Faculty of Science

School of Mathematics and Statistics

ZZSC5905

Statistical Inference for Data Scientists

Hexamester 5 2021

Course Outline

Description
This course provides an introduction to probability and distribution theory and introductory statistical inference. You will learn the fundamental principles of inference, including sufficiency, likelihoods, likelihood principle, frequentist and Bayesian methods, computationally intensive methods such as bootstrap, and first-order and higher-order asymptotics. We'll also cover estimation, confidence set construction, and hypothesis testing in detail. You'll learn how to determine appropriate inference procedures and to draw inferences using the chosen procedure.

Units of Credit
The course is worth 6 units of credit.

Learning Outcomes
On successful completion of the course, you should be able to:

1. Show how Statistical Inference arises from the first principles of Probability Theory.
2. Understand the fundamental principles of inference: sufficiency, likelihood.
3. Estimate key population parameters of interest, to test hypotheses about them and to construct confidence regions.
4. Use likelihood-based and Bayesian inference methods in practice. Use higher order asymptotics to improve first order asymptotic inference.
5. Use compute packages to generate output for the most common Inference Procedures and for computer-intensive calculations such as bootstrapping.

Schedule

Date	Week	Topic	Assessment Due
23 Aug	0	Orientation Week	
30 Aug	1	Probability and the general inference problem	
06 Sep	2	Data reduction and its purpose	1
13 Sep	3	Bayesian and Maximum Likelihood Estimators	
20 Sep	4	The purpose of hypothesis testing	
27 Sep	5	Higher order asymptotic expansions	2
4 Oct	6	Bootstrap and robust statistics	3
11 Oct	7	Examination Week	Final exam

Assessment

In order to pass the course, you must:

- achieve a total mark of at least 50;
- meet any additional requirements of the assessment tasks.

The assessment tasks are:

No.	Type	Weight	Due*	Learning Outcomes
1	Online quiz	10%	Week 2, Monday, 12pm, 6 September	1
2	Online quiz	20%	Week 5, Monday, 12pm, 27 September	1, 2, 3, 4
3	Online quiz	20%	Week 6, Wednesday, 12pm, 6 October	1, 2, 3, 5
4	Online final examination (2 hours)	50%	Week 7, Tuesday, 8am-11am and 4pm-7pm, 12 October	1, 2, 3, 4, 5

*All dates and times are Sydney (Australia) dates and times

**Please note that the final exam is on the. There are 2 access windows to choose from: 8am-11am and 4pm-7pm 12 October. All times are Sydney Australia time. If you are based in a different time zone you will need to keep this in mind when booking and when you will need to start the exam.

You will be penalised 10% per day of the marks available for an assessment task if you submit it after the due date, unless you have an approved extension through Special Consideration.

Teaching Staff

Your teaching staff are:

- Tom Stindl, t.stindl@unsw.edu.au (Online Lecturer and Course Convenor)

Teachers are your main point of contact. Their consultation times will be advised on the course website.

Resources

The website for the course is on Moodle, at: http://moodle.telt.unsw.edu.au. All readings and activities will be available there - no additional materials are required.

Technical Requirements

The course is fully online. You will need:

- A fast and reliable computer (or equivalent device), with an up-to-date operating system
- A fast and reliable internet connection
- The latest version of a modern browser (e.g. Edge, Chrome, Firefox or Safari)
- A reliable way to store your files - either on your computer with a backup routine, or in the cloud (e.g. using Dropbox)
- There is no specific software requirement as all activities can be done in Ed, though students might prefer to work locally, in which case they would need to install RStudio.

In addition to the above requirements there are specific device requirements for the Online Examination.

Device Requirements for Online Examination

Feature	Minimum Requirements	Recommended
Computer	Desktop computer or laptop (tablets and mobile phones do not meet the requirement).	
Operatin gsystem	Windows 10, macOS 10.10: Yosemite (or newer)	
Processor	Intel i-Series i3 or equivalent(Windows/Mac)	Intel Core i5 or higher or equivalent(Windows/Mac)
Memory (RAM)	8GB	16GB or higher
Hard drive	20MB free space	2GB free space
Internet speed	3 Mbps upload/3 Mbps download	5 Mbps upload/20 Mbps download
Keyboard	Full physical keyboard	
Graphics Tablet	Not required but recommended -will make freehand input of equations and diagrams easier.	A graphics tablet device that is compatible with your operatingsystem with: • An active area of 152.0 x 95.0 mm (6.0 x 3.7 in) or greater • A resolution of 2540 lpi orhigher • Reading speed (pen) of 133pps or higher Examples: • Wacom Intuos S tablet • Xp-pen G640 tablet • HUION 680TF graphics tablet • Wacom Intuos M tablet CTL-6100WL
Browsers	Browser with pop-up blocker disabled and script blockers disabled. Most recent version of the following browsers: • Google Chrome • Mozilla Firefox	

Learning and Teaching Activities

The course contains a variety of resources and activities that are carefully designed to enhance your learning.

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Some activities require you to work and think alone, by reading some text, listening to a recording or watching a video. You might be asked to engage with the material and explore interactive elements by clicking to reveal content, to help you better absorb and process the concepts. Some activities require you to produce work of your own. You might be answering a question, writing code to solve a problem, or posting to a forum, for example. Some activities are assessment tasks, which have been carefully designed to measure how well you have achieved the learning outcomes of the course. Typically, you will get feedback on your work, either from yourself (by checking your work with models that are provided), or from an automatic marking process, or from your peers, or from your teacher.

You also have access to a variety of ways to communicate with your peers and with the teaching staff. The general discussion forums are a place for you to ask and answer questions, to interact with your peers, and to be challenged by your teachers. Getting involved in these forums will enhance your learning experience and make it more enjoyable. Your course may include Webinars, which provide an opportunity to hear directly from your Online Lecturers and ask questions in real time. All webinars are recorded so you can access them at any time. Online Lecturers are available for consultations and will post information about how to access consultations on the course website. You can also contact your Online Lecturer by email using the email address in the teaching staff section of this outline.

It is up to you how much work you do. The more time and effort that you can dedicate to the course, the better will be your learning and your results.

Special Consideration

If illness or other circumstances beyond your control interfere with your assessment performance then you can apply for special consideration, to get an extra opportunity to demonstrate your level of performance.

You must make your application online, through the Special Consideration portal on myUNSW. Do not apply to your course teaching staff - they will be notified automatically.

You must apply before the assessment task is due or the exam is held - if you submit the assessment or sit the exam then you are declaring yourself well enough to do so and are unable to subsequently apply for special consideration. If illness or misadventure prevent you from applying in advance, then you must apply as soon as possible, and provide evidence that you could not apply sooner. If you become unwell on the day of the exam, you must provide evidence dated within 24 hours of the exam, with your application.

Your application will be considered centrally, by a case review team, and they will notify you of the outcome. If your application is successful, then your course teaching staff will arrange an alternative assessment for you.

You can read more about special consideration at: https://student.unsw.edu.au/special-consideration.

online.unsw.edu.au

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Academic Integrity

UNSW values academic integrity and has strict rules against cheating. In particular, it has strict rules against trying to get credit that you don't deserve. Thus, you should not plagiarise - i.e. present someone else's work as if it's your own. This could be the work of an academic, or a peer, or a contract writer, and it includes work of all kinds - exact words, general ideas, designs, drawings, software, and so on. Nor should you recycle your own work - i.e. submit it for credit in multiple courses. UNSW also has strict rules against helping others to cheat - e.g. by giving someone your work to copy, or doing someone's work for them, and so on.

For further information about academic integrity and plagiarism at UNSW go to:
https://student.unsw.edu.au/plagiarism

For information about acknowledging your sources and referencing go to:
https://student.unsw.edu.au/referencing. If you are not sure what referencing style to use in this course, you should ask your Online Lecturer.

Evaluation and Development

Toward the end of the hexamester you will be asked to give feedback about the course, via UNSW's MyExperience survey. Your feedback will be used, along with feedback from other stakeholders, to help improve the course. You can also contact your Course Convenor any time you have suggestions or other feedback.

Quality Assurance

UNSW actively monitors student learning and quality of the student experience in its programs. A random selection of completed assessment tasks may be used for quality assurance, such as determining the extent to which program learning goals are being achieved. The information is required for accreditation purposes, and aggregated findings will be used to inform changes aimed at improving the quality of programs. All material used for such processes will be treated as confidential.