Lecture 1 – Course Overview

Module 1 – Welcome and Introduction

CS/ISyE/ECE 524

Welcome & Introduction Module Learning Outcomes

By the end of this module, you should….

- Know what to expect in this class
  - Logistics
  - Tentative(!) schedule of topics
- Understand the basic components of optimization (languages, solvers, algorithms, models)

Logistics

Class structure:

Lecture videos: Posted weekly

“In-person” times: MW 2:35-4:10pm

F 9:35-11:10am

Watch videos and bring questions to live sessions. Practice problems will be available to work on during live sessions

Instructional staff:

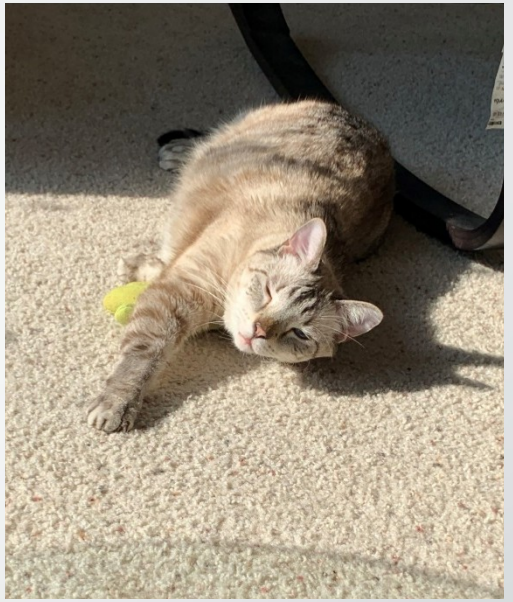
Instructor: Dr. Amanda Smith

TA: Emad Sadeghi

First live session will be Wednesday, June 17

Who am I?

- **Your instructor:** Amanda Smith
  - B.S. IE, UW-Madison (2013)
  - Esker, Inc. (2011-2014)
  - U.S. Federal Government (2014-2015)
  - M.S. IE (DSOR), UW-Madison (2016)
  - Ph.D. IE (Optimization), UW-Madison (2018)
  - Now: Associate Chair for Undergraduate Affairs
  - For fun: Reading, constantly drinking coffee, hanging out with my cat



- **Your turn!**
  - Fill out survey on Canvas
  - Make sure you complete it before the end of the first week (June 19)!

Course webpage

We will use Canvas for pretty much everything!

Lecture slides & videos

Assignments

Grading

Discussion

Announcements….

All assignments will need to be submitted ***electronically***

Make sure you can login to your Canvas account!

Prerequisites

Some familiarity with linear algebra (Math 340 or equivalent)

- Basic understanding of matrices, vectors
- We will review most concepts as needed

Comfortable with programming (introductory CS course)

- If you've never written code before in your life, this course will be ***very difficult***
- Experience with numerical computing (MATLAB, R, Julia, Python) will be very helpful

Computing

- We will exclusively use **Julia** in this course
  - New scientific computing language (like Python, MATLAB)
  - Open-source (no license needed!)
  - Very fast

Course Learning Objectives

Extract a sensible mathematical model from a problem description provided in plain text and solve the problem. Specifically:

- Identify decision variables, algebraic constraints, and an objective function.
- Categorize the model type (LP, MIP, QP, NLP, etc.).
- Simplify the model if possible.
- Implement and solve the problem in Julia
- Interpret the solution and provide an answer in plain text.

Demonstrate an intuitive understanding for broad classes of optimization models. Specifically:

- Visualize and illustrate algebraic constraints geometrically.
- Summarize the general algorithmic techniques used to solve different classes of optimization problems and comment on their efficiency, reliability, and scalability.
- Perform appropriate sensitivity and trade-off analyses

Coursework

HOMEWORK: 50%

MIDTERM EXAM: 15%

GROUP PROJECT: 35%

PIAZZA DISCUSSION PARTICIPATION: EXTRA CREDIT! (SEE SYLLABUS FOR DETAILS)

Homework (Problem solving) (50%)

- Approximately weekly (6-8 total)
- First homework will be due Wednesday, June 24, at 11:59pm
- Graded on rough 4-point scale
  - You'll need to check it yourself!
- You'll turn in one ***IJulia notebook*** in PDF format (I'll explain this soon).
- Lowest score will be dropped!
- Late work will have 25%/day decay
  - Assignments will have 1 point deducted for every day they are late (e.g., turn it in by 11:59pm on June 25 to earn up to 3 points, June 26 to earn up to 2 points, etc.)

Midterm Exam (15%)

- Written exam **Friday, July 17th**
- Will only test theoretical and problem-solving knowledge (i.e., no coding on the exam)
- No final (hooray!)
- The exam will be 1.5 hours long
- Other logistics to be announced later
- The exam will be open notes, but you must complete it independently.
  - Any improper collaboration will result in an automatic 0 for all parties involved and, depending on severity, will be reported to the Academic Integrity office.

Group Project (35%)

- Project will apply concepts from class to a “real-world” problem
- Groups of 1-3 students
- Example projects posted on Canvas
- Proposal due Friday, July 10th
- Details of project assignment will be given in first few weeks of class

Textbook?

- No required text!
- All material will be posted on Canvas
- Some possibly useful references:
  - S. Boyd and L. Vandenberghe. *Convex Optimization*. Cambridge University Press, 2004. The book is available for free here: http://stanford.edu/~boyd/cvxbook/.
  - H.P. Williams. *Model Building in Mathematical Programming*, 5th Edition. Wiley, 2013
  - R.L. Rardin. *Optimization in Operations Research*. Prentice Hall, 1998.