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10MCA44

Fourth Semester MCA Degree Examination, June 2012
Design and Analysis of Algorithms

Time: 3 hrs. Max. Marks:100

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

1 a. 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)**

b. Compare the orders of growth of $\log_2 n$ and $\sqrt{n}$ using limits. **(04 Marks)**

c. Write the steps for analyzing efficiency of non-recursive algorithms. **(05 Marks)**

d. Obtain the time complexity of bubble sort algorithms. **(05 Marks)**

2 a. Show that the recurrence relation, $t(n) = \begin{cases} 1, & n = 1 \\ t(\lfloor n/2 \rfloor) + 1, & \text{otherwise} \end{cases}$ has solution $O(\log_2 n)$, where t(n) is the time complexity of binary search. **(07 Marks)**

b. Discuss divide and conquer strategy for designing algorithm in brief. **(03 Marks)**

c. Write recursive mergesort algorithm. Show that the time complexity of this algorithm is O(nlogn). **(10 Marks)**

3 a. Consider the following instance of the knapsack problem: n = 3, m = 20, $(p_1, p_2, p_3)=(25, 24, 15)$ and $(w_1, w_2, w_3)=(18, 15, 10)$. Obtain the feasible solution by three different strategies and hence get the optimal solution. Please note 'n' is the number of objects, 'm' is the capacity of knapsack, p's are the profits associated with objects and w's are the weights. **(10 Marks)**

b. Consider the following undirected graph in Fig. Q3 (b).

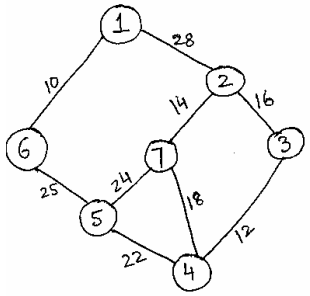

Fig. Q3 (b)

Apply Kruskal's algorithm to find minimum spanning tree. (Do not trace the algorithm, only different stages to be shown). **(05 Marks)**

c. What is subset paradigm and ordering paradigm? Explain with example. **(05 Marks)**

4 a. Apply Warshall's algorithm to find the transitive closure for the following graph in Fig.Q4 (a).

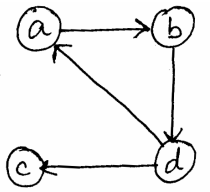

Fig. Q4 (a)

(Show all the matrices at intermediate steps) **(10 Marks)**

4 b. Solve the traveling salesman problem for a directed graph whose cast adjacency matrix edge length matrix is: **(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. Write an algorithm for DFS traversal and apply it to the graph in Fig. Q5 (a), considering the starting vertex 'a'. Also, write the corresponding DFS forest. **(10 Marks)**

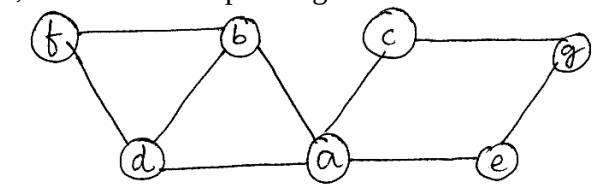

Fig. Q5 (a)

b. Write Horspool's algorithm to search a pattern in a given text and apply it to search for the pattern "BAOBAB" in the text "BESS KNEW ABOUT BAOBABS". **(10 Marks)**

6 a. What are lower-bound arguments? Describe in brief different methods for obtaining lower bounds. **(10 Marks)**

b. Draw a decision-tree to sort three elements by selection sort. **(05 Marks)**

c. Define P, NP and NP-complete problems. **(05 Marks)**

7 a. What is a state-space tree? Draw the state-space tree of the backtracking algorithm applied to the instance S = {3, 5, 6, 7} and d = 15 of the subset-sum problem. **(10 Marks)**

b. Write short notes on: i) Branch and bound design technique ii) Nearest neighbor algorithm. **(10 Marks)**

8 a. Define the following:
i) Speed up of the parallel algorithm
ii) Linear speed up
iii) Maximum speed up. **(06 Marks)**

b. Briefly discuss different ways of resolving read and write conflicts. **(06 Marks)**

c. Describe two basic problems that come up in the parallel solution of numerous problems. **(08 Marks)**

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