Academic subject: Probabilistic Methods in Finance

Degree Class: LM-40 – Matematica		**Degree Course:** Mathematics	**Academic Year:** 2018/2019
		Kind of class: optional	**Year:** / **Period:** 1
			ECTS: 7 divided into **ECTS lessons:** 6,5 **ECTS exe/lab/tutor:** 0,5

Time management, hours, in–class study hours, out–of–class study hours
lesson: 52 exe/lab/tutor: 8 in–class study: 60 out–of–class study: 115

Language: Italian	**Compulsory Attendance:** no		
Subject Teacher: Nicola Cufaro Petroni	**Tel:** +39 080 5443212 **e–mail:** nicola.cufaropetroni@uniba.it	**Office:** Department of Mathematics Room 2 , Floor II	**Office days and hours:** Tuesday 11-13. Other days and times by appointment

Prerequisites:
Usual knowledge of calculus and real analysis in one and several variables, and of probability

Educational objectives:
Acquiring language and techniques to calculate the prices of derivative securities with random underlyings, especially european and american otpions, bonds, forwards and futures

Expected learning outcomes (according to Dublin Descriptors)

Knowledge and understanding:
Acquiring the fundamental notions of mathematical finance and stochastic processes theory. Acquiring the related calculation techniques

Applying knowledge and understanding:
The acquired notions and techniques are widely applied in the price calculation of the financial assets, and are used in a number of exercises

Making judgements:
Ability of analyzing and solving problems in mathematical finance. Ability of selecting tools and techniques to calculate derivative prices

Communication:
Student should acquire the probabilistic language and formalism necessary to read and understand scientific texts and literature, to expound the acquired notions and to analyze and solve problems

Lifelong learning skills:
Acquiring suitable learning methods, supported by text reading and problem solving as shon during the course

Course program

1. The binimial no-arbitrage pricing model
   1.1. One-period binomial model
   1.2. Multiperiod binomial model
   1.3. Computational considerations
2. Probability theory on coin toss spaces
   2.1. Finite probability spaces
   2.2. Random variables, distributions and expectations
   2.3. Conditional expectations
   2.4. Martingales
   2.5. Markov processes
3. State prices
   3.1. Change of measure
   3.2. Radon-Nikodym derivative process

3.3. Capital asset pricing model
4. American derivative securities
   4.1. Non-path dependent american derivatives
   4.2. Stopping times
   4.3. General american derivatives
   4.4. American call options
5. Random walk
   5.1. First passage times
   5.2. Reflection principle
   5.3. Perpetual american put
6. Interest-rate-dependent assets
   6.1. Binomial model for interest rates
   6.2. Fixed income derivatives
   6.3. Forward measures
   6.4. Futures

Teaching methods:
Lectures and exercise sessione

Auxiliary teaching:
Papers, notes and complements available on the web page
http://www.ba.infn.it/~cufaro/didactic.html

Assessment methods:
Oral exam

Bibliography:
S.E. Shreve: Stochastic Calculus for Finance I – The binomial asset pricing model (Springer 2004)