



# STAT6175

## Linear Models

Session 2, In person-scheduled-weekday, North Ryde 2023

*School of Mathematical and Physical Sciences*

### Contents

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<a href="#"><u>General Information</u></a>	2
<a href="#"><u>Learning Outcomes</u></a>	2
<a href="#"><u>General Assessment Information</u></a>	3
<a href="#"><u>Assessment Tasks</u></a>	5
<a href="#"><u>Delivery and Resources</u></a>	8
<a href="#"><u>Unit Schedule</u></a>	8
<a href="#"><u>Policies and Procedures</u></a>	9

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#### **Disclaimer**

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## General Information

Unit convenor and teaching staff

Lecturer/Convener

Hassan Doosti

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Contact via Email

Room 534, 12 Wally's Walk

Please refer to iLearn for Consultation hours.

Credit points

10

Prerequisites

((STAT6170 or STAT670) and (BCA802 or STAT8602 or MATH604 or MATH6904)) or  
(Admission to MDataSc and (STAT6170 or STAT670))

Corequisites

STAT6180 or STAT680 or STAT6183 or STAT683

Co-badged status

This unit is co-badged STAT3175.

Unit description

This unit discusses statistical modelling in general and in particular demonstrates the wide applicability of linear and generalized linear models. Topics include multiple linear regression, logistic regression and Poisson regression. The emphasis is on practical issues in data analysis with some reference to the theoretical background. Statistical packages are used for both model fitting and diagnostic testing.

## Important Academic Dates

Information about important academic dates including deadlines for withdrawing from units are available at <https://www.mq.edu.au/study/calendar-of-dates>

## Learning Outcomes

On successful completion of this unit, you will be able to:

**ULO1:** Define relevant terminology and describe the main concepts of linear models and simple generalized linear models.

**ULO2:** Formulate and solve theoretical problems in linear modelling (using matrix notation when necessary).

**ULO3:** Fit a linear model to obtain estimates together with their standard errors in applied problems.

**ULO4:** Analyse the adequacy of a linear model and suggest appropriate modifications when needed.

**ULO5:** Formulate and solve applied problems using linear modelling.

**ULO6:** Use standard statistics packages to carry out these analyses.

**ULO7:** Communicate clearly your knowledge of the subject matter of linear models and their solutions to problems involving linear modelling.

## General Assessment Information

### Requirements to Pass this Unit

To pass this unit you must:

- Attempt all assessments, and
- Achieve a total mark equal to or greater than 50%

### Assignment Submission

Assignment submission will be online through the iLearn page. Your name and Student ID should appear on the first page.

Submit assignments online via the appropriate assignment link on the iLearn page. A personalised cover sheet is not required with online submissions. Read the submission statement carefully before accepting it as there are substantial penalties for making a false declaration.

- Assignment submission is via iLearn.
- Please make sure that your assignment is word processed.
- You should upload one single PDF file.
- Please note the quick guide on how to upload your assignments provided on the iLearn page.
- If there are technical obstructions to your submission online, please email us to let us know.

You may submit as often as required prior to the due date/time. Please note that each submission will completely replace any previous submissions. It is in your best interest to make frequent submissions of your partially completed work as insurance against technical or other problems near the submission deadline.

### Late Assessment Submission Penalty

Unless a Special Consideration request has been submitted and approved, a 5% penalty (of the total possible mark of the task) will be applied for each day a written report or presentation assessment is not submitted, up until the 7<sup>th</sup> day (including weekends). After the 7<sup>th</sup> day, a grade

of '0' will be awarded even if the assessment is submitted. The submission time for all uploaded assessments is **11:55 pm**. A 1-hour grace period will be provided to students who experience a technical concern.

For any late submission of time-sensitive tasks, such as scheduled tests/exams, performance assessments/presentations, and/or scheduled practical assessments/labs, please apply for [Special Consideration](#).

### **Assessments where Late Submissions will be accepted**

In this unit, late submissions will be accepted as follows:

- Assignment 1 – YES, Standard Late Penalty applies
- Assignment 2 – YES, Standard Late Penalty applies
- Assignment 3 – YES, Standard Late Penalty applies
- Final Examination - NO, unless Special Consideration is Granted

### **Special Consideration**

The [Special Consideration Policy](#) aims to support students who have been impacted by short-term circumstances or events that are serious, unavoidable and significantly disruptive, and which may affect their performance in assessment. If you experience circumstances or events that affect your ability to complete the assessments in this unit on time, please inform the convenor and submit a Special Consideration request through [ask.mq.edu.au](http://ask.mq.edu.au).

### **FINAL EXAM POLICY**

It is Macquarie University policy not to set early examinations for individuals or groups of students. All students are expected to ensure that they are available until the end of the teaching semester, that is, the final day of the official examination period. The only excuse for not sitting an examination at the designated time is because of documented illness or unavoidable disruption. In these special circumstances, you may apply for special consideration via [ask.mq.edu.au](http://ask.mq.edu.au).

If you receive special consideration for the final exam, a supplementary exam will be scheduled in the interval between the regular exam period and the start of the next session. By making a special consideration application for the final exam you are declaring yourself available for a resit during this supplementary examination period and will not be eligible for a second special consideration approval based on pre-existing commitments. Please ensure you are familiar with the policy prior to submitting an application.

You can check the supplementary exam information page on FSE101 in iLearn ([bit.ly/FSESupp](http://bit.ly/FSESupp)) for dates, and approved applicants will receive an individual notification one week prior to the exam with the exact date and time of their supplementary examination.

## Assessment Tasks

Name	Weighting	Hurdle	Due
<a href="#">Assignment 1</a>	15%	No	Week 4
<a href="#">Assignment 2</a>	15%	No	Week 8
<a href="#">Assignment 3</a>	15%	No	Week 12
<a href="#">Final examination</a>	55%	No	Formal Examination Period

### Assignment 1

Assessment Type [1](#): Quantitative analysis task

Indicative Time on Task [2](#): 10 hours

Due: **Week 4**

Weighting: **15%**

Reinforce and apply the concepts covered in lectures and the skills learned in SGTA classes, through data analysis.

On successful completion you will be able to:

- Define relevant terminology and describe the main concepts of linear models and simple generalized linear models.
- Formulate and solve theoretical problems in linear modelling (using matrix notation when necessary).
- Fit a linear model to obtain estimates together with their standard errors in applied problems.
- Analyse the adequacy of a linear model and suggest appropriate modifications when needed.
- Formulate and solve applied problems using linear modelling.
- Use standard statistics packages to carry out these analyses.
- Communicate clearly your knowledge of the subject matter of linear models and their solutions to problems involving linear modelling.

### Assignment 2

Assessment Type [1](#): Quantitative analysis task

Indicative Time on Task [2](#): 10 hours

Due: **Week 8**

Weighting: **15%**

Reinforce and apply the concepts covered in lectures and the skills learned in SGTA classes, through data analysis.

On successful completion you will be able to:

- Define relevant terminology and describe the main concepts of linear models and simple generalized linear models.
- Formulate and solve theoretical problems in linear modelling (using matrix notation when necessary).
- Fit a linear model to obtain estimates together with their standard errors in applied problems.
- Analyse the adequacy of a linear model and suggest appropriate modifications when needed.
- Formulate and solve applied problems using linear modelling.
- Use standard statistics packages to carry out these analyses.
- Communicate clearly your knowledge of the subject matter of linear models and their solutions to problems involving linear modelling.

## Assignment 3

Assessment Type <sup>1</sup>: Quantitative analysis task

Indicative Time on Task <sup>2</sup>: 10 hours

Due: **Week 12**

Weighting: **15%**

Reinforce and apply the concepts covered in lectures and the skills learned in SGTA classes, through data analysis.

On successful completion you will be able to:

- Define relevant terminology and describe the main concepts of linear models and simple generalized linear models.
- Formulate and solve theoretical problems in linear modelling (using matrix notation when necessary).

- Fit a linear model to obtain estimates together with their standard errors in applied problems.
- Analyse the adequacy of a linear model and suggest appropriate modifications when needed.
- Formulate and solve applied problems using linear modelling.
- Use standard statistics packages to carry out these analyses.
- Communicate clearly your knowledge of the subject matter of linear models and their solutions to problems involving linear modelling.

## Final examination

Assessment Type <sup>1</sup>: Examination

Indicative Time on Task <sup>2</sup>: 23 hours

Due: **Formal Examination Period**

Weighting: **55%**

Formal invigilated examination testing the learning outcomes of the unit.

On successful completion you will be able to:

- Define relevant terminology and describe the main concepts of linear models and simple generalized linear models.
- Formulate and solve theoretical problems in linear modelling (using matrix notation when necessary).
- Fit a linear model to obtain estimates together with their standard errors in applied problems.
- Analyse the adequacy of a linear model and suggest appropriate modifications when needed.
- Formulate and solve applied problems using linear modelling.
- Use standard statistics packages to carry out these analyses.

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<sup>1</sup> If you need help with your assignment, please contact:

- the academic teaching staff in your unit for guidance in understanding or completing this type of assessment
- the [Writing Centre](#) for academic skills support.

<sup>2</sup> Indicative time-on-task is an estimate of the time required for completion of the assessment

task and is subject to individual variation

## Delivery and Resources

Delivery and Resources

There is one one hour lecture and one two hour SGTA each week. **Lectures begin in Week 1 and SGTAs in Week 2.** Please consult the timetable for the scheduling of these activities.

Attendance will be kept.

In addition to the one hour lecture there are online resources including videos which should be viewed prior to the one hour lecture.

### Technologies used and required

Lecture material will be placed on iLearn. The statistical package R will be used.

### SGTA

SGTAs are held in computing labs and allow you to practice techniques learnt in lectures and from above mentioned online resources. You will complete worksheets as part of the learning process.

### Text book

The recommended text (available from the Co-op Bookshop) is: Chatterjee S & Hadi AS (2012). Regression Analysis By Example, 5th Revised edition, Wiley. This is available online.

### Recommended book

Extending the Linear Model with R: Generalized Linear, Mixed Effects and Nonparametric Regression Models, Second Edition, 2 by Julian J. Farawa.

### COVID Information

For the latest information on the University's response to COVID-19, please refer to the Coronavirus infection page on the Macquarie website: <https://www.mq.edu.au/about/coronavirus-faqs>. Remember to check this page regularly in case the information and requirements change during semester. If there are any changes to this unit in relation to COVID, these will be communicated via iLearn.

### Methods of Communication

We will communicate with you via your university email or through announcements on iLearn. Queries to the convenor can either be placed on the iLearn discussion board or sent to [tania.prvan@mq.edu.au](mailto:tania.prvan@mq.edu.au) from your **university email** address.

## Unit Schedule

Week	Topics
1.	Simple linear regression. Multiple linear regression.
2.	The model in matrix form. Diagnostics.



Week	Topics
3.	Diagnostics. Transformations
4.	Transformations. Collinearity.
5.	Polynomial regression. Categorical covariates.
6.	Analysis of change. Analysis of covariance (ANCOVA).
7.	Confounding. Interaction.
	<b>TWO WEEK BREAK</b>
8.	Variable selection. Model building.
9.	Introduction to generalized linear models. Logistic regression.
10.	Logistic regression. Poisson regression.
11.	Poisson regression. Negative binomial regression.
12.	Negative binomial regression. Gamma regression.
13.	Revision.

## Policies and Procedures

Macquarie University policies and procedures are accessible from [Policy Central \(https://policies.mq.edu.au\)](https://policies.mq.edu.au). Students should be aware of the following policies in particular with regard to Learning and Teaching:

- [Academic Appeals Policy](#)
- [Academic Integrity Policy](#)
- [Academic Progression Policy](#)
- [Assessment Policy](#)
- [Fitness to Practice Procedure](#)
- [Assessment Procedure](#)
- [Complaints Resolution Procedure for Students and Members of the Public](#)
- [Special Consideration Policy](#)

Students seeking more policy resources can visit [Student Policies \(https://students.mq.edu.au/support/study/policies\)](https://students.mq.edu.au/support/study/policies). It is your one-stop-shop for the key policies you need to know about throughout your undergraduate student journey.

To find other policies relating to Teaching and Learning, visit [Policy Central \(https://policies.mq.edu.au\)](https://policies.mq.edu.au) and use the [search tool](#).

## Student Code of Conduct

Macquarie University students have a responsibility to be familiar with the Student Code of Conduct: <https://students.mq.edu.au/admin/other-resources/student-conduct>

## Results

Results published on platform other than [eStudent](#), (eg. iLearn, Coursera etc.) or released directly by your Unit Convenor, are not confirmed as they are subject to final approval by the University. Once approved, final results will be sent to your student email address and will be made available in [eStudent](#). For more information visit [ask.mq.edu.au](http://ask.mq.edu.au) or if you are a Global MBA student contact [globalmba.support@mq.edu.au](mailto:globalmba.support@mq.edu.au)

## Academic Integrity

At Macquarie, we believe [academic integrity](#) – honesty, respect, trust, responsibility, fairness and courage – is at the core of learning, teaching and research. We recognise that meeting the expectations required to complete your assessments can be challenging. So, we offer you a range of resources and services to help you reach your potential, including free [online writing and maths support](#), [academic skills development](#) and [wellbeing consultations](#).

## Student Support

Macquarie University provides a range of support services for students. For details, visit <http://students.mq.edu.au/support/>

## The Writing Centre

[The Writing Centre](#) provides resources to develop your English language proficiency, academic writing, and communication skills.

- [Workshops](#)
- [Chat with a WriteWISE peer writing leader](#)
- [Access StudyWISE](#)
- [Upload an assignment to Studiosity](#)
- [Complete the Academic Integrity Module](#)

The Library provides online and face to face support to help you find and use relevant information resources.

- [Subject and Research Guides](#)
- [Ask a Librarian](#)

## Student Services and Support

Macquarie University offers a range of [Student Support Services](#) including:

- [IT Support](#)
- [Accessibility and disability support](#) with study
- Mental health [support](#)
- [Safety support](#) to respond to bullying, harassment, sexual harassment and sexual assault

- [Social support including information about finances, tenancy and legal issues](#)
- [Student Advocacy](#) provides independent advice on MQ policies, procedures, and processes

## Student Enquiries

Got a question? Ask us via [AskMQ](#), or contact [Service Connect](#).

## IT Help

For help with University computer systems and technology, visit [http://www.mq.edu.au/about\\_us/offices\\_and\\_units/information\\_technology/help/](http://www.mq.edu.au/about_us/offices_and_units/information_technology/help/).

When using the University's IT, you must adhere to the [Acceptable Use of IT Resources Policy](#). The policy applies to all who connect to the MQ network including students.