Register Number:……..

KUMARAGURU
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B.E/B.TECH DEGREE EXAMINATIONS: NOV/DEC 2024

(Regulation 2018)

Third Semester

COMPUTER SCIENCE AND ENGINEERING

U18CSI3204: Database Management Systems

COURSE OUTCOMES

CO1: Construct ER Models for a given database application.

CO2: Design relational schema using database design principles.

CO3: Identify key constraints for relations and devise queries using SQL.

CO4: Apply indexing techniques to access and generate user reports for a database.

CO5: Build web applications using PHP & MySQL.

CO6 Illustrate concepts for transaction processing and concurrency control for RDBMS

Time: Three Hours **Maximum Marks: 100**

Answer all the Questions:-

PART A (10 x 2 = 20 Marks)

(Answer not more than 40 words)

1.	Define an ER model and explain its significance in database design.	CO1	[K_1]
2.	Describe two differences between relational and hierarchical database models.	CO2	[K_2]
3.	Explain functional dependency and its role in normalization.	CO2	[K_2]
4.	XYZ Corporation is experiencing redundancy in their Employee database. Analyze and suggest how normal forms can reduce redundancy with examples of 1NF and 2NF.	CO2	[K_3]
5.	A bank database has a transaction table with frequent duplicate transactions due to system errors. Develop an SQL query to delete duplicates while retaining one instance of each unique transaction.	CO3	[K_3]
6.	A hospital's database stores patient information in non-clustered indices on patient IDs. Explain how non-clustered indexing could affect performance if queries frequently search by patient name instead of ID.	CO4	[K_3]
7.	Write an SQL query to retrieve the top 5 employees with the highest salaries in the 'Employee' table, sorted in descending order.	CO3	[K_3]
8.	Explain the concept of static vs. dynamic hashing and where each is used.	CO4	[K_2]
9.	In an online banking system, a user initiates a fund transfer transaction, which undergoes various states like validation and processing. Depict the state diagram of an online transaction,	CO6	[K_3]

showing the key states and transitions involved.

10. Name and briefly describe two commonly used aggregate functions in SQL. CO3 [K_1]

Answer any FIVE Questions:-
PART B (5 x 16 = 80 Marks)
(Answer not more than 400 words)

11. a) Consider two transactions T1 and T2 in a distributed database system. Both transactions need to access two shared resources: R1 and R2. The operations involved are as follows: 7 CO6 [K_4]
    - T1 begins by accessing R1 for a read operation, then accesses R2 for a write operation.
    - T2 begins by accessing R2 for a read operation, then accesses R1 for a write operation.

    Modify the sequence of lock and unlock operations for T1 and T2 so that they adhere to the Two-Phase Locking (2PL) protocol. After applying the modifications, analyze whether the new sequence ensures serializability and prevents potential deadlocks

    b) You are designing a report for an airline booking system, where you have tables for Flights, Customers, and Reservations. You need to create a report that displays all flight reservations, including customers who have not made a reservation for a flight yet. Write an SQL query using the Right Outer Join & Left Outer Join to retrieve this data and explain the logic behind it 7 CO3 [K_4]

    c) Compare dense index and sparse index. 2 CO4 [K_2]

12. a) Explain the ACID properties of transactions and analyze their significance in ensuring reliable database operations 7 CO6 [K_2]

    b) Describe the two-phase locking protocol and illustrate how it can be used to maintain consistency during concurrent transactions. 7 CO6 [K_3]

    c) Identify a potential deadlock scenario in transaction processing and propose a strategy to avoid it. 2 CO6 [K_2]

13. a) Develop an ER model for a library database that includes entities for books, members, and loans. Specify relationships, cardinalities, and key attributes. ER Model for Library Database 7 CO1 [K_3]

    Books

    - Book_ID: Unique identifier for each book (Primary Key)
    - Title: Title of the book
    - Author: Author(s) of the book

- Publisher: Publisher of the book
- CopiesAvailable: Number of copies available in the library

Members

- Member_ID: Unique identifier for each member (Primary Key)
- Name: Name of the member
- Phone_Number: Contact phone number
- Membership_Date: Date the member joined the library

Loans

- Loan_ID: Unique identifier for each loan transaction (Primary Key)
- Book_ID: Foreign key reference to Book_ID in the Books entity (Foreign Key)
- Member_ID: Foreign key reference to Member_ID in the Members entity (Foreign Key)
- Loan_Date: Date when the book was borrowed
- Due_Date: Date when the book is due for return
- Return_Date: Date when the book was returned, if applicable
- Fine: Fine amount, if the book is returned late

Relationships

- Members can borrow multiple Books, but each loan is for a single Book (One-to-Many relationship between Members and Loans).
- Each Book can be loaned out multiple times, but each loan record links to only one Member (One-to-Many relationship between Books and Loans).

	b)	Convert the ER model from part (a) into a relational schema. List tables, attributes, and primary and foreign keys.	7	CO1	[K_4]
	c)	Explain the concept of referential integrity and how it applies to the library database schema	2	CO1	[K_2]
14.	a)	Consider the schema for a hotel booking database as follows:	7	CO3	[K_3]

- ROOMS(HOTEL_NAME, CITY, ROOM_TYPE, ROOM_NUMBER, PRICE_PER_NIGHT)
- HOTELS(HOTEL_NAME, HOTEL_CHAIN, TOTAL_ROOMS, AMENITIES)

Create the following SQL queries based on the provided schema:

(i) Create a query to display the number of hotels in each city.

(ii) Create a query to display the names of hotel chains operating in Mumbai but not in Pune.

	(iii)	Create a query to display the room types available in hotel in New York City.			
	b)	A library management system stores information about books, borrowers, and librarians in a single unnormalized table. The table contains details about the books (title, author, and ISBN), the borrowers who checked out the books, and the librarian who facilitated the checkout. Apply the normalization process to transform it through 1NF, 2NF and 3NF.	7	CO2	[K_3]
	c)	Define a foreign key and provide an example of a foreign key relationship in a university database schema.	2	CO3	[K_1]
15.	a)	Explain the architecture of a DBMS with a labeled diagram. Describe the role of each component.	7	CO1	[K_2]
	b)	Construct the B+ Tree, calculate its height, and illustrate the k-level B+ Tree (where k = 3), showing the internal and leaf nodes with the key sequences. Insert the keys 10, 20, 5, 6, 30, 25, 15, 8, 35, 40 into an empty B+ Tree of order 3, ensuring proper node splitting during insertion.	7	CO4	[K_3]
	c)	List two advantages of using a database over a file-based storage system.	2	CO1	[K_1]
16.	a)	A web application needs a PHP script to retrieve and display customer details from a MySQL database. Write a sample PHP script and describe each section of the code.	7	CO5	[K_5]
	b)	Explain the importance of RAID levels in data storage systems.	7	CO4	[K_2]
	c)	Consider the following relation schema for a library database: • book (BookID, title, author, genre) • borrower (MemberID, name, address) • borrow (MemberID, BookID, borrow_date, return_date) Develop a DDL query to create the tables with appropriate key constraints (primary and foreign keys) in SQL.	2	CO4	[K_3]

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