ISOM 4840
Financial Service Operations Management

Spring 2025

CLASS SCHEDULE

Section L1: Tuesday and Thursday, 10:30AM - 11:50AM, Rm 1011, LSK Bldg

INSTRUCTOR

Prof. Lijian Lu
Office: LSK 4068
Office hours: Wed. 5 p.m. – 6 p.m. and by appointment
Email: lijianlu@ust.hk

TEACHING ASSISTANT

Mr. Ce Zhang
Office: LSK 4063
Office hours: Tue. 4 p.m. – 5 p.m. or by appointment
Email: czhangdp@connect.ust.hk

COURSE OVERVIEW & OBJECTIVE

Financial markets are characterized by continuous innovation in the creation of financial products, evolving risk management techniques, and increasingly powerful computational capabilities. In this course, we will discuss financial models and computational methods that help solve problems which appear every day in the financial markets. Examples of problems we will discuss are pricing and hedging techniques for a wide array of equity derivatives, hedging and risk management, short and long term portfolio optimization, interest rate models and interest rate derivatives, credit sensitive securities, volatility estimation, etc. We will use a hands-on approach and apply the financial models and the computational methods to real-world problems. We will focus

on the context in which the financial models and the computational methods are applicable, and highlight their limitations.

RECOMMENDED BACKGROUND

This course assumes:

a) working knowledge of probability and statistics (at the level of ISOM 2500 or Math 2411);

b) working knowledge of elementary optimization and simulation (at the level of ISOM 2700);

Good review reading material for the course may be found in the textbooks (Optional):

- J. C. Hull, "Options, Futures, and Other Derivatives", 11th Edition, Prentice Hall;
- David G. Luenberger, "Investment Science", 2nd Edition, Oxford University Press.
- Trevor Hastie, Jerome Friedman, and Robert Tibshirani, "The Elements of Statistical Learning ", Springer (https://link.springer.com/book/10.1007/978-0-387-21606-5).

For the homework assignments (see below), we will assume:

- Proficiency with Excel, including its Solver (the built-in optimizer);
- Basic knowledge, or willing to learn, of one programming language (can be Visual Basic (VBA), or Matlab, or Python, or C/Java).
    - For Matlab, read **matlab_tutorial.pdf** on canvas (www.mathworks.com/academia/student_center/tutorials/launchpad.html or Google "MATLAB tutorial")

GRADING POLICY

Homework Assignment	40%
Final Exam	60%
Total	**100%**

1) **Homework Assignment**
    - There will be approximately **three-four** homework

assignments throughout the semester.
    - For each homework assignment, you will have **one week** to complete.
        - The homework assignment will be released on Sunday, and must be completed and submitted by the due time (**23:59 on Sunday**) each week.
    - Students may work on the homework assignments in groups of **up to three** students per group.
        - If you work in a group, please submit only one answer sheet for the whole group.
    - It is highly recommended that students first work individually on all the problems in the homework assignments, and then confer with the other members of the group to check results, discuss difficulties, and/or resolve discrepancies.
    - No makeup homework will be given. The homework for the week will be waived only if you have a valid reason, such as medical emergency.
2) **Exam:** We will only have a final exam that lasts **2 hours**. You are allowed to use learning materials in the exam, more information will be available in due course.

The homework assignments and the final exam will be designed to be as relevant, applicable and instructive as possible. Students taking this course are expected to spend a significant amount of time outside of the lectures to digest the material, complete the homework assignments, and prepare for the final exam.

ACADEMIC INTEGRITY

Students at HKUST are expected to observe the Academic Honor Code at all times (see http://rpghandbook.ust.hk/student-conduct-and-academic-integrity#honor for more information). Zero tolerance is shown to those who are caught cheating on exam. In addition to receiving a zero mark on the exam involved, the final course grade will appear on your record with an X, to show that the grade resulted from cheating. This X grade will stay with your record until graduation. If you receive another X grade, you will be dismissed from HKUST.

TEACHING APPROACH

The general teaching approach is lecturing, case discussions, as well as problem solving and demonstrations in the classroom. Lecture notes, additional reading articles, and learning resources are posted on Canvas. For many topics, we will start with an example (which can be a real business problem or a simplified version) with concrete numbers and clearly defined questions that are often of managerial relevance. Then we provide rigorous Excel spreadsheet analysis to solve the problem and discuss managerial insights based on the analysis.

COURSE OUTLINE (Tentative)

This course has the following four modules, each of which consists of several topics that are connected to some extent and share the common theme of the module.

1) Pricing and Hedging: Equity

- Asset pricing models
  - Capital asset pricing model (CAPM)
  - The arbitrage pricing theorem (APT)
- Statistical models for risk management and hedging;

2) Portfolio construction and optimization

- Single-period (short-term investment horizon) asset allocation
  - Efficient frontier
  - Modern portfolio theory (MPT)
    - Markowitz mean-variance
  - Alternative risk measures
    - Semi-variance, downside risk, value-at-risk
- Multi-period (long-term horizon) portfolio optimization
  - Growth optimal portfolio
  - Growth optimal mean-variance portfolio
  - Volatility drag and pumping

3) Pricing and Hedging: Option

- Modeling and computational underpinnings for pricing equity options in the Black-Scholes framework, including analytic methods, lattice methods, and simulation methods.
- Discussion of the deviations of real markets from the assumptions of the Black-Scholes model.

- Extensions of the Black-Scholes model, including jump-diffusion models and stochastic volatility models.
- Investing in and hedging options portfolios in practice.

4) Pricing and Hedging: Fixed income

- Statistical analysis and modeling of the evolution of interest rates.
- Models for the pricing of interest-rate sensitive securities, including single factor models (e.g. Ho-Lee, Black-Derman-Toy) and multi-factor models (e.g. Heath-Jarrow-Morton).