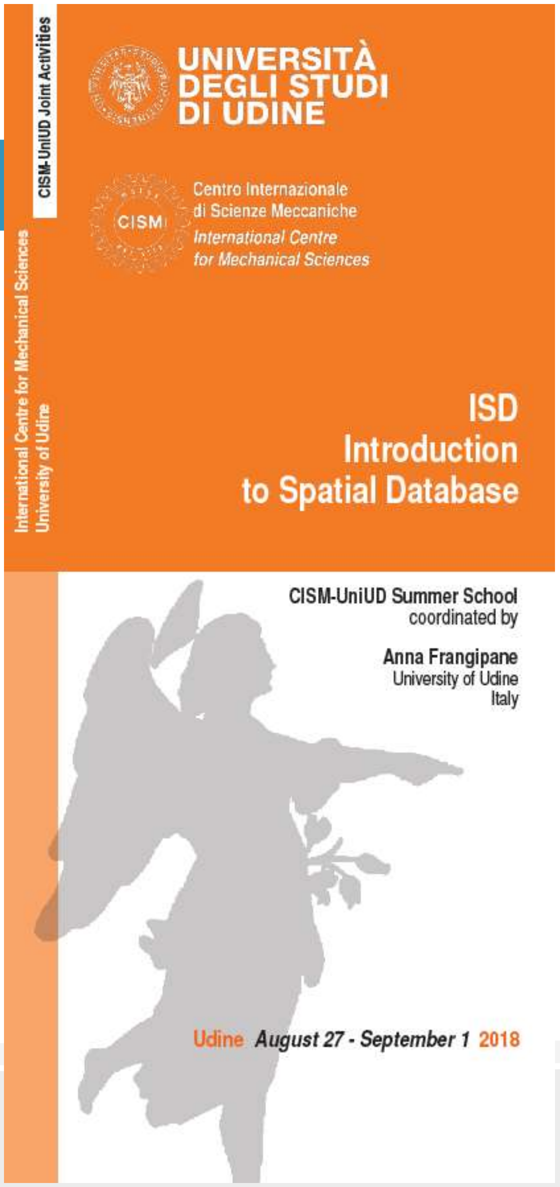
CISM-UniUD Joint Activities
UNIVERSITÀ DEGLI STUDI DI UDINE
Centro Internazionale di Scienze Meccaniche
International Centre for Mechanical Sciences
International Centre for Mechanical Sciences University of Udine
ISD Introduction to Spatial Database
CISM-UniUD Summer School coordinated by
Anna Frangipane University of Udine Italy
Udine August 27 - September 1 2018

Introduction to (My)SQL

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Outline

1. Data Definition Language
2. Data Manipulation Language
3. Exercises

All the material is available online:

`https://github.com/basaldella/isd2018`

MySQL Workbench/Recap

We will use MySQL Workbench as our tool of choice for working with MySQL.

You will work with a database installed in the Artificial Intelligence Laboratory servers. The credentials are:

- hostname: `db.ailab.uniud.it`
- username: `isdXX`, where XX is the number of your PC
- password: `ISD2018`

Data Definition Language

Data Definition Language

Instruction set used to

- Create Tables
- Modify Tables
- Delete Tables
- Enforcing constraints

Table creation

```
CREATE TABLE Table_Name (
    Field_1 DATATYPE FIELD_ATTRIBUTES,
    Field_2 DATATYPE FIELD_ATTRIBUTES,
    ...
    TABLE_ATTRIBUTES
);
```

Table creation/2

```
CREATE TABLE Students (
  ID int NOT NULL
AUTO_INCREMENT,
  LastName varchar(255),
  FirstName varchar(255),
  Address varchar(255),
  Country varchar(255),
  PRIMARY KEY (ID)
);
```

We create a table…

- called "Students",
- with the columns "ID", "LastName", "FirstName", "Address", "Country",
- all the columns but "ID" will contain text
- "ID" will be numeric, it **must** be always assigned, and it´s automatically increased each time we add a row
- "ID" will be the primary key

Foreign Keys

Suppose that we need a table to keep track the receipts of the students attending a summer school. We could build something like that:

ID	student	amount	notes
1	3	300.00	IBAN: 123456
2	5	300.00	Paid in cash
3	1	0	Sponsored by uni
…	…	…	

The column “**student**” is a **foreign key** that references the previous table

Foreign keys/2

```
CREATE TABLE Receipts(
  ID int NOT NULL AUTO_INCREMENT,
  Student int,
  Amount float,
  Notes varchar(255),
  PRIMARY KEY (ID),
  FOREIGN KEY (Student) REFERENCES Students(ID)
);
```

Table creation: key syntax

Primary key on column "`Column_A`":

```
PRIMARY KEY (Column_A)
```

Multiple keys: `PRIMARY KEY (Column_A,Column_B,...)`

Foreign key where "`Column_A`" references "`Column_B`" on "`Table_B`":

```
FOREIGN KEY (Column_A) REFERENCES
Table_B(Column_B)
```

SQL Data types

You may have noticed that each column is assigned a **type** (the green part after the column name).

Example:

- `Amount float`
- `Notes varchar(255)`

The **type** of a column determines what kind of data can we put inside it.

SQL Data types

Example:

- `255` is a number.
- `1.23` is a number.
- `‘Hello’` is a string.
- `True` is a Boolean value.
- `‘255’` is a…?

SQL Data types

We usually put strings between quotes to avoid confusion!

- `255` is **different** from `'255'`
- `True` is **different** from `'True'`

MySQL has many, many data types. We will consider only a small subset of them, which should suffice for our purposes.

SQL Data types: reference

Type	Name	Description	Example

String	`VARCHAR(length)`
	`VARCHAR(255)`
		Stores a string with length up to the value specified. Usually we set length=255.	`john.doe`
			`New York`

Numeric	`INT, INTEGER`
	`FLOAT, DOUBLE, REAL`
		Store integers or floating point numbers	`12`
			`3.1415`

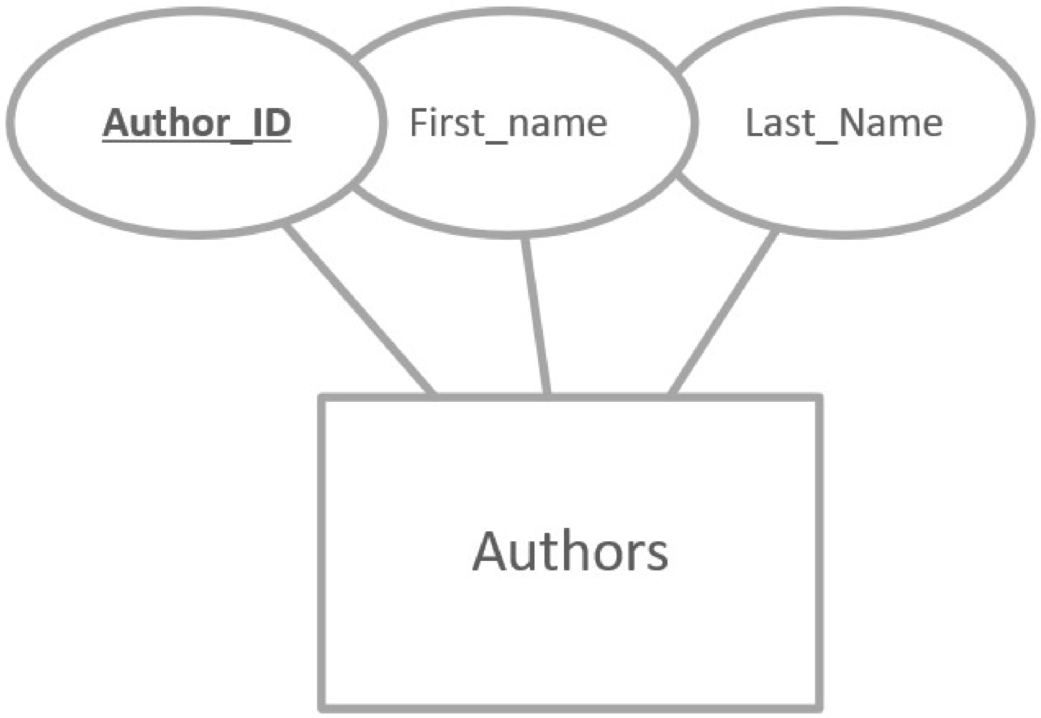
Date	`DATE, TIME`
	`DATETIME, TIMESTAMP`
		Store dates, times, or date *and* time (with precision up to a second).	`01-01-2018`
			`01-01-2018 00:00:00`

Boolean	`BOOLEAN`	Boolean values	`TRUE, FALSE`

Field Properties

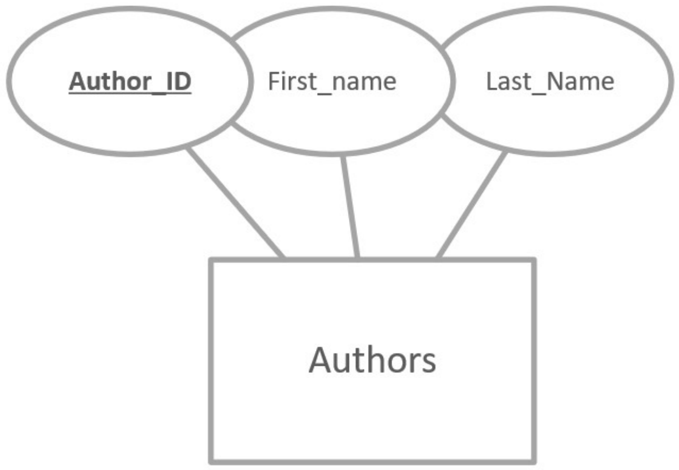
- `NOT NULL`: the field must always have a value
  Example: first name must be not null, middle name may be optional
- `UNIQUE`: the column won't contain duplicate values
- `DEFAULT value`: set the default value for a column, if it's not set by the user
  Example: `item_price float DEFAULT 0.0`
- `AUTO_INCREMENT`: usually used with keys, ensures that the value in the column is unique, and generates automatically new values

Example: the table **`Authors`**



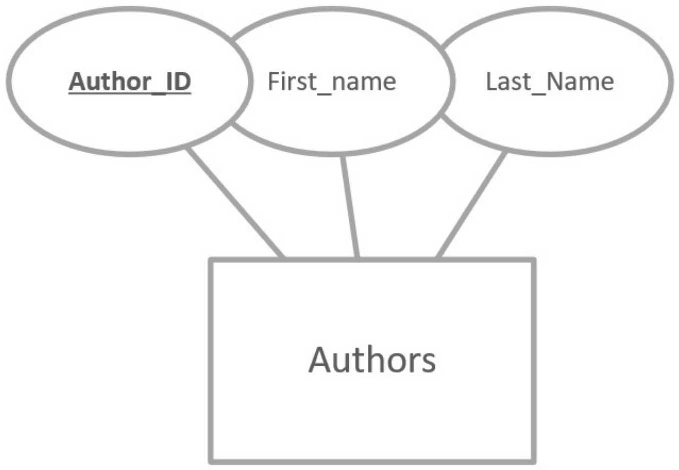
Code

```
CREATE TABLE Authors(

        );
```



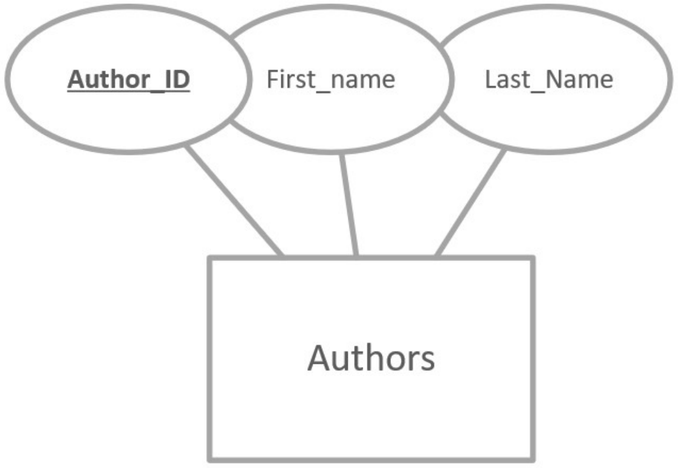
Code

```
CREATE TABLE Authors(
        author_id INT AUTO_INCREMENT,

        );
```



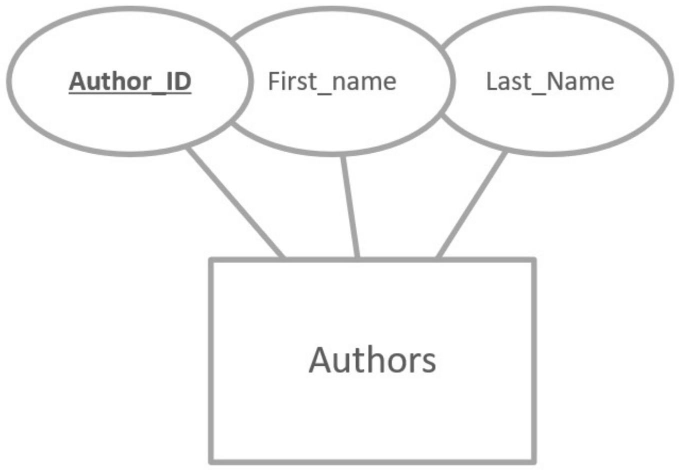
Code

```
CREATE TABLE Authors(
        author_id INT AUTO_INCREMENT,
        first_name VARCHAR(255),

        );
```



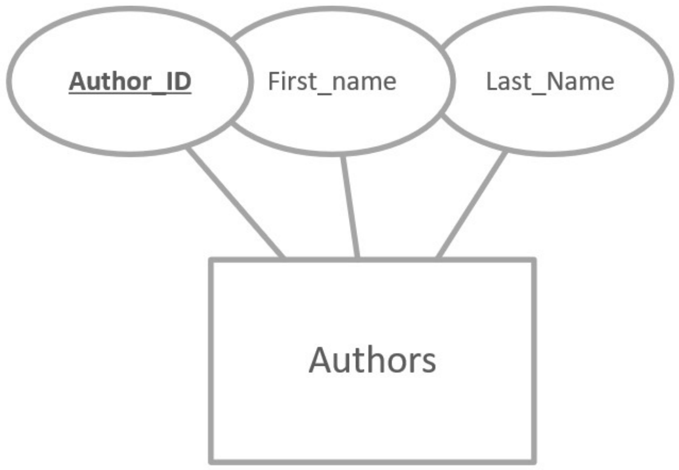
Code

```
CREATE TABLE Authors(
      author_id INT AUTO_INCREMENT,
      first_name VARCHAR(255),
      last_name VARCHAR(255),

      );
```



Code

```
CREATE TABLE Authors(
      author_id INT AUTO_INCREMENT,
      first_name VARCHAR(255),
      last_name VARCHAR(255),
      PRIMARY KEY (author_id)
      );
```



Modify Table

The instruction `ALTER TABLE` can be used to modify tables.

- `ALTER TABLE table_name`
  `ADD column_name type properties;`
- `ALTER TABLE table_name`
  `DROP COLUMN column_name;`
- `ALTER TABLE table_name`
  `MODIFY column_name type properties;`
- `ALTER TABLE table_name`
  `ADD CONSTRAINT table_constraint`

Delete a Table

The instruction `DROP TABLE` can be used to delete tables.

- Drop a table:
  `DROP TABLE` `table_name`
- Drop the table, but first check if exists:
  `DROP TABLE IF EXISTS` `table_name`

`WARNING``:` dropping a table is NOT reversible

Data Manipulation Language

Data Manipulation Language

Instruction set used to

- Insert
- Update
- Remove

data from tables.

Note that we may want to update or remove only a subset of a table, so what instruction may come in handy..?

Insert data/1

We use the **`INSERT INTO`** instruction to insert data into a table. We can use it in two ways:

1. We can specify the columns we want to set; or
2. We can add data for all the columns.

Note that

- We must **always set** columns that are marked **`NOT NULL`**
- We **don't have to set** columns that are marked **`AUTO_INCREMENT`** when we use the first syntax.

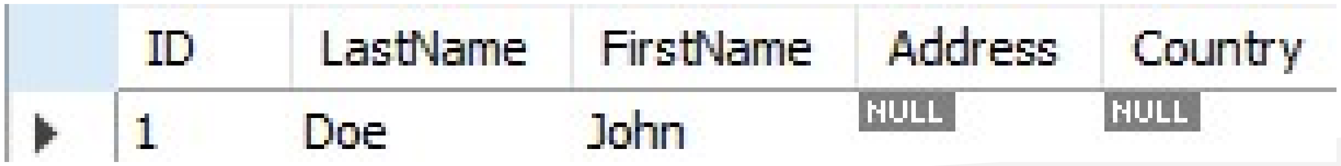
Insert data/2

```
INSERT INTO table_name (field_1,field_2,...)
VALUES (val_1,val_2,...);
```

Example:

```
INSERT INTO Students (LastName,FirstName) VALUES
("Doe", "John");
```

Result:

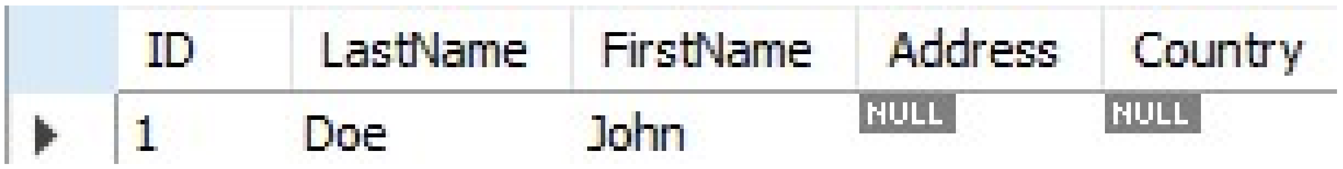


	ID	LastName	FirstName	Address	Country
▶	1	Doe	John	NULL	NULL

Insert data/2

```
INSERT INTO Students (LastName,FirstName) VALUES
("Doe", "John");
```

Result:



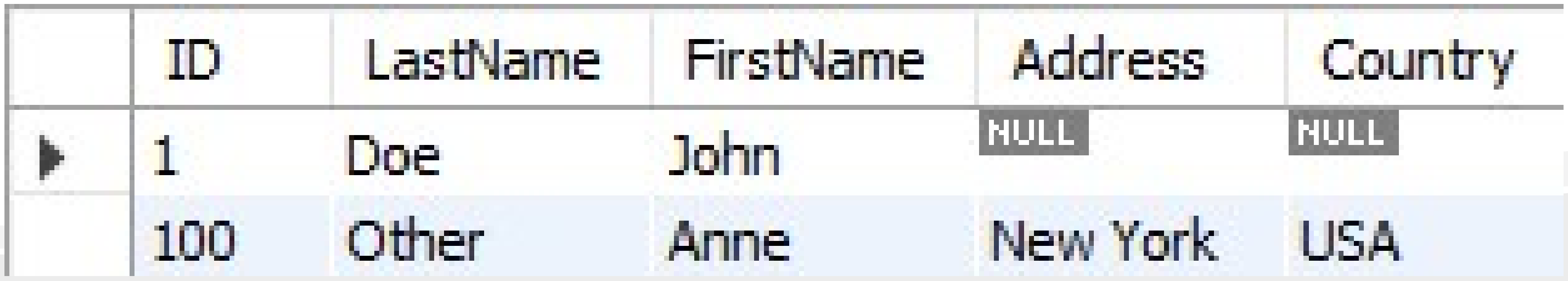
	ID	LastName	FirstName	Address	Country
▶	1	Doe	John	NULL	NULL

Note the `ID`, automatically set at 1, and the Address and Country automatically set as **`NULL`**

Insert data/3

```
INSERT INTO table_name
VALUES (val_1,val_2,...);
```

Example:



	ID	LastName	FirstName	Address	Country
▶	1	Doe	John	NULL	NULL
	100	Other	Anne	New York	USA

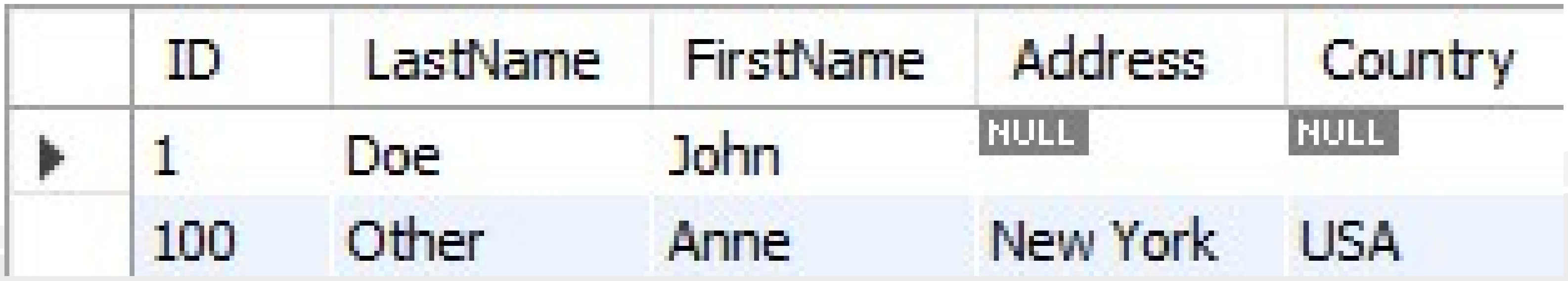
Insert data/3

```
INSERT INTO table_name
VALUES (val_1,val_2,...);
```

Example:

```
INSERT INTO Students
VALUES (100,“Other”, “Anne”, “New York”, “USA”);
```

Result:



	ID	LastName	FirstName	Address	Country
▶	1	Doe	John	NULL	NULL
	100	Other	Anne	New York	USA

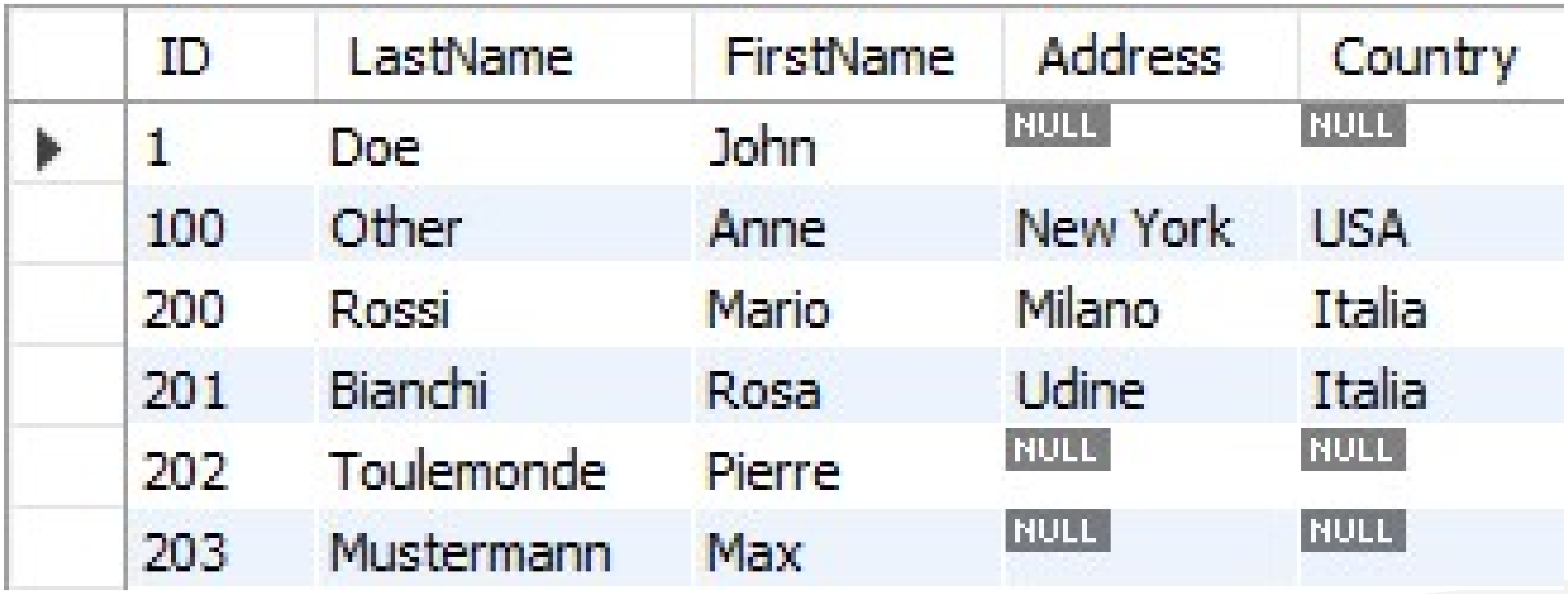
Insert Data/4

Multiple insertions: just concatenate the values with a comma.
Examples:

```
INSERT INTO Students VALUES
(200,'Rossi','Mario','Milano','Italia'),
(201,'Bianchi','Rosa','Udine','Italia')
```

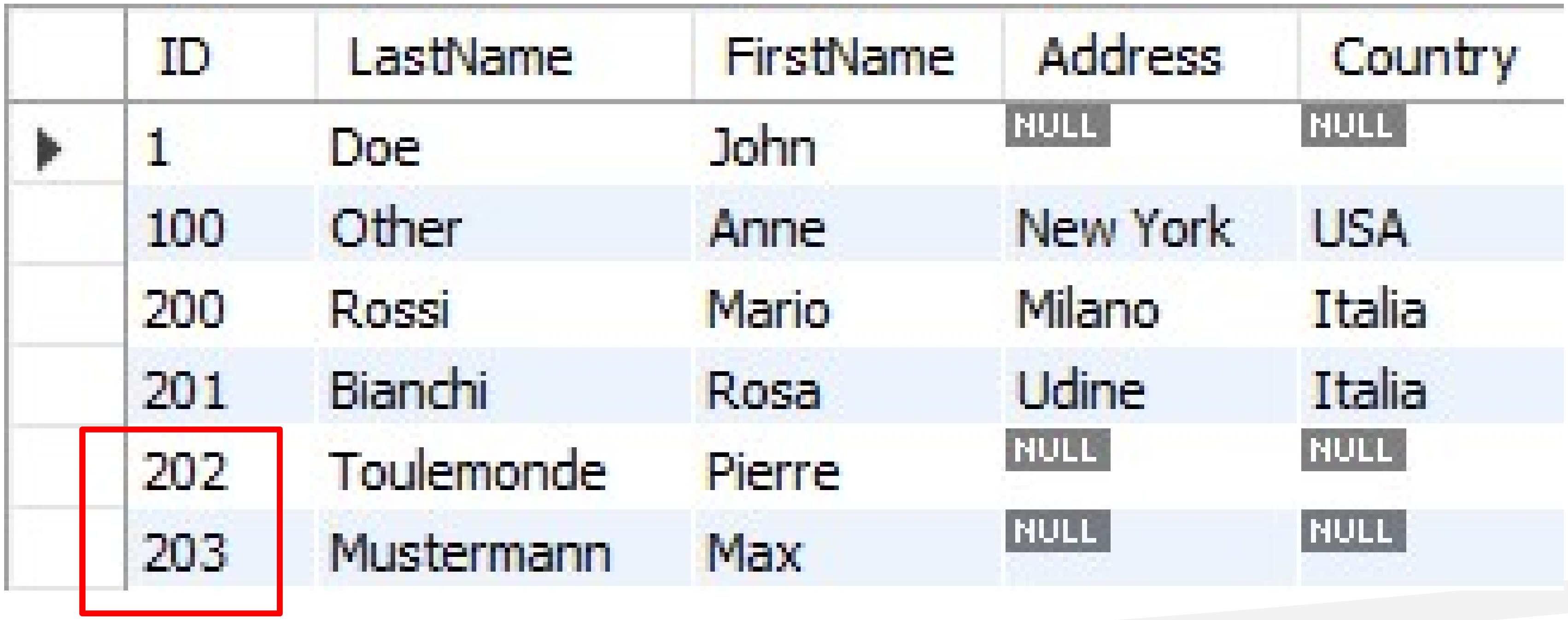
```
INSERT INTO Students (LastName,FirstName) VALUES
('Toulemonde','Pierre'),
('Mustermann ','Max')
```

Insert Data/4



	ID	LastName	FirstName	Address	Country
▶	1	Doe	John	NULL	NULL
	100	Other	Anne	New York	USA
	200	Rossi	Mario	Milano	Italia
	201	Bianchi	Rosa	Udine	Italia
	202	Toulemonde	Pierre	NULL	NULL
	203	Mustermann	Max	NULL	NULL

Insert Data/4



ID	LastName	FirstName	Address	Country
1	Doe	John	NULL	NULL
100	Other	Anne	New York	USA
200	Rossi	Mario	Milano	Italia
201	Bianchi	Rosa	Udine	Italia
202	Toulemonde	Pierre	NULL	NULL
203	Mustermann	Max	NULL	NULL

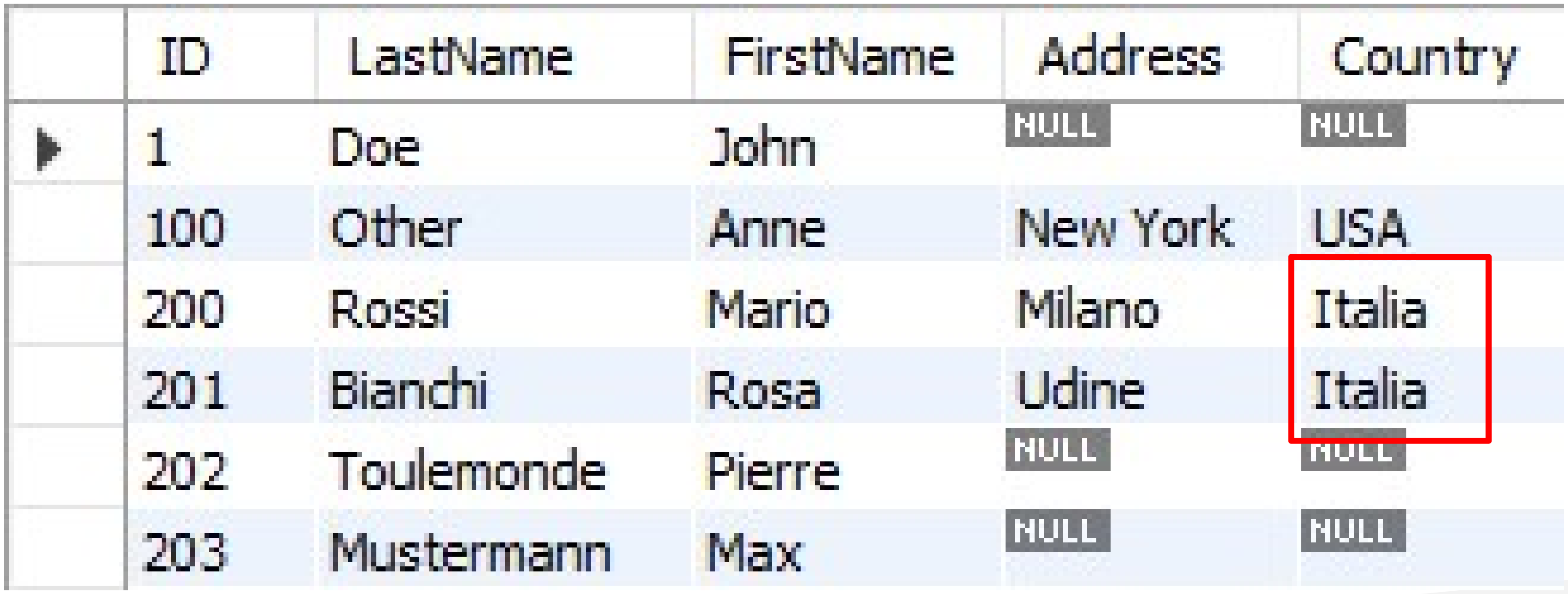
Update data/1

We use the **`UPDATE`** instruction to modify the rows of a table.

- To select the rows we want to update, we use the **`WHERE`** clause – much like in a **`SELECT`**
- Syntax:

```
UPDATE table_name
SET field_1=val_1,field_2=val_2,...
WHERE field=val;
```

Update Data/Example



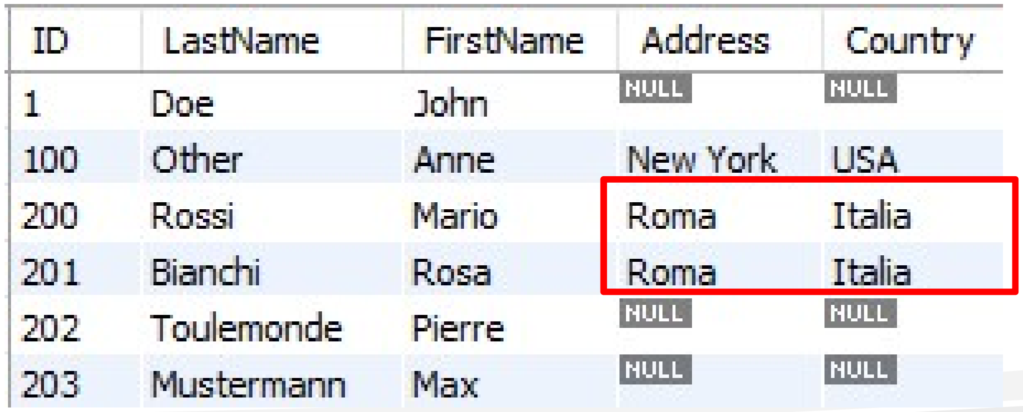
	ID	LastName	FirstName	Address	Country
▶	1	Doe	John	NULL	NULL
	100	Other	Anne	New York	USA
	200	Rossi	Mario	Milano	Italia
	201	Bianchi	Rosa	Udine	Italia
	202	Toulemonde	Pierre	NULL	NULL
	203	Mustermann	Max	NULL	NULL

Update Data/Example

Example:

-
  ```
  UPDATE Students
  SET Address='Roma'
  WHERE Country='Italia';
  ```

Result:



ID	LastName	FirstName	Address	Country
1	Doe	John	NULL	NULL
100	Other	Anne	New York	USA
200	Rossi	Mario	Roma	Italia
201	Bianchi	Rosa	Roma	Italia
202	Toulemonde	Pierre	NULL	NULL
203	Mustermann	Max	NULL	NULL

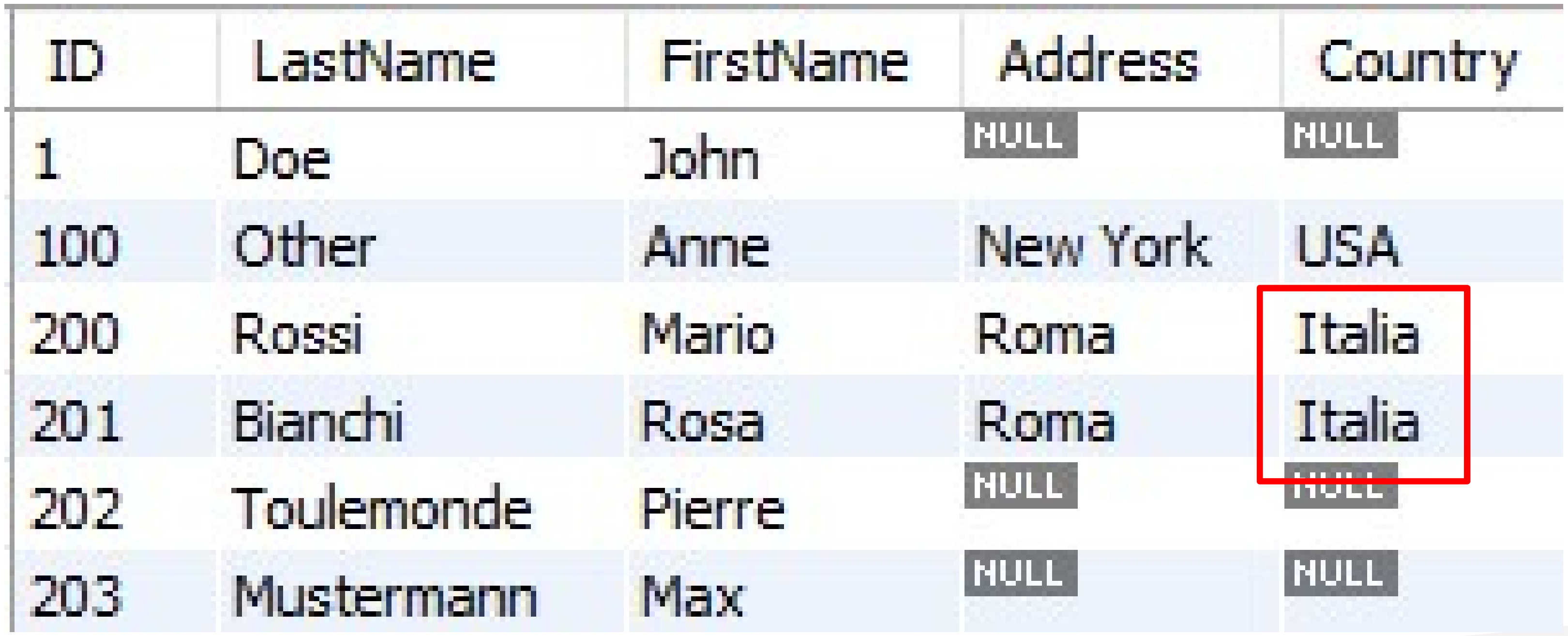
Delete Data/1

We use the **`DELETE`** instruction to delete the rows of a table.

- To select the rows we want to delete, we use the **`WHERE`** clause – much like in a **`SELECT`** and exactly as in a **`UPDATE`**
- Syntax:

```
DELETE FROM table_name
WHERE field=val;
```

Delete Data/Example



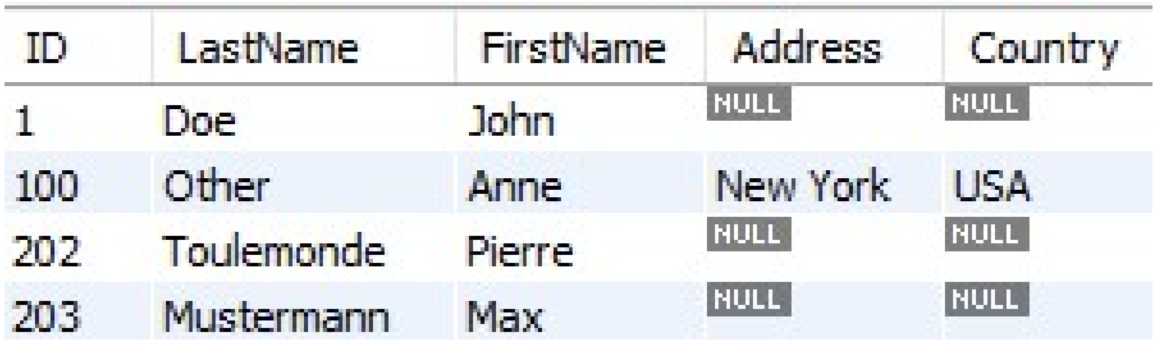
ID	LastName	FirstName	Address	Country
1	Doe	John	NULL	NULL
100	Other	Anne	New York	USA
200	Rossi	Mario	Roma	Italia
201	Bianchi	Rosa	Roma	Italia
202	Toulemonde	Pierre	NULL	NULL
203	Mustermann	Max	NULL	NULL

Delete Data/Example

Example:

- `DELETE FROM Students WHERE ?=?;`

Result:



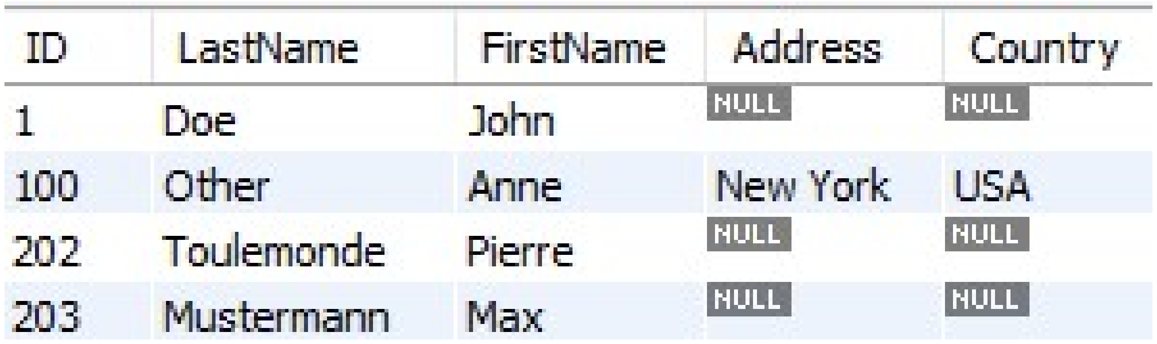
ID	LastName	FirstName	Address	Country
1	Doe	John	NULL	NULL
100	Other	Anne	New York	USA
202	Toulemonde	Pierre	NULL	NULL
203	Mustermann	Max	NULL	NULL

Delete Data/Example

Example:

- `DELETE FROM Students WHERE Country=‘Italia’;`

Result:



ID	LastName	FirstName	Address	Country
1	Doe	John	NULL	NULL
100	Other	Anne	New York	USA
202	Toulemonde	Pierre	NULL	NULL
203	Mustermann	Max	NULL	NULL

Recap

Now we have all the tools for

- Creating tables, setting primary and foreign keys;
- Inserting rows into tables;
- Updating and deleting rows;
- Searching into tables (from yesterday's lecture!)

Exercises

Today’s Database: Pizzerias

Today **you** will create the **Pizzerias** database, slightly modified from yesterday’s afternoon lecture.

You will have to:

- Draw the ER diagram
- CREATE the tables
- I will provide you the data ☺
- UPDATE the data!

Pizzerias

- A **pizzeria** has a name, and is located in a street, in a neighborhood, of a city.
- A **pizzeria** serves many **pizzas** at different prices.
- A **person** has a name, a gender, and lives in a city.
- A person **frequents** one or more pizzerias.
- A person **likes** one more pizzas.