Database Systems
Assignment 3
(Deadline: April 24, 2024)

Instructions

Assignment groups:

This assignment can be done within a group of two (2) students. There is no restriction on the selection of group members. Students are allowed to make groups according to their preferences. ***The group members must belong to the same sections***.

Submission:

All submissions MUST be uploaded on Google Classroom. Solutions sent to the emails will not be graded. To avoid last minute problems (unavailability of Google Classroom, load shedding, network down etc.), you are strongly advised to start working on the project from day one. Combine all your work in one zip file named ROLL_NUM_P_02 (e.g., 20i-1234_P_02.zip). Submit the .zip file in the classroom within a given deadline. Failure to submit according to the above format would result in ZERO marks.

Deadline:

Correct and timely submission of project is responsibility of every group; hence no relaxation will be given to anyone.

Plagiarism:

ZERO marks will be awarded if any significant part of project is found plagiarized.

Viva:

Viva will be conducted for all the groups for the assignment.

Question 1

Online Academic Platform and College Management System

Introduction:

Our case study focuses on the development of an online platform for a College Management System. This system is designed to provide a range of functionalities for managing colleges, students, courses, faculty, and various user roles within the education ecosystem. The primary objective is to streamline college operations, enhance student management, and ensure the efficient administration of educational resources.

Business Requirements Analysis:

In the context of this College Management System, the initial analysis of the business requirements is as follows:

1. College Management:

- The system allows the management of multiple colleges or educational institutions.
- Each college offers a set of academic departments or schools (e.g., Engineering, Business, Arts).
- College information, departments, and relevant data are managed by the system administrator.

2. Faculty Assignment:

- Faculty members are assigned to specific departments by the administrator.
- Faculty assignments can vary:
  - They can work within the same department for all working days.
  - They can work in different departments on different days.
  - They can work in different departments within the same day.
- Assignments can be created with recurring schedules (daily, weekly, or monthly) and can have a specified range or an end-by date.
- Administrators can also select specific days for weekly and monthly recurrences.
- Faculty assignments can be updated or changed by administrators.
- Faculty members cannot be assigned to departments outside of department-specific working hours.

3. Student Enrollment:

- Students can request enrollment in specific courses through college staff.
- College staff can view available courses, course schedules, and faculty assignments.
- Enrollments can be for single courses or full programs.
- College staff can modify or update student enrollments at any time.

4. Course Selection:

- Students can select courses directly from a catalog or opt for a predefined academic program.

- When selecting courses individually, any available course with corresponding faculty can be chosen.
- When opting for a predefined program, the system automatically assigns courses and faculty based on the program requirements.

5. Course Availability:

- Students can enroll in courses offered by the college if the faculty is assigned to the course during the timeslot.
- For example, a student can enroll in a course with a specific faculty member at 10:00 AM if the faculty is assigned to that course from 9:00 AM to 11:00 AM on that day.

6. Student Access:

- Students can log in to the college management system to view their course enrollment history.
- Student access is restricted to their own course enrollments, and they cannot view enrollments of other students.

7. Course Cancellation:

- If a faculty assignment is cancelled or a faculty member is on leave, all affected course enrollments are adjusted accordingly.

8. Academic Program Management:

- The college staff can manage predefined academic programs, specifying course requirements and faculty assignments.
- Staff can also update and modify these programs as needed.

9. Admin Dashboard:

- The admin dashboard provides insights and statistics related to faculty assignments, student course enrollments, program effectiveness, and resource allocation.

Based on above scenario, please perform the following tasks

Tasks:

1. Develop an entity-relationship diagram (ERD) for the College Management System:

- Identify the entities
- Define relationships: example Enrollments (between Students and Courses)
- Specify multiplicity or cardinality/modality e.g (many-one, many-many, etc.)
- Identify attributes, primary keys, and foreign keys. Make sure to add sufficient attributes other than defined in the scenrio
- Incorporate constraints in the ERD.

2. Conver ERD to EERD

3. Map the model to the relational data model:

- Define tables and specify the attributes for each entity.
- Clearly define primary keys and foreign keys to establish relationships.
- Ensure that user management is represented in the schema, with tables for Users, Roles, and Credentials.

4. Identify different queries for the College Management System:

- Assuming a calendar view/functionality is available for scheduling and managing courses and faculty assignments, identify relevant queries.
- Queries must include creation/updation of colleges, departments, faculty assignments, student enrollments, and program management. Add 10 sample records in each table.
- Develop 10 queries related to generating reports, in addition to the following sample queries:
  1. List all students enrolled in courses within College Edwrd (weekly, monthly, daily).
  2. List all courses related to a specific department in all colleges (weekly, monthly, daily).
  3. List students with enrollments in specific courses (weekly, monthly, daily).
  4. List all courses or faculty assignments within a certain time.
  5. Faculty members with overlapping assignments in different departments (weekly, monthly, daily).
  6. Faculty members with the least number of assignments in specific departments (weekly, monthly, daily).
  7. Faculty members with the most assignments in specific departments (weekly, monthly, daily).
  8. Students with recurrent enrollments in the same courses.
  9. Students with recurrent enrollments in different courses.
- Include queries related to user management, such as adding administrators, faculty, students, and college staff, as well as managing their credentials and roles.

Question 2

Tables that have redundant data can suffer from different anomalies, which can introduce inconsistencies into a database. The rules associated with the most used normal forms, namely first (1NF), second (2NF), and third (3NF).

Please see the following data related to college management system.

Student _id	Student _City	Student _Name	Course _Offer _id	Course _Semester	Course Offered Year	Course Grade	Course ID	Course _Name
1	Rawalpindi	Ali	1	Fall	2006	3.5	C1	Database
1	Rawalpindi	Ali	2	Fall	2006	3.3	C2	PF
2	Lahore	Aleena	3	SPRING	2007	3.1	C3	OOP
2	Lahore	Aleena	2	Fall	2006	3.4	C2	PF

Based on above scenario, please perform the following tasks

1.Provide one example of each of the following from above table.

- *Insertion Anomaly*
- *Deletion Anomaly*
- *Update Anomaly*

2. Normalize the above data up to third normal form (3NF). Show detailed normalization process.

What to submit

You are required to submit a written report supporting your implementation along with a text file with your all SQL queries. The report should include your design decisions and rationale on the following issues:

1. *ER diagram*
2. *EERD diagram*
3. *Relational database schema*
4. *SQL queries for table, constraints creation.*
5. *SQL queries for data insertion, fetching etc.*
6. *Snapshot of the tuples in tables and results of the SQL queries.*
7. *Solution of Question 2*