CSE/PC/B/T/213/2022

B. E. COMPUTER SC. & ENGINEERING EXAMINATION, 2022

(2nd Year, 1st Semester)

DATA STRUCTURES AND ALGORITHMS

Time : Five hours **Full Marks : 70**

Answer all questions. Be brief and to the point in answering questions.

1. (a) What is the difference between Abstract Data Type and Data Structure? Explain with the help of an example.

2+1

(b) What do you mean by O(n)? Explain with an example.

2+1

(c) What do you mean by a Threaded Binary Tree? Why is it required?

3

(d) What is Non-linear Recursion? Give an example of such an algorithm?

2+1

(e) What is the difference between void pointer and byte pointer in C language?

2

2. Answer any two from the following:

(a) Write C language functions for *full_q, empty_q and enqueue* functions for an array-based Queue with only the *front* and *rear* index variables. You need to define the data type also.

2+2+3

(b) Write a commented C language function for the conversion infix expressions to postfix expressions having integer coefficients. Explain what error conditions can be checked in your function.

5+2

(c) Write a C language function to multiply two sparse matrices. Consider that the product matrix will also be sparse. Explain your choice of sparse matrix representation and any limitation thereof.

4+3

3. Answer any two from the following:

(a) Define a Heap Data Structure. Explain how a heap can be used to sort an array in decreasing order. What is the time complexity of such sorting algorithm?

2+3+2

(b) What is a Spanning Tree of a Graph? Design a greedy algorithm to find out a minimum cost spanning tree of a graph. Analyze the time complexity of your algorithm.

2+3+2

(c) Develop a recursive algorithm to test whether a given Binary Tree is a Binary Search Tree. What type of recursion you have used in your algorithm? Write an algorithm to find the in-order predecessor of the root of a binary tree.

3+1+3

4. Answer any two from the following:

(a) Discuss various Data Structures which can be used to represent Lists. Explain the space overhead of each of the alternatives. What advantage or disadvantages you get in implementing the Polynomial data structure using the above kind of lists?

4+3

(b) What data structure you will use for storing a large number of records in hard disk so that they can be accessed with almost equal number of disk accesses? Explain the method of storage and the number of disk accesses required for reading a record.

2+3+3

(c) What are the data structures for representing Graphs. Which one will you choose for representing very dense graphs and sparse graphs and why?

4+3

5. Answer any two from the following:

(a) In solving a problem, a stream of data records are sent to your program. Your program needs to reorder the data records according to some conditions before sending them to the processing module. What should be your choice of data structure for the receiving module? Explain the reason for selecting such a data structure.

4+3

(b) You have a large number of data records, each having a unique key field. The predominant activities on the records are insertion and search. The application requires the access to each of the record to take almost constant time. Explain your choice of data structure for the application. Explain how the records will be actually accessed and the kind of overhead you have to bear with.

3+2+2

(c) You are going to develop an application for domestic Air Travel tour operator. Consider there are 40 airports in the country and seven airlines. Explain your choice of data structures and algorithms for the application.

4+3

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