Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.TECH (EE/CSE/IT/ECE/EEE/ICE)/SEM-3/CS-302/2009-10

2009

DATA STRUCTURE & ALGORITHMS

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 any *ten* of the following : $10 \times 1 = 10$

i) The time complexity of binary search is

a) $0(n^2)$ b) $0(n)$

c) $0(\log n)$ d) $0(n \log n)$.

ii) The fastest sorting algorithm for an almost already sorted array is

a) quick sort

b) merge sort

c) selection sort

d) insertion sort.

iii) The ratio of items present in a hash table to the total size is called

a) balance factor b) load factor

c) item factor d) weight factor.

iv) The Linear Probing Technique for collision resolution can lead to

a) Primary clustering

b) Secondary clustering

c) Overflow

d) Efficient storage utilization.

v) A height balanced binary tree is a binary tree in which the height of two subtrees of every mode never differ by more than

a) 1 b) 2

c) 3 d) none of these.

vi) Which tree structure is used for efficient access of records residing in disc memory ?

a) AVL Tree b) B Tree

c) 2-3 Tree d) Binary Tree.

vii) Any connected graph with x vertices must have at least

a) $x + 1$ edges b) $x - 1$ edges

c) x edges d) $x/2$ edges.

viii) Which of the following is essential for converting an infix expression to postfix notation ?

a) A parse tree

b) An operand stack

c) An operator stack

d) None of these.

ix) The values in a BST can be sorted in ascending order by using which of the following traversals ?

a) Pre-order b) In-order

c) Post-order d) Level-order.

x) The prefix expression for the infix expression

$a * (b + c) / e - f$ is

a) $/ * a + bc - ef$

b) $- / * + abcef$

c) $- / * a + bcef$

d) None of these.

xi) In *C* language, malloc( ) returns

a) integer pointer

b) structure pointer

c) null pointer

d) void pointer.

xii) Fibonacci function $fib\ (\ n\ ) = fib\ (\ n - 1\ ) + fib\ (\ n - 2\ )$ is an example of

a) Linear Recursion b) Binary Recursion

c) Non-linear Recursion d) Mutual Recursion.

xiii) A linear list in which elements can be added or removed at either end but not in the middle is known as

a) Stack b) Queue

c) Dequeue d) Heap.

GROUP – B

(Short Answer Type Questions)

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

2. Prove that

$O\ (f\ (\ x\ )\ ) + O\ (\ g\ (\ x\ )\ ) = O\ (\ max\ (f\ (\ x\ )\ ,\ g\ (\ x\ )\ )$.

3. a) Convert the following infix expression into equivalent postfix expression using stack :

$(\ A + B\ ) * C - (\ D - E\ )\ )\ /\ (\ F + G\ )$.

b) What is a Max Heap ? 4 + 1

4. What is a priority queue ? Mention the different design options for priority queue. 2 + 3

5. "Binary search technique cannot be implemented using Linked list." — Justify the validity of the statement.

6. Show how the following integers can be inserted in an empty binary search tree in the order they are given :

50, 30, 10, 90, 100, 40, 60, 20, 110, 5.

Draw the tree in each step.

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. 3 × 15 = 45

7. a) Prove that, the height of a binary tree that contains n elements, $n \geq 0$, is at most n and at least

$[\log (n + 1)]$.

b) The order of nodes of a binary tree in Preorder and in order traversal are as under :

In order : D B F E G H I A C

Pre-order : A B D E F G H I C

Draw the corresponding binary tree.

c) How does static allocation differ from dynamic allocation of memory ? 5 + 5 + 5

8. a) What is a Stack ADT ?

b) Write a *C* function for popping an element from a stack implemented using linked list.

c) Explain three uses of stack data structure. 5 + 5 + 5

9. a) Explain with a suitable example the principle of operation of QuickSort algorithm.

b) In which cases, QuickSort becomes a 'SlowSort' ? What is the remedy in those cases ?

c) Compare the performance and operation of BubbleSort and SelectionSort. 5 + 5 + 5

10. a) Show the steps in creation of a height balanced binary AVL TREE using insertion of items in the following order — show the balanceing steps required.

(March, May, November, August, April, January, December, July, February, June, October, September)

b) What do you mean by a *B*-Tree and what are the uses of such a tree in data structures ?

c) Consider a *B*-Tree of order 5 as shown below — insert the elements 4, 5, 58, 6 in this order in the *B*-Tree.

dia

8 + 2 + 5

11. a) Compare BFS and DFS. Discuss the two different ways of representing a graph.

b) Draw the minimum cost spanning tree for the graph given below and also find its cost.

dia

c) What is a complete graph ? Show that the sum of degree of all the vertices in a graph is always even.

5 + 5 + 5