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10MCA44

Fourth Semester MCA Degree Examination, Dec.2015/Jan.2016
Design and Analysis of Algorithms

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions.***

1 a. Define time complexity. What are the factors on which time complexity depends on? **(05 Marks)**

b. Discuss the various asymptotic notations in detail. **(06 Marks)**

c. For the given algorithm i) Identify the basic operation ii) Find the time complexity and explain the steps.

```
Algorithm max (a [ ], n)
    pos ← 0
    for i ← 1 to n – 1 do
        if a [i] > a [pos]    pos ← i
    end for
return pos
```

(05 Marks)

d. What are the two types of recursions? How do we design recursive functions? **(04 Marks)**

2 a. Solve the following recursive relation

$$t(n) = \begin{cases} 1 & \text{if } n = 0 \\ 1 + t(n-1) & \text{otherwise} \end{cases}$$ **(05 Marks)**

b. Write an algorithm for selection sort and obtain its time complexity. **(10 Marks)**

c. With a neat diagram and general algorithm discuss the divide and conquer strategy in detail. **(05 Marks)**

3 a. Using Master's Theorem, Prove that the time complexity of quick sort algorithm is $O(n \log_2 n)$ in best case. **(05 Marks)**

b. Find an optimal solution to the given knapsack problem using greedy method.
$n = 7, m = 15$
$P_1 \ldots . P_7 = \{10, 5, 15, 7, 6, 18, 3\}$
$W_1 \ldots . W_7 = \{2, 3, 5, 6, 7, 1, 4, 1\}$
where n is number of objects. m is maximum capacity of knapsack
$P_1 . . P_7$ is the profit of each object
$W_1 . . W_7$ the weight associated with each object. **(10 Marks)**

c. For the given graph, obtain shortest path from source to all other possible nodes using Dijkstra's algorithm. Assume the source node to be 5. [Do not trace the algorithm shown the intermediate steps]. **(05 Marks)**

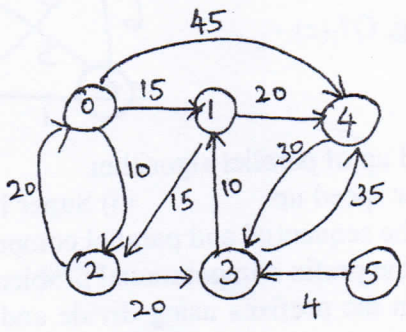

Fig. Q3 (c)

4 a. Solve the all pairs shortest path problem for the given di graph using Floyd's algorithm. [Intermediate matrices should be shown]. **(10 Marks)**

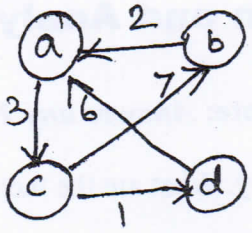

Fig. Q4 (a)

b. Solve the travelling salesman problem for the given adjacency matrix using dynamic programming. **(10 Marks)**

	1	2	3	4
1	0	10	15	20
2	5	0	9	10
3	6	13	0	12
4	8	8	9	0

5 a. Discuss the concept of decrease and conquer in detail. **(04 Marks)**

b. Apply source removal method algorithm to topologically sort the graph. Trace the algorithm and shown the steps. **(08 Marks)**

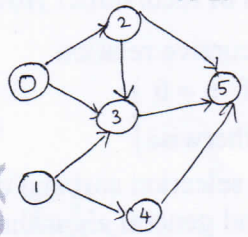

Fig. Q5 (b)

c. Write an algorithm for comparison counting. Explain its advantages and disadvantages. **(08 Marks)**

6 a. What are lower bounds? What are the advantages of finding lower bounds? **(04 Marks)**

b. Describe the different ways of obtaining lower bounds. **(06 Marks)**

c. What are decision trees Obtain a decision tree to find the minimum of three members? Prove that the bound of the tree is information theoretic lower bound. **(10 Marks)**

7 a. What is back tracking? Draw the state space tree for n-queens problem assuming n = 4. **(10 Marks)**

b. What is NP – hard problem? Explain how to solve a NP- hard problem. **(04 Marks)**

c. Solve the travelling salesman problem using Nearest neighbor method. Also find the accuracy rate of the algorithm. **(06 Marks)**

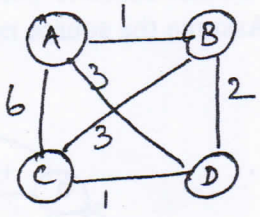

Fig. Q7 (c)

8 a. Defined i) Speed up of parallel algorithm
ii) Linear speed up iii) Super linear speed up. **(06 Marks)**

b. Briefly discuss the sequential and parallel computational model. **(04 Marks)**

c. Let the input to the prefix computational problem is 12, 3, 6, 8, 4, 5, 7 and let $\oplus$ be addition operation. Obtain the prefixes using divide and conquer strategy with n = p = 8. Write an algorithm for same. **(10 Marks)**

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