Databases

WWI-21-DSA/WWI-21-DSB

Database project - description

17. January 2023

This project is designed to assess basic skills of design and implementation of relational databases. The project should be a group work where each group could have at most three members. Each project should address its own independent problem. PostgreSQL has to be used as an RDBMS.

1 Requirements specification

Select an arbitrary problem and write a specification of requirements for your database application. The specification should be written in text form similar to the form used to describe UNIVERSITY database in the lecture exercise No. 2.

2 ER Diagram

Create an Entity-Relationship diagram for the database whose specification is described in task No. 1. ER-diagram should be created using the Chen notation which was used in lectures. This ER-diagram has to be submitted as part of the final project documentation.

1. ER diagram should contain at least 7 entities.
2. Many-to-many, one-to-many and one-to-one relationship have to be included in the diagram.
3. The diagram has to include at least one weak entity set.
4. Database design tool such as pgAdmin4 or MySQL Workbench can be used to create database. However it's not obligatory.

3 Transforming ER-diagram into Relational Model

Convert the ER diagram into a relation schema represented in SQL. You have to include tables (relations), keys (primary keys and unique constraints), referential integrity constraints (foreign keys) as well as all additional constraints necessary to implement the database. DDL statements must correspond to the ER diagram.

1. Make an analyses to check whether database relations satisfy at least 3NF. Documentation of the project should contain this normalization section.
2. Declare relations using SQL DDL statements. Final documentation of the project has to contain a database dump file of your database with DDL statements and insert statements to populate the database with test data necessary for the project evaluation.
3. The database should have at least two views (one simple view and one materialized view).
4. The database should define at least one stored procedure (stored function). This procedure should be executed by a trigger when an event occurs.

5. Documentation of the project should include at least 7 SQL queries defined over the database. These queries cannot be just simple SQL queries. These SQL queries should contain advanced constructs for retrieving data such as joins, renaming, nested queries, set operations and aggregate functions. Additionally, each query should have description of what it does (written in plain English).

6. Based on the business functions and defined queries, choose attributes that should have secondary indexes in order to increase efficiency of certain defined queries. Define indexes on those attributes.

4 Application

Database application should have a graphical user interface to execute corresponding business functions. To this end, the application uses CRUD (create, read, update, delete) operations, views and queries over database tables, and other database elements defined in task No 3. The application should be developed as a web application.

1. Backend of the database application should be implemented using the Python programming language.

2. The application could be developed using a Python framework for web programming such as Flask and SQLAlchemy can be use as Object-Relational Mapping tool. Using other Python frameworks, similar to those already mentioned, is allowed.

3. Given that the backend is implemented in Python, students can use given Python frameworks to implement the frontend. However, students could also use another technologies to implement frontend of the application.

5 Submission

Groups should submit the project in the following form:

1. Groups should first submit preliminary specification of the project (pdf file) that contains group name, names of group participants and problem specification. This specification can be extended during the program implemention but the whole topic cannot be changed.

2. Final documentation of the complete project (containing specification, ER diagram and explanation of all other necessary project elements) has to be submitted as a pdf file to the Moodle assignment for the project which will be open during the next semester. That file should be named project_documentation_group_name.pdf

3. Source code of the project and scripts that create and populate the database should be submitted as a zip file together with the final documentation.

4. Each group is expected to record a video of 5 - 10 minutes in which it presents its project. This Video should explain how application functionalities work using frontend of the application and briefly the structure of the database.

5. The application and database should be wrapped up in Docker containers. A docker-compose.yml file that can be used to start necessary containers should be included in the zip file containing the source code and other files in the final documentation.

- Deadline for the submission of the preliminary specification with names of group participants is February 15, 2023 (11:59 pm).

- Deadline for the submission of the complete project is July 15, 2023 (11:59 pm).

- Before submitting the project make sure that it satisfies necessary requirements and that all necessary files are included. A good way to check whether the project works is to install and run it on a machine different from the one on which it was developed. The project is submitted by one single member of the group.

6 Evaluation

The evaluation of the project will be done in the following way:

1. ER diagram and DDL - max 8 points
2. SQL queries (views, stored function (procedure), etc.) - max 5 points
3. Normalization - max 3 points
4. Application - max 4 points
5. Bonus: 5 points
6. **Total : 25 points**