USN | | | | | | | | | | 10CS43

Fourth Semester B.E. Degree Examination, Dec.2018/Jan.2019
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. Explain the different types of asymptotic notations with an example. **(09 Marks)**
   b. Explain the general plan for analyzing the efficiency of a recursive algorithm. Also explain the Tower of Hanoi puzzle. **(09 Marks)**
   c. Solve the following recurrence relation:
   $$x(n) = x(n-1) + 5 \quad \text{for } n > 1$$
   $$x(1) = 0$$
   (02 Marks)

2. a. Apply quick sort to sort the list 5, 3, 1, 9, 8, 2, 4, 7 in alphabetical order and give an algorithm for quick sort. **(08 Marks)**
   b. Explain merge sort algorithm and apply to sort the list in ascending order 8, 3, 2, 9, 7, 1, 5,4. **(08 Marks)**
   c. Consider the following set of 14 elements, list in an array list.
   $-15, -6, 0, 7, 9, 23, 54, 82, 101, 112, 125, 131, 142, 151.$
   When binary search is applied on these elements, find the elements which required maximum number of comparisons. Also determine average number of key comparisons for successful search and unsuccessful search. **(04 Marks)**

3. a. Using Kruskal's algorithm, obtain a minimum cost spanning tree for the graph given below Fig.Q3(a). **(07 Marks)**

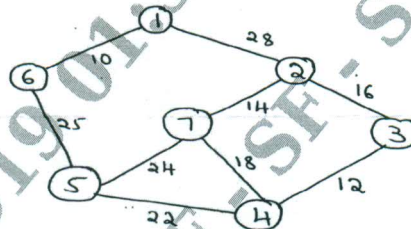

Fig.Q3(a)

   b. Solve the following instance of knapsack problem, using greedy technique:

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

Knapsack capacity M = 20. **(07 Marks)**
   c. Apply Dijkstra's algorithm to find the single source shortest path problem for the following graph shown in Fig.Q3(c), taking vertex "a" as the source. **(06 Marks)**
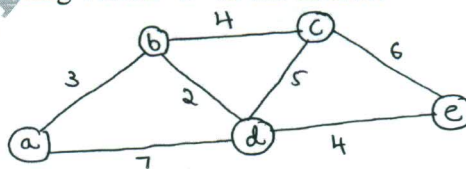

Fig.Q3(c)

10CS43

4 a. Using Floyd's algorithm, solve all pairs shortest path problem for the following graph. [Refer Fig.Q4(a)] **(10 Marks)**
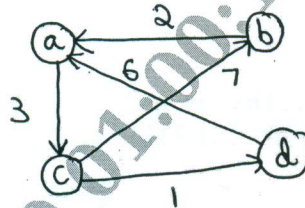

Fig.Q4(a)

b. Find the optimal solution and optimal tour in the graph using TSP. Use dynamic programming technique. **(10 Marks)**

$$\begin{bmatrix} 0 & 10 & 15 & 20 \\ 5 & 0 & 9 & 10 \\ 6 & 13 & 0 & 12 \\ 8 & 8 & 9 & 0 \end{bmatrix}$$

PART – B

5 a. Write an algorithm for comparison counting sort and also apply the algorithm to sort the list 62, 31, 84, 96, 19, 47. **(08 Marks)**

b. Show how Horspool's algorithm can be used to search for the pattern BARBER in a given text. Consider all the 4 cases. **(08 Marks)**

c. Apply source removal method to find the topological sorting for the digraph given below Fig.Q5(c). **(04 Marks)**
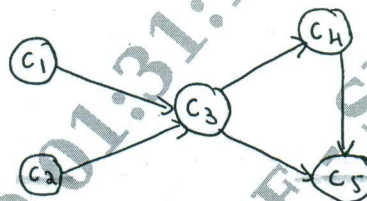

Fig.Q5(c)

6 a. Write the decision tree for the 3 element selection sort and insertion sort. **(10 Marks)**

b. Write a note on challenges of numerical algorithms. **(06 Marks)**

c. Define : (i) class P   (ii) class NP   (iii) Tractable problem   (iv) Polynomial reduction. **(04 Marks)**

7 a. Solve the following assignment problem using branch and bound technique: **(10 Marks)**

```
     Job1 Job2 Job3 Job4
   ⎡  9    2    7    8  ⎤ Person a
   ⎢  6    4    3    7  ⎥ Person b
   ⎢  5    8    1    8  ⎥ Person c
   ⎣  7    6    9    4  ⎦ Person d
```

b. Using backtracking technique, write the state space tree for finding a Hamiltonian circuit for the given graph.[Refer Fig.Q7(b)] **(04 Marks)**
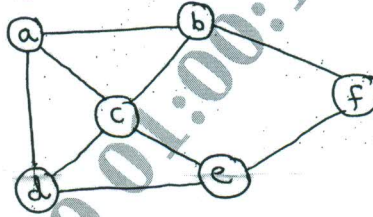

Fig.Q7(b)

c. Using back tracking, obtain a solution to the subnet problem by taking s = {3, 6, 5, 7} and d = 15. **(06 Marks)**

8   Write short notes on :
a. List ranking
b. Computational model. **(20 Marks)**

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