ACST356
Mathematical Theory of Risk
S1 Day 2015
Dept of Applied Finance and Actuarial Studies

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# General Information

Unit convenor and teaching staff  
Lecturer  
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E4A609  
Mondays 2-4 during teaching weeks or by appointment  

Teaching Assistant and Tutor  
Andrew Xu  
Contact via online forum  

Credit points  
3  

Prerequisites  
39cp 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](https://www.mq.edu.au/study/calendar-of-dates)

# Learning Outcomes

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

- Describe, develop, apply and analyse the modelling of loss distributions both with and without limits and risk-sharing arrangements  
- Derive, apply, explain and analyse the concepts of Bayesian statistics including
Empirical Bayes models
Construct risk models involving frequency and severity distributions and calculate the moment generating functions and moments both with and without risk-sharing arrangements
Use Monte Carlo simulation to model observations from various loss models, calculate the number of simulations required and extend these techniques to more complex scenarios
Define, explain and analyse the concept of ruin and describe the relationships between different probabilities of ruin including the effect of simple reinsurance arrangements
Explain and apply the concepts of decision theory

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 Tasks

<table>
<thead>
<tr>
<th>Name</th>
<th>Weighting</th>
<th>Due</th>
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<tbody>
<tr>
<td>Assignment</td>
<td>20%</td>
<td>3pm, Monday 25 May</td>
</tr>
<tr>
<td>Final exam</td>
<td>70%</td>
<td>Exam period</td>
</tr>
<tr>
<td>Class Test</td>
<td>10%</td>
<td>Tuesday 21 April</td>
</tr>
</tbody>
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Assignment
Due: 3pm, Monday 25 May
Weighting: 20%

Written assignment worked on in groups of 3, 4 or 5 students. Submit to BESS by 3pm on Monday 25 May.

No extensions will be granted. Late tasks will be accepted up to 72 hours after the submission deadline. There will be a deduction of 20% 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 - 40% penalty). This penalty does not apply for cases in which an application for special consideration is made and approved.

On successful completion you will be able to:
• Describe, develop, apply and analyse the modelling of loss distributions both with and without limits and risk-sharing arrangements
• Derive, apply, explain and analyse the concepts of Bayesian statistics including Empirical Bayes models
• Construct risk models involving frequency and severity distributions and calculate the moment generating functions and moments both with and without risk-sharing arrangements
• Use Monte Carlo simulation to model observations from various loss models, calculate the number of simulations required and extend these techniques to more complex scenarios
• Define, explain and analyse the concept of ruin and describe the relationships between different probabilities of ruin including the effect of simple reinsurance arrangements

Final exam
Due: Exam period
Weighting: 70%

Three hour written exam held during the university exam period. To be eligible to pass this unit, a pass is required in the final examination.

On successful completion you will be able to:
• Describe, develop, apply and analyse the modelling of loss distributions both with and without limits and risk-sharing arrangements
• Derive, apply, explain and analyse the concepts of Bayesian statistics including Empirical Bayes models
• Construct risk models involving frequency and severity distributions and calculate the moment generating functions and moments both with and without risk-sharing arrangements
• Use Monte Carlo simulation to model observations from various loss models, calculate the number of simulations required and extend these techniques to more complex scenarios
• Define, explain and analyse the concept of ruin and describe the relationships between different probabilities of ruin including the effect of simple reinsurance arrangements
• Explain and apply the concepts of decision theory

Class Test
Due: Tuesday 21 April
Weighting: 10%
In class test covering Sections 1 to 5 inclusive.

On successful completion you will be able to:

• Describe, develop, apply and analyse the modelling of loss distributions both with and without limits and risk-sharing arrangements
• Derive, apply, explain and analyse the concepts of Bayesian statistics including Empirical Bayes models

**Delivery and Resources**

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

https://timetables.mq.edu.au/2015/

Lectures are held on Tuesdays from 11 to 1 in E7BT5 and on Wednesdays from 10 to 11 also in E7BT5.

Tutorials are held on Wednesdays from 12 to 1, 1 to 2 and 2 to 3.

Lecture Handouts (i.e. notes with gaps) are available for downloading from the ACST356 iLearn page. It is recommended that you print the relevant section of the Lecture Handout in advance of the relevant lecture, and bring it to classes to complete.

Complete Notes including solutions to Lecture Exercises and solutions to Section Exercises will be available for downloading from the ACST356 iLearn page within 24 hours after the relevant tutorials covering that material have all been completed. This schedule is fixed and will not be varied for individual students unless the formal grounds for Special Consideration or Equity Support are met.

Other resources (not required)


ActEd CT6 notes are not set as required or recommended reading for this unit, since the unit notes are comprehensive and detailed. The ActEd CT6 notes will also NOT be set as recommended reading for ACST357. If you decide to purchase the ActEd CT6 notes, please buy directly from ActEd. Those who want to view a copy of the ActEd CT6 notes during the session should contact the teaching assistant. Arrangements will be made for you to view them in the Department of Applied Finance and Actuarial Studies. The notes are not available in the library. This reference copy of the notes cannot under any circumstances be photocopied.

Other useful references:


https://unitguides.mq.edu.au/unit_offerings/51844/unit_guide/print
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:


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/)

Results

Results shown in iLearn, 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](http://ask.mq.edu.au).

Further information regarding supplementary exams, including dates, is available here [http://www.businessandeconomics.mq.edu.au/current_students/undergraduate/how_do_i/special_consideration](http://www.businessandeconomics.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/](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](mailto:disabilityservice@mq.edu.au) 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](mailto:ask.mq.edu.au)

**IT Help**


When using the University’s IT, you must adhere to the [Acceptable Use Policy](http://informatics.mq.edu.au/help/). 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**

- Describe, develop, apply and analyse the modelling of loss distributions both with and without limits and risk-sharing arrangements
- Derive, apply, explain and analyse the concepts of Bayesian statistics including Empirical Bayes models
- Construct risk models involving frequency and severity distributions and calculate the moment generating functions and moments both with and without risk-sharing arrangements
- Use Monte Carlo simulation to model observations from various loss models, calculate
the number of simulations required and extend these techniques to more complex scenarios

• Define, explain and analyse the concept of ruin and describe the relationships between different probabilities of ruin including the effect of simple reinsurance arrangements

• Explain and apply the concepts of decision theory

**Assessment tasks**

• Assignment

• Final exam

• Class Test

**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**

• Describe, develop, apply and analyse the modelling of loss distributions both with and without limits and risk-sharing arrangements

• Derive, apply, explain and analyse the concepts of Bayesian statistics including Empirical Bayes models

• Construct risk models involving frequency and severity distributions and calculate the moment generating functions and moments both with and without risk-sharing arrangements

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• Explain and apply the concepts of decision theory

**Assessment tasks**

• Assignment

• Final exam

• Class Test
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**

- Describe, develop, apply and analyse the modelling of loss distributions both with and without limits and risk-sharing arrangements
- Derive, apply, explain and analyse the concepts of Bayesian statistics including Empirical Bayes models
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