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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  $\leftarrow$  0 to n - 1  
   for j  $\leftarrow$  0 to i  
     A [i] [j]  $\leftarrow$  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)

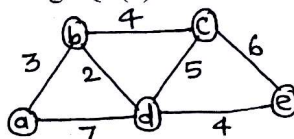


Fig. Q6(a)

- 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)

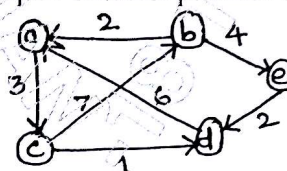


Fig. Q7(b)

OR

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

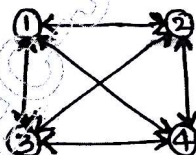


Fig. Q8(a)

0	10	15	20
5	0	9	10
6	13	0	12
8	8	9	0

- 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)

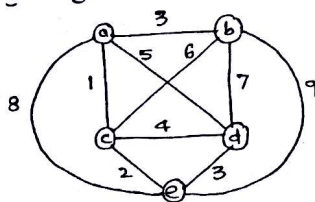


Fig. Q10(a)

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