



# STAT8178

## Modern Computational Statistical Methods

Session 1, Weekday attendance, North Ryde 2020

*Department of Mathematics and Statistics*

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## General Information

Unit convenor and teaching staff

Unit Convenor/Lecturer

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please refer to iLearn

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Credit points

10

Prerequisites

(STAT806 or STAT810 or STAT8310 or STAT6110) or (Admission to MBusAnalytics and BUSA8000 and ECON8040)

Corequisites

Co-badged status

This unit is co-badged with STAT7178.

Unit description

This unit offers students the opportunity to study some modern computational methods in statistics. The first half of the unit covers maximum likelihood computations, Bayesian computations using Monte Carlo methods, missing data and the EM algorithm. The second half considers Kernel density estimation, Kernel regression, quantile regression and inferences using Monte-Carlo and bootstrapping methods. State-of-the-art computing softwares are used.

## 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:** Derive and explore Maximum Likelihood and Bayesian estimators.

**ULO2:** Apply EM algorithm to deal with missing data.

**ULO3:** Produce estimates of bias and variance along with confidence interval by applying Monte-Carlo and bootstrapping methods.

**ULO4:** Apply nonparametric function estimation approaches to estimate density function, regression function and quantile regression function.

**ULO5:** Evaluate the performance of nonparametric curve estimators by applying Monte-Carlo and bootstrapping methods.

## Assessment Tasks

### Coronavirus (COVID-19) Update

Assessment details are no longer provided here as a result of changes due to the Coronavirus (COVID-19) pandemic.

Students should consult [iLearn](#) for revised unit information.

[Find out more about the Coronavirus \(COVID-19\) and potential impacts on staff and students](#)

## General Assessment Information

**MID-SEMESTER TEST:** During Week 7, a test will be made available on the iLearn site of the unit. The test's due date is Friday 11.59pm in Week 7. Students are allowed a maximum of two hours and one attempt to complete the test before the deadline.

**The only excuse for not completing the mid-semester test at the designated time period is 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).**

**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. Discussions are allowed but the final work must be your personal effort.

- Assignment submission is via iLearn. You should upload this as a single PDF file. Assignments should be word-processed.
- 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).
- 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, 20% of the earned mark will be deducted for each 24-hour period (or part thereof) that the submission is late for the first 2 days (including weekends and/or public holidays). For example, if an assignment is submitted 25 hours late, its mark will attract a penalty equal to 40% of the earned mark. After 2 days (including weekends and public holidays) a mark of 0% will be awarded. Timed assessment tasks (e.g. tests, examinations) do not fall under these rules.

**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](https://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](https://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.

## Delivery and Resources

### Coronavirus (COVID-19) Update

Any references to on-campus delivery below may no longer be relevant due to COVID-19.

Please check here for updated delivery information: [https://ask.mq.edu.au/account/pub/display/unit\\_status](https://ask.mq.edu.au/account/pub/display/unit_status)

## Lectures

You are required to attend one 3-hour combined lecture and SGTA class each week. Please consult the university timetables for the exact time and location of the class.

## Prescribed texts

Students should obtain the lecture overheads from iLearn prior to the lecture. The lecture overheads are available module by module.

The following are recommended reading books for this unit:

- Computational Statistics Handbook with MATLAB®, W. L. Martinez and A. R. Martinez, Chapman & Hall. (QA276.4.M272)
- Local regression and likelihood, C. Loader, Springer-Verlag, 1999. QA276.8 .L6/1999.
- Quantile Regression, Roger Koenker, Cambridge University Press 2005,

## Unit webpage

Unit webpage is located on iLearn at <https://ilearn.mq.edu.au>.

You can only access the material on iLearn if you are formally enrolled in the unit. All lecturing materials are available at this webpage.

## Teaching and Learning Strategy

The unit is taught in both traditional mode and external mode. In traditional mode, students are on campus in standard semesters with weekly lectures. In external mode, students access all teaching material from iLearn and do not attend lectures on campus.

Students are expected to

- attend all the lectures if enrolled internally;
- have read through the material to be covered using the lecture notes provided on iLearn;
- submit assignments on time via iLearn;
- participate the mid-semester test at the designated time;
- contact the unit convenor in advance if for any reason, you cannot hand in your assessment tasks on time;

Refer to the next section for a week-by-week list of topics to be covered in this unit.

## Software used in teaching

We are using MATLAB, R and JAGS/WinBUGS in teaching this unit. R, JAGS/WinBUGS are free software and are widely used nowadays by statisticians. More information about R can be found at <http://www.r-project.org/>, JAGS at "<http://mcmc-jags.sourceforge.net>" and WinBUGS at "<http://www.mrc-bsu.cam.ac.uk/bugs/>". Matlab is commercial software, but is available for

Macquarie students and staff: <https://web.science.mq.edu.au/it/matlab/>.

## Unit Schedule

### Coronavirus (COVID-19) Update

The unit schedule/topics and any references to on-campus delivery below may no longer be relevant due to COVID-19. Please consult [iLearn](#) for latest details, and check here for updated delivery information: [https://ask.mq.edu.au/account/pub/display/unit\\_status](https://ask.mq.edu.au/account/pub/display/unit_status)

Week	Topic	Task Due
1	Likelihood and maximum likelihood estimates (MLE)	
2	Iterative methods for computing MLE	
3	Iterative methods for computing MLE (cont.) & Prior and posterior distributions	
4	Prior and posterior distributions (cont.) & Bayesian Estimation	Assignment 1
5	Asymptotic distribution: ML & Bayesian Estimates	
6	Missing data mechanism, incomplete data and its inference and the Expectation and Maximisation (EM) algorithm	
7	Histogram & density estimation	Test
8	Kernel density estimation	
9	Kernel regression	
10	Quantile regression	Assignment 2
11	Monte-Carlo method for hypothesis testing	
12	Bootstrapping	
13	Revision	

Students should read the lecture notes, which will be available at the unit web page, before the lecture.

## Policies and Procedures

Macquarie University policies and procedures are accessible from [Policy Central \(https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policy-central\)](https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policy-central). 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](#)
- [Grade Appeal Policy](#)
- [Complaint Management Procedure for Students and Members of the Public](#)
- [Special Consideration Policy](#) (**Note:** *The Special Consideration Policy is effective from 4 December 2017 and replaces the Disruption to Studies Policy.*)

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

If you would like to see all the policies relevant to Learning and Teaching visit [Policy Central](http://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policy-central) (<http://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policy-central>).

## Student Code of Conduct

Macquarie University students have a responsibility to be familiar with the Student Code of Conduct: <https://students.mq.edu.au/study/getting-started/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)

## Student Support

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

## Learning Skills

Learning Skills ([mq.edu.au/learningskills](http://mq.edu.au/learningskills)) provides academic writing resources and study strategies to help you improve your marks and take control of your study.

- [Getting help with your assignment](#)
- [Workshops](#)
- [StudyWise](#)
- [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

Students with a disability are encouraged to contact the [Disability Service](#) who can provide appropriate help with any issues that arise during their studies.

## Student Enquiries

For all student enquiries, visit Student Connect at [ask.mq.edu.au](http://ask.mq.edu.au)

If you are a Global MBA student contact [globalmba.support@mq.edu.au](mailto:globalmba.support@mq.edu.au)

## 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

No substantial changes from the 2019 offering.

## Changes since First Published

Date	Description
18/02/2020	Amendments to the shared teaching, assessment tasks and learning activities were updated in the CMS.