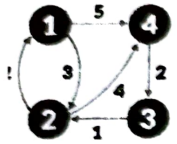
adjacency matrix, (∞ means there is no direct edge between the corresponding vertices). (10)



$A^0 =$

	1	2	3	4
1	0	3	∞	5
2	2	0	∞	4
3	∞	1	0	∞
4	∞	∞	2	0

(b) Write a short note on Backtracking Programming.

7. (a) Given a cost matrix of size 5 where cost[i][j] denotes the cost of moving from city i to city j. Solve the following problem to complete a tour from the city N_0 to all other cities such that visit each city exactly once and then at the end come back to city N_0 in min cost using Branch & Bound Methodology. (10)

	N_0	N_1	N_2	N_3	N_4
N_0	INF	20	30	10	11
N_1	15	INF	16	4	2
N_2	3	5	INF	2	4
N_3	19	6	18	INF	3
N_4	16	4	7	16	INF

(b) Differentiate between P, NP, NP-Hard, NP-Complete problems. (5)

Roll No. ..... Total Pages : 4

602201

May 2024

MCA- II SEMESTER

Analysis Design of Algorithms (MCA-20-102)

Time : 3 Hours] [Max. Marks : 75

Instructions :

1. *It is compulsory to answer all the questions (1.5 marks each) of Part-A in short.*
2. *Answer any four questions from Part-B in detail.*
3. *Different sub-parts of a question are to be attempted adjacent to each other.*

PART–A

1. (a) Differentiate between stack and queue data structures. (1.5)

(b) In which case adjacency list is preferred instead of an adjacency matrix? (1.5)

(c) Compare the time and space complexities of selection sort, insertion sort, quick sort and merge sort. (1.5)

(d) Given a sorted array of integers, explain why binary search is more efficient than linear search for finding an element in the array. (1.5)

(e) Explain why a greedy algorithm is used for the Fractional Knapsack Problem instead of the 0/1 Knapsack Problem. (1.5)

(f) Consider a graph G = (V, E), where V = { $v_1, v_2,...,v_{100}$}, E = {(v_i, v_j) | $1 \le i \le j \le 100$} and weight of the edge (v_i, v_j) is |i–j|. Find the weight of minimum spanning tree of G. Also Justify your answer. (1.5)

(g) What is the time complexity of Bellman-Ford single-source shortest path algorithm on a complete graph of n vertices? Also Justify your answer. (1.5)

(h) Define backtracking and list two problem types where backtracking is an effective solution strategy. (1.5)

(i) Draw all the possible solutions of 4-Queens problem. (1.5)

(j) The problem of determining whether there exists a cycle in an undirected graph is in P Class (Polynomial time). Justify the statement. (1.5)

PART–B

2. (a) Write an algorithm for Push and Pop operations of a stack. Discuss in detail any *one* application of stack. (10)

(b) Given a Binary Search Tree (BST), write an algorithm to find the element with the given value in the BST. (5)

3. (a) Apply insertion sort on the following given unsorted array. Also write its algorithm with time and space complexities. (10)

24	16	6	20	8	33

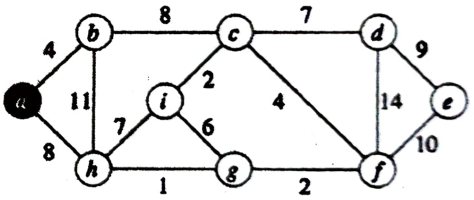
(b) Differentiate between Big-O (O), Omega (Ω) and theta (θ) notations. (5)

4. (a) For the given set of items and knapsack capacity = 15 kg, find the optimal solution for the Fractional knapsack problem making use of Greedy Approach. (10)

Objects:	1	2	3	4	5	6	7
Weight (w)	1	3	5	4	1	3	2
Profit (P)	5	10	15	7	8	9	4

(b) Write a short note on Strassen's matrix multiplication.

5. (a) Suppose that the graph G = (V, E) is represented as an adjacency matrix. Write an algorithm of Prim's algorithm and also analyze its time complexity when implemented min-priority queue using binary min-heap. Apply Prim's algorithm on the following graph to find out Minimum Spanning Tree. (10)



(b) Distinguish between the methodologies and applications of Breadth-First Search (BFS), Dijkstra's Algorithm, and the Bellman-Ford Algorithm in the context of finding the shortest path in graphs. (5)

6. (a) Find the shortest path between all the pairs of vertices in a weighted graph represented by the following