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) The total number of NULL links in a binary tree with n nodes is
(a) n + 1 (b) 2^n (c) n (d) n-1

(ii)
```
void fun1(struct node* head){
    if (head == NULL)
        return;
    fun1(head->next);
    printf("%d  ", head->data);
}
```
Above code
(a) Prints all nodes of linked lists.
(b) Prints alternate nodes in reverse order.
(c) Prints alternate nodes of Linked list.
(d) Prints all nodes of linked list in reverse order.

(iii) The postfix equivalent of the infix notation (A – B)* (C/ D + E)*F is
(a) AB–CDE +/F** (b) AB–CD/E+*F*
(c) AB–CD+/EF** (d) AB–*CDE/+F*

(iv) In linear search algorithm the worst case occurs when the item is
(a) Somewhere in the middle of the array
(b) The last element in the array or is not there at all
(c) Not in the array at all
(d) The last element in the array.

(v) In the worst case, number of comparisons needed to search a singly linked list of length n is
(a) log2 n (b) n (c) n^2 (d) n/2.

(vi) Suppose we are sorting a list of 10 values using quicksort. After first partition the output will look like this: 4, 2, 5, 1, 7, 9, 13, 12, 11, 10

Which statement is correct?
(a) The pivot is not the 7, but it could be the 9.
(b) The pivot could be the 7, but it is not the 9.
(c) The pivot could be either the 7 or the 9.
(d) Neither the 7 nor the 9 is the pivot.

(vii) Key to represent relationship between tables is called
(a) Primary key (b) Candidate key
(c) Foreign key (d) Super key.

(viii) _____ is a virtual table, which collects its data from the result of SQL SELECT statement.
(a) Transaction (b) View (c) Sequence (d) Synonyms.

(ix) Cartesian product in relational algebra is
(a) Unary operator (b) Binary operator
(c) Ternary operator (d) None of these.

(x) A term saying that no two transactions to be executed concurrently is referred as
(a) Durability (b) Atomicity
(c) Inconsistency (d) Isolation.

Group – B

2. (a) Write a function to delete the last element of a singly linked list and then write an appropriate function to display the existing linked list. You must show how you are handling underflow condition.
Write a function to insert a new node at a specified position of a singly linked list.

(b) What do you understand by stack overflow and stack underflow? Give examples.
(3 + 2 + 4) + (2 + 1) = 12

3. (a) What are the advantages of using a circular queue over a linear queue? Write the algorithm or pseudo-code for the dequeue operation in a circular queue. Your code must guard against underflow.

(b) Write an algorithm or pseudo-code to evaluate a postfix expression using a stack.
Use the algorithm to evaluate: 7 6 2 / + 8 –
Show all the intermediate steps.

(c) When can you observe the overflow condition in a linked list?
(2 + 3) + (3 + 3) + 1 = 12

Group – C

4. (a) Explain the differences between recursion and iteration.
Convert the following recursive function into an equivalent iterative function:
int fun (int n)
{

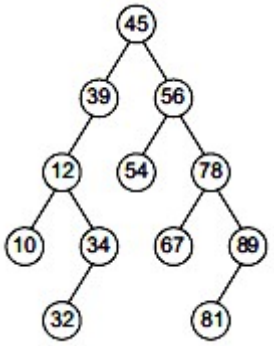
```
    if (n > 0)
        return n * fun(n – 2);
    else
        return 1;
}
```

Assume that n is a non-negative integer.

(b) Arrange the following list of elements in ascending order using quicksort.
77, 66, 55, 44, 33, 11, -2, -10
Show each step of the algorithm. Assume that the first element of each data set is chosen as pivot.

(2 + 4) + 6 = 12

5. (a) Consider the BST below and do the following operations:



(i) Find out the inorder, preorder and postorder traversal sequences.
(ii) Delete the root node.
(iii) After that insert 11,22,33,44, 55, 66 in the existing BST.

(b) Suppose you are asked to search for an element in an array of 500 integers. Which type of searching algorithm would you choose and why? How many comparisons would your chosen algorithm make in the worst case?

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

Group – D

6. (a) There are two schemas Employee and Department respectively:

Fname	Lname	SSN	DOB	Address	Salary	Sex	DNo

DeptName	DNo	Dlocation

(i) Write a relational algebra expression to display name, SSN, DeptName of all the employees whose DNO=5 and salary>25000.

(ii) Write a relational algebra expression to give new name Dept to Department table as well as rename the names of the 3 attributes names also.

(b) Write the symbols of entity set, multivalued attribute, relationship set and weak entity set.

(c) What is schema and instance of a database? Explain with an example.

(2 + 2) + 4 + 4 = 12

7. (a) What are the different levels of abstraction? Explain with the help of a diagram.

   (b) What do you mean by cardinality ratio? What are the different types of cardinality ratios?

   (c) Differentiate between DDL and DML.

5 + 3 + 4 = 12

Group – E

8. (a) Define full and partial functional dependency. Explain both of them with examples.

   (b) (i) Find out 1NF form of this table.

Emp_id	Emp_Name	Phone	State
E12	John	7272859860, 9023678450	Punjab
E20	Sam	9024678920	UP
E11	Harry	7276896402, 7278235406	MP

   (ii) Consider the following relation R and its functional dependencies:
   R(A,B, C,D). FD{AD->B, AD->C, A->B, B->C}
   Let the relation be in 1NF, achieve highest level of normalization.

(2 + 4) + (2 + 4) = 12

9. (a) Write the ACID properties.

   (b) What do you mean by a conflict serializable schedule? Explain with an example.

   (c) What is referential integrity? Explain with an example.

6 + 3 + 3 = 12

Department & Section	Submission link:
CE A	https://classroom.google.com/c/MTIyMzkyMjYxMzc3/a/Mjc0MTExNzIzODI0/details
CE B	https://classroom.google.com/c/MTQxODc3MTg3NjY4/a/MjcxMDI3MDk5ODk0/details