



ACST884

Survival Models

S1 Day 2019

Department of Actuarial Studies and Business Analytics

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General Information

Unit convenor and teaching staff

Lecturer

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Contact via email

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TBA

Credit points

4

Prerequisites

STAT810 or STAT806

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.

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:

Describe estimation procedures for lifetime distributions

Derive maximum likelihood estimators for transition intensities

Describe and classify stochastic processes

Define and apply a Markov chain

Define and apply a Markov process

Describe and illustrate methods of valuing cashflows that are contingent upon multiple transition events

Describe and use methods of projecting and valuing expected cashflows that are contingent upon multiple decrement events

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

Close-book mid-term test and final examination

• The mid-term test and final examination will be close-book. For each test, students will be provided reference sheets which cover relevant contents of Formulae and Tables for Actuarial Examinations (2002) published by the Institute and Faculty of Actuaries. Non-programmable calculators with no text-retrieval capacity are permitted.

Gradebook

• It is the responsibility of students to view their marks for each within session assessment on iLearn within 20 working 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 marks (not including the final exam mark) will not be addressed.

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

Supplementary exams

• Information regarding supplementary exams, including dates, is available at:
http://www.businessandconomics.mq.edu.au/current_students/undergraduate/how_do_i/special_consideration

Assessment Tasks

Name	Weighting	Hurdle	Due
<u>Individual Assignment</u>	20%	No	Week 7
<u>Mid-term Test</u>	20%	No	Week 8
<u>Final Exam</u>	60%	No	Examination Period

Individual Assignment

Due: **Week 7**

Weighting: **20%**

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

On successful completion you will be able to:

- Describe estimation procedures for lifetime distributions
- Derive maximum likelihood estimators for transition intensities

Mid-term Test

Due: **Week 8**

Weighting: **20%**

Problem-solving questions requiring detailed solutions

On successful completion you will be able to:

- Describe estimation procedures for lifetime distributions
- Derive maximum likelihood estimators for transition intensities
- Describe and classify stochastic processes
- Define and apply a Markov chain

Final Exam

Due: **Examination Period**

Weighting: **60%**

Problem-solving questions requiring detailed solutions

On successful completion you will be able to:

- Describe estimation procedures for lifetime distributions
- Derive maximum likelihood estimators for transition intensities
- Describe and classify stochastic processes
- Define and apply a Markov chain
- Define and apply a Markov process
- Describe and illustrate methods of valuing cashflows that are contingent upon multiple transition events
- Describe and use methods of projecting and valuing expected cashflows that are contingent upon multiple decrement events

Delivery and Resources

Classes

- This unit is taught through 2 hours of lectures and 2 hours of workshops/tutorials per week.
- The timetable for classes can be found on the University web site at: <http://www.timetables.mq.edu.au/>
- Workshops/tutorials start in Week 1.

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 Individual Assignment.
- Application of R will be introduced in the weekly workshop/tutorial.
- Students are expected to understand and properly use R outputs in the Mid-term test and Final exam.

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 ACST886.

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: Markov chains

Week 7 (last week before semester break): Markov chains; **Due of Individual Assignment**

Week 8 (first week after semester break): Markov jump processes; **Mid-term test**

Week 9: Markov jump processes

Week 10: Applications of Markov processes

Week 11: Applications of Markov processes

Week 12: Competitive risks and multiple decrement tables

Week 13: 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 \(https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policy-central\)](https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policy-central). 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](#) (**Note:** *The Special Consideration Policy is effective from 4 December 2017 and replaces the Disruption to Studies Policy.*)

Undergraduate students seeking more policy resources can visit the [Student Policy Gateway \(https://students.mq.edu.au/support/study/student-policy-gateway\)](https://students.mq.edu.au/support/study/student-policy-gateway). It is your one-stop-shop for the key policies you need to know about throughout your undergraduate student journey.

If you would like to see all the policies relevant to Learning and Teaching visit [Policy Central \(https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policy-central\)](https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/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/study/getting-started/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 or if you are a Global MBA student contact 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) 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

If you are a Global MBA student contact globalmba.support@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/.

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

- Describe estimation procedures for lifetime distributions
- Derive maximum likelihood estimators for transition intensities
- Describe and classify stochastic processes
- Define and apply a Markov chain

- Define and apply a Markov process
- Describe and illustrate methods of valuing cashflows that are contingent upon multiple transition events
- Describe and use methods of projecting and valuing expected cashflows that are contingent upon multiple decrement events

Assessment tasks

- Individual Assignment
- Mid-term Test
- Final Exam

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

- Describe estimation procedures for lifetime distributions
- Derive maximum likelihood estimators for transition intensities
- Describe and classify stochastic processes
- Define and apply a Markov chain
- Define and apply a Markov process
- Describe and illustrate methods of valuing cashflows that are contingent upon multiple transition events
- Describe and use methods of projecting and valuing expected cashflows that are contingent upon multiple decrement events

Assessment tasks

- Individual Assignment
- Mid-term Test
- Final Exam

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

- Describe estimation procedures for lifetime distributions
- Derive maximum likelihood estimators for transition intensities
- Describe and classify stochastic processes
- Define and apply a Markov chain
- Define and apply a Markov process
- Describe and illustrate methods of valuing cashflows that are contingent upon multiple transition events
- Describe and use methods of projecting and valuing expected cashflows that are contingent upon multiple decrement events

Assessment tasks

- Individual Assignment
- Mid-term Test
- Final Exam