Exam.Code:0915
Sub. Code: 6392

2074

B.E. (Computer Science and Engineering)

Third Semester

CS-302: Database Systems

Time allowed: 3 Hours **Max. Marks: 50**

NOTE: Attempt five questions in all, including Question No. 1 (Section-A) which is compulsory and selecting two questions each from Section B-C.

x-x-x

Section A: Attempt all questions (10 marks)

Q1) Compare the following with example:

(i) Entity Integrity, Referential Integrity **(2 marks)**

ii) Aggregation and Attribute inheritance **(2 marks)**

iii)Wait die and Wound wait **(2 marks)**

iv) Clustered, Non-Clustered, Sparse and Dense Indexes **(2 marks)**

v) RBAC, MAC and DAC **(2 marks)**

Section B: Attempt any two questions(20 marks)

Q2)a) Design a comprehensive Entity-Relationship (ER) model for a University Information System that encompasses various aspects of academic administration. Consider entities such as students, courses, faculty, departments, and examinations. Define the attributes for each entity and establish relationships between them. Address complex scenarios such as course prerequisites, multiple faculty members teaching a course, student enrollment in courses, examination scheduling, and academic advising. Ensure that your ER model accurately represents the intricate workings of a university system while maintaining data integrity and security.Describe specific features and relationships that handle these complexities within the ER model. **(6 marks)**

b) What are views and how they are stored in the database. Explore the consequences on base tables when performing insert, update, or delete operations on views and vice versa: Write a view in SQL named employee_deptt_information from two tables: "Employees" and "Departments." **(4 marks)**

Q3) Consider a relational database with two tables: "Employees" and "Departments."

Employees: EmployeeID (Primary Key),FirstName, LastName, Salary, DepartmentID (Foreign Key), ManagerID (Foreign Key), HireDate, Email, Phone, Address

Departments:DepartmentID (Primary Key), DepartmentName, Location, Budget, SupervisorID (Foreign Key).Write queries in SQL or Relational algebra for following:

a)Retrieve the names and hire dates of employees who have been with the company for at least five years and have a salary greater than 5 lacs. Include their names, hire dates, and email addresses. Sort the result by hire date in ascending order. **(2 marks)**

b)List the names of employees who manage other employees within the same department. Include the employee's name, the names of the managed employees, and the department name they all belong to. **(2 marks)**

c)Find the department(s) with the highest average salary among employees who were hired in the last three years. Display the department name, average salary, and the count of employees hired in that period.**(2 marks)**

d)Retrieve the names of managers who supervise more than one department. Include the manager's name and the count of departments they manage. **(2 marks)**

e)List the names and hire dates of employees who earn more than the average salary of their department and have a manager who is not in the same department as them. Include the employee name, salary, department name, and manager's name. **(2 marks)**

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Q4)a) Design a relational database schema for a University Management System that encompasses student enrollment, course information, faculty profiles, examination results, and department details. Apply all six normal forms (1NF, 2NF, 3NF, BCNF, 4NF, 5NF, 6NF) to guarantee data integrity and minimize redundancy. Provide a concise description of each normalization step to illustrate the systematic progression towards a well-structured and normalized database.**(6 marks)**

b)Define and elaborate on the concepts of Functional Dependency (FD), Multivalued Dependency (MVD), and Join Dependency (JD) in the normalization process of relational databases. Explain the roles that each of these dependencies plays in ensuring data integrity, minimizing redundancy, and achieving higher normal forms in the database design. **(4 marks)**

Section C: Attempt any two questions(20 marks)

Q5)a) Design a trigger named audit_trail_students to capture and log all insertions, deletions, and updates on the students_data table into the audit_trail_students_data table within the University Management System. Ensure the trigger includes fields for user identification, operation type, and date-time stamp to maintain a comprehensive audit trail of data modifications. **(5 marks)**

b) Develop a PL/SQL script utilizing an explicit cursor to identify the top ten performing students in the "Database Management System" course for the 3rd semester of the B.E. Computer Science and Engineering program at the University Management System. Retrieve and display the names of these students along with their corresponding scores. **(5 marks).**

Q6a) Explain the concept of optimistic concurrency control in databases. Provide an overview of the optimistic locking technique, detailing how it works and its advantages. Discuss a scenario where optimistic concurrency control would be beneficial, and describe the potential challenges associated with its implementation. **(5 marks)**

b)Compare and contrast the two-phase locking (2PL) and timestamp-based concurrency control techniques in databases. Highlight the key characteristics, advantages, and limitations of each method. Discuss a real-world scenario where one approach might be more suitable than the other and explain the reasons behind your choice. **(5 marks)**

Q7)a) Compare and contrast the deferred and immediate update recovery techniques in databases. Explain the fundamental differences between these two approaches, highlighting their strengths and potential drawbacks. Discuss a scenario where each technique would be more suitable and provide reasons for your choice. Additionally, address the impact of these recovery techniques on transaction durability and system performance. **(5 marks)**

b)Explain the concepts of Discretionary Access Control(DAC) and Mandatory Access Control(MAC) in the context of database security. Compare and contrast these two access control models, highlighting their key principles, implementation mechanisms, and advantages. Discuss a scenario where each model might be more suitable based on security requirements and regulatory compliance. Additionally, address the challenges associated with maintaining and managing access control policies in DAC and MAC environments.**(5 marks)**

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