MATH39511 - 2011/2012

General Information

- Title: Actuarial Models
- Unit code: MATH39511
- Credits: 10
- Prerequisites: None
- Co-requisite units: None
- School responsible: Mathematics
- Members of staff responsible: Dr. R. Loeffen

Specification

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.

Brief Description of the unit

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.

Learning Outcomes

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

Future topics requiring this course unit

Syllabus

1. Markov chains (4 Lectures): describe the concept of a Markov chain and illustrate their usefulness as a mortality model;
2. Markov jump processes (5 Lectures): describe the concept of a Markov process together with their methods of estimation; provide their applications as sickness and marriage models;
3. Survival models (1 Lecture): revise various actuarial notations dened within the Contingencies I course and describe the Gompertz and Makeham laws of mortality;
4. Estimating the lifetime distribution (6 Lectures): describe various estimation procedures such as: Kaplan-Meier and Nelson-Aalen;
5. The Cox regression model (3 Lectures): illustrate the Cox model for proportional hazards;
6. Binomial and Poisson models (5 Lectures): describe the Poisson approximation for transition intensities and the binomial model of mortality;
7. Exposed to risk (2 Lectures): understand the estimation of age depending transition intensities;
8. Graduation and statistical tests (5 Lectures): explain statistical tests of crude estimates for comparing with a standard table and a test for smoothness of a set of graduated estimates;
9. Methods of graduation (2 Lectures): describe the process of graduation.

Textbooks

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

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

Teaching and learning methods

1. **Lectures and Tutorials:** There are three lectures and one feedback tutorial class each week.
2. **Private Study:** In addition, students should expect to spend at least three hours each week on private study for this course unit.

Assessment

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%.

Arrangements