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

Instructor – Amir Sadr, as73@nyu.edu
Time: M, W, 11:00 am-12:15 pm EST, Recitation: F 12:30-1:45 pm
Location: Online, Zoom invite will be posted on course website at NYU Classes
Office Hours: via Zoom, before or after the class - Scheduled via Email (as73@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 instead 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 - Preprints of this book and extra material will be provided before each class on NYU Classes.

Grading

- 55% based on survey, homework assignments, including Excel spreadsheet calculations.
- 20% Midterm exam
- 25% Final exam

Gradescope

All work (survey, homework assignments, midterm, final) should be uploaded and submitted as pdf files to Gradescope link on NYU Classes.

MATH-UA 250, MA-UY 4324 – Mathematics of Finance - Spring 2021 - Syllabus

Session	Date	Syllabus	Test, HW	Grade %
Lecture 1	Mon Feb 1	Finance, Market Participants, Money, Time Value		
Lecture 2	Wed Feb 3	PV, FV, Rates, Simple vs. compounding	Survey #1 Due	5%
Lecture 3	Mon Feb 8	Interest rates, Single cash flows, Yield, IRR		
Lecture 4	Wed Feb 10	Bonds, Level pay loans, Root solving		
	Mon Feb 15	~~President's Day - No Classes~~		
Lecture 5	Wed Feb 17	Sensitivities, PV01, Convexity, Taylor Series		
Lecture 6	Mon Feb 22	Yield curve, Bootstrap method		
Lecture 7	Wed Feb 24	Random returns, Risk appetite		
Lecture 8	Mon Mar 1	Utility theory, Markowitz Mean-variance theory	HW # 1 Due	10%
Lecture 9	Wed Mar 3	Efficient frontier, MVP, Lagrange multipliers		
Lecture 10	Mon Mar 8	Multiple risky assets		
Lecture 11	Wed Mar 10	Risk-free asset, Market portfolio		
Lecture 12	Mon Mar 15	CML, CAPM		
Lecture 13	Wed Mar 17	Performance ratios, Regression, Z-Score		
Lecture 14	Mon Mar 22	Risk-management: Kelly's criterion, Gambler's ruin	HW # 2 Due	20%
Lecture 15	Wed Mar 24	**In-Class Zoom Midterm**	Midterm	20%
Lecture 16	Mon Mar 29	Forward contracts, Cash and carry		
Lecture 17	Wed Mar 31	Binomial model		
Lecture 18	Mon Apr 5	No arbitrage, Self-financing		
Lecture 19	Wed Apr 7	Risk-Neutral valuation		
Lecture 20	Mon Apr 12	Random walk, Brownian motion		
Lecture 21	Wed Apr 14	Black-Scholes-Merton call formula		
	Mon Apr 19	~~Spring Break - No Classes~~		
Lecture 22	Wed Apr 21	CRR model, PDE, Greeks		
Lecture 23	Mon Apr 26	Delta hedging, Gamma versus Theta		
Lecture 24	Wed Apr 28	American options, Backward induction		
Lecture 25	Mon May 3	Path-dependent options, Simulation	HW # 3 Due	20%
Lecture 26	Wed May 5	Interest rate curves		
Lecture 27	Mon May 10	Short rate models		
	Wed May 12	**In-Class Zoom Final**	Final	25%
			Total	**100%**

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