Nirma University

Institute of Technology

Semester End Examination (IR), May - 2017

B. Tech. in Computer Engineering / Information Technology, Semester-VI

CE601 Design and Analysis of Algorithms

Roll / Exam No. | Supervisor's Initial with Date

Time: 3 Hours | Max Marks: 100

Instructions:
1. Attempt all the questions.
2. Figures to right indicate full marks.
3. Draw neat sketches wherever necessary.

Section I

Q-1 Do as directed **[18]**

a) Design an optimal algorithm to perform sorting of an array consisting of n elements using merge sort. Analyse time complexity of the algorithm by showing step by step calculations for each step of the algorithm. [10]

b) What is the significance of "Asymptotic notations" in analysing the time complexity of an algorithm? Differentiate between each of the asymptotic notations through suitable examples and figures. [8]

Q-2 Do as directed **[16]**

a) What is the advantage of using "Fibonacci Heap"? Describe all its operations in detail. [6]

OR

a) Given an array A of size n and containing integer values (Z). Design an algorithm to compute the maximum sum of the subarray. [6]

b) Propose an optimal solution to the "8-Queens problem" using backtracking. [6]

c) What is the significance of "Disjoint set structures"? Explain any one of its operations in brief. [4]

Q-3 Do as directed **[16]**

a) How can the method of "Potential function" be used to perform amortized analysis of an algorithm? [6]

OR

a) Explain the following terms with examples :- [6]
1) P 2) NP-Complete 3) NP-Hard

b) What is the primary requirement to perform search operation using "binary search"? Can we use linked list to implement "binary search"? Give suitable reasons for your answer. [6]

c) Which are the "worst case" scenarios possible in the Quick sort algorithm? What will be the running time of the algorithm in those scenarios? [4]

Section II

Q-4 Do as directed **[16]**

a) Solve the recurrence by Recurrence Tree method. [4]
$T(n) = 4T(n/2) + n^2$

b) Solve the following recurrence relation. [4]

$T(n) = 1$, if $n=1$

$= 4T_{(n-1)} - 2^n$, otherwise.

c) Dynamic Programing Approach always gives an optimal solution. [4]
True or False? Explain with justification and example.

d) What do you mean by smooth function? How do you find out whether a given function is smooth or not? Give a suitable example. [4]

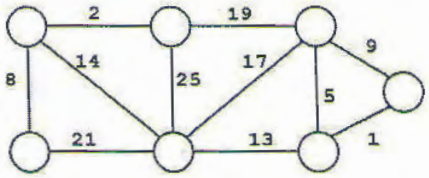
OR

d) Solve the Knapsack problem for the following data using Greedy Approach. Total capacity of knapsack is 100 Kg. [4]

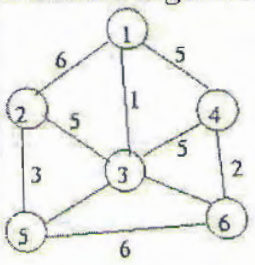
	Object 1	Object 2	Object 3	Object 4	Object 5
Weights (Kg)	10	20	30	40	50
Values (Rs.)	20	30	66	40	60

Q-5 Do as directed **[16]**

a) For the following graph, find minimum spanning tree using Prim's algorithms by applying Greedy Approach. [8]



b) For the following graph, find minimum spanning tree using Kruskal's algorithms by applying Greedy Approach. [8]



OR

b) Prove that for finding n^{th} Fibonacci number using dynamic programing approach, the complexity is in O(log n). [8]

Q-6 Do as directed **[18]**

a) Given two strings, X = abbccccb and Y = abdccabb. Find the long common subsequence of X and Y using dynamic programing. [6]

b) Find the optimal order and cost for multiplying the matrices :- [6]

A × B × C × D × E using dynamic programming.

where A is 10×4, B is 4×5, C is 5×20, D is 20×2 and E is 2×50

c) For the following diagram, solve the single source shortest problem using Dijikstra's Algorithm. [6]