ST338-15 Actuarial Models

22/23

Department
Statistics
Level
Undergraduate Level 3
Module leader
Joan Nakato
Credit value
15
Module duration
10 weeks
Assessment
Multiple
Study location
University of Warwick main campus, Coventry

Description

Introductory description

This module runs in Term 2 and is available for students on a course where it is a listed option and as an Unusual Option to students who have completed the prerequisite modules.
Pre-requisites:
Statistics Students: ST218 Mathematical Statistics A AND ST219 Mathematical Statistics B
Non-Statistics Students: ST220 Introduction to Mathematical Statistics and ST104 Statistical Laboratory.

Results from this module may be partly used to determine exemption eligibility in the Institute and Faculty of Actuaries (IFoA) modules CS2 and CM1. (Independent application with the IFoA may be required to receive the exemption.)

Module web page

Module aims

To cover part of the syllabus for Institute of Actuaries exam CS2 and CM1.

Outline syllabus

This is an indicative module outline only to give an indication of the sort of topics that may be covered. Actual sessions held may differ.

- Principles of actuarial modelling
- Principles of stochastic processes
- Markov chains and Markov jump processes
- Survival models: lifetimes, curtate future lifetime, expected value and variance.
- Estimation procedures for lifetime distributions: Kaplan—Meier estimate, Cox model
- Multi-state Markov models.
- Maximum likelihood estimators for transition intensities in multi-state models.
- Estimation in the Markov Model.
- Estimating mortality rates by age: exact methods, census approximations
- Process of graduation.
- Statistical tests for life tables.

Learning outcomes

By the end of the module, students should be able to:

- Describe the principles of actuarial modelling
- Describe the general principles of stochastic processes and their classification into different types.
- Define and apply a Markov chain.
- Define and apply a Markov jump process.
- Explain the concept of survival models.
- Describe estimation procedures for lifetime distributions
- Derive maximum likelihood estimators for the transition intensities in models of transfers between states with piecewise constant transition intensities.
- Describe the two-state model of a single decrement and compare its assumptions with those of the random lifetime model, derive maximum likelihood estimators for transition intensities and state the Poisson approximation to the estimator in the case of a single decrement.
- Describe how to estimate transition intensities depending on age, exactly or using the census approximation.
- Describe how to test crude estimates for consistency with a standard table or set of graduated estimates and describe the process of graduation.

Indicative reading list

View reading list on Talis Aspire

Subject specific skills

TBC

Transferable skills

TBC

Study

Study time

Type	Required	Optional
Lectures	28 sessions of 1 hour (15%)	2 sessions of 1 hour
Seminars	8 sessions of 1 hour (4%)	
Tutorials	(0%)	
Private study	112 hours (59%)	
Assessment	42 hours (22%)	
Total	190 hours	

Private study description

Weekly revision of lecture notes and materials, wider reading of actuarial syllabus, practice exercises and preparing for class tests and the examination.

Costs

No further costs have been identified for this module.

Assessment

You do not need to pass all assessment components to pass the module.

Students can register for this module without taking any assessment.

Assessment group D3

	Weighting	Study time	Eligible for self-certification
Computer Based Assessment 1	10%	15 hours	No
Computer based assessment which will take place at a fixed time during the term that the module is delivered.			
Computer Based Assessment 2	10%	15 hours	No
Computer based assessment which will take place at a fixed time during the term that the module is delivered.			

	Weighting	Study time	Eligible for self-certification
Written assignment	10%	12 hours	Yes (extension)

Due in week 10 of term 2.
You will use the R program to carry out calculations and fit models on provided data sets in response to a set of questions. You will present, discuss and evaluate the results.
The number of words noted below refers to the amount of time in hours that a well-prepared student who has attended lectures and carried out an appropriate amount of independent study on the material could expect to spend on this assignment. 500 words is equivalent to one page of text, diagrams, formula or equations; your assignment should not exceed 12 pages in length.

In-person Examination	70%		No

You will be required to answer all questions on this examination paper.

- Answerbook Pink (12 page)
- Students may use a calculator
- Formulae & Tables for Examinations (Inst of Actuaries 2002) GOLD HARDBACK BOOK
- Cambridge Statistical Tables (blue)

Assessment group R2

	Weighting	Study time	Eligible for self-certification
In-person Examination - Resit	100%		No

You will be required to answer all questions on this examination paper.

- Answerbook Pink (12 page)
- Students may use a calculator
- Formulae & Tables for Examinations (Inst of Actuaries 2002) GOLD HARDBACK BOOK
- Cambridge Statistical Tables (blue)

Feedback on assessment

Solutions and cohort level feedback will be provided for the class tests within 4 weeks of the test. Your paper will not be returned as it must be retained for the external examiners but you may make an appointment with the module leader to view your script and receive individual feedback.

Solutions and cohort level feedback will be provided after the Summer examination.

Past exam papers for ST338

Availability

Courses

This module is Optional for:

- Year 3 of UCSA-G4G1 Undergraduate Discrete Mathematics
- Year 3 of UCSA-G4G3 Undergraduate Discrete Mathematics
- Year 4 of UCSA-G4G4 Undergraduate Discrete Mathematics (with Intercalated Year)
- Year 4 of UCSA-G4G2 Undergraduate Discrete Mathematics with Intercalated Year
- USTA-G300 Undergraduate Master of Mathematics,Operational Research,Statistics and Economics
    - Year 3 of G300 Mathematics, Operational Research, Statistics and Economics
    - Year 4 of G300 Mathematics, Operational Research, Statistics and Economics
- USTA-G1G3 Undergraduate Mathematics and Statistics (BSc MMathStat)
    - Year 3 of G1G3 Mathematics and Statistics (BSc MMathStat)
    - Year 4 of G1G3 Mathematics and Statistics (BSc MMathStat)
- USTA-G1G4 Undergraduate Mathematics and Statistics (BSc MMathStat) (with Intercalated Year)
    - Year 4 of G1G4 Mathematics and Statistics (BSc MMathStat) (with Intercalated Year)
    - Year 5 of G1G4 Mathematics and Statistics (BSc MMathStat) (with Intercalated Year)

This module is Option list A for:

- Year 3 of USTA-G300 Undergraduate Master of Mathematics,Operational Research,Statistics and Economics
- USTA-G301 Undergraduate Master of Mathematics,Operational Research,Statistics and Economics (with Intercalated
    - Year 3 of G30E Master of Maths, Op.Res, Stats & Economics (Actuarial and Financial Mathematics Stream) Int
    - Year 4 of G30E Master of Maths, Op.Res, Stats & Economics (Actuarial and Financial Mathematics Stream) Int

This module is Option list B for:

- Year 3 of USTA-Y602 Undergraduate Mathematics,Operational Research,Statistics and Economics