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)**
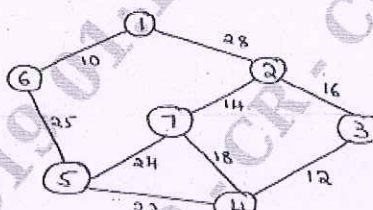

Fig.Q3(a)

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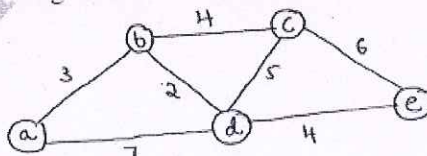
4   a. Using Floyd's algorithm, solve all pairs shortest path problem for the following graph.
        [Refer Fig.Q4(a)]   (10 Marks)

Fig.Q4(a)
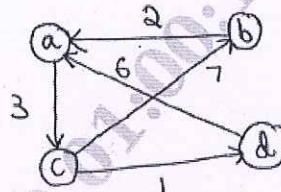
  b. Find the optimal solution and optimal tour in the graph using TSP. Use dynamic
      programming technique.   (10 Marks)

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

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
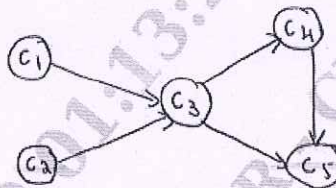   Fig.Q5(c).   (04 Marks)

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

$$\begin{bmatrix} 9 & 2 & 7 & 8 \\ 6 & 4 & 3 & 7 \\ 5 & 8 & 1 & 8 \\ 7 & 6 & 9 & 4 \end{bmatrix}$$ Person a
                                                              Person b
                                                              Person c
                                                              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)
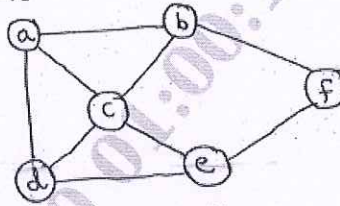

Fig.Q7(b)

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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