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17CS43

Fourth Semester B.E. Degree Examination, June/July 2019
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 a array using sequential search. Discuss the worst case, best case and average case efficiency of this algorithm. **(08 Marks)**

b. Discuss adjacency matrix and adjacency list representation of a graph with suitable example. **(06 Marks)**

c. Give the recursive algorithm to solve towers of Hanoi problem. Show that the efficiency of this algorithm is exponential. **(06 Marks)**

OR

2 a. Give the general plan for analyzing time efficiency of non recursive algorithms. Derive the worst case analysis for the algorithm to check whether all the elements in a given array are distinct. **(08 Marks)**

b. List and define any three asymptotic notations. What are the various basic asymptotic efficiency classes? **(06 Marks)**

c. Explain the following types of problems:
(i) Combinatorial problems (ii) Graph problems. **(06 Marks)**

Module-2

3 a. Write an algorithm to sort 'n' numbers using Quick sort. Trace the algorithm to sort the following list in ascending order.
80 60 70 40 10 30 50 20 **(08 Marks)**

b. Discuss general divide and conquer technique with control abstraction and recurrence relation. **(06 Marks)**

c. Apply DFS based algorithm and source removal method to find the topological sequence for the graph shown in Fig.Q3(c). **(06 Marks)**

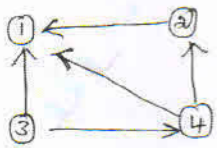

Fig.Q3(c)

OR

4 a. Apply Strassen's matrix multiplication to multiply following matrices. Discuss how this method is better than direct matrix multiplication method.

$$\begin{bmatrix} 4 & 3 \\ 2 & 1 \end{bmatrix} \times \begin{bmatrix} 2 & 5 \\ 1 & 6 \end{bmatrix}$$

(08 Marks)

b. Write recursive algorithm to find maximum and minimum element in an array. **(06 Marks)**

c. Write an algorithm to sort 'n' number using merge sort. **(06 Marks)**

Module-3

5 a. Write an algorithm to solve knapsack problem using Greedy technique. Find the optimal solution to the knapsack instance n = 7, m = 15
$(P_1, P_2 \ldots\ldots P_7) = (10, 5, 15, 7, 6, 18, 3)$
$(W_1, W_2 \ldots\ldots W_7) = (2, 3, 5, 7, 1, 4, 1)$ **(10 Marks)**

b. Apply Prim's algorithm and Kruskal's method to find the minimum cost spanning tree to the graph shown in Fig.Q5(b). **(10 Marks)**

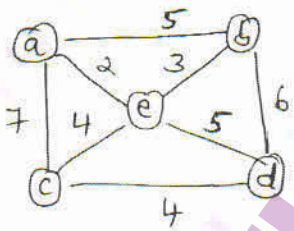

Fig.Q5(b)

OR

6 a. Write an algorithm to solve single source shortest path problem. Apply the algorithm to the graph shown in Fig.Q6(a) by considering 'a' as source. **(10 Marks)**

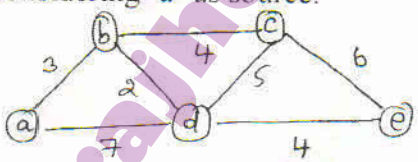

Fig.Q6(a)

b. Define heap. Write bottom-up heap construction algorithm. Construct heap for the list 1, 8, 6, 5, 3, 7, 4 using bottom-up algorithm and successive key insertion method. **(10 Marks)**

Module-4

7 a. Define transitive closure of a directed graph. Find the transitive closure matrix for the graph whose adjacency matrix is given.

$$\begin{bmatrix} 1 & 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 1 \\ 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 1 \end{bmatrix}$$

(10 Marks)

b. Find the optimal tour for salesperson using dynamic programming technique. The directed graph is shown in Fig.Q7(b). **(10 Marks)**

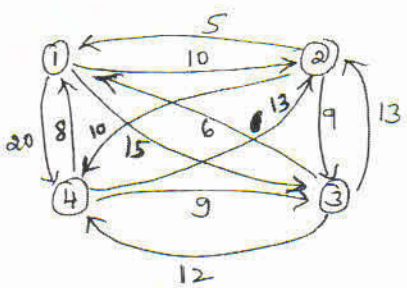

Fig.Q7(b)

OR

8 a. Write an algorithm to construct optimal binary search tree for the following data:

Key	A	B	C	D
Probability	0.1	0.2	0.4	0.3

(10 Marks)

b. Apply the bottom-up dynamic programming algorithm to the following instance of the knapsack problem. Knapsack capacity W = 10.

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

(10 Marks)

Module-5

9 a. Construct state-space tree for solving four queens problem using backtracking. **(06 Marks)**

b. Discuss graph coloring problem. Find different solutions for 4 nodes and all possible 3 coloring problem. **(06 Marks)**

c. Write a note on: (i) Non deterministic algorithms. (ii) LC branch and bound solution to solve O/I knapsack problem. **(08 Marks)**

OR

10 a. What are the two additional items required by Branch and Bound technique, compared with backtracking. Solve the following assignment problem using branch and bound technique, whose cost matrix for assigning four jobs to four persons are given

$$\begin{bmatrix} 9 & 2 & 7 & 8 \\ 6 & 4 & 3 & 7 \\ 5 & 8 & 1 & 8 \\ 7 & 6 & 9 & 4 \end{bmatrix}$$

(10 Marks)

b. Discuss the following :

(i) Subset sum problem

(ii) NP hard and NP complete classes. **(10 Marks)**

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