Point estimation with the focus on maximum likelihood (ML) estimators and their properties, including sufficiency and asymptotic efficiency; exponential families; computational aspects of ML estimation, including the EM algorithm; interval estimation; hypothesis tests; an introduction to the Bayesian approach to inference; multivariate normal distribution and the distribution of quadratic forms; basic distributional results for the general linear model.
Staff
Lecturer and Course Coordinator: Professor Geoff McLachlan

- **Email:** gjm@maths.uq.edu.au
- **Phone:** +61 7 336 52150, +61 7 334 62623
- **Fax:** +61 7 336 51477
- **Postal address:**
  Department of Mathematics
  University of Queensland
  St. Lucia, Brisbane, Australia 4072
- **Office in Dept. of Mathematics:** Room 745, Priestley Building (No. 67)
- **Office in IMB:** Room 6.114, Queensland Bioscience Precinct (West Wing)

**Consultation hours or Office hours:**
In Maths Office:
Tuesday 2 – 3 p.m.
Wednesday 9 – 10 a.m.

**Web page** The course profile and course material can be found on the web at the following address: www.maths.uq.edu.au/courses/STAT3001

**Class contact hours:** 3L, 1T

Tuesday 9, Room 67-343
Tuesday 10, Room 83-S437
Friday 9, Room 83-C516

Tuesday 2, Room 50-C203 (Tutorial)

**Assumed background:**

The students are expected to have a basic knowledge of probability and statistics that would enable them to complete the course STAT2004. That is, it is advantageous if students have some idea of the concept of a random variable and its distribution, and the use of statistical models to represent data on random phenomena in order to draw inferences from observed samples.
Course goals/rationale:

On completing this course students will:

- Have an understanding of how point estimators are formed and assessed in forming estimates from an observed random sample.
- Have an understanding of the use of confidence intervals and tests of hypotheses.
- Have an understanding of the distinction between the frequentist and Bayesian frameworks for statistical inference.
- Have knowledge of the extension of the univariate normal distribution to the multivariate case where more than one normal random variable is to be studied simultaneously.
- Have an understanding of the application of the general linear model to data.
Graduate Attributes:

The following graduate attributes will be developed in the course –

**In-Depth Knowledge of the Field of Study**

- A comprehensive and well-founded knowledge of the field of study.

**Effective Communication**

- The ability to collect, analyse, and organise information and ideas, and to convey those ideas clearly and fluently, in both written and spoken form – by working through regular assignment problems and a final examination.
- The ability to engage effectively and appropriately with information and communication Technologies – by working through assignment problems.

**Independence and Creativity**

- The ability to work and learn independently – by learning the relevant techniques and explaining solutions to problems in your own way.
- The ability to generate ideas - in order to solve assignment problems.
- The ability to identify problems, create solutions – through evaluating the lecture and assignment material.

**Critical Judgement**

- The ability to define and analyse problems - by working through the lecture and assignment material.
- The ability to apply critical reasoning to issues through independent thought and informed judgement – by working through assignment and examination problems.
- The ability to evaluate opinions, make decisions and to reflect critically on the justifications for decisions - by working on assignment problems.

**Ethical And Social Understanding**

- An appreciation of the philosophical and social contexts of the discipline – through in-class discussions.

For more information on the University policy on development of graduate attributes in courses, refer to the web


**Teaching and Learning Methods**

*There will be three lectures each week, where the basic material and ideas will be presented. Assignments will be set at regular intervals, five in all, and will involve using the techniques*
developed in lectures to solve problems motivated by applications. The lecturer will be present at the tutorials to offer help and hints for solving the problems.

ASSESSMENT

Required assessment tasks:

Advise students how performance in the course will be assessed; this includes:

- There will be 5 assignments during the course, at 2-3 weekly intervals.
- Each assignment is worth 7% of the final assessment.
- Each assignment will be marked and returned after 1-2 weeks.
- The 5 assignments together with a 2-hour final examination worth 65% make up the total assessment for the course.

Assessment criteria

List the assessment criteria by which the student’s level of achievement in the course will be judged.

- The extent to which they demonstrate the student’s understanding of the methods and techniques outlined in lectures.
- Their ability to apply these methods and techniques successively in new situations.
- Their ability to apply their conclusions in a clear and cogent form.
- Their ability to interpret the meaning of the results obtained.

Criteria for the award of grades

Your grade for this course will be determined by which of the following levels of achievement that you consistently display in the items of summative assessment.

Grade of 7: (86% - 100%) the student demonstrates an excellent understanding of the theory of the topics listed in the course outline and is highly proficient in applying the techniques to solve both theoretical and practical problems.

Grade of 6: (75% - 85%) the student demonstrates a comprehensive understanding of the theory of the topics listed in the course outline and is proficient in applying the techniques to solve both theoretical and practical problems.

Grade of 5: (65% - 74%) the student demonstrates a good understanding of the theory of the topics listed in the course outline and can apply the techniques to solve problems.
Grade of 4: (50 – 64%) the student demonstrates an understanding of the theory of the topics listed in the course outline and demonstrates a knowledge of the techniques used to solve problems.

Grade of 3: (45% - 49%) the student demonstrates some understanding of the theory of the topics listed in the course outline and demonstrates a knowledge of the techniques used to solve problems.

Grade of 2: (25 – 44%) the student demonstrates limited understanding of the theory of the topics listed in the course outline and demonstrates limited knowledge of the techniques used to solve problems. This includes attempts at expressing their deductions and explanations and attempts to answer a few questions accurately.

Grade of 1: (1 – 24%) the student demonstrates very limited understanding of the theory of the topics listed in the course outline and of the basic concepts in the course material. This includes attempts at answering some questions but demonstrating very limited understanding of the key concepts.

Assessment policy

Students should be familiar with the rules which relate to assessment in their degrees as well as general university policy such as found in the General Award Rules. These are all set out on the myAdvisor page on the UQ website


Plagiarism:

The University has adopted the following definition of plagiarism:

“Plagiarism is the action or practice of taking and using as one’s own the thoughts or writings of another, without acknowledgment. The following practices constitute acts of plagiarism and are a major infringement of the University's academic values:

- Where paragraphs, sentences, a single sentence or significant parts of a sentence are copied directly, and are not enclosed in quotation marks and appropriately footnoted;

- Where direct quotations are not used, but are paraphrased or summarised, and the source of the material is not acknowledged either by footnoting or other simple reference within the text of the paper; and

- Where an idea which appears elsewhere in printed, electronic or audio-visual material is used or developed without reference being made to the author or the source of that material.”

When a student knowingly plagiarises someone’s work, there is intent to gain an advantage and this may constitute misconduct.

Students are encouraged to study together and to discuss ideas, but this should not result in students handing in the same or similar assessment work. Do not allow another student to
copy your work. While students may discuss approaches to tackling a tutorial problem, care
must be taken to submit individual and different answers to the problem. Submitting the
same or largely similar answers to an assignment or tutorial problem may constitute
misconduct.

For more information on the University policy on plagiarism, please refer to

**Supplementary examinations**

A supplementary examination may be awarded in one course to students who obtain a grade
of 2 or 3 in the final semester of their program and require this course to finish their degree.
You should check the rules for your degree program for information on the possible award of
supplementary examinations. Applications for supplementary examinations must be made to
the Director of Studies in the Faculty.

EPSA Faculty policy on the award of supplementary exams may be found via the Faculty
Guidelines on Examinations from the EPSA student page

**Special examinations**

If a student is unable to sit a scheduled examination for medical or other adverse reasons,
she/he can and should apply for a special examination. Applications made on medical grounds
should be accompanied by a medical certificate; those on other grounds must be supported by
a personal declaration stating the facts on which the application relies.

Applications for special examinations for central and end-of-semester exams must be made
through the Student Centre. Applications for special examinations in school exams are made
to the course coordinator.

More information on the University’s assessment policy may be found

EPSA Faculty policy on the award of special exams may be found via the Faculty Guidelines
on Examinations from the EPSA student page

**Feedback on assessment:**

You may request feedback on assessment in this course progressively throughout the semester
from the course coordinator. Feedback on assessment may include discussion, written
comments on work, model answers, lists of common mistakes and the like.

Students may peruse examinations scripts and obtain feedback on performance in a final
examination provided that the request is made within six months of the release of final course
results. After a period of six months following the release of results, examination scripts may
be destroyed.

Information on the University’s policy on access to feedback on assessment may be found at
EPSA Faculty policy on assessment feedback and re-marking may be found at 
Textbook and references

Reference texts:


Library contact:
The liaison librarian for the physical sciences disciplines is located in the Physical Sciences and Engineering Library in the Hawken Building and may be consulted for assistance in the course:

Leith Woodall
Email: l.woodall@library.uq.edu.au
Extension: 52367
Students with disabilities:

Any student with a disability who may require alternative academic arrangements in the course is encouraged to seek advice at the commencement of the semester from a Disability Adviser at Student Support Services.

Assistance for Students:

Students with English language difficulties should contact the course coordinator or tutors for the course.

Students with English language difficulties who require development of their English skills should contact the Institute for Continuing and TESOL Education on extension 56565.

The Learning Assistance Unit located in the Relaxation Block in Student Support Services. You may consult learning advisers in the unit to provide assistance with study skills, writing assignments and the like. Individual sessions are available. Student Support Services also offers workshops to assist students. For more information, phone 51704 or on the web http://www.sss.uq.edu.au/index.html.

Student Liaison Officer:

The School of Physical Sciences has a Student Liaison Officer as an independent source of advice to assist students with resolving academic difficulties.

The Student Liaison officer during 2005 will be Dr Peter Adams, Room 547 Priestley building, (email pa@maths.uq.edu.au)

Program of work for the semester:

The frequentist approach to estimation; point estimation; desirable properties of estimators, including sufficiency and efficiency; uniformly minimum variance unbiased estimators; minimum variance bound estimators; maximum likelihood (ML) theory; asymptotic properties of ML estimators; computation of ML estimates including via the EM algorithm; some alternatives to ML estimation; interval estimation; tests of hypotheses including the score test, Wald's test, and the likelihood ratio test; an introduction to the Bayesian approach to inference; multivariate normal distribution and the distribution of quadratic forms; basic distributional results for the general linear model.