



# UNIVERSITÀ DI PISA

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## MATHEMATICAL METHODS FOR INSURANCE

**EMANUELE VANNUCCI**

Anno accademico 2023/24  
CdS BANCA, FINANZA AZIENDALE E  
MERCATI FINANZIARI  
Codice 640PP  
CFU 6

Moduli MATHEMATICAL METHODS FOR INSURANCE	Settore/i SECS-S/06	Tipo LEZIONI	Ore 42	Docente/i EMANUELE VANNUCCI
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### Obiettivi di apprendimento

#### *Conoscenze*

Prepare students to deal with economic and financial assessments in conditions of uncertainty due to problems related to life insurance and non-life insurance issues.

#### *Modalità di verifica delle conoscenze*

The assessment will take place both on the theoretical aspects illustrated during the course, and on the resolution of numerical exercises, also with the aid of IT tools.

#### *Capacità*

The student will be able to understand the fundamental concepts underlying the economic relationships between the parties involved in the insurance market: company, policyholders, supervisory bodies.

#### *Modalità di verifica delle capacità*

The student must show that he has understood the importance of measuring and managing the uncertainty inherent in insurance contracts.

#### *Prerequisiti (conoscenze iniziali)*

The student is required to know basic general mathematics concepts, such as calculus of derivatives and solutions of linear systems. We will refer to the concept of discrete and continuous random variables. The meaning of integral calculus will be introduced to account for distributions of random variables. The fundamental concepts of discounting and capitalization of classical financial mathematics will be used in conditions of certainty.

#### *Indicazioni metodologiche*

The student will have to carry out in parallel the preparation relating to the theoretical aspects and that relating to the resolution of numerical exercises (also with the aid of IT tools).

#### *Programma (contenuti dell'insegnamento)*

Introduction of the concept of discrete and continuous random variables and of choice criteria in conditions of uncertainty. Review of financial mathematics. Calculation of premium and mathematical reserve in life insurance. Forms of performance adjustment. Recent Life Insurance Products. Financial derivatives embedded in life insurance contracts. Data analysis for biometric risk coverages. The concept of utility and convenience in taking out insurance contracts. The Total Claim Amount as sum of random variables. Main reinsurance treaties and new form or Insurance Risk Transferring.



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Cat-Risk assessment and management through a resilience approach.  
Claims reserve: notes. Health insurance assessment through Markov Models.

### Bibliografia e materiale didattico

Didactic material including exercises at the link  
<https://elearning.ec.unipi.it/course/view.php?id=166>

### Indicazioni per non frequentanti

It is possible to prepare the exam using the didactic material on the website  
<https://elearning.ec.unipi.it/course/view.php?id=166>  
and it is possible to contact the teacher for all the necessary clarifications,  
both in terms of content and organizational.

### Modalità d'esame

The exam takes place in written form, with both theory questions and questions relating  
to numerical exercises, which will be described and carried out during the course.

### Altri riferimenti web

<https://elearning.ec.unipi.it/course/view.php?id=166>

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