

Registration No.:

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Total Number of Pages: 02

Course: IDD (B.Tech and M.Tech)  
Sub\_Code: RCS4C002/RIT4C002

4<sup>th</sup> Semester Back Examination: 2024-25

SUBJECT: Design and Analysis of Algorithm

BRANCH(S): CSE, CSEAI, CSEAIML, CSEDS, CST, ELECTRICAL & C.E, ELECTRONICS & C.E, IT

Time: 3 Hours

Max Marks: 100

Q.Code: S428

Answer Question No.1 (Part-I) which is compulsory, any eight from Part-II and any two from Part-III.  
The figures in the right hand margin indicate marks.

Part-I

Q1 Answer the following questions: (2 x 10)

- Which one is bigger  $n^{100}$  or  $2^n$ ? Justify your answer.
- What will be the time complexity of merge sort if all the elements are already arranged in increasing order?
- Differentiate between Dynamic Programming and Greedy methods.
- Which one is better in terms of space complexity, Quick sort or Merge sort? Justify your answer
- Differentiate between max heapify and min heapify?
- Define divide and conquer approach. Mention two examples.
- If the graph contains 6 nodes, then how many maximum spanning tree is possible?
- What are the constraints required for a Backtracking method?
- Define time complexity and space complexity of an algorithm.
- Determine whether the following problems are P, NP, or NP-Complete, Satisfiability problem, Hamiltonian cycle, TSP problem, Knapsack problem, Clique, Set partitioning.

Part-II

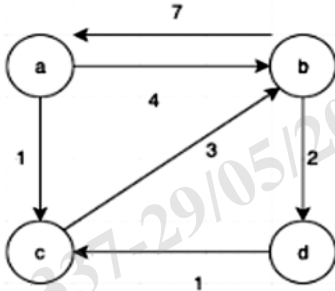
Q2 Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve) (6 x 8)

- Explain how the LIFO Branch and Bound technique works to solve the 8-puzzle problem. Explain by constructing the state space tree.
- Solve the following recurrence relations by using Master's method.  
 $T(n) = 2T(n/2) + n^3$   
 $T(n) = 16T(n/4) + n$
- Write an algorithm for Binary search and analyse its Best, Worst, and Average case time complexity.
- Explain topological sorting with suitable example.
- Define recursion. Explain recursion tree method to solve recursion.
- Solve the knapsack problem for  $n = 4$ ,  $W = 40$ ,  $(p_1, p_2, p_3, p_4) = (11, 21, 31, 33)$   
 $(w_1, w_2, w_3, w_4) = (2, 11, 22, 15)$
- Define Big-Oh and Big-omega notation. Find Big-Oh for the function  $f(n) = 4n^2 + 2n + 7$
- Explain dis-joint set. Write the operation supported by dis-joint set.

- i) Differentiated between Prim's and Kruskal algorithm. Let G be the complete undirected graph on 4 vertices having 6 edges weights 1, 2, 3, 4, 5, 6. What is the maximum possible weight that a minimum spanning tree of G can have.
- j) Apply the Bottom up Dynamic Approach to the following instance of 0/1 knapsack problem. The maximum capacity of the knapsack is 10.

Item	Weight	Profit
1	7	42
2	3	12
3	4	40
4	5	25

- k) Describe Floyd Warshall algorithm for all pairs shortest path problem. Apply the same to the following Graph and discuss its time complexity.



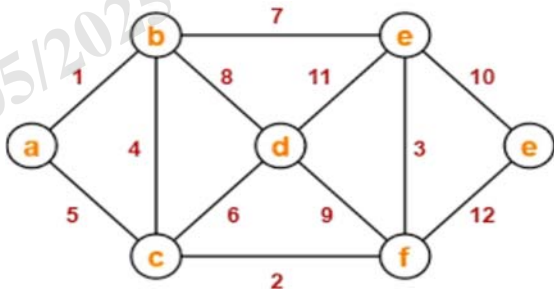
- l) Explain MERGE SORT for the given elements: 27, 18, 19, 14, 16, 23, 21, 12

### Part-III

#### Only Long Answer Type Questions (Answer Any Two out of Four)

(16 x 2)

- Q3 a) Create max-heap for following elements: 3, 2, 4, 5, 1, 6, 7. Draw diagrams by inserting one element at a time. Find the time complexity if heap is created with n elements by using insertion process. (8)
- b) Find Huffman code for a - 4, b - 5, c - 7, d - 8, e - 10, f - 12, g - 20. (8)
- Q4 a) Write an algorithm for Activity selection problem. Solve the problem where start times = (1, 3, 0, 5, 3, 5, 6, 8, 8, 2, 12) and Finish times = (4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14). (8)
- b) Find LCS for X = ABABDC and Y = BCBCABAD. Write an algorithm for LCS. (8)
- Q5 a) Discuss the relation between P, NP, NP-complete and NP-Hard problem with suitable example. (8)
- b) Discuss the 4 - queen's problem. Draw the portion of the state space tree for n = 4 queens using backtracking algorithm. (8)
- Q6 a) (8)



Explain how Kruskal's algorithm can be used to find minimum spanning tree of a graph given above.

- b) Find an optimal parenthesization of a matrix chain multiplication whose sequence of dimensions (orders) are  $\langle 10, 20, 50, 1, 100 \rangle$ . (8)