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15CS43

Fourth Semester B.E. Degree Examination, Dec.2017/Jan.2018
Design and Analysis of Algorithms

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Define an algorithm. Discuss the criteria of an algorithm with an example. **(06 Marks)**

b. Prove that : If $t_1(n) \in O(g_1(n))$ and $t_2(n) \in O(g_2(n))$ then
$t_1(n) + t_2(n) \in O(\max\{g_1(n), g_2(n)\})$ **(06 Marks)**

c. Explain the two common ways to represent a graph with an example **(04 Marks)**

OR

2 a. Consider the following algorithm
Algorithm GUESS (A[ ] [ ])
for i ← 0 to n – 1
for j ← 0 to i
A [i] [j] ← 0
i) What does the algorithm compute?
ii) What is basic operation?
iii) What is the efficiency of this algorithm? **(03 Marks)**

b. List and explain important problem types that are solved by computer. **(07 Marks)**

c. Design an algorithm for checking whether all elements in a given array are distinct or not. Derive its worst complexity. **(06 Marks)**

Module-2

3 a. Explain divide and conquer technique. Write a recursive algorithm for finding the maximum and minimum element from a list. **(08 Marks)**

b. Apply quick sort to sort the list E, X, A, M, P, L, E in alphabetical order. Draw the tree of the recursive calls made. **(08 Marks)**

OR

4 a. Discuss Strassen's matrix multiplication and derive its time complexity. **(08 Marks)**

b. Design merge sort algorithm and discuss its best-case, average-case and worst-case efficiency. **(08 Marks)**

Module-3

5 a. Solve the greedy knapsack problem where
m = 10, n = 4, P = (40, 42, 25, 12), W = (4, 7, 5, 3). **(06 Marks)**

b. What is job sequencing with deadlines problem? Let n = 5, profits [10, 3, 33, 11, 40] and deadlines [3, 1, 1, 2, 2] respectively. Find the optimal solution using greedy algorithm. **(05 Marks)**

c. Define minimum cost spanning tree (MST). Write Prim's algorithm to construct minimum cost spanning tree. **(05 Marks)**

OR

6 a. Design Dijkstra's algorithm and apply the same to find the single source shortest path for graph taking vertex 'a' as source of Fig. Q6(a). **(08 Marks)**

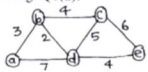


Fig. Q6(a)

b. Construct a Huffman code for the following data :

Character	A	B	C	D	-
Probability	0.4	0.1	0.2	0.15	0.15

Encode the text ABACABAD and decode the text 100010111001010, using the above code. **(04 Marks)**

c. Construct the heap for the list 2, 9, 7, 6, 5, 8 by the bottom-up algorithm. **(04 Marks)**

Module-4

7 a. Define transitive closure. Write Warshall's algorithm to compute transitive closure. Find its efficiency. **(08 Marks)**

b. Apply Floyd's algorithm to find all pair shortest path for the graph of Fig. Q7(b). **(08 Marks)**

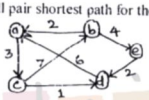
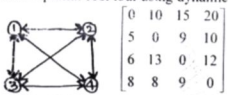


Fig. Q7(b)

OR

8 a. For the given cost matrix, obtain optimal cost tour using dynamic programming. **(08 Marks)**



$$\begin{bmatrix} 0 & 10 & 15 & 20 \\ 5 & 0 & 9 & 10 \\ 6 & 13 & 0 & 12 \\ 8 & 8 & 9 & 0 \end{bmatrix}$$

Fig. Q8(a)

b. Write a pseudocode to find an optimal binary search tree by dynamic programming. **(08 Marks)**

Module-5

9 a. Write the pseudocode for backtracking algorithm. Let w = {3, 5, 6, 7} and m = 15. Find all possible subsets of w that sum to m. Draw the state space tree that is generated. **(09 Marks)**

b. Draw the portion of the state space tree for m – colorings of a graph when n = 4 and m = 3. **(07 Marks)**

OR

10 a. With the help of a state space tree, solve the Travelling Salesman Problem (TSP) of Fig.Q10(a), using branch-and-bound algorithm. **(08 Marks)**

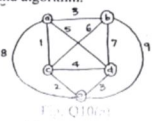


Fig. Q10(a)