

MATH-UA.250, MA-UY.4324 – Mathematics of Finance - Fall 2021

Instructor: Amir Sadr, amir.sadr@nyu.edu

Time: Tue, Thu, 4:55 pm-6:10 pm EST, Recitation: F 12:30-1:45 pm

Location: CIWW 312

Office Hours: Before or after the class – Must be scheduled via email (amir.sadr@nyu.edu)

Course Description

Introduction to the mathematics of finance. Topics include: Linear programming with application pricing and quadratic. Interest rates and present value. Basic probability: random walks, central limit theorem, Brownian motion, lognormal model of stock prices. Black-Scholes theory of options. Dynamic programming with application to portfolio optimization.

Prerequisites

MATH-UA 123 Calculus III or MATH-UA 213 Math for Economics III (for Economics majors), and an introductory course in probability or statistics (MATH-UA 233 Theory of Probability, MATH-UA 235 Probability and Statistics, ECON-UA 18 Statistics, ECON-UA 20 Analytical Statistics, STAT-UB 103 Statistics for Business Control and Regression/Forecasting Models, or equivalent) with a grade of C+ or better.

Programming

- **Required:** The course will use Excel and its statistical tools and financial functions in lecture notes and homework assignments.
- *Optional:* Students can also use **Python 3.x** together with the scientific stack (*numPy*, *SciPy*, *pandas*, *matplotlib*) - **Anaconda 3.x** distribution is highly recommended.

Textbook

Mathematical Techniques in Finance: An Introduction, Amir Sadr, Wiley 2021 – The preprint will be provided to the class via Brightspace.

Grading

- 55% Homework assignments, including Excel spreadsheet calculations.
- 20% Midterm exam
- 25% Final exam

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Session	Date	Syllabus	HW, Exams	Grade %
1	Thu Sep 2	Finance, Market Participants, Money, Time Value		
2	Tue Sep 7	PV, FV, Rates, Simple vs. compounding		
3	Thu Sep 9	Interest rates, Single cash flows, Yield, IRR		
4	Tue Sep 14	Bonds, Root solving		
5	Thu Sep 16	Sensitivities, PV01, Convexity, Taylor Series		
6	Tue Sep 21	Level pay loans		
7	Thu Sep 23	Yield curve, Bootstrap method		
8	Tue Sep 28	Random returns, Risk appetite	HW # 1 Due	15%
9	Thu Sep 30	Utility theory, Markowitz Mean-variance theory		
10	Tue Oct 5	Efficient frontier, MVP, Lagrange multipliers		
11	Thu Oct 7	Multiple risky assets, Risk-free asset, Market portfolio		
	Tue Oct 12	Legislative Monday – No class		
12	Thu Oct 14	CML, CAPM		
13	Tue Oct 19	Performance ratios, Regression, Z-Score		
14	Thu Oct 21	Risk-management: Kelly's criterion, Gambler's ruin	HW # 2 Due	20%
15	Tue Oct 26	In-Class Midterm exam	Midterm	20%
16	Thu Oct 28	Forward contracts, Cash and carry		
17	Tue Nov 2	Binomial model		
18	Thu Nov 4	No arbitrage, Self-financing		
19	Tue Nov 9	Risk-Neutral valuation		
20	Thu Nov 11	Random walk, Brownian motion		
21	Tue Nov 16	Black-Scholes-Merton call formula		
22	Thu Nov 18	CRR model, PDE, Greeks		
23	Tue Nov 23	Delta hedging, Gamma versus Theta		
	Thu Nov 25	Thanksgiving – No class		
24	Tue Nov 30	American options, Backward induction		
25	Thu Dec 2	Path-dependent options, Simulation		
26	Tue Dec 7	Interest rate curves	HW # 3 Due	20%
27	Thu Dec 9	Interest rate instruments, models		
28	Tue Dec 14	Review		
	Tue Dec 21	In-Class Final exam	Final	25%

Students requesting academic accommodations are advised to reach out to the Moses Center for Student Accessibility as early as possible in the semester for assistance.

Moses Center for Student Accessibility

- Telephone: 212-998-4980
- Website: www.nyu.edu/csa
- Email: mosescsa@nyu.edu