



## UNSW Course Outline

# MATH2901 Higher Theory of Statistics - 2024

Published on the 20 May 2024

## General Course Information

**Course Code :** MATH2901

**Year :** 2024

**Term :** Term 2

**Teaching Period :** T2

**Is a multi-term course? :** No

**Faculty :** Faculty of Science

**Academic Unit :** School of Mathematics & Statistics

**Delivery Mode :** In Person

**Delivery Format :** Standard

**Delivery Location :** Kensington

**Campus :** Sydney

**Study Level :** Undergraduate

**Units of Credit :** 6

### Useful Links

[Handbook Class Timetable](#)

## Course Details & Outcomes

### Course Description

This course is the entry point for a statistics major and a prerequisite for most higher-level statistics courses. Statistics has important connections with many branches of mathematics and offers an interesting career path for the mathematically minded. This course will introduce

the basics of statistics from a mathematical perspective. Topics include random variables, univariate, and bivariate distributions, transformations of random variables, convergence of random variables, the sampling distribution and the Central Limit Theorem. Estimation and inference which include moment and likelihood estimation, interval estimation, and hypothesis testing are also covered. Students in MATH2901 will focus on proof and theoretical considerations, extension material and challenge questions. MATH2801 will focus more on the core material and developing key skills in mathematical statistics.

## Course Aims

The aim of this course is to introduce the theoretical underpinnings of statistics, essential knowledge for anyone considering a career in quantitative modelling or data analysis. The course will introduce the basics of probability and distribution theory on which modern statistical practice is founded and will be taught how to apply it to answer important practical questions raised in medical research, ecology, the media and more.

## Relationship to Other Courses

Prerequisite: MATH1231 or MATH1241 or MATH1251 or DPST1014

# Course Learning Outcomes

Course Learning Outcomes
CLO1 : Apply probability rules in a given setting to calculate key quantities.
CLO2 : Use key theoretical tools to explore the properties of random variables.
CLO3 : Apply key methods of statistical inference in applied settings.
CLO4 : Use R to perform statistical computations and simulations.
CLO5 : Derive a breadth of fundamental results in the theory of probability and random variables.

Course Learning Outcomes	Assessment Item
CLO1 : Apply probability rules in a given setting to calculate key quantities.	<ul style="list-style-type: none"><li>• Online Quiz</li><li>• Midterm test</li><li>• Final exam</li></ul>
CLO2 : Use key theoretical tools to explore the properties of random variables.	<ul style="list-style-type: none"><li>• Midterm test</li><li>• Final exam</li></ul>
CLO3 : Apply key methods of statistical inference in applied settings.	<ul style="list-style-type: none"><li>• Online Quiz</li><li>• Midterm test</li><li>• Final exam</li></ul>
CLO4 : Use R to perform statistical computations and simulations.	<ul style="list-style-type: none"><li>• Online Quiz</li></ul>
CLO5 : Derive a breadth of fundamental results in the theory of probability and random variables.	<ul style="list-style-type: none"><li>• Midterm test</li></ul>

## Learning and Teaching Technologies

Moodle - Learning Management System

## Assessments

### Assessment Structure

Assessment Item	Weight	Relevant Dates
Online Quiz Assessment Format: Individual	10%	Start Date: Not Applicable Due Date: Week 4
Midterm test Assessment Format: Individual	30%	Due Date: Week 7
Final exam Assessment Format: Individual	60%	Due Date: Exam Period

# **Assessment Details**

## **Online Quiz**

### **Assessment Overview**

An introductory quiz that covers material from the first 3 weeks of the course. It will run in Week 4 and will be conducted on Mobius. The quiz will be available throughout whole of week 4 and you can attempt the quiz multiple times. The quiz typically consists of multiple choice and short answer questions which require students to perform some simple computations using R. It will be returned with feedback and or solutions.

### **Course Learning Outcomes**

- CLO1 : Apply probability rules in a given setting to calculate key quantities.
- CLO3 : Apply key methods of statistical inference in applied settings.
- CLO4 : Use R to perform statistical computations and simulations.

### **Detailed Assessment Description**

An introductory quiz that covers material from the first 3 weeks of the course. It will run in Week 4 and will be conducted on Mobius. The quiz will be available throughout whole of week 4 and you can attempt the quiz multiple times. The quiz typically consists of multiple choice and short answer questions which require students to perform some simple computations using R. It will be returned with feedback and or solutions.

### **Assessment Length**

1 week

### **Assignment submission Turnitin type**

Not Applicable

## **Midterm test**

### **Assessment Overview**

A 50-minute pen-and-paper test will be held in class in Week 7. It will consist of 4 to 5 questions and will cover week 1 to 5 materials on probability. Feedback in the form of a mark will be given. Discussions will also be carried out later in class.

### **Course Learning Outcomes**

- CLO1 : Apply probability rules in a given setting to calculate key quantities.
- CLO2 : Use key theoretical tools to explore the properties of random variables.
- CLO3 : Apply key methods of statistical inference in applied settings.
- CLO5 : Derive a breadth of fundamental results in the theory of probability and random

variables.

#### Detailed Assessment Description

A 50-minute online test will be held in week 7 under exam conditions. It will consist of 4 to 5 questions and will cover week 1 to 5 materials on probability. Feedback in the form of a mark will be given. Discussions will also be carried out later in class.

#### Assignment submission Turnitin type

Not Applicable

### **Final exam**

#### Assessment Overview

The final exam is designed to examine your problem-solving skills and understanding of all topics delivered across the term, including material from lectures and tutorials. The exam is typically 2 hrs long. The examination will occur during the official university examination period. Feedback is available through inquiry with the course convenor.

#### Course Learning Outcomes

- CLO1 : Apply probability rules in a given setting to calculate key quantities.
- CLO2 : Use key theoretical tools to explore the properties of random variables.
- CLO3 : Apply key methods of statistical inference in applied settings.

#### Detailed Assessment Description

The final exam is designed to examine your problem-solving skills and understanding of all topics delivered across the term, including material from lectures and tutorials. The exam is typically 2 hrs long. The examination will occur during the official university examination period. Feedback is available through inquiry with the course convenor.

#### Assignment submission Turnitin type

Not Applicable

## **General Assessment Information**

#### Grading Basis

Standard

# Course Schedule

Teaching Week/Module	Activity Type	Content
Week 1 : 27 May - 2 June	Lecture	Introduction - Probability theory
Week 2 : 3 June - 9 June	Lecture	Random Variables
Week 3 : 10 June - 16 June	Lecture	Random vectors
Week 4 : 17 June - 23 June	Lecture	Common distributions
Week 5 : 24 June - 30 June	Lecture	Central Limit Theorem, transformations of random variables
Week 6 : 1 July - 7 July	Lecture	Midterm break
Week 7 : 8 July - 14 July	Lecture	Estimators and Their Properties
Week 8 : 15 July - 21 July	Lecture	Parameter Estimation and Inference
Week 9 : 22 July - 28 July	Lecture	Hypothesis Testing
Week 10 : 29 July - 4 August	Lecture	Small Sample Inference From Normal Samples and Power of Hypothesis Tests

## Attendance Requirements

Students are strongly encouraged to attend all classes and review lecture recordings.

## Course Resources

### Recommended Resources

Recommended textbooks

- All of Statistics, by Wasserman
- Mathematical Statistics & Data Analysis by Rice
- A first look at rigorous probability theory, by Rosenthal

## Course Evaluation and Development

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.

# Staff Details

Position	Name	Email	Location	Phone	Availability	Equitable Learning Services Contact	Primary Contact
Convenor	Gery Geenens		H13 Anita Lawrence building 2053		Please use email to make appointment	No	Yes

## Other Useful Information

### Academic Information

Upon your enrolment at UNSW, you share responsibility with us for maintaining a safe, harmonious and tolerant University environment.

You are required to:

- Comply with the University's conditions of enrolment.
- Act responsibly, ethically, safely and with integrity.
- Observe standards of equity and respect in dealing with every member of the UNSW community.
- Engage in lawful behaviour.
- Use and care for University resources in a responsible and appropriate manner.
- Maintain the University's reputation and good standing.

For more information, visit the [UNSW Student Code of Conduct Website](#).

### Academic Honesty and Plagiarism

**Referencing** is a way of acknowledging the sources of information that you use to research your assignments. You need to provide a reference whenever you draw on someone else's words, ideas or research. Not referencing other people's work can constitute plagiarism.

Further information about referencing styles can be located at <https://student.unsw.edu.au/referencing>

**Academic integrity** is fundamental to success at university. Academic integrity can be defined as a commitment to six fundamental values in academic pursuits: honesty, trust, fairness, respect, responsibility and courage. At UNSW, this means that your work must be your own, and others' ideas should be appropriately acknowledged. If you don't follow these rules, plagiarism may be detected in your work.

Further information about academic integrity, plagiarism and the use of AI in assessments can be located at:

- The [Current Students site](#),
- The [ELISE training site](#), and
- The [Use of AI for assessments](#) site.

The Student Conduct and Integrity Unit provides further resources to assist you to understand your conduct obligations as a student: <https://student.unsw.edu.au/conduct>

## Submission of Assessment Tasks

### Penalty for Late Submissions

UNSW has a standard late submission penalty of:

- 5% per day,
- for all assessments where a penalty applies,
- capped at five days (120 hours) from the assessment deadline, after which a student cannot submit an assessment, and
- no permitted variation.

*Any variations to the above will be explicitly stated in the Course Outline for a given course or assessment task.*

Students are expected to manage their time to meet deadlines and to request extensions as early as possible before the deadline.

### Special Consideration

If circumstances prevent you from attending/completing an assessment task, you must officially apply for special consideration, usually within 3 days of the sitting date/due date. You can apply by logging onto myUNSW and following the link in the My Student Profile Tab. Medical documentation or other documentation explaining your absence must be submitted with your application. Once your application has been assessed, you will be contacted via your student email address to be advised of the official outcome and any actions that need to be taken from there. For more information about special consideration, please visit: <https://student.unsw.edu.au/special-consideration>

**Important note:** UNSW has a “fit to sit/submit” rule, which means that if you sit an exam or submit a piece of assessment, you are declaring yourself fit to do so and cannot later apply for Special Consideration. This is to ensure that if you feel unwell or are faced with significant

circumstances beyond your control that affect your ability to study, you do not sit an examination or submit an assessment that does not reflect your best performance. Instead, you should apply for Special Consideration as soon as you realise you are not well enough or are otherwise unable to sit or submit an assessment.

## Faculty-specific Information

### Additional support for students

- [The Current Students Gateway](#)
- [Student Support](#)
- [Academic Skills and Support](#)
- [Student Wellbeing, Health and Safety](#)
- [Equitable Learning Services](#)
- [UNSW IT Service Centre](#)
- Science EDI Student [Initiatives](#), [Offerings](#) and [Guidelines](#)

### School-specific Information

#### School of Mathematics and Statistics 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 web site starting at: [The School of Mathematics and Statistics 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 Initial Handout and Course Home Page. Lack of knowledge about a policy will not be an excuse for failing to follow the procedure in it.

#### Special Consideration - Short Extension Policy

The School of Mathematics and Statistics has carefully reviewed its range of assignments and projects to determine their suitability for automatic short extensions as set out by the UNSW Short Extension Policy. Upon comprehensive examination of our course offerings that

incorporate these types of assessments, we have concluded that our current deadline structures already accommodate the possibility of unexpected circumstances that may lead students to require additional days for submission. Consequently, the School of Mathematics and Statistics has decided to universally opt out of the Short Extension provision for all its courses, having pre-emptively integrated flexibility into our assessment deadlines. The decision is subject to revision in response to the introduction of new course offerings. Students may still apply for Special Consideration via the usual procedures.

## Computing Lab

The main computing laboratory is room G012 of the Anita B.Lawrence Centre (formerly Red Centre). You can get to this lab by entering the building through the main entrance to the School of Mathematics (on the Mezzanine Level) and then going down the stairs to the Ground Level. A second smaller lab is Room M020, located on the mezzanine level through the glass door (and along the corridor) opposite the School's entrance.

For more information, including opening hours, see the [computing facilities webpage](#). Remember that there will always be unscheduled periods when the computers are not working because of equipment problems and that this is not a valid excuse for not completing assessments on time.

## School Contact Information

Please visit the [School of Mathematics and Statistics website](#) for a range of information.

For information on Courses, please go to "Student life & resources" and either Undergraduate and/or Postgraduate and respective "Undergraduate courses" and "Postgraduate courses" for information on all course offerings.

All school policies, forms and help for students can be located by going to the "Student Services" within "Student life & resources" page. We also post notices in "Student noticeboard" for your information. Please familiarise yourself with the information found in these locations. If you cannot find the answer to your queries on the web you are welcome to contact the Student Services Office directly.

## Undergraduate

E: [ug.mathsstats@unsw.edu.au](mailto:ug.mathsstats@unsw.edu.au)

P: 9385 7011 or 9385 7053

**Postgraduate**

E: pg.mathsstats@unsw.edu.au

P: 9385 7053

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 use your UNSW student email and state your student number in all emails to us.**