No of Pages : 3 Course Code : 20MX22

Roll No:
(To be filled in by the candidate)

PSG COLLEGE OF TECHNOLOGY, COIMBATORE - 641 004

SEMESTER EXAMINATIONS, AUGUST 2023

MCA Semester : 2

20MX22 DESIGN AND ANALYSIS OF ALGORITHMS

Time : 3 Hours **Maximum Marks : 100**

INSTRUCTIONS:
1. Answer **ALL** questions. Each question carries 25 Marks.

1. a) Define Big O notation. Write the significance of Big O notation. Give sample code with the following complexity i. O(n) ii. O(n^2) and iii. O(log n). (5)

   b) Illustrate i. Heap sort and ii. Radix Sort with the numbers 46, 22, 66, 90, 19, 78 and 5. Write the complexity of the sorting algorithms. (8)

   c) i) Write an algorithm for Quick sort. Applying the algorithm, sort the following list of elements 12, 25, 3, 45, 56, 34, 70, 27, 189, 59, 75. Show the results of the intermediate passes. Write the recurrence relation corresponding to best and worst case. Solve the recurrence relations and find the complexity of best and worst case. (12)

   (OR)

   ii) Write an algorithm for Merge sort. Applying the algorithm, sort the following list of elements 12, 25, 3, 45, 56, 34, 70, 27, 189, 59, 75. Show the results of the intermediate passes. Write the recurrence relation. Solve the recurrence relations and find the complexity of Merge Sort. (12)

2. a) Consider the B+ tree of order 4 shown in fig 1. Insert 8, 30 and 14 in the tree. Show the tree after deleting 13 and 4.Indicate the action taken at each step. (5)

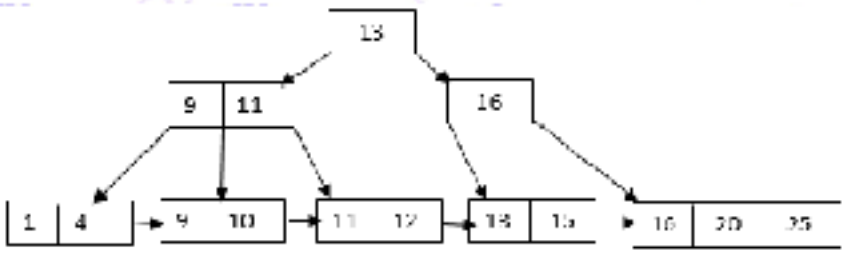

Fig.1

b) What is a Binary Search Tree (BST)? Write algorithms for the insert and delete operations on element in BST. Indicate the complexity of the algorithms. Illustrate the operations with a suitable example. (8)

c) What is an AVL tree? Compare Binary Search tree and AVL tree with regard to searching operations. Describe the various types of rotations. Create AVL tree by inserting the following elements one by one in the given order 15, 20, 24, 10, 13, 7, 30, 36 and 25. Delete 10 and 30 and show the resultant tree. (12)

3. a) Write the control abstraction for divide and conquer method of algorithm design. Write an algorithm based on this principle to find the maximum and minimum among a given set of elements. (5)

b) State Principle of Optimality. Apply dynamic programming to find the shortest path between all the pairs of vertices for the graph given in fig. 2. (8)

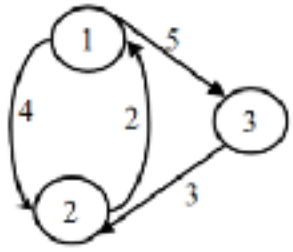

Fig.2

c) i) Show that dynamic programming can be used to solve the multistage decision graph problem. Find the shortest path from source vertex (vertex 1) to destination vertes (vertex 12) in the graph shown in Fig 3. (12)

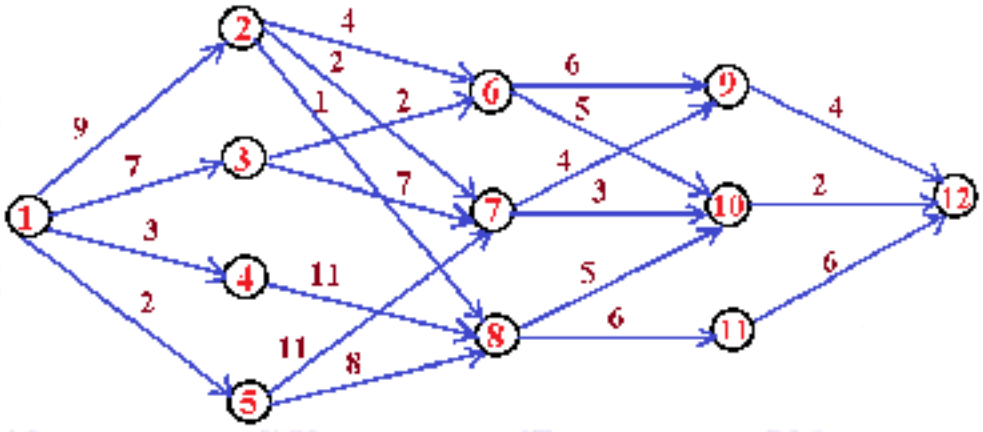

Fig 3

(OR)

ii) Describe how dynamic programming is used in solving the Knapsack problem. Solve the following instance n=4, m=15, weight w={2,4,6,9} and profit p={10, 10, 12, 18}. (12)

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4. a) Explain how greedy method is used in solving optimization problems. Give the pseudocode to illustrate the general principles. (5)

   b) What are Huffman Codes? Explain the steps in generating Huffman codes using greedy method of algorithm design, Find the Huffman Codes for the following characters: (8)

	a	b	c	d	e	f
Frequency	45	13	12	16	9	5

   c) Explain the control abstraction for backtracking method. Applying backtracking principles, solve N Queens problem. Write algorithm to print all solution to N queens problem. Draw the state space tree of 4 queen problem generated during backtracking. (12)

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FD/CSK