

DBMS –Question Bank

Chapter-1:

- 1) List four significant differences between a file-processing system and a DBMS.
- 2) Explain the two-tier and three-tier architectures. Which is better suited for Web applications? Why?
- 3) Explain the concept of physical data independence, and its importance in database systems.
- 4) Elaborate the role of a Database Administrator (DBA) and highlight two key responsibilities.
- 5) Explain different type of database users and the main activities of each user.
- 6) Explain database architecture with the help of suitable block diagram. Also explain functionalities of each database component in detail with the help of examples.

Chapter-2:

- 1) What two conditions must be met before an entity can be classified as a weak entity? Give an example of a weak entity.
- 2) What is a recursive relationship? Give an example.
- 3) What is a derived attribute? Give an example.
- 4) Describe the role of attributes and keys in an ER model, and explain how they contribute to data integrity with an example.
- 5) A database is being constructed to keep track of the teams and games of a sports league. A team has a number of players, not all of whom participate in each game. It is desired to keep track of the players participating in each game for each team, the positions they played in that game, and the result of the game. Design an ER schema diagram for this application, stating any assumptions you make. Choose your favorite sport (e.g., soccer, baseball, football).
- 6) Create an ERD based on the following requirements:
The COMPANY database keeps track of a company's employees, departments, and projects. Suppose that after the requirements collection and analysis phase, the database designers provide the following description of the part of the company that will be represented in the database.
 - i. The company is organized into departments. Each department has a unique name, a unique number, and a particular employee who manages the department. We keep track of the start date when that employee began managing the department. A department may have several locations.
 - ii. A department controls a number of projects, each of which has a unique name, a unique number, and a single location.
 - iii. We store each employee's name, Social Security number, address, salary, sex (gender), and birth date. An employee is assigned to one department, but may work on several projects, which are not necessarily controlled by the same department. We keep track of the current number of hours per week that an employee works on each project. We also keep track of the direct supervisor of each employee (who is another employee).
 - iv. We want to keep track of the dependents of each employee for insurance purposes. We keep each dependent's first name, sex, birth date, and relationship to the employee.
- 7) Use the following business rules to create an Entity Relationship Diagram (ERD). Write all appropriate connectivity's and cardinalities in the ERD.
 - i. A department employs many employees, but each employee is employed by only one department.
 - ii. Some employees, known as "rovers," are not assigned to any department.
 - iii. A division operates many departments, but each department is operated by only one division.
 - iv. An employee may be assigned many projects, and a project may have many employees assigned to it.

- v. A project must have at least one employee assigned to it.
- vi. One of the employees manages each department, and each department is managed by only one employee.
- vii. One of the employees runs each division, and each division is run by only one employee.

Chapter-3

- 1) Which relational algebra operators can be applied to a pair of tables that are not union-compatible?
- 2) What is a subclass? When is a subclass needed in data modeling?
- 3) Describe how the Entity-Relationship (ER) model can be mapped to the relational model. Provide an example of an entity and its corresponding relational schema
- 4) Discuss the correspondences between the ER model constructs and the relational model constructs. Show how each ER model construct can be mapped to the relational model and discuss any alternative mappings.
- 5) Discuss user-defined and attribute-defined specializations, and identify the differences between the two.
- 6) An EER model contains the following:
Two subclasses: **Car** and **Truck** as shown in Figure-1 and a superclass **Vehicle** (VehicleID, Price, License_plate_no). The superclass-subclass relationship is **disjoint** and **total** as shown in figure-2

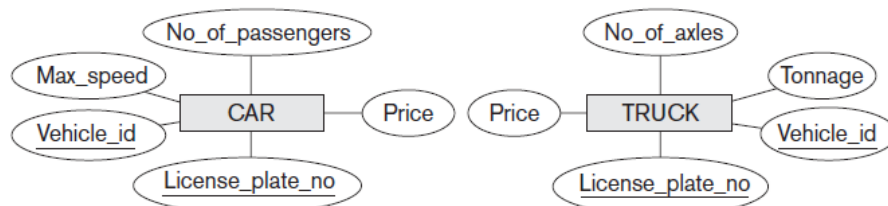


Figure-1: Two entity types, CAR and TRUCK.

- a. Explain how you would map this EER diagram to a relational model using the **generalization** mapping strategy.
- b. Write the relational schema for the superclass and subclasses, ensuring that the disjoint and total constraints are reflected in the schema.

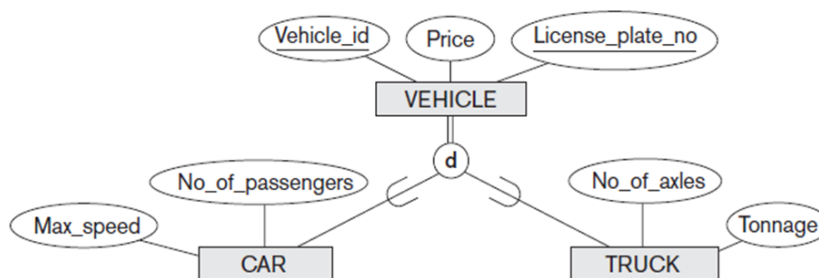


Figure-2: Generalizing CAR and TRUCK into the superclass VEHICLE.

employee (person_name, street, city)
works (person_name, company_name, salary)
company (company_name, city)
manages (person_name, manager_name)

Figure-3: Relational Database.

- 7) Consider the relational database of Figure-3. Give an expression in the **Relational Algebra** to express each of the following queries:
 - a. Find the names of all employees who work for “IDFC First Bank”.

- b. Find the names and cities of residence of all employees who work for “IDFC First Bank”.
- c. Find the names, street address, and cities of residence of all employees who work for “IDFC First Bank” and earn more than Rs. 10,000.

Chapter-4:

- 1) Why can we have at most one primary or clustering index on a file, but several secondary indexes?
- 2) Describe the concept of a cursor and how it is used in embedded SQL.
- 3) What is stored procedure? List the circumstances in which the stored procedure is useful.
- 4) Interpret why, when a manager, say Sachin grants an authorization, the grant should be done by the manager role, rather than by the user Santosh.
- 5) Demonstrate how the key and foreign key constraints be enforced by the DBMS.
- 6) What are the differences among primary, secondary, and clustering indexes? How do these differences affect the ways in which these indexes are implemented? Which of the indexes are dense, and which are not?

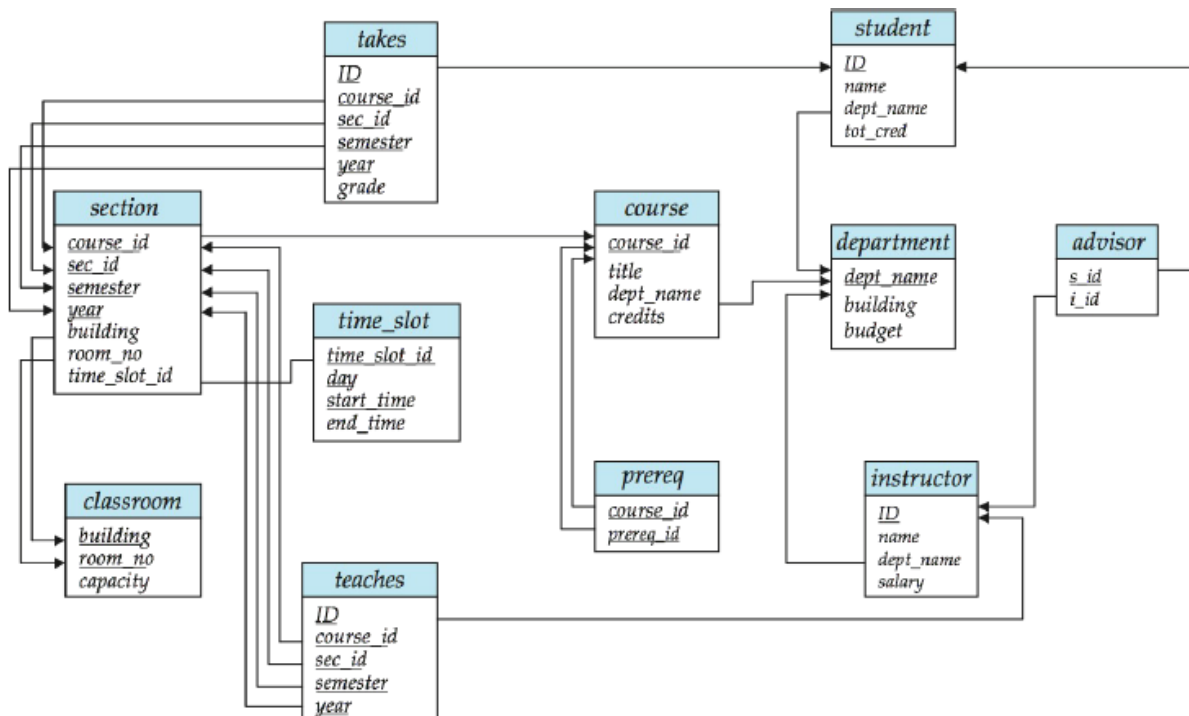


Figure-4: University Database

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classroom(building, room_number, capacity)
department(dept_name, building, budget)
course(course_id, title, dept_name, credits)
instructor(ID, name, dept_name, salary)
section(course_id, sec_id, semester, year, building, room_number, time_slot_id)
teaches(ID, course_id, sec_id, semester, year)
student(ID, name, dept_name, tot_cred)
takes(ID, course_id, sec_id, semester, year, grade)
advisor(s_ID, i_ID)
time_slot(time_slot_id, day, start_time, end_time)
prereq(course_id, prereq_id)

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Figure-5: Schema of the university database

- 7) Consider the University database shown in figure-4/5 and write the following SQL queries.
 - i. Create the table teaches and student.
 - ii. Find the names of all instructors in the Computer Science department who have salary greater than Rs. 70,000.”

- iii. Retrieve the names of all instructors, along with their department names and department building name.”
 - iv. For each course section offered in 2024, find the average total credits (tot cred) of all students enrolled in the section, if the section had at least 20 students.
- 8) Consider the Company relational database schema (from Navathe) and write the following queries:
- i. Retrieve the names of all employees in department 5 who work more than 10 hours per week on the LUX project.
 - ii. List the names of all employees who have a dependent with the same first name as themselves.
 - iii. Find the names of all employees who are directly supervised by Laxman.
- 9) Suppose you are developing a Java application that connects to a MySQL database using JDBC. Consider the following database schema for an "Employee" table:
Employee(EmployeeID INT, Name VARCHAR(50), Position VARCHAR(50), Salary DECIMAL(10,2))
Write a JDBC code snippet to establish a connection to the MySQL database and execute an SQL query that retrieves all employees with a salary greater than 50,000.

Chapter-5:

- 1) Suppose that we decompose the schema $r(A, B, C, D, E)$ into
 $r1(A, B, C)$
 $r2(A, D, E)$
Show that this decomposition is a lossless decomposition if the following set F of functional dependencies holds:
 $A \rightarrow BC$
 $CD \rightarrow E$
 $B \rightarrow D$
 $E \rightarrow A$
- 2) Explain how functional dependencies can be used to indicate the following:
 - a. A one-to-one relationship set exists between entity sets student and instructor.
 - b. A many-to-one relationship set exists between entity sets student and instructor.
- 3) Why are certain functional dependencies called trivial functional dependencies? Explain with example.
- 4) Consider the following set F of functional dependencies on the relation schema $R(A, B, C, D, E, F)$:
 $A \rightarrow BCD$
 $BC \rightarrow DE$
 $B \rightarrow D$
 $D \rightarrow A$
 - a. Compute B^+ .
 - b. Give a 3NF decomposition of R .
- 5) What three data anomalies are likely to be the result of data redundancy? How can such anomalies be eliminated?
- 6) Use the dependency diagram shown in Figure-6 to create two new dependency diagrams, one normalized to Second Normal Form (2NF) and the other to Third Normal Form (3NF).

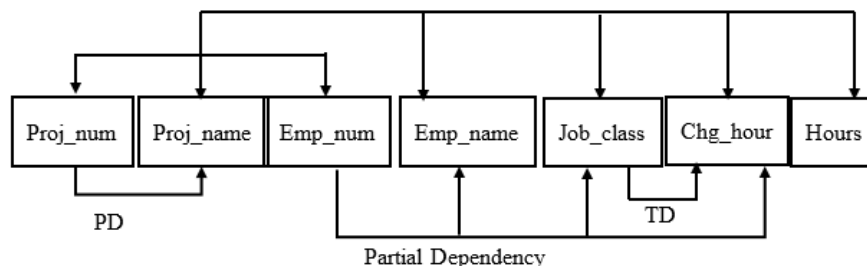


Figure-6: The Functional Dependency Diagram.

Chapter-6:

- 1) What is the two-phase locking protocol? How does it guarantee serializability?
- 2) Discuss the problems of deadlock and starvation, and the different approaches to dealing with these problems.
- 3) Discuss the UNDO and REDO operations and the recovery techniques that use each.
- 4) Discuss the deferred update technique of recovery. What are the advantages and disadvantages of this technique? Why is it called the NO-UNDO/REDO method?
- 5) What do the terms steal/no-steal and force/no-force mean with regard to buffer management for transaction processing?
- 6) Explain the distinction between the terms serial schedule and serializable schedule.
- 7) List all possible schedules for transactions T1 and T2 in Figure 7, and examine which are conflict serializable (correct) and which are not.

| T_1 | (b) | T_2 |
|--|-----|---|
| read_item(X); $X := X - N$; write_item(X); read_item(Y); $Y := Y + N$; write_item(Y); | | read_item(X); $X := X + M$; write_item(X); |

Figure 7: Sample transactions: T1 and T2

- 8) Explain which of the following schedules is (conflict) serializable. For each serializable schedule, determine the equivalent serial schedules.
 - a. r1(X); r3(X); w1(X); r2(X); w3(X);
 - b. r1(X); r3(X); w3(X); w1(X); r2(X);
 - c. r3(X); r2(X); w3(X); r1(X); w1(X);
 - d. r3(X); r2(X); r1(X); w3(X); w1(X);