National University of Computer and Emerging Sciences

Karachi Campus

Database Systems (CS2005)

Mid 1 Exam

Date: Friday, Sep 20th 2024

Course Instructor(s): Dr. Zulfiqar Ali Memon, Dr. Anam Qureshi, Ms. Javeria Farooq, Mr. Basit Ali, Ms. Atiya Jokhiyo, Ms. Abeer Gauher, Ms. Fizza Aqeel, Mr. Omer Qureshi, Ms. Zain Noreen, and Ms. Alina Arshad

Total Time (Hrs):	1
Total Marks:	15
Total Questions:	3

Do not write below this line

Attempt all the questions.

CLO # 1: Explain fundamental database concepts

Q1: [marks: 3] [Estimated Time: 10 minutes]

TechSecure is a multinational cybersecurity solutions provider. TechSecure currently uses isolated file-based systems across multiple regional offices to manage client data, security reports, and product deployments. Due to data redundancies and delays in client responses, the company plans to host a server-based mobile application with a Database Management System (DBMS) to centralize data storage and optimize decision-making.

1. What specific features of the DBMS would resolve the limitations of TechSecure's existing file-based system?
2. What type of client-server architecture should TechSecure implement for their global solution? Justify your answer with the help of diagram(s).

CLO # 3: Demonstrate an understanding of normalization theory to normalize the database and formulate, using SQL & relational algebra, solutions to a broad range of query & data problems.

Q2: [marks: 7] [Estimated Time: 30 minutes]

Given below is a database schema for a university system that manages students, courses, enrollments, professors, and departments.

- **Students** (student_id, student_name, email, department_id, enrollment_date)
- **Courses** (course_id, course_name, credits, department_id, professor_id)
- **Professors** (professor_id, professor_name, email, department_id)
- **Departments** (department_id, department_name)
- **Enrollments** (enrollment_id, student_id, course_id, enrollment_date, grade)

Write SQL Queries for the following questions:

1. Create table **Courses** with the appropriate data types, primary and foreign key constraints.
   a. Course name and credits should be NOT NULL.
   b. For foreign keys, include actions for update and delete.
   c. Credits should only be 1 or 3.
2. Find the names of students enrolled in courses taught by Professor "Ahmed" ?
3. Retrieve the list of students who are in the same department.
4. Find the names of all such students that are studying in the "Computer Science" department?
5. Find the departments that offer more than 5 courses?
6. Find the number of students in each department ordered by the highest number of students in a department?
7. Delete all the students enrolled in the course "Introduction to Programming".

CLO # 1: Explain fundamental database concepts.

Q3: [marks: 5] [15 minutes]

You are provided with the following snapshot of a relational database that models a company's employee and department structure. The relevant attributes along with the constraints are shown below in Table 01 and Table 02.

Table 01: Departments

Dept_ID PK	Dept_Name	Manager_ID
1	HR	101
2	IT	102
3	Finance	NULL

Table 02: Employees

Emp_ID PK	Emp_Name	Dept_ID Ø	Salary > 30000	Supervisor
101	Ahmed	1	60000	NULL
102	Fatima	2	80000	101
103	Saad	3	55000	101
104	Umer	2	50000	102
105	Amina	3	45000	103

Constraints:

Primary Key: Dept_ID in Departments, Emp_ID in Employees.

Foreign Key Constraints:

- Manager_ID in Departments references Emp_ID in Employees.
- Dept_ID in Employees references Dept_ID in Departments.
- Supervisor in Employees references Emp_ID in Employees.

Check Constraint: The Salary of any employee must be greater than 30000.

NOT NULL: Emp_Name and Dept_ID in Employees cannot be NULL.

Your task is to identify which schema-based constraint(s) will be violated if we perform the following tasks. Also provide the solution for violation.

1. Insert into employees values (106, "Falaq", 4, 60000,102)
2. UPDATE Employees SET Salary = 25000 WHERE Emp_ID = 104;
3. DELETE FROM Employees WHERE Emp_ID = 101;
4. INSERT INTO Employees VALUES (108, NULL, 3, 29000, 103);
5. UPDATE Employees SET Supervisor= 104 WHERE Emp_ID = 102;

Good Luck!