



# ACST818

## Survival Models

S1 Day 2016

*Dept of Applied Finance and Actuarial Studies*

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#### **Disclaimer**

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## General Information

Unit convenor and teaching staff

Xian Zhou

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Credit points

4

Prerequisites

(ACST601 and ACST603 and ACST604) or (admission to MActPrac post 2014)

Corequisites

ACST851 and (STAT806 or STAT810)

Co-badged status

Co-taught with ACST358

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. 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 11am, Wednesday 30 March 2016.

Answers to the take-home test are to be submitted in paper form by 3pm, Wednesday 18 May 2016.

### 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.

### Supplementary exams:

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

[http://www.businessandconomics.mq.edu.au/current\\_students/undergraduate/how\\_do\\_i/disruption\\_to\\_studies](http://www.businessandconomics.mq.edu.au/current_students/undergraduate/how_do_i/disruption_to_studies)

## Assessment Tasks

Name	Weighting	Due
Quiz	10%	30 March

Name	Weighting	Due
<u>Test</u>	20%	18 May
<u>Examination</u>	70%	Examination period

## Quiz

Due: **30 March**

Weighting: **10%**

True/false and 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: **18 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
- 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

## Examination

Due: **Examination period**

Weighting: **70%**

Open-book examination with a combination of true/false, multiple-choice and 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
- Able to solve Markov transition probabilities via matrix theory and differential equations and to estimate the transition rates
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## **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 2.

### **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 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: Confidence intervals; Cox proportional hazards models

Week 6: Cox proportional hazards models

Week 7: Stochastic processes; Markov chains

Week 8: Markov chains

Week 9: Markov jump processes

Week 10: Markov jump processes

Week 11: Applications of Markov processes

Week 12: Applications of Markov processes

Week 13: Revision

**Note:** This is only a tentative schedule. The actual schedule will depend on 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](http://mq.edu.au/policy/docs/academic_honesty/policy.html)

**New Assessment Policy in effect from Session 2 2016** [http://mq.edu.au/policy/docs/assessment/policy\\_2016.html](http://mq.edu.au/policy/docs/assessment/policy_2016.html). For more information visit [http://students.mq.edu.au/events/2016/07/19/new\\_assessment\\_policy\\_in\\_place\\_from\\_session\\_2/](http://students.mq.edu.au/events/2016/07/19/new_assessment_policy_in_place_from_session_2/)

Assessment Policy prior to Session 2 2016 <http://mq.edu.au/policy/docs/assessment/policy.html>

Grading Policy prior to Session 2 2016 <http://mq.edu.au/policy/docs/grading/policy.html>

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

Complaint Management Procedure for Students and Members of the Public [http://www.mq.edu.au/policy/docs/complaint\\_management/procedure.html](http://www.mq.edu.au/policy/docs/complaint_management/procedure.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).

## **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://www.mq.edu.au/about\\_us/offices\\_and\\_units/information\\_technology/help/](http://www.mq.edu.au/about_us/offices_and_units/information_technology/help/).

When using the University's IT, you must adhere to the [Acceptable Use of IT Resources 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

### 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
- 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

## **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**

- 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**

- Test
- Examination