

Approximation Algorithms (ADM 3, winter 2010/2011): List of covered Topics

Introduction to the techniques: set cover (Chapter 1)

- LP rounding, dual rounding, primal-dual, greedy (1.1-1.6)

Greedy algorithms and local search (Chapter 2)

- k-center (2.2)
- Scheduling jobs on identical parallel machines (2.3)
- The traveling salesman problem (2.4)
- Maximizing float in bank accounts (2.5)
- Finding minimum-degree spanning trees (2.6)

Rounding data and dynamic programming (Chapter 3)

- The knapsack problem (3.1)
- Scheduling jobs on identical parallel machines (3.2)

Deterministic rounding of linear programs (Chapter 4)

- Solving large LPs via the ellipsoid method (4.3)
- The prize-collecting Steiner tree problem (4.4)
- The uncapacitated facility location problem (4.5)

Random sampling and randomized rounding of linear programs (Chapter 5)

- Simple algorithms for MAX SAT and MAX CUT (5.1)
- Derandomization (5.2)
- Flipping biased coins (5.3)
- Randomized rounding (5.4)
- Choosing the better of two solutions (5.5)
- Non-linear randomized rounding (5.6)
- The prize-collecting Steiner tree problem (5.7)
- The uncapacitated facility location problem (5.8)
- Chernoff bounds (5.10)
- Integer multicommodity flows (5.11)

Randomized rounding of semidefinite programs (Chapter 6)

- A brief introduction to semidefinite programming (6.1)
- Finding large cuts (6.2)
- Approximating quadratic programs (6.3)
- Coloring 3-colorable graphs (6.5)

The primal-dual method (Chapter 7)

- The set cover problem: a review (7.1)
- The feedback vertex set problem in undirected graphs (7.2)
- The shortest s-t path problem (7.3)
- The generalized Steiner tree problem (7.4)
- The uncapacitated facility location problem (7.6)

Cuts and metrics (Chapter 8)

- The multiway cut problem and a minimum-cut based algorithm (8.1)
- The multiway cut problem and an LP rounding algorithm (8.2)
- The multicut problem (8.3)
- Probabilistic approximation of metrics by tree metrics (8.5)
- The buy-at-bulk network design problem (8.6)

Further uses of greedy and local search algorithms (Chapter 9)

- Local search for the uncapacitated facility location problem (9.1)
- Local search for the k-median problem (9.2)

Further uses of deterministic rounding (Chapter 11)

- Minimum-cost bounded-degree spanning trees (11.2)
- Survivable network design (11.3)

Further uses of randomized rounding of semidefinite programming (Chapter 13)

- Approximating quadratic programs (13.1)
- Coloring 3-colorable graphs (13.2)
- The unique games problem (13.3)
- A reduction from the unique games problem to the multicut problem (16.5)

Further uses of the primal-dual method (Chapter 14)

- The prize-collecting Steiner tree problem (14.1)

Further uses of randomized rounding (Chapter 12)

- The Steiner tree problem (12.3)

Open problems (Chapter 17)