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10CS43

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

Time: 3 hrs.

Max. Marks: 100

**Note: Answer any FIVE full questions, selecting at least TWO questions from each part.**

**PART – A**

- 1 a. With the help of a flow chart, explain the sequence of steps in design and analysis of an algorithm. (10 Marks)
- b. Consider the following recursive algorithm for computing the sum of the first n numbers.  
 $S(n) = 1 + 2 + 3 + \dots + n$ .  
 Algorithm S(n)  
     if (n = 1) return 1  
     else return(S(n - 1) + n)  
 end algorithm  
 set up and solve a recurrence relation for the number of times the algorithms basic operation is executed. (05 Marks)
- c. Write a recursive algorithm to compute the factorial of a non-negative integer n and analyze its efficiency. (05 Marks)
- 2 a. Is merge sort stable? Suggest an algorithm for merge sort and analyze its efficiency. (10 Marks)
- b. Write the algorithm for binary search and find its best, average and worst case efficiency. (10 Marks)
- 3 a. Explain the Kruskal's algorithm to find minimum spanning tree(MST). Apply it for the following graph, Fig.3(a). (06 Marks)

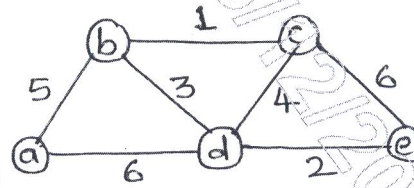


Fig.Q3(a)

- b. Mention the three requirements to be specified by any greedy algorithm. For the given jobs with deadline, find the maximum profit by sequencing them.  $N = 5$ ,  $(P_1, P_2, P_3, P_4, P_5) = (20, 15, 10, 5, 1)$  and  $(d_1, d_2, d_3, d_4, d_5) = (2, 2, 1, 3, 3)$ . (04 Marks)
- c. Write algorithm for greedy knapsack problem. Find the optimal solution for the Knapsack instance, number of objects(n) = 3, capacity of knapsack(M) = 20, Profits( $P_1, P_2, P_3$ ) = (25, 14, 15) and weights ( $w_1, w_2, w_3$ ) = (18, 15, 10). (10 Marks)
- 4 a. Define transitive closure of a graph. Write Warshall's algorithm to compute transitive closure of a graph. Find its efficiency. (07 Marks)
- b. Using Floyd's algorithm, find all pair shortest path for the graph of Fig.Q4(b). (07 Marks)

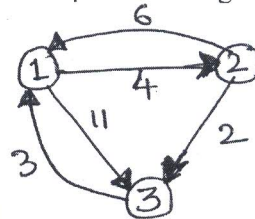


Fig.Q4(b)

- c. Write Bellman and Ford algorithm to compute single source shortest path. (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.

PART – B

- 5 a. Bring out the differences between DFS and BFS. Traverse the following graph of Fig.Q5(a) by DFS and construct the corresponding DFS forest and also show its stack content. (10 Marks)

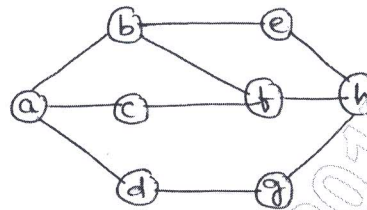


Fig.Q5(a)

- b. What do you mean by space and time trade off? Explain the Horspool's string matching algorithm. (10 Marks)
- 6 a. What are decision trees? Give and explain the decision tree for 3-element selection sort. (10 Marks)
- b. Explain the concepts of P, NP and NP – complete problems. (10 Marks)
- 7 a. Explain 4 – queen's problem using back tracking method and draw state – space tree for the same. (05 Marks)
- b. Apply the branch –and-bound algorithm to solve the assignment problem of assigning n people to n jobs so that the total cost of the assignment is as small as possible. (10 Marks)

Job → 1

1	2	3	4	Person a
9	2	7	8	Person b
6	4	3	7	Person c
5	8	1	8	Person d
7	6	9	4	

(10 Marks)

- c. Write the steps and apply nearest neighbor approximation algorithm on the TSP problem with starting vertex a, and calculate the accuracy ratio of approximation. (05 Marks)

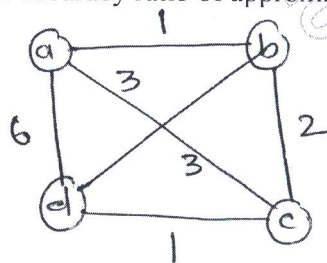


Fig.Q7(c)

- 8 a. Let the input to the prefix computation problem be 5, 12, 8, 6, 3, 9, 11, 12, 1, 5, 6, 7, 10, 4, 3, 5 and let  $\oplus$  stand for addition. Solve the problem using work optimal algorithm. (10 Marks)
- b. For an  $n \times n$  matrix M with nonnegative integer coefficients, define  $\tilde{M}$  and give an algorithm for computing  $\tilde{M}$ . Prove that  $\tilde{M}$  can be computed from a  $n \times n$  matrix M in  $O(\log n)$  time using  $n^{3+\epsilon}$  common CRCW PRAM processors for any fixed  $\epsilon > 0$ . (10 Marks)

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