

Name :

Roll No. :

Invigilator's Signature :

CS/MCA/SEM-2/MCA-203/2010

2010

DATA STRUCTURES WITH C

Time Allotted : 3 Hours

Full Marks : 70

The figures in the margin indicate full marks.

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

GROUP - A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for the following :

10 × 1 = 10

- i) The complexity of binary search algorithm is
 - a) $O(n)$
 - b) $O(\log n)$
 - c) $O(n^2)$
 - d) $O(n \log n)$.
- ii) The operation of processing each element in the list is known as
 - a) Sorting
 - b) Merging
 - c) Inserting
 - d) Traversal.
- iii) Finding and removing an element (by copying succeeding elements down one index) from an array (sorted in ascending order) of length n that is full requires how many copy operations and how many comparisons between elements in the worst case ? (Assume that the element appears in the array .)
 - a) $O(\log n)$ copy operations and $O(n)$ comparisons between elements

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- b) $O(n)$ copy operations and $O(1)$ comparisons between elements
 - c) $O(1)$ copy operations and $O(\log n)$ comparisons between elements
 - d) $O(n)$ copy operations and $O(n)$ comparisons between elements.
- iv) To implement recursion, we require
- a) Stack
 - b) Queue
 - c) Both (a) & (b)
 - d) None of these.
- v) The Worst case occurs in linear search algorithm when
- a) Item is somewhere in the middle of the array
 - b) Item is not in the array at all
 - c) Item is the last element in the array
 - d) Item is the last element in the array or is not there at all.
- vi) Tail recursive function means
- a) A function where last statement is a recursive call
 - b) A nested function
 - c) A function with an infinite loop
 - d) None of these.
- vii) Sparse matrix is
- a) All 0 element matrix
 - b) A unit matrix
 - c) Mostly 0 element matrix
 - d) A few 0 element matrix.
- viii) Which of the following is a linear data-structure ?
- a) Graph
 - b) Binary Search Tree
 - c) Double Linked-List
 - d) None of these.
- ix) Prerequisite of Binary Search is
- a) Array must be sorted in ascending order
 - b) Array must be sorted in descending order
 - c) Either (a) or (b)
 - d) None of these.

- x) Circular Queue uses which of the following strategy ?
- a) FIFO
 - b) LIFO
 - c) None of these
 - d) Both (a) and (b).

GROUP - B

(Short Answer Type Questions)

Answer any *three* of the following. $3 \times 5 = 15$

2. Compare linked list with array in respect of both advantages and disadvantages.
3. Prove that for any non-empty binary tree T , if n_0 be the number of leaves and n_1 be the number of nodes of degree 2, then $n_0 = n_1 + 1$.
4. Construct a Binary tree with the help of the following preorder and inorder traversal and also find the postorder traversal.
Preorder : A B C D F H J M K E G I L N
Inorder : A D J M H K F C I N L G E B.
5. Define circular queue. What are the advantages of circular queue over linear queue ? Define priority queue.
6. Write a C function to delete a node from the end of a singly linked list.

GROUP - C

(Long Answer Type Questions)

Answer any *three* of the following. $3 \times 15 = 45$

7. a) How can a polynomial such as $5x^4 - 3x^2 + 9x - 11$ be represented by a linked list ?
- b) Write an algorithm to delete a node from a doubly linked list.
- c) Explain the advantages of binary search over sequential search.
- d) Are recursive routines more efficient than non-recursive routines ? Justify your answer with example.

4 + 5 + 3 + 3

8. a) Convert the following infix expression into equivalent postfix expression using stack :
 $A \wedge B * (C + D) + (E - F) + G / (H + W)$.
- b) Can a queue be represented by a circular linked list with only one pointer pointing to the tail of the queue? Write C functions for the Add and Delete operations on such a queue.
- c) Compare the advantages and disadvantages of implementing a stack as an array with implementing a stack as a linked list.
- d) Define Deque and its types. Write some of the applications of stacks and queues. $4 + 5 + 3 + 3$
9. a) Draw a binary search tree whose elements are inserted in the following order :
50, 70, 90, 93, 100, 20, 10, 12, 9, 25, 51, 15, 95.
- b) Explain the algorithm to search a node in a binary search tree.
- c) What is height balanced tree? Explain what you mean by balance factor. Construct a height balanced tree from the following sequence of integers :
50, 72, 96, 94, 107, 26, 12, 11, 9, 2. $5 + 5 + 5$
10. a) Sort the following list in ascending order using merge sort. Show the step by step process :
80, 75, 45, 90, 30, 40, 12, 15, 93, 8, 50, 10.
- b) What do you mean by Hashing and Hash functions? Describe any three Hash functions with suitable examples. Explain any two methods of dealing with hash collision.
- c) Write the algorithm of Binary search. $4 + (2 + 3 + 2) + 4$
11. Write short notes on any *three* of the following : 3×5
- a) Tail Recursion
 - b) Threaded binary tree
 - c) Importance of Garbage collection and compaction
 - d) Sparse matrix and its representation
 - e) Dequeue-operation and application.