# Data Structures and Algorithms

| Topic | No. of Sessions |
|---|---|
| **Introduction** | **1** |
| **Induction** | **1** |
| **Analysis of algorithms** | |
| • Growth of functions | **1** |
| • Recurrence relations | **1** |
| **Design of algorithms** | |
| • Divide and conquer: The skyline problem, Counting inversions, Finding the closest pair of points | **3** |
| • Greedy algorithms: Interval scheduling, Scheduling to minimize lateness | **2** |
| • Dynamic programming: Weighted interval scheduling, Segmented least squares, Knapsack problem | **3** |
| **Data structures** | |
| • Stack and queues, Linked lists, Rooted trees | **1** |
| • Direct-address table, Hash table, Hash function | **1** |
| • Binary search tree, AVL trees, Red-Black trees | **1** |
| • Graphs | **1** |
| **Graph algorithms** | |
| • Depth-first search, topological sort, strongly connected components | **2** |
| • Greedy shortest paths | **2** |
| • Network flow: max-flow-min-cut theorem, bipartite matching | **2** |
| **Algorithms involving sequences and sets** | |
| • Binary search and variations | **1** |
| • Sorting: Insertion sort, Bucket sort, Mergesort, Heapsort | **2** |
| **Randomized algorithms** | |
| • Quicksort | **1** |
| • Load balancing | **1** |
| **Computability and complexity** | |
| • P vs NP, NP-hardness, Cook-Levin Theorem | **1** |
| • NP-hardness reductions: 3SAT, Independent Set, Clique, Vertex Cover | **1** |
| • Undecidability: Halting problem, diagonalization, reductions, Rice's theorem | **1** |

## References:


[1] Jon Kleinberg, and Eva Tardos, *Algorithm design*, Pearson, 2006.

[2] Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, *Introduction to Algorithms*, 3rd Edition, MIT Press.

[3] Udi Manber. *Introduction to algorithms: a creative approach*. MA: Addison-Wesley.