



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 :  $10 \times 1 = 10$

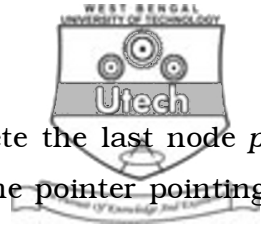
i) Base address of a floating point 2 D array A is 2000.

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] ?

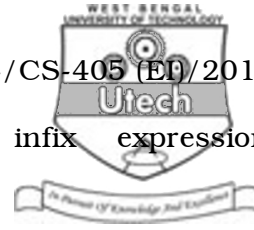
- |         |          |
|---------|----------|
| a) 2022 | b) 2052  |
| c) 2026 | d) 2044. |

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)  $p \rightarrow \text{next} = \text{NULL}$ ;      b)  $p = \text{NULL}$
- c)  $p \rightarrow \text{prev} \rightarrow \text{next} = \text{NULL}$    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

$$a + b*(c + d)/f + d*e \text{ is}$$

- 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)  $O(n^2)$   
 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.

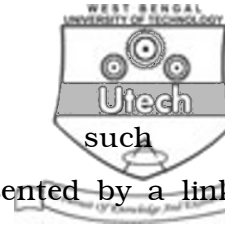
3 × 15 = 45

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.
-