Content:

**Divide and Conquer 分治法**

Topics:

*Karatsuba（大整数乘法4->3）、Strassen（大矩阵乘法8->7）、Sorting（归并排序）*

*Counting Inversions（逆序对计算）、Median-of-the-median（5个5个一组排序然后取中位数）*

*Closest pair（最近点对）、Fast Fourier Transform（快速傅里叶变换）*

Master Theorem主定理进行算法复杂度递推式分析**（样例可以多注意）或者猜后再证**

正确性证明：基于归纳法进行证明（Induction）

**Graph Algorithms 图相关算法**

Topics:

*DFS, BFS, Dijkstra, Bellman-Ford, Floyd-Warshall (DP), Kruskal and Prim(Greedy)*

*Find SCC or cycle (based on DFS). Traverse the graph (DFS&BFS ok). Cross edge and back edge.*

*最短路径算法 BFS for unweighted single source. Dijkstra for positive weighted single source.*

*Bellman-Ford for general weighted single source and Floyd-Warshall for all.*

**Greedy贪心算法**

Topics:

*Exact Algorithms: MST (minimum spanning tree), Task Schedule (earliest first) & Huffman Coding*

*Prim & Kruskal (Union-Find Set, Path Compression)*

*Key: Show that the solution at the current iteration is still a part of an optimal solution.*

*Approximation Algorithms: Make-span Minimizing & set cover/ max-k-coverage*

*Easy to design but hard to analyze.*

*Require adequate understanding on the problem’s nature. Find a “reference” that your solution can compare with. Reference: OPT, or lower bound (upper bound) to OPT. and other tricks….*

***Dynamic Programming 动态规划***

*Topics:*

*从DAG入手，需要理解整个状态转移的过程。*

*LIS (最长不减子序列), Edit Distance (字符串转换且改变次数最小), Knapsack (背包问题)*

*Floyd-Warshall, Independent Set on Trees (also a greedy algorithm)*

*Correctness证明 induction: Validity of recurrence relation is just the validity of inductive step!*

***Flow and Matching 流问题与匹配***

*Topics:*

*Ford-Fulkerson Algorithm O(|E|\*fmax)*

*Edmonds-Karp Algorithm O(|V|\*|E|^2)*

*Dinic's Algorithm O(|V|^2\*|E|)*

*需要理解这几个算法的核心推导过程以及分析理解的过程。*

***Linear Programming 线性规划问题***

*Topics:*

*包括计算最优计算Optimal等等*

**Hardness and Approximation Algorithms 困难问题与近似算法**

Topics:

NP-complete只是判定问题！ NP-hard有更多更复杂的问题。

课上提供的都可以直接拿来使用来证明问题

**背包九讲|数独问题|经典DP问题|作业|经典NP问题|机考作业题及代码|整数规划问题是NPC|反悔贪心**