

# Principles of Software Engineering and Data Bases

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**Exercise Lecture:** 03 - ER Diagram



**POLITECNICO**  
MILANO 1863

# Exercise 1 - Rental Service

- 👉 The rental service has a catalog of **vehicles**.
- 👉 Each car has:
  - 🔍 A license plate number.
  - 🔍 A color.
  - 🔍 Belongs to a category.
- 👉 Each category has a rental rate.

## Exercise 2 - Movies

Define an ER schema that describes the data for an application related to movie scheduling in cinemas. The cinemas screen movies that have a director and actors. The following information is relevant:

- 👉 For movies: title, genre, director, duration, and release date
- 👉 For cinemas: name, city, address, and number of seats
- 👉 For actors: first name, last name, age, phone number, and acting style (e.g., comedic, dramatic, etc.)

Additionally:

- 👉 Each movie has one and only one director.
- 👉 Each movie has zero or more actors.
- 👉 Each movie is scheduled in one or more cinemas.

## Exercise 3 - Car Manufacturers

Define an ER schema for a database related to the price lists of a set of car manufacturers. The following information is of interest:

- 👉 **Manufacturers:** Each manufacturer has a unique name (identifier) and an address.
- 👉 **Models** (e.g., Punto and Golf): Each model has a name, launch year, and market segment. The market segment is coded with a letter and a short description (e.g., segment 'A' corresponds to the description 'subcompact car'). A model is uniquely identified by its name together with the manufacturer.
- 👉 **Versions of models:** Each version is identified by the manufacturer name, the model name, and a specific version name (e.g., FIAT Punto 75S). For each version, the following attributes are relevant: price, engine, engine displacement, power, number of doors, and maximum speed. Each model version has one and only one engine.
- 👉 **Engines** (e.g., Fire 1000): Identified by a code, engines are characterized by displacement, number of cylinders, and power. Some engines may exist without being currently used in any model.

## Exercise 4 - Bus Service Company

Define an ER schema for a database related to a bus service company.

- 👉 **Company:** A company manages a bus transportation service. The company owns a certain number of buses of different models, which are used on various routes.
- 👉 **Buses:** Each bus is associated with a particular depot where it is kept overnight. A bus can operate on different routes, and the same applies to drivers and inspectors, who may work on various buses and routes.
- 👉 **Employees:** The company's staff includes drivers and inspectors (who provide service on specific routes), sales assistants (who are stationed at certain stops), and administrative and maintenance staff who work at the company headquarters. For each employee, basic information such as name, surname, and role is required.
- 👉 **Routes:** Each route includes a departure location, an arrival location, and several intermediate stops.
- 👉 **Depots:** Each bus is associated with a particular depot. Each driver is also associated with a specific depot, and the first and last routes of the day are always conducted on a bus from the driver's assigned depot. However, drivers may operate buses from other depots on other routes during the day.

## Exercise 5 - Paleontological Research

Design a database for the scientific community involved in paleontological research. The database must store information regarding **fossil specimens** of vertebrates that are held by museums. Each fossil specimen is characterized by the location and year of discovery, the researcher responsible for the discovery, the museum and the specific hall where it is stored, and the presumed species it belongs to.

- 👉 Each fossil specimen can be attributed to multiple **species**, each with a different probability level.
- 👉 Each species may have multiple names if different researchers have provided the same name for distinct species. In such cases, the official name is the oldest name.
- 👉 **Museums** are characterized by their halls, their researchers, and their director (who may be a paleontologist or a researcher in a different field).

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## Exercise 5 - Paleontological Research

- 👉 Find all fossil specimens discovered by a specific researcher and display the year of discovery, location, and the hall where they are stored.
- 👉 List all fossil specimens along with their associated species names and the probability level of each species.
- 👉 Find the official name of each species based on the oldest naming date. Display the species ID, official name, and the researcher who provided this name.

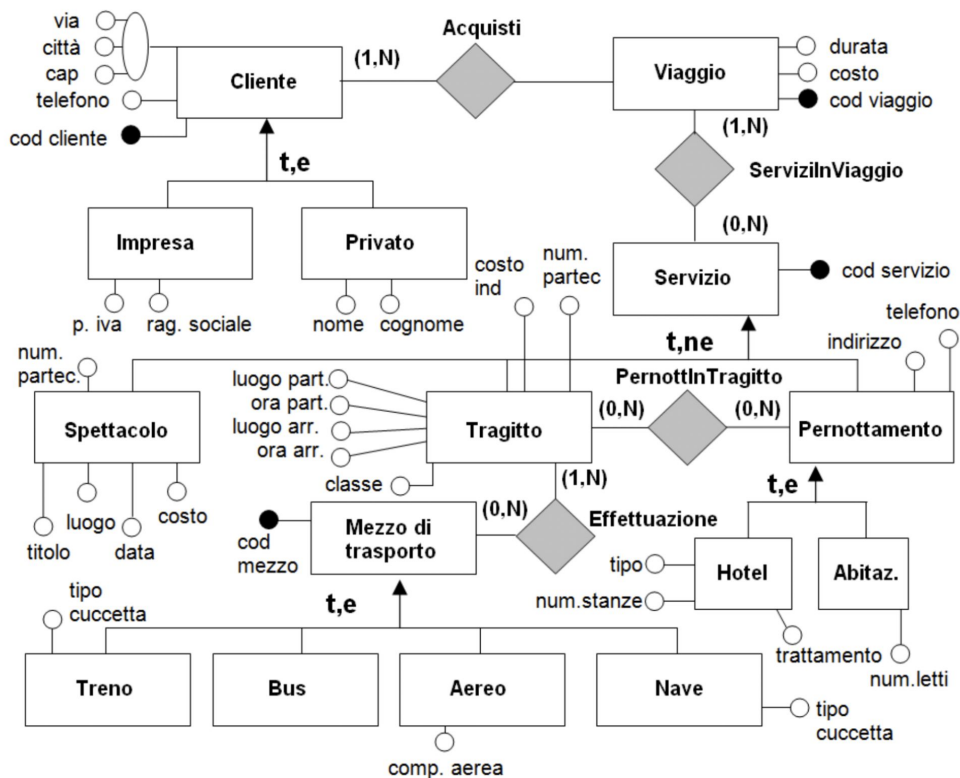
## Exercise 6 - Travel Agency

A travel agency manages information about its clients and their trips. For each client, it is known whether they are a business (characterized by a business name and VAT number) or an individual. In both cases, the address (street, city, postal code), various phone contacts, and a client identifier assigned by the agency are recorded. Each trip is associated with a client (even if multiple people may participate) and is characterized by a unique identifier, a total cost, and a total duration. The cost includes agency fees as well as the cost of various services that make up each trip. These services include transportation, accommodations, and events.

- 👉 **Transportation:** Covers a journey from a departure location and time to an arrival location and time, which can be by train, bus, plane, or boat. Each transportation service has a number of participants, an individual cost, and a class (assumed to be the same for all participants). For air travel, the airline is recorded. For overnight train or boat trips, various sleeping berths (single, double, or triple) can be used.
- 👉 **Accommodations:** Take place over consecutive nights. For each night of accommodation, the total cost is recorded. If the accommodation is in a hotel, the number and type (single, double, triple) of rooms and the service level (bed only, half board, or full board), assumed to be the same for all participants, are recorded. If the accommodation is in houses, the total number of beds available is noted. In both cases, the address and phone number are recorded. Additionally, some accommodations may occur during a transportation service; in such cases, the accommodation cost is zero, as it is already covered by the transportation cost.
- 👉 **Events:** Each event is characterized by a title, location, date, individual cost, and the number of participants.



# Exercise 6 - Travel Agency



## Exercise 6 - Travel Agency

- 👉 Find all transportation services and display their departure and arrival locations, mode of transportation, and number of participants.
- 👉 List all trips along with their total cost, total duration, and the total number of participants across all associated transportation services.
- 👉 Find the total cost of transportation for each trip where all transportation services are flights (mode = 'Plane'). Display the trip ID, total duration, and total transportation cost.