

Projects for the Database Laboratory

Thessaloniki, November 2022

1. The Car Delegation

The dealership has mechanics, salesmen, can sell new and used cars, and can also service cars.

For each seller we enter a unique code, their surname and name. A seller can sell several cars, but each car is sold by only one seller.

For each car we enter a unique code, the company that manufactured it, its model, its colour, its year of manufacture, its serial number and whether it is for sale (Y) or for repair only (N).

For each customer we enter a unique code, their surname and name, their contact phone number and their address (city, postal code, street, number). A customer can buy several cars, but each car is bought by only one customer.

A salesman cuts a single invoice for each car he sells. A customer receives an invoice for each car he buys. When an invoice is cut, its code number, the date of issue and the total value in euro are recorded.

A customer can come to the service department to have his/her car repaired (without necessarily having bought his/her car from the dealership). When a customer brings in one or more cars for repair, a service ticket is cut for each car. When a service ticket is cut (and during the repair), a unique code is recorded for the ticket, the date the car was brought into the service department, the date the car was picked up by the service department, comments/observations about the repair, and the cost of the repair.

A car that comes in for service can be repaired by many mechanics and each mechanic can work on many cars. For each mechanic we enter a code, his last name and his first name. For each service performed and for each mechanic working on it, we record the hours of work required, as well as the mechanic's comments on the repair.

- I. Construct the ER diagram of the database by identifying the entities and their relationships. Document, based on the database requirements listed above, (a) the type of each association in the model and (b) whether or not each entity necessarily participates in its associations.
- II. Construct the complete relational model by converting the corresponding ER constructed in question I. Write down the SQL-DDL code that will construct the DB according to this model.
- III. Provide the SQL expressions for the following queries:
 1. Display all the details of cars whose model includes the word "Toyota".
 2. Display a list of all invoices cut during the year 2021.
 3. Calculate the total number of cars repaired at the service station.
 4. Display the codes and full names of customers who have bought more than two cars.
 5. Display the name of the engineer who worked the most hours.
 6. Calculate the total turnover of the dealership from its service department in the year 2021.
 7. Display the code and full name of the seller who made the most sales.

2. The Bank

The bank has a set of customers for whom it registers a unique code, their name, surname, maiden name, telephone numbers (as many as they have), their home address (city, street, number, postal code), VAT number and their ATM.

The bank has three types of accounts for its customers: savings, demand and loan. Each account belongs to a single customer (no joint accounts are allowed). However, a customer may have more than one account.

For each customer's account, the bank stores a unique account code, the type of account (savings, demand or loan) and the current balance of the customer's account. In addition, for each account, its activity is recorded, whether it is a savings, demand or loan account. For each account movement there is a code that uniquely identifies it, the type of movement (withdrawal, deposit, etc.), the date of the account movement and the amount of the account movement.

An account may optionally be linked to one or more credit cards, and a credit card may be linked to one or more accounts. In the case of a linked card, the card ID, card PIN and card expiration date must be entered.

Each customer can have an e-Banking account with a unique password, which requires a username, a password and an e-mail address to access it.

The bank has many employees and each of the employees is identified by a unique code, their first name, surname, home address and contact telephone number.

Each customer can be served by several employees and each employee can serve several customers. Each time a service is performed it is recorded, with the date and time it was performed.

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- II. Construct the complete relational model by converting the corresponding ER constructed in question I. Write down the SQL-DDL code that will construct the DB according to this model.
- III. Provide the SQL expressions for the following queries:
 1. To display a list of all the details of the account movements made in the month of September 2021 sorted according to the date of the movement.
 2. To display the full names and telephone numbers of all bank employees in alphabetical order by surname and then by name.
 3. To display the full names, usernames and passwords of all e-banking customers.
 4. To display the codes and names of all employees who have served the customer "Papadopoulos Christos".
 5. Display the full names of customers who have at least one savings account or a current account.
 6. Display the full names of customers who have more than one loan account.
 7. Display the full names of customers who use at least three credit cards.

3. The Electronic Bookstore

An e-bookstore (e-shop) sells books to its customers, which it keeps in various warehouses.

For each customer a unique code is registered, his/her name, surname, patronymic, telephone numbers (as many as he/she has), home address (city, street, number, postal code) and e-mail address.

For each book the bookstore has a unique code, its title, the authors of the book, its year of publication, its ISBN, its publisher's code, its selling price and the quantity available in the warehouse.

Every book has at least one author, and one author can write many books. For each author a unique code, his/her full name and e-mail address is recorded.

Each book is published by a particular publisher, but one publisher can publish many books. For each publisher a unique code is recorded, its name, its address, its telephone numbers (as many as it has), and its URL.

The books are in storage. A book (with all its available copies) is located in a particular warehouse. A warehouse can have many books. A unique code, its address (town, street, number, postcode) and its contact telephone number are recorded for each repository.

Every time a customer wants to make a purchase, they have a shopping cart. For each shopping cart a unique code is recorded, the code of the customer making the purchase, and the date on which the purchase is made. The contents of the basket may contain one or more books with their respective prices (which may have been discounted).

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- II. Construct the complete relational model by converting the corresponding ER constructed in question I. Write down the SQL-DDL code that will construct the DB according to this model.
- III. Provide the SQL expressions for the following queries:
 1. Display the titles of all books published by "IEEE" in alphabetical order.
 2. Display the names of the publishers of all books whose titles begin with "Programming".
 3. Display a list of all the items in the books by the author "Paulo Coelho".
 4. Calculate the total quantity of books available in each warehouse.
 5. To display the name of the customer who made the largest shopping basket in terms of value.
 6. Display the full name of the author who has written the most books.
 7. To display the codes and titles of books purchased by more than 5 different customers.

4. The Commercial Enterprise

The trading company has a set of items which it buys from various suppliers and sells to its customers.

For each item the firm records a unique code, a summary and a detailed description of the item, the category of the item, its current purchase price, its current selling price, and its current available quantity.

For each supplier, the company records a unique code, his name, his address (city, region, postal code, street, number) and his telephone numbers (as many as he has). Each supplier can sell and supply a number of different items to the company. Also, the undertaking may also supply a particular item from different suppliers.

For each customer the company records a unique code, his name, his address (city, region, postal code, street, number) and his telephone numbers (as many as he has). Each customer can purchase various items from the firm.

Each time a purchase of an item is made from a supplier, the date of the purchase, the quantity purchased, the unit price (on that particular day), and the total value of the purchase are recorded.

Each time a sale of an item is made to a customer, the date of the sale, the quantity sold, the unit price (on that particular day), and the total value of the sale are recorded.

The company has a number of employees. For each employee the enterprise records a unique code, his surname, his name, his home address (city, district, postal code, street, number), a contact telephone number, his tax identification number and his VAT number.

For each purchase (or sale), the code of the employee who made the corresponding purchase (or sale) should be recorded.

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- II. Construct the complete relational model by converting the corresponding ER constructed in question I. Write down the SQL-DDL code that will construct the DB according to this model.
- III. Provide the SQL expressions for the following queries:
 1. To display all the details of employees whose surname begins with "Papa".
 2. To display a list of the items of the business (it will contain a code, summary-analytical description, category) sorted according to their summary description.
 3. Show the code and a brief description of each item sold at a price of more than 100 euros in the year 2021.
 4. Calculate the total cost of all the items available to the firm based on their current available quantity and their current cost (purchase) price.
 5. To display the codes and names of the suppliers who supply the company with items in the category "Electronics".
 6. Display the code and the full name of the Customer who made the highest turnover in the year 2021.
 7. Display the full name of the employee who made the fewest sales.

5. The Educational Group

An educational group has a set of schools in different places, which employ employees and teachers, and have a set of students.

For each school in the group, a unique code, its title, its address (city, street, number, postal code) and its telephone numbers (as many as it has) are recorded.

For each employee working in the group, a unique code, his/her name, surname, job position in the group, home address (city, street, number, postal code), tax identification number, VAT number, telephone number, contact number and date of employment are registered. An employee works in a specific school of the group.

For each teacher working in the group, a unique code, his/her name, surname, speciality, home address (city, street, number, postal code) and contact telephone number are registered. A teacher may work in one or more schools in the group (at different times). For each school where he/she works, the working hours are recorded (in plain text).

For each student of a group school, information such as his/her code, name, surname, mother's and father's name, date of birth, home address (city, street, number, postal code), contact phone numbers (landline and mobile) and total number of absences is recorded.

The students of a school are organised into sections. For each section, a unique code, a distinctive title, the number of the section and the number of students it holds are registered.

For each teacher, the courses he or she teaches are listed. For each course a unique code, a title and a description of the course are recorded. A particular course may be taught by several teachers, but delivered by one teacher within a department.

For each student a list of grades of the courses he/she is attending is recorded (when they are registered).

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- II. Construct the complete relational model by converting the corresponding ER constructed in question I. Write down the SQL-DDL code that will construct the DB according to this model.
- III. Provide the SQL expressions for the following queries:
 1. Show the total number of employees employed by the educational group.
 2. To show the total number of teachers employed by the group by subject.
 3. Display the averages of the grades recorded per course.
 4. To display a list of all the teachers with the specialty "Philologist".
 5. For each teacher, the courses he/she teaches (code, title).
 6. To display the codes and full names of teachers who teach more than three courses.
 7. Display the codes and full names of teachers who teach in more than two schools.