Question Paper

Exam Date & Time: 09-Jan-2024 (02:30 PM - 05:30 PM)

MANIPAL ACADEMY OF HIGHER EDUCATION

FIFTH SEMESTER B.TECH. DEGREE EXAMINATIONS - JANUARY 2024
SUBJECT: ICT 3157 - DATABASE SYSTEMS

Marks: 50 **Duration: 180 mins.**

Answer all the questions.

1A) Describe the three components of the CAP theorem and their significance in a distributed system. (5)

Consider the below Inventory Collection structure with the few sample data,

```
db.collection('inventory').insertMany([
{
   item: 'planner',
   instock: [
     { warehouse: 'A', qty: 40 },
     { warehouse: 'B', qty: 5 }
   ]    },
{   item: 'postcard',
   instock: [
     { warehouse: 'B', qty: 15 },
     { warehouse: 'C', qty: 35 }
   ]    }    ]);
```

Formulate the mongodb query to retrieve the following information:
i) select all documents where qty is less than or equal to 20 and item is not 'postcard' nor 'planner'.
ii) instock array has at least one embedded document that contains the field qty that is greater than 10 and less than or equal to 20.
iii) instock array has at least one embedded document that contains the field qty equal to 5 and at least one embedded document (but not necessarily the same embedded document) that contains the field warehouse equal to A.

1B) Examine whether the schedules generated by Two phase locking protocol, and Validation based protocol are recoverable? justify your answer with the suitable example. (3)

1C) Identify the benefit of the below schedule K , and justify your answer. (2)

K: S1(A) R1(A) X2(C) W2(C) X1(B) W1(B) S1(B) R2(B) X1(A) W1(A) R1(B)

R: S1(A) R1(A) X2(C) W2(C) X1(B) W1(B) S1(B) R2(B) X1(A) W1(A) R1(B)
[Note: S is Shared Lock, X is Exclusive Lock]

2A)	Consider the following schema for a Library Database: BOOK(**Book_id**, Title, Publisher_Name, Pub_Year) BOOK_AUTHORS(Book_id, Author_Name) PUBLISHER(**Name**, Address, Phone) BOOK_COPIES(Book_id, Branch_id, No-of_Copies) BOOK_LENDING(Book_id, Branch_id, Card_No, Date_Out, Due_Date) LIBRARY_BRANCH(**Branch_id**, Branch_Name, Address) Write SQL queries to 1) Retrieve details of all books in the library - id, title, name of publisher, authors, number of copies in each branch, etc. 2) Get the particulars of borrowers who have borrowed more than 3 books, but from Jan 2017 to Jun 2017. 3) Delete a book in BOOK table. Update the contents of other tables to reflect this data manipulation operation. 4) Partition the BOOK table based on year of publication. Demonstrate its working with a simple query. 5) Create a view of all books and its number of copies that are currently available in the Library	(5)
2B)	Create a Pl/SQL program to retrieve the ID, name and address. Created Table include following attributes ID,NAME, AGE, ADDRESS, SALARY	(3)
2C)	Write SQL Queries for using below table Worker with attributes WORKER_ID, FIRST_NAME,LAST_NAME, SALARY,JOINING_DATE, DEPARTMENT i) Write an SQL query to fetch "FIRST_NAME" from the Worker table using the alias name < WORKER_NAME>Write an ii) SQL query to fetch unique values of DEPARTMENT from the Worker table.	(2)
3A)	Consider a relation R(C,S,J,D,P,Q,V) having the following functional dependencies: Fd1: C-> CSJDPQV Fd2: SD->P Fd3: JP->C Fd4: J->S Fd4: J->S Identify the current normal form seen in these functional dependencies. Convert these to the highest normal forms possible. Examine whether the normalized schema is dependency preserving and lossless join.	(5)
3B)	Consider relation R(P,Q,R,S,T,V) having the following functional dependencies P->QRS, P->TV, QR->PS, QR->T, QR->V, Q->V, S->T. Relation is decomposed into R1(P,Q,R,S), R2(Q,V) and R3(S,T)	(3)
3C)	Examine if this decomposition dependency preserving? If not state the reasons. Describe a scenario that prompts the need for a database view, taking into consideration the specific requirements in Employee appraisal management system and Student Information system.	(2)
4A)	Construct the ER diagram for the following Library Database schema: BOOK(**Book_id, Title, Publisher_Name**, Pub_Year) BOOK_AUTHORS(**Book_id**, Author_Name) PUBLISHER(**Name**, Address, Phone) BOOK_COPIES(Book_id, Programme_id, No-of_Copies) BOOK_LENDING(Book_id, Programme_id, Card_No, Date_Out, Due_Date) LIBRARY_PROGRAMME(**Programme_id**, Programme_Name, Address)	(5)
4B)	Consider the relation scheme R = {E, F, G, H, I, J, K, L, M, M} and the set of functional dependencies {{E, F} -> {G}, {F} -> {I, J}, {E, H} -> {K, L}, K -> {M}, L -> {N} on R. What is the key for R in below option with justification? A. {E, F} B. {E, F, H} C. {E, F, H, K, L} D. {E}	(3)
4C)	Illustrate ACID properties in DBMS.	(2)
5A)	Examine whether the following schedule can be conflict serializable or view serializable. Show all the steps properly. S: R2(A) R1(A) W1(C) W3(C) W1(B) W4(B) W3(A) R4(C) W2(D) R2(B) W4(A) W4(B)	(5)
5B)	A library needs to manage its resources efficiently to serve its patrons effectively. The library contains	(3)

various types of entities, including books, patrons, authors, and library staff. Each book has specific attributes such as title, ISBN, and publication year, and it may be authored by one or more authors. Patrons can borrow multiple books, and each book may be borrowed by multiple patrons. The library staff is responsible for managing the borrowing and returning of books.
Relate the requirements of the library system to different levels of abstraction. Justify your answer.

5C) In the context of an e-commerce platform, compare and contrast the challenges and advantages of using a traditional file system versus a relational database for managing a large-scale product catalog. (2)

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