



## UNSW Course Outline

# MATH3821 Statistical Modelling and Computing - 2024

Published on the 17 May 2024

## General Course Information

**Course Code :** MATH3821

**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 is an undergraduate level course in statistical modelling and computing, and is a compulsory third-year course for student completing statistics majors. The course introduces modern approaches to statistical modelling and computing. Topics covered in seminars include

linear models, generalised linear models, Bayesian linear model, nonparametric regression, nonparametric density estimation and bandwidth selection, Monte Carlo simulation, bootstrap method and Markov chain Monte Carlo. Implementation of the above procedures is conducted using the statistical package R which is introduced during tutorial classes.

## Course Aims

This course aims to introduce students to techniques and procedures for statistical modeling and computing. The course will introduce the theory and applications for flexible regression modeling including parametric and non-parametric methods. Applications of simulation in statistical inference such as Monte Carlo simulation, bootstrap methods, and Markov chain Monte Carlo will be discussed.

## Relationship to Other Courses

Prerequisite: MATH2831 or MATH2931

# Course Learning Outcomes

| Course Learning Outcomes   |
|--|
| CLO1 : State definitions used in statistical modelling and computing.                            |
| CLO2 : Apply appropriate theorems in statistical modelling and computing in the correct context. |
| CLO3 : Apply the methods of statistical modeling and computing to solve appropriate problems.    |
| CLO4 : Apply appropriate procedures for a problem given particular assumptions.                  |
| CLO5 : Communicate results to a general audience.  |

| Course Learning Outcomes   | Assessment Item  |
|--|--|
| CLO1 : State definitions used in statistical modelling and computing.                            | <ul style="list-style-type: none"><li>Assignment 1</li><li>Mid-term Test</li><li>Assignment 2</li><li>Final Exam</li></ul> |
| CLO2 : Apply appropriate theorems in statistical modelling and computing in the correct context. | <ul style="list-style-type: none"><li>Assignment 1</li><li>Mid-term Test</li><li>Assignment 2</li><li>Final Exam</li></ul> |
| CLO3 : Apply the methods of statistical modeling and computing to solve appropriate problems.    | <ul style="list-style-type: none"><li>Assignment 1</li><li>Mid-term Test</li><li>Assignment 2</li><li>Final Exam</li></ul> |
| CLO4 : Apply appropriate procedures for a problem given particular assumptions.                  | <ul style="list-style-type: none"><li>Assignment 1</li><li>Mid-term Test</li><li>Assignment 2</li><li>Final Exam</li></ul> |
| CLO5 : Communicate results to a general audience.  | <ul style="list-style-type: none"><li>Assignment 1</li><li>Mid-term Test</li><li>Assignment 2</li><li>Final Exam</li></ul> |

## Learning and Teaching Technologies

Moodle - Learning Management System

# Assessments

## Assessment Structure

| Assessment Item                                | Weight | Relevant Dates        |
|--|--------|-----------------------|
| Assignment 1<br>Assessment Format: Individual  | 10%    | Due Date: Week 4      |
| Mid-term Test<br>Assessment Format: Individual | 20%    | Due Date: Week 7      |
| Assignment 2<br>Assessment Format: Individual  | 10%    | Due Date: Week 9      |
| Final Exam<br>Assessment Format: Individual    | 60%    | Due Date: Exam Period |

## Assessment Details

### Assignment 1

#### Assessment Overview

In Week 4 you will submit answers to an assignment that covers material from the first three weeks of the course. The assignment will be available two weeks before the submission date. Feedback will be given in the form of marks and comments from academic staff.

#### Course Learning Outcomes

- CLO1 : State definitions used in statistical modelling and computing.
- CLO2 : Apply appropriate theorems in statistical modelling and computing in the correct context.
- CLO3 : Apply the methods of statistical modeling and computing to solve appropriate problems.
- CLO4 : Apply appropriate procedures for a problem given particular assumptions.
- CLO5 : Communicate results to a general audience.

#### Detailed Assessment Description

In Week 4 you will submit answers to an assignment that covers material from the first three weeks of the course. The assignment will be available two weeks before the submission date. Feedback will be given in the form of marks and comments from academic staff.

#### Assessment information

Standard late submission rules apply.

#### Assignment submission Turnitin type

This assignment is submitted through Turnitin and students do not see Turnitin similarity reports.

## Mid-term Test

### Assessment Overview

The mid-term Test is designed to assess your knowledge covered in lectures in Weeks 1-5 inclusive. Mid-term Test will typically be scheduled in Week 7 with a time limit of 50 minutes. Typical questions include problem solving which require clear and logical presentation of correct solutions. You will be provided with feedback with comments and/or solutions.

### Course Learning Outcomes

- CLO1 : State definitions used in statistical modelling and computing.
- CLO2 : Apply appropriate theorems in statistical modelling and computing in the correct context.
- CLO3 : Apply the methods of statistical modeling and computing to solve appropriate problems.
- CLO4 : Apply appropriate procedures for a problem given particular assumptions.
- CLO5 : Communicate results to a general audience.

### Detailed Assessment Description

The mid-term Test is designed to assess your knowledge covered in lectures in Weeks 1-5 inclusive. Mid-term Test will typically be scheduled in Week 7 with a time limit of 50 minutes. Typical questions include problem solving which require clear and logical presentation of correct solutions. You will be provided with feedback with comments and/or solutions.

### Assignment submission Turnitin type

Not Applicable

## Assignment 2

### Assessment Overview

In week 9 you will submit answers to an assignment that covers material from Weeks 4-8. The assignment will be available two weeks before the submission date. Feedback will be given in the form of marks and comments from academic staff.

### Course Learning Outcomes

- CLO1 : State definitions used in statistical modelling and computing.
- CLO2 : Apply appropriate theorems in statistical modelling and computing in the correct context.
- CLO3 : Apply the methods of statistical modeling and computing to solve appropriate problems.
- CLO4 : Apply appropriate procedures for a problem given particular assumptions.
- CLO5 : Communicate results to a general audience.

### **Detailed Assessment Description**

In week 9 you will submit answers to an assignment that covers material from Weeks 4-8. The assignment will be available two weeks before the submission date. Feedback will be given in the form of marks and comments from academic staff.

### **Assessment information**

Standard late submission rules apply.

### **Assignment submission Turnitin type**

This assignment is submitted through Turnitin and students do not see Turnitin similarity reports.

## **Final Exam**

### **Assessment Overview**

The final exam is designed to summarise your learning and problem-solving skills on all topics delivered across the 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 : State definitions used in statistical modelling and computing.
- CLO2 : Apply appropriate theorems in statistical modelling and computing in the correct context.
- CLO3 : Apply the methods of statistical modeling and computing to solve appropriate problems.
- CLO4 : Apply appropriate procedures for a problem given particular assumptions.
- CLO5 : Communicate results to a general audience.

### **Detailed Assessment Description**

The final exam is designed to summarise your learning and problem-solving skills on all topics delivered across the 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.

### **Assignment submission Turnitin type**

Not Applicable

# General Assessment Information

*This course follows the 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.*

## Grading Basis

Standard

# Course Schedule

| Teaching Week/Module         | Activity Type | Content  |
|------------------------------|---------------|--|
| Week 1 : 27 May - 2 June     | Topic         | Introduction to R; Revision of linear models       |
| Week 2 : 3 June - 9 June     | Topic         | Regression with Factors; Binomial Regression       |
|                              | Assessment    | Assignment 1 released                              |
| Week 3 : 10 June - 16 June   | Topic         | Binomial regression; theory of GLMs                |
| Week 4 : 17 June - 23 June   | Topic         | Poisson regression; scatterplot smoothing; splines |
|                              | Assessment    | Assignment 1 due                                   |
| Week 5 : 24 June - 30 June   | Topic         | Properties of smoothers; additive models           |
| Week 6 : 1 July - 7 July     | Topic         | Flex Week: No Classes                              |
| Week 7 : 8 July - 14 July    | Topic         | Nonparametric density estimation                   |
|                              | Assessment    | Mid-term test; Assignment 2 released               |
| Week 8 : 15 July - 21 July   | Topic         | Kernel density estimation; Bayesian linear models  |
| Week 9 : 22 July - 28 July   | Topic         | Bayesian linear models                             |
|                              | Assessment    | Assignment 2 due                                   |
| Week 10 : 29 July - 4 August | Topic         | Simulation methods                                 |

## Attendance Requirements

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

## Staff Details

| Position | Name             | Email | Location | Phone | Availability | Equitable Learning Services Contact | Primary Contact |
|----------|------------------|-------|----------|-------|--------------|-------------------------------------|-----------------|
|          | Peter Braunstein |       |          |       |              | 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](mailto: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.**