UNIVERSITY OF TECHNOLOGY SYDNEY

School of Mathematical and Physical Sciences

Information Sheet for

37458 Advanced Bayesian Methods

Preliminary Version: 15th March, 2019

Autumn, 2019

Subject Coordinators and Lecturer:

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Assumed Knowledge

Statistical distribution theory; Fundamentals of statistical inference.

Overview of Subject Content

Advanced data analysis via contemporary Bayesian statistical models and software. Models include generalised linear models, linear mixed models and generalised additive models. The R, BUGS and Stan computing environments will be used for analysis of a wide array of data sets. Principles and theory of the underlying methodology will be covered.

Tentative Class and Tutorial Schedule

Class 1.	*VENUE:* Room 9a, Level 5, Building 7. Introduction; Review of distribution theory; The R computing environment. **Assignment 1** made available.
Tutorial for Assignment 1 (optional)	4pm-5pm Thursday 21st March *VENUE:* Room 8, Level 5, Building 7
Class 2.	*VENUE: To be determined.* **Assignment 1** submitted in person at start of class. Introductory graph theory; Probabilistic graphs. **Assignment 2** made available.
Tutorial for Assignment 2 (optional)	*To be determined.* *VENUE: To be determined.*

Class 3.	*VENUE for first hour: To be determined.* **Assignment 2** submitted in person at start of class. Results for probabilistic graphs. Introduction to the Stan computing environment. *VENUE for second hour: To be determined.* **Laboratory 1** made available and commenced.
Class 4.	*VENUE: To be determined.* **Laboratory 1** submitted by e-mail 1 hour before start of class. Introduction to Bayesian Statistical Inference Bayesian linear regression. **Assignment 3** made available.
Tutorial for Assignment 3 (optional)	*To be determined.* *VENUE: To be determined.*
Class 5.	*VENUE: To be determined.* **Assignment 3** submitted in person at start of class. Bayesian linear mixed models Generalised response Bayesian models – examples and computing in R and Stan. **Assignment 4** made available.
Tutorial for Assignment 4 (optional)	*To be determined.* *VENUE: To be determined.*
Class 6.	*VENUE for first hour: To be determined.* **Assignment 4** submitted in person at start of class. Advanced Bayesian models and analyses. *VENUE for second hour: To be determined.* **Laboratory 2** made available and commenced.
Classes 7–12.	Everything still to be determined as of mid-March 2019.

Subject Materials

The subject materials comprise notes and slides, some of which are handed out in class. All slides will be posted on the subject web-site within 24 hours of the relevant class being delivered.

References

There is no assigned text for this subject. Reference books of some relevance are:

Gelman, A., Carlin, J.B., Stern, H.S., Dunson, D.B., Vehtari, A. and Rubin, D.B. (2014). *Bayesian Data Analysis, Third Edition*, Boca Raton, Florida: CRC Press.

Faraway, J.J. (2006). *Extending the Linear Model with R*, Boca Raton, Florida: Chapman & Hall/CRC.

Harezlak, J., Ruppert, D. and Wand, M.P. (2018). *Semiparametric Regression with R*. New York: Springer.

McCulloch, C.E. & Searle, S.R. (2001). *Generalized, Linear, and Mixed Models*, New York: Wiley.

You are not required to purchase reference books. Copies of these books may be available in the

Library. These books are recommended only and are not intended to be an exhaustive list. You are encouraged to use the Library catalogue and databases to locate additional readings with similar titles and contents.

Subject Learning Outcomes

After successful completion of this subject, students should:

(1) Have a thorough understanding of the elements of probabilistic graph theory and its relationship with Bayesian data analysis.

(2) Formulate regression models for analysis of a complicated data set. Complications may include data with repeated measures or a categorical response variable. Models include generalised linear models, linear mixed models and generalised additive models.

(3) Fit such models and perform subsequent analyses and diagnostics using the computer packages R, BUGS and/or Stan.

(4) Have a basic understanding of Markov chain Monte Carlo methodology that is used by contemporary software such as BUGS and Stan for making approximate and practical Bayesian inference.

(5) Write independent code in the R language.

(6) *Possibly others to be added here depending on second half.*

Assessment

Your final mark in 37458 Seminar (Statistics) will be determined as follows:

Laboratories	15%
Assignments	35%
Final Exam	50%

Scaling of marks is not a standard procedure in this subject.
Note that you are not required to pass each individual component to receive a Pass grade in 37458 Advanced Bayesian Methods. However, you would seriously jeopardise your chances of passing this subject if you do not aim to be successful in every component of the assessment.

Final Examination

The final examination in 37458 Advanced Bayesian Methods will be as follows:

Duration:	2 hours
Value:	50% of final mark.

The examination will be held during the examination period in June 2019, at a time to be advised by the University. As a student enrolled in the University of Technology Sydney, you are required to be available for the entire examination period in June 2019.

Assignments and Laboratories

Each week you will be given an assignment or asked to complete a laboratory. Each assignment must be handed in during class by the date specified on the assignment. Assignments will be marked and returned during the following class.

- You must show working for each question on the assignment.

- Untidy or illegible work will not be assessed.
- Assignments will not be accepted outside classes or after the due date – unless you are successful in applying for special consideration (see later).
- Faxed or emailed assignments will not be accepted.
- Extensions for assignments will not be granted.
- Late assignments will be penalised at a rate of 10% per day, not including weekends and public holidays.

Every assignment submitted will contribute towards your final assessment. However, the primary purpose of each assignment is to give you feedback on your progress and understanding of the work.

If you wish to seek special consideration for a late assignment then please contact the lecturer (`matt.wand@uts.edu.au`).

Notification of Alterations

If any alterations occur in the lecture times, assignment content or assignment due dates then you will be notified by an e-mail message to your University of Technology Sydney e-mail address.

Cheating, Plagiarism and Other Misconduct

The University and Faculty of Science encourage students to undertake their academic studies with the highest integrity and take seriously any instances of student misconduct.

Student misconduct as defined by Rule 16.2 can include cheating (examples of which may be in formal or informal examinations, copying work from another student for individual reports or assignments, altering data, submitting work which has been written by another person as your own) or plagiarism as defined in Rule 16.2.1(4).

Penalties for misconduct relating to a specific subject are outlined in Rule 16.3.1(9). Students should be aware that any incident of misconduct is placed on record with the Registrar.

If you are uncertain as to what constitutes student misconduct or plagiarism, you are strongly advised to:

1. read Section 16 of *Student Misconduct and Appeals of the Student and Related Rules*:

   `www.gsu.uts.edu.au/rules/student/section-16`

2. consult the plagiarism help site: www.ssu.uts.edu.au/helps/resources/plagiarism
3. speak to the academic staff responsible for your subject.

Plagiarism detection software such as `Turnitin` or other methods to detect plagiarism may be used to check your work in any subject.

Consultation

If you are having any difficulties with 37458 Advanced Bayesian Methods, you are encouraged to seek advice from the lecturer.

Web-site

All relevant material for this subject will be posted on the web-site:

`matt-wand.utsacademics.info/37458.html`

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