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13MCA41

Fourth Semester MCA Degree Examination, June/July 2015
Analysis & Design of Algorithms

Time: 3 hrs. Max. Marks:100

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

1 a. With the help of a flow chart, explain the various steps of algorithm design and analysis process. **(08 Marks)**

b. If $f_1(n) \in O(g_1(n))$ and $f_2(n) \in O(g_2(n))$, prove that $f_1(n) + f_2(n) \in O(\max\{g_1(n), g_2(n)\})$. **(04 Marks)**

c. Explain asymptotic notations with graph and example for each. **(08 Marks)**

2 a. Solve the recurrence relation for M(n), where M(n) denotes the number of moves in Tower of Hanoi puzzle for 'n' disks. **(05 Marks)**

b. Write an algorithm for selection sort. Obtain an expression for C(n) where C(n) denotes the number of times the algorithms basic operation is executed. **(08 Marks)**

c. Write Brute force string matching algorithm. Apply this algorithm to search the pattern "HIM" in the text "NOBODY-NOTICED-HIM". What is the worst case efficiency of an algorithm? **(07 Marks)**

3 a. Apply Quicksort algorithm to sort the string "ALGORITHMS". Draw the tree of recursive calls for the given string. **(07 Marks)**

b. Write the algorithm for Binary Search. Prove that its efficiency is $\log_2 n$ in average case. **(07 Marks)**

c. Discuss strassen's matrix multiplication algorithm. **(06 Marks)**

4 a. Write similarities and dissimilarities between depth first search and breadth first search. **(04 Marks)**

b. Write depth first search algorithm. Apply this algorithm for the following graph with C as a source node. **(10 Marks)**

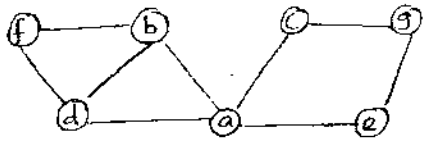

Fig. Q4 (b)

c. Explain how topological sorting algorithm is different from other sorting algorithms. Apply topological sorting algorithm for the following graph and write the sorted list of vertices. **(06 Marks)**

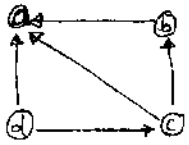

Fig. Q4 (c)

5 a. Write sorting by counting algorithm. Apply this algorithm to sort the list 62, 31, 84, 96, 19, 47, what the count array stores? **(10 Marks)**

b. Discuss Horspool's string matching algorithm. Apply this to find the pattern "BARBER" in the text "JIM-SAW-ME-IN-A-BARBER-SHOP". **(10 Marks)**

6 a. What is dynamic programming? Find transitive closure of a given diagraph using Warshall's algorithm. **(05 Marks)**

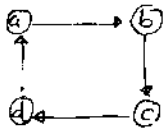

Fig. Q6 (a)

b. Write Floyd's algorithm. Apply this algorithm to find all pairs shortest path for the given digraph. **(08 Marks)**

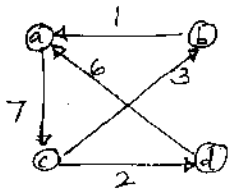

Fig. Q6 (b)

c. Using dynamic programming solve the following Knapsack instance.
$N = 4, M = 4$ $(\omega_1, \omega_2, \omega_3, \omega_4) = (2, 1, 3, 2)$
$(P_1, P_2, P_3, P_4) = (12, 10, 20, 15)$ **(07 Marks)**

7 a. Write Prim's algorithm. Apply this algorithm to find minimum cost spanning tree of a given graph. **(08 Marks)**

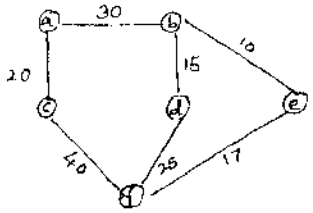

Fig. Q7 (a)

b. Apply Dijkstra's algorithm to find single source shortest path assuming vertex 'a' as a source node. **(06 Marks)**

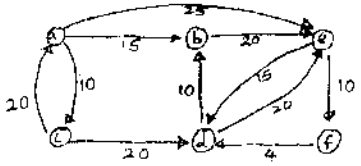

Fig. Q7 (b)

c. Define the following: i) Minimum cost spanning tree ii) Feasible solution iii) Optimal solution. **(06 Marks)**

8 a. Explain P, NP and NP complete problems with an example. **(06 Marks)**

b. Using Backtracking, solve subset sum problem for the following instance n = 5, d = 9, set S = {1, 2, 5, 6, 8} **(07 Marks)**

c. Draw state space tree of branch-and-bound technique to find optimal tour for travelling sales person for the given graph. **(07 Marks)**

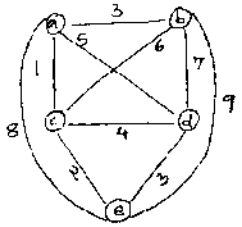

Fig. Q8 (c)

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