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Question Paper Code : 11179

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2026.

Fourth Semester

Computer Science and Engineering

CS3492 – DATABASE MANAGEMENT SYSTEMS

(Common to : Computer and Communication Engineering/Computer Science and
Business Systems/Information Technology)

(Regulations 2021)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. List out any four capabilities that should be provided by a DBMS.
2. Differentiate order by and group by clause.
3. What is weak and strong entity? Give an example.
4. What is lossless decomposition?
5. Define concurrency control access.
6. Justify why cascadeless schedule is desirable.
7. What are the ACID properties?
8. Define shadow paging.
9. Give the significant need of using distributed databases.
10. What is SQL injection attack?

PART B — (5 × 13 = 65 marks)

11. (a) Illustrate a Schema diagram for a university database by specifying necessary entity, properties information and constraints. Identify atleast three primary users for your database, and design a view for each of user.

Or

- (b) Consider the relational conceptual database schema for keeping track of course registration of students:

COURSES (Code, Title, Dept)

Registered (Code, SSN)

STUDENTS (SSN, Name, Dept, GPA)

Here, COURSES contains a tuple for each course, recording its code, title, and department offering the course. STUDENTS records the SSN, name, department, and GPA of the students. REGISTERED keeps the relation courses enrolled by students:

Write relational algebra expressions for the following queries:

- (i) Retrieve the name of each student who has registered in the course titled "Database Systems". (3)
 - (ii) List the information of the students belonging to department "CS". (2)
 - (iii) Retrieve the title of the course along with the number of students who registered in this course in the descending order of registered student number. (3)
 - (iv) Retrieve the name of student(s) who earned the maximum GPA in each department (2)
 - (v) Find the student who got the second largest GPA in "Database Systems". (3)
12. (a) Design an E/R diagram describing the following requirements to design database application.
- * A Person has attributes pid (key) and name.
 - * A Skier is a type of Person with attribute aptitude.
 - * A Snowboarder is a type of Skier.
 - * A PairOfSkis has attribute sid (key) and model.
 - * A Snowboard has attribute sid (key) and model.
 - * A Skier owns zero or more PairOfSkis. The ownership relation has a purchase price. A PairOfSkis is owned by at most one Skier.
 - * A Snowboarder owns zero or more Snowboards. The ownership relation has a purchase price. A Snowboard is owned by at most one Snowboarder.

- * A Person can rent a PairOfSkis or a Snowboard. A person cannot rent more than one PairOfSkis or one Snowboard at the same time. A person cannot rent a PairOfSkis and a Snowboard at the same time either. A piece of equipment can be rented by at most one person at a time. The rental comes with a start date and an end date. Make assumptions wherever necessary.

Or

- (b) Briefly explain the normalization forms (1NF, 2NF, 3NF, BCNF). Normalize the following schema, with given constraints, to 4NF.

- books(accessionno, isbn, title, author, publisher)
- users(userid, name, deptid, deptname) :

Identified functional dependencies are :

- accessionno $\rightarrow$ isbn, isbn $\rightarrow$ title, isbn $\rightarrow$ publisher, isbn $\rightarrow$ author,
userid $\rightarrow$ name, userid $\rightarrow$ deptid, deptid $\rightarrow$ deptname

13. (a) Consider the following schedule of transactions:

T1: R(A), W(A), R(B), W(B)

T2: W(B), R(B), W(A), R(A)

Determine if the given schedule is conflict serializable using the precedence graph method. Show the construction of the precedence graph by justifying your reasoning. If the schedule is not conflict serializable, provide a serializable equivalent schedule by reordering the transactions. Justify your answer.

Or

- (b) (i) Describe the ARIES recovery algorithm. (9)
- (ii) In the ARIES recovery algorithm:
- (1) If at the beginning of the analysis pass, a page is not in the checkpoint dirty page table, will we need to apply any redo records to it? Why? (2)
 - (2) What is RecLSN, and how is it used to minimize unnecessary redos? (2)

14. (a) Consider B+ Tree for the following scenarios. A PARTS file with Part# as the key field includes records with the following Part # values: 23, 65, 37, 60, 46, 92, 48, 71, 56, 59, 18, 21, 10, 74, 78, 15, 16, 20, 24, 28, 39, 43, 47, 50, 69, 75, 8, 49, 33, 38. Suppose that the search field values are inserted in the given order in a B+-tree of order $p = 4$ and $pleaf = 3$; show how the tree will expand and what the final tree will look like.

Or

- (b) Explain the different algorithms used for selection operation and their associated cost.
15. (a) Explain the need of Transaction management in Distributed Databases.

Or

- (b) Describe in detail the principles of database security, including authentication, authorization, and access control mechanisms. Discuss the differences between Mandatory Access Control (MAC), and Role-Based Access Control (RBAC) models.

PART C — ($1 \times 15 = 15$ marks)

16. (a) (i) Define the term deadlock in concurrency control. Give an example of a set of transactions and locks that they acquire that results in deadlock. (5)
- (ii) Define a deadlock detection scheme and how this scheme would prevent deadlock in your example. (5)
- (iii) Define a deadlock prevention scheme and how this scheme would prevent deadlock in your example. (5)

Or

- (b) (i) A Parts file with Part# as the hash key includes records with the following parts values: 2369, 3760, 4692, 4871, 5659, 1821, 1074, 7115, 1620, 2428, 3943, 4750, 6975, 4981, 9208. The file uses eight buckets numbered 0 to 7. Each bucket uses 1 disk block and contains a maximum of two records. Using the hash function $h(K) = K \bmod 8$, load the records into the file in the given order. Use open addressing to handle overflow. Show how the records would be stored. (3)
- (ii) Brief on static hashing. (5)
- (iii) Discuss on techniques that allow Dynamic File Expansion. (7)