



# STAT8121

## Multivariate Analysis

Session 2, Special circumstances 2021

*Archive (Pre-2022) - Department of Mathematics and Statistics*

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#### Disclaimer

Macquarie University has taken all reasonable measures to ensure the information in this publication is accurate and up-to-date. However, the information may change or become out-dated as a result of change in University policies, procedures or rules. The University reserves the right to make changes to any information in this publication without notice. Users of this publication are advised to check the website version of this publication [or the relevant faculty or department] before acting on any information in this publication.

#### Session 2 Learning and Teaching Update

The decision has been made to conduct study online for the remainder of Session 2 for all units WITHOUT mandatory on-campus learning activities. Exams for Session 2 will also be online where possible to do so.

This is due to the extension of the lockdown orders and to provide certainty around arrangements for the remainder of Session 2. We hope to return to campus beyond Session 2 as soon as it is safe and appropriate to do so.

Some classes/teaching activities cannot be moved online and must be taught on campus. You should already know if you are in one of these classes/teaching activities and your unit convenor will provide you with more information via iLearn. If you want to confirm, see the list of [units with mandatory on-campus classes/teaching activities](#).

Visit the [MQ COVID-19 information page](#) for more detail.

## General Information

Unit convenor and teaching staff

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Please refer to iLearn

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Credit points

10

Prerequisites

((Admission to MAppStat or MSc or MScInnovationStat or GradCertAppStat or GradDipAppStat or MDataSc) and (STAT680 or STAT6180)) or (admission to MLabAQMgt or GradDipLabAQMgt or MMarScMgt or GradDipMarScMgt or MConsBiol or GradDipConsBiol and (STAT830(Cr) or STAT8830)) or (Admission to MBusAnalytics and ECON8040) or (Admission to MActPrac and (STAT806 or STAT810 or STAT8310))

Corequisites

Co-badged status

Unit description

*This unit has an online offering for S2 which is **synchronous**, meaning there will be set times to attend online lectures and tutorials.*

This unit introduces methodologies and techniques for the exploration and analysis of multivariate data. Topics include graphical displays, discriminant analysis, principal components analysis, multivariate normal distribution, multivariate linear models, and cluster analysis.

## 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:** Understand the fundamental difference between univariate and multivariate analysis.

**ULO2:** Know how to perform hypothesis testing (mainly the Hotelling T2 test and chi-square test) using multivariate data.

**ULO3:** Understand and be able to apply MANOVA and understand multivariate regression.

**ULO4:** Know the theories of PCA and factor analysis (FA), and be able to apply these methods to real data.

**ULO5:** Understand likelihood based, as well as minimum expected cost based, discriminant analysis. Be able to apply these discriminant analysis methods to real data.

**ULO6:** Know how to display multivariate data graphically using R and be able to use the R package for multivariate data analysis.

## General Assessment Information

**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.

- Assignment submission is via iLearn. You must upload your work as a single scanned PDF file.

Please note 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 ASSIGNMENT:** All assessment tasks must be submitted by the official due date and time. In the case of 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) including weekends and/or public holidays.

**FINAL EXAMINATION:** 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. In case of unavoidable disruption, the students may be eligible for Special Consideration. The application for Special Consideration can be lodged via [ask.mq.edu.au](https://ask.mq.edu.au).

**SUPPLEMENTARY EXAMINATIONS IMPORTANT:** 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. If you apply for special consideration, you must give the supplementary examination priority over any other pre-existing commitments, as such commitments will not usually be considered an acceptable basis for a second application for special consideration. Please ensure you are familiar with the policy prior to submitting an application. Approved applicants will receive an individual notification sometime in the 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 Exam</a>	55%	No	University Formal 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 should prepare this assignment using a word-processing software such as Microsoft Word or Latex and then students should convert the assignment to a pdf document.

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:

- Understand the fundamental difference between univariate and multivariate analysis.
- Know how to perform hypothesis testing (mainly the Hotelling T2 test and chi-square test) using multivariate data.
- Know how to display multivariate data graphically using R and be able to use the R package for multivariate data analysis.

### 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 should prepare this assignment using a word-processing software such as Microsoft Word or Latex and then students should convert the assignment to a pdf document.

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:

- Understand and be able to apply MANOVA and understand multivariate regression.
- Know how to display multivariate data graphically using R and be able to use the R package for multivariate data analysis.

## Assignment 3

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

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

Due: **Week 12**

Weighting: **15%**

Students should prepare this assignment using a word-processing software such as Microsoft Word or Latex and then students should convert the assignment to a pdf document.

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:

- Understand the fundamental difference between univariate and multivariate analysis.
- Know the theories of PCA and factor analysis (FA), and be able to apply these methods to real data.
- Understand likelihood based, as well as minimum expected cost based, discriminant analysis. Be able to apply these discriminant analysis methods to real data.
- Know how to display multivariate data graphically using R and be able to use the R package for multivariate data analysis.

## Final Exam

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

Indicative Time on Task <sup>2</sup>: 40 hours

Due: **University Formal Examination Period**

Weighting: **55%**

An invigilated exam is to be scheduled in the university exam period.

On successful completion you will be able to:

- Understand the fundamental difference between univariate and multivariate analysis.
- Know how to perform hypothesis testing (mainly the Hotelling T2 test and chi-square test) using multivariate data.
- Understand and be able to apply MANOVA and understand multivariate regression.
- Know the theories of PCA and factor analysis (FA), and be able to apply these methods to real data.
- Understand likelihood based, as well as minimum expected cost based, discriminant analysis. Be able to apply these discriminant analysis methods to real data.
- Know how to display multivariate data graphically using R and be able to use the R package for multivariate data analysis.

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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

We use R software. R can be downloaded from <http://www.r-project.org/> free of charge. From Week 2, students will be given exercises each week covering materials from the lectures, and most exercises require using R.

Recommended references are

"Applied Multivariate Statistical Analysis" by R. A. Johnson, Dean W. Wichern (6th edition);

"Multivariate Analysis – methods and applications" by Dillon and Goldstein;

"Multivariate statistical modelling based on generalized linear models" by Fahrmeir & Tutz;

"A first course in multivariate statistics" by Flury, B.;

"Multivariate statistics: A practical approach" by Morrison, D..

## Unit Schedule

Week	Topic
1	Introduction to multivariate analysis; Overview of matrix algebra
2	Basic concepts of multivariate distribution; Sample statistics
3	Multivariate sample statistics (cont.); Some useful multivariate distributions
4	Inferences: estimation and hypothesis testing
5	Inferences (cont.)
6	MANOVA
7	MANOVA (cont.); Multivariate regression
8	Regression (cont.); Principal component analysis (PCA)
9	Factor analysis (FA)
10	Factor analysis (FA) (cont.)
11	Discriminant analysis and classification
12	A brief introduction to canonical correlation analysis
13	A brief introduction to cluster analysis

## 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](#)
- [Grade Appeal Policy](#)
- [Complaint Management 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)

## 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.