CO 372: Portfolio Optimization Models
Winter 2021
Course Outline
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1. **Learning goal.** Understand models and computational methods for the portfolio optimization problem, which is: Given a universe of n financial instruments, find amounts $x_1, \ldots, x_n$ of each to purchase in order to optimally balance risk and return. The course covers classical portfolio theories, some more modern topics, optimization topics including quadratic programming, and Matlab.

2. **Course topics.**

   (a) Linear algebra review

   (b) QR factorization

   (c) Quadratic functions / Efficient frontier / Capital market line

   (d) Quadratic programming / KKT conditions for QP / Active set method for QP

   (e) Parametric programming

   (f) VaR and CVaR

   (g) Special topics: Automatic differentiation, obtaining the covariance matrix, transaction costs, machine learning

   (h) Matlab programming interspersed throughout

3. **Learning material.** The learning material will consist of video lectures and PDF lecture notes.

4. **Lecture format.** Lectures will be posted on Sundays for the following week. Approximately 75 minutes of lecture is posted per week divided into 5–10 modules.

5. **Course requirements.**

   - Seven problem sets; lowest one is dropped. Problem sets together worth 50%.

   - Take-home written final exam. Planned length is 2–3 hours in student-selected 8-hour slot within 48 hour period during exam period. Final exam worth 50%.

   - Final exam will be unproctored. Exam questions will be randomized, and no two question sheets will be the same.