# Quantitative Finance

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***COURSE AIMS AND EXPECTED LEARNING OUTCOMES***

This course deals with important quantitative tools for the study of capital markets. We will examine the crucial principles of absence of arbitrage and of market completeness in the presence of risk. Such principles will be applied to investment strategies and derivative contracts. Theory will be constantly illustrated with classroom applications.

At the end of the course, the student will be familiar with models of risky financial markets that she/he will be able to harness for asset pricing purposes. In particular, they will be able to:

– construct investment strategies and spot first- and second-type arbitrage opportunities;

– associate the no-arbitrage assumption with the existence of a risk-neutral probability measure;

– relate the concept of market completeness to the one of payoff profiles’ replication;

– find no-arbitrage prices for claims that provide given payoff profiles (also via binomial trees);

– work out either paper-and-pencil or numerical solutions of such pricing problems.

***COURSE CONTENT***

*One-period financial markets*

– Investment strategies, first/second-type arbitrage opportunities, and violations of the Law of One Price;

– First/Second Fundamental Theorem of Asset Pricing (risk-adjusted probability measures in an arbitrage-free complete/incomplete market);

– No-arbitrage pricing of contingent claims.

*Multi-period financial markets*

– Underlying asset price dynamics via binomial trees;

– Pricing European/American-style derivative securities via binomial trees.

***READING LIST***

Lecture notes made available on *Blackboard*.

A. Sbuelz - A. Tarelli, , *Quantitative Finance: Problems and Solutions,* Giappichelli, 2021.

K. Sydsaeter - P.J. Hammond, *Mathematics for Economic Analysis,* Prentice-Hall, 1995.

***TEACHING METHOD***

The course is based on frontal teaching with classroom applications of the theory covered.

***ASSESSMENT METHOD AND CRITERIA***

The valuation mark is based on the weighted average of the performances in a final written exam (75%) and in an assignment (25%).

The final written exam is made of open and/or multiple-choice questions, aimed at assessing the understanding of the topics studied. The points awarded for each question is specified in the text of the exam.

The assignment is related to applied aspects of the contents covered.

The weighted-average score, rounded to the closest integer (i.e. ceiled if the decimal part is at least 0.5, floored otherwise), will be the final mark of the course. A mock exam and a mock assignment, representing the formats of the final written exam and of the actual assignment, are published on Blackboard.

***NOTES AND PREREQUISITES***

Students should be acquainted with:

– fundamentals of linear algebra;

– basic notions of financial mathematics under certainty (e.g. Compounded interest and annuities);

– random variables and the features of their probability distributions (mean, variance and standard deviation), as well as the features of joint and conditional distributions (covariance and correlation, conditional expectation and variance); Gaussian distributions;

***OFFICE HOURS***

The instructors’ office hours are published on the corresponding personal web pages.