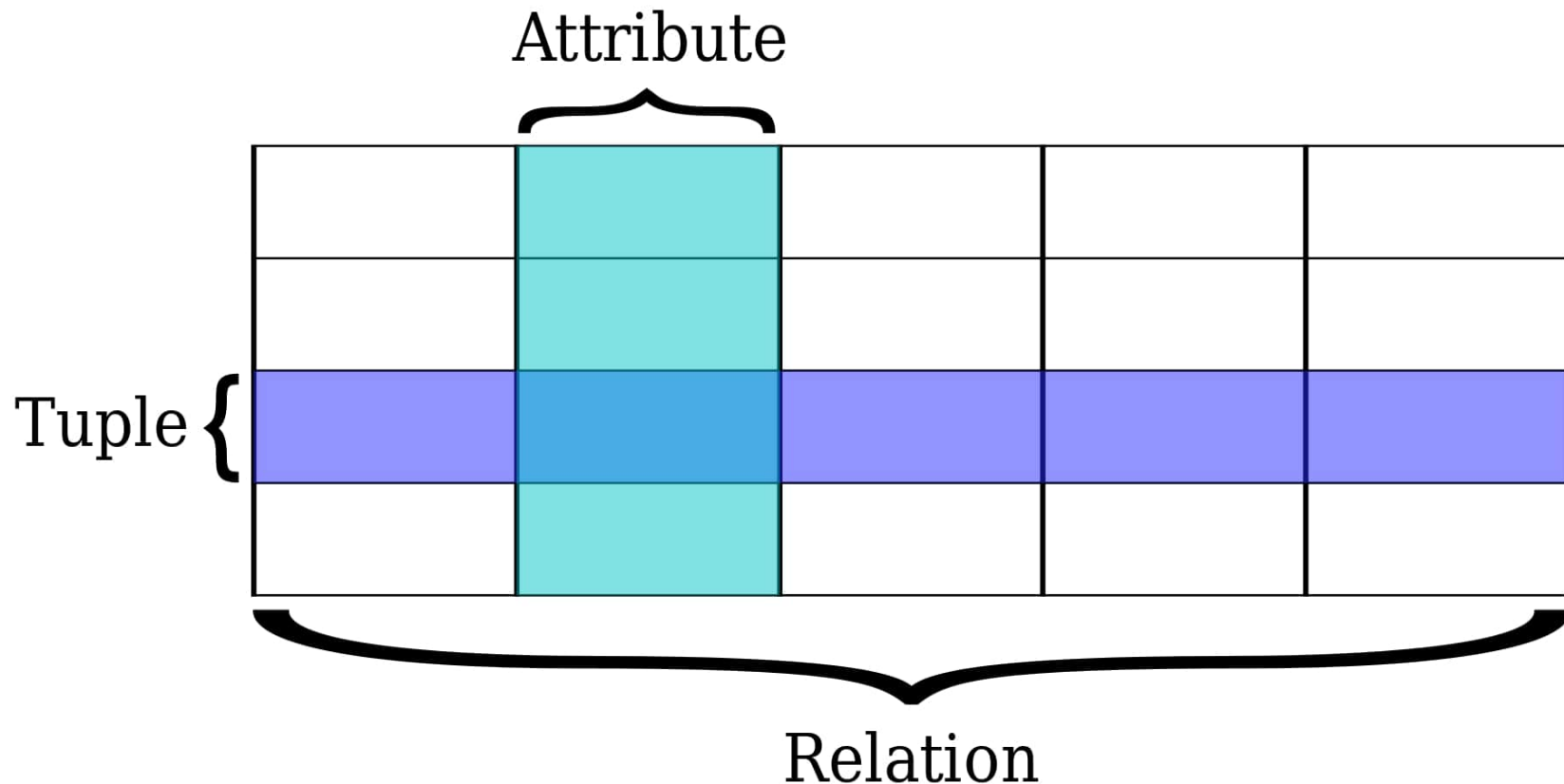
Study Plane		
Student ID	Course ID	Grades

Schema = structural description of relations in database

Instance = actual contents at given point in time

Students			
ID	Name	Adress	Birth

Database = set of named relations (or tables)
Each relation has a set of named attributes (or columns)
Each tuple (or row) has a value for each attribute
Each attribute has a type (or domain)



Null: Special value for "unknown" or undefined

Students			
ID	Name	Adress	Age
123	George	Nancy	23
312	Sam	Metz	20
432	Sandra	Metz	Null

Key: attribute whose value is unique in each tuple
or
set of attributes whose combined values are
unique

Study Plane		
Stud. ID	course ID	Grades
123	1121	15
123	3223	19
432	1121	20
132	3121	12

Students			
ID	Name	Adress	Age
123	George	Nancy	23
312	Sam	Metz	20
432	Sandra	Metz	Null

Exercise:

Find a rational module that satisfies the following:

A company wants to make a database system that includes the following:

- The company has several branches. Every branch has ID, city name (in which the branch is).
- Every employee has an ID, name, first name, salary.

Employee			
ID	Name	<i>1st</i> Name	Salary

Branche	
ID	City

Exercise:

Find a rational module that satisfies the following:

A company wants to make a database system that includes the following:

- The company has several branches. Every branch has ID, city name (in which the branch is).
- Every employee has an ID, name, first name, salary.
- Every branch has a chef (who is an employee).

Employee			
ID	Name	1st Name	Salary

Branche		
ID	City	Chef

Chef	
Branch ID	Employee ID

MySql Workbench



MySql Workbench



We will use it for:

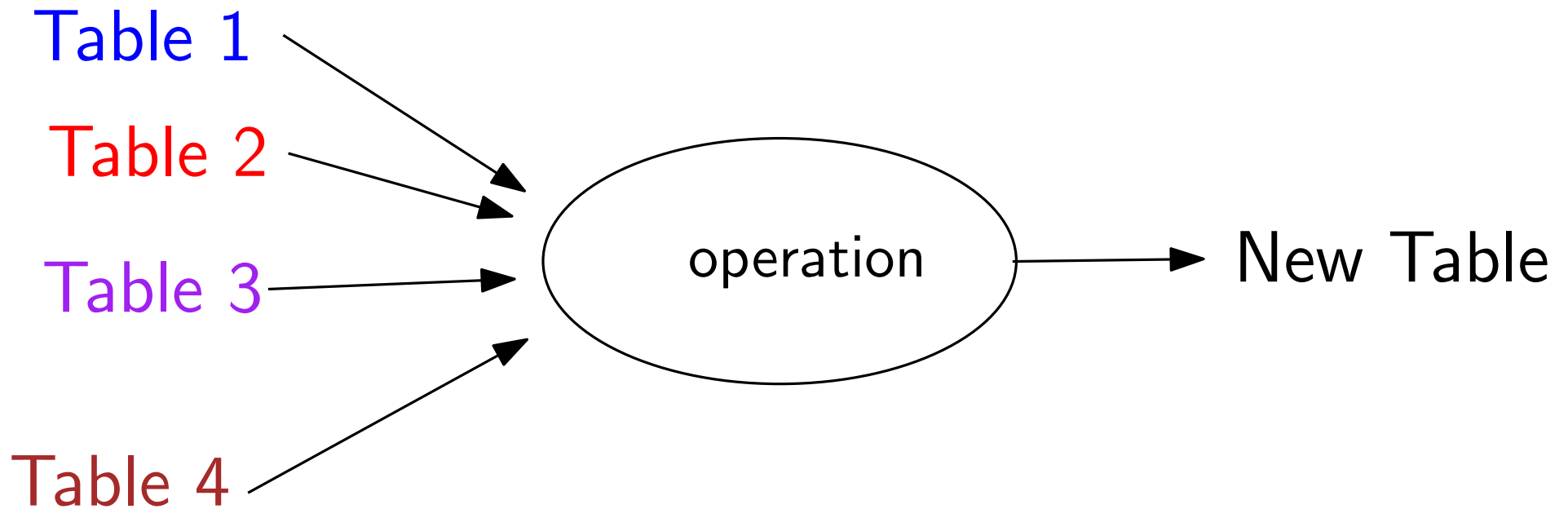
1. Creating DB and inserting data into it.
2. Queries (asking for informations about the data)
3. Modifying data

Queries (asking for informations about the data)

Some queries are difficult and not easy to be written

Relational algebra helps us to describe the queries in a mathematical way

What is Relational Algebra



Examples: simple college admissions database

University (U-Name,city,capacity)

Students (sID,Name,Bac score)

Apply (sID,U-Name, discipline, decision)

University (U-Name,city,fees)

Students (sID,Name,Bac score)

Apply (sID,U-Name, discipline, decision)

Students		
sID	Name	Bac s

University		
Name	City	capacity

Apply			
sID	U-Name	Discipline	Decision

Relational Algebra

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

Applied to one table to give rows (tuples)

1. Select Students with Bac score > 12
2. Select Universities in Paris and capacity > 20000

Relational Algebra

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

Applied to one table to give columns (tuples)

1. ID and decision of all applications
2. ID and decision of Students with Bac score
> 12

Relational Algebra

Third operator: Cross-product Π (Table 1 ,Table 2 ... Table k)