

BTCS403**V Semester Examination, December - 2023****B.Tech. (EC, EI, MX)****Data Structures and Algorithms**

Choice Based Credit System (CBCS)

Time: 3 Hrs.**Maximum Marks: 60****Minimum Pass Marks: 24**

- Note: 1) All questions carry equal marks, out of which part 'A' and 'B' carry 3 marks and part 'C' carries 6 marks.
2) From each question, part 'A' and 'B' are compulsory and part 'C' has internal choice.
3) Draw neat diagram, wherever necessary.
4) Assume suitable data wherever necessary.

- Q.1(A)** What is data structure? Differentiate between primitive and non-primitive data structures. **03**
- (B)** What is meant by the complexity of an algorithm? How do you determine its time complexity? **03**
- (C)** What is an array, and briefly describe the types of arrays? How is a two-dimensional array represented in memory? **06**

OR

What is sparse matrix? Write a C program to add two sparse matrices and explain the assumed data structure.

- Q.2(A)** Describe the process of dynamic memory allocation and de-allocation for a linked list. **03**
- (B)** How does a circular linked list differ from a doubly linked list in terms of structure and functionality? **03**
- (C)** Explain linked list with an example. What are the benefits of using linked list over array? How can you insert and delete a node in a singly linked list? **06**

OR

Explain the structure of doubly linked list (DLL). Differentiate between a DLL and doubly circular linked list (DCLL). Explain the procedures to insert a node in DLL at the beginning and at the last.

- Q.3(A)** What is a priority queue? Implement using a linked list. **03**
- (B)** Explain recursion with an example. Why is recursion required? **03**

Contd...

- (C) What is a stack, and why is it called LIFO? How can you use a stack to convert an infix expression to postfix? Convert the infix expression $D + (((F-C) * (A-E) + B)/H) ^ (G-I)$ to postfix using a stack.

06

OR

Define a Queue as an Abstract Data Type (ADT) and explain its key characteristics. Describe its primitive operation on array implementation and linked list implementation. Implement queue using C.

- Q.4(A) What are the differences between depth first search (DFS) and breadth first search (BFS)?

03

- (B) Explain Kruskal's algorithm with an example.

03

- (C) What is a binary tree? A binary tree T has 12 nodes. The in-order and pre-order traversals of T yield the following sequence of nodes:

In-order: D P O A B R J V K N T M

Pre-order: J P D B O A R T V K N M

Construct the Binary tree T showing each step. Explain, how you can arrive at a solution in brief?

06

OR

Explain the concept of a height-balanced tree. Write an algorithm to insert a node in a non-empty AVL tree. Construct an AVL from the data given below:

10, 20, 30, 25, 27, 7, 4, 23, 26, 21.

- Q.5(A) Differentiate between stable and unstable sorting algorithms. Provide examples of each.

03

- (B) Explain merge sort with an example. Discuss the key advantages and disadvantages of merge sort.

03

- (C) Describe the concept of the divide-and-conquer algorithm and illustrate the process of the quick sort algorithm with the following array of numbers: (75, 54, 21, 43, 5, 20, 9, 56, 38, 24). Calculate the intermediate steps, showing how the array is partitioned and sorted. Finally, discuss the time complexity of the quick sort algorithm.

06

OR

Write short notes on (any two):

I. Selection Sort

II. Radix Sort

III. Heap Sort
