Name : .....

Roll No. : .....

Invigilator's Signature : .....

2012

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 the following : $10 \times 1 = 10$

i) Inserting a new node after a given node in a doubly linked list requires

a) four pointer exchanges

b) two pointer exchanges

c) one pointer exchanges

d) *np* pointer exchange.

ii) A complete binary tree with n leaves contains

a) n nodes b) $\log_2 n$ nodes

c) $2n - 1$ nodes d) 2^n nodes.

iii) A vertex of degree one is called

a) Isolated vertex b) Pendant vertex

c) Coloured vertex d) Null vertex.

iv) A sort, which iteratively passes through a list to exchange the first element with any element less than it and then repeats with a new first element, is called

a) Bubble sort b) Selection sort

c) Heap sort d) Quick sort.

v) The postfix equivalent of the prefix $* + ab - cd$ is

a) $ab + cd - *$ b) $ab \pm cd *$

c) $ab + cd * -$ d) $abcd + - *$.

vi) A linear list that allows elements to be added or removed at either end but not in the middle is called

a) stack b) queue

c) priority queue d) none of these.

vii) Which of the following methods had the best average case complexity for searching ?

a) Hashing b) Sequential search

c) Random search d) Binary search.

viii) The technique of linear probing for collision resolution can lead to

a) clustering

b) efficient storage utilization

c) underflow

d) overflow.

ix) If a binary tree is threaded for in-order traversal a right NULL link of any node is replaced by the address of its

a) successor b) predecessor

c) root d) own.

x) For a function $f(n) = 1000\, n \log n + 500\, n^4 + 0{\cdot}52^n$, we can say that $f(n)$ is

a) $O(n^4)$ b) $O(n \log n)$

c) $O(2^n)$ d) none of these.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. 3 × 5 = 15

2. Discuss the advantages and disadvantages of linked list over array as linear data structure and also write down the function to insert an element into a sorted array of descending order.

3. Define hashing. Explain with a suitable example the collision resolution technique using linear probing with open addressing.

4. Define big *O* notation. What is stack and why is this called LIFO ?

5. Write the algorithm for in-order traversal of a threaded binary tree.

6. Prove that for any non-empty binary tree *T*, if n_0 is the number of leaves and n_2 be the number of nodes having degree 2 then prove

$$n_0 = n_2 + 1.$$

7. Write an algorithm to delete a node from a doubly linked list, where a node contains one data and two addresses (previous and next) portion.

GROUP – C

(Long Answer Type Questions)

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

8. a) Write the algorithm of binary search and calculate the complexity for best, worst and average cases.

b) Why is queue data structure called FIFO ?

c) Construct the following queue of characters where queue is a circular array which is allocated six memory cells.

FRONT = 2, REAR = 4 & QUEUE : …… , *A, C, D,* …… , ……

Describe the queue as the following operations take place :

i) *F* is added to the queue.

ii) Two characters are deleted from the queue.

iii) *K, L, M* are added into the queue.

iv) *R* is added to the queue.

v) One character is deleted from the queue.

9. a) How can a polynomial such as

$5x^8 + 600x^5 + 45x^2 - 5x + 56$

be represented by a linked list.

b) Write the algorithm to reverse linked list.

c) What is dummy node in a linked list.

d) Write the function in *c* language to find the predecessor of a node in linked list.

10. a) The in-order & pre-order traversal sequences of nodes in a binary tree are given as follows :

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

Draw the binary tree. State the algorithm to construct the tree.

b) Insert the following keys in order given below to build them into an AVL tree :

g, h, s, l, e, m, t, u.

c) What is two-way threading ?

11. a) What is stack ?

b) Write the algorithm to evaluate postfix expression using stack data structure, and hence evaluate following postfix expression :

5 + 67 + –

c) Convert the following infix expression into equivalent postfix expression :

$a + b * c + (d * e + f) * g$.

12. Write short notes on the following :

a) Quick sort

b) *B*-tree

c) Tail recursion

d) AVL Tree.