



# STAT3110

## Statistical Inference

Session 1, In person-scheduled-weekday, North Ryde 2022

*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

(20cp at 2000 level including (STAT272 or STAT2372 or STAT273 or STAT2173)) or [(STAT270 or STAT2170) and (COMP257 or COMP2200) and (admission to BIT or BAdvIT)]

Corequisites

Co-badged status

Unit description

This unit provides an introduction to likelihood-based statistical inference. After a brief discussion of the multivariable calculus concepts needed, students will study (multivariate) change of variable, the likelihood function and maximum likelihood estimation, using examples of distributions from 2000-level probability units. The theory of estimation and hypothesis testing will be discussed, including most powerful tests, large sample theory, the sufficiency principle, the likelihood ratio principle, and sequential probability ratio tests.

## 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

**ATTENDANCE and PARTICIPATION:** Please contact the unit convenor as soon as possible if you have difficulty attending and participating in any classes. There may be alternatives available to make up the work. If there are circumstances that mean you will miss a class, you can apply for Special Consideration via [ask.mq.edu.au](https://ask.mq.edu.au)

**ASSIGNMENT SUBMISSION:** 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.

**LATE SUBMISSION OF WORK:** All assessment tasks must be submitted by the official due date and time. In the case of a late submission for a non-timed assessment (e.g. an assignment), if special consideration has NOT been granted, a 12-hour grace period will be given after which the following deductions will be applied to the awarded assessment mark: 12 to 24 hours late = 10% deduction; for each day thereafter, an additional 10% per day or part thereof will be applied until five days beyond the due date. After this time, a mark of zero (0) will be given.

For example, an assessment worth 20% is due 5 pm on 1 January. Student A submits the assessment at 1 pm, 3 January. The assessment received a mark of 15/20. A 20% deduction is then applied to the mark of 15, resulting in the loss of three (3) marks. Student A is then awarded

a final mark of 12/20.

**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 11
<a href="#">Final Exam</a>	55%	No	University examination period

### Assignment 1

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

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

Due: **Week 4**

Weighting: **15%**

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.

## Assignment 2

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

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

Due: **Week 8**

Weighting: **15%**

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:

- Analyse a range of statistical inference contexts and evaluate how the concept of likelihood and the principle of maximum likelihood estimation can be applied.

## Assignment 3

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

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

Due: **Week 11**

Weighting: **15%**

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: **55%**

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.

<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

Off-shore students must email the convenor as soon as possible to discuss study options.

For each week, there is a one-hour lecture online via Zoom. There will also be another one-hour pre-recorded Zoom lecture that students should watch each week at their own convenient time.

There is also one 2-hour SGTA class each week to attend, either on-campus or online - check the timetable for options.

## Unit Schedule

Week	Topic	Work Due
	Large sample probability concepts	
	Estimation concepts	A1 - wk 4

Likelihood	
Estimation methods	
Hypothesis testing concepts	A2 - wk 8
Hypothesis testing methods	A3 - wk 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](https://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 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.