



# ACST356

## Mathematical Theory of Risk

S1 Day 2019

*Department of Actuarial Studies and Business Analytics*

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#### **Disclaimer**

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## General Information

Unit convenor and teaching staff

Unit convenor and lecturer

Jackie Li

[jackie.li@mq.edu.au](mailto:jackie.li@mq.edu.au)

Contact via Email

E4A 610

Wednesdays 2pm-3pm during teaching weeks or by appointment

Credit points

3

Prerequisites

(39cp at 100 level or above) including STAT272

Corequisites

Co-badged status

Unit description

This unit examines the use of statistical models in the insurance context. Statistical models of the number of claims and the sizes of the claims are studied. These models are used as a basis for the study of risk theory, ruin theory and the effect of reinsurance. Decision theory and simulation are also studied. Students gaining a grade of credit or higher in both ACST356 and ACST357 are eligible for exemption from subject CT6 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:

Model insurance claims using loss distributions and Bayesian analysis

Perform Monte Carlo simulation for insurance models

Apply premium principles to price insurance products

Construct risk models with frequency and severity distributions and apply ruin theory to insurance problems

Apply credibility theory and decision theory to insurance problems

## General Assessment Information

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.

## Assessment Tasks

Name	Weighting	Hurdle	Due
Assignment	15%	No	Week 3 and Week 12
Class Test	15%	No	Week 7
Final exam	70%	No	Exam period

### Assignment

Due: **Week 3 and Week 12**

Weighting: **15%**

There are two written assignments due in Week 3 (5%) and Week 12 (10%). Marks will be granted for accuracy and clarity of the work submitted.

No extensions will be granted. Students who have not submitted the task prior to the deadline will be awarded a mark of zero (0) for the task, except for cases in which an application for special consideration is made and approved.

On successful completion you will be able to:

- Model insurance claims using loss distributions and Bayesian analysis
- Perform Monte Carlo simulation for insurance models
- Apply premium principles to price insurance products
- Construct risk models with frequency and severity distributions and apply ruin theory to

insurance problems

- Apply credibility theory and decision theory to insurance problems

## Class Test

Due: **Week 7**

Weighting: **15%**

The class test covers the lecture content in Week 1 to Week 5. Students will have 75 minutes to complete the test. Marks will be granted for accuracy and clarity of the work submitted. It will be conducted in the Wednesday lecture in Week 7.

You are permitted one (1) A4 page of paper containing reference material printed on both sides. The material may be handwritten or typed. The page will not be returned to you at the end of the class test.

Students who do not attend the class test will be awarded a mark of zero (0) for the test, except for cases in which an application for special consideration is made and approved.

On successful completion you will be able to:

- Model insurance claims using loss distributions and Bayesian analysis

## Final exam

Due: **Exam period**

Weighting: **70%**

A three-hour (3) written exam will be held during the normal university exam period. Questions will cover the entire unit. Marks will be granted for accuracy and clarity of the work shown.

You are permitted one (1) A4 page of paper containing reference material printed on both sides. The material may be handwritten or typed. The page will not be returned to you at the end of the final exam. Non-programmable calculators with no text-retrieval capacity are permitted.

Students who do not attend the final exam will be awarded a mark of zero (0) for the exam, except for cases in which an application for special consideration is made and approved.

On successful completion you will be able to:

- Model insurance claims using loss distributions and Bayesian analysis
- Perform Monte Carlo simulation for insurance models

- Apply premium principles to price insurance products
- Construct risk models with frequency and severity distributions and apply ruin theory to insurance problems
- Apply credibility theory and decision theory to insurance problems

## Delivery and Resources

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

<https://timetables.mq.edu.au/2019/>

Lecture notes are available for download from iLearn. You will need to print the lecture notes and bring them to classes to complete.

From Week 8 onward, the required textbook is:

Dickson, D. (2016). Insurance Risk and Ruin. Cambridge University Press.

Other references include:

Hossack, I.B., Pollard, J.H. and Zehnwrith, B. (1999). Introductory Statistics with Applications in General Insurance. 2nd Edition. Cambridge University Press.

Klugman, S.A., Panjer, H.H. and Willmot, G.E. (2004). Loss Models: From Data to Decisions. 2nd Edition. Wiley: New York.

Casualty Actuarial Society (2001). Foundations of Casualty Actuarial Science. 4th Edition.

Students will be required to use iLearn, Excel, PDF, Word, and a non-programmable calculator.

## Unit Schedule

Week 1	Loss Models I
Week 2	Loss Models II
Week 3	Loss Models III
Week 4	Loss Models IV
Week 5	Reinsurance and Deductibles
Week 6	Simulation
Week 7	Class Test

Week 8 Premium Principles

Week 9 Risk Models

Week 10 Ruin Theory

Week 11 Ruin Theory with Reinsurance

Week 12 Credibility Theory

Week 13 Decision Theory

## 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](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)

## Supplementary exams

Information regarding supplementary exams, including dates, is available at:

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

## 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)

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

### 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**

- Model insurance claims using loss distributions and Bayesian analysis
- Perform Monte Carlo simulation for insurance models
- Apply premium principles to price insurance products
- Construct risk models with frequency and severity distributions and apply ruin theory to insurance problems
- Apply credibility theory and decision theory to insurance problems

## **Assessment tasks**

- Assignment
- Class Test
- Final exam

## **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**

- Model insurance claims using loss distributions and Bayesian analysis
- Perform Monte Carlo simulation for insurance models
- Apply premium principles to price insurance products
- Construct risk models with frequency and severity distributions and apply ruin theory to insurance problems
- Apply credibility theory and decision theory to insurance problems

## **Assessment tasks**

- Assignment
- Class Test
- Final exam



## 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

- Model insurance claims using loss distributions and Bayesian analysis
- Perform Monte Carlo simulation for insurance models
- Apply premium principles to price insurance products
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### Assessment tasks

- Assignment
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