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

PSG COLLEGE OF TECHNOLOGY, COIMBATORE - 641 004

SEMESTER EXAMINATIONS,   JUNE 2022

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.							
2. Course Outcome : Table	Qn.1	CO1.	Qn.2	CO2.	Qn.3	CO3.	Qn.4	CO4.

1. a) Solve the following recurrence relations   (5)

   i) $T(n) = T(n-1) + a$ ii) $T(n) = 2T(n/2) + n$

         $T(0) = 1$ $T(1) = 1$

   where a is a constant

   b) Sort the following numbers using i. Radix sort and ii. Heap Sort. What is the complexity of radix sort and Heap sort?   (8)

         45, 25, 64, 62, 5, 9, 48, 18, 34

   c) Formulate algorithm for quick sort. Trace the algorithm on the following input 26, 12, 62, 60, 45, 56, 10, 30. Write the recurrence relation corresponding to best case and worst case. What is the best and worst case complexity?

2. a) What is a trie? Create a trie with the following elements: data, dag, dog, code, cape, cap, date. Delete dog and cap. Describe how search operation is performed on trie.

                                                                                  (5)

   b) Insert the following elements into an initially empty Binary Search Tree.   (8)

         25, 40, 65, 60, 55, 42, 35, 30.

   Delete 40, 65 and 42. Show the resultant tree. Write algorithm for insertion operation on Binary Search Trees. What is best case and worst case complexity? Will the order of inserting elements affect the complexity of insertion? Justify your answer.

   c) Define a B Tree of order m. How is B+ tree different from B tree? Create a B Tree of order 5 by inserting the following elements: 15, 20, 10, 14, 25, 20, 40, 50, 60, 100, 85, 80, 105, 110, 115, 125, 130, 135, and 145. Delete 135, 110, 20. Show the resultant tree. Indicate the action taken at each step

3. a) Write an algorithm for finding the shortest distance between all pairs of vertices shown in fig 1. Trace the algorithm on the graph of figure 1. What algorithm design technique is used in formulation of all pairs shortest path algorithm?   (5)

Fig 1

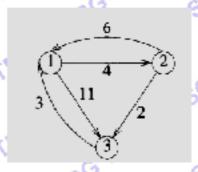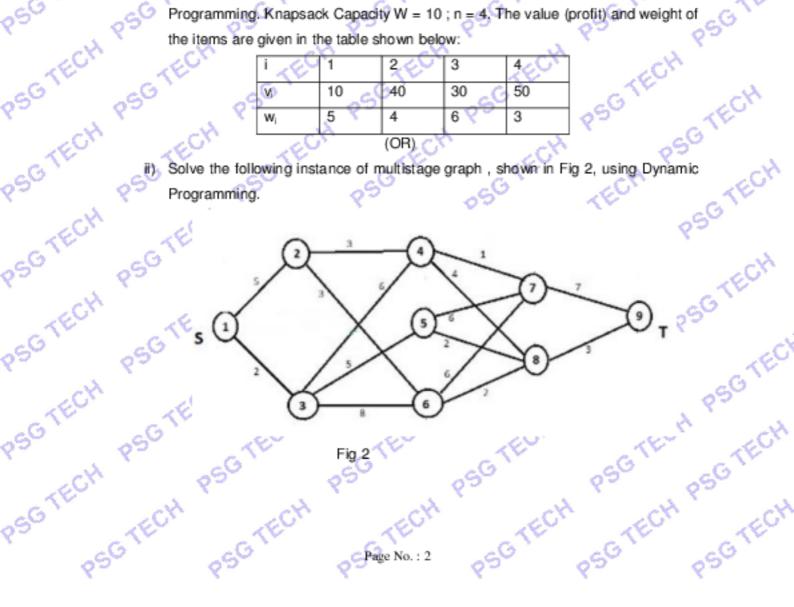b) Explain the divide and conquer method of algorithm design. Write an algorithm for merge sort and describe how divide and conquer principle is used in merge sort algorithm. What is the complexity of merge sort? Sort the following numbers using mergesort : 45, 25, 60, 75, 12, 5   (8)

c) i) Solve the following instance of 0/1 knapsack problem using Dynamic Programming. Knapsack Capacity W = 10 ; n = 4. The value (profit) and weight of the items are given in the table shown below:

i	1	2	3	4
v_i	10	40	30	50
w_i	5	4	6	3

(OR)

ii) Solve the following instance of multistage graph , shown in Fig 2, using Dynamic Programming.

Fig 2
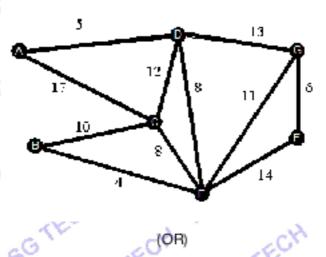
4. a) Generate Huffman Codes for the following messages

Message	Frequency
M_1	2
M_2	3
M_3	6
M_4	8
M_5	12
M_6	14

Encode message $M_5 M_3 M_2 M_1$ an decode 00011010111

b) i) Differentiate explicit and implicit constraints. State the objective function, explicit constraint and implicit constraint of 0/1 knapsack problem and Sum of subsets problem.   (4)

   ii) Draw the statespace tree generated by Backtracking algorithm for the following instance of sum of subsets problem :

        $n = 6$; $m = 30$, $w[1..6] = \{ 5, 10, 12, 13, 15, 18\}$

c) i) Explain how greedy principle is used in Prims algorithm. Write Prims algorithm for generating minimum spanning tree of a graph. Construct minimum spanning tree of the graph shown in Fig 3.

(OR)

   ii) Explain the principles of backtracking. Write the general backtracking algorithm. Describe how it can be used to solve 4 queens problem. Draw the state space tree generated for 4 queens problem. What is the bounding function used to kill the nodes? Describe the terms live node, E node and dead node with respect to the state space tree generated.

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