CS6550: Advanced Algorithms: Techniques for Optimization and Sampling

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The design of algorithms is traditionally a discrete endeavor. However, many advances have come from a continuous viewpoint. Typically, a continuous process, deterministic or randomized is designed (or shown) to have desirable properties, such as approaching an optimal solution or a desired distribution, and an algorithm is derived from this by appropriate discretization. We will use this viewpoint to develop several general techniques and build up to state-of-the-art in polynomial algorithms for optimization and sampling. These techniques include:

- Reduction
- Elimination
- Conditioning
- Geometrization
- Expansion
- Sparsification
- Acceleration
- Decomposition
- Discretization

Prerequisite: CS6515 (graduate algorithms) or equivalent, basic knowledge of probability and linear algebra.

Textbook (draft, with Yin Tat Lee)

Grading:
HW (30%): Biweekly HW. You are encouraged to collaborate on HW, but must write your own solutions. Submit via gradescope (link on canvas).

Three in-class mid-term exams (20%+25%+20% each).

Send comments on textbook via this form (up to 0.5% per chapter and 5% total).

Bonus (up to 10%): simpler proofs, new exercises.