

《近似算法》教学大纲

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English:

For many important optimization problems, there are no known polynomial-time algorithms that can compute the exact optimum. In particular, using the concept of NP-completeness, one can show that a great number of problems are equally hard to solve, in the sense that the existence of a polynomial-time algorithm for any one of them would imply polynomial-time algorithms for all the rest. Approximation algorithms have since been developed in response to such apparent hardness of these problems by relaxing the algorithm designer's goal to pursue the exact optimum. Instead, we aim to efficiently compute a solution that can closely approximate the optimal solution in terms of its value. Such trade-off between optimality and tractability is the paradigm of approximation algorithms. This summer course will cover the fundamental concepts in approximation algorithms. The topics we will discuss include 1) Greedy algorithms and local search; 2) Rounding data and dynamic programming; 3) Deterministic and randomized rounding of linear programming; 4) Randomized rounding of semidefinite programming, and 5) The primal-dual schema.

中文:

对于现实生活中的许多重要的优化问题，我们并不知道如何在多项式时间内计算出这些问题的最优解。于此同时，利用 NP 完全性定理我们可以证明有许多问题具有相同的难度，其中任何一个问题具有多项式时间的算法都意味着全部这些问题都具有多项式时间的算法。近似算法就是在如此环境下发展起来，为了调和最优性与可计算性的矛盾的一种计算方法。在近似算法中，我们不再要求必须计算出问题的准确最优解，而是希望能够在多项式时间内得到一个近似的最优解。在这个暑期学期中，我们将会讨论如何利用近似算法中得各种方法和技巧，以及如何运用它们来解决不同类型的问题，其中包括 1) 贪心算法和局部搜索；2) 数据取整和动态规划；3) 线性规划的确定性和随机性取整方法；4) 半正定规划的随机取整方法；5) 原对偶方法