MACQUARIE UNIVERSITY
DIVISION OF ECONOMIC AND FINANCIAL STUDIES
UNIT OUTLINE

ACST356 Mathematical Theory of Risk

FIRST SEMESTER 2006

Unit convenor:	**Leonie Tickle**
Prerequisites:	**STAT 272 (P)**

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

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. The use of no claim discount systems as a method of experience rating is described. Decision theory and simulation are also studied.

This unit relies heavily on your previous study in STAT 272 and you should ensure that you revise STAT 272 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

The teaching staff involved in this unit are Leonie Tickle, who is also the unit convenor, Shauna Ferris and Claymore Marshall.

Questions relating to the administration of the unit should be directed to Leonie Tickle as the unit convenor. You should post such queries to the Discussion Board of the website or (for administrative queries of a private nature) using the Private Mail facility of the website.

Questions relating to the unit content should be directed to your lecturer **for the relevant section of work**. You may ask your questions during the tutorial or by making an appointment to see the lecturer (use the Private Mail facility of the website to arrange an appointment time in advance). You should make use of the Discussion Board to ask questions of your classmates and to answer the queries posted.

CLASSES

Classes (all of which start in week one) are held:

Tuesday	2 pm – 4 pm	Lecture	W5A T2
Wednesday	11 am – 12 noon	Lecture	E7B T5
Wednesday	12 noon – 1 pm	Tutorial	E7B T5

REQUIRED AND RECOMMENDED TEXTS AND/OR MATERIALS

Required texts

A set of lecture notes for the first five weeks of lectures will be available for purchase from the Co-op bookshop. Arrangements for other weeks will be advised in classes.

Optional recommended text

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

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

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.

These texts are available in the library.

UNIT WEB PAGE

To access the website, go to http://online.mq.edu.au and login using your usual login and password. You will then have access to the websites for all the units in which you are enrolled. If you have any trouble logging in (e.g. you have forgotten your password), please contact the Library Information Customer Service Desk.

Before logging in, you should follow the link labelled "Technical Information" and read all the information there, including the Information Technology Security Policy and Rules and the Information Technology Usage Rules. This technical information also mentions a number of "plugins" that may be required. Of those listed, in this unit you will only need Acrobat Reader.

The website for this unit contains:
- **Unit announcements.** Lecture and other announcements will be posted here.
- **Unit outline.** A copy of this unit outline.
- **Discussion board.** To discuss problems with your fellow students.
- **Private mail.** To contact the lecturers and for the lecturers to contact you.
- **Unit notes.** Complete lecture notes for downloading each week.
- **Quizes.** A quiz for each week of work, with solutions.
- **Optional modelling exercise.** This covers works in weeks 1 – 5.
- **Tests and exams.** Past class tests and exams with solutions.
- **Revision exercises.** Additional revision questions with solutions.

It is your responsibility to check the website regularly to make sure that you are up-to-date with announcements and with messages sent to your Private Mail address.

Remember to close your browser when you have finished using the site. If you don't, another person can use the still running browser to access the website with your account.

LEARNING OUTCOMES

The learning outcomes of this unit are summarised at the start of each section of work. You should revise these after each week to ensure your understanding of the learning objectives.

In addition to the discipline-based learning objectives, all academic programs at Macquarie seek to develop students' generic skills in a range of areas. One of the aims of this unit is that students develop their skills in the following: *Critical analysis skills; Problem-solving skills;Creative thinking skills.*

TEACHING AND LEARNING STRATEGY

The unit material is covered in the three hours of lectures each week. The tutorial is an opportunity for you to attempt questions for each section of work, or to ask the lecturer questions. You should also use the Discussion Board to ask questions or discuss concepts covered in the unit.

Week Number	Week Beginning	Topic Covered	Test	Lecturer
1	27 February	1. Loss models		LT
2	6 March	Loss models (cont)		LT
3	13 March	2. Estimation and testing fit		LT
4	20 March	Estimation and testing fit (cont)		LT
5	27 March	3. Reinsurance and deductibles		LT
6	3 April	4. Introduction to simulation		LT
7	10 April	5. Aggregate risk models	Test 1	SF
STUDY BREAK	17 April 24 April			
8	1 May	Aggregate risk models (cont)		SF
9	8 May	Aggregate risk models (cont)		SF
10	15 May	6. Ruin theory		SF
11	22 May	7. Credibility theory	Test 2	LT
12	29 May	8. Rating; no claim discount		CM
13	5 June	9. Decision theory		SF

This unit is assessed using two class tests and a final examination. This is suitable given the problem-solving and technical nature of the unit. It is also to encourage you to revise the material regularly, since the unit is challenging and demanding.

Tests

Each test is worth 10% of the final assessment for the unit.

Test 1 will be held Tuesday 11 April at 2 pm. It will cover Sections 1 to 3 inclusive.

Test 2 will be held Tuesday 23 May at 2 pm. The coverage of Test 2 will be advised in lectures.

A Formulae Sheet will be provided in the class tests. No other reference material is permitted.

Applications for special consideration due to documented illness or unavoidable disruption must be made on the "Advice of Absence or other Circumstances" form. These are available from http://www.reg.mq.edu.au/academic-index.htm and should be submitted to the Student Enquiry Service on Level 1 of the Lincoln Building.

Exam

The final examination is worth 80% of the final assessment for the unit.

A Formulae Sheet will be provided in the final exam. No other reference material is permitted. You should familiarise yourself with the information in the Formulae Sheet and its layout, prior to the examination.

The University Examination period in First Half Year 2006 is from 14 June to 30 June. 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 from http://www.timetables.mq.edu.au/exam.

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. Information about unavoidable disruption and special consideration is available from the 2006 Handbook, Bachelor Degree Rules 7 and 9. Forms to apply for special consideration are available at http://www.reg.mq.edu.au/academic-index.htm.

If a Supplementary Examination is granted as a result of the Special Consideration process the examination will be scheduled after the end of the official examination period.

You are advised that it is Macquarie University policy not to set early examinations for individuals or groups of students. All students are expected to ensure that they are available until the end of the teaching semester, that is the final day of the official examination period.

Test and Examination Rules

Normal examination rules apply to the conduct of class tests and the final examination. These rules are set out under the heading "Conduct of Examinations" in the Student Information – Assessment section of the current Macquarie University Handbook of Undergraduate Studies. Students are responsible for familiarising themselves with these rules prior to the class tests and the final examination.

You should ensure that your handwriting in the class tests and in the final examination is legible. Sections of work that are not legible will not be marked.

Academic Senate has resolved that no mobile phones should be bought into examination rooms. Mobile phones must be switched off and sealed in closed bags during class tests.

Calculators will be allowed in the class tests and the final examination but a clear indication of the steps involved in every calculation must be shown. Any machines that have a text-retrieval capacity, whether or not they have a full alphabet on the keyboard, are not allowed. Calculators may be checked at the commencement of the class tests and final exam, and the make/model may be recorded.

Dictionaries will not be permitted in the class tests or the final examination.

PLAGIARISM

The University defines plagiarism in its rules: "Plagiarism involves using the work of another person and presenting it as one's own." Plagiarism is a serious breach of the University's rules and carries significant penalties. You must read the University's practices and procedures on plagiarism. These can be found in the Handbook of Undergraduate Studies or on the web at: http://www.student.mq.edu.au/plagiarism/.

The policies and procedures explain what plagiarism is, how to avoid it, the procedures that will be taken in cases of suspected plagiarism, and the penalties if you are found guilty. Penalties may include a deduction of marks, failure in the unit, and/or referral to the University Discipline Committee.

UNIVERSITY POLICY ON GRADING

Academic Senate has a set of guidelines on the distribution of grades across the range from fail to high distinction. Your final result will include one of these grades plus a standardised numerical grade (SNG).

On occasion your raw mark for a unit (i.e., the total of your marks for each assessment item) may not be the same as the SNG which you receive. Under the Senate guidelines, results may be scaled to ensure that there is a degree of comparability across the university, so that units with the same past performances of their students should achieve similar results.

It is important that you realise that the policy does not require that a minimum number of students are to be failed in any unit. In fact it does something like the opposite, in requiring examiners to explain their actions if more than 20% of students fail in a unit.

For an explanation of the policy see
http://www.mq.edu.au/senate/MQUonly/Issues/Guidelines2003.doc or
http://www.mq.edu.au/senate/MQUonly/Issues/detailedguidelines.doc.

STUDENT SUPPORT SERVICES

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

ERIC

The EFS Resource and Information Centre (ERIC) is located in room E4B106 and offers photocopying facilities, reading areas and reference material.

ACSTINFO

This ACSTINFO site is used to distribute information to all students majoring in actuarial studies. The information supplied may include administrative information and job advertisements. You will retain access to this site during the vacation following the end of this semester.

It is to your advantage to ensure you read information on this web site regularly. You should not assume that information posted there will also be repeated in lectures.

To access the site, go to: http://online.mq.edu.au/pub/ACSTINFO/ (Note that the address is case-sensitive.) When you login to this site, please read the section labelled "How to use this site." This contains useful information which will help you determine when there is new information on the site which you should read.

INSTITUTE OF ACTUARIES OF AUSTRALIA

There are advantages to joining the Institute of Actuaries of Australia as a student. Please refer to

http://www.actuaries.asn.au/PublicSite/membership2005/membership_frameset.htm

for information.