ACST356

Mathematical Theory of Risk

S1 Day 2014

Applied Finance and Actuarial Studies

Contents

General Information

Unit convenor and teaching staff
Unit Convenor
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E4A609
Friday 11-1 during my teaching weeks, or other times by appointment

Lecturer
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Monday 11-1 during teaching weeks, or other times by appointment

Credit points
3

Prerequisites
39cp including STAT272(P)

Corequisites

Co-badged status
This unit is co-taught with ACST861.

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:

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

Name	Weighting	Due
Assignment	20%	Friday 30th May at 3pm
Class Test	10%	Thursday 1st May at 4pm
Final exam	70%	Exam period

Assignment

Due: **Friday 30th May at 3pm**
Weighting: **20%**

Written assignment worked on in groups of size 3, 4, or 5 students requiring answers to a series of short answer problems. Graded on a pass/fail basis.

No extensions will be granted. Students who have not submitted the task prior to the deadline will be awarded a mark of zero for the task, expect 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

Class Test

Due: **Thursday 1st May at 4pm**
Weighting: **10%**

In class test covering Sections 1 to 5.

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

Final exam

Due: **Exam period**
Weighting: **70%**

Three hour written exam held during the university exam period. A passing grade on the final exam is required in order to pass the unit.

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

Delivery and Resources

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

https://timetables.mq.edu.au/2014/

Lectures are held on Thursdays from 4pm to 6pm in E7BT4 and on Fridays from 3pm to 4pm in W5AT1.

Tutorials are held on Fridays from 2pm to 3pm, from 4pm to 5pm and from 5pm to 6pm.

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)

Dickson, D. (2005). *Insurance risk and ruin.* Cambridge University Press: Cambridge

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 circumstancers be photocopied.

Other useful references:

Hossack, I.B., Pollard J.H. and Zehnwirth, B. (1999). *Introductory statistics with applications in general insurance, second edition.* Cambridge University Press: Cambridge

Klugman, S.A., Panjer, H.H and Willmot, G.E. (2004). Loss models: from data to decisions, second edition. Wiley: New York

Casualty Actuarial Society. (2001). *Foundations of Casualty Actuarial Science, 4th edition.* Casualty Actuarial Society.

Unit Web Page

The web page for this unit can be found at http://ilearn.mq.edu.au

Technologies Used and Required

MS Excel and MS Word will be used throughout the unit. Students will be required to use a non-programmable calculator in the final examination and in the class test.

Changes since 2013

No significant changes to the unit this year.

Unit Schedule

This appears in a separate document available on the unit iLearn page.

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

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

Disruption to Studies Policy 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/

Supplementary Exams Further information regarding supplementary exams, including dates, is available here 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/

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

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

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
- 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

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

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- 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

- 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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Assessment tasks

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- Class Test
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Research and Practice

This unit uses research from external sources relating to the development of risk and ruin theory.