Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.Tech (EIE)/SEM-4/CS-405 (EI)/2010

2010

DATA STRUCTURE AND 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) Base address of a floating point 2 *D* array *A* is 2000. *A* is stored in row-major order in memory, lower limit is adapted as 0 & the dimensions of *A* are 4 and 5 respectively. What will be the address of *A* [2] [3] ?

   a) 2022 b) 2052

   c) 2026 d) 2044.

   ii) How many BST can be formed with 1, 2, 3, 4 ?

   a) 1 b) 2

   c) 4 d) 6.

iii) Which is the correct notation to delete the last node p from a doubly linked list ? (prev is the pointer pointing to the previous node and next is the pointer pointing to the next node)

a) p-> next = NULL: b) p = NULL

c) p->prev->next = NULL d) None of these.

iv) The integers 1, 2, 3, 4 are pushed into a stack in that order. They may be propped out of the stack in any valid order. Which of the following can never be produced in such a way ?

a) 1, 2, 3, 4 b) 4, 2, 3, 1

c) 4, 3, 2, 1 d) 3, 2, 4, 1.

v) The complexity of merge sort algorithm is

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

c) O(n log n) d) O(log n).

vi) Selection sort and quick sort both fall into the same category of sorting algorithms. What is this category ?

a) O(n log n) sorts

b) Divide-and-conquer sorts

c) Interchange sorts

d) Average time is quadratic.

vii) A postfix expression for the infix expression $a + b*(c + d)/f + d*e$ is

a) $ab + cd + * f/d + e*$ b) $abcd + * f/ + de* +$

c) $a*b + cd/f*de^{++}$ d) None of these.

viii) A full binary tree with n non-leaf nodes contains

a) $\log_2(n)$ nodes b) n+1 nodes

c) $2n$ nodes d) $2n + 1$ nodes.

ix) What is the Big Oh notation of the following expression

$F(n) = n \log n^2 + n^2 + e^{\log n}$

a) O(n) b) $O\left(n^2\right)$

c) O($n \log n^2$) d) O($e^{\log n}$).

x) Ratio of number of items in hash table, to the table size is called

a) Load factor b) Item factor

c) Balanced factor d) All of these.

GROUP – B

(Short Answer Type Questions)

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

2. Discuss the advantages & disadvantages of linked list over array as linear data structure to & also write down the function 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 & why this is 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 & n_2 be the number of nodes having degree 2, then prove that $n_0 = n_2 + 1$.

GROUP – C

(Long Answer Type Questions)

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

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

b) Why is queue data structures 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) Two characters are deleted from the queue.

v) *R* is added to the queue.

vi) One character is deleted from the queue.

8. 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 a linked list.

9. a) The in-order & pre-order traversal sequence of nodes in a binary tree are given as

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 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 ?

10. a) What is stack ?

   b) Write the algorithm to evaluate postfix expression using stack data structure & hence evaluate following postfix expression : 5 + 6 7 + –

   c) Convert the following in-fix expression into equivalent post-fix expression : *a* + *b***c* + (*d***e* + *f*)**g*.

11. Write short notes on the following :

a) Merge sort.

b) *B*-Tree.

c) Tail recursion.

d) AVL Tree.