

MCA/2ND SEM/MCAP 1203/2019
DATABASE MANAGEMENT SYSTEMS I
(MCAP 1203)

Time Allotted : 3 hrs

Full Marks : 70

Figures out of the right margin indicate full marks.

***Candidates are required to answer Group A and
any 5 (five) from Group B to E, taking at least one from each group.***

***Candidates are required to give answer in their own words as far as
practicable.***

Group – A
(Multiple Choice Type Questions)

1. Choose the correct alternative for the following: **10 × 1 = 10**
- (i) Consider a relation R(A,B,C,D,E) with the following functional dependencies: $ABC \rightarrow DE$ and $D \rightarrow AB$. The number of super keys of R is:
(a) 2 (b) 7 (c) 10 (d) 12.
- (ii) The term attribute refers to a _____ of a table.
(a) record (b) column (c) tuple (d) key.
- (iii) 'AS' clause is used in SQL for
(a) selection operation (b) rename operation
(c) join operation (d) projection operation.
- (iv) A relation is in _____ if an attribute of a composite key is dependent on an attribute of other composite key.
(a) 2NF (b) 3NF (c) BCNF (d) 1NF.
- (v) Foreign key constraint is also known as
(a) domain integrity (b) entity integrity
(c) referential integrity (d) key integrity.
- (vi) Consider a functional dependency $\alpha \rightarrow \beta$ where α is part of primary key and β is prime. This functional dependency holds which maximum normal form?
(a) 1NF (b) 2NF (c) 3NF (d) BCNF.
- (vii) The _____ operator preserves unmatched rows of the relations being joined.
(a) inner join (b) outer join (c) union (d) union join.

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- (viii) All aggregate functions except _____ ignore null values in their input collection.
(a) count(attribute) (b) count(*)
(c) avg (attribute) (d) sum(attribute).
- (ix) Index which has an entry for some of key value is classified as
(a) linear index (b) dense index
(c) non dense index (d) cluster index.
- (x) The most commonly used operation in relational algebra for projecting a set of tuple from a relation is
(a) join (b) projection (c) select (d) union.

Group – B

2. (a) Distinguish between database management system and traditional file management system for the following aspects:
(i) Data redundancy and inconsistency
(ii) Data isolation
(iii) Data integrity
(iv) Atomicity
- (b) Explain the three levels of data abstraction.
- (c) Explain the following with suitable example:
(i) Multivalued attribute
(ii) Derived attribute
- 6 + 3 + 3 = 12**
3. (a) Consider a university database for the scheduling of classrooms for final exams. This database could be modelled as the single entity set exam, with attributes course-name, section-number, room-number, and time. Alternatively, one or more additional entity sets could be defined, along with relationship sets to replace some of the attributes of the exam entity set, as
○ *course* with attributes name, department, and c-number
○ *section* with attributes s-number and enrolment, and dependent as a weak entity set on course
○ *room* with attributes r-number, capacity, and building
- Construct an E-R diagram illustrating the use of all three additional entity sets listed.
- (b) Explain the following terms in connection with E-R diagram, with an example:
(i) Specialization
(ii) Aggregation

8 + (2 + 2) = 12

Group – C

4. (a) Let R(ABCD) be a relation with the set of functional dependencies $F=\{A \rightarrow CD, D \rightarrow A\}$. R is decomposed into two relations R1(AD) and R2(BCD). Find whether this decomposition is
 (i) lossless or lossy.
 (ii) dependency preserving or not.
- (b) Given a relation R(ABCDE) with the following FDs $\{AB \rightarrow CD, D \rightarrow A, BC \rightarrow DE\}$
 List all the candidate keys.
- (c) Let R(ABCDE) be a relation with the set of functional dependencies $F=\{AB \rightarrow CD, D \rightarrow A, BC \rightarrow DE\}$. Find the highest normal form of R.
- (2 + 2) + 4 + 4 = 12**
5. (a) Find out the closure of attribute set (AG) i.e., $(AG)^+$ in the relational schema R and set of functional dependencies F given below:
 $R = (A, B, C, G, H, I)$ and $F = \{A \rightarrow B, A \rightarrow C, CG \rightarrow H, CG \rightarrow I, B \rightarrow H\}$
 Is (AG) is a super key of R?
- (b) Consider the relation R with a set of functional dependencies F given below:
 $R=(A, B, C, D)$ and $F = \{C \rightarrow D, C \rightarrow A, B \rightarrow C\}$
 (i) Identify all candidate keys for R.
 (ii) Identify the best normal form that R satisfies.
 (iii) Decompose R into a set of BCNF relations.

$$(3 + 1) + (2 + 2 + 4) = 12$$

Group – D

6. (a) Consider the **SPC** relations:
Suppliers (SID, Sname, Rating)
Parts (PID, Pname, Color)
Catalog (SID, PID, Cost)
 Write the following queries in relational algebra using the **SPC** relations.
 (i) Retrieve SIDs of Suppliers not supplying any part.
 (ii) Retrieve SIDs of Suppliers, those who supply every part.
 (iii) Retrieve SIDs of Suppliers those who supply some red part or some green part.
- (b) Write the following queries in SQL using the above **SPC** relations.
 (i) Find the Pname of parts for which there is some supplier.
 (ii) Retrieve SIDs of Suppliers who supplied every red part.
 (iii) Retrieve SIDs of Suppliers who supplied some red part or some green part. [Use set operator].

$$(3 \times 2) + (3 \times 2) = 12$$

7. (a) Consider the relational database given below, where the primary keys are underlined.
 (i) client (client-id, name, city)
 (ii) product (product-id, description, cost)
 (iii) salesman(salesman-id, name, target, city)
 (iv) sales_order(order-id, date, client_id, salesman_id)
 (v) order_details(order-id, product id, quantity)

Write SQL queries to implement the following:

- (i) Display descriptions of all products ordered by **Vishal** and sold by a salesman located in the city "Kolkata".
 (ii) Display descriptions of products that have been ordered at least once.
 (iii) Display all cities in which at least one client or salesman are located.
 (iv) List all salesmen grouped by city along with the total cost of all items sold by them, in decreasing order of total cost.
 (v) Display the names of all salesmen who sales all the products.
- (b) Define left outer join with a suitable example.

$$(5 \times 2) + 2 = 12$$

Group – E

8. (a) What are dense indexing and sparse indexing? Explain with example.
 (b) What is the difference between *cluster* and *non - cluster* index?
 (c) What is subquery? What is the difference between nested subquery and correlated subquery? Explain with example.

$$5 + 4 + (1 + 2) = 12$$

9. (a) What is materialized view? Describe the advantages of materialized view.
- (b) Construct a B+-tree for the following set of key values:
 (2, 3, 5, 7, 11, 17, 19, 23, 29, 31)
 Assume that the number of key values that will fit in one node is three.
 Show the form of the tree after each of the following series of operations:
 (i) Insert 9.
 (ii) Insert 10.
 (iii) Delete 23.
 (iv) Delete 19.

$$(1 + 2) + 9 = 12$$