UNSW SCIENCE

School of Maths and Statistics

Course outline

MATH3811
Statistical Inference

MATH3911
Higher Statistical Inference

Term 1, 2023

Cricos Provider Code: 00098G

Staff

Position	Name	Email	Room
Lecturer-in-charge	Dr Tom Stindl	t.stindl@unsw.edu.au	RC-2086

Please refer to your Timetable on MyUNSW for your Lecture Tut, Lab enrolment days and times.

Timetable MATH3811 http://timetable.unsw.edu.au/2023/MATH3811.html

Timetable MATH3911 http://timetable.unsw.edu.au/2023/MATH3911.html

Administrative Contacts

Please visit the School of Mathematics and Statistics website for a range of information on School Policies, Forms and Help for Students.

For information on Courses, please go to "Current Students" and either Undergraduate and/or Postgraduate", Course Homepage" for information on all course offerings,

The "Student Notice Board" can be located by going to the "Current Students" page; Notices are posted regularly for your information here. Please familiarise yourself with the information found in these locations. The School web page is: https://www.maths.unsw.edu.au

If you cannot find the answer to your queries on the web you are welcome to contact the Student Services Office directly.

By email Undergraduate ug.mathsstats@unsw.edu.au

By phone: 9385 7053 or 9385 7111

Should we need to contact you, we will use your official UNSW email address of in the first instance. **It is your responsibility to regularly check your university email account. Please state your student number in all emails.**

Course Information

Assumed knowledge / Pre-Requisite: MATH2831 or MATH2931

Exclusions:

MATH3811 - MATH3911, MATH5905

MATH3911 – MATH3811, MATH5905

Course Aims

The aim of the course is to introduce the main ideas and principles behind the parametric and nonparametric inference procedures. The basic methods of inference used throughout Statistics will be discussed rigorously. Students will learn how to choose the appropriate inference procedure and how to perform inference using the chosen procedure.

Course Description

Coverage of the main parametric and non-parametric and techniques used in statistics. Uniformly minimum variance estimation. Cramer-Rao inequality, Lehmann-Scheffe theorem. Monotone likelihood ratio distributions and uniformly most powerful unbiased tests. Generalised likelihood ratio tests, exact tests and large sample tests. Bayesian point estimation, interval estimation and hypothesis testing. Robustness and bootstrap resampling. Order statistics, goodness of fit, contingency tables. Statistical inference based on ranks. One sample, two sample and k-sample problems, blocked data, independence and association.

Assessment and Deadlines

Assessment	Week	Weighting %	Due date if applicable
Assignment 1	Week 4	10%	Friday, 10 March
Mid-session Test	Week 7	20%	Thursday, 30 March
Assignment 2	Week 9	10%	Friday, 14 April
Final Exam		60%	UNSW Final Exam Period

Late Submission of Assessment Tasks

No late submissions will be accepted. (Where "late" in this context means after any extensions granted for Special Consideration or Equitable Learning Provisions.)

Course Learning Outcomes (CLO's)

1. Show how Statistical Inference arises from the first principles of Probability Theory.
2. Demonstrate knowledge of the concepts of finite-sample and asymptotic efficiency of inference procedure.
3. Estimate key population parameters of interest, to test hypotheses about them and to construct confidence regions.
4. Use in practice the Nonparametric estimation and testing procedures.
5. Use the R package to generate output for the most common Inference Procedures. More specifically, how to perform computer intensive calculations such as bootstrapping, robust estimation and nonparametrics within R.

Course Schedule

The course will include material taken from some of the following topics. This is should only serve as a guide as it is not an extensive list of the material to be covered and the timings are approximate. The course content is ultimately defined by the material covered in lectures.

Weeks	Topic	Reading (if applicable)
1	The general inference problem (2 hours). Principles of Statistical Inference (2 hours)	Refer to Moodle Lecture notes
2	Principles of Statistical Inference (continued) (2 hours) Information and Likelihood (2 hours)	
3	Maximum likelihood inference (4 hours)	
4	Hypothesis testing including Generalized Likelihood Ratio Test (GLRT) (4 hours)	
5	Bayesian Inference (2 hours). Bootstrap and Jackknife (2 hours)	
7	Midsession test. Bootstrap computing in R (1 hour) Order statistics (2 hours)	
8	Robustness (1 hour including computing in R) Rank-based inference (1 hour)	
9	Rank-based inference continued (1 hour) Goodness-of-fit tests, contingency tables (3 hours)	
10	K sample problems (K>2) (2 hours) Measures of association (2 hours)	

Textbook

- (GJJ) Garthwaite, P., Jolliffe, I., Jones, B. Statistical Inference. Second edition. Oxford University Press (2002). This is the recommended text.
- (HMcKC) Hogg,R., McKean,J., Craig, A. Introduction to Mathematical Statistics, Pearson education (2005).
- (D) Davison, A.C. Statistical models. Cambridge University Press (2008).
- (ZL) Zwanzig, S., Liero, H. Introduction to the theory of statistical inference. Taylor and Francis (2011).
- (YS) Young, G. and Smith, R. Essentials of statistical inference. Cambridge University Press (2005).
- (G) Gibbons, J. and Chakraborti, S. (2003) Nonparametric statistical inference. Marcel Dekker (2003).

Moodle

Log in to Moodle to find announcements, general information, notes, lecture slide, classroom tutorial and assessments etc.

https://moodle.telt.unsw.edu.au

School and UNSW Policies

The School of Mathematics and Statistics has adopted a number of policies relating to enrolment, attendance, assessment, plagiarism, cheating, special consideration etc. These are in addition to the Policies of The University of New South Wales. Individual courses may also adopt other policies in addition to or replacing some of the School ones. These will be clearly notified in the Course Initial Handout and on the Course Home Pages on the Maths Stats web site.

Students in courses run by the School of Mathematics and Statistics should be aware of the School and Course policies by reading the appropriate pages on the Maths Stats web site starting at:

https://www.maths.unsw.edu.au/currentstudents/assessment-policies

The School of Mathematics and Statistics will assume that all its students have read and understood the School policies on the above pages and any individual course policies on the Course Home Page. Lack of knowledge about a policy will not be an excuse for failing to follow the procedure in it.

Academic Integrity and Plagiarism

UNSW has an ongoing commitment to fostering a culture of learning informed by academic integrity. All UNSW staff and students have a responsibility to adhere to this principle of academic integrity. Plagiarism undermines academic integrity and is not tolerated at UNSW. *Plagiarism at UNSW is defined as using the words or ideas of others and passing them off as your own.*

The **UNSW Student Code** provides a framework for the standard of conduct expected of UNSW students with respect to their academic integrity and behaviour. It outlines the primary obligations of students and directs staff and students to the Code and related procedures.

In addition, it is important that students understand that it is not permissible to buy essay/writing services from third parties as the use of such services constitutes plagiarism because it involves using the words or ideas of others and passing them off as your own. Nor is it permissible to sell copies of lecture or tutorial notes as students do not own the rights to this intellectual property.

If a student breaches the Student Code with respect to academic integrity, the University may take disciplinary action under the **Student Misconduct Procedure**.

The UNSW Student Code and the Student Misconduct Procedure can be found at:
https://student.unsw.edu.au/plagiarism

An online Module "Working with Academic Integrity" (https://student.unsw.edu.au/aim) is a six-lesson interactive self-paced Moodle module exploring and explaining all of these terms and placing them into your learning context. It will be the best one-hour investment you've ever made.

Plagiarism

Plagiarism is presenting another person's work or ideas as your own. Plagiarism is a serious breach of ethics at UNSW and is not taken lightly. So how do you avoid it? A one-minute video for an overview of how you can avoid plagiarism can be found https://student.unsw.edu.au/plagiarism.

Additional Support

ELISE (Enabling Library and Information Skills for Everyone)

ELISE is designed to introduce new students to studying at UNSW.

Completing the ELISE tutorial and quiz will enable you to:

- analyse topics, plan responses and organise research for academic writing and other assessment tasks
- effectively and efficiently find appropriate information sources and evaluate relevance to your needs
- use and manage information effectively to accomplish a specific purpose
- better manage your time
- understand your rights and responsibilities as a student at UNSW
- be aware of plagiarism, copyright, UNSW Student Code of Conduct and Acceptable Use of UNSW ICT Resources Policy
- be aware of the standards of behaviour expected of everyone in the UNSW community
- locate services and information about UNSW and UNSW Library

Some of these areas will be familiar to you, others will be new. Gaining a solid understanding of all the related aspects of ELISE will help you make the most of your studies at UNSW.

The *ELISE* training webpages:

https://subjectguides.library.unsw.edu.au/elise/aboutelise

Equitable Learning Services (ELS)

If you suffer from a chronic or ongoing illness that has, or is likely to, put you at a serious disadvantage, then you should contact the Equitable Learning Services (previously known as SEADU) who provide confidential support and advice.

They assist students:

- living with disabilities
- with long- or short-term health concerns and/or mental health issues
- who are primary carers
- from low SES backgrounds
- of diverse genders, sexes and sexualities
- from refugee and refugee-like backgrounds
- from rural and remote backgrounds
- who are the first in their family to undertake a bachelor-level degree.

Their web site is: https://student.unsw.edu.au/els/services

Equitable Learning Services (ELS) may determine that your condition requires special arrangements for assessment tasks. Once the School has been notified of these, we will make every effort to meet the arrangements specified by ELS.

Additionally, if you have suffered significant misadventure that affects your ability to complete the course, please contact your Lecturer-in-charge in the first instance.

Academic Skills Support and the Learning Centre

The Learning Centre offers academic support programs to all students at UNSW Australia. We assist students to develop approaches to learning that will enable them to succeed in their academic study. For further information on these programs please go to:

http://www.lc.unsw.edu.au/services-programs

Applications for Special Consideration for Missed Assessment

Please adhere to the Special Consideration Policy and Procedures provided on the web page below when applying for special consideration.

https://student.unsw.edu.au/special-consideration

Please note that the application is not considered by the Course Authority, it is considered by a centralised team of staff at the Nucleus Student Hub.

The School will contact you (via student email account) after special consideration has been granted to reschedule your missed assessment, for a *lab test or paper-based test* only.

For applications for special consideration for *assignment extensions*, please note that the new submission date and/or outcome will be communicated through the special consideration web site only, no communication will be received from the School.

For Dates on Final Term Exams and Supplementary Exams please check the “Key Dates for Exams” ahead of time to avoid booking holidays or work obligations.

https://student.unsw.edu.au/exam-dates

If you believe your application for Special Consideration has not been processed, you should email specialconsideration@unsw.edu.au immediately for advice.

Course Evaluation and Development (MyExperience)

Student feedback is very important to continual course improvement. This is demonstrated within the School of Mathematics and Statistics by the implementation of the UNSW online student survey *myExperience*, which allows students to evaluate their learning experiences in an anonymous way. *myExperience* survey reports are produced for each survey. They are released to staff after all student assessment results are finalised and released to students. Course convenor will use the feedback to make ongoing improvements to the course.