

# Database Systems (CS2005)

## Mid 1 Exam

Date: Monday, Sep 22<sup>nd</sup> 2025

**Course Instructor(s):** Dr. Zulfiqar Ali Memon,  
Dr. Farrukh Salim, Ms. Atiya Jokhio, Ms. Javeria  
Farooq, Mr. Basit Ali, Ms. Hajira Ahmed, Mr. Ali  
Naseer, Mr. Huzaifa, Mr. Umair

**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

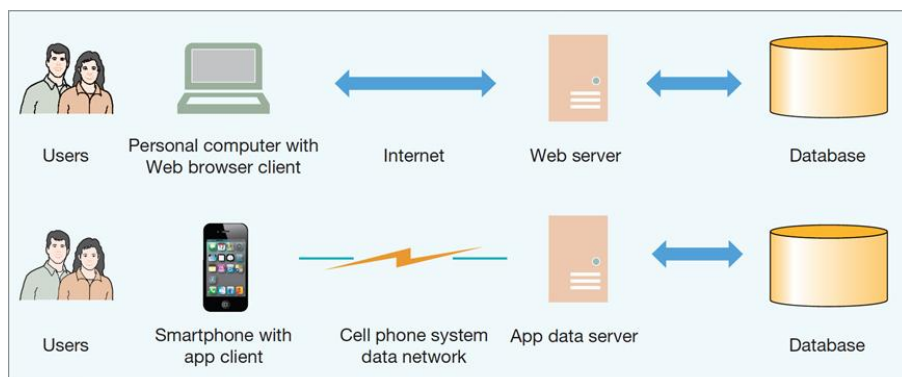
**Q1:** [marks: 4] [Estimated Time: 10 minutes]

1. GlobalTech, which manages a complex database system for its global operations. GlobalTech uses a sophisticated DBMS that adheres to the three-schema architecture. The system is designed to support various user applications. Describe how the three-schema architecture ensures program-data independence in GlobalTech's system. How does this separation benefit the Sales Application, Finance Application, and IT Management in terms of development and maintenance?

The three-schema architecture consists of the internal schema (physical storage), the conceptual schema (logical structure), and the external schemas (views)

Benefits for:

- **Sales Application:** Interacts with a simplified view that presents only the necessary customer orders and product details. The application is insulated from schema changes related to data storage or additional attributes not relevant to sales.
  - **Finance Application:** Utilizes detailed views and queries that support financial reporting and compliance. The application relies on the conceptual schema to access detailed transaction data while remaining unaffected by changes in physical storage.
  - **IT Management:** Accesses the full schema information from the conceptual schema and catalog. The IT team can manage performance and optimize queries based on the detailed schema without impacting the applications.
2. Suppose you are at NU University and want to access a database book. Create a diagram showing how a user retrieves data from a database system. Label and describe each component involved and explain the interactions between the user and the database.



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The user makes a request through the UI, which is processed by the application layer and converted into a database query. The DBMS retrieves the data from the database and sends it back to the application, which displays the result to the user via the UI.

### **CLO # 1: Explain fundamental database concepts**

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**Q2:** [marks: 2+2+2= 6] [Estimated Time: 25 minutes]

1. Write DDL statements to create relations for Society and members. Carefully read the scenario and apply all possible constraints mentioned below. Don't mention any extra constraint(s) that are not specified in the question.
  - a) **Societies (SocietyID, SocietyName, Category, Budget)**
    - i. Each society has a unique SocietyID.
    - ii. SocietyName must be unique.
    - iii. Category defaults to 'Creativity' if not specified. Category can be (e.g., Technical, Creativity, Sports),
    - iv. Budget must be greater than 0.
  - b) **Members (MemberID, Email, Semester, SocietyID)**
    - i. Each member has a unique MemberID.
    - ii. Email must be unique.
    - iii. Semester must be between 1 and 8.
    - iv. SocietyID to which they belong, if a society is deleted, all its members should also be deleted.

```
CREATE TABLE Societies (  
    SocietyID VARCHAR(10) PRIMARY KEY,  
    SocietyName VARCHAR(50) UNIQUE NOT NULL,  
    Category VARCHAR(20) DEFAULT 'Creativity'  
    CHECK (Category IN ('Technical', 'Creativity', 'Sports')),  
    Budget DECIMAL(10,2) CHECK (Budget > 0)  
);  
-- 2. Members Table  
CREATE TABLE Members (  
    MemberID VARCHAR(10) PRIMARY KEY,  
    Email VARCHAR(50) UNIQUE NOT NULL,  
    Semester INT CHECK (Semester BETWEEN 1 AND 8),  
    SocietyID VARCHAR(10),  
    FOREIGN KEY (SocietyID) REFERENCES Societies(SocietyID)  
    ON DELETE CASCADE ON UPDATE CASCADE  
);
```

2. Suppose the university decides that deleting a society should not delete its members but instead set their SocietyID to NULL. Write the modified foreign key constraint.

```
ALTER TABLE Members  
ADD CONSTRAINT fk_members_society  
FOREIGN KEY (SocietyID) REFERENCES Societies(SocietyID)  
ON DELETE SET NULL ON UPDATE CASCADE;
```

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**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.

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**Q3:** [marks: 5] [Estimated Time: 25 minutes]

A database is designed to store information about cricket matches. The schema is as follows:

- Matches (match\_id, match\_date, venue\_id, team1\_id, team2\_id, winner\_id)
- Teams (team\_id, team\_name, country)
- Players (player\_id, player\_name, team\_id)
- Match\_Scores (match\_id, player\_id, score)
- Venues (venue\_id, venue\_name, city)

**Write SQL Queries for the following questions:**

1. Find the names of all players who scored more than 100 in any single match.

```
SELECT player_name  
FROM Players  
WHERE player_id IN (  
    SELECT player_id  
    FROM Match_Scores  
    WHERE score > 100  
);
```

2. List the names of all venues where the 'Pakistan' team has won a match.

```
SELECT venue_name  
FROM Venues  
WHERE venue_id IN (  
    SELECT venue_id  
    FROM Matches  
    WHERE winner_id IN (  
        SELECT team_id  
        FROM Teams  
        WHERE team_name = 'Pakistan'  
    )  
);
```

3. Fetch the names of all players who have a score of exactly 50 in any match.

```
SELECT player_name  
FROM Players  
WHERE player_id IN (  
    SELECT player_id  
    FROM Match_Scores  
    WHERE score = 50  
);
```

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4. Print the names of players who have an average score of over 75.

```
SELECT player_name  
FROM Players  
WHERE player_id IN (  
    SELECT player_id  
    FROM Match_Scores  
    GROUP BY player_id  
    HAVING AVG(score) > 75  
);
```

5. List the names of all players who scored more than 100 in a match played at 'Gaddafi Stadium'.

```
SELECT player_name  
FROM Players  
WHERE player_id IN (  
    SELECT player_id  
    FROM Match_Scores  
    WHERE score > 100  
    AND match_id IN (  
        SELECT match_id  
        FROM Matches  
        WHERE venue_id = (  
            SELECT venue_id  
            FROM Venues  
            WHERE venue_name = 'Gaddafi Stadium'  
        )  
    )  
);
```

Good Luck!