ACST818
Survival Models
S1 Day 2017
Dept of Applied Finance and Actuarial Studies

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General Information

Unit convenor and teaching staff
Xian Zhou
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Credit points
4

Prerequisites
ACST603 or (admission to MActPrac post 2014)

Corequisites
ACST851 and (STAT806 or STAT810)

Co-badged status

Unit description
This unit provides sophisticated statistical and probabilistic models for survival, sickness, insurance losses and other actuarial problems based on survival data. Techniques of survival analysis are used to estimate survival and loss distributions and evaluate risk factors in actuarial applications. Methods of both nonparametric and parametric estimation are utilised. Advanced models based on Markov chains and processes will also be introduced to capture the features of stochastic transitions between different survival or loss states and to estimate the transition rates.

Important Academic Dates
Information about important academic dates including deadlines for withdrawing from units are available at https://students.mq.edu.au/important-dates

Learning Outcomes

1. Understand different types of survival models and their connections with practical actuarial problems.
2. Master the skills of nonparametric and parametric methods to estimate parameters and probability distributions.
3. Grasp the ideas and concepts of Markov properties and processes.
4. Able to solve Markov transition probabilities via matrix theory and differential equations.
5. Capable of integrating advanced mathematical theory and techniques of survival models into actuarial modelling and applications.
General Assessment Information

Extensions and penalties on coursework assessment tasks

• Tasks 10% or less – No extensions will be granted. Students who have not submitted the task prior to the deadline will be awarded a mark of 0 for the task, except for cases in which an application for disruptions to studies is made and approved.

• Tasks above 10% - No extensions will be granted. There will be a deduction of 10% of the total available marks made from the total awarded mark for each 24 hour period or part thereof that the submission is late (for example, 25 hours late in submission – 20% penalty). This penalty does not apply for cases in which an application for disruption of studies is made and approved. No submission will be accepted after solutions have been posted.

Submission of assessment tasks

• Answers to the quiz are to be submitted in paper form by 3pm, Wednesday 22 March 2017.

• Answers to the take-home test (Test 1) are to be submitted in paper form by 3pm, Monday 8 May 2017.

Open-book final examination

• The final examination will be open-book in the sense that students can bring in any materials written or printed on paper with any size and number of pages.

Gradebook

• It is the responsibility of students to view their marks for each within session assessment on iLearn within 20 working days of posting. If there are any discrepancies, students must contact the unit convenor immediately. Failure to do so will mean that queries received after the release of final results regarding assessment marks (not including the final exam mark) will not be addressed.

• Assessment criteria for all assessment tasks will be provided on the unit iLearn site.

Supplementary exams

• Information regarding supplementary exams, including dates, is available at:

http://www.businessandeconomics.mq.edu.au/current_students/undergraduate/how_do_i/special_consideration

Assessment Tasks

<table>
<thead>
<tr>
<th>Name</th>
<th>Weighting</th>
<th>Hurdle</th>
<th>Due</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quiz</td>
<td>5%</td>
<td>No</td>
<td>22 March</td>
</tr>
<tr>
<td>Test 1</td>
<td>20%</td>
<td>No</td>
<td>8 May</td>
</tr>
<tr>
<td>Test 2</td>
<td>15%</td>
<td>No</td>
<td>6 June</td>
</tr>
</tbody>
</table>

https://unitguides.mq.edu.au/unit_offerings/80335/unit_guide/print
### Quiz

**Due:** 22 March  
**Weighting:** 5%

Take-home quiz with multiple-choice questions. Feedbacks to the quiz will be provided before the end of week 4 (Friday, 24 March).

This Assessment Task relates to the following Learning Outcomes:

- Understand different types of survival models and their connections with practical actuarial problems.
- Grasp the ideas and concepts of Markov properties and processes.

### Test 1

**Due:** 8 May  
**Weighting:** 20%

Take-home test with problem-solving questions

This Assessment Task relates to the following Learning Outcomes:

- Master the skills of nonparametric and parametric methods to estimate parameters and probability distributions.
- Capable of integrating advanced mathematical theory and techniques of survival models into actuarial modelling and applications.

### Test 2

**Due:** 6 June  
**Weighting:** 15%

Class test with multiple-choice questions. It will be held during lecture hours in the lecture room (duration: 90 minutes).

This Assessment Task relates to the following Learning Outcomes:

- Understand different types of survival models and their connections with practical actuarial problems.
- Grasp the ideas and concepts of Markov properties and processes.
- Able to solve Markov transition probabilities via matrix theory and differential equations.
• Capable of integrating advanced mathematical theory and techniques of survival models into actuarial modelling and applications.

Examination
Due: Examination Period
Weighting: 60%

Open-book final examination with problem-solving questions (duration: 3 hours plus 10 minutes reading)

This Assessment Task relates to the following Learning Outcomes:
• Master the skills of nonparametric and parametric methods to estimate parameters and probability distributions.
• Able to solve Markov transition probabilities via matrix theory and differential equations.
• Capable of integrating advanced mathematical theory and techniques of survival models into actuarial modelling and applications.

Delivery and Resources

Classes
• This unit is taught through 3 hours of lectures and 1 hour of tutorials per week.
• The timetable for classes can be found on the University web site at: http://www.timetables.mq.edu.au/
• Tutorials start in Week 2

Consultation hours
Refer to iLearn

Unit Web Page
• The web page for this unit can be found at: http://ilearn.mq.edu.au

Technology Used and required
• You will need access to the internet to obtain course information and download teaching materials from the unit website.
• It is your responsibility to check the unit website regularly to make sure that you are up-to-date with the information for the unit.

Required and Recommended Texts and/or Materials
• Lecture Notes are the required materials and will be posted on the website before the lectures.
• The main additional reading materials are the ActEd CT4 notes. This will also be used as background reading for ACST359/819.
Unit Schedule

Week 1: Principle of actuarial modelling; Probability models
Week 2: Survival analysis; Estimation of survival distributions
Week 3: Estimation of survival distributions; Variance estimation
Week 4: Variance estimation and confidence intervals
Week 5: Cox proportional hazards models
Week 6: Cox proportional hazards models; Stochastic processes
Week 7: Markov chains
Week 8: Test 1
Week 9: Markov chains; Markov jump processes
Week 10: Markov jump processes
Week 11: Markov jump processes; Applications of Markov processes
Week 12: Applications of Markov processes
Week 13: Test 2

Note: This is only a tentative schedule. The actual schedule will be adjusted from time to time in accordance with the progress of lectures.

Policies and Procedures

Macquarie University policies and procedures are accessible from Policy Central. Students should be aware of the following policies in particular with regard to Learning and Teaching:

Academic Honesty Policy http://mq.edu.au/policy/docs/academic_honesty/policy.html

In addition, a number of other policies can be found in the Learning and Teaching Category of Policy Central.

Student Code of Conduct

Macquarie University students have a responsibility to be familiar with the Student Code of Conduct.
Graduate Capabilities

PG - Discipline Knowledge and Skills

Our postgraduates will be able to demonstrate a significantly enhanced depth and breadth of knowledge, scholarly understanding, and specific subject content knowledge in their chosen fields.

This graduate capability is supported by:
Learning outcomes

- Understand different types of survival models and their connections with practical actuarial problems.
- Master the skills of nonparametric and parametric methods to estimate parameters and probability distributions.
- Grasp the ideas and concepts of Markov properties and processes.
- Able to solve Markov transition probabilities via matrix theory and differential equations.
- Capable of integrating advanced mathematical theory and techniques of survival models into actuarial modelling and applications.

PG - Critical, Analytical and Integrative Thinking

Our postgraduates will be capable of utilising and reflecting on prior knowledge and experience, of applying higher level critical thinking skills, and of integrating and synthesising learning and knowledge from a range of sources and environments. A characteristic of this form of thinking is the generation of new, professionally oriented knowledge through personal or group-based critique of practice and theory.

This graduate capability is supported by:

Learning outcomes

- Understand different types of survival models and their connections with practical actuarial problems.
- Master the skills of nonparametric and parametric methods to estimate parameters and probability distributions.
- Grasp the ideas and concepts of Markov properties and processes.
- Capable of integrating advanced mathematical theory and techniques of survival models into actuarial modelling and applications.

PG - Research and Problem Solving Capability

Our postgraduates will be capable of systematic enquiry; able to use research skills to create new knowledge that can be applied to real world issues, or contribute to a field of study or practice to enhance society. They will be capable of creative questioning, problem finding and problem solving.

This graduate capability is supported by:

Learning outcomes

- Master the skills of nonparametric and parametric methods to estimate parameters and probability distributions.
- Able to solve Markov transition probabilities via matrix theory and differential equations.
• Capable of integrating advanced mathematical theory and techniques of survival models into actuarial modelling and applications.