



# STAT6110

## Statistical Inference

Session 2, Online-scheduled-In person assessment, North Ryde 2023

*School of Mathematical and Physical Sciences*

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#### **Disclaimer**

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## General Information

Unit convenor and teaching staff

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Credit points

10

Prerequisites

((MATH604 or MATH6904 or BCA802 or STAT8602) and (STAT670 or STAT6170) and (STAT680 or STAT6180) and (STAT683 or STAT6183)) or (Admission to MDataSc and (STAT670 or STAT6170) and (STAT680 or STAT6180))

Corequisites

Co-badged status

Unit description

This unit introduces the fundamental principles of statistical inference and estimation theory. The unit begins with a discussion of random samples and their use in drawing inferences about a population. A discussion of estimation concepts is then provided, particularly unbiasedness, consistency and efficiency. Likelihood theory is developed, including the concept of sufficiency and the maximum likelihood approach to estimation. Hypothesis testing concepts and methods are discussed with a particular focus on likelihood ratio, score and Wald tests. The relative frequency interpretation of key concepts such as confidence intervals and p-values is emphasised. An introduction to Bayesian inference principles is also provided.

## 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:** Apply random sampling concepts to make inferences about a population.

**ULO2:** Use estimation principles (including unbiasedness, consistency and relative efficiency) to assess the performance of inference procedures.

**ULO3:** Analyse a range of statistical inference contexts and evaluate how the concept of

likelihood and the principle of maximum likelihood estimation can be applied.

**ULO4:** Use hypothesis testing approaches (including likelihood ratio tests, score tests and Wald tests) to carry out statistical tests in various contexts.

**ULO5:** Evaluate the relevance of the principles of Bayesian inference in various contexts, and apply them to solve inference problems.

## 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%

**Hurdle Assessments:** None of the above assessment tasks is a hurdle

**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 7th day (including weekends). After the 7th 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 via [ask.mq.edu.au](http://ask.mq.edu.au)

Assignments 1 and 2: YES, Standard Late Penalty applies

Class Test: NO, unless Special Consideration is Granted

Final Exam: NO, unless Special Consideration is Granted

**Special Considerations:** 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).

**Submission of Assessments:** Assignment submission will be online through the iLearn 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. You should upload this as a single scanned PDF file.
- Please note the quick guide on how to upload your assignments provided on the iLearn page.

- Please make sure that each page in your uploaded assignment corresponds to only one A4 page (do not upload an A3 page worth of content as an A4 page in landscape). If you are using an app like Clear Scanner, please make sure that the photos you are using are clear and shadow-free.
- It is your responsibility to make sure your assignment submission is legible.
- If there are technical obstructions to your submitting 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 interests to make frequent submissions of your partially completed work as insurance against technical or other problems near the submission deadline.

## Assessment Tasks

Name	Weighting	Hurdle	Due
<a href="#">Assignment 1</a>	25%	No	Week 4
<a href="#">Class test</a>	15%	No	Week 8
<a href="#">Assignment 2</a>	25%	No	Week 11
<a href="#">Final Exam</a>	35%	No	University examination period

### Assignment 1

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

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

Due: **Week 4**

Weighting: **25%**

Students are required to submit their assignments (pdf documents) before the due time. Students will submit their assignments via a link on iLearn.

On successful completion you will be able to:

- Apply random sampling concepts to make inferences about a population.
- Use estimation principles (including unbiasedness, consistency and relative efficiency) to assess the performance of inference procedures.

## Class test

Assessment Type <sup>1</sup>: Quiz/Test

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

Due: **Week 8**

Weighting: **15%**

Students are required to take a test.

On successful completion you will be able to:

- Use estimation principles (including unbiasedness, consistency and relative efficiency) to assess the performance of inference procedures.
- Analyse a range of statistical inference contexts and evaluate how the concept of likelihood and the principle of maximum likelihood estimation can be applied.
- Evaluate the relevance of the principles of Bayesian inference in various contexts, and apply them to solve inference problems.

## Assignment 2

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

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

Due: **Week 11**

Weighting: **25%**

Students are required to submit their assignments (pdf documents) before the due time. Students will submit their assignments via a link on iLearn.

On successful completion you will be able to:

- Use hypothesis testing approaches (including likelihood ratio tests, score tests and Wald tests) to carry out statistical tests in various contexts.
- Evaluate the relevance of the principles of Bayesian inference in various contexts, and apply them to solve inference problems.

## Final Exam

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

Indicative Time on Task <sup>2</sup>: 12 hours

Due: **University examination period**

Weighting: **35%**

Formal invigilated examination testing the learning outcomes of the unit.

On successful completion you will be able to:

- Apply random sampling concepts to make inferences about a population.
- Use estimation principles (including unbiasedness, consistency and relative efficiency) to assess the performance of inference procedures.
- Analyse a range of statistical inference contexts and evaluate how the concept of likelihood and the principle of maximum likelihood estimation can be applied.
- Use hypothesis testing approaches (including likelihood ratio tests, score tests and Wald tests) to carry out statistical tests in various contexts.
- Evaluate the relevance of the principles of Bayesian inference in various contexts, and apply them to solve inference problems.

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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

### Classes

Students should enrol in the following classes each week:

- 1 x 1-hour Q&A lecture session beginning in **Week 1** (attend either in-person if enrolled on an in-person scheduled weekday or online if enrolled on an Online-scheduled)
- 1 x 2-hour Small Group Teaching Activity (SGTA) beginning in **Week 2**. Attendance and participation are highly recommended!

The timetable for classes can be found on the University website at: <http://www.timetables.mq.edu.au>

Students can change their SGTA and practical classes online only by using eStudent at: <https://student1.mq.edu.au/>.

Students are expected to self-study to learn the basics outside of class each week by watching the pre-recorded lectures and reading the textbook. After studying the weekly lecture content on their own, students attend a one-hour Q&A lecture session (on-campus or online) where they can practice and apply what they have learned under the lecturer's supervision.

## Methods of Communication

We will communicate with you via your university email or through announcements on iLearn. Queries to convenors can either be placed on the iLearn discussion board or through direct email to unit convenors.

## 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 the semester. If there are any changes to this unit in relation to COVID, these will be communicated via iLearn.

## Reference book

Mathematical statistics with applications, 7th edition, Wackerly, Dennis D; Mendenhall, III, William; Scheaffer, Richard L

## Unit Schedule

Week	Topic	Work Due
	Probability and random samples	
	Large sample probability concepts	
	Estimation concepts	A1- Week 4
	Likelihood	
	Estimation methods	
	Hypothesis testing concepts	Test - Week 8
	Hypothesis testing methods	A2 - Week 11
	Bayesian inference	
	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.

## Changes from Previous Offering

Assessment weights have been changed.