Programmation et traitement statiques de données

Master 1-SAD-S1

Summary

Introduction

What is a database?

Introduction

What is a database?

- The database (DB) is a system that records information.

- It is a simple way to store information.

- This information is organized and structured in a way that allows for easy access and modification of its content

But what is data?

A photo, video, text, numbers,…, etc.

Introduction

What is a database?

o It is necessary to be able to manage and interact with this database.

o You must be able to send messages (queries) in order to add, modify information, delete,

and display elements from the database
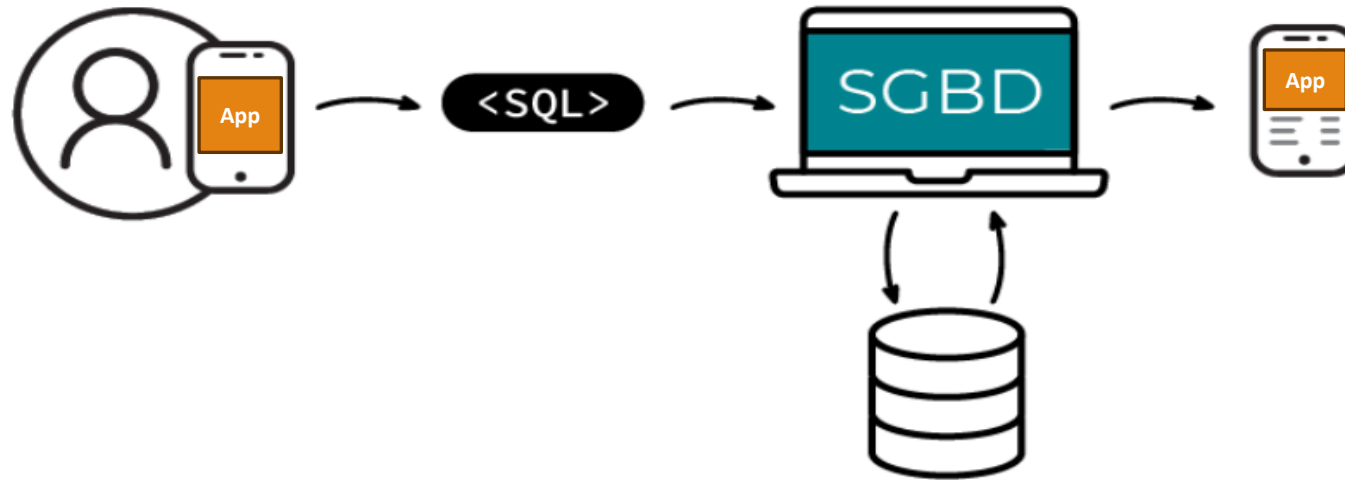
Introduction

What is a database?

A database alone is not sufficient; it is necessary to also have :

- o A system for managing this database => '**DBMS**' (Database Management System).

- o A language for transmitting instructions to the database (through the management system) => '**SQL**'

  (Structured Query Language).

- o These databases follow the rules of the relational model => '**Relational Databases**'.

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What is a database?

The relationship between the SQL language and the DBMS during an action on the application

Introduction

What is a database?

1. **A database management system (DBMS):**

    Is software that allows managing the data in a database. Managing means selecting and displaying

    information from this database, modifying data, adding, or deleting.

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What is a database?

1. **A database management system (DBMS):**

   The most known are:

   o **MySQL:** free and open-source, probably the most famous DBMS.

   o **PostgreSQL:** free and open-source like MySQL, with more features but slightly less well-known.

   o **SQLite:** free and open-source, very lightweight but limited in features.

   o **Oracle:** used by large enterprises; certainly one of the most comprehensive DBMS, but it's not open-source.

   o **Microsoft SQL Server:** Microsoft's DBMS."

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What is a database?

- Most DBMS are based on a **client-server** model.

- The database is located on a server, and to interact with this database, we need to use client software that will query the server and transmit the response that the server provides. (Example: **Client = a web browser**).

- The server can be installed on a different machine from the client; this is often the case when dealing with large databases.

- We need a language to communicate with the client, to give it the queries we want to perform. In this case, the language is SQL.

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What is a database?

2. **SQL (Structured Query Language):**

o   Is a computer language that allows interacting with databases. It is the most widely used language.

o   It is the language we will use to instruct the client to perform operations on the database stored on

     the server.

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What is a database?

SQL offers three modalities:

◦ **DDL (Data Definition Language)**

Intended for creating or deleting objects in the database (tables, etc.)

◦ **DCL (Data Control Language)**

Manages database users and their rights on objects (rights to view, modify, etc.)

◦ **DML (Data Manipulation Language)**

intended for manipulating data contained in tables

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What is a database?

A simple SQL query has the following form:

> **SELECT** $A_1, A_2, ..., A_n$
> **FROM** $tab_1, tab_2, ...tab_m$
> **WHERE** C.

- ○ **A_n**: Attributes.

- ○ **Tab_m**: Relations (table).

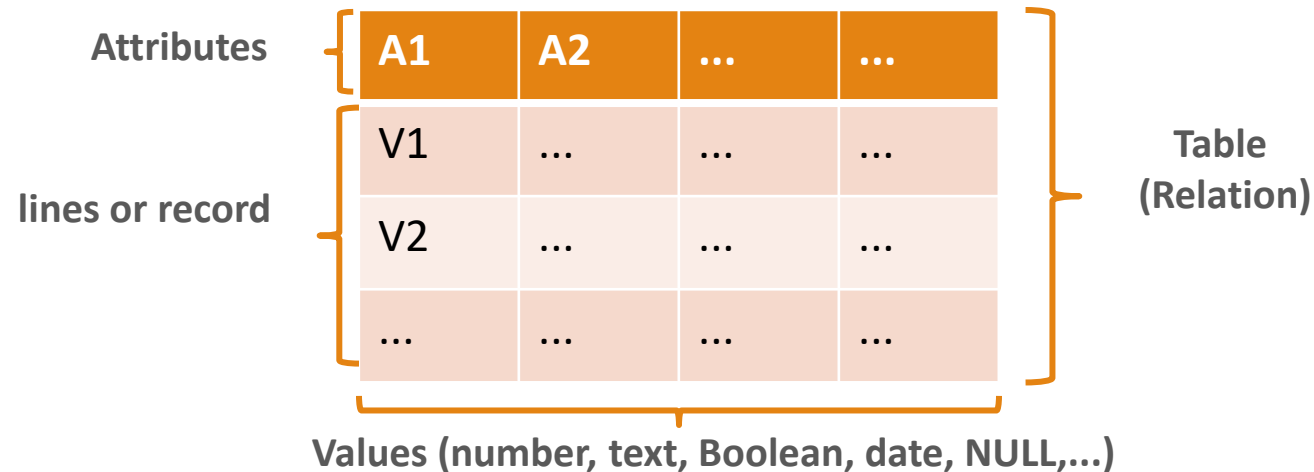- ○ **C**: A condition (or predicate).

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What is a database?

3. **Relational Model**

The relational model is a way to model the relationships that exist among various pieces of

information contained in a database

	A1	A2	...	...
Attributes				
lines or record	V1	...	...	...
	V2	...	...	...
	...	...	...	...

Table (Relation)

Values (number, text, Boolean, date, NULL,...)

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What is a database?

o **Attribute**

An attribute is an identifier (a name) describing data stored in a database.

o **Domain**

The domain of an attribute is the set, finite or infinite, of its possible values.

o **Relation**

A relation R is represented in the form of two-dimensional tables.

o **Relation Schema**

A relation schema R is used to describe a relation. **R(A1:D1, A2:D2, ..., An:Dn)** is a group of attributes. Each attribute Ai is the name of a role played by its domain Di in the relation schema R.

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What is a database?

◦ **Primary Keys**

The primary key of a table is a uniqueness constraint composed of one or more columns. The primary

key of a row uniquely identifies that row within the table

o   We will therefore define 'id' as the primary key of a table, using the keywords:

PRIMARY KEY(id).

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What is a database?

- **Foreign keys**

  Foreign keys are used to manage relationships between multiple tables and ensure data integrity.

  A foreign key is a bit more complex to create than a primary key because it requires two elements:

  - the column(s) on which the foreign key is created - we use **FOREIGN KEY**.

  - the column(s) that will serve as a reference - we use **REFERENCES**.

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What is a database?

◦ **Example:** Relation=Student

ID	First Name	Last Name	Email
1	Manel	Med	Manel@email.com
2	Mohammed	Iben	mm@email.com
3	Ilyes	Ben	yes@email.com

Student <**ID:** Integer, **First Name:** String, **Last Name:** String, **Email:** String>

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What is a database?

3.1 Relational Algebra

o Relational algebra allows us to answer queries.

o Various operations can be applied to these relations, which enable us to extract information from them.

o Some of the most commonly used operations include (where A and B are two relations):

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- **Selection (or restriction) $\sigma(A)$**

  which means obtaining the rows from A that meet certain criteria.

- **Projection $\pi(A)$**

  which means obtaining some attributes of the rows from A.

- **Union A∪B**

  which means obtaining everything that is in relation A or in relation B.

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◦ **Intersection A ∩ B**

refers to obtaining everything that is present in both relation A and relation B

◦ **Difference A−B**

means obtaining what is in relation A but not in relation B.

◦ **Join A⋈B**

involves obtaining the set of rows resulting from the combination of relation A and relation B using a common piece

of information

Database normalization