Students in this unit should read this unit guide carefully at the start of semester. It contains important information about the unit. If anything in it is unclear, please consult one of the teaching staff in the unit.

**ABOUT THIS UNIT**

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 this unit and ACST862 General Insurance Pricing and Reserving may apply for exemption from subject CT6 of the professional exams of the Institute of Actuaries of Australia.

This unit relies heavily on your statistics studies (probability theory in particular) and you should ensure that you revise this work if necessary. In particular, you should be familiar with:

- the theory of statistical distributions, including the meaning of a random variable, discrete and continuous random variables, density functions, cumulative density functions;
- basic results relating to expectation, variance, covariance, and moment and cumulant generating functions;
- joint random variables and marginal density functions;
- the use of Normal Distribution and Chi-Squared distribution tables;
- probability theory, including conditional probability; and
- some mathematical techniques and results including integration by parts and the binomial, logarithmic, exponential, and Taylor series approximations.

**TEACHING STAFF**

A/Prof David Pitt is the unit convenor and will be giving the lectures.

Danny Bechara is the teaching administrator for this unit. Administrative questions that are not covered in this unit outline should be directed to him via the private Mail facility of the website. If the questions are of interest to everyone, the question and the reply will be posted to the website, so you should specifically request if you want your message to remain private.
Questions about unit content should be sent to the Discussion Board of the website or raised during tutorials or lectures.

If you need to contact lecturing staff, including to arrange for an in-person meeting, please do so via the private Mail facility of the website.

**CONTACTING STAFF**

Consultation Times

| Weeks 1 to 13 | David Pitt | Fri 2-4 | E4A609 |

You are encouraged to seek help at a time that is convenient to you from a staff member teaching on this unit during their regular consultation hours. In special circumstances, an appointment may be made outside regular consultation hours. Staff will not conduct consultations by email. You may, however, phone staff during their consultation hours.

Students experiencing significant difficulties with any topic in the unit must seek assistance immediately.

**CLASSES**

The timetable for classes can be found on the University web site at: [http://www.timetables.mq.edu.au/](http://www.timetables.mq.edu.au/)

**Lectures** are held Thursday 4 - 5 in W5AT1 and Friday 12 – 2 in W5AT2. The unit material is covered in the three hours of lectures each week.

**Tutorials** are held Wednesday 10 - 12, commencing in Week 2. **You must attend the tutorial class in which you are enrolled.** The tutorial is an opportunity for you to attempt the section exercises given at the end of each section of work, and to discuss problems with the tutor.

**REQUIRED AND RECOMMENDED TEXTS AND/OR MATERIALS**

**Required texts**

Lecture Handouts (i.e. notes with gaps) are available for downloading from the ACST861 teaching website. 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 ACST861 teaching website 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.

If you decide to purchase the optional texts (the ActEd CT6 notes and / or the Dickson text – see below), it is recommended that you read the relevant sections in advance of the lecture. During the lecture you can then work through the Lecture Handout, which will cover similar ground but expressed in a different way.
Optional recommended text

The following text may be helpful for some sections of the unit, but is not required reading.


This book is available from the Macquarie University Co-op Bookshop. Copies are also available in the Reserve section of the library.

Optional ActEd material

The 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 make your order on the ASSOC webpage [www.mgassoc.org](http://www.mgassoc.org) by going to the “Order ActEd Notes” tab on the left. Those who want to view a copy of the ActEd CT6 notes during the semester should contact the teaching assistant using private Mail on the ACST356 website. 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


These texts are available in the library, with a single copy of each also available in the Reserve section of the library.

TECHNOLOGY 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 the in-class tests.

UNIT WEB PAGE

- Course material is available on the learning management system (iLearn)
- The web page for this unit can be found at [http://ilearn.mq.edu.au](http://ilearn.mq.edu.au)

LEARNING OUTCOMES

The broad learning outcomes of this unit are given below. The learning outcomes as well as the specific learning objectives are given in the lecture notes at the start of each section of work. You should review these in advance of each lecture and after completing each section of work.
On completion of this unit you should be able to do the following.

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

GRADUATE CAPABILITIES

In addition to the discipline-based learning objectives, all academic programs at Macquarie seek to develop the capabilities the University's graduates will need to develop to address the challenges, and to be effective, engaged participants in their world. This unit contributes to this by developing the following graduate capabilities:

1. Discipline Specific Knowledge and Skills:
   (a) Have a deep intuitive understanding of the meaning of probability and the methods of manipulating probabilities.
   (b) Have skills in fitting and assessing the reliability of statistical models, particularly in the context of financial applications.

2. Critical, Analytical and Integrative Thinking
3. Problem Solving and Research Capability

LEARNING AND TEACHING ACTIVITIES

- The unit is taught using three hours of lectures and a weekly tutorial.
- You are expected to read lecture materials in advance of the lectures and to participate actively in the tutorial classes.

RESEARCH AND PRACTICE

- This unit uses research from external sources relating to the development of risk and ruin theory. For a list of references see the list at the end of the optional recommended text by Dickson.
<table>
<thead>
<tr>
<th></th>
<th>Assessment Task 1</th>
<th>Assessment Task 2</th>
<th>Assessment Task 3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Title/Name</strong></td>
<td>Class Test</td>
<td>Assignments</td>
<td>Final Exam</td>
</tr>
<tr>
<td><strong>Description (including length or similar as applicable)</strong></td>
<td>In class test covering Sections 1 to 5.</td>
<td>Written assignment worked on in groups of size 3, 4 or 5 requiring the review of a complex topic and a description of the work researched. In addition a series of short answer questions will be answered.</td>
<td>Three hour written exam.</td>
</tr>
<tr>
<td><strong>Due date</strong></td>
<td>Held on Friday 27\textsuperscript{th} April at 12pm.</td>
<td>Due Friday 25\textsuperscript{th} May at 3pm.</td>
<td>During the university exam period.</td>
</tr>
<tr>
<td><strong>% Weighting</strong></td>
<td>10%</td>
<td>20%</td>
<td>70%</td>
</tr>
<tr>
<td><strong>Grading method</strong></td>
<td>Test will be marked against a marking template.</td>
<td>Pass/Fail basis.</td>
<td>Exam will be marked against a marking template.</td>
</tr>
<tr>
<td></td>
<td></td>
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</tr>
<tr>
<td><strong>Submission method</strong></td>
<td>At conclusion of the test.</td>
<td>To BESS.</td>
<td>Exam period.</td>
</tr>
<tr>
<td><strong>Feedback (type, method, date)</strong></td>
<td>Marked papers and feedback within 12 working days of the class test date.</td>
<td>Marked assignments and feedback within 10 working days of the assignment due date.</td>
<td>Final result communicated to students for entire assessment.</td>
</tr>
<tr>
<td><strong>Estimated student workload (hours)</strong></td>
<td>25 hours</td>
<td>30 hours</td>
<td>40 hours</td>
</tr>
<tr>
<td><strong>Learning outcomes assessed (max 6)</strong></td>
<td>Outcomes 1 and 2 inclusive and Outcome 7</td>
<td>Outcomes 1 to 5 inclusive and Outcome 7</td>
<td>Outcomes 1 to 6 inclusive</td>
</tr>
<tr>
<td><strong>Graduate capabilities assessed (max 4)</strong></td>
<td>Capabilities 1, 2 and 3</td>
<td>Capabilities 1, 2 and 3</td>
<td>Capabilities 1, 2 and 3</td>
</tr>
</tbody>
</table>

- Extension requests will only be considered given evidence of significant disruption for the assignment.

- Late submissions without an extension will not be marked under any circumstances.

- A final examination is included as an assessment task for this unit to provide assurance that:
  i) the product belongs to the student and
  ii) the student has attained the knowledge and skills tested in the exam.
<table>
<thead>
<tr>
<th>Week</th>
<th>Week Beginning</th>
<th>Lecturer</th>
<th>Thursday 4-5 class</th>
<th>Friday 12-2 class</th>
<th>Tutorial</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>27 Feb</td>
<td>DP</td>
<td>Lecture: Section 1 <em>Loss Models – I</em></td>
<td>Lecture: Section 1 (cont)</td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>5 Mar</td>
<td>DP</td>
<td>Lecture: Section 2 <em>Loss Models – II</em></td>
<td>Lecture: Section 2 (cont)</td>
<td>Section 1 Exercises</td>
</tr>
<tr>
<td>3</td>
<td>12 Mar</td>
<td>DP</td>
<td>Lecture: Section 3 <em>Loss Models – III</em></td>
<td>Lecture: Section 3 (cont)</td>
<td>Section 2 Exercises</td>
</tr>
<tr>
<td>4</td>
<td>19 Mar</td>
<td>DP</td>
<td>Lecture: Section 4 <em>Loss Models – IV</em></td>
<td>Lecture: Section 4 (cont)</td>
<td>Section 3 Exercises</td>
</tr>
<tr>
<td>5</td>
<td>26 Mar</td>
<td>DP</td>
<td>Lecture: Section 5 <em>Reinsurance and Deductibles</em></td>
<td>Lecture: Section 5 (cont)</td>
<td>Section 4 Exercises</td>
</tr>
<tr>
<td>6</td>
<td>2 Apr</td>
<td>DP</td>
<td>Lecture: Section 6 (cont)</td>
<td>No class: Good Friday</td>
<td>Section 5 Exercises</td>
</tr>
<tr>
<td></td>
<td>STUDY BREAK</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>9 April</td>
<td></td>
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<td></td>
<td>16 April</td>
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</tr>
<tr>
<td>7</td>
<td>23 April</td>
<td>DP</td>
<td>Lecture: Section 7 <em>Individual Risk Model</em></td>
<td>Class Test</td>
<td>Mock Test</td>
</tr>
<tr>
<td>8</td>
<td>30 April</td>
<td>DP</td>
<td>Lecture: Section 7 (cont)</td>
<td>Lecture: Section 8 <em>Collective Risk Model</em></td>
<td>Section 6 Exercises</td>
</tr>
<tr>
<td>9</td>
<td>7 May</td>
<td>DP</td>
<td>Lecture: Section 8 (cont)</td>
<td>Lecture: Section 8 (cont)</td>
<td>Section 7 Exercises</td>
</tr>
<tr>
<td>10</td>
<td>14 May</td>
<td>DP</td>
<td>Lecture: Section 8 (cont)</td>
<td>Lecture: Section 9 (cont)</td>
<td>Section 8 (I) Exercises</td>
</tr>
<tr>
<td></td>
<td>Lecture: Section 9 <em>Ruin Theory</em></td>
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</tr>
<tr>
<td>11</td>
<td>21 May</td>
<td>DP</td>
<td>Lecture: Section 9 (cont)</td>
<td>Lecture: Section 10 <em>Credibility Theory</em></td>
<td>Section 8 (II) Exercises</td>
</tr>
<tr>
<td>12</td>
<td>28 May</td>
<td>DP</td>
<td>Lecture: Section 10 (cont)</td>
<td>Lecture: Section 10 (cont)</td>
<td>Section 9 Exercises</td>
</tr>
<tr>
<td></td>
<td>Lecture: Section 11 <em>Decision Theory</em></td>
<td></td>
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</tr>
<tr>
<td>13</td>
<td>4 Jun</td>
<td>DP</td>
<td>Lecture: Section 11 (cont)</td>
<td>Section 11 Exercises, Review</td>
<td>Section 10 Exercises</td>
</tr>
</tbody>
</table>
A 3 hour final examination for this unit will be held during the University Examination period.

The University Examination period in First Half Year 2012 is from 12\textsuperscript{th} June to 29\textsuperscript{th} June inclusive.

You are expected to present yourself for examination at the time and place designated in the University Examination Timetable. The timetable will be available in Draft form approximately eight weeks before the commencement of the examinations and in Final form approximately four weeks before the commencement of the examinations.  
\url{http://exams.mq.edu.au/}

The only exception to not sitting an examination at the designated time is because of documented illness or unavoidable disruption. In these circumstances you may wish to consider applying for Special Consideration. The University's policy on special consideration process is available at \url{http://www.mq.edu.au/policy/docs/special_consideration/policy.html}

If a Supplementary Examination is granted as a result of the Special Consideration process the examination will be scheduled after the conclusion of the official examination period. (Individual Faculties may wish to signal when the Faculties' Supplementary Exams are normally scheduled.)

The Macquarie university examination policy details the principles and conduct of examinations at the University. The policy is available at: \url{http://www.mq.edu.au/policy/docs/examination/policy.htm}

\subsection*{A\,c\,a\,d\,e\,m\,i\,c H\,o\,n\,e\,s\,t\,y}

The nature of scholarly endeavour, dependent as it is on the work of others, binds all members of the University community to abide by the principles of academic honesty. Its fundamental principle is that all staff and students act with integrity in the creation, development, application and use of ideas and information. This means that:

- all academic work claimed as original is the work of the author making the claim
- all academic collaborations are acknowledged
- academic work is not falsified in any way
- when the ideas of others are used, these ideas are acknowledged appropriately.

Further information on the academic honesty can be found in the Macquarie University Academic Honesty Policy at \url{http://www.mq.edu.au/policy/docs/academic_honesty/policy.html}

\subsection*{Grades}

Macquarie University uses the following grades in coursework units of study:

HD - High Distinction  
D - Distinction  
CR - Credit  
P - Pass  
F - Fail
Grade descriptors and other information concerning grading are contained in the Macquarie University Grading Policy which is available at: http://www.mq.edu.au/policy/docs/grading/policy.html

**Grading Appeals and Final Examination Script Viewing**

If, at the conclusion of the unit, you have performed below expectations, and are considering lodging an appeal of grade and/or viewing your final exam script please refer to the following website which provides information about these processes and the cut off dates in the first instance. Please read the instructions provided concerning what constitutes a valid grounds for appeal before appealing your grade.

http://www.businessandeconomics.mq.edu.au/new_and_current_students/undergraduate_current_students/how_do_i/grade_appeals

**Special Consideration**

The University is committed to equity and fairness in all aspects of its learning and teaching. In stating this commitment, the University recognises that there may be circumstances where a student is prevented by unavoidable disruption from performing in accordance with their ability. A special consideration policy exists to support students who experience serious and unavoidable disruption such that they do not reach their usual demonstrated performance level. The policy is available at: http://www.mq.edu.au/policy/docs/special_consideration/policy.html

**Student Support Services**

Macquarie University provides a range of Academic Support Services. Details of these and other services for students can be accessed at http://www.student.mq.edu.au.

[Individual Unit Convenors may wish to add Unit/ Faculty specific support eg BESS, Room, PAL, E4B Consultation Room.]

**IT Conditions of Use**

Access to all student computing facilities within the Faculty of Business and Economics is restricted to authorised coursework for approved units. Student ID cards must be displayed in the locations provided at all times.

Students are expected to act responsibly when using University IT facilities. The following regulations apply to the use of computing facilities and online services:

- Accessing inappropriate web sites or downloading inappropriate material is not permitted. Material that is not related to coursework for approved units is deemed inappropriate.
- Downloading copyright material without permission from the copyright owner is illegal, and strictly prohibited. Students detected undertaking such activities will face disciplinary action, which may result in criminal proceedings.

Non-compliance with these conditions may result in disciplinary action without further notice. Students must use their Macquarie University email addresses to communicate with staff as it is University policy that the University issued email account is used for official University communication.