FACULTY OF SCIENCE

SCHOOL OF MATHEMATICS AND STATISTICS

MATH3821
Statistical Modelling and Computing

Session 2, 2017

Units of Credit

6 UOC

Prerequisites

MATH2831 / MATH2931

Syllabus

The main purpose of this course is to give an introduction to flexible, modern approaches to regression and simulation methods using the statistical package R. In particular, various extensions of the linear models discussed in MATH2831 are considered: we consider regression models where we allow the mean response to be a quite general smooth function (nonparametric regression methods such as scatter plot smoothing, penalised splines, etc.) and regression models for data which are discrete or non-Gaussian (generalised linear models). The Bayesian linear model is also covered and simulation techniques such as Markov chain Monte Carlo and classic Monte Carlo methods are used to compute these models.

Course Notes

Electronic notes of lecture material, as well as tutorial and lab problems will be made available via the Moodle for MATH3821.

Aims

The aim of MATH3821 is that at the end of session you should understand the concepts and techniques involved in the syllabus and be able to apply those concepts and techniques to the solution of appropriate problems. The R package will allow you to solve problems computationally.

Course Outcomes

A student should

- state definitions as specified in the syllabus

- have working knowledge of appropriate theorems

- apply the concepts and techniques of the syllabus to solve appropriate problems

- have the ability to use specific and general results given specified assumptions

- use terminology and reporting styles appropriately and successfully to communicate information and understanding

Advice to students

Students are strongly advised to take note of the detailed syllabus and notes provided in lectures and tutorials. Active participation in the tutorials are strongly encouraged.

The level of depth of understanding required in this course is best understood by considering the examples given in lectures, exercises in tutorials, assignments and midsession tests (if applicable).

Teaching strategy

MATH3821 is taught through carefully planned lectures that logically develop the concepts and techniques specified in the course. Examples are emphasised as they provide the underlying motivation for the course, and because students best understand the general theory when it is developed from simple, and then more complex examples.

Small group tutorials allow students to apply the material introduced in the lectures. These tutorials provide the opportunity for individual assistance. Students are expected to print out and bring their tutorial exercises and are expected to work conscientiously at the exercises in the tutorials.

Students are encouraged to give constructive feedback during the teaching session. They are encouraged to work collaboratively with other students to develop their understanding and their problem solving skills.

Assessment

Assessment of the subject will be based on the following components with weights as shown:

- Assignments: 20%

- Mid-session test: 20%

- End-of-session Examination: 60%

Note that

- Tutors are expected to enter assessment task marks onto the computer within a fortnight of the due date of the assessment. It is your responsibility to check that these marks are correct. If there is an error, speak to your tutor as soon as possible.

- Your final raw mark is scaled by the School of Mathematics and Statistics to produce your final grade. This is done so that the final distribution of the marks is consistent with general university guidelines regarding the percentage of students with various grades, and to maintain consistent standards from year to year. A committee of teaching staff determines the final scaling.

Midsession tests

A midsession test will be given in week 10. It will contributing 20% towards the final grade.

Normal exam conditions apply in tests. If special considerations apply, you should go through the usual applications procedure. However a re-sit is not given for tests conducted during session.

Assignment

There will be a total of two assignments. Each assignment will contribute 10% to the final mark for the course. Where applicable, oral presentations may be required as part of the assessment for the assignments. These will be conducted during the tutorial/lab classes.

Assignments must be handed in by the due date and time. Late submission will not be accepted unless there is documentary evidence of mitigating circumstances.

Each assignment must include a signed declaration of the plagiarism coversheet.

All work submitted for assessment (other than formal examination scripts) will be returned with comments on the assessment where appropriate.

Lecturers in charge

Dr Yanan Fan (Roon RC2055)
Phone: 9385 7034 Email: Y.Fan@unsw.edu.au

Lectures

Monday 9.00-10.00: LEC: Webster Theatre A Weeks 1-12
Tuesday 12.00-2.00: LAB RC-G12A Weeks 2-13
Thursday 11-12: LEC CLB 5 Weeks 1-12
Thursday 2.00-4.00: LAB RC-G12C Weeks 2-13

Tutorials and Lab classes

Each student in MATH3821 is enrolled in a time slot. Each week there will be two hours of tutorial time, both held in the labs, you will be given a variety of lab and tutorial questions to solve during these times **Note there is no tutorial (or lab) in week 1**. The main purpose of tutorials is provide you with an opportunity to get help with any problems which you find difficult and any parts of the lectures or textbook which you do not understand. In order to get real benefit from tutorials you should

- study your lecture notes and attempt relevant problems **before** the tutorial so that you can find out the areas which you have difficulties.

- make sure that your tutor is aware of the areas in which you need help.

- be specific as possible in describing your difficulties – don't just say "could you explain about regression".

- be active participant in tutorials, asking and answering questions rather than just sitting and watching.

Getting help outside tutorials

If you are having difficulty understanding the lectures or doing suggested problems, always try to get help through your tutorials. However if this is not possible please make an appointment with the lecturer in charge.

Textbook

Notes are available electronically via Moodle. Supplementary reading for the course can be found in the following:

W. N. Venables and B. D. Ripley (1999), *Modern Applied Statistics with S-PLUS (Third Edition)*, Wiley.

T. J. Hastie and R. J. Tibshirani (1990), *Generalized Additive Models*, Chapman and Hall.

T. J. Hastie, R. J. Tibshirani and J Friedman (2001), *The Elements of Statistical Learning: Data mining, inference and prediction*, Springer

D. Ruppert, M. P. Wand and R. J. Carroll (2003), *Semiparametric Regression*, Cambridge University Press

Chris J. Lloyd (1999), *Statistical Analysis of Categorical Data*, Wiley.

P.J. Green and B.W. Silverman (1994), *Nonparametric Regression and Generalized Linear Models*, Chapman and Hall.

Annette J. Dobson (1990), *An Introduction to Generalized Linear Models*, Chapman and Hall.

Andrew Gelman, J. B. Carlin, H. S. Stern and D. B. Rubin (2004), *Bayesian Data Analysis*, Chapman and Hall.

Computing

Students are expected to have access to the computing labs in the School. A basic knowledge of R is assumed.

Graduate Attributes

This course allows you to enhance your research, inquiry and analytical thinking skills. This is because the understanding of concepts and problem solving skills are strongly emphasised in the course, and because you need to show independence to master the use of R, try to develop your communication skills to be active participants in your tutorials, and in writing clear, logical arguments when solving problems.

Course Evaluation and Development

The School of Mathematics and Statistics evaluates each course each time it is run. We carefully consider the student responses and their implications for course development. It is common practice to discuss informally with students how the course and their mastery of it are progressing.

School Rules and Regulations

Fuller details of the general rules regarding attendence, release of marks, special consideration etc are available via the School of Mathematics and

Statistics Web page at
`http://www.maths.unsw.edu.au/students/current/policies/studentpolicy.html`.

Plagiarism and academic honesty

Plagiarism is the presentation of the thoughts or work of another as one's own.
Issues you must be aware of regarding plagiarism and the university's policies
on academic honesty and plagiarism can be found at `http://www.lc.unsw.edu.au/plagiarism`
and `http://www.lc.unsw.edu.au/plagiarism/plagiarism_STUDENTBOOK.pdf`.