UCL SUMMER SCHOOL

Quantitative Modelling Techniques for Finance and Actuarial Sciences

Key Information

Module code: ISSU0083
Taught during: Session One: Monday 01 July – Friday 19 July 2019
Module workload: 45 teaching hours plus approximately 100 study hours
Module leaders: Dr Niloufar Abourashchi, Dr Codina Cotar, Dr Matina Rassias
Department: Department of Statistical Science
Credit: 15 UCL credits, 7.5 ECTS, 4 US
Level: Level 3, third year undergraduate
Pre-requisites: A minimum of two years of undergraduate study in a quantitative subject at the time of joining the UCL Summer School
Assessment: Quiz (20%), Examination (80%)

Module Overview

The implementation of sound quantitative actuarial models is a vital task to assess risk in insurance, finance and other industries and professions. This course provides a self-contained introduction to both theoretical and practical implementation of various quantitative modelling techniques applicable to finance and insurance. We combine diverse quantitative disciplines, from probability to statistics, from actuarial science to quantitative finance. Students will be able to apply the acquired knowledge to evaluate various insurance products.

Week One

- Principles of Actuarial modelling
- Fundamentals of Stochastic processes
- Continuous time Markov processes
- Survival models

Week Two

- Estimation procedures for lifetime distributions
- Maximum likelihood estimators for the transition intensities in models of transfer between states
- Introduction to the Binomial model

Week Three

- Comparison of the Binomial model with multiple states models
- Estimation of transition intensities
- Standard statistical tests in insurance (chi-square test, standardised deviations test, sign test, cumulative deviation test, grouping of signs test, serial correlations test)
Module Aims
The aim of this module is to provide a grounding in stochastic processes and survival models and their application. The module is suitable for people who would like to continue their studies in financial mathematics or who seek a financial career in the future and/or are aiming to take any finance related professional exam such as actuarial exams. The course will cover core technical reading (CT4) of the Society of Actuaries.

Teaching Methods
Teaching will be via a combination of lectures and interactive workshops. Handout notes and various other material will be offered and communicated via UCL’s virtual learning environment Moodle. We aim the lectures to be engaging with the use of educational technology, e.g. multiple-choice quizzes via online quiz platforms, whenever available and if considered appropriate. We will also invite guest speakers from the financial industry (at least one hour per week will be offered to an external speaker) followed by group discussions on the topic of the talk. Thus, students will gain additional insight into the practical work in the financial industry and life insurance.

Learning Outcomes

Upon successful completion of this module, students will be able to:

- Describe and apply the principles of actuarial modelling in an insurance framework
- Describe the general principles of stochastic processes, and their classification into different types
- Define and apply Markov chains and Markov processes
- Describe the concept of survival models
- Describe the estimation method for life time distributions
- Derive maximum likelihood estimators for the transition intensities in models of transfers between states with piecewise constant transition intensities.
- Describe how to estimate transition intensities depending on age, exactly or using the census approximation

Assessment Methods

- Online quiz (20%)
- Final exam (80%)

Key Texts


Module Leaders

Dr Niloufar Abourashchi is a Teaching fellow at UCL, with PhD in stochastic differential equations with application in finance, who has taught modules on actuarial mathematics, financial mathematics and risk management. She has supervised undergraduate and MSc students with Actuarial mathematics topics.

Dr Codina Cotar is a Reader in Probability at UCL, with extensive expertise in probability and financial mathematics. She has taught modules on probability, financial mathematics and risk management in the past both at UCL and at Technical University of Munich. She has supervised numerous undergraduate and MSc thesis with financial mathematics and risk management topics.

Dr Matina Rassias is a Senior Teaching Fellow at UCL, with a PhD in Statistics and Modelling Science; her thesis is focused on stochastic functional differential equations and applications. She has a wide range of Statistics and Mathematics teaching experience both on specialist and non-specialist degree programmes by having taught in various higher education institutions in the UK, USA and Greece.