



Department of Applied Finance and Actuarial Studies  
Faculty of Business and Economics

**ACST602**  
Statistical Modelling in Finance and Insurance

**Semester 2, 2011**

**Unit Outline**

**Unit Convener: Kehui Luo**

Please read this unit outline carefully at the beginning of semester as it contains important information for you. If anything in it is unclear, ask one of the teaching staff in the unit.

## About this unit

ACST602 is a four credit point unit offered by the Applied Finance and Actuarial Studies Department in the Faculty of Business and Economics. It is taught by the Statistics Department in the Faculty of Science, and is offered in second semester. It is a Gateway unit in the Master of Actuarial Practice program.

Topics covered include hypothesis testing and confidence intervals; method of moments and maximum likelihood; inference about one and two sample problems under normal theory; simple linear regression and analysis of residuals; multiple regression model, model fit, diagnostics and selection; categorical data analysis using chi-square tests; applications of linear modeling to problems arisen in insurance and finance.

## Teaching Staff

ACST602 is taught by members of the Statistics Department:

|                |                 |   |
|----------------|-----------------|---|
| Dr Kehui Luo   | Office: E4A 532 | email: <a href="mailto:Kehui.luo@mq.edu.au">Kehui.luo@mq.edu.au</a>     |
| Dr Thomas Fung | Office: E4A 530 | email: <a href="mailto:Thomas.fung@mq.edu.au">Thomas.fung@mq.edu.au</a> |

## Classes

You should attend the following class each week:

- 2 hour lecture beginning in Week 1: Monday 2-4 pm, F9C 012.
- 1 hour practical beginning in Week 1: Monday 4-5pm, E4B 208 (right after the lecture).

## Text book / Lecture notes

There is no set textbook for this unit. Weekly lecture slides will be available at least two days before the lecture. Students should read the lecture notes before the lecture. All teaching materials will be available via Blackboard.

### References that may be useful

- Wackerly, D., Mendenhall W. Scheaffer (2002 or other edition). Mathematical Statistics with Applications, Duxbury [QA276 .M426](#)
- Chatterjee, S. Hadi, A. and Price, B. (2006). Regression Analysis by Example, John Wiley and Sons, QA278.2 .C5
- Devore, J. and Peck, R. (2005 or newer). Statistics The Exploration and Analysis of Data, Brooks/Cole, QA276 .D48
- Frees, E. W. (2010). Regression Modeling with Actuarial and Financial applications, Cambridge (just ordered through MU library acquisition section)
- Kleinbaum D., Kupper, L.L., et al (1998) Applied Regression Analysis and Other Multivariable Methods, (3<sup>rd</sup> Edition) Brooks/Cole, QA278.A665
- Faraway, J.J. (2002). Practical Regression and ANOVA using R. <http://cran.r-project.org/doc/contrib/Faraway-PRA.pdf>
- R Development Core Team: An Introduction to R. <http://cran.r-project.org/doc/manuals/R-intro.pdf>
- "The R Guide" (version 2.5) by Jason Owen. <http://cran.r-project.org/doc/contrib/Owen-TheRGuide.pdf>

Copies of these books are held in the Reserve section of the library.

You will need a calculator with statistical mode for the final examination.

## Software

The statistical software R will be used. This is a free software environment for statistical computing and graphics and is downloadable from the website <http://www.r-project.org/> in versions for Windows, MacOS and Unix platforms. R is also available in the computer labs in E4B.

## Blackboard

We will use Blackboard for distribution of course notes, data sets, solutions, announcements and discussions. The URL to access Blackboard is <https://learn.mq.edu.au> and we particularly encourage you to use the 'Discussions' to communicate with other students and the lecturers.

## Staff consultation hours

Members of the Statistics Department have consultation hours each week when they are available to help students. These consultation hours are listed on the doors of the Statistics staff located on the 5<sup>th</sup> floor of E4A.

## Computing Laboratories

R installed in the computing labs in E4B, and may be used for assignments. **It is convenient to bring a memory stick when using these computers.**

### Lab opening hours

Term Time (Teaching and exam period only):

8 am – 10 pm Monday – Friday

9 am – 5 pm Saturday, Sunday

Outside Term Time (including midsemester break, midyear break):

9 am – 7 pm Monday – Friday

9 am – 5 pm Saturday, Sunday

**WARNING:** students are strongly advised not to remain alone in the labs after normal office hours. You should seek out a lab that has other students working in it and/or has a lab monitor. You are encouraged to phone University Security phone x7112 from inside the lab (see <http://www.bgo.mq.edu.au/security2.htm>) at any time after hours, during term time, if you require an escort to your vehicle or public transport.

## Learning Outcomes

By the end of this unit, students should,

- Understand the theory of estimation and sampling distribution;
- Have a solid understanding of hypothesis test and linear regression models;
- Understand and be able to carry out one and two sample tests, and chi-square tests;
- Be able to assess model fit for simple and multiple regression models;
- Understand model diagnostics and selection;
- Be able to interpret results from hypothesis tests and linear regression models;
- Use R statistical package to carry out various hypothesis tests, fit simple or multiple linear regression models with continuous and/or categorical covariates, and produce relevant statistical plots/graphs.

## Graduate Capabilities

Through these Learning Outcomes, this unit contributes to the development of the following Graduate Capabilities:

- Critical scientific thinking; analytical skills; applied statistical skills; ability to diagnose and resolve problems; scientific integrity.
- Understanding of theoretical statistical concepts.
- Ability to communicate and convey statistical concepts and results in forms effective with different audiences, in a scientifically honest manner.

## Teaching Strategy

Students will be asked to participate actively to the unit and to study on a weekly basis. To achieve this, students will be trained and evaluated every week using practicals.

Lectures and practicals begin in Week 1. Copies of the lecture notes and practical problems will be handed out in Week 1; for the rest of semester students should print off the weekly course notes and practicals from Blackboard, and bring them to lectures and practicals.

## Assessment

Macquarie University Assessment Policy and Code of Practice can be accessed at:

<http://www.mq.edu.au/policy/docs/assessment/policy.html>

[http://www.mq.edu.au/policy/docs/assessment/policy\\_code\\_of\\_practice.html](http://www.mq.edu.au/policy/docs/assessment/policy_code_of_practice.html)

Assessment in this unit has the following components:

|                       |     |     |
|-----------------------|-----|-----|
| Coursework            |     |     |
| Assignments (2 x 10%) | 20% |     |
| Practicals            | 10% |     |
| Prac Test             | 10% |     |
| Total coursework      |     | 40% |
| Final Examination     |     | 60% |

In order to pass the unit, students need to perform satisfactorily (i.e. achieve at least 50%) on each component of the assessment.

### Assignments

There are two assignments, worth 10% each. They should be submitted *to the lecturer*, by the due time and date. Extensions to assignments are at the discretion of the lecturer. It is the responsibility of the student to prove that there has been unavoidable disruption. **Late submissions will not be accepted in the absence of an approved extension.**

### Practicals

There will be 10 Practical to be assessed. They are equally weighted and together worth 10% of the unit assessment. They become available each week at least two days prior to the practical, starting from week 1. Students need to submit their solutions at the beginning of the next Practical class (see the Unit Schedule at the end of this guide for details). **Late submissions will not be accepted.**

## Prac Test

This will be 50 minutes duration carried out during the practical class in Week 12, and it is worth 10% of the unit assessment. It will cover the course materials taught from Weeks 1 to 11. For this test, you are expected to use appropriate test/method/model to analyse some data sets in R, and obtain relevant results.

A calculator may be required for this test.

## Final Examination

This will be of 3 hours duration with 10 minutes reading time.

The examination will cover the material studied in the whole unit and address all the unit outcomes. A calculator will be required for the final examination; in addition you may take one A4 sheet, handwritten on both sides, into the examination.

You MUST perform satisfactorily in the final examination in order to pass the unit, regardless of your performance throughout the semester. The University Policy on Grading is given at <http://www.mq.edu.au/policy/docs/grading/policy.html>

The University Examination period in Second Half Year 2011 is 14 November – 2 December. 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.

<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 the special consideration process is available at:

[http://www.mq.edu.au/policy/docs/special\\_consideration/policy.html](http://www.mq.edu.au/policy/docs/special_consideration/policy.html)

Requests should be made through the Faculty of Science web page for Special Consideration Applications:

[http://web.science.mq.edu.au/undergraduate\\_programs/current/admin\\_central/](http://web.science.mq.edu.au/undergraduate_programs/current/admin_central/)

A supplementary examination will only be granted if a student has satisfactory coursework (ie. at least 20 marks out of 40). If a supplementary exam is granted as a result of the Special Consideration process, it will be scheduled after the conclusion of the official exam period.

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

## Academic Honesty Policy

Academic honesty is an integral part of the core values and principles contained in the Macquarie University Ethics Statement. Its fundamental principle is that all staff and students act with integrity in the creation, development, application and use of ideas and information. You must read the University's policy on Academic Honesty. This can be found on the MQ web site at:

[http://www.mq.edu.au/policy/docs/academic\\_honesty/policy.html](http://www.mq.edu.au/policy/docs/academic_honesty/policy.html)

Penalties may include a deduction of marks, failure in the unit, and/or referral to the University Discipline Committee.

## Student Support Services

Macquarie University provides a range of Academic Student Support Services. You can see details at <http://www.mq.edu.au/currentstudents/undergrads/health.html>. Information about study resources is given at <http://www.mq.edu.au/currentstudents/undergrads/resources.html>.

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**Unit schedule**

| <b>Date</b> | <b>Week</b> | <b>Topic</b>   | <b>Assessment</b>  |
|-------------|-------------|--|--|
| 1 Aug       | 1           | Method of moments and maximum likelihood;<br>Properties of estimators.     | Prac 1 handed out  |
| 8 Aug       | 2           | Methodology of statistical tests<br>Test of population mean.               | Prac 1 handed in<br>Prac 2 handed out                            |
| 15 Aug      | 3           | Confidence interval;<br>Significance level, power of test and sample size. | Prac 2 handed in<br>Prac 3 handed out<br>Assignment 1 handed out |
| 22 Aug      | 4           | Paired and two sample problems;<br>Assumptions.                            | Prac 3 handed in<br>Prac 4 handed out                            |
| 29 Aug      | 5           | Simple linear regression.  | Prac 4 handed in<br>Prac 5 handed out<br>Assignment 1 handed in  |
| 5 Sept      | 6           | Residual diagnostics;<br>Transformation.                                   | Prac 5 handed in<br>Prac 6 handed out                            |
| 12 Sept     | 7           | Introduction to multiple linear regression                                 | Prac 6 handed in<br>Prac 7 handed out                            |
|             |             | Mid-semester break   |  |
| 3 Oct       | 8           | No lecture (public holiday)  |  |
| 10 Oct      | 9           | Multiple regression models and relevant hypothesis tests                   | Prac 7 handed in<br>Prac 8 handed out<br>Assignment 2 handed out |
| 17 Oct      | 10          | Multiple regression models (Contd.): case studies                          | Prac 8 handed in<br>Prac 9 handed out                            |
| 24 Oct      | 11          | Model fit and diagnostics, variable selection; Prediction                  | Prac 9 handed in<br>Prac 10 handed out<br>Assignment 2 handed in |
| 31 Oct      | 12          | Chi-square tests   | Prac 10 handed in<br><b>Prac Test</b>                            |
| 7 Nov       | 13          | Revision   | (Self-study)   |