

**2024**

*Time : 3 hours*

*Full Marks : 70*

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

*The figures in the margin indicate full marks.*

*Answer from **all** the Sections as directed.*

**(Data Structure)**

**Section – A**

1. Choose the correct answer from given options :

1×5 = 5

(a) Which of the following data structure is needed to convert infix notation to postfix notation ?

- (i) Tree
- (ii) Branch
- (iii) Stack
- (iv) Queue

(b) Which of the following application makes use of a circular linked list ?

- (i) ~~Recursive function calls~~
- (ii) Undo operation in a text editor
- (iii) Implement Hash Tables
- (iv) Allocating CPU to resources

(c) Which of the following tree data structures is not a balanced binary tree ?

- (i) ~~Splay tree~~
- (ii) B-tree
- (iii) AVL tree
- (iv) Red-black tree

(d) What is the time complexity for searching a key or integer in Van Emde Boas dat ?

- (i)  $(M!)$
- (ii)  ~~$(\log M)$~~
- (iii)  $(\log(\log M))$
- (iv)  $(M^2)$

(e) If binary trees are represented in arrays, what formula can be used to locate a left child, if the node has an index  $i$  ?

- (i)  ~~$2i + 1$~~
- (ii)  $2i + 2$
- (iii)  $2i$
- (iv)  $4i$

2. State True or False :

$$1 \times 5 = 5$$

- (a) Access of elements in linked list takes more time than compared to arrays.
- (b) The associativity of an exponentiation operator  $^$  is right to left.
- (c) If two operators have the same precedence, associativity comes into action.
- (d) Binary search cannot be implemented using linked lists.
- (e) Implementing a doubly linked list is more difficult than singly linked list.

### Section - B

3. Answer any four questions of the following :

$$5 \times 4 = 20$$

- (a) ~~Distinguish between linear search and binary search.~~
- (b) Write an algorithm to traverse a binary search tree in post order.
- (c) ~~Compare quick sort and selection sort.~~
- (d) Write a function to insert a number at the specified position of an array ?
- (e) What is sparse matrix ? How do you represent it using an array ?

- (f) Write a function to insert a node as last node in circular linked list.

### Section- C

4. Answer any four questions of the following :

$$10 \times 4 = 40$$

- (a) Write an algorithm to perform Bubble sort.
- (b) Write a C program to perform push, pop and traverse operations in stack.
- (c) What are the rules to convert postfix expression to prefix expression using stack data structure ? Explain it using following postfix expression :
- $a b + c - d e f ^ { \wedge \wedge } * g / .$
- (d) Create a B tree of order 4 using the following list : 5, 3, 21, 9, 13, 22, 7, 10, 11, 14, 8, 16.
- (e) What is heap ? Explain max heap and min heap using the following list : 8, 71, 41, 31, 10, 11, 16, 46, 51, 31, 21, 13.
- (f) Write functions to insert and delete node specified by node number in doubly linear linked list.

