AMATH 515
Optimization: Fundamentals and Applications

Winter 2023, MW 9:00 - 10:20, SMI 211

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Course Description and Objectives. We give a basic introduction to optimization, including modeling, algorithms, and theory. This class serves students gearing up for research in optimization methods, as well as users of optimization in applied areas.

The course covers a range of problem types and algorithms, with detailed motivating examples and emphasis on building blocks and practical implementation. Theoretical development that supports these concepts is also presented, including some concepts of convex analysis and duality, and simple analysis of first-order algorithms and underlying properties of building blocks that we use.

Prerequisites. Proficiency in linear Algebra and advanced calculus/analysis. Strongly recommended: familiarity and/or strong interest in statistics, as many of our models require statistical modeling. Prior courses in optimization (along the lines of 408) are very helpful, as is programming experience in Python or similar language.

References.

- *Course notes*. These will be available on Canvas.
- *Convex Optimization*, Stephen Boyd. (Helpful secondary reference).
- *First-Order Methods in Optimization*, Amir Beck. (Helpful secondary reference).
- *Numerical Recipes*, Nocedal and Wright. (Helpful secondary reference).
- Papers discussed in class will be available on Canvas.

Course Webpage. `https://canvas.uw.edu/courses/1611202`.
You can find this directly through Canvas.

Grading Policy. Grading will be based on **five homework assignments**. The homeworks will cover modeling, theory, and computation. Homework will be submitted via Gradescope. Use code **G28RBR** to register at `gradescope.com`.

All theoretical solutions must be typeset and uploaded using the PDF format; we recommend LaTeX is recommended for typesetting. LaTeX solution templates for the homeworks are provided on the website, and if you're new to LaTeX, we recommend using the simple editor available for free at `overleaf.com`.

Computational solutions will be uploaded to gradescope and **automatically graded**. Python starter files will be provided on the course website.

A starter homework, called Homework 0, is provided to make sure you are comfortable with all aspects of the class. You have a week to complete this homework; please complete it as