The Hong Kong University of Science and Technology

Optimizing Decisions for Personal and Business Development (IEDA 1250)

Spring, 2026

Instructor

- Prof. Bo YANG (yangb@ust.hk)

Class schedule

- Monday 16:30 – 17:50, Room 5403
- Friday 12:00 – 13:20, Room 5403

Tutorial

- Monday 18:00 – 18:50, Room 6555
- Tuesday 12:00 – 12:50, Room 6555

Office hour

- Friday 14:00 – 15:00, Office 5584

Teaching assistant

- Ms. Hanyan DUAN (hduanag@connect.ust.hk)

Course Description

Optimization plays a central role in enhancing decision making – be it in traditional engineering and business settings or in today's more dynamic world powered by advanced AI techniques. This course introduces the core modeling and solution ideas behind optimization, with an emphasis on how to translate real problems into mathematical models and interpret solutions for actionable insights. We begin with linear programming, covering formulation, graphical methods, duality, and the practical use of commercial solvers, and then extend these ideas to integer programming and modern modeling techniques. To broaden the decision-making toolkit, the course also covers probability basics, strategic interaction through introductory game theory, system analysis via queueing theory, and sequential decision making through dynamic programming and a brief introduction to Markov decision processes. Throughout, examples are drawn from operations and analytics applications such as inventory and production planning, and financial decision making, preparing students for more advanced study in optimization, and related decision analytics settings.

Recommended Textbooks

The textbooks are optional but recommended for students with particular interests in optimization. They contain broader and deeper contents than those covered in class. In particular, the third textbook contains rigorous mathematical proofs for many optimization algorithms (i.e., explanations on "why" the algorithms work).

- *Introduction to Operations Research*, by Hillier, Frederick S., and Gerald J. Lieberman, McGraw-Hill, 2015.
- *Operations and Supply Chain Management*, by F. R. Jacobs and R. Chase (13th edition), McGraw-Hill, 2018
- *Convex Optimization*, by Boyd, Stephen, 2004

This course will loosely follow the first textbook. There is no need for students to go through all materials to obtain descent scores.

Prerequisites

No prerequisite is required, as the course serves as an introduction to optimization.

Course Web Page

A web page will be available for this course on Canvas. The web page contains announcements, lecture notes, homework assignments and solutions. Slides will also be posted on Canvas before each lecture.

Grading

The final grade will be determined using the following weights:

1. Two Individual Assignments 20%
2. Midterm Exam 40%
3. Final Exam 40%

4. Class Participation 0%

Grading will be lenient in this course. In other words, requests for regrading will **NOT** be considered unless there are obvious grading errors. If students insist on regrading, all questions will be regraded for fairness.

Assignments

There will be two homework assignments. Students are expected to work individually on them. A soft copy of the homework should be uploaded via Canvas on or before the due date. There will be a week for students to finish the homework. Late submissions will **NOT** be accepted, as the solution will be posted right after the due time.

Exams

The midterm and final exams will take place during class. They are 80 minutes exam. The time and location for the exams will be determined later.

Class Participation

Please come to the class fully prepared. This will maximize the gain from the class. Regular attendance and participation in all classes will be helpful for the boundary case.

Policies

As a member of the HKUST community, students are expected to meet the highest standards of academic behavior. Please review the university statement on academic integrity. On homework assignments, high-level collaboration, like discussion on methods to solve homework problems, is permitted. However, sharing solutions or numerical answers is not allowed and is considered cheating. Sharing solutions or cheating on exams will result in a zero grade on that assignment or exam, and related university policies will be strictly enforced.

If you use generative AI tools for learning or drafting, you must ensure the submitted work is your own. Using tools to generate complete solutions and submitting them as your own work is not allowed.

Tentative Topics

We will walk through the following topics. Coding skills are not required, though there are "programmings" in the topics.

1. Introduction

- Motivating examples

2. Deterministic decision making: Introduction to linear programming
    - Motivating examples
    - Linear programming model
    - Graphical solution
    - Duality theory
    - Commercial solver: Excel and Gurobi
3. Deterministic decision making: Introduction to integer programming
    - Motivating examples
    - Integer programming model
    - Branch and bound approach
    - Modeling techniques
    - Commercial solver: Excel and Gurobi
4. Probability basics
    - Definitions such as probability, random variables, and cumulative distribution function
    - Discrete probability distributions
5. Making decisions with other players: Introduction to game theory
    - Motivating examples
    - Definitions
    - Dominating policies
    - Minimax theorem
    - LP approach
6. Decision making in service oriented processes: Introduction to queueing theory
    - Motivating examples
    - Basic metrics and parameters to a queueing system
    - Little's law
    - M/M/1 queue
    - PASTA
    - M/M/k queue

7. Sequential decision making: Introduction to dynamic programming
    - Motivating examples
    - Backward induction
    - Shortest path problem
    - Recourse allocation problem
    - Production planning
    - Brief introduction to Markov decision processes
8. Decision making in investment (optional)
    - Brief introduction to risk neutral probability, replication, binomial tree, hedging, and valuation via real options approach