



DA 507
Modeling and Optimization

Course Syllabus
Fall 2023-2024

Instructor

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Course Schedule

Saturdays 9:00 am-12:00 pm, Wednesdays 7:00 pm-10:00 pm (Altunizade Campus G08-G09)

Course Description, Aim and Content

In today's economy, business professionals make decisions which may prescribe the course of actions whose extent may vary from day-to-day operations to strategies that influence the future of their companies. Although analytical modeling tools have been out there a very long time, they were typically judged to be useless and cumbersome in the past in the context of business decision making processes. With the advances in computing power, information collection and data processing technologies, analytics has become of very critical interest in this context, and modeling tools have turned out to be essential in implementing analytics.

In this course, we cover various analytical modeling tools with a focus on optimization models. Each tool is to be covered to an extent where decision makers will be able to

- identify the necessity of analytical modeling
- realize the use of optimization models in data analytics
- distinguish the type of models that could be used for a decision problem
- lead/participate in a team of problem solvers
- understand the underlying

in the course of business decision making processes.

Examples of modeling and optimization techniques from other courses will be covered. Case studies from real-life businesses will be delivered by professionals who are employing such tools and techniques.

Recommend or Required Reading

- Model Building in Mathematical Programming, H. P. Williams, 4th edition, John Wiley & Sons, 1999. ISBN-13: 978-0471997887
- Operations Research: Applications and Algorithms, W. L. Winston, 4th edition, Cengage Learning, 2003. ISBN-13: 978-0534380588
- Optimization Models For Decision Making: Volume 1, Katta G. Murty, Internet Edition, http://ioe.engin.umich.edu/people/fac/books/murty/opti_model/.

Grading

Assignments	30%
Term Project	30%
Final Exam	40%
Total	100%

The instructor might adjust this grading scheme if necessary.

Assignments

- We will have **Three** assignments during the semester.
- Late deliveries will not be accepted, and the maximum number of collaborating students is **4**.

Term Project:

The students need to develop their coding capabilities. Hence, there will be a group project assignment. The students are required to use Python and Gurobi. The project will be assigned in the second half of the semester. **The maximum number of collaborating students is 4**. Students will present their work in the last week of the semester.

Exams

One comprehensive Final Exam on **Wednesday evening 10.01.2024**.

Software

- You are required to install Python distribution of Anaconda. I recommend you install the latest version with Python 3.X (<https://www.anaconda.com/>)
- You are also required to install Gurobi solver from <https://www.gurobi.com/>
- You can follow the guidance uploaded to SU Course.

Make-up Exam Policy

You have to have a valid reason for not taking an exam. If proof such as a medical report is not brought to me before or within the first three days of the exams, you will NOT be given a make-up exam and will be assumed to score 0 in the missed exam. The make-up exams may need to be scheduled after the final exam, which may be comprehensive.

Academic Integrity and Conduct:

Each student in this course is expected to abide by the Sabanci University Academic Integrity Statement (available at <http://www.sabanciuniv.edu/en/academic-integrity-statement>) and to behave properly against the instructor and the course assistants. The violations of the integrity principles and any disrespect toward course assistants will not be tolerated.

Disclaimer:

The instructors reserve the right to alter the grading policy, change examination dates, and modify the syllabus and course content when necessary. Modifications will be announced in class and via SUCourse. Students are responsible for keeping up with the announced changes.

Tentative Course Outline

Week	Day	Topics
1	W*	Syllabus Review and Course Introduction Decision Making Processes - Analytical Models
	S	Linear and Integer programming problems and formulations - Examples of LP
2	W	Linear and Integer programming problems and formulations (continue) - Examples of LP (continue)
	S	Linear and Integer programming problems and formulations (continue) - Examples of Integer programming problems and formulations - Solution methods for linear programming problems <ul style="list-style-type: none"> o Graphical Solution Method o Simplex Algorithm
3	W	Linear and Integer programming problems and formulations (continue) - Sensitivity Analysis (Primal-Dual LP) - Solution methods for Integer programming problems <ul style="list-style-type: none"> o Branch & Bound Method
	S	Fundamental Problems in OR
4	W	Heuristics
	S	Heuristics (continue)
5	W	Nonlinear optimization and gradient descent
	S	Simulation
6	W	Stochastic Models - Discrete time Markov Chains
	S	Stochastic Models - Discrete time Markov Chains (continue) Stochastic Models - Continuous time Markov Chains
7	W	Stochastic Models Continuous time Markov Chains (continue)
	S	Project Proposal Presentations

*W: Wednesday, S: Saturday