Question Paper

Exam Date & Time: 01-Dec-2023 (10:00 AM - 01:00 PM)

MANIPAL ACADEMY OF HIGHER EDUCATION

Manipal School of Information Sciences (MSIS), Manipal
First Semester Master of Engineering - ME (VLSI Design) Degree Examination - November / December 2023

Data Structures [VLS 5101]

Marks: 100 **Duration: 180 mins.**

Friday, December 1, 2023

Answer all the questions.

1)	Define data structure. Explain time complexity and space complexity with an example. Illustrate space complexity for a recursive and non-recursive function. (APPLY, CO1) (1+4+5 =10 marks)	(10)
2)	Design data structure for Pixel data in a single linked list. Write function to insert and delete element in O(1) time. (Note: Each Pixel will consist of RGB value, opacity, brightness etc) (APPLY, CO2)(2+4+4)	(10)
3)	Define Stack data structure. List applications of Stack. Provide data structure for array based Stack. Implement push( ) and pop( ) functions. (APPLY, CO2) (1+1+2+3+3 marks)	(10)
4)	Design data structure for linked list based Queue Write functions to create new queue, add to queue and delete from queue. (APPLY, CO2)(2+2+3+3 marks)	(10)
5)	Q5 A. List the properties of binary search tree. Define data structure for binary search tree. (APPLY, CO2) (4 Marks) Q5 B. (ANALYZE, CO2) (1.5x4 = 6)	(10)

Index Order of Insertion	Key/ Data
1	11
2	9
3	6
4	17
5	8
6	22
7	15
8	6
9	0
10	53
11	9
12	3

Table 1

a. Create a binary search tree (BST) from the Table 1.
b. Delete key 9 from BST and display the BST.
c. Insert key 10 and 7 to the BST and display the BST.
d. Find the height of the BST? In which level key 10 is present in the BST.

6) Define hashing. With an example explain closed hashing. Explain any two techniques to overcome collision problem. Define data structure to store integer values in hash table of size 10 and a function to initialize the hash table. (APPLY, CO4) (1+2+2+5 marks) (10)

7) Implement a sorting technique that works on $O(N^2)$ in worst case and O(N) in best case . Illustrate with an example. (APPLY, CO3) (6+4 marks) (10)

8) Define Minimum Spanning Tree. Write a pseudo code for Prims's algorithm to find Minimum Spanning Tree. Illustrate with an example by considering a graph with 6 vertices. (APPLY, CO4) (2+4+4 marks) (10)

9) Write a program to traverse a given graph. Illustrate the code by using a graph with 5 vertices. (APPLY, CO4) (5+5 marks) (10)

10) Given two linked list A and B, Create linked list C = A intersection B. Define the data structure for the following problem and write the function List * intersection(List *, List *). Note: Assume List * Initialize_list() and List * insert_at end(List *, int) are implemented. (APPLY, CO2) (2+8 marks) (10)

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