

CO 471/671 Course Outline
Spring 2020
Instructor: S. Vavasis

1 Format

The course will be delivered via pre-recorded lectures posted on-line with live interactive office hours.

2 Course requirements

- Seven problem sets. The first six are each worth 15% of the final mark, with the lowest dropped (so a total of 75%). The last is worth 25% of the final mark.
- Two one-on-one oral exams per student. Each oral exam will go over one of the problem sets. Students will have an opportunity to partially earn back lost marks by correcting problem set mistakes during the exam.
- Grad students enrolled in CO671 will have one extra question per problem set compared to undergrad students enrolled in CO471.

3 Topics covered

1. Review of convexity, linear programming, and semidefinite matrices.
2. Introduction to semidefinite programming.
3. Weak and strong duality.
4. Properties of the semidefinite cone.
5. Ellipsoid method for semidefinite programming.
6. Interior-point methods.
7. Applications to approximation algorithms.
8. Applications to geometric graphs.
9. Applications to statistics and machine learning.
10. First-order methods

4 Text

The first 60% of the course will use material from L. Tuncel, *Polyhedral and semidefinite programming methods in combinatorial optimization*, 2010. The remainder will be based on recent literature.

5 Prerequisites

- For undergraduates: MATH 239 or 249, AMATH/PMATH 331 or PMATH 351, CO 255; Cumulative overall average of at least 80%.
- For grad students: Prior courses on linear programming, multivariate calculus, and introductory real analysis.