

2024

COMPUTER SCIENCE — HONOURS

Paper : CC-3

(Data Structure)

Full Marks : 50

*The figures in the margin indicate full marks.*

*Candidates are required to give their answers in their own words as far as practicable.*

Answer *question no. 1* and *any four* questions from the rest.

1. Answer *any five* questions :

2×5

- Define Non-linear Data structure with suitable example.
- State the two main advantages of using recursion.
- What is the best case and average case time complexity of insertion sort?
- Explain circular linked list with suitable diagram.
- Represent the following polynomial using linked list :

$$f(x) = 2x^6 - 4x^4 + 2x - 4.$$

- Differentiate complete binary tree and full binary tree with suitable diagram.
  - Name any two hashing techniques.
  - State any two advantages of heap data structure over stack.
2. (a) Define min heap.
- (b) Construct min heap with the following elements. Then arrange it in ascending order of values 210, 7, 92, 84, 26, 741, 93, 35, 69. Show all the steps. 2+(5+3)
3. (a) Write the algorithms for Push, Pop and Display operations on a Stack.
- (b) Define the advantages of Circular Queue over Linear Queue.
- (c) What is De-queue? (2+2+1)+3+2
4. (a) Explain the concept of open hashing.
- (b) Create a Binary Search Tree with the following elements : 10, 3, 17, 12, 15, 16, 0, 2, 39. Show steps.
- (c) Prove that the height of a complete binary tree with  $n$  number of nodes is  $\lceil \log_2(n + 1) \rceil$ . 2+3+5

Please Turn Over

5. (a) Write an algorithm to sort the elements of an array using merge sort.  
(b) What are the differences between quick sort and merge sort? 6+4
6. (a) What are sparse matrices? Illustrate with an example.  
(b) What is threaded binary tree? Explain with suitable diagram.  
(c) What is skewed binary tree? Explain with diagram. 4+3+3
7. (a) Write an algorithm to insert a node in a Binary Search Tree (BST).  
(b) Show the following steps to delete the node 21 from the BST with the following nodes :  
14, 21, 55, 5, 77, 23, 44, 11. 6+4
8. (a) Write a recursive algorithm for pre-order traversal in a binary tree.  
(b) Construct a binary tree from the following traversals :  
Pre-order : A, B, D, H, I, E, C, F, J, G, K, L  
In-order : H, D, I, B, E, A, F, J, C, K, G, L 6+4
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