KATHMANDU UNIVERSITY
End Semester Examination
August, 2025

Level : B.E./B.Sc./BIT
Year : II
Time : 2 hrs. 30mins.

Course : COMP 232
Semester : II
F. M. : 55

SECTION "B"
[6 Q. × 4 = 24 marks]

Attempt ANY SIX questions. Write the answers in your own words as far as practicable.

1. Why do we need a database management system? Differentiate between two-tier and three-tier architecture of database applications.

2. Design an Entity Relationship (ER) model for the Cafeteria Management System intended for Kathmandu University that captures all necessary entities, attributes, and relationships and cardinalities to manage students, staff, menu items, orders, payments and inventory, State necessary assumptions.

3. Consider a database consisting of the following four relation schemas:

```
customer(c_id, c_name, c_gender, c_city )
hotel(h_id, h_name, h_city )
room(r_id, r_type, r_price, h_id )
reservation(c_id, h_id, r_id, res_date)
```

Answer the following questions using relational algebra and corresponding SQL queries for each

a. Get the complete details of all rooms priced above 5000.
b. Get the details of all rooms in hotels located in Kathmandu.
c. Find the names of customers who have made at least one reservation.
d. Get the details of rooms reserved on either of the dates 2025-08-15 or 2025-08-16 or both.

4. Consider a relation R(A, B, C, D, E) having a set of FD's F={A→BC, CD→E, B→D, E→A. List all the candidate keys of relation R. Also find primary key, prime attributes and non-prime attributes.

5. What are ACID properties, explain with suitable examples for each.

6. Define deadlock in the context of database systems. Explain the major types of deadlock.

7. Define NoSQL Databases. What are the different types of NoSQL databases, Explain.

P.T.O.

SECTION "C"

[2 Q. × 8 = 16 marks]

Attempt ANY TWO questions.

8. Define functional dependency (FD), list the major types of FDs. Using appropriate examples of FDs, explain the process of transforming a relation into First Normal Form (1NF), Second Normal Form (2NF), Third Normal Form (3NF), and Boyce Codd Normal Form (BCNF). [2+2+1+1+1+1]

9. Consider the following schedule: `T1:Read(X), T2:Read(X), T3:Read(X), T3:Read(Y), T2: Write(X), T1: Read(Y), T1: Write(Y), T2: Read(Y), T2: Write(Y), T3: Write(X.`

   a. Draw a precedence graph for the given schedule. [2]
   b. Is this schedule conflict serializable? [2]
   c. How can a precedence graph be used to determine whether a schedule is serializable? [2]
   d. Add lock and unlock instructions to these transactions so that they observe strict 2-phase locking protocol. [2]

10. Answer the following questions relating database recovery:

   a. Define database recovery. [2]
   b. What are the situations when database recovery would be necessary? [2]
   c. How can a log file be used for recovery. [2]
   d. Define cascading rollback with example. [2]