



# ACST818

## Survival Models

S1 Day 2014

*Applied Finance and Actuarial Studies*

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## General Information

Unit convenor and teaching staff

Unit Convenor

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E4A 607

Refer to the unit's web site

Credit points

4

Prerequisites

ACST601 and ACST602 and ACST604

Corequisites

STAT806 or STAT810

Co-badged status

Co-taught with ACST358 Survival Analysis

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

## Assessment Tasks

Name	Weighting	Due
Assignment 1	10%	Friday, 28 March 2014
Assignment 2	20%	Friday, 16 May 2014
Examination	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
- Capable of integrating advanced mathematical theory and techniques of survival models into actuarial modelling and applications

## 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
- Capable of integrating advanced mathematical theory and techniques of survival models into actuarial modelling and applications

## 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
- Capable of integrating advanced mathematical theory and techniques of survival models into actuarial modelling and applications

## **Delivery and Resources**

### **Classes**

- This unit will consist of 3 hour lectures and 2 hour tutorial per week.
- Tutorials start in Week 2.
- Tutorial exercises will be available from the unit web site each week before tutorials.
- Tutorial exercises will not be assessed, but they form a very important part of the study and are closely related to the assessed components (tests and examination).
- Tutorials are important opportunities for you to work on the week's tutorial questions and to obtain help with them as needed. The more preparation you do for the tutorial, the more you will benefit from the session.
- The timetable for classes can be found on the University web site at:  
<http://www.timetables.mq.edu.au/>
- Any alterations to classes will be advised in lectures and/or on the unit webpage.

### **Required and Recommended Texts and/or Materials**

- The primary texts for the unit are the Lecture Notes provided by the Lecturer.
- Lecture Notes will be posted on the unit 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**

Course materials are available on the learning management system (iLearn)

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.

## Teaching and Learning 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 learnt in classes; and complete the Assignment and all Practice Tasks independently.

The planned week-by-week list of the topics is provided in Unit Schedule. Note that this is a tentative schedule, and small departures are expected on the basis of week to week progress.

## 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

**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)

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

### 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

- Assignment 1



- Assignment 2
- 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

- 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
- Capable of integrating advanced mathematical theory and techniques of survival models into actuarial modelling and applications

### Assessment tasks

- Assignment 1
- Assignment 2
- 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

- 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**

- Assignment 2
- Examination

## **Research and Practice**

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