

Total No. of printed pages = 7

**END SEMESTER REGULAR / RETEST  
EXAMINATION, JULY - 2023**

Semester : 4th

Subject Code : CO - 401

**DATA STRUCTURE**

Full Marks - 70

Time - Three hours

The figures in the margin indicate full marks for the questions.

**Instructions :**

- (i) All questions of PART - A are compulsory.
- (ii) Answer any five questions from PART - B.

**PART - A**

Marks - 25

1. Fill up the blanks :

1×5=5

(a) STACK is a \_\_\_\_\_ Data structure.

(b) Big O notation helps to determine the \_\_\_\_\_ complexity of an algorithm.

(c) Strlen ( ) function gives the \_\_\_\_\_ of a string.

[Turn over

(d) Binary search uses the \_\_\_\_\_ principle.

(e) In \_\_\_\_\_ Heap, the first element is the largest element.

2. Write True or False :  $1 \times 5 = 5$

(a) The towers of Hanoi problem can be easily implemented using searching.

(b) Time complexity of Bubble Sort is  $O(1)$ .

(c) The data structure, which is used in DFS, is stack.

(d) Hashing is an approach in which time required to search an element does not depend on the total number of elements.

(e) A data structure where elements can be added or removed at end but not in the middle, is called Deque.

3. Define the following terms :  $1 \times 5 = 5$

(a) Inorder Traversal

(b) Heapify

(c) Circular Queue

(d) Strcat ( )

(e) Degree of graph.

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4. Choose the most appropriate answer :  $1 \times 10 = 10$

(a) The complexity of Binary Search algorithm is

(i)  $O(n)$  (ii)  $O(\log n)$

(iii)  $O(n^2)$  (iv)  $O(n \log n)$

(b) An array x is declared as `int x[2][3]`; Array m has

(i) 2 elements (ii) 4 elements

(iii) 6 elements (iv) 16 elements

(c) Queue follows the data structure called as

(i) last in first out (ii) first in last out

(iii) last in last out (iv) first in first out

(d) When a `pop()` operation is called on an empty stack, what is the condition called ?

(i) Over flow (ii) Under flow

(iii) Syntax Error (iv) Garbage Error

(e) If the elements "P", "Q", "R" and "S" are placed in a queue and are removed one at a time, the order they will be removed is

(i) PQRS (ii) SRQP

(iii) QSRP (iv) RQSP

29/CO-401/DS/4th Sem (3)

[Turn over

(f) In a binary tree, the node that has no child is known as

- (i) Parent
- (ii) Leaf
- (iii) Edge
- (iv) None of these

(g) The matrix that has most of the elements (not all) as Zero is

- (i) Identity Matrix
- (ii) Unit Matrix
- (iii) Sparse Matrix
- (iv) Zero Matrix

(h) Quick sort uses the principle of

- (i) Divide-and-conquer
- (ii) Backtracking
- (iii) Heuristic approach
- (iv) Greedy approach

(i) In which type of linked lists traversals can be performed in both directions

- (i) Singly Linked Lists
- (ii) Doubly Linked Lists
- (iii) Circular Linked Lists
- (iv) None of the above

(j) The Data structures used on BFS (Breadth First Search) on a graph is

- (i) Stack
- (ii) Queue
- (iii) Tree
- (iv) All of these.

PART - B

Marks - 45

5. (a) Write briefly about following :

6

- (i) Time complexity
- (ii) Space complexity
- (iii) Worst case of an algorithm.

(b) State some differences between Linear Data Structure and Non-Linear Data Structure. 3

6. (a) How multi-dimensional arrays are represented in memory? 3

(b) Give the meaning of the following string function : 3

- (i) Strlen()
- (ii) Strcpy()
- (iii) Strcmp()

(c) Write a function to find the length of a string. 3

7. (a) Define Linked List, Circular Linked List and Doubly Linked List.  $2 \times 3 = 6$

(b) State some differences between linked list and array. 3

8. (a) Write an algorithm to sort elements using Bubble Sort. 4

(b) Explain binary search with an example or write an algorithm of binary search. 3

(c) What is hashing? 2

9. (a) Define Stack as a data structure and discuss its applications.  $2 + 2 = 4$

(b) Convert  $((A - (B + C)) * D) \uparrow (E + F)$  infix expression to postfix form. 5

10. (a) What is a binary tree and BST? 2

(b) What is a heap? What are the heap properties? 4

(c) Define Max Heap and Min Heap. 3

11. (a) Define the following term with example: 4

(i) Pre-order Traversal of a binary tree

(ii) Adjacency matrix.

(b) What is Huffman encoding? Create Huffman Tree for the following characters bcaaddccacac.  $2 + 3 = 5$

12. Write short notes on any three:  $3 \times 3 = 9$

(a) BFS

(b) Sequential Access File Organization

(c) Insertion Sort

(d) Threaded Binary Tree

(e) Queue and Priority Queue.