UNSW Course Outline

MATH2801 Theory of Statistics - 2024

Published on the 20 May 2024

General Course Information

Course Code : MATH2801
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

The course introduces theoretical concepts used in classical and modern statistics. MATH2801 is the entry-point for a statistics major and a prerequisite for most higher-level statistics courses. Topics covered include probability, random variables, standard distributions, bivariate

distributions, transformations, central limit theorem, sampling distributions, point estimation, interval estimation, maximum likelihood estimation and hypothesis testing. Students will use the (free) statistics package R/RStudio. Lecture content will be delivered either in-person or online and will be recorded and made available online. Tutorials will be either in-person or online.

Note: The Assumed Knowledge is first year probability theory and integration. Probability theory revision notes will be made available online and some exercises will be revised briefly in the first tutorial. MATH2801 is compulsory for mathematics majors to ensure an introduction to statistics as a discipline for studying stochastic (random) systems, as opposed to the deterministic. MATH2901 (Higher Theory of Statistics) is a more theoretical/advanced version of MATH2801 which spends more time on proof and theoretical considerations.

Course Aims

The aim of this course is to introduce students to the theoretical underpinnings of statistics, essential knowledge for anyone considering a career in quantitative modelling or data analysis. Students will learn probability and distribution theory on which modern statistical practice is founded, and how to apply this theory to answer important practical questions raised in medical research, ecology, the media and more. In tutorials, students will learn to solve various challenging statistical problems, conduct data analysis and learn basic computer programming in the software R/RStudio.

Relationship to Other Courses

See MATH2901: Higher Theory of Statistics for the higher version of this course.

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/RStudio to perform statistical computations and simulations.
CLO5 : Derive selected 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.	• Online Quiz • Midterm Test • Final exam
CLO2 : Use key theoretical tools to explore the properties of random variables.	• Online Quiz • Midterm Test • Final exam
CLO3 : Apply key methods of statistical inference in applied settings.	• Final exam
CLO4 : Use R/RStudio to perform statistical computations and simulations.	• Online Quiz
CLO5 : Derive selected fundamental results in the theory of probability and random variables.	• Midterm Test • Online Quiz • Final exam

Learning and Teaching Technologies

Moodle - Learning Management System | Echo 360

Learning and Teaching in this course

New ideas and skills are introduced and demonstrated in lectures, then students develop these skills by applying them to specific tasks in tutorials and assessments.

We believe that effective learning is best supported by a climate of inquiry, in which students are actively engaged in the learning process. This course has a strong emphasis on problem-solving tasks in tutorials and in assessments. Students are expected to devote the majority of class and study time to the solving of such tasks.

Additional Course Information

Please see Moodle announcement for any updates or changes.

Assessments

Assessment Structure

Assessment Item	Weight	Relevant Dates
Online Quiz Assessment Format: Individual	10%	Start Date: 17/06/2024 09:00 AM Due Date: 21/06/2024 05:00 PM Post Date: 26/06/2023 12:00 AM
Midterm Test Assessment Format: Individual	30%	Start Date: In Week 7 Due Date: In Week 7 Post Date: 26/07/2024 05:00 PM
Final exam Assessment Format: Individual	60%	Start Date: During exam period Due Date: During exam period

Assessment Details

Online Quiz

Assessment Overview

You will be expected to complete an introductory online 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 number of Quiz attempts will be set and announced prior to Week 4. Questions will require either a calculated solution to be added, or the question may contain multiple choices to select from.

The Quiz will be returned with feedback and/or solutions as required by the School and University Policy.

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.
- CLO4 : Use R/RStudio to perform statistical computations and simulations.
- CLO5 : Derive selected fundamental results in the theory of probability and random variables.

Detailed Assessment Description

You will be expected to complete an introductory online 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 number of Quiz attempts will be set and announced prior to Week 4. Questions will require either a calculated solution to be added, or the question may contain multiple choices to select from.

The Quiz will be returned with feedback and/or solutions as required by the School and University Policy.

Assessment Length

~ 1 hour

Submission notes

Done on Mobius

Assessment information

The number of Quiz attempts will be set and announced prior to Week 4. Questions will require either a calculated solution to be added, or the question may contain multiple choices to select from. You may use *R/RStudio* to perform calculations.

Feedback will be returned with feedback and/or solutions in Mobius as required by the School and University Policy.

More details about the quiz will be posted on the Moodle coursepage.

Assignment submission Turnitin type

This is not a Turnitin assignment

Midterm Test

Assessment Overview

In Week 7 you will complete an online midterm test in Mobius. It is designed to give you feedback on progress and mastery of the first parts of the course, under exam conditions and to evaluate progress towards the stated learning outcomes.

The online mid-term test is held under exam conditions. The midterm test will usually have a one-hour time limit. You only have one attempt at the midterm test. Questions typically include material from Weeks 1 to 5 covered in lectures and tutorials. Questions will require either a

calculated solution to be added, or the question may contain multiple choices to select from. More information about what will be assessed will be made available closer to the time in lectures.

You will be provided with feedback with comments and/or solutions.

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.
- CLO5 : Derive selected fundamental results in the theory of probability and random variables.

Detailed Assessment Description

In Week 7 you will complete a mid-term test conducted in your tutorial. It is designed to give you feedback on progress and mastery of the first parts of the course, under exam conditions and to evaluate progress towards the stated learning outcomes.

The mid-term test is held under exam conditions. The midterm test will usually have a 50-minute time limit. You only have one attempt at the mid-term test. Questions typically include material from Weeks 1 to 5 covered in lectures and tutorials. More information about what will be assessed will be made available closer to the time of lectures.

You will be provided with feedback with comments and/or solutions.

Assessment Length

50 mins

Submission notes

Online test in Mobius

Assessment information

In Week 7 you will complete a mid-term test conducted in your tutorial. It is designed to give you feedback on progress and mastery of the first parts of the course, under exam conditions and to evaluate progress towards the stated learning outcomes.

The mid-term test is held under exam conditions. The midterm test will usually have a 50-minute time limit. You only have one attempt at the mid-term test. Questions typically include material from Weeks 1 to 5 covered in lectures and tutorials. More information about what will be assessed will be made available closer to the time of lectures.

You will be provided with feedback with comments and/or solutions.

More details about the test will be posted on the Moodle coursepage.

Assignment submission Turnitin type

This is not a Turnitin assignment

Final exam

Assessment Overview

The final exam is designed to summarise your learning and problem-solving skills on all topics delivered across the entire term, including material from lectures and tutorials. The exam is typically 2hrs 10 minutes and consists of short numerical and short answer responses - details will be confirmed during the course. 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.
- CLO5 : Derive selected fundamental results in the theory of probability and random variables.

Detailed Assessment Description

The final exam is designed to summarise your learning and problem-solving skills on all topics delivered across the entire term, including material from lectures and tutorials. The exam is typically 2hrs 10 minutes and consists of short numerical and short answer responses - details will be confirmed during the course. The examination will occur during the official university examination period. Feedback is available through inquiry with the course convenor.

Assessment Length

2 hours

Submission notes

Hand written exam

Assessment information

The final exam is designed to summarise your learning and problem-solving skills on all topics delivered across all weeks of the entire term, including material from lectures and tutorials. The exam is typically 2hrs 10 minutes and consists of short numerical and short answer responses - details will be confirmed during the course.

The examination will occur during the official university examination period. Feedback is

available through inquiry with the course convenor.

More details about the final exam will be posted on the Moodle coursepage.

Assignment submission Turnitin type

This is not a Turnitin assignment

General Assessment Information

See Moodle course page or contact the course convenor for further details.

Grading Basis

Standard

Requirements to pass course

Final mark >= 50

Course Schedule

Teaching Week/Module	Activity Type	Content
Week 1 : 27 May - 2 June	Topic	Introduction to statistics which includes the course outline; key themes; descriptive summary statistics. Your first tutorial will revise some probability concepts.
Week 2 : 3 June - 9 June	Topic	Random variables: expectation; moments; standard deviation and variance; Chebychev's inequality and applications; transformations of a single variable. In the Week 2 tutorial, we will be learning about R/RStudio. Please make sure to bring your laptop to the tutorial class and have R/RStudio installed before the tute.
Week 3 : 10 June - 16 June	Topic	Common distributions: discrete and continuous distributions; quantiles; quantile plots.
Week 4 : 17 June - 23 June	Topic	Bivariate distributions and survey designs and experiments.
Week 5 : 24 June - 30 June	Topic	Distribution of sums and averages: distributions of sums and averages; convolution formulae; moment generating functions; convergence in probability and convergence in distribution; Slutsky's Theorem; Central Limit Theorem (CLT); Delta Method.
Week 6 : 1 July - 7 July	Topic	Flexibility week: No lectures or tutorials will be running in Week 6.
Week 7 : 8 July - 14 July	Topic	Estimators and their properties: parametric models and parameter estimators; bias, consistency, mean square error; standard error of an estimator; confidence intervals via asymptotic normality, sample size determination.
Week 8 : 15 July - 21 July	Topic	Parameter estimation and inference: method of moments and maximum likelihood estimation (mle) and their properties; asymptotic normality of mle; likelihood based confidence intervals
Week 9 : 22 July - 28 July	Topic	Hypothesis testing: Wald tests and CLT based tests.
Week 10 : 29 July - 4 August	Topic	Small sample inference from normal samples: examples of normal and non-normal sample inference.

Attendance Requirements

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

General Schedule Information

Each week we will have **two** (2 hours) and **one** (1 hour) in-person lecture (total: 5 hours).

See the MATH2801 Moodle page to obtain the lecture notes. A new chapter will be added each week.

Course Resources

Prescribed Resources

The content of the course will be defined by the lectures.

Recommended Resources

The following are recommended additional references.

- Robert V. Hogg, Joseph W. McKean, and Allen T. Craig (2019). *Introduction to mathematical statistics*, eighth edition. Pearson Education, Upper Saddle River NJ.

Hogg *et al.* cover not only MATH2801/2901 content but also MATH3811 so that it would be a useful resource for you throughout a statistics major.

- John A. Rice (2007). *Mathematical Statistics and Data Analysis*, third edition. Duxbury, Belmont CA. (Call number: 519.9/569 L (High Use Collection)).

The book by Rice does not follow the content of MATH2801/2901 as closely as Hogg *et al*. but would be a useful source for alternative explanations of key concepts and practice exercises.

Additional Costs

UNSW The Nucleus: Student Hub

Course Evaluation and Development

Course evaluation will be conducted in MyExperience

Staff Details

Position	Name	Email	Location	Phone	Availability	Equitable Learning Services Contact	Primary Contact
Lecturer	Jakub Stokl osa		H13 Anita Lawrence building 2082	Please use Teams	10 AM - 4 PM Tuesday to Friday	No	Yes
	Jakub Stokl osa					No	No

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 Plagarism

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

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.**