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MATH39511

Actuarial Models

Unit code:	MATH39511
Credit Rating:	10
Unit level:	Level 3
Teaching period(s):	Semester 1
Offered by	School of Mathematics
Available as a free choice unit?:	N

Requisites

Prerequisite

- [MATH20972 - Actuarial Insurance](#) (Compulsory)

Additional Requirements

MATH39511 pre-requisites

Students are not permitted to take, for credit, MATH39511 in an undergraduate programme and then MATH69511 in a postgraduate programme at the University of Manchester, as the contents of the two courses overlap significantly.

Aims

The aim of this unit is to provide an understanding of the use of mathematical models of mortality, illness and other life history events in the study of processes of actuarial interest and to develop the skills of estimating the parameters in these models including the skills of how to apply methods of smoothing observed rates of mortality and of how to test the goodness-of-fit of the models.

Overview

This course unit is primarily concerned with mortality models and the statistical estimation of mortality rates in such models. The course starts with an introduction of stochastic models for transitions between multiple states (e.g., alive, ill, dead) and their properties. It then proceeds to develop and use such models in the context of mortality and other actuarial statistics. The estimation of and statistical tests of mortality rates within such models is then looked at.

Assessment Further Information

- Coursework: handing in homework for a number of selected exercises, 10%.
- Examination at the end of the semester, two and a half hours duration, 90%

Learning outcomes

- Upon successful completion, the students are expected to be able to describe and apply techniques developed during the course.

Syllabus

- Markov chains (5 Lectures): describe the concept of a Markov chain and illustrate their usefulness as a mortality model;
- Markov jump processes (10 Lectures): describe the concept of a Markov process together with their methods of estimation; provide their applications as sickness and marriage models;
- Binomial and Poisson models (3 Lectures): describe the Poisson approximation for transition intensities and the binomial model of mortality;
- Exposed to risk (1 Lecture): understand the estimation of age depending transition intensities;
- Graduation and statistical tests (3 Lectures): explain statistical tests of crude estimates for comparing with a standard table and a test for smoothness of a set of graduated estimates;
- Methods of graduation (1 Lecture): describe the process of graduation.
- Survival models (1 Lecture): revise various actuarial notations denoted within the Contingencies I course and describe the Gompertz and Makeham laws of mortality;
- Estimating the lifetime distribution (6 Lectures): describe various estimation procedures such as: Kaplan-Meier and Nelson-Aalen;
- The Cox regression model (3 Lectures): illustrate the Cox model for proportional hazards;

Recommended reading

- Core Reading: Subject CT4, Models. Produced by the Actuarial Education Company.

- Actuarial Mathematics (1997), second edition. Newton L. Bowers Jr. et al, Society of Actuaries.
- Statistical Models and Methods for Lifetime Data (2003), second edition. Jerald F. Lawless, John Wiley & Sons.

Feedback methods

Tutorials will provide an opportunity for students' work to be discussed and provide feedback on their understanding.

Study hours

- Lectures - 33 hours
- Tutorials - 11 hours
- Independent study hours - 56 hours

Teaching staff

Ronnie Loeffen - Unit coordinator