Algorithms and Theory of Computation
Syllabus

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1. Basic Tools and Techniques: order notation, induction, recurrence relations. Summing sequences (BB:1-4, CLRS:1-3); lower bound for comparison-based sorting algorithms (CLRS:8.1).

2. Divide and conquer algorithms: quick sort, insertion sort, heap sort, linear time selection. (BB:7, CLRS:4 &, 6-8)

3. Union-find problems, priority queues. (CLRS:6.5 & 19, 21)

4. Greedy Algorithms: minimum spanning tree, graph traversal, shortest path algorithms, rational Knapsack problem. (BB:6, CLRS:16, 23)

5. Dynamic Programming. 0-1 knapsack problems, shortest paths, optimal binary search trees, matrix chain products. (BB:8, CLRS:15)

6. Graph Algorithms: breadth-first, depth-first-search, topological sort, strongly connected components, All pair shortest paths, Maximum flow & Branch and Bound. (BB:9, CLRS:22, 24, 25, 26)

7. Probabilistic Analysis and Randomized Algorithms. (CLRS:5)

8. NP-completeness: the classes P and NP, NP-complete problems, Cook's Theorem, Hamiltonian Circuit and other examples of NP-complete problems, dealing with NP-complete problems. NP-hard problems. (CRLS:34, BB:12.5)

Algorithms and Theory Bibliography

1. [CLRS] Cormen, Leiserson, Rivest, and Stein, *Introduction to Algorithms*, Third Edition, MIT Press 2009.

2. [BB] Giles Brassard and Paul Bratley, *Fundamentals of Algorithms*, Prentice Hall, 1996.