



MAULANA ABUL KALAM AZAD UNIVERSITY OF  
TECHNOLOGY, WEST BENGAL

Paper Code : BCA-302

## DATA STRUCTURE 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 any ten of the following :  $10 \times 1 = 10$
- i) Prefix notation is also known as
- a) reverse polish notation
  - b) reverse notation
  - c) polish reverse notation
  - d) polish notation.

- ii) The searching an element in a hash table of size  $m$  with  $n$  keys requires
- $O(n)$  comparisons
  - $O(m/n)$  comparisons
  - $O(m)$  comparisons
  - $O(n/m)$  comparisons.
- iii) The complexity of linear search algorithm is
- $O(n)$
  - $O(\log n)$
  - $O(n^2)$
  - $O(n \log n)$ .
- iv) The best data structure to see whether an arithmetic expression has balanced parenthesis is
- stack
  - queue
  - tree
  - list.
- v) The sparse matrix is a matrix whose
- most of the elements are non-zero
  - most of the elements are zero and half of the elements are non-zero
  - half of the elements are zero
  - none of these.

- vi) The postfix notation is also known as
- polish notation
  - reverse polish notation
  - reverse notation
  - none of these.
- vii) For any non-empty binary tree  $T$ , if  $n$  is the number of nodes and  $e$  is the number of edges, then the relation between  $e$  and  $n$  is
- $e = n - 1$
  - $e = n + 1$
  - $e + 1 = n$
  - $e = n$ .
- viii) When determining the efficiency of algorithm the time factor is measured by
- counting microseconds
  - counting the number of key operations
  - counting the number of statements
  - counting the kilobytes of algorithm.

- ix) A data structure where elements can be added or removed at either end but not in the middle is
  - a) linked list
  - b) stack
  - c) queue
  - d) deque.
- x) Complexity expressed in  $O$ -notation is
  - a) lower bound
  - b) upper bound
  - c) middle between (a) and (b)
  - d) none of these.
- xi) When the malloc() function returns NULL value it means
  - a) memory is not allocated
  - b) memory is allocated but no data entered
  - c) both (a) and (b)
  - d) none of these.

**GROUP - B**  
**( Short Answer Type Questions )**

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

2. Write a C function to implement 'PUSH' and 'POP' operations in a stack.  $2\frac{1}{2} + 2\frac{1}{2}$

3. Convert the following infix expression into postfix form by using stack :

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

4. What are the advantages of linked list over array ?  
What are the disadvantages over array ?  $2\frac{1}{2} + 2\frac{1}{2}$
5. What is B-tree ? What is the difference between a B-tree and a B+tree ?  $3 + 2$
6. What is dequeue ? What is the advantage of dequeue over ordinary queue ?  $3 + 2$

#### **GROUP - C**

##### **( Long Answer Type Questions )**

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

7. a) What are the differences between general tree and a binary tree ?  $2$
- b) Prove that the height  $h$  of a binary tree  $T$  is  $h = \log_2 ( n + 1 )$ .  $3$
- c) Construct a B-tree of order 5 from the following key values :  $5$
- a, g, f, b, k, d, h, m, j, e, s, i, r, x, c, l, n, t, u, p
- d) What is hashing ? How is collision problem solved in hashing ?  $1 + 4$

8. a) Explain with an example the heap sort algorithm.  
b) Write an algorithm for this heap sort.  
c) Find the time complexity of the above algorithm.

5 + 5 + 5

9. Write the functions for the following :

- a) Insert a node after a particular node in singly linked list.  
b) Reverse display of the list in doubly linked list.  
c) Physically reverse the singly linked list. 5 + 5 + 5

10. a) What is an adjacency matrix representation of a graph ?  
b) Prove that maximum number of nodes on level  $i$  of a binary tree is  $2^{i-1}$ ,  $i \geq 1$ .  
c) What is the difference between recursion and iteration ?  
d) What will be the complexity for the following operations—quick sort, binary search, selection sort ? 5 + 3 + 2 + 5

11. Write short notes on any *three* of the following :       $3 \times 5$

- a) AVL tree
  - b) Threaded binary tree
  - c) Search algorithm of BST
  - d) Priority queue
  - e) ADT.
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