U.S.N | | | | | | | | | | |

P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belgaum)

Third Semester, Master of Computer Applications (MCA)

Semester End Examination; Dec - 2016/Jan - 2017

Analysis and Design of Algorithms

Time: 3 hrs *Max. Marks: 100*

***Note**: Answer **FIVE** full questions, selecting **ONE** full question from each unit.*

UNIT - I

1 a. Write an algorithm to compute *gcd* of two number using Euclid's algorithm (using repetitive subtraction). 5

b. Write the formal definitions of asymptotic notations. 6

c. Write the general plan for analyzing non-recursive algorithms. Also write an algorithm to find the largest of *N* elements and analyze its time efficiency. 9

2 a. Design an algorithm for brute-force pattern matching and obtain the time complexity in the best-case and worst-case. 10

b. Write the bubble sort algorithm and show that the worst-case efficiency is quadratic. 10

UNIT - II

3 a. Describe Binary search algorithm. Show that the worst case efficiency is $\theta(\log n)$. 10

b. Write the merge sort algorithm and find the time complexity using Master's theorem. 10

4 a. Write the pseudo code for Prim's algorithm. Apply the same for the graph in Fig. Q4(a). 10

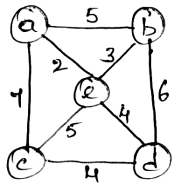


Fig: Q4(a)

b. Apply Greedy method to find an optimal solution to the Knapsack instance n = 7, m = 15, 10

$(P_1, P_2, P_3, P_4, P_5, P_6, P_7) = (10, 5, 15, 7, 6, 18, 3)$

$(w_1, w_2, w_3, w_4, w_5, w_6, w_7) = (2, 3, 5, 7, 1, 4, 1)$.

UNIT - III

5 a. Explain the three major variations of decrease and conquer with an example each. 12

b. Consider the graph Fig. Q5(b)

i) Write down the adjacency matrix for the graph

ii) Starting at vertex *a* and resolving ties by the vertex alphabetical order, traverse the graph by DFS and construct the corresponding DFS tree. Give the order in which the vertices were reached for the first time and the order in which the vertices become dead ends. 8

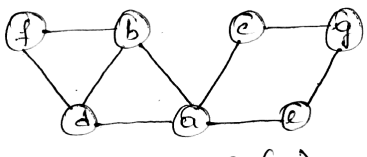


Fig : Q5(b)

Contd.....2

6 a. Write the pseducode to sort *N* elements using comparison counting method. Apply the same to sort the elements: 62, 31, 84, 96, 19, 47. 10

b. What is Topological sorting? Apply DFS-based algorithm to solve the topological sorting problem for the diagraph in Fig. Q6(b).

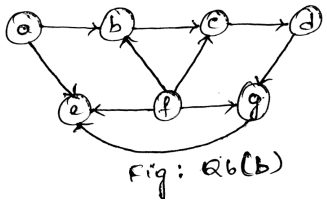


Fig : Q6(b) 10

UNIT - IV

7 a. Solve the all-pairs shortest path problem for the diagraph with the weight matrix.

$$\begin{bmatrix} 0 & \infty & 3 & \infty \\ 2 & 0 & \infty & \infty \\ \infty & 7 & 0 & 1 \\ 6 & \infty & \infty & 0 \end{bmatrix}$$ 10

b. Solve the following TSP which is represented as a graph Fig : Q7(b)

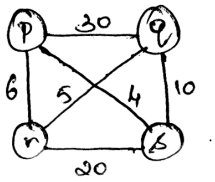


Fig: Q7(b). 10

8 a. Write short notes on P, NP and NP Complete problems. 12

b. Explain any two methods for establishing lower bounds. 8

UNIT - V

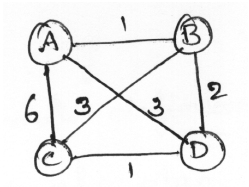
9 a. Apply backtracking to solve the following instance of the subset-sum problem :
S = {1, 2, 5, 6, 8} and d = 9. 10

b. Solve the following instance of the Knapsack problem by the branch-and-bound algorithm.

Item	Weight	Value
1	4	$40
2	7	$42
3	5	$25
4	3	$12

W = 10 10

10 a. Solve the following instance of the traveling salesperson problem using nearest-neighbor algorithm.



10

b. Explain the different types of computational models. 10

* * *