FIN-UY 3233
Derivatives and the Options Market
Spring 2023

Tuesdays, 6:00 pm to 8:30 pm
2 MetroTech, Room 907

Instructor
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Leon's Office Hours
Thursdays, 3 pm – 5:30 pm

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Review Sessions (Weekly) via Zoom
(date/time to be determined)

Course Overview

At an introductory level, mathematical techniques in finance can be roughly categorized into two distinct domains.

The first of these two areas (and the one that developed first) can be motivated with the question: How can we construct desirable investment "portfolios" from assumptions about the return potential of the "individual" assets and from the fact that – from a forward-looking view – the returns of different assets can be inter-dependent. Once we make simplifying assumptions about the "uncertainty" of the asset-specific returns we can deploy techniques from linear algebra and optimization to identify portfolios with favorable attributes. Our endpoint here will

be to introduce Modern Portfolio Theory (Markowitz Theory) and extract some of its key implications.

The second area is underpinned by the pricing problem for a "derivative security." That would be a financial contract whose value at some future date is based on the value of an "underlying asset," which could be a stock, bond, foreign currency, or another type of investment. What do we need to know about the "underlying" to be able to price the derivative? For this line of thinking our goal is the famous Black-Scholes formula for option pricing.

We will study the insights that led to this formula, how it opened the door to the concept of "risk-neutral pricing," and how market realities determine the model's range of applicability and need for refinement.

For intuitional purposes it's helpful to relate these two foundational concepts with some motivating examples.

Mathematical Tools

Calculus: How can we "extend" it to "random" functions?

Basic probability: Mean, standard deviation and variance, random variables.

Stochastic processes: Brownian motion, lognormal model of stock prices.

Linear algebra: Matrix theory, linear regression, dynamic programming (optimization).

Textbook

Mathematics for Finance: An Introduction of Financial Engineering (Second Edition) by Mark Capinski and Tomasz Zastawniak

Grading

40%: Homework.
(Collaboration on homework is encouraged.)

25%: Take-home midterm.

35%: Take-home final.

Family, Health or Other Issues Arising During the Semester

If you encounter any unforeseen family, health or other issues during the semester which create circumstances that prevent you from meeting course requirements, please raise them directly with Deanna Rayment in the Office of Student Affairs at 646-997-3046 (deanna.rayment@nyu.edu) before requesting any accommodation from the instructors.

Moses Center Statement of Disability

If you are student with a disability who is requesting accommodations, please contact New York University's Moses Center for Students with Disabilities (CSD) at 212-998-4980 (mosescsd@nyu.edu). You must be registered with CSD to receive accommodations. Information about the Moses Center can be found at www.nyu.edu/csd. The Moses Center is located at 726 Broadway on the 2nd floor.

NYU Tandon School of Engineering

Policies and Procedures on Academic Misconduct

A. Introduction: The School of Engineering encourages academic excellence in an environment that promotes honesty, integrity, and fairness, and students at the School are expected to exhibit those qualities in their academic work. It is through the process of submitting their own work and receiving honest feedback on that work that students may progress academically. Any act of academic dishonesty is seen as an attack upon the School and will not be tolerated. Furthermore, those who breach the School's rules on academic integrity will be sanctioned under this Policy. Students are responsible for familiarizing themselves with the School's Policy on Academic Misconduct.

B. Definition: Academic dishonesty may include misrepresentation, deception, dishonesty, or any act of falsification committed by a student to influence a grade or other academic evaluation. Academic dishonesty also includes intentionally damaging the academic work of others or assisting other students in acts of dishonesty. Common examples of academically dishonest behavior include, but are not limited to, the following:

1. **Cheating:** intentionally using or attempting to use unauthorized notes, books, electronic media, or electronic communications in an exam; talking with fellow students or looking at another person's work during an exam; submitting work prepared in advance for an in-class examination; having someone take an exam for you or taking an exam for someone else; violating other rules governing the administration of examinations.

2. Fabrication: including but not limited to, falsifying experimental data and/or citations.

3. Plagiarism: intentionally or knowingly representing the words or ideas of another as one's own in any academic exercise; failure to attribute direct quotations, paraphrases, or borrowed facts or information.

4. Unauthorized collaboration: working together on work that was meant to be done individually.

5. Duplicating work: presenting for grading the same work for more than one project or in more than one class, unless express and prior permission has been received from the course instructor(s) or research adviser involved.

6. Forgery: altering any academic document, including, but not limited to, academic records, admissions materials, or medical excuses.

Disability Disclosure Statement

Academic accommodations are available for students with disabilities. Please contact the **Moses Center for Students with Disabilities** (212-998-4980 / mosescsd@nyu.edu) for further information. Students who are requesting academic accommodations are advised to reach out to the Moses Center as early as possible in the semester for assistance.

Inclusion Statement

The NYU Tandon School values an inclusive and equitable environment for all our students. The instructors hope to foster a sense of community in this class and consider it a place where individuals of all backgrounds, beliefs, ethnicities, national origins, gender identities, sexual orientations, religious and political affiliations, and abilities will be treated with respect. It is our intent that all students' learning needs be addressed both in and out of class, and that the diversity that students bring to this class be viewed as a resource, strength, and benefit. If this standard is not being upheld, please feel free to speak with either of the instructors.