ISyE 4133: Advanced Optimization

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Lecture: TU,TH 1:30PM-2:45PM, Instr Center 111.
Office Hours: TU 3:00PM-4:00PM.
Teaching Assistant: Michael Wang (Office hours:11:00 AM-12:00 NOON Monday, Wednesday), Alex Forney (Office Hours: Monday 1-2pm, ISyE Main 342).

1 Course Outline

Many real-world problems require advanced techniques to formulate and solve large scale optimization problems. Sometimes even new optimization algorithms and procedures need to be designed. The objective of this class is to help students learn the basic theory in the area of optimization. They will also gain practical skills to model and solve real-world problems. Students will learn

- a deeper understanding of the key concepts, theory, and algorithms of linear optimization, integer optimization, and some modern convex optimization,
- more advanced modeling techniques,
- ways of solving optimization problems that are too hard, too large for direction solution,
- ways of solving optimization problems faster when speed is essential,
- ways to assess the quality of sub-optimal solutions.

1.1 Topics

Modeling of Optimization Problems. Algorithms for Linear Programming . Simplex Method. Structure of Polyhedra. Duality in Linear Programming. Primal-Dual Methods. Column Generation, Constraint Generation. Decomposition Methods for Linear programming. Integer Programming algorithms. Cut Generation. Branch and Bound. Branch and Cut. Lagrangian Duality. Approximation Algorithms. Non-Linear Programming. Convex Optimization. First Order Methods.

Usage of optimization software to solve small as well as large scale problems.

1.2 Grading

1. Assignments (Every week / every 2 weeks): 20 Points
2. Class Quizzes: 10 points
3. Project: 10 points.
4. Mid-Term: 20 points.
5. Final: 40 points.

1.3 Academic Honor Code

Please review the Georgia Tech Academic Honor Code. The directions for assignments, quizzes, etc will be provided.

1.4 Resources

Canvas: This course will be hosted on the Canvas (and not the old T-square system). Homework assignments and solutions, and other announcements will be posted on Canvas.

Piazza: There is a Piazza for this course, which can be accessed through Canvas. Please use Piazza for discussions with other students. TAs and Instructors will look out but will not be regularly on it.

Contacting the instructors: If you have general question about the content, homeworks or logistics of the course, you are encouraged to post it on Piazza. That will help clear up issues for all students. Feel free to also respond to the questions from your friends on Piazza. If you want to email the instructors, please start your subject with [ISYE 4133]. We also hold regular office hours, please do show up for them.

Notes: Class notes will be provided for each lecture which will be primary source. The following textbooks are recommended.

1. Guenin, Bertrand, Jochen Könemann, and Levent Tuncel. A gentle introduction to optimization. Cambridge University Press, 2014.
2. Bertsimas, Dimitris, and John N. Tsitsiklis. Introduction to linear optimization. Vol. 6. Belmont, MA: Athena Scientific, 1997.