



# ACST358

## Survival Models

S1 Day 2014

*Applied Finance and Actuarial Studies*

### Contents

---

<a href="#"><u>General Information</u></a>	2
<a href="#"><u>Learning Outcomes</u></a>	2
<a href="#"><u>Assessment Tasks</u></a>	3
<a href="#"><u>Delivery and Resources</u></a>	5
<a href="#"><u>Unit Schedule</u></a>	5
<a href="#"><u>Learning and Teaching Activities</u></a>	6
<a href="#"><u>Policies and Procedures</u></a>	6
<a href="#"><u>Graduate Capabilities</u></a>	8
<a href="#"><u>Research and Practice</u></a>	10

---

#### **Disclaimer**

Macquarie University has taken all reasonable measures to ensure the information in this publication is accurate and up-to-date. However, the information may change or become out-dated as a result of change in University policies, procedures or rules. The University reserves the right to make changes to any information in this publication without notice. Users of this publication are advised to check the website version of this publication [or the relevant faculty or department] before acting on any information in this publication.

## 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

3

Prerequisites

ACST255(P) and STAT272(P)

Corequisites

Co-badged status

Co-taught with ACST818 Survival Models

Unit description

This unit develops probabilistic and statistical models for survival and death, health and sickness, loss and claims, and other insurance related problems. Students will estimate lifetime distributions and model parameters; assess risk factors; and evaluate the goodness of fit of the models. Survival analysis for censored and truncated data, Cox proportional hazards models with covariates, and Markov processes for multiple state models, will be considered. Students gaining a grade of credit or higher in both ACST358 and ACST359 are eligible for exemption from subject CT4 of the professional exams of the Institute of Actuaries of Australia.

## 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.

## Assessment Tasks

Name	Weighting	Due
<a href="#"><u>Assignment 1</u></a>	10%	Friday, 28 March 2014
<a href="#"><u>Assignment 2</u></a>	20%	Friday, 16 May 2014
<a href="#"><u>Examination</u></a>	70%	Examination period

### Assignment 1

Due: **Friday, 28 March 2014**

Weighting: **10%**

**Type of questions:** Multiple-choice

**Submission:** By answer sheet

**Extension:** 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 special consideration is made and approved.

**Penalties:** Not applicable

**What is required to complete the unit satisfactorily:** Not Applicable

**Weight:** 10% upon passing the final examination

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.

### Assignment 2

Due: **Friday, 16 May 2014**

Weighting: **20%**

**Type of questions:** Detailed solutions required

**Submission:** By answer sheets

**Extension:** 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 special consideration is made and approved.

**Penalties:** Not applicable

**What is required to complete the unit satisfactorily:** 60 marks out of 100 are required for satisfactory coursework

**Weight:** 20% upon passing the final examination

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.

## Examination

Due: **Examination period**

Weighting: **70%**

**Type of questions:** A combination of multiple-choice and questions requiring detailed solutions

**Examination conditions:** Open-book, any materials on paper allowed

**What is required to complete the unit satisfactorily:** Passing the final examination is required to pass this unit.

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.

## Delivery and Resources

### Classes

This unit is taught through 3 hours of lectures and 1 hour of tutorials per week.

Tutorials start in Week 2.

The timetable for classes can be found on the University web site at:

<http://www.timetables.mq.edu.au/>

### 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 Web Page

The web page for this unit can be found at: <http://ilearn.mq.edu.au>

### Teaching and Learning Activities

This unit is taught through 3 hours of lectures and 1 hour of tutorials per week.

Lectures will cover the topics and materials in accordance with the syllabus for Institute of Actuaries of Australia (IAAust) subject CT4.

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.

### 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.

### Changes Since the Last Offering of This Unit

Teaching materials are updated.

## 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
8	Markov chains
9	Markov chains; Markov jump processes
10	Markov jump processes
11	Markov jump processes; 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 learnt in classes; and complete the Assignment and all Practice Tasks independently.

## 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/)

### Supplementary Exams

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

[http://www.businessandconomics.mq.edu.au/current\\_students/undergraduate/how\\_do\\_i/special\\_consideration](http://www.businessandconomics.mq.edu.au/current_students/undergraduate/how_do_i/special_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

### Discipline Specific Knowledge and Skills

Our graduates will take with them the intellectual development, depth and breadth of knowledge, scholarly understanding, and specific subject content in their chosen fields to make them competent and confident in their subject or profession. They will be able to demonstrate, where relevant, professional technical competence and meet professional standards. They will be able to articulate the structure of knowledge of their discipline, be able to adapt discipline-specific knowledge to novel situations, and be able to contribute from their discipline to inter-disciplinary solutions to problems.

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.

### Assessment tasks

- Assignment 1
- Assignment 2
- Examination

### Critical, Analytical and Integrative Thinking

We want our graduates to be capable of reasoning, questioning and analysing, and to integrate and synthesise learning and knowledge from a range of sources and environments; to be able to



critique constraints, assumptions and limitations; to be able to think independently and systemically in relation to scholarly activity, in the workplace, and in the world. We want them to have a level of scientific and information technology literacy.

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

## **Assessment tasks**

- Assignment 1
- Assignment 2
- Examination

## **Problem Solving and Research Capability**

Our graduates should be capable of researching; of analysing, and interpreting and assessing data and information in various forms; of drawing connections across fields of knowledge; and they should be able to relate their knowledge to complex situations at work or in the world, in order to diagnose and solve problems. We want them to have the confidence to take the initiative in doing so, within an awareness of their own limitations.

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

## **Assessment tasks**

- Assignment 2
- Examination

## Research and Practice

This unit gives you opportunities to conduct your own research and provides extensive examples of applications for practice.