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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 $t_1(n) \in 0(g_1(n))$ and $t_2(n) \in 0(g_2(n))$ then
$$t_1(n) + t_2(n) \in 0 (\max\{g_1(n), g_2(n)\})$$
(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)**
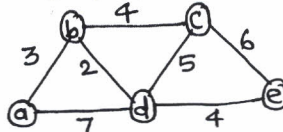

Fig. Q6(a)

   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)**

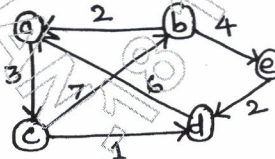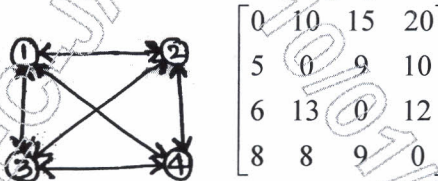   b. Apply Floyd's algorithm to find all pair shortest path for the graph of Fig. Q7(b). **(08 Marks)**

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)**
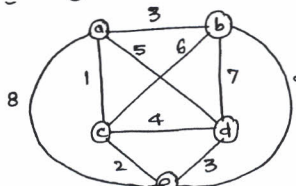

Fig. Q10(a)

   b. Explain the classes of NP – Hard and NP – complete. **(08 Marks)**