Question Paper

Exam Date & Time: 27-Nov-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 (Embedded Systems / Cyber Security) Degree Examination - November / December 2023

Data Structures and Algorithms [ESD 5102]

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

Monday, November 27, 2023

Answer all the questions.

1) Design data structure for a single linked list. Write function to insert and delete element in O(1) time. (ANALYZE, CO1)(2+4+4) (10)

2) 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)

3) 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)

4) Q4 A. List the properties of binary search tree? Define data structure for binary search tree. (APPLY, CO2) (4 Marks) (10)

Q4 B. (ANALYZE, CO2) (1.5x4 = 6)

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?

5) 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, CO2) (1+2+2+5 marks) (10)

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

7) With required data structure write a program to create adjacency list. (APPLY, CO2) 10 Marks (10)

8) Define Minimum Spanning Tree. Write pseudo code for Kruskals'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) Define dynamic programming. Illustrate dynamic programming using matrix chain multiplication by considering 3 matrices of dimension 100x50, 50x10 and 10x20. Obtain the proper order of multiplication of the matrices so that the total number of scalar products is a minimum. (APPLY, CO4) (2+8 = 10 marks) (10)

10) Define back tracking algorithm. Illustrate back tracking algorithm using NQueen's problem (APPLY, CO4) (2+8 = 10 Marks) (10)

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