

Academic subject: Probabilistic Methods in Finance			
Degree Class: LM-40 – Matematica		Degree Course: Mathematics	
		Academic Year: 2017/2018	
		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 options, bonds, forwards and futures			
Expected learning outcomes (according to Dublin Descriptors)		<p>Knowledge and understanding: Acquiring the fundamental notions of mathematical finance and stochastic processes theory. Acquiring the related calculation techniques</p> <p>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</p> <p>Making judgements: Ability of analyzing and solving problems in mathematical finance. Ability of selecting tools and techniques to calculate derivative prices</p> <p>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</p> <p>Lifelong learning skills: Acquiring suitable learning methods, supported by text reading and problem solving as shown during the course</p>	
Course program			
<ol style="list-style-type: none"> 1. The binomial no-arbitrage pricing model <ol style="list-style-type: none"> 1.1. One-period binomial model 1.2. Multiperiod binomial model 1.3. Computational considerations 2. Probability theory on coin toss spaces <ol style="list-style-type: none"> 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 <ol style="list-style-type: none"> 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 sessions

Auxiliary teaching:

[Papers, notes and complements available on the web page](http://www.ba.infn.it/~cufaro/didactic.html)

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Assessment methods:

Oral exam

Bibliography:

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