Advanced Lecture

Approximation Algorithms

Winter 2008/09

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Organizational Issues

- Time and Room:
  - Tuesdays 12-14 in E1.4 room 024
  - Thursdays 12-14 in E1.3 room 003
- Break?
- Please fill in the list of participants
- Integrated lecture: 3+1

Exercise Sessions

- About every two weeks
- Exercises (homework)
  - Different levels of difficulty
  - At least one week for solving
  - Additional material
- We expect you to participate actively!
- You present the solutions

Credit (6 LP)

- Regular participation of lecture and exercise sessions.
- Active participation in exercise sessions
  - Exercises have associated points (typically 1 or 2)
  - Each participant who presents a solution at the board earns points.
  - At the end of the semester each participant should have at least 3 points.
- Exam in the last week of the semester.

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Course page:

http://www.mpi-inf.mpg.de/~rraman/approxCoursePage.html

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Introduction/Motivation

NP-hard Optimization Problems

Most interesting optimization problems are **NP-hard**!

Insist on optimal solutions
→ **exponential** time

Satisfied by suboptimal solutions
→ **polynomial** time

Performance analysis
of suboptimal polynomial time algorithms

- How to assess the **performance of algorithms**?
- How to compare algorithms?
- Various approaches for measuring the performance
  - Empirical analysis
  - Average case analysis
  - **Worst case analysis**
- An **approximation algorithm** finds in **polynomial time** a solution that is **guaranteed** to be within a constant factor of an optimal solution.

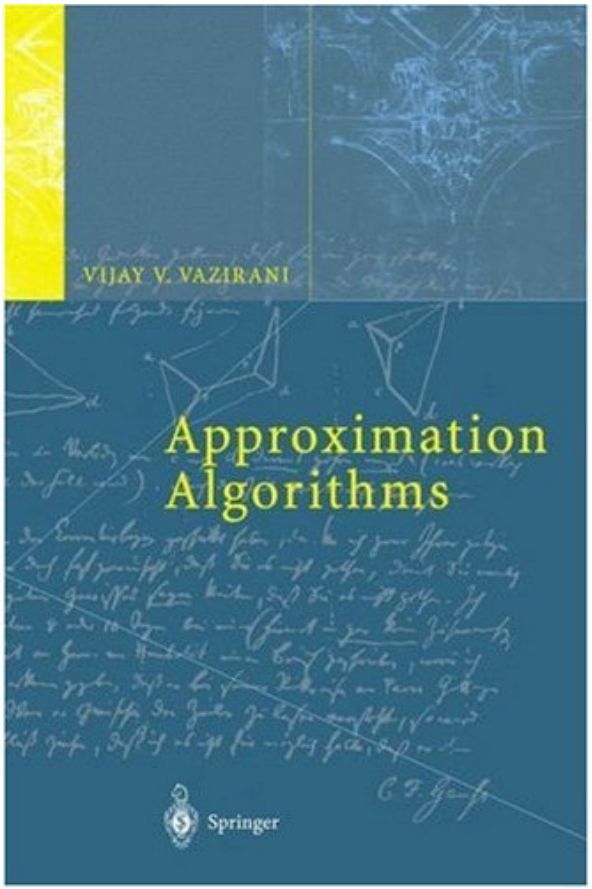
Goal of the course

- **broad introduction** into the design and analysis of approximation algorithms
- **fundamental techniques**, **problems**, and **results** in this area
- **Techniques**
  - Greedy algorithms, combinatorial techniques
  - Approximation Schemes and Dynamic Programming
  - Local Search
  - Linear Programming, Randomized Rounding
  - Primal-Dual and Local Ratio
  - Semi-definite Programming, …

Goal of the course

- **broad introduction** into the design and analysis of approximation algorithms
- **fundamental techniques**, **problems**, and **results** in this area
- **Problems**
  - Vertex Cover, Set Cover
  - Traveling Salesman Problem
  - Knapsack, Bin packing
  - Multiprocessor Scheduling
  - Connectivity, Network Design
  - Cut and Flow problems, …

References



- Book by Vijay Vazirani
  Approximation Algorithms
  Springer, 2001

- Additional recent articles