DATA STRUCTURE & ALGORITHM
(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
<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) What is the best case time complexity of Merge Sort?
        (a) O(n)   (b) O(n logn)   (c) O(n²)   (d) O(logn).

   (ii) Quick sort running time depends on the selection of
        (a) size of array   (b) pivot element
        (c) sequence of values   (d) none of the above.

   (iii) Re-balancing of AVL tree costs
        (a) O(1)   (b) O(log n)   (c) O(n)   (d) O(n²).

   (iv) How many swaps are required to sort the given array using bubble sort - {2, 5, 1, 3, 4}?
        (a) 5   (b) 6   (c) 7   (d) 4.

   (v) Which of the following searching techniques do not require the data to be in sorted form?
        (a) Binary Search   (b) Interpolation search
        (c) Linear Search   (d) All of the above.

   (vi) In a min-heap
        (a) parent nodes have values greater than or equal to their child nodes
        (b) parent nodes have values less than or equal to their child nodes
        (c) both statements are true
        (d) both statements are wrong.

   (vii) A complete binary tree of level 5 has how many nodes?
        (a) 15   (b) 25   (c) 63   (d) 30.

   (viii) Which of the following asymptotic notation is the worst among all?
        (a) O(n+9378)   (b) O(n³)
        (c) nO(1)   (d) O(n²).

   (ix) The minimum number of edges required to create a cyclic graph of n vertices is
        (a) 2n   (b) n-1   (c) n+1   (d) n.

   (x) When inorder traversing a tree resulted E A C K F H D B G; the preorder traversal would return
        (a) FAEKCDBHG   (b) EAFKHDCBG
        (c) FAEKCDHGB   (d) FEAKDCHBG

Group – B

2. (a) Write an algorithm to find the sum of the following series up to nth term while n will be supplied as user input: a2/3, a4/5, a6/7, ...

   (b) What will be the address of the floating point element present at 5th column and 3rd row in a 10x5 matrix having a base address 2000?

   (c) What is a sparse matrix? State with example. When it is advantageous to use it over normal matrix?

   5 + 3 + (2 + 2) = 12

3. (a) Why linked list is called linear data structure?

   (b) What are the major advantages and disadvantages of linked list over array?

   (c) Write an algorithm to delete an element from a doubly linked list. The position of the element will be supplied by the user.

   (d) What is the advantage of using a doubly linked list over singly linked list?

   2 + 4 + 4 + 2 = 12

Group – C

4. (a) Convert following infix expression to postfix expression: ((a+b)/d-((e-f)+g))

   (b) Explain Deletion operation for queue with algorithm

   (c) Write a short note on circular queue.

   5 + 4 + 3 = 12

5. (a) Compare recursion and iteration. Which one is better and why?

(b)   Explain tail recursion with example.

(c)   Write recursive function for computing Fibonacci Series and GCD.

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

Group – D

6. (a)   Define complete Tree. Insert the following elements into a binary search tree:
45, 29, 56, 12, 34, 78, 32, 10, 89, 54, 67, 81

(b)
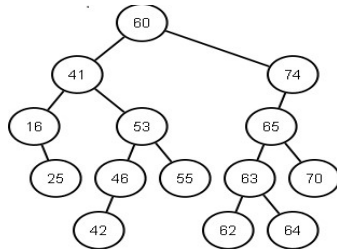
Traverse the above tree using pre-order, in-order and post-order traversal algorithm.

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

7. (a)   Write short note on B-Tree?

(b)   What is the critical node in AVL tree? Explain with example.

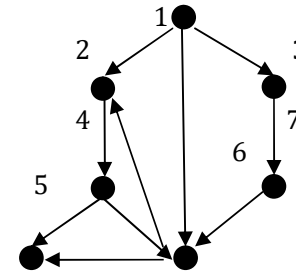(c)   Write an algorithm to delete an element from BST.

5 + 3 + 4 = 12

Group – E

8. (a)   Write an algorithm to sort a set of elements using merge sort.

(b)   "Quick sort is not at all quick in some cases" – Justify the statement.

(c)   Why insertion sort is called online sort? Explain with example.

(d)   What is the time complexity of binary search and why the value is so?

6 + 3 + 2 + 1 = 12

9. (a)   What is collision? How it can be resolved?

(b)   What is the time complexity of bubble sort? Can you implement the bubble sort in such a way, so that, the best case time complexity

becomes O(n) where n is the size of input.

(c)   For the following graph, find (i) bfs traversal, (ii) dfs traversal.

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