

MCA 1st Semester Exam., 2024

**ADVANCED DATABASE
MANAGEMENT SYSTEMS**

Time : 3 hours

Full Marks : 70

Instructions :

- (i) The marks are indicated in the right-hand margin.*
- (ii) There are **SEVEN** questions in this paper.*
- (iii) Attempt **FIVE** questions in all.*
- (iv) Question Nos. 1 and 2 are compulsory.*

SECTION—A

- 1. Choose the correct answer from the following :** **2×10=20**

(a) Which of the following features is supported in the relational database model?

- (i) Complex data types*
- (ii) Multivalued attributes*
- (iii) Association with multiplicities*
- (iv) Generalization relationships*

(b) In relational database, if relation R is in BCNF, then which of the following is true about relation R?

- (i) R is in 4NF*
- (ii) R is not in 1NF*

(2)

- (iii) R is in 2NF and not in 3NF
- (iv) R is in 2NF and 3NF
- (c) Which of the following desired features is beyond the capability of relational algebra?
 - (i) Aggregate computation
 - (ii) Multiplication
 - (iii) Finding transitive closure
 - (iv) All of the above
- (d) Which of the following key constraints is required for functioning of foreign key in the context of relational databases?
 - (i) Unique key
 - (ii) Candidate key
 - (iii) Primary key
 - (iv) Check key
- (e) Which of the following statements contains an error?
 - (i) Select * from emp where empid = 10003;
 - (ii) Select empid from emp where empid = 10006;
 - (iii) Select empid from emp;
 - (iv) Select empid where empid = 1009 and lastname = 'GELLER';

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(3)

- (f) In contemporary databases, the top level of the hierarchy consists of ____ each of which can contain ____.
 - (i) catalogs, schemas
 - (ii) schemas, catalogs
 - (iii) environment, schemas
 - (iv) schemas, environment
- (g) What is the property of relational database model?
 - (i) Data is presented as a collection of relations
 - (ii) Each relation is depicted as a table
 - (iii) Each row ("tuple") represents as a single entity
 - (iv) All of the above
- (h) In order to maintain the consistency during the transaction database provides
 - (i) atomic
 - (ii) flashback
 - (iii) commit
 - (iv) retain

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(4)

- (i) An association between the student and course entities is
 - (i) 1:1 relationship
 - (ii) 1:M relationship
 - (iii) M:M relationship
 - (iv) None of the above
- (j) Administrative supervision of database activities is the responsibility of the
 - (i) database administrator
 - (ii) DP manager
 - (iii) DB manager
 - (iv) DP administrator

SECTION—B

2. Answer any *four* of the following questions :

5×4=20

- (a) Draw and explain the three-level architecture of the database system and also explain what are weak and strong entities in short.
- (b) How does an ORDBMS support encapsulation and data hiding principles from object-oriented programming? Provide examples.
- (c) Describe the key features and benefits of temporal databases. How do they handle time-varying data, and what are some common use cases?

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(5)

- (d) Describe the concept of fragmentation in distributed databases. What are the different types of fragmentation, and how do they contribute to efficient data distribution? Also explain the importance of query optimization in distributed databases.
- (e) Explain the concept of dimensional modeling in data warehousing. What are the primary components of a dimensional model, such as facts and dimensions, and how are they used to organize data for analysis?

SECTION—C

Answer any *three* of the following questions :

10×3=30

3. Consider the following relational schema for a library :
- member(memb no, name, dob)
 - books(isbn, title, authors, publisher)
 - borrowed(memb no, isbn, date)
 - Instructor(ID, name, dept_name, salary)
 - Section(course_id, semester, year, building, room_number, time_slot_id)
 - Teaches(ID, course_id, sec_id, semester, year)
 - Student(ID, name, dept_name, tot_cred)

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(6)

Write each of the following queries in SQL and relational algebra. Create the appropriate tables and insert at least five records :

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1. Obtain the names of all instructors whose department is in the Watson building.
2. Obtain the IDs of all students who were taught by an instructor named Einstein.
3. Obtain the enrolment of each section that was offered in Autumn 2009.
4. Obtain the names of all students who have taken at least one Computer Science Course.
5. Obtain the IDs and names of all students who have not taken any course offering before Spring 2009.
6. For each department, obtain the maximum salary of instructors in that department. You may assume that every department has at least one instructor.
7. Obtain the lowest, across all departments, of the per-department maximum salary computed by the preceding query.

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(7)

4. (a) Consider the following relation of a student database :

Student (enrolno, name, age)

Result (enrolno, coursecode, marks)

Course (coursecode, c_name)

Passing marks in a subject are 50

Write a trigger that will give 3 grace marks to the students having 47 marks, 2 grace marks to the students having 48 marks and 1 grace mark to the student having 49 marks. Another condition for triggering is that a student's age must exceed 30 to get grace marks.

- (b) What is the difference between active and passive data dictionary? $6+4=10$

5. The UA Office of Appointed Personnel is asked, "What is the maximum salary?"

(a) Give this query in SQL on a snapshot database, storing only the current information.

(b) Now that the salary history is stored, we'd like a history of the maximum salary over time. The problem, of course, is that SQL does not provide temporal aggregates. One way to do this is indirectly, by converting the

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snapshot aggregate query into a non-aggregate query, then converting that into a temporal query. The non-aggregate query finds those salaries for which a greater salary does not exist. Write this query in SQL, again, on a snapshot database.

- (c) Now convert this latter query into a temporal query. This is quite challenging. 2+4+4=10

6. (a) What is datagrid? What is the requirement of datagrid (give at least three requirements)? Describe the structure of datagrid with the help of a block diagram.

- (b) What are the database requirements for genome? List out them and explain in detail. 5+5=10

7. What is the difference between database processing and data mining processing? Also explain the working of Apriori algorithm with an example. 10

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