CBCS SCHEME

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21CS42

Fourth Semester B.E. Degree Examination, Dec.2023/Jan.2024
Design and Analysis of Algorithms

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Design an algorithm to search an element in an array using sequential search. Discuss its efficiency in best, worst and average cases. **(08 Marks)**

b. Give the general plan for analyzing any non recursive algorithm. Write an algorithm to check whether array elements are distinct. Discuss its efficiency. **(08 Marks)**

c. Define Big Oh (O) and Big Omega (Ω) notations. **(04 Marks)**

OR

2 a. Discuss the various steps in algorithm design and analysis process with the flow diagram. What are the criteria satisfied by any algorithm. **(08 Marks)**

b. Give the general plan for analyzing any recursive algorithm. Write and solve the recurrence relation to find the solution for Tower's of Hanoi problem. **(08 Marks)**

c. Write an algorithm to sort 'n' number using selection sort method. **(04 Marks)**

Module-2

3 a. Design an algorithm to sort 'n' numbers using Quick sort. Apply the algorithm for the data 35, 20, 15, 45, 10, 60, 15, 70.
Each time, show the splitting position. **(08 Marks)**

b. Discuss the general Divide and Conquer method along with control abstraction. Write the recurrence relation for divide and conquer. **(06 Marks)**

c. Write an algorithm sort the numbers using insertion sort. Discuss its efficiency. **(06 Marks)**

OR

4 a. Obtain the Topological sequence for the following graph using i) Source removal method ii) DFS based algorithm. [Refer Fig.Q4(a)]

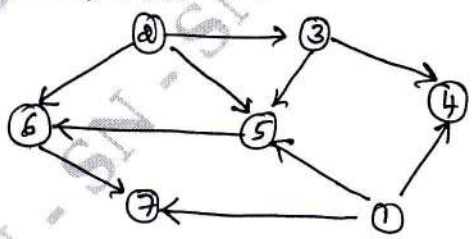

Fig.Q4(a) **(07 Marks)**

b. Design an algorithm to sort numbers using merge sort. Write the complexity of merge sort. **(07 Marks)**

c. Write recursive algorithm to find maximum and minimum element in an array. Construct tree of recursive call for the data,
22, 13, -5, -8, 15, 60, 17, 31, 47 **(06 Marks)**

Module-3

5 a. Write an algorithm to solve Greedy knapsack problem. Find an optimal solution to the knapsack instance n = 7, m = 15, $(P_1, P_2 \ldots P_7) = (10, 5, 15, 7, 6, 18, 3)$ and $(w_1, w_2 \ldots w_7) = (2, 3, 5, 7, 1, 4, 1)$ using Greedy method. **(10 Marks)**

b. Design Prim's algorithm to find the minimum cost spanning tree. Apply Pr_1
Write an algorithm to construct heap using Bottom-up approach. Apply both bottom-up and Top down method to construct the max heap for the data 12, 23, 45, 28, 55, 15, 67, 33. **(10 Marks)**

OR

6 a. Design Prim's Algorithm to find the minimum cost spanning tree. Apply Prim's algorithm for the following graph in Fig.Q6(a).

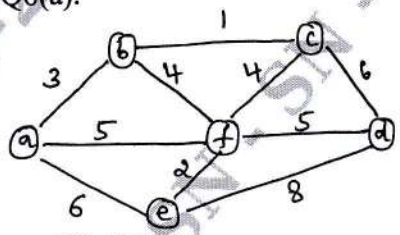

Fig.Q6(a) **(10 Marks)**

b. Write Huffman's algorithm. Construct Huffman tree and find the code for each character.

Characters :	A	B	C	D	E
Probability :	0.4	0.1	0.2	0.15	0.15

(10 Marks)

Module-4

7 a. Write Floyd's Algorithm to solve all pairs shorted path problem. Apply Floyd's algorithm for the following graph in Fig.Q7(a).

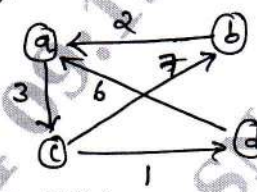

Fig.Q7(a) **(10 Marks)**

b. Write the pseudocode for comparison counting sort. Discuss its efficiency. **(06 Marks)**

c. Write Bellman and Ford Algorithm to compute the shortest path. **(04 Marks)**

OR

8 a. Discuss general dynamic programming approach. Find the optimal tour for the salesperson if he starts from city 1, using dynamic programming. Graph and the distance matrix are given. [Refer Fig.Q8(a)]

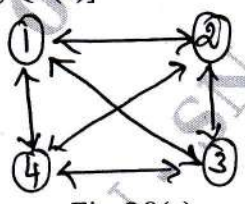

Fig.Q8(a)

	1	2	3	4
1	0	10	15	20
2	5	0	9	10
3	6	13	0	12
4	8	8	9	0

(10 Marks)

b. Write pseudocode for Horspool's string matching algorithm. **(06 Marks)**

c. Write Warshall's algorithm to compute Transitive closure. **(04 Marks)**

Module-5

9 a. Discuss general Backtracking technique. Construct state space tree to solve Four Queens problem. **(08 Marks)**

b. Discuss the following :

i) Graph coloring problem and its solution using Backtracking.

ii) Branch and Bound technique to solve knapsack problem. **(12 Marks)**

OR

10 a. Discuss general branch and bound technique. Construct state space tree to solve the following assignment problem with 4 jobs and 4 persons. Assignment cost is given.

$$C = \begin{array}{c} \\ a \\ b \\ c \\ d \end{array} \begin{array}{c} \begin{array}{cccc} 1 & 2 & 3 & 4 \end{array} \\ \begin{bmatrix} 9 & 2 & 7 & 8 \\ 6 & 4 & 3 & 7 \\ 5 & 8 & 1 & 8 \\ 7 & 6 & 9 & 4 \end{bmatrix} \end{array}$$

(08 Marks)

b. Discuss the following :

i) Sum of subset problem and solution using backtracking.

ii) P, NP and NP complete problem. **(12 Marks)**

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