CSE/PC/B/T/213/2024(S)

B. E. COMPUTER SC. & ENGINEERING EXAMINATION, 2024 SUPPLEMENTARY
(2nd Year, 1st Semester)
DATA STRUCTURES AND ALGORITHMS

Time : Three hours **Full Marks : 100**

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

1. (a) Show how the following array will be sorted in increasing order using selection sort:
30 90 60 100 10 20 40 70 50.
3

(b) Show how the following infix expression can be converted to the postfix representation:
a + b * c + (d * e + f) * g.
4

(c) Show that $5x^2 + 6x + 7 = \Theta(x^2)$.
5

(d) How can you represent a generalized tree using a binary tree? Explain with an example.
3

(e) What is a synonym? Explain.
2

(f) What do you mean by a Transitive Closure Matrix? Explain with an example.
3

2. Answer any two from the following:

(a) Write commented C language functions for *insert_after* and *delete_after* operations for an array-based List of positive integers terminated by a sentinel -1. What changes you will incorporate in the above two functions if sentinel is not used.
6+4

(b) Explain what you mean by equality of two Single-Linked Lists. Write a commented C language function for checking whether two such lists are equal or not.
4+6

(c) What do you mean by Folding Hash function in the context of keys which are long strings of character? Write a commented C language function to find the hash value of a long string of characters by applying the Folding Hash method. What are your assumptions while writing the function?
3+2+3+2

3. Answer any two from the following:

(a) Develop an iterative algorithm for Binary Search. Explain the condition to be maintained for Binary Search to be applicable. Find out the time complexity of your algorithm.
5+2+3

(b) Design a Greedy algorithm to find out Shortest Path from a given node to all other nodes of a given weighted Graph. Explain how the greedy strategy has been used in your algorithm. Analyze the time complexity of your algorithm.
4+3+3

(c) Develop a recursive algorithm to test whether a given Binary Tree is a Binary Search Tree. In the context of the operations on Search Trees, why do you require Balanced Trees? Explain.
6+4

4. Answer any two from the following:

(a) Discuss various Data Structures which can be used to represent a List. Explain the space overhead of each of the alternatives. Explain how you can represent the transitive closure matrix of a sparse graph efficiently.

4+3+3

(b) What data structure will you use for evaluating postfix expressions? What are the errors you can detect in a postfix expression using your algorithm? Show how the following postfix expression will be evaluated step by step:

25 40 30 – 70 * + 25 / $, where $ is a sentinel.

3+3+4

(c) What do you mean by Bucket Hashing? Explain how you can use it for efficient storage of a large number of records in hard disks? Find out the expected number of disk reads to search a record in the Bucket Hashing scheme.

4+3+3

5. Answer any two from the following:

(a) In solving a problem, each data node has a structure containing some information field. The total number of bytes in the structure is 4096. You have a maximum of 30,000 such structures to process. What are the possible schemes of storage of the data in array in main memory? If frequent sorting on a key field is required on the data, what scheme will be better if you want to minimize the time for data movement during swapping? Explain.

6+4

(b) You have a very large number of very big records, each having a key field. The total size of the records is such that they can't fit in the main memory in an array. What are the candidate data structures for the application? Explain their scheme of storage and compare the performances for insertion, search and delete operations.

2+3+5

(c) You are going to develop an application for Heatstroke Patient Treatment Resource Help. Consider there are 4 hospitals with known number of initial Heatstroke beds, 50 medicine suppliers, 6 ambulance agencies and 10 Oxygen vendors in a locality. Explain your choice of data structures and algorithms for the application.

4+6

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