DATA STRUCTURE AND RDBMS
(CSEN 3206)

Time Allotted : 3 hrs   **Full Marks : 70**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and
<u>any 5 (five)</u> from Group B to E, taking <u>at least one</u> 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)   Linked List is used to implement data structures like
          (a) Stacks   (b) Queues
          (c) Trees   (d) All of these.

    (ii) Which function places an element on the stack?
          (a) POP()   (b) PUSH()   (c) PEEK()   (d) isEmpty().

    (iii) The circular queue will be full only when
          (a) FRONT=MAX-1 and REAR=MAX-1   (b) FRONT=0 and REAR=MAX-1
          (c) FRONT= MAX-1 and REAR=0   (d) FRONT=0 and REAR=0.

    (iv) Degree of a leaf node is
          (a) 0   (b) 1   (c) 2   (d) 3.

    (v)   When the left sub-tree of the tree is one level higher than that of the right sub-tree, then the balance factor is
          (a) 0   (b) 1   (c) -1   (d) 2.

    (vi) In which sorting, consecutive adjacent pairs of elements in the array are compared with each other?
          (a) Bubble Sort   (b) Selection Sort
          (c) Merge Sort   (d) Radix Sort.

    (vii) In an E-R diagram an entity set is represented by
          (a) rectangle   (b) ellipse
          (c) a diamond box   (d) circle.

    (viii) Which of the following is not a DDL statement?
          (a) ALTER   (b) DROP   (c) SELECT   (d) CREATE.

(ix)   Which of the following operation is used if we are interested in only certain columns of table?
(a) PROJECTION   (b) UNION   (c) SELECTION   (d) JOIN.

(x)   CARTESIANPRODUCT in relational algebra is
(a) a unary operation   (b) a binary operation
(c) a ternary operation   (d) not defined.

Group – B

2.   (a)   Convert the following infix expression to its equivalent postfix notation (Show all intermediate steps)
A*(B - C)/ D +E/(F+G*H)

(b)   Evaluate the following postfix expression using stack (Show all intermediate steps)
10 7 5 - 10 + 2 / +

(c)   Write an algorithm to delete operation in a queue. What are the advantages of circular queue over linear queue?

4 + 3 + (3 + 2) = 12

3.   (a)   Consider the following operations in Circular Queue
(i)   insert the following values 40, 30, 23, 7, 67
(ii) delete 40, 30, 23
(iii) insert 80, 75, 11
The Circular Queue can accommodate a maximum of five elements. Front and Rear are set to zero at beginning. What will be the Front and Rear values after every operation?

(b)   Suppose L is a linked list with n items where each item is considered as an integer. Write a function/pseudo-code to insert an item "t" after a specified integer present in L.

6 + 6 = 12

Group – C

4.   (a)   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

(b)   Perform **insertion sort** on the given list. Show different iterations.
35 55 75 95 85 45 15 65 05

(c)   Write a function to perform linear search on an n element array.

5 + 4 + 3 = 12

5.   (a)   Write a recursive function to perform factorial of a given number.

(b) Draw a binary search tree for the following input list
60,25,75,15,50,66,33,44,39,73.
Then **delete** the nodes **25, 75, 44** from the tree.
Write down the **postorder** traversal sequence from the constructed BST.

(c) Critically comment: Binary search is better than Linear search.

3 + (3 + 2 + 2) + 2 = 12

Group – D

6. (a) Discuss the advantages and disadvantages of DBMS over conventional file management system.

(b) Draw an E-R diagram for a travel agency consisting of the following:
Customers, buses, drivers, conductors, guides, tickets, booking, agents, reservations, conducted tours and hotels.
Clearly describe entities, attributes, primary key and relations.

4 + 8 = 12

7. Consider the following relations: **(4 × 3) = 12**
HOTEL (hotelno, name, city)
ROOM (roomno, hotelno, type, tariff)
BOOKING (hotelno, guestno, datefrom, dateto, roomno)
GUEST (guestno, name, city)
Write down the expressions in **relational algebra** for the following queries:
(i) List all the hotels which are situated in KOLKATA.
(ii) List all single rooms with a charge below 1000.
Write down the **SQL** statements for the following:
(iii) List all guests currently staying at TAJ hotel.
(iv) List the price per night and type of all rooms at GRAND hotel.

Group – E

8. (a) When do we call a relation is in 3NF? How does it differ from BCNF.

(b) What is lossless decomposition?

(c) Given a relational schema Supply(sno, city, status, pno, qty) with FD set
$F = \{ sno \rightarrow city, city \rightarrow status, \{sno, pno\} \rightarrow qty\}$
Reduce it into 3NF.

(2 + 2) + 2 + 6 = 12

9. (a) What are the ACID properties of a transaction? Explain.

(b) Let T1, T2 and T3 be transactions that operate on the same data items A, B and C.
Let r1(A) mean that T1 reads A
w1(A) means that T1 writes A
Consider the following schedule:

S: r1 (X); r2 (Z); r1 (Z); r3 (X); r3 (Y); w1 (X); w3 (Y); r2 (Y); w2 (Z); w2 (Y);
By using a Precedence Graph, find out if the given schedule is Serializable or not.

6 + 6 = 12

Department & Section	Submission Link
CE & ME	https://classroom.google.com/u/1/w/MjQzMTIyMTIzNjUx/tc/MzY0MzU3NDIxOTg3