

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

- Design an algorithm to search an element in an array using sequential search. Discuss its efficiency in best, worst and average cases. (08 Marks)
 - 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)
 - Define Big Oh (O) and Big Omega (Ω) notations. (04 Marks)

OR

- Discuss the various steps in algorithm design and analysis process with the flow diagram. What are the criteria satisfied by any algorithm. (08 Marks)
 - 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)
 - Write an algorithm to sort 'n' number using selection sort method. (04 Marks)

Module-2

- 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)
 - Discuss the general Divide and Conquer method along with control abstraction. Write the recurrence relation for divide and conquer. (06 Marks)
 - Write an algorithm sort the numbers using insertion sort. Discuss its efficiency. (06 Marks)

OR

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

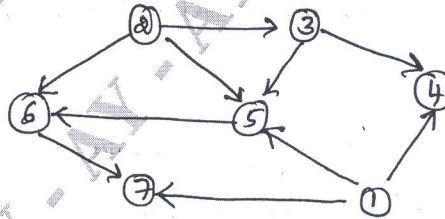


Fig.Q4(a)

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

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and/or equations written eg, 42+8 = 50, will be treated as malpractice.

Module-3

- 5 a. Write an algorithm to solve Greedy knapsack problem. Find an optimal solution to the knapsack instance $n = 7, m = 15, (P_1, P_2, \dots, P_7) = (10, 5, 15, 7, 6, 18, 3)$ and $(w_1, w_2, \dots, w_7) = (2, 3, 5, 7, 1, 4, 1)$ using Greedy method. (10 Marks)
- b. Design Prim's algorithm to find the minimum cost spanning tree. Apply Prim's 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).

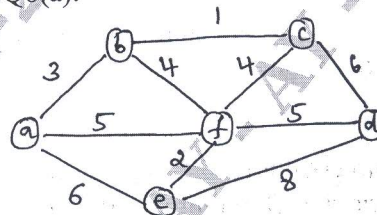


Fig.Q6(a)

- b. Write Huffman's algorithm. Construct Huffman tree and find the code for each character. (10 Marks)

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 shortest path problem. Apply Floyd's algorithm for the following graph in Fig.Q7(a).

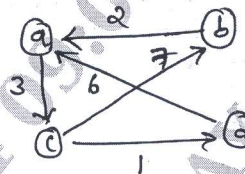


Fig.Q7(a)

- b. Write the pseudocode for comparison counting sort. Discuss its efficiency. (10 Marks)
- c. Write Bellman and Ford Algorithm to compute the shortest path. (06 Marks)
- (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)]

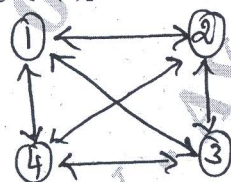


Fig.Q8(a)

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

- b. Write pseudocode for Horspool's string matching algorithm. (10 Marks)
- c. Write Warshall's algorithm to compute Transitive closure. (06 Marks)
- (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. (12 Marks)
- 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.

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

(08 Marks)

- b. Discuss the following :
- i) Sum of subset problem and solution using backtracking. (12 Marks)
- ii) P, NP and NP complete problem. (12 Marks)
