Optimizing Decisions for Personal and Business Development
IEDA 1250

HKUST, Summer 2026

Course Syllabus

Course Information

Instructor:	Prof. Bo Yang (yangb@ust.hk)
Class Schedule:	Monday, Wednesday, Friday, 9:00–12:20
Tutorial:	TBD
Teaching Assistants:	TBD

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. The course covers linear programming, integer programming, probability, game theory, queueing theory, and dynamic programming, each of which offers a different perspective on how decisions can be modeled and analyzed. These topics are illustrated through applications in operations and analytics, including inventory management, production planning, service systems, and financial decision making. The course is intended to develop both practical modeling skills and a foundation for further study in optimization and decision analytics.

Intended Learning Outcomes

By the end of this course, students should be able to

- formulate introductory mathematical models for real-world decision problems, using tools such as linear programming, integer programming, game theory, queueing theory, and dynamic programming;
- interpret model outputs and communicate solution insights clearly in practical decision-making contexts;
- use quantitative reasoning to compare alternative decisions in personal, business, and engineering applications.

The course is introductory and emphasizes modeling, interpretation, and applications. It includes basic mathematical derivations to support understanding of the main concepts but does not cover advanced mathematical proofs or technical derivations.

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.

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:

- Two Individual Assignments 20%
- Midterm Exam 35%
- Final Exam 35%
- Class Participation 10%

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

This course will be assessed using criterion-referencing and grades will not be assigned using a curve.

Assignments

There will be two homework assignments, as summarized below.

Assignment	Coverage	Duration
Assignment 1	Topics 1–4	One week
Assignment 2	Topics 5–7	One week

The release dates will be announced on Canvas and may vary depending on the progress of the course. See the tentative topic list at the end of the syllabus for details of topic coverage.

Detailed rubrics for each assignment will be provided. Students can refer to these rubrics to understand how their work will be assessed.

Students are expected to complete both assignments individually. A soft copy must be submitted via Canvas on or before the specified due date. Late submissions will not be accepted, as solutions will be posted shortly after the deadline.

Students may use generative AI tools for limited support, such as clarifying concepts or improving the presentation of their work, but all submitted work must be their own. The use of generative AI to produce complete solutions, or the submission of AI-generated work as one's own, is not permitted and will result in a grade of zero for the assignment.

Exams

The midterm and final exams will each be 80 minutes in duration. The midterm exam will be held during class after the completion of the game theory topic, subject to the progress of the course. The final exam will take place during the last class meeting.

Class Participation

Students are expected to come to class prepared and ready to engage with the course material. Regular attendance and active participation will help students benefit fully from the course and may be taken into consideration in borderline grading cases.

Policies

As members of the HKUST community, students are expected to uphold the highest standards of academic integrity. Students should review the university statement on academic integrity and follow all related university policies.

For homework assignments, discussion of general ideas and solution approaches is permitted. However, sharing complete solutions, numerical answers, or submitted work is not allowed. Any violation of these rules, including cheating on assignments or examinations, will result in appropriate penalties, which may include a grade of zero for the relevant assignment or examination, in accordance with university regulations.

Tentative Topics

We will walk through the following topics. Coding skills are not required for this course, although the term "programming" appears in the titles of several topics.

1. Introduction

- Motivating examples

2. Deterministic decision making: Introduction to linear programming
    - Motivating examples
    - Linear programming formulations
    - Graphical solution methods
    - Duality
    - Commercial solvers: Excel and Gurobi
3. Deterministic decision making: Introduction to integer programming
    - Motivating examples
    - Integer programming formulations
    - Branch-and-bound
    - Basic modeling techniques
    - Commercial solvers: Excel and Gurobi
4. Probability basics
    - Basic definitions, including probability, random variables, and cumulative distribution functions
    - Discrete probability distributions
5. Decision making with strategic interaction: Introduction to game theory
    - Motivating examples
    - Basic definitions
    - Dominant strategies
    - Minimax theorem
    - Linear programming approach
6. Decision making in service systems: Introduction to queueing theory
    - Motivating examples
    - Basic performance measures and parameters of queueing systems
    - 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 problems
    - 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