

AMSI Online: Honours and Masters Subject Guide

Modern Statistical Computing Techniques

Semester 2, 2026

Administration and contact details

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Subject details

Handbook entry URL	https://www.qut.edu.au/study/unit?unitCode=MXN442
Subject homepage URL	
Honours student hand-out URL	
Teaching period (start and end date):	20 July 2026 – 13 November 2026
Exam period (start and end date):	No exam
Contact hours per week:	2 hours teaching and 1 hour workshop
AMSI Online enrolment closure date:	
Lecture day(s) and time(s):	To be confirmed
Description of electronic access arrangements for students (for example, LMS)	Students will be added to the unit canvas page

Subject content

1. Subject content description

This unit is intended to provide you with skills in advanced computational methods and algorithms for handling complex and computationally demanding problems in statistics. We will cover advanced Monte Carlo methods for estimating quantities of interest under an assumed complex (possibly Bayesian) statistical model, discussing their properties and implementation. The unit is designed to complement a research project in statistics and is oriented to enable you to proceed to a variety of workplaces, or to further professional development, or to research.

2. Week-by-week topic overview

Week 1: Generating random univariate variables

Week 2: Monte Carlo integration

Week 3: Importance sampling and Laplace approximation

Week 4: Introduction to Markov chain Monte Carlo (MCMC)

Week 5: Advanced MCMC I

Week 6: Advanced MCMC II

Week 7: No lecture

Week 8: Adaptive importance sampling

Week 9: Introduction to sequential Monte Carlo (SMC)

Week 10: Adaptive strategies for SMC

Week 11: Introduction to approximate Bayesian computation (ABC)

Week 12: SMC-ABC

Week 13: No lecture (project due)

3. Assumed prerequisite knowledge and capabilities

- Undergraduate knowledge in probability and statistics (with Bayesian statistics), linear algebra, and calculus.
- Familiarity with computer programming in a language such as Python, R, and MATLAB.

4. Learning outcomes and objectives

- Employ advanced knowledge of the theory of statistical computation and sampling methods necessary for advanced applications in economics, scientific, medical, health and engineering problems.
- Formulate and apply advanced computational approaches applicable to data science.
- Demonstrate advanced practical ability to conduct data analyses and simulations using computational platforms such as Python, R, and MATLAB.
- Summarise and explain in written and/or oral form, the motivation, details and results of a statistical simulation.

AQF specific Program Learning Outcomes and Learning Outcome Descriptors (if available):

AQF Program Learning Outcomes addressed in this subject	Associated AQF Learning Outcome Descriptors for this subject
Employ advanced knowledge of the theory of statistical computation and sampling methods necessary for advanced applications in economics, scientific, medical, health and engineering problems.	K1
Formulate and apply advanced computational approaches applicable to data science.	A2 S2
Demonstrate advanced practical ability to conduct data analyses and simulations using computational platforms such as Python, R, and MATLAB.	A1 S4
Summarise and explain in written and/or oral form, the motivation, details and results of a statistical simulation.	S5

<p>Learning Outcome Descriptors at AQF Level 8</p> <p>Knowledge K1: coherent and advanced knowledge of the underlying principles and concepts in one or more disciplines K2: knowledge of research principles and methods</p> <p>Skills S1: cognitive skills to review, analyse, consolidate and synthesise knowledge to identify and provide solutions to complex problem with intellectual independence S2: cognitive and technical skills to demonstrate a broad understanding of a body of knowledge and theoretical concepts with advanced understanding in some areas S3: cognitive skills to exercise critical thinking and judgement in developing new understanding S4: technical skills to design and use in a research project S5: communication skills to present clear and coherent exposition of knowledge and ideas to a variety of audiences</p> <p>Application of Knowledge and Skills A1: with initiative and judgement in professional practice and/or scholarship A2: to adapt knowledge and skills in diverse contexts A3: with responsibility and accountability for own learning and practice and in collaboration with others within broad parameters A4: to plan and execute project work and/or a piece of research and scholarship with some independence</p>

5. Learning resource

Students will be provided with a full set of lecture notes, lecture slides, and supplementary material in the form of worksheets and code examples.

6. Assessment breakdown

Exam	0%
Assignment	100%
Class work	0%

Assignment due dates	Exam date (approximate)
Problem solving task 1 (25%): Week 4	No exam
Problem solving task 2 (25%): Week 10	
Project (50%): Week 13	
Click here to enter a date.	

Institution honours program details

Weight of subject in total honours assessment at host department	
Thesis/subject split at host department	
Honours grade ranges at host department	
H1	Enter range %
H2a	Enter range %
H2b	Enter range %
H3	Enter range %

Institution masters program details

Weight of subject in total masters assessment at host department	
Thesis/subject split at host department	
Masters grade ranges at host department	
H1	Enter range %
H2a	Enter range %
H2b	Enter range %
H3	Enter range %