# Nirma University

## Institute of Technology

Semester End Examination (IR), December - 2016

B. Tech. in Information Technology, Semester-VII

2CE339 Analysis and Design of Algorithm

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) Illustrate the working of Insertion sort algorithm by applying it on the sequence of elements :- <70, 30, 40, 10, 80, 20, 60, 50>. Comment on its complexity in worst case. [6]

b) Illustrate the working of Merge sort algorithm by applying it on the sequence of elements :- <50, 20, 40, 70, 10, 30, 20, 60>. Comment on its complexity in best case. [6]

c) Prove the correctness of "PARTITION" procedure in Quick sort. [6]

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

a) Apply Recursion Tree method on the following recurrence relation :- $T(n) = 3T(n/4) + n^2$ [6]

**OR**

a) Solve the following recurrence relation using Master method :- $T(n) = 2T(n/2) + 10n$ [6]

b) Solve the following recurrence relation using "Change of variable" method :- $T(n) = 2T(\sqrt{n}) + \log n$ [6]

c) What is the significance of asymptotic notations? Explain Big-Oh notation and Big-Omega notation through suitable examples. [4]

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

a) Let G = (V,E) be a complete undirected graph of 4 vertices and 6 edges. Weights of the edges are 1, 2, 3, 4, 5 and 6. What can be the maximum weight of the Minimum Spanning Tree? [6]

**OR**

a) Let G = (V,E) be the weighted undirected graph of 4 vertices whose edge weights are as follows:- [6]
w(1,2) = 2, w(1,3) = 8, w(1,4) = 5,
w(2,1) = 2, w(2,3) = 5, w(2,4) = 8,
w(3,1) = 8, w(3,2) = 5, w(3,4) = X,
w(4,1) = 5, w(4,2) = 8, w(4,3) = X.
Calculate the largest possible integer value of X, for which at least one shortest path between some pair of vertices will contain the edge with weight X.

b) An array consists of six elements:-15, 19, 10, 7, 17, 16. Sort it in ascending order using heap sort. [6]

c) Calculate the time complexity of the following function :- [4]

```
int fun (int n)
{
if (n == 2)
return 1;
else
return (fun(floor(sqrt(n))) +n );
}
```

NOTE:- n is a multiple of 2

**Section II**

**Q-4 Do as directed** **[18]**

a) For a binary heap, the following operation is defined :- [6]
Delete(i) -> To delete the item in the $i^{th}$ node. It is given that depth of the binary heap is d and it is implemented in an array. Find the time complexity to refix the heap after removal of an element.

b) Explain the importance of "Disjoint Set Structures" through suitable examples. [6]

c) Differentiate between the following terms with proper example:- [6]
i) Greedy Approach vs. Dynamic Programming
ii) Djikstra's Algorithm vs. Floyd's Algorithm

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

a) Consider four matrices A, B, C and D with their dimensions being (10,20), (20,50), (50,1) and (1,100) respectively. Compute the total number of scalar multiplications required to perform the following operations:- 1) A x (B x (C x D)) and 2) (A x (B x C)) x D [6]

**OR**

a) Propose an optimal solution to the "Job Scheduling Problem with deadlines" through a suitable example. [6]

b) What is the advantage of "Hashing" technique? How do we organize all the elements/values (keys) to implement hashing? Explain any two collision-resolution techniques through suitable examples. [6]

c) Propose an optimal solution to the "Fractional Knapsack problem" with a suitable example. [4]

**Q-6 Do as directed** **[16]**

a) Discuss the solution of "8-Queens problem" through backtracking. [6]

**OR**

a) Given a set S of n activities with start time, $S_i$, and finish time, $F_i$ ,of an $i^{th}$ activity. Design a greedy algorithm which computes the maximum size of mutually compatible activities. [6]

b) Which important properties must be possessed by the problems that are solved using "Dynamic Programming"? [6]

c) Differentiate between :- Prim's algorithm and Kruskal's algorithm. [4]