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10CS43

Fourth Semester B.E. Degree Examination, June/July 2015
Design and Analysis of Algorithms

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Discuss the various stages of algorithm design and analysis process using a flow chart. **(10 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. Consider the following algorithm :

```
Algorithm Mystery (n)
//input : A non negative integer n
S ← 0
for i ← 1 to n do
    S ← S + i * i
return S
```

i) What does this algorithm compute?
ii) What is its basic operation?
iii) How many times is the basic operation executed?
iv) What is the efficiency class of this algorithm? **(04 Marks)**

2 a. Write merge sort algorithm and discuss its efficiency. Sort the list E, X, A, M, P, L, E in alphabetical order using the merge sort. **(10 Marks)**

b. Design an algorithm for binary search, give an example. Show that the worst case efficiency of binary search is $\theta(\log n)$. **(10 Marks)**

3 a. Solve the following instance of knapsack problem using greedy algorithm. Knapsack weight M = 20. **(04 Marks)**

Item	1	2	3
Weight	18	15	10
Profit	25	24	15

b. Using the prim's algorithm, determine the minimum cost spanning tree for the graph of Fig. Q3(b). **(08 Marks)**

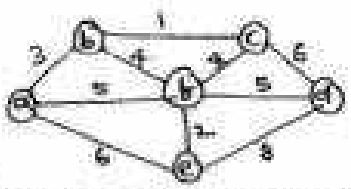

Fig.Q3(b)

c. Design the Dijkstra's algorithm and apply the same to find the single source shortest paths problem for the graph taking vertex 'a' as source in Fig. Q3(c). **(08 Marks)**

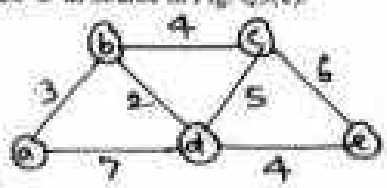

Fig.Q3(c)

4 a. Define transitive closure of a graph. Write Warshall algorithm to compute transitive closure of a directed graph. Apply the same on the graph defined by the following adjacency matrix.

$$\begin{bmatrix} 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 \end{bmatrix}$$

(10 Marks)

b. Using Floyd's algorithm, find all pair shortest path for the graph of Fig. Q4(b). (06 Marks)

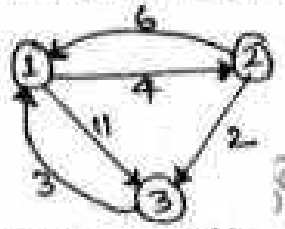

Fig.Q4(b)

c. Write a note on travelling sales person problem. (04 Marks)

PART – B

5 a. Write insertion sort algorithm. Apply it to arrange the following numbers in increasing order 89, 45, 68, 90, 29, 34, 17. (08 Marks)

b. Design a BFS algorithm to check the connectivity of a given graph. (08 Marks)

c. What is time-space trade off of an algorithm? (04 Marks)

6 a. Write short notes on :
i) Tight lower bound
ii) Trivial lower bound
iii) Information-theoretic lower bounds. (12 Marks)

b. Define decision tree? Draw the decision tree to sort the elements using insertion sort. (08 Marks)

7 a. Write the pseudo code for backtracking algorithm. Apply backtracking to solve the instance of the sum of subset problem : S = {3, 5, 6, 7} and d = 15. (10 Marks)

b. With the help of a state space tree, solve the travelling salesman problem of Fig. Q7(b), using Branch-and-bound algorithm. (10 Marks)

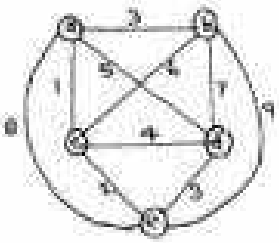

Fig.Q7(b)

8 a. What is prefix computing problem? Write the algorithms for prefix computation which uses: i) n processors ii) n/log n processors. (10 Marks)

b. 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 ⊕ stand for addition. Solve the problem using work optimal algorithm. (10 Marks)

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