



**PRESIDENCY UNIVERSITY
BENGALURU**

SCHOOL OF ENGINEERING

MAKE UP EXAMINATION- JAN 2023

Course Code: CSE-212

Course Name: Analysis of Algorithms

Program : B. Tech

Date: 25-JAN-2023

Time: 9.30 AM – 12.30 PM

Max Marks: 100

Weightage: 50%

Instructions:

- (i) Read the all questions carefully and answer accordingly.
- (ii) Question paper consists of 3 parts.
- (iii) Scientific and Non-programmable calculators are permitted.

Part A [Memory Recall Questions]

Answer all the Questions. Each question carries TWO marks. (10Qx 2M= 20M)

1. What do you understand by finiteness property of an algorithm? (CO1) [Bloom's level K]
2. Define Θ asymptotic notation. (CO1) [Bloom's level C]
3. Define Travelling Salesman Problem (CO2) [Bloom's level K]
4. Explain sequential search method in a linked list. (CO2) [Bloom's level C]
5. What is the running time of QUICKSORT when all elements of array A have the same value? (CO3) [Bloom's level A]
6. Write down time complexity for all cases of merge sort. (CO3) [Bloom's level C]
7. What is memoization in dynamic programming? (CO4) [Bloom's level K]
8. What do you mean by a greedy algorithm? (CO4) [Bloom's level C]
9. Define Upper and Lower bound of an algorithm. (CO5) [Bloom's level C]
10. What is Backtracking? (CO5) [Bloom's level C]

Part B [Thought Provoking Questions]

Answer all the Questions. Each question carries SEVEN marks. (5Qx7M=35M)

11. State Master's Theorem. Solve the following recurrence relations using master's theorem
 - (i) $T(n) = 3T(n/2) + n^2$
 - (ii) $T(n) = 16T(n/2) + n$
 - (iii) $T(n) = T(n/4) + 5$
 - (iv) $T(n) = 2T(n/2) - n \log n$ [3+4] (CO3) [Bloom's level C]
12. (a) Consider the array 15,20,30. How many steps are needed to search the key value 30 using linear search and binary search?
 (b) Distinguish between iteration and recursion [3+4] (CO1) [Bloom's level C]
13. (a) Use the substitution method to solve the recurrence $T(n) = T(n-1) + \Theta(n)$
 (b) Use recurrence tree method to solve the recurrence $T(n) = 2T(n/2) + n^2$
 [3 + 4] (CO2) [Bloom's level C]

14. A thief enters a house for robbing it. He can carry a maximal weight of 5 kg into his bag. There are 4 items in the house with the following weights and values. What items should thief take if he either takes the item completely or leaves it completely? Find the optimal solution using Dynamic Programming Approach.

Item	Weight	Value
Mirror	2	3
Silver nugget	3	4
Painting	4	5

[7](CO4) [Bloom's level C]

15. (a) Define sum of sub set problem.
 (b) Given a set of four integers 3,4,5 and 6 and the desired sum is 13. Find the sum of subsets.
 (c) Draw the state space tree of the solution. [1+1+5] (CO5) [Bloom's level C]

Part C [Problem Solving Questions]

Answer all the Questions. Each question carries FIFTEEN marks. (3Qx15M=45M)

16. Professor Borden proposes a new divide-and-conquer algorithm for computing minimum spanning trees, which goes as follows. Given a graph $G = (V, E)$ partition the set V of vertices into two sets V_1 and V_2 such that $|V_1|$ and $|V_2|$ differ by at most 1. Let E_1 be the set of edges that are incident only on vertices in V_1 , and let E_2 be the set of edges that are incident only on vertices in V_2 . Recursively solve a minimum-spanning-tree problem on each of the two subgraphs $G_1 = (V_1, E_1)$ and $G_2 = (V_2, E_2)$. Finally, select the minimum-weight edge in E that crosses the cut (V_1, V_2) , and use this edge to unite the resulting two minimum spanning trees into a single spanning tree. Either argue that the algorithm correctly computes a minimum spanning tree of G , or provide an example for which the algorithm fails. (CO2) [Bloom's level C]
17. (a) Illustrate recursion tree by sorting the array of integers 15,15,15,15,15,15 using
 (i) Merge sort
 (ii) Quick sort, last element as pivot
 (b) Statistically, on an average quick sort performs a 3-to-1 partitions to the input array of Integers. Use substitution method to find the asymptotic bound for average case for quicksort. [6+9] (CO3) [Bloom's level C]
18. Find the Minimum Spanning Tree for the following graph using Prim's Algorithm and Kruskal's Algorithm. Will the two algorithms give the same result or not. If not, why not? (CO4) [Bloom's level C]

