STAT8121

Multivariate Analysis

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

School of Mathematical and Physical Sciences

Contents

General Information

Unit convenor and teaching staff
Lecturer and Convenor
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iLearn

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 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

Requirements to pass this unit:

1. Attempt all assessments and
2. Achieve a total mark equal to or greater than 50%

ASSIGNMENT SUBMISSION: Assignment submission will be online through the iLearn page. Submit assignments online via the appropriate assignment link on the iLearn page.

• Assignment submission is via iLearn. You should upload this as a single scanned PDF file.

• It is your responsibility to make sure your assignment submission is legible.

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 ASSIGNMENT: Standard Late Penalty

Unless a Special Consideration request has been submitted and approved, 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 (including weekends and/or public holidays) will be applied until five days beyond the due date. After this time, a mark of zero (0) will be given.

Assignments 1, 2 and 3: YES, Standard Late Penalty applies

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.

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.

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
Assignment 1	15%	No	Week 4
Assignment 2	15%	No	Week 8
Assignment 3	15%	No	Week 12
Final Exam	55%	No	University Examination Period

Assignment 1

Assessment Type [1]: Quantitative analysis task
Indicative Time on Task [2]: 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 [1]: Quantitative analysis task
Indicative Time on Task [2]: 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 [1]: Quantitative analysis task
Indicative Time on Task [2]: 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 [1]: Examination
Indicative Time on Task [2]: 40 hours
Due: **University 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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[1] 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.

[2] 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: The lectures begin in Week 1. SGTAs begin in Week   2.

Students must attend two hours of lectures and 1-hour of SGTA per week.

The lecture notes will be made available on *iLearn* before the lecture. SGTA exercises will be set weekly and will be available on iLearn before each class. The timetable for classes can be found

at   https://www.timetables.mq.edu.au

iLEARN: All unit-related materials including lecture notes, SGTA's, and instructions for assessment tasks and administrative updates, will be published on iLearn.

SOFTWARE: We use **R** software. **R** can be downloaded from http://www.r-project.org/ free of charge.

Recommended references:

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

"*The R software*." Lafaye de Micheaux, Pierre Lafaye, Rémy Drouilhet, and Benoit Liquet. Springer. New York, 2013.

 "Multivariate Statistical Methods: A Primer, 4th Edition" by Manly, Bryan FJ, and Jorge A. Navarro Alberto. Chapman and Hall/CRC, 2016.

"*Introduction to multivariate analysis*." by Chatfield C. and Collins AJ, Chapman and Hall/CRC.

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

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.

Unit Schedule

Study Week	Lecture topics
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 and cluster analysis.

Policies and Procedures

Macquarie University policies and procedures are accessible from Policy Central (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). 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) 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 or if you are a Global MBA student contact 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/.

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

Based on the experience from the previous offering, taking into account the positive student feedback, no change to the delivery of the unit has been planned.