



# ACST818

## Survival Models

S1 Day 2015

*Dept of Applied Finance and Actuarial Studies*

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#### **Disclaimer**

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## General Information

Unit convenor and teaching staff

Unit Convenor

Xian Zhou

[xian.zhou@mq.edu.au](mailto:xian.zhou@mq.edu.au)

Contact via [xian.zhou@mq.edu.au](mailto:xian.zhou@mq.edu.au)

E4A 607

Refer to the unit's web site

Credit points

4

Prerequisites

(ACST601 and ACST603 and ACST604) 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://www.mq.edu.au/study/calendar-of-dates>

## Learning Outcomes

On successful completion of this unit, you will be able to:

Understand different types of survival models and key concepts of survival analysis

Able to connect the concepts of survival models and statistical inference with practical actuarial problems

Master the skills of nonparametric and parametric methods to estimate parameters and

probability distributions

Understand the ideas and concepts of Markov properties and processes

Able to solve Markov transition probabilities via matrix theory and differential equations and to estimate the transition rates

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:

No extensions will be granted. Late tasks will be accepted up to 72 hours after the submission deadline. There will be a deduction of 20% 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 – 40% penalty). This penalty does not apply for cases in which an application for disruption to studies is made and approved.

### Submission of assessment tasks:

Answers to the quiz are to be submitted to BESS in paper form by 11am, Friday 20 March 2015.

Answers to the take-home test are to be submitted to BESS in paper form by 3pm, Friday 8 May 2015.

### 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 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 tasks (not including the final exam mark) will not be addressed.

## Assessment Tasks

Name	Weighting	Due
<u>Quiz</u>	10%	20 March
<u>Test</u>	20%	8 May

Name	Weighting	Due
<u>Examination</u>	70%	Examination period

## Quiz

Due: **20 March**

Weighting: **10%**

Multiple-choice questions

On successful completion you will be able to:

- Understand different types of survival models and key concepts of survival analysis
- Able to connect the concepts of survival models and statistical inference with practical actuarial problems

## Test

Due: **8 May**

Weighting: **20%**

Problem-solving questions

On successful completion you will be able to:

- Understand different types of survival models and key concepts of survival analysis
- Able to connect the concepts of survival models and statistical inference with practical actuarial problems
- Master the skills of nonparametric and parametric methods to estimate parameters and probability distributions
- Understand 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

## Examination

Due: **Examination period**

Weighting: **70%**

Open-book examination with a combination of multiple-choice problem-solving questions.

On successful completion you will be able to:

- Able to connect the concepts of survival models and statistical inference with practical actuarial problems

- Master the skills of nonparametric and parametric methods to estimate parameters and probability distributions
- Understand the ideas and concepts of Markov properties and processes
- Able to solve Markov transition probabilities via matrix theory and differential equations and to estimate the transition rates
- 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 2 hours 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 1 (updated)

### **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.

### **What is required to complete the unit satisfactorily**

To be eligible to pass this unit, a pass is required in the final examination.

## Unit Schedule

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

**Note:** This is only a tentative schedule. The actual schedule will depend on the progress of lectures.

## Learning and Teaching Activities

### Teaching Activities

The unit is taught through 3 hours of lectures and 1 hour of tutorial per week. Lectures will cover the topics and materials in accordance with the syllabus of Subject CT4 of Institute of Actuaries (IA). Tutorials will discuss exercise questions covered by the lectures.

## Learning Activities

Students are expected to listen carefully to all lectures and tutorials; participate in discussions during tutorials, read relevant materials in advance; review the knowledge learned in classes; and complete assignment and practice tasks independently.

## Practices

Practices on covered topics will be provided in addition to tutorial exercises.

## Attendance

Attending all classes is crucial to achieving satisfactory performance.

## 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](http://mq.edu.au/policy/docs/academic_honesty/policy.html)

Assessment Policy <http://mq.edu.au/policy/docs/assessment/policy.html>

Grading Policy <http://mq.edu.au/policy/docs/grading/policy.html>

Grade Appeal Policy <http://mq.edu.au/policy/docs/gradeappeal/policy.html>

Grievance Management Policy [http://mq.edu.au/policy/docs/grievance\\_management/policy.html](http://mq.edu.au/policy/docs/grievance_management/policy.html)

Disruption to Studies Policy [http://www.mq.edu.au/policy/docs/disruption\\_studies/policy.html](http://www.mq.edu.au/policy/docs/disruption_studies/policy.html) *The Disruption to Studies Policy is effective from March 3 2014 and replaces the Special Consideration Policy.*

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: [https://students.mq.edu.au/support/student\\_conduct/](https://students.mq.edu.au/support/student_conduct/)

## Results

Results shown in *iLearn*, or released directly by your Unit Convenor, are not confirmed as they are subject to final approval by the University. Once approved, final results will be sent to your student email address and will be made available in [eStudent](#). For more information visit [ask.mq.edu.au](http://ask.mq.edu.au).

### Supplementary Exams

*Further information regarding supplementary exams, including dates, is available here*

[http://www.businessandconomics.mq.edu.au/current\\_students/undergraduate/how\\_do\\_i/specia/consideration](http://www.businessandconomics.mq.edu.au/current_students/undergraduate/how_do_i/specia/consideration)

## Student Support

Macquarie University provides a range of support services for students. For details, visit <http://students.mq.edu.au/support/>

### Learning Skills

Learning Skills ([mq.edu.au/learningskills](http://mq.edu.au/learningskills)) provides academic writing resources and study strategies to improve your marks and take control of your study.

- [Workshops](#)
- [StudyWise](#)
- [Academic Integrity Module for Students](#)
- [Ask a Learning Adviser](#)

## Student Services and Support

Students with a disability are encouraged to contact the [Disability Service](#) who can provide appropriate help with any issues that arise during their studies.

## Student Enquiries

For all student enquiries, visit Student Connect at [ask.mq.edu.au](http://ask.mq.edu.au)

## IT Help

For help with University computer systems and technology, visit <http://informatics.mq.edu.au/help/>.

When using the University's IT, you must adhere to the [Acceptable Use Policy](#). The policy applies to all who connect to the MQ network including students.

## 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 key concepts of survival analysis
- Able to connect the concepts of survival models and statistical inference with practical actuarial problems
- Master the skills of nonparametric and parametric methods to estimate parameters and probability distributions



- Understand the ideas and concepts of Markov properties and processes
- Able to solve Markov transition probabilities via matrix theory and differential equations and to estimate the transition rates
- Capable of integrating advanced mathematical theory and techniques of survival models into actuarial modelling and applications

## **Assessment tasks**

- Quiz
- Test
- Examination

## **Learning and teaching activities**

- The unit is taught through 3 hours of lectures and 1 hour of tutorial per week. Lectures will cover the topics and materials in accordance with the syllabus of Subject CT4 of Institute of Actuaries (IA). Tutorials will discuss exercise questions covered by the lectures.
- Students are expected to listen carefully to all lectures and tutorials; participate in discussions during tutorials, read relevant materials in advance; review the knowledge learned in classes; and complete assignment and practice tasks independently.
- Practices on covered topics will be provided in addition to tutorial exercises.

## **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 key concepts of survival analysis
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- Practices on covered topics will be provided in addition to tutorial exercises.

## **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 and to estimate the transition rates
- Capable of integrating advanced mathematical theory and techniques of survival models into actuarial modelling and applications

## **Assessment tasks**

- Test
- Examination

## **Learning and teaching activities**

- The unit is taught through 3 hours of lectures and 1 hour of tutorial per week. Lectures

will cover the topics and materials in accordance with the syllabus of Subject CT4 of Institute of Actuaries (IA). Tutorials will discuss exercise questions covered by the lectures.

- Students are expected to listen carefully to all lectures and tutorials; participate in discussions during tutorials, read relevant materials in advance; review the knowledge learned in classes; and complete assignment and practice tasks independently.
- Practices on covered topics will be provided in addition to tutorial exercises.

## **Changes from Previous Offering**

Teaching materials are updated.

## **Co-taught Status**

This unit is co-taught with ACST358 Survival Models.

## **Research & Practice, Global & Sustainability**

The content of this unit is well connected to a number of research topics in statistics and actuarial studies.

This unit is designed to tackle general insurance problems in practice.

The knowledge and skills provided by this unit are globally accepted and recognized.

The topics of survival models in this unit are naturally and intrinsically aimed at sustainable development of the society.