Introduction to Systems Analysis and Optimization

Nur Shlapobersky, Alexandra Coso Strong (*Advising)*

Prerequisites

ENGR3531/MTH2131 - Data Science

Resources

Discovering Statistics Using R, Andy Field
Design and Analysis of Experiments, Douglas C. Montgomery
Multidiscipline Design Optimization, Garret N. Vanderplaats

Goals

- Develop introductory understanding of hypothesis testing, ANOVA, Decision-Making models, Sensitivity Analysis, Design of Experiments, and Numerical Optimization
- Apply systems thinking with quantitative data
- Grow comfortable with Python's Scipy library for performing statistics and optimization
- Apply learned concepts, tools, and techniques to a project of student's choosing

Deliverables & Assessment

- Roughly every two weeks, the student will give an oral presentation on the studied material.
- For the two case studies, the student will write a short report and present it.
- For the final project, the student will submit the first draft of a research paper, and prepare a poster presentation.

Course Outline

9/4 Week 1 - Statistics Review

Statistics Using R: Ch 2.4-2.6
Researching Python statistics and optimization packages

9/11 Week 2 - Assumptions, *t-tests*

Statistics Using R: Ch 5, 9

9/18 Week 3

Anova, 2-means

9/25 Week 4

Begin first case study
Sensitivity Analysis

10/2 Week 5

Finish first case study

10/9 Week 6

Review/feedback for first case study
DOE, Design and Analysis of Experiments

10/16 Week 7

Begin second case study
Light optimization
Unconstrained optimization

10/23 Week 8

Finish second case study
Intro to constrained optimization

10/30 Week 9

Review/feedback for second case study
Stochastic optimization

11/6 Week 10

Create project proposal/abstract

11/13 Week 11

Work on project
Identify additional texts/learning needed

11/20 Week 12

Work on project

11/27 Week 13

Begin assembling work into research paper
Begin creating/processing results

12/4 Week 14

Finalize results, work on paper

12/11 Week 15

Finish first draft of paper