Entity Relationship Diagram

Exercise 1 – Plant wholesaler

You are requested to design a database for the management of the wholesale sale of plants, taking into account the following information:

- Different species of plants are available for sale. For each species both the Latin name and the common name are known, as well as a unique code through which the species is identified. For each species it is also known whether it is typically suited for indoor (apartment) or outdoors (garden) and whether it is an exotic species or not. Plants can be non-flowering or flowering. In the case of flowering plant species, all the colors in which the plant is available are known.

- Customers are identified by a customer code and can be both private customer and resellers. For each private customer, the tax code, name and address of the person are known, while for each reseller the VAT number, name and address are known.

- Suppliers are identified through a supplier code; for each supplier, the name, tax code and address are also known. A supplier can supply different plant species. However, plants of the same species are always purchased from the same supplier.

- We want to keep track of all purchases made by each customer. A purchase, made on a specific date, relates to a certain quantity of plants belonging to a specific species.

- The price list keeps track of the prices assumed over time by each species of plants.

a) Describe the Entity-Relationship diagram addressing the above requirements.
b) Provide a normalized relational logical schema for the same database

Exercise 2 – Municipal swimming pools

You are requested to design a database containing information relating to the swimming pools managed by the municipality of Turin, taking into account the following information:

- The pools are uniquely identified by the name (for example Vigone, Comunale, Trecate, etc.). For each pool, the address, a telephone number and the name of a manager are also known. If the swimming pool also has an outdoor pool, the database contains information on when this pool can be used (for example from March to September, from July to August, etc.)
- Courses are organized at the pools; the same type of course can be offered by different swimming pools in different modalities. Each course is therefore identified by the name of the activity carried out (e.g., Aerobics, Acquagym, Synchronized swimming, or course for pregnant women), and by the name of the swimming pool where this course takes place. For each course, available at a certain swimming pool, available information include the cost, the maximum and minimum number of participants, on which days of the week it takes place and at what time. At each swimming pool each course is held only once per day, but several times during the week.
- The teaching staff rotates among the various pools. Each teacher is identified by the tax code and is characterized by the name, surname, mobile phone number, if available, and the teacher's list of qualifications (for example diving instructor, aerobics instructor, etc.). Within the database we want to keep track of all the

time intervals in which a teacher worked at each swimming pool. It is possible that the same teacher works at the same swimming pool in different time intervals.

- The swimming pools can be attended either by people who are enrolled in courses, or according to the "single entry" method for free swimming (note that only people who have never attended courses are registered for single entry). All people who access the municipal swimming pools are identified by their tax code and also known by their name, address and telephone number.
- Persons who are enrolled in courses must present a medical certificate. Therefore, if the person is enrolled in a course, the database contains information about the doctor who issued the certificate, the date on which the person presented the certificate, the person's age, and the list of courses to which the person is enrolled. For people with "single entry" registration, only the date on which the last entry was made and at which swimming pool are known.

a) Describe the Entity-Relationship diagram addressing the above requirements.
b) Provide a normalized relational logical schema for the same database

Exercise 3 – Court and courtrooms

You are requested to design a database containing information for the management of some activities of the Italian courts.

- The courts are characterized by a unique numeric code, by the city and address where they are located and a list of telephone numbers. Each court is characterized by the hours of operation (opening time and closing time) which varies according to the day of the week. For each court it is requested to store the opening hours on each day. Each court has several courtrooms used for hearings. Each courtroom is identified by a unique code within the court in which it is located and is characterized by a name.
- Various cases are being disputed in the courts. The people involved in the lawsuits are identified by a unique code and are characterized by their name and a mobile phone number. People are divided into judges and lawyers. For each judge, the list of honorary titles acquired is known. In particular, for each title, the date on which the title was awarded to the judge and a brief description of the reason for which the title was awarded are known. Consider that the same title may have been assigned to several judges, but only once to each judge. For lawyers, the address of the office where they work is known.
- The cases are identified by a unique numeric code. Each case is characterized by a name, a start date and an end date (consider that the end date is known only after the case is finished). The lawyer assigned to follow the case is known.
- Different hearings may be held for each case. Each hearing is characterized by the case to which it refers, the courtroom in which it takes place, and the date, start time and end time in which it takes place. It should be noted that several hearings cannot be held simultaneously in the same courtroom for the same cause or for different causes.

a) Describe the Entity-Relationship diagram addressing the above requirements.
b) Provide a normalized relational logical schema for the same database

Exercise 4 – Foreign language courses

You are requested to design a database containing information the management of a school that provides language courses.

- Language courses are uniquely identified by a code and the start date of the course. The language taught, cost and level (e.g. beginner, intermediate, advanced) are also known for each course.

- The language courses are organized in lessons. Each lesson is identified by a unique code within the course and is characterized by the day on which it is held, start time and end time, minimum and maximum number of participants.
- Lessons are held on the school premises. For each lesson it is necessary to memorize the room where it takes place. The rooms, identified by an alphanumeric code, are classified into classrooms and laboratories. The classrooms are characterized by the maximum capacity, the floor on which they are located and the number of blackboards present. The laboratories, on the other hand, are characterized by the name, the number of personal computers present and the type of audio system they have.
- The language experts who work at the school are characterized by their tax code, name, surname, e-mail address, telephone number and list of qualifications acquired with the date of achievement and the mark obtained. For each qualification, the language institute that issued it is also known. Each linguistic expert teaches at least one course, while the same course can be taught by more than one linguistic expert.
- The language experts are in charge of the laboratories. The database shall store all the time periods in which the language experts have been responsible for the different laboratories. A laboratory can have several managers in the same period of time, and a language expert can be responsible for several laboratories in the same period of time.
- Students enrolled in the school are identified by a registration number and characterized by name, address, telephone number and e-mail address if available. For each student, the list of courses in which they are enrolled and the list of lessons they have attended is also known. A lesson can be attended by several students.
- The school organizes language exams for students who want to get a certificate. Each exam is identified by a unique code and is characterized by the type of certificate issued and by the organization that organizes it (for example, Cambridge, Oxford, etc.). The database stores all the registrations for exams made by people who attend courses at the school. Each registration is characterized by the student who signs up, the exam they want to take, and the day on which the exam will be held. A person can take at most one exam per day, while for the same exam the same person can register several times to take the exam on different days.

a) Describe the Entity-Relationship diagram addressing the above requirements..
b) Provide a normalized relational logical schema for the same database