



# COMSATS University Islamabad (CUI)

Department of Computer Science  
MID-TERM Examination Spring - 2026  
BS(CS, SE, AI, DS, CT)- SEMESTER

Course: CSC270 -Database Systems

Date: April 21, 2026

Maximum Marks: 25

Time Allowed: 80 Minutes

Instructor name: Dr. Rubina Adnan, Ms. Sadia Mariam, Mr. Waqas Ali , Mr. Muhammad Haris

- All questions are self-explanatory and require no further explanations during exam time.
- Make sure that you have signed the attendance sheet before leaving the examination room.
- Return the question paper along with the answer sheet.
- Attempt all questions.

**[CLO1: Explain database concepts and principles 05 Marks]**

### Question No. 1

Explain the fundamental limitations of file-based systems and how DBMS overcomes these issues. Analyze the role of DBMS in ensuring data integrity and consistency in comparison to file systems. **[02 Marks]**

### Question No. 2

Explain the three-level DBMS architecture and analyze how it facilitates data abstraction for different types of users. Illustrate your answer with a practical example from a university database system e.g. CU Online.

**[03 Marks]**

**[CLO2: Apply the concept of domain and tuple relational calculus 10 Marks]**

**Question No. 3: For the following scenario, you are to write relational algebra queries, against the following needs, over a small sample database. The database contains the following 4 relations.**

**[5\*1=5 Marks]**

**Medicine** (MedID: integer, MedName: string, Company: string, Price: float)

**Customer** (CustID: integer, CustName: string, City: string)

**Order** (OrderID: integer, CustID: integer, OrderDate: date)

**Order\_Detail** (OrderID: integer, MedID: integer, Quantity: integer)

- Find customer names along with the medicines they ordered.
- Find medicines manufactured by "ABC Pharma" OR "XYZ Pharma".
- Find customers who either placed orders OR belong to Lahore.
- Find total quantity ordered for each customer.
- Find pairs of customers who live in the same city.

**Question No. 4: Suppose relations E (EID, DID) and D (DID, Dname) have the following tuples:**

**[1.5+ 02 + 1.5 = 5 Marks]**

**E**

EID	DeptID
101	10
102	20
103	10
104	30

**D**

DeptID	DeptName
10	HR
20	IT
40	Finance

- Compute the natural join of relations and show the resultant relation.
- Explain what happens to the tuple (104, 30) during the natural join in 4(i). Also write a relational algebra expression to handle such cases.
- Write a relational algebra expression using cross product to obtain the same result (Same number of Attributes and Tuples) as in 4(i).

**Question No. 5: Consider the following scenario.**

**[4+4+2 = 10 Marks]**

- i. Develop an Entity-Relationship Diagram (ERD) showing: Entities and attributes
- ii. Extend your ERD to an EERD by incorporating: Generalization/Specialization
- iii. Convert your EERD into a Relational Schema, clearly specifying Primary keys

PakWheels.pk is a leading online automobile marketplace in Pakistan that connects buyers, sellers, and dealers for the trading of vehicles. The platform allows individuals as well as registered dealers to list vehicles for sale, while buyers can browse listings, compare options, and contact sellers. Each seller can create an account on the platform and may list multiple vehicles for sale. Sellers can be individual users or registered dealers. Every vehicle listed on the platform is described by attributes such as vehicle ID, make, model, year, price, mileage, registration city, and condition (new or used). Some vehicles may have additional features such as transmission type, fuel type, and color. Buyers can register on the platform and maintain their profiles. A buyer can search for vehicles using filters such as price range, city, and model. Buyers can express interest in a vehicle by contacting the seller or saving the vehicle as a favorite. A buyer may interact with multiple sellers, and a seller may receive inquiries from multiple buyers.

Each vehicle listing is associated with a specific seller and includes details such as the listing date and status (active, sold, expired). Once a vehicle is sold, its status is updated accordingly, but the record is retained for historical purposes. The platform also allows buyers to post reviews and ratings for sellers based on their transaction experience. Additionally, PakWheels supports a feature where buyers can schedule an inspection request for a vehicle. Each inspection request is linked to a specific vehicle and buyer, and includes details such as inspection date and status. A seller can list multiple vehicles, but each vehicle is listed by only one seller. A buyer can interact with multiple vehicle listings, and each interaction (such as inquiry or inspection request) must be recorded separately. The system must ensure that all relationships between buyers, sellers, and vehicles are properly maintained while preserving data consistency and avoiding redundancy.