CS 425 - Course Project
Database Organization: Fall 2023

<<select a DB application from a pool of topics – refer to a shared spreadsheet >>

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1 Project Timeline

The project consists of five (5) deliverables. This is a group project and must not exceed five (5) members. Each group will record a video to demonstrate the application at the end of this course. There are specific deliverables that need to be met at each project development phase. Every member of the group must contribute to each phase of the project, and you will be graded based on your individual contribution and the overall project result. Deadlines will also be announced on the course platform.

The deliverables include:

1st Deliverable (Design a relational database) – 29th Sept 2023.
Design a relational database consisting of the most essential information required for your selected application. Explore the website of the selected application to identify the relevant data, relationships, semantics, constraints, users, and users' needs, and interesting use cases (a use case is a description of how a user might interact with a database, system, or process to achieve a specific goal or perform a particular task). Represent your design using the Entity relationship - Diagram (ERD). Make sure your ERD consists of between 6 to 8 entities. Reduce your ERD into relation schemas to represent the database at the logical level.

See example of the relational schema that can be extracted from the [F1 official website: F1 - The Official Home of Formula 1® Racing]. Additionally, relationships, constraints, and user use cases can be found on the website.

Relation schema (showing relations/entities and attributes)
Driver (DriverID, TeamID, Country, Podiums, Points, GrandsPrixEntered, WorldChampionships, HighestRaceFinish, HighestGridPosition, DateofBirth, PlaceofBirth)

Team (TeamID, Base, TeamChief, TechnicalChief, Chassis, PowerUnit, FirstTeamEntry, WorldChampionships, HighestRaceFinish, PolePositions, Fastest Laps)

Race (RaceID, Position, Number, DriverID, Car, Laps, Time/retired, Points)

2nd Deliverable (Create and load data into the database) – 6th October 2023.
Create the database in the database system (MySQL, PostgreSQL) using general Data Definition Language (DDL) statements. Load mock data (from free online data generator tools) into the database. Ensure that you have loaded at least 15 records per relation. Furthermore, you are required to implement indexes, views, temporary tables, triggers, stored procedures, and functions in your database (assume interesting business logic where applicable). Display the statements you have employed for each task, along with the corresponding output.

3rd Deliverable (Test a variety of SQL queries) – 20th October 2023.
Test a variety of SQL queries of your choice on your database. Additional points will be awarded for queries derived from interesting use cases. Ensure that you test at least 15 different (including advanced window features, and OLAP) queries and provide: 1) the query explanation/description, 2) the SQL statement/commands, and 3) the output/result for each query.

4th Deliverable (Write and test a simple program/application) – 27th October 2023.
Write a program in a programming language that SQL supports to implement basic Create, Read, Update, and Delete (CRUD) operations, which encompass adding, reading, modifying, and deleting database records. The program or application must be developed using Python, Java, or C/C++, and it can be web-based, a desktop application, or a command-line tool. The application's functionality should be demonstrated through a video recording to be submitted by the due date.

5th Deliverable (For Credit: Extend program) – 17th November 2023.
Extend the program developed in the 4th deliverable to encompass a range of challenging/complex SQL queries, including set operations, set membership, set comparison, subqueries using the WITH clause, advanced aggregate functions, and OLAP. Furthermore, your program or application should include a user-friendly interface with menus, buttons, icons, etc. The application's functionality should be demonstrated through a video recording to be submitted by the due date.

2 Overview

The goal is to build an application that uses a database backend. Explore the official website, identify essential information to store in the database. Create the database and load mock data to support a wide range of SQL queries. The application should support a basic interface, Create, Read, Update, and Delete (CRUD) operations, and test several use cases identified for the database application.

3 Database Requirements

3.1 Users

Clearly identify the type of users for the database application selected for this project and describe the role of each user.

3.2 Data, relationships, and constraints

Identify the type of data, data relationships, data semantics, and any constraints to be considered during the database creation. Clearly describe each of these design aspects considered for your database application.

3.3 Use cases

Identify and clearly describe the database use cases the need to be tested using the application. Develop sample queries that are suitable to test each use case.

4 Application Requirements

The application should support the following features:

- A user-friendly interface that allows users to connect to the database.
- Basic CRUD operations (such as add/delete/modify records), and complex sample queries (such as set operations, aggregate functions, set membership, set comparison, subqueries using WITH clause, OLAP queries).
- Test a variety of use cases identified for the selected application.
  - These may include searching and browsing products or services, putting products into a shopping cart, place an order, compute relevant analytics, etc.

Submission instructions:

You are required to compress all your working files and folders for each deliverable into a single folder, which should be submitted using the provided submission link under the assignment tab on the course platform by each due date.

END