



# ACST357

## General Insurance Pricing and Reserving

S2 Day 2015

*Dept of Applied Finance and Actuarial Studies*

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#### **Disclaimer**

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## General Information

Unit convenor and teaching staff

Unit Convenor

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Tues 16h-17h

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Please refer to iLearn

Credit points

3

Prerequisites

ACST356 and STAT271

Corequisites

Co-badged status

Unit description

This unit examines the use of statistical models in general insurance. The models include those used in time series analysis, generalised linear statistical modelling and runoff triangle models. Time series models are considered for both single and multiple time series. These models are often used for forecasting and inferring the behaviour of times series. Generalised linear models are used in the pricing of insurance such as automobile or home owner insurance. Runoff triangle models are used to predict outstanding insurance liabilities. The use of no claim discount systems as a method of experience rating is also described. A good knowledge of the material covered in STAT271 is essential. Students should understand regression analysis, and the nature and use of a statistical model. 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:

Understand some important techniques used by actuaries to perform analysis and modelling in general insurance pricing and reserving

Manage to perform statistical analyses relevant to this unit using the statistical package R

Understand basic theories and methodologies on time series model building and forecasting as well as their applications

Understand some important theories and techniques of generalized linear models (GLMs)

Apply deterministic and stochastic methods for calculating outstanding claims provisions in general insurance

Learn how to use run-off triangles for claims reserving and prediction

## General Assessment Information

- **To be eligible to pass this unit, a pass is required in the final examination**
- **Criteria and standards for grading**
  - Numerically correct answers based on correct reasoning
- **Submission methods**
  - Assignments are submitted via iLearn
  - Midterm is in class on the indicated date
- **Late assessments, extensions, penalties, resubmissions**
  - No extensions will be granted. Students who have not submitted the task prior to the deadline will be awarded a mark of 0 for the task, except for cases in which an application for special consideration is made and approved.
- **Midterm and Final examination conditions.**
  - You are permitted ONE A4 page of paper containing reference material printed on both sides. The material may be handwritten or typed. The page will not be returned at the end of the midterm or final examination.
  - 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.

- **Standardised Numerical Grade (SNG)** will be awarded based on your overall performance. An SNG gives you an indication of how you have performed within the band for your descriptive grade. The SNG is not a mark, and you may not be able to work it out based on your raw examination and other assessment marks. Nor are you able to determine you are “one mark away” from a different grade.
- **Supplementary Exams.** Further information regarding supplementary exams, including dates, is available here [http://www.businessandconomics.mq.edu.au/current\\_students/undergraduate/how\\_do\\_i/special\\_consideration](http://www.businessandconomics.mq.edu.au/current_students/undergraduate/how_do_i/special_consideration)

## Assessment Tasks

| Name                              | Weighting | Due                           |
|-----------------------------------|-----------|-------------------------------|
| <a href="#">Class Test</a>        | 10%       | Tuesday 6 October 14:00h      |
| <a href="#">Assignment</a>        | 20%       | TBA                           |
| <a href="#">Final Examination</a> | 70%       | In the university exam period |

### Class Test

Due: **Tuesday 6 October 14:00h**

Weighting: **10%**

Non-programmable calculators with no text-retrieval capacity are allowed.

Class test under Midterm and Final examination conditions described in the general assessment information section

On successful completion you will be able to:

- Manage to perform statistical analyses relevant to this unit using the statistical package R
- Understand basic theories and methodologies on time series model building and forecasting as well as their applications
- Understand some important theories and techniques of generalized linear models (GLMs)

### Assignment

Due: **TBA**

Weighting: **20%**

TBA

On successful completion you will be able to:

- Apply deterministic and stochastic methods for calculating outstanding claims provisions in general insurance
- Learn how to use run-off triangles for claims reserving and prediction

## Final Examination

Due: **In the university exam period**

Weighting: **70%**

Examination under Midterm and Final examination conditions described in the general assessment information section

On successful completion you will be able to:

- Understand some important techniques used by actuaries to perform analysis and modelling in general insurance pricing and reserving
- Understand basic theories and methodologies on time series model building and forecasting as well as their applications
- Understand some important theories and techniques of generalized linear models (GLMs)
- Learn how to use run-off triangles for claims reserving and prediction

## Delivery and Resources

### Classes

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

## Required and Recommended Texts and/or Materials

### Required texts

A set of lecture notes and study pack including tutorial exercises and R examples are available for downloading from the ACST357/862 teaching website.

### Optional ActEd material

The ActEd CT6 are not set as required or recommended reading for this unit, since the lecture notes are comprehensive and detailed.

Other useful references:

- Generalized linear models for Insurance Data. Cambridge University Press: Cambridge.
- Hossack, I.B., Pollard J.H, and Zehnwirth, B. (1999). Introductory statistics with applications in general insurance, second edition. Cambridge University Press: Cambridge.
- De Jong, P. and Heller, G.Z., (2008). Generalized linear models for Insurance Data. Cambridge University Press: Cambridge.
- Casualty Actuarial Society. (2001). Foundations of Casualty Actuarial Science, 4th edition. Casualty Actuarial Society.

## Technology Used and Required

- Latex and PDF are used for preparing the lecture and tutorial materials.
- The R statistical software package will be used throughout the unit.
- Students will be required to use a non-programmable calculator in the final examination and during the in-class test.

### Unit Web Page

To access the website, go to <http://ilearn.mq.edu.au> and login using your usual login and password.

## Teaching and Learning Strategy

- The unit is taught using three hours of lectures and a weekly tutorial. Tutorials commence in Week 2.
- Concepts and examples (including computing examples in R using real datasets in finance and insurance) will be discussed in the lectures.
- Problem sets will be discussed in tutorials.
- You are expected to read lecture materials in advance of the lectures and to participate actively in the tutorial classes.

## What has changed since the previous offering of this unit?

Lecture notes

## Unit Schedule

| Week Number | Week Beginning Monday | Topic and Notes   | Tutorial    |
|-------------|-----------------------|---|-------------|
| 1           |                       | Time Series: Introduction; Stationary Time Series; ACF and PACF | No tutorial |

|                |  |  |                 |
|----------------|--|--|-----------------|
| 2              |  | Time Series: Autoregressive (AR) Models; Moving Average (MA) Models; Autoregressive Integrated Moving Average (ARIMA) Models | Tutorial Set 1  |
| 3              |  | Time Series Box Jenkin Algorithm I: Identification and Estimation  | Tutorial Set 2  |
| 4              |  | Time Series: Box Jenkin Algorithm II: Diagnostic Checking and Prediction   | Tutorial Set 3  |
| 5              |  | GLMs: Review of Linear Regression; Introduction to GLMs  | Tutorial Set 4  |
| 6              |  | GLMs: Exponential Family Linear Predictor; Link Function   | Tutorial Set 5  |
| 7              |  | GLMs: Model Fitting, Selection and Analysis of Residuals   | Tutorial Set 6  |
| STUDY<br>BREAK |  | No classes<br>No classes   | STUDY<br>BREAK  |
| 8              |  | 1. Class Test<br>2. Introduction to Claim Reserving  | Revision        |
| 9              |  | Introduction to Claim Reserving  | Tutorial Set 7  |
| 10             |  | Outstanding Claims (deterministic)   | Tutorial Set 8  |
| 11             |  | Outstanding Claims (deterministic)   | Tutorial Set 9  |
| 12             |  | Outstanding Claims (stochastic)  | Tutorial Set 10 |
| 13             |  | Outstanding Claims (stochastic)  | Tutorial Set 11 |

## 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](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](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](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/](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).

## 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)



## 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

- Understand some important techniques used by actuaries to perform analysis and modelling in general insurance pricing and reserving
- Manage to perform statistical analyses relevant to this unit using the statistical package R
- Understand basic theories and methodologies on time series model building and forecasting as well as their applications
- Understand some important theories and techniques of generalized linear models (GLMs)
- Apply deterministic and stochastic methods for calculating outstanding claims provisions in general insurance
- Learn how to use run-off triangles for claims reserving and prediction

### Assessment tasks

- Class Test
- Assignment
- Final Examination

### 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**

- Understand some important techniques used by actuaries to perform analysis and modelling in general insurance pricing and reserving
- Manage to perform statistical analyses relevant to this unit using the statistical package R
- Understand basic theories and methodologies on time series model building and forecasting as well as their applications
- Understand some important theories and techniques of generalized linear models (GLMs)
- Apply deterministic and stochastic methods for calculating outstanding claims provisions in general insurance
- Learn how to use run-off triangles for claims reserving and prediction

## **Assessment tasks**

- Class Test
- Assignment
- Final Examination

## **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**

- Understand some important techniques used by actuaries to perform analysis and modelling in general insurance pricing and reserving
- Manage to perform statistical analyses relevant to this unit using the statistical package R
- Apply deterministic and stochastic methods for calculating outstanding claims provisions in general insurance

## Assessment tasks

- Class Test
- Assignment
- Final Examination

## Research and Practice

### Research and Practice

The student will learn some basic theories and methodologies in time series analysis, generalized linear models and run-off triangles which are expected to be useful for researching and practising general insurance pricing and reserving.

## Changes since First Published

| Date       | Description                  |
|------------|------------------------------|
| 24/07/2015 | Co-badged status is removed. |