

DATA STRUCTURE & RDBMS
(CSEN 3106)

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) What is the average case running time of an insertion sort algorithm?
(a) $O(N)$ (b) $O(N \log N)$ (c) $O(\log N)$ (d) $O(N^2)$
- (ii) What is the corresponding postfix expression of "3+4*5/6"?
(a) 3456+*/ (b) 34+56*/ (c) 345*6/+ (d) 34+5*6/
- (iii) Which of the following is false about a binary search tree?
(a) The left child is always lesser than its parent
(b) The right child is always greater than its parent
(c) The left and right sub-trees should also be binary search trees
(d) In order sequence gives decreasing order of elements.
- (iv) If a user tries to push 1 element into a stack having already five elements and having stack size of 5, then what happens to the stack?
(a) Overflow (b) Underflow (c) Crash (d) None of these.
- (v) Depth First Search is equivalent to which of the traversal in the Binary Trees?
(a) Pre-order Traversal (b) Post-order Traversal
(c) Level-order Traversal (d) In-order Traversal.
- (vi) Which of the following key cannot be null?
(a) Primary Key (b) Candidate Key
(c) Super Key (d) None of these.
- (vii) A View is a
(a) Temporary table (b) Permanent table
(c) Virtual table (d) Dynamic table.
- (viii) What is the function of the following command?
Delete from r where P = 10;
(a) Clears all entries from the relation (b) Deletes the relation
(c) Deletes particular tuple(s) from relation (d) All of these.

- (ix) A transaction is said to be atomic if and only if
(a) transaction is partially completed (b) transaction is fully completed
(c) transaction does not take place (d) none of the above.
- (x) What is information about data called?
(a) Hyper data (b) Tera data
(c) Meta data (d) Relations.

Group - B

2. (a) Write the algorithm to push an element into a stack. Explain with an example.
[[CO1, CO2](Remember/LOCQ)]
(b) Distinguish between stack and queue. What are the postfix and prefix forms of the following given expression? $A+B*(C-D)/(P-R)$ [[CO2](Understand/IOCQ)]
4 + (4 + 4) = 12
3. (a) Convert the following infix expression into its equivalent postfix expression (Show all intermediate steps): $A*(B+D)/E-F*(G+H/K)$.
[[CO1, CO6] (Evaluate, HOCQ)]
(b) Consider an 25 X 4 matrix A. Suppose Base(A) = 200 and w = 4 words per memory cell. What will be the address of A[12,3] in row major and column major order? [[CO1](Remember/LOCQ)]
(c) What is/are the advantage(s) of a circular queue over a linear queue?
[[CO4] (Analyze/IOCQ)]
6 + 4 + 2 = 12

Group - C

4. (a) Write a recursive function to find the factorial of a given number.
[[CO1] (Remember/LOCQ)]
(b) Create a BST for the following sequence of numbers (Show all intermediate trees). 8,3,1,5,6,7,11,9,14,10,15,12,13 [[CO1](Understand/LOCQ)]
(c) Delete the nodes **15, 5, 11** from the constructed BST in 4.(b) and reconstruct the tree (Show all intermediate steps). [[CO1](Understand/LOCQ)]
3 + 4 + 5 = 12
5. (a) Perform Bubble sort on the given list. Show the different iteration steps.
32, 51, 27, 85, 66, 23, 13, 57
What is the average case time complexity of bubble sort algorithm?
[[CO4] (Analyze/IOCQ)]
(b) Construct a binary search tree whose nodes in inorder and preorder are given as follows (Show all intermediate steps):
Inorder: **D B H E A I F J C G**
Preorder: **A B D E H C F I J G** [[CO6] (Construct/HOCQ)]
(c) Explain binary search algorithm with suitable example.
[[CO1] (Understand/LOCQ)]
(4 + 1) + 3 + 4 = 12

Group - D

6. (a) A university database contains information about professors (identified by a social security number) and courses (identified by a course ID). Each of the following situations concern the relationship set between the teacher and the student. Draw an ER diagram for each of the following situation (assuming that no further constraints hold).
- (i) Professors can teach the same course over several semesters and each offering must be recorded.
 - (ii) Each professor teaches exactly one course.
 - (iii) Each professor teaches at least one course and some professors may teach multiple courses.
 - (iv) Each professor teaches at least one course and some professors must teach all the courses. [(CO6) (Evaluate/HOCQ)]
- (b) What are the different types of joins in SQL? [(CO5)(Understand/LOCQ)]
- 10 + 2 = 12**
7. (a) Consider a relational database as given below:
Flight(flight_no, flight_name, start_airport)
Seat(seat-no, flight-no, type, price)
Schedule(flight-no, day_of_week, type)
Where the underlined attributes are the primary keys.
Write SQL queries for the following:
- (i) Find all the flight names starting from airport "ABC".
 - (ii) List the price and type of all seats of "PQR" flight.
 - (iii) List the flight number and price of all "business" (type) seats with price below 6000/-
 - (iv) Find all those flight names which are scheduled to fly on Saturdays and Sundays (i.e. day_of_week) [(CO4, CO5) (Analyze/IOCQ)].
- (b) Describe the three-level architecture of DBMS. [(CO1)(Remember/LOCQ)]
- (4 × 2) + 4 = 12**

Group - E

8. (a) What is Normalisation? What normal form is the following relation 'Stuff' in? Relation Stuff (D, O, N, T, C, R, Y) where FD's are DO -> NTCRY, CR ->D, D -> N. [(CO1)(Remember/LOCQ)]
- (b) Find candidate keys for R(A,B,C,D,E,F) with following FDs :
AB -> C, C -> DE, E -> F, F -> B, E -> A. [(CO1)(Understand/LOCQ)]
- (c) Describe the different states of a Transaction life cycle.
[(CO1)(Remember/LOCQ)]
- (2 + 3) + 4 + 3 = 12**
9. (a) How BCNF is better than 3NF? Explain with example. Why certain functional dependencies are called trivial functional dependencies?
[(CO5)(Remember/IOCQ)]
- (b) Convert the following Table in 1NF. [(CO5)(Evaluate/HOCQ)]

ID	Name	Courses
1	A	c1, c2
2	E	c3
3	M	c2, c3

(4 + 3) + 5 = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	43.75%	31.25%	25%

Course Outcome (CO):

After the completion of the course students will be able to

CO 1: Analyze and remember the basics of data structures along with terminology, features, classifications, and characteristics embodied in database systems.

CO 2: Understand the significance and utility of different data structures and the context of their application.

CO 3: Evaluate an understanding of the relational data model.

CO 4: Analyze and remember the behavior of different data structures in algorithms.

CO 5: Analyze and apply using SQL and relational algebra, solutions to a broad range of query and data update problems.

CO 6: Evaluate different types of solutions (e.g. sorting in data structure, complex querying in dbms) to the same problem.

*LOCQ: Lower Order Cognitive Question; IOCQ: Intermediate Order Cognitive Question; HOCQ: Higher Order Cognitive Question

Department & Section	Submission Link
CE - A	https://classroom.google.com/c/NDA2MTQwOTkxMTg1/a/NDYzODMwOTQ5OTY5/details
CE - B	https://classroom.google.com/c/Mzk3Nzc4NzAzNDAz/a/NDU4NzM3NzU4NzIz/details