UTD
CS 4347 Database Systems
Database Project Description

Project Objective:
This project requires students to work on a database project to exercise the relational DBMS software, SQL, and database design techniques learned and to gain the project experiences. The major focus of the project will be Entity-Relationship modeling, relational database design, SQL, normalization, and Web-based database system development.

Project Ideas: read page four of this document

Team Structure:
The project is a team project for students to learn how to become effective team players in a software project. Each team may have 4-5 students (not 1, 2, or 3 and not 6), and one student will be dedicated as the team leader. Each team member must contribute to all project deliverables.

Database Management System:
You are allowed to use any DBMS that is free and available to you such as PostgreSQL and MySQL

Project Phases and Deliverables Items

Phase 1 (Due on Sunday 02/13/2022): Requirements Analysis (15%)
System requirement specifications are due that includes:
  a) System description
  b) Context diagram (system architecture)
  c) Functional requirements (user's operational concepts)
  d) Non-functional requirements (e.g., response time, maintainability)

Phase 2 (Due on Sunday 03/06/2022): Conceptual and Logical Database Design (15%)
The following document is due for this phase
  a) ER Diagram (including the description of the entities, attributes, keys, cardinality, andparticipation constraints)
  b) Database Schema
  c) List of business rules and integrity constraints of the database.
  d) Interface requirements

Phase 3: (Due on Sunday 04/03/2022) Normalization and Database Implementation and Testing (25%)
  The following tasks and documents are due for this phase
  a) Specify a set of functional dependencies for each relation presented then show the normalizationprocess and normalized tables for each relation to 3NF (if applicable).
  b) Show the implementation of tables in the target DBMS (snapshots of tables in DBMS)
  c) SQL statements for database construction and data population
  d) Identify the functional dependencies of the database schema
  e) Implementation and demonstration of the database system (snapshots of GUI)
  f) Suggestions on database tuning in terms of index structures, database design, or queries. (optional)
  g) Additional queries and views (snapshots of query and view implementations)

Phase 4. (Due on Sunday 04/24/2022) Front end application (25%)
The last part of this assignment is to write an application that users can use to communicate with your database. This application should be written in a programming language of your choice (such as Java) that uses a DB connecter (such as JDBC) to connect to your database to manipulate the proper data. Your application program should consist of a continuous loop in which:
  a) A list of at least five alternative options is offered to the user. (An additional alternativeshould be quit.)
  b) The user selects an alternative.
  c) The system prompts the user for appropriate input values.
  d) The system accesses the database to perform the appropriate queries and/or modifications.
  e) Data or an appropriate acknowledgment is returned to the user.

Both input and output in the application should be in a format more convenient and pleasing than rawinteractive SQL. Please include some interesting queries or modifications, i.e., operations that requiresome of the more complex SQL constructs such as subqueries, aggregates, set operators, etc. As a general example, if your database is a campus applicant database, then your interface might include inits menu several useful queries on the database, with some queries performing statistical analysis requiring multiple levels of grouping, and other queries.
 For this phase, just demonstrate this application to the TA during the final demo.

Final Complete Project Report (Due: Monday 05/02/2022) (20%)

Submit a well written and complete report that includes the work that you have done in all the previous phases (one through four), The Contents of the Final Project Report should include, but not be limited to the following sections:

1. **Cover page**
   Provide the title of the course, the title of the project, the name of the instructor, names of team members,and date.

2. **Table of contents**
   Show the contents of the report and their corresponding page number
3. **Introduction**
   Provide a brief description of the project and the section organization of this report.

4. **System Requirements**
   Give the context diagram (system architecture diagram) of the database system.List the interface requirements of the system (or each subsystem).
   List the functional and non-functional requirements of the database system.

5. **Conceptual Design of the Database**
   The complete Entity-Relationship (ER) model of your database.
   The data dictionary and business rules (i.e., constraints) of your ER model.

6. **Logical Database Schema**
   Give the schema of the database which is restructured and translated from the ER diagram presentedin the section "Conceptual Design of the Database". Show the schema with appropriate referential constraints.
   Give the SQL statements used to construct the schema.
   List the expected database operations and estimated data volumes.

7. **Functional Dependencies and Database Normalization**
   Identify and analyze the functional dependencies for each relation presented in the section "LogicalDatabase Schema".
   Show the normalization process and normalized tables for each relation to 3NF (if applicable).Give the SQL statements for constructing the normalized table (if applicable).

8. **The Database System**
   Give a brief description of how to install and invoke your system.
   Provide the "screen dumps" showing how to use your system step
   by step.

9. **Suggestions on Database Tuning (optional)**
   Give suggestions on tuning your database in terms of index structures, database design, and/orqueries.

10. **Additional Queries and Views**
    Define at least **3 complex queries and/or 2 views**. In the queries and views, you must demonstratethe uses of aggregate operators, group by clause, order by clause, and nest queries.
    Show the SQL statement for each of the defined queries and views, and its corresponding executionresults.

11. **User application interface**: describe how you build the system user interface and how users use your system. Give a list of functions that are offered by your system to the users. Explain how thefunctions are implemented in SQL;

12. **Conclusions and Future Work**
    Give a conclusion or your feedback about this
    project.Provide a brief description of possible
    future work.

13. **References**
    List the references or books used for this project.

14. **Appendix**
    An appendix that contains the zip file containing the work products (including demo slides, final report, SQLscripts, and source code of the project).
    The zip file must have the following directories for all the teams:
    /doc (contain all documents and presentation slides)

/project (contain all source code, test code, data, web pages, SQL scripts, library, and executable files)
a README file (describing how to install and use your program)

Project Ideas
You are encouraged to come up with projects of your own. The project ideas listed below can serve as aguide or as inspiration for a slightly different project.

1. **Scheduling Application** - A consulting company has a lunchroom, 12 conference rooms, 6 LCD projectors, 3 portable PCs, etc. They need to be able to schedule each of these resources for a givenday and time period and avoid conflicting use of resources. Also, management would like to report on resource utilization per week, month, year. They are also considering renting out resources to other companies if resource utilization is low. Queries might include:

   ➢ When is the next day resource X is free between 1:00 and 5:00?
   ➢ How many hours per week on average is conference room X occupied?

2. **Supply Cabinet** - A company centrally maintains supplies for each of its branch offices. They needa database to keep track of what they have in stock, requests from branch offices for supplies and purchasing of supplies from vendors. Should keep track of the vendor with the best price for a particular supply. They would also like to minimize shipping costs by shipping several supplies at one time to a given branch office. Queries might include:

   ➢ When should supply X be replenished?
   ➢ How many shipments, on average, go out to the branch offices per week?

3. **Baseball Statistics** (or other sports team) - A professional baseball team would like to maintain a database that records player statistics on all team members and complete records of every game (onan inning-by-inning basis). Each player would have a set of offense and defense statistics. Queries include:

   ➢ What is the batting average for player X
   ➢ Who is the best relief pitcher to use against a left-handed batter?

4. **Portfolio Management System** - a small hedge fund would like to track its investment portfolios.

Bad Project Ideas
You may not choose any of the following as project ideas:
- Restaurant (Customer/Menu/Order/Food)
- Hotel (Guest/Room/Reservation)
- Pizza Delivery (Customer/Order/Delivery)
- E-Commerce (Customer/Order/Product)