



**UNIVERSITY OF SRI JAYEWARDENEPURA - FACULTY OF APPLIED SCIENCES**  
**BSc Degree First Year Second Semester Course Unit Examination –April 2025**  
**DEPARTMENT OF COMPUTER SCIENCE**

**CSC209 2.0 Database Management System**

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**Time: Two (02) hours    No. of questions: 04    No. of pages: 09    Total marks: 100**  
**Answer ALL questions on the given space.**

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**Question 1    [20 Marks]**

- i. Explain the concept of a Data Model. Identify two (2) types of data models used in database systems. (5 Marks)

- ii. Compare the Relational Database (RDB) and the Structured File-Based Approaches for data storage and retrieval by highlighting their distinguishing characteristics. (4 Marks)

- iii. Examine the table 1 shown below.

Table 1: Branch details

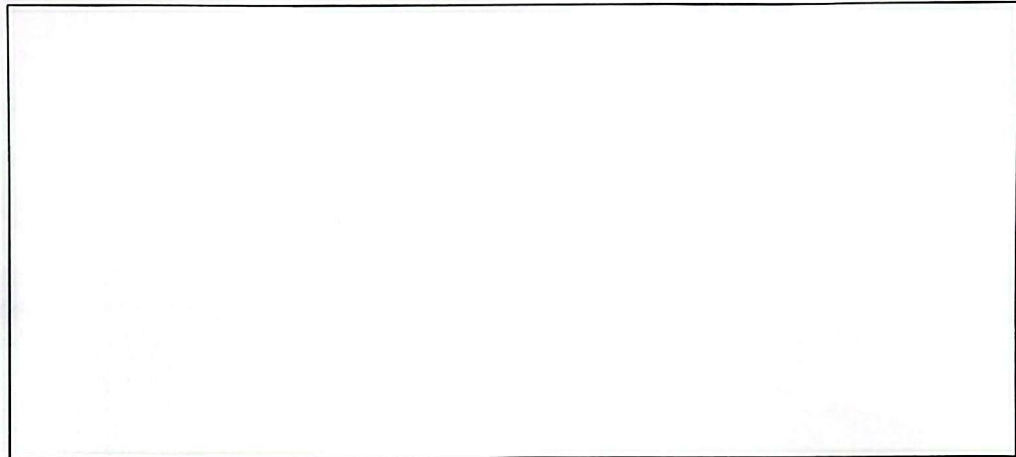
<i>branchNo</i>	<i>branchAddress</i>	<i>telNo</i>	<i>mgrStaffNo</i>	<i>name</i>
B001	8 Jefferson Way, Portland, OR 97201	503-555-3618	S1500	Tom Daniels
B002	City Center Plaza, Seattle, WA 98122	206-555-6756	S0010	Mary Martinez
B003	14 – 8th Avenue, New York, NY 10012	212-371-3000	S0145	Art Peters
B004	16 – 14th Avenue, Seattle, WA 98128	206-555-3131	S2250	Sally Stern

a) Why is this table 1 not in 3NF?

(3 Marks)

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b) Describe and illustrate the process of normalizing the data shown in this table to the third normal form (3NF). (5 Marks)



c) Identify the primary, (alternate) and foreign keys in your 3NF relations. (3 Marks)

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## Question 2 [30 Marks]

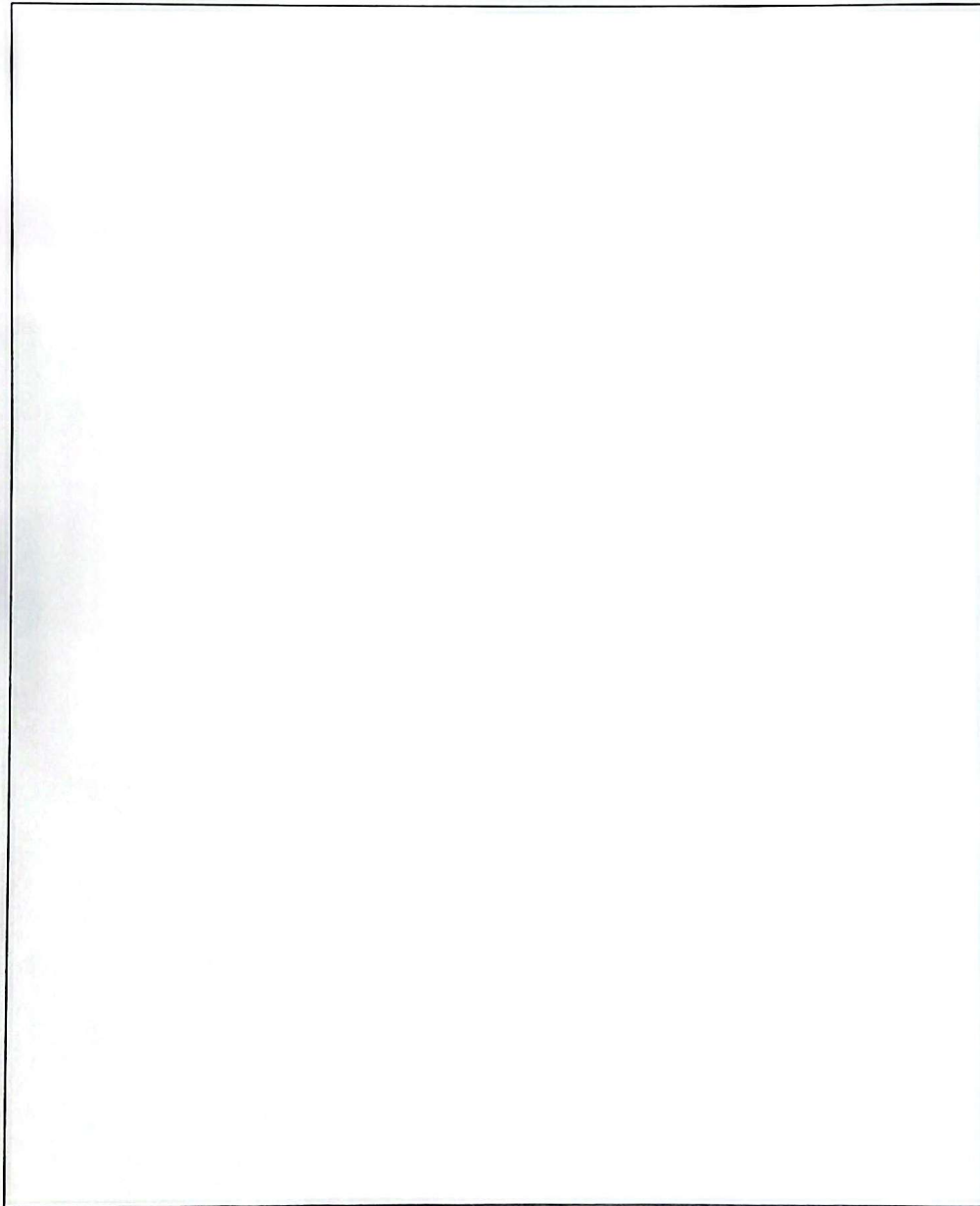
i. A restaurant wants to implement a menu ordering system to facilitate food ordering and service management. The system should support interactions between customers, waiters, chefs, and supervisors while ensuring accountability for all transactions.

The restaurant operates as follows:

- Customers can view the menu, request a waiter, place food orders, and receive the final bill using a computer at their table. A customer can place multiple orders, but each order is linked to a single table. The total bill amount is a derived attribute, calculated based on the ordered food items.
- Waiters use a wireless tablet PC to initialize tables for customers, assist with orders, send orders to the kitchen, and finalize customer bills. A waiter can serve multiple tables, but each table is assigned to one waiter at a time.
- Chefs access a touch-display system to view incoming orders from waiters. They update the status of each item (e.g., pending, preparing, ready) and send notifications when meals are completed. Each chef may prepare multiple food items, and a food item may be prepared by one or more chefs (multivalued attribute).

- The system maintains full accountability and logging records, ensuring all transactions are properly recorded. Each transaction log includes a timestamp (derived attribute) to track events.
- Supervisors have access to special functions to handle exceptional cases, such as refunds or customers leaving without paying.

Based on the given scenario, draw an Entity-Relationship (ER) diagram that accurately represents the restaurant's menu ordering system including entities, attributes, relations, primary keys, cardinalities, and etc. (16 Marks)



- ii. A car rental company keeps records of all rental vehicles. Each vehicle has details such as a unique vehicle identification number, license number, manufacturer, model, date of purchase and color.

The company offers below types of vehicles for rent:

- Trucks, which are used to transport goods and have a specific cargo capacity.
- Sports Cars, which are high-performance vehicles with certain horsepower and renter age requirement.
- Vans, which are designed to carry multiple passengers.
- Off-Road Vehicles, which has information about ground clearance and drivetrain (four- or two-wheel drive).

The company wants to develop a well-structured system to organize its data efficiently and avoid unnecessary repetition of information.

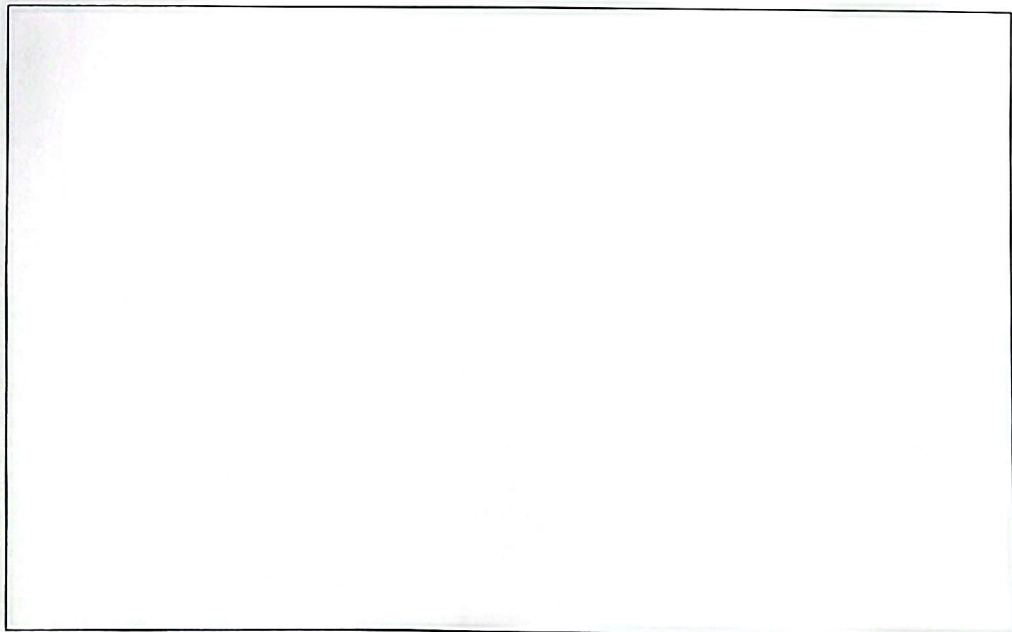
- a) Does the classification of rental vehicles in the given scenario represent a specialization or generalization in the context of data modeling? Justify your answer. (3 Marks)

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- b) Identify the disjointness and completeness constraints on the given data modeling? (4 Marks)

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- c) Draw a complete EER diagram to represent the database structure, including necessary entities, attributes, relationships, specialization/generalization, cardinalities and constraints. (7 Marks)





### Question 3 [25 Marks]

- i. Describe the difference between a Relation and a Relation Schema. (4 Marks)

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- ii. What is a “key” in the Relational Model? (3 Marks)

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- iii. Consider the following relations for a database that keeps track of business trips of salespersons in a sales office:

SALESPERSON (SSN, Name, Start\_Year, Dept\_No)

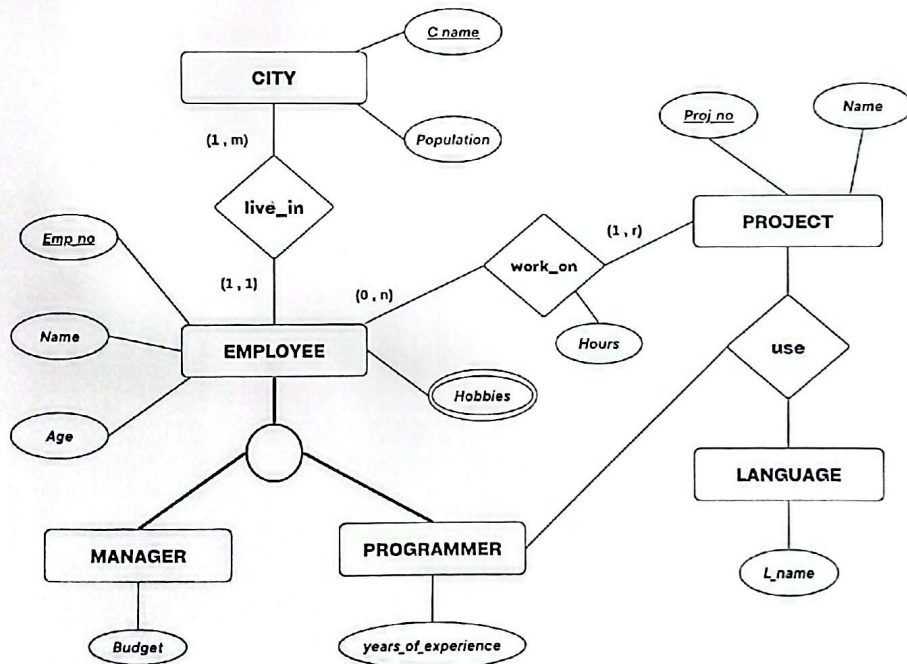
TRIP (SSN, From\_City, To\_City, Departure\_Date, Return\_Date, Trip\_ID)

EXPENSE (Trip\_ID, Account#, Amount)

- Specify the foreign keys for this schema, stating any assumptions you make. (4 Marks)

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- iv. Map the below EER diagram into a relational data model. (14 Marks)



**Question 4 [25 Marks]**

- i. Explain the difference between HAVING and WHERE clauses in SQL. Provide an example where both are used in a single query. (5 Marks)

- ii. Write the SQL commands based on the ENQUIRY table.

Table : ENQUIRY

Name of column	Type	Size	Constraints
visitorID	Decimal	4	Primary key
visitorName	Varchar	20	
visitorMobile	Char	10	Not null
visitorAddress	Varchar	40	

- a) Write a SQL command to create the table ENQUIRY including its constraints. ( 3 Marks)

- b) Write an SQL command to delete an enquiry record from the ENQUIRY table where the visitorID is 1005. (Assume 1005 is an available record in the table). (3 Marks)

- c) Write an SQL command to insert a new visitor into the ENQUIRY table with the following details: (3 Marks)

visitorID: 1006

visitorName: 'John Doe'

visitorMobile: '0712345678'

visitorAddress: '123, Baker Street'

- iii. Consider the given relation schema. Write the following queries in SQL.

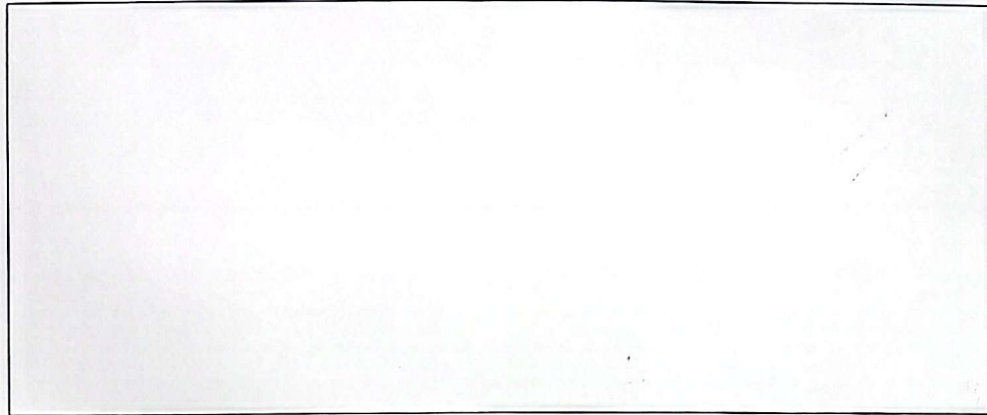
Employee(empno,name,office,age)

Books(isbn,title,authors,publisher)

Loan(empno,isbn,date)

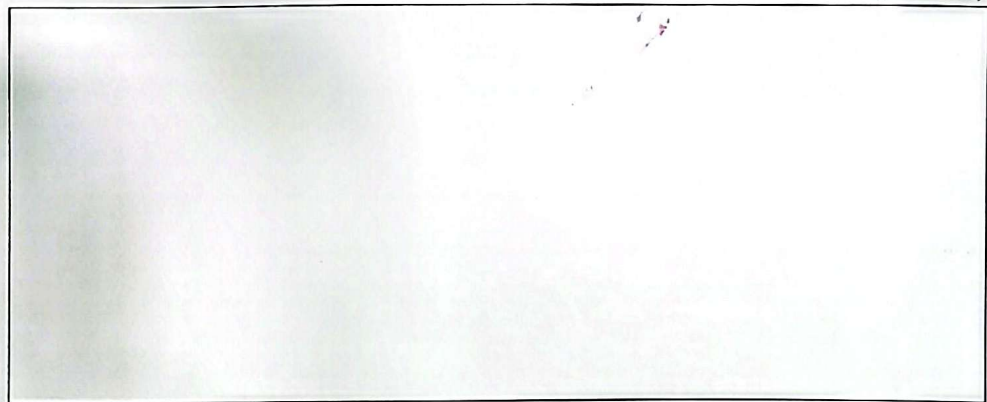
a) Find the title and author of all books.

(3 Marks)



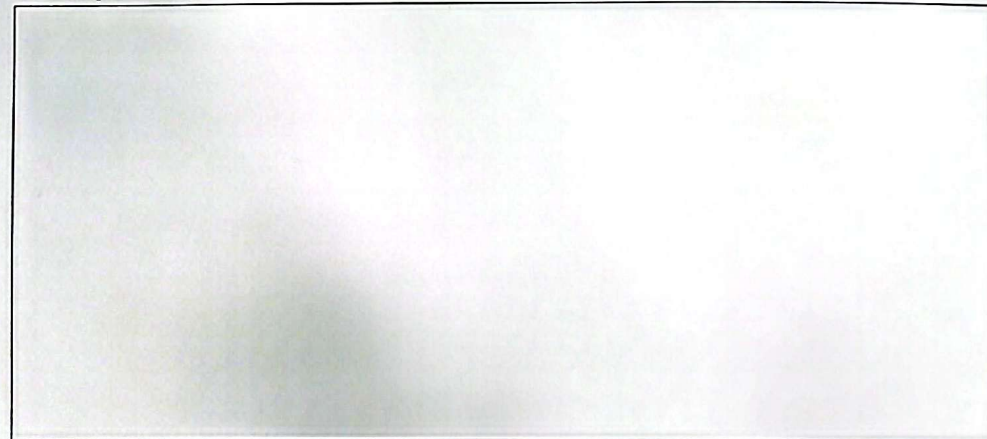
b) Find the name of all employees who have borrowed a book published by McGraw-Hill.

(4 Marks)



c) For each publisher, find the name of employees who have borrowed more than five books of that publisher.

(4 Marks)



END