Combinatorial Optimization

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LEC-00

DT. 10/01//22

Prerequisite

- Linear Algebra
- Introduction to Probability
- Data Structures
- Design and Analysis of Algorithms
- Discrete Structures

Credits, hours, and timings

- Credits: 3
- Number of hours: 40 – 45
- Timings
  - Monday: 11 – 11: 55
  - Wednesday: 10 – 10:55
  - Thursday: 9 – 9:55

Topics to be covered

- Introduction and Motivation
- Some classic optimization problems

  Network flows

  Bipartite Matching
- Polyhedral Combinatorics and Linear Programming
- Matroids and Matroid Intersection
- Approximation Algorithms for NP-hard problems

Course objective

- We focus on designing exact and approximation algorithms for solving combinatorial optimization problems
- Combinatorial algorithms for some classic optimization problems
- Linear programming approach for these problems
- When problems can be solved exactly using linear programming
- Iterative-rounding: an useful paradigm in designing LP-based algorithms
- Extension complexity: limitations on LP-based algorithms

Evaluation

- Two exams: 20% + 30% = 50%
- Assignment: 20%
- Class performance: 10%
- Presentation: 20%

Books

- C. Papadimitriou and K. Steiglitz, Combinatorial Optimization: Algorithms and Complexity, Prentice-Hall, 1982
- Lex Schrijver: Combinatorial Optimization: Polyhedra and Efficiency, 3-Volume book, Springer-Verlag, 2003
- **Reference Books**
  - J. Lee, A First Course in Combinatorial Optimization, Cambridge University Press, 2004
  - W. Cook, W. Cunningham, W. Pulleyblank and A. Schrijver, *Combinatorial Optimization*