Database Project Guidelines

Please note that the following provides high level tasks for the project. For any discrepancy, please refer to the original documentation provided in the professor's slides.

Group Requirements

1. **Team Size:** Up to **4 students** (can be across sections).

2. **Technologies:**

   - **Backend:** Microsoft SQL Server
   - **Frontend:** .NET Framework (Console App, GUI, or Web App)
   - **ORM:** LINQ and Entity Framework

3. **Design Pattern:** Factory Pattern (to switch between LINQ and Stored Procedure business logic at runtime).

4. **Rules:**

   They are as follows:

   - Any submissions after the designated deadlines of any phase will result in -30% penalization for that phase.
   - In case of any plagiarism, you will be awarded zero in the course project and -20% in your current total score of quizzes.
   - During any in-person evaluation of any phase, all group members must be present otherwise that member of the group will receive zero for that phase.
   - Failure to effectively explain your meaningful contribution in the group for any phase will result in receiving zero in that phase.
   - All submissions will be made in the LMS Classroom.

Phase 1: Proposal & ER Diagram (10%)

Deadline: November 2, 2025 (11:55 PM)
Objective: Lay the foundation of your project by finalizing the idea and database structure. This phase focuses on planning and database structure design. Students must prepare a proposal and an ER diagram.

Instructions:

1. Install SQL Server Management Studio (SSMS) on a Windows Virtual Machine (VM) to design the ER diagram.

2. A template for Phase 1 submission will be provided — students must strictly follow it. - Include project title, brief description, group members, and key entities/relationships.

What to Submit:

- **Project Proposal Document**

    a. Title and brief description (1–2 paragraphs).
    b. Problem statement and motivation (why is this system useful).
    c. Objectives and major system features.

- **Database Design**

    ○ **ER Diagram:** Entities, attributes, and relationships.

- **Phase Format:**

    ○ Use the provided Word template named `GroupX_Phase1.docs` and submit a PDF file.

Phase 2: Database Implementation (30%)

Deadline: November 16, 2025 (11:55 PM)
Objective: Build and test your database in SQL Server. In this phase, students will implement the database schema, populate it with data, and use SQL Server features studied in class.

Instructions:

1. Create an SQL script that can create all objects (tables, views, triggers, stored procedures, etc.) on the instructor's server.

2. The database must contain at least 1 million rows across relevant tables for scalability testing.

3. Each SQL Server feature (Stored Procedures, Functions, Triggers, CTEs, Views, Indexes, Table Partitioning) must be implemented at least twice in a meaningful and architecture-relevant way.

What to Submit:

1. **Database Creation Script**

   ○ Submit a SQL script (`.sql`) that can create all objects (tables, views, triggers, stored procedures, etc.) on the instructor's server

2. **Documentation and Testing Evidence**

   ○ Short Report PDF of document containing definition, description and screenshots of queries, triggers, and stored procedure executions, as well as Output of sample test cases.

Phase 3: Application Development (30%)

Deadline: November 30, 2025 (11:55 PM)
Objective: Implement the front-end and business logic to connect with the database. Students will build a backend application using the .NET Framework that connects to the SQL Server database.

Instructions:

1. Implement two versions of the business logic layer: one using LINQ + Entity Framework and another using Stored Procedures.

2. Use the Factory Design Pattern to dynamically load the appropriate logic layer (LINQ vs SP) at runtime.

3. Perform CRUD operations and demonstrate interaction with the database.

4. For the Front-end, create a simple, functional UI (Windows Forms / WPF / ASP.NET) with input validation, navigation between modules, and clean layout for each main entity.

What to Submit:

1. **Application:**
    - Source code folder (zipped) for both frontend and backend.
    - ReadMe file explaining setup and execution steps.

2. **Presentation Video:**
    - 5-7 minute demo video showcasing main functionalities and highlighting the contribution of each member during development.

Phase 4: Viva and Final Presentation (30%)

Deadline: To be announced
Objective: In this phase, each group will present their final system and demonstrate its functionality. Any member of group can be asked randomly to demonstrate the system.

Instructions:

1. Will be shared soon

Optional Extra Credit (Grade Boost)

Objective: Implement **High Availability (HA)** for your database using **SQL Server Availability Groups** with **container-based clustering**.

What You'll Learn:

- How enterprise databases remain **available during failures**.
- How clustering ensures **data replication and automatic failover**.

Implementation Options:

1. **Sidecar Implementation**

   Run SQL Server and clustering software in separate containers (side by side).

2. **Custom Image Implementation**

   Create your own SQL Server container image with the clustering software.

Tools & Technologies:

- Docker / Kubernetes
- SQL Server 2022 (Linux Containers)
- DH2i DxEnterprise (for container-based HA)

Note:
Students who attempt and successfully complete the Extra Credit part will receive a one-grade improvement. For example, if a student's final grade is B and they successfully complete the Extra Credit, their grade will be upgraded to B+.
This applies only if the Extra Credit work is fully functional and correctly demonstrated.