



# ACST3058

## Survival Models

Session 1, Special circumstances 2021

*Department of Actuarial Studies and Business Analytics*

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#### **Disclaimer**

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#### **Notice**

As part of [Phase 3 of our return to campus plan](#), most units will now run tutorials, seminars and other small group activities on campus, and most will keep an online version available to those students unable to return or those who choose to continue their studies online.

To check the availability of face-to-face activities for your unit, please go to [timetable viewer](#). To check detailed information on unit assessments visit your unit's iLearn space or consult your unit convenor.

## General Information

Unit convenor and teaching staff Unit Convenor Xian Zhou <a href="mailto:xian.zhou@mq.edu.au">xian.zhou@mq.edu.au</a>
Credit points 10
Prerequisites (ACST255 or ACST2055) and (STAT272 or STAT2372)
Corequisites
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 be introduced to capture the features of stochastic transitions between different survival or loss states and to estimate the transition rates. Methods for valuing cashflows that are contingent upon multiple transition events and methods of projecting and valuing such expected cashflows will also be covered. Students gaining a weighted average of credit across all of ACST3058, ACST3060 and the CS2-related components of the assessment in ACST3059 (minimum mark of 60% on all three components) will satisfy the requirements for exemption from the professional subject CS2 of the Actuaries Institute.

## 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

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

**ULO1:** Apply and analyse different types of survival models and justify their connections with practical actuarial problems.

**ULO2:** Apply statistical inference technique to estimate parameters and probability

distributions of survival models.

**ULO3:** Demonstrate an understanding of the concepts and properties of Markov processes.

**ULO4:** Solve Markov transition probabilities via matrix theory and differential equations.

**ULO5:** Perform valuation of cashflows that are contingent upon multiple transition / decrement events.

## General Assessment Information

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

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.

### Late submissions and extensions

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 special consideration 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 special consideration is made and approved. No submission will be accepted after solutions have been posted.

## Assessment Tasks

Name	Weighting	Hurdle	Due
<a href="#"><u>Class Test</u></a>	20%	No	21/04/21
<a href="#"><u>Assignment</u></a>	20%	No	02/06/21
<a href="#"><u>Final Exam</u></a>	60%	No	Examination Period

### Class Test

Assessment Type <sup>1</sup>: Quiz/Test

Indicative Time on Task <sup>2</sup>: 17 hours

Due: **21/04/21**

Weighting: **20%**

The test will be approximately 90 minutes, to be held during class time.

On successful completion you will be able to:

- Apply and analyse different types of survival models and justify their connections with practical actuarial problems.
- Apply statistical inference technique to estimate parameters and probability distributions of survival models.
- Demonstrate an understanding of the concepts and properties of Markov processes.

## Assignment

Assessment Type <sup>1</sup>: Quantitative analysis task

Indicative Time on Task <sup>2</sup>: 20 hours

Due: **02/06/21**

Weighting: **20%**

Problem-solving questions requiring detailed solutions using the statistical package R.

On successful completion you will be able to:

- Apply and analyse different types of survival models and justify their connections with practical actuarial problems.
- Apply statistical inference technique to estimate parameters and probability distributions of survival models.
- Solve Markov transition probabilities via matrix theory and differential equations.
- Perform valuation of cashflows that are contingent upon multiple transition / decrement events.

## Final Exam

Assessment Type <sup>1</sup>: Examination

Indicative Time on Task <sup>2</sup>: 28 hours

Due: **Examination Period**

Weighting: **60%**

The final examination will be a three-hour written paper with ten minutes reading time, to be held during the University Examination period.

On successful completion you will be able to:

- Apply and analyse different types of survival models and justify their connections with practical actuarial problems.
- Apply statistical inference technique to estimate parameters and probability distributions of survival models.
- Demonstrate an understanding of the concepts and properties of Markov processes.
- Solve Markov transition probabilities via matrix theory and differential equations.

- Perform valuation of cashflows that are contingent upon multiple transition / decrement events.
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<sup>1</sup> If you need help with your assignment, please contact:

- the academic teaching staff in your unit for guidance in understanding or completing this type of assessment
- the [Learning Skills Unit](#) for academic skills support.

<sup>2</sup> Indicative time-on-task is an estimate of the time required for completion of the assessment task and is subject to individual variation

## 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 from 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.
- The statistical package R will be extensively employed in this unit. The application of R is essential to completing the Assignment.
- Application of R will be introduced in the weekly lecture/tutorial.
- Students are expected to understand and properly use R outputs in all assessment tasks.

### 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 CS2 notes. This will also be used as background reading for ACST3059.

## Unit Schedule

**Week 1:** Probability models (revision); Survival analysis

**Week 2:** Estimation of survival distributions

**Week 3:** Variance estimation and confidence intervals

**Week 4:** Cox proportional hazards models

**Week 5:** Cox proportional hazards models; Stochastic processes;

**Week 6 (last week before semester break):** Markov chains

**Week 7 (first week after semester break):** **Class test;** Markov chains

**Week 8:** Markov jump processes

**Week 9:** Markov jump processes

**Week 10:** Applications of Markov processes

**Week 11:** Applications of Markov processes

**Week 12:** Multi-state insurance models and multiple decrement tables

**Week 13:** **Assignment** and Revision

**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 \(https://policies.s.mq.edu.au\)](https://policies.s.mq.edu.au). Students should be aware of the following policies in particular with regard to Learning and Teaching:

- [Academic Appeals Policy](#)
- [Academic Integrity Policy](#)
- [Academic Progression Policy](#)
- [Assessment Policy](#)
- [Fitness to Practice Procedure](#)
- [Grade Appeal Policy](#)
- [Complaint Management Procedure for Students and Members of the Public](#)
- [Special Consideration Policy](#)

Students seeking more policy resources can visit [Student Policies \(https://students.mq.edu.au/support/study/policies\)](https://students.mq.edu.au/support/study/policies). It is your one-stop-shop for the key policies you need to know about

throughout your undergraduate student journey.

To find other policies relating to Teaching and Learning, visit [Policy Central \(https://policies.mq.edu.au\)](https://policies.mq.edu.au) and use the [search tool](#).

## Student Code of Conduct

Macquarie University students have a responsibility to be familiar with the Student Code of Conduct: <https://students.mq.edu.au/admin/other-resources/student-conduct>

## Results

Results published on platform other than [eStudent](#), (eg. iLearn, Coursera etc.) 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](https://ask.mq.edu.au) or if you are a Global MBA student contact [globalmba.support@mq.edu.au](mailto:globalmba.support@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](https://mq.edu.au/learningskills)) provides academic writing resources and study strategies to help you improve your marks and take control of your study.

- [Getting help with your assignment](#)
- [Workshops](#)
- [StudyWise](#)
- [Academic Integrity Module](#)

The Library provides online and face to face support to help you find and use relevant information resources.

- [Subject and Research Guides](#)
- [Ask a Librarian](#)

## Student Enquiry Service

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

If you are a Global MBA student contact [globalmba.support@mq.edu.au](mailto:globalmba.support@mq.edu.au)

## Equity 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.

## 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.

## Changes from Previous Offering

The main changes include:

- Addition of topics on valuing cashflows contingent upon multiple transition events and multiple decrement tables
- Incorporation of statistical package R