STAT8111

Generalized Linear Models

Session 2, Fully online/virtual 2021

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

Contents

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
Convenor/Lecturer
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See iLearn for details

Lecturer
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See iLearn for details

Credit points
10

Prerequisites
((Admission to MAppStat or MScInnovationStat or GradCertAppStat or GradDipAppStat or MDataSc) and ((STAT806 or STAT810 or STAT6110) and STAT6175)) or (admission to MMarScMgt or MConsBiol or GradDipConsBiol and (STAT830(Cr) or STAT8830(Cr))) or (Admission to MBusAnalytics and BUSA8000 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 starts with the classical normal linear regression model. The family of generalized linear models is then introduced, and maximum likelihood estimators are derived. Models for counted responses, binary responses, continuous non-normal responses and categorical responses; and models for correlated responses, both normal and non-normal, and generalised additive models, are studied. All models and methods are illustrated using data sets from disciplines such as biology, actuarial studies and medicine.

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: Formulate a generalized linear model and derive its maximum likelihood estimators.

ULO3: Perform model selection and test hypothesis.

ULO2: Answer research questions by exploring data graphically; selecting and applying appropriate modelling techniques; appraising underlying model assumptions and goodness of fit, and modifying the analysis if required.

ULO4: Apply the generalized additive model to incorporate nonlinear forms of the predictors and use random effects or generalized estimating equations to model correlated data.

ULO5: Use statistical software to create model output and interpret them.

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. 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 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 submission 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 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: There is no final exam for this unit.

Assessment Tasks

Name	Weighting	Hurdle	Due
Assignment 1	30%	No	Week 4
Assignment 2	40%	No	Week 9
Assignment 3	30%	No	Week 13

Assignment 1

Assessment Type [1]: Quantitative analysis task
Indicative Time on Task [2]: 10 hours
Due: **Week 4**
Weighting: **30%**

Assignment

On successful completion you will be able to:

- Formulate a generalized linear model and derive its maximum likelihood estimators.
- Perform model selection and test hypothesis.
- Answer research questions by exploring data graphically; selecting and applying appropriate modelling techniques; appraising underlying model assumptions and goodness of fit, and modifying the analysis if required.
- Use statistical software to create model output and interpret them.

Assignment 2

Assessment Type [1]: Quantitative analysis task

Indicative Time on Task [2]: 12 hours
Due: **Week 9**
Weighting: **40%**

Assignment

On successful completion you will be able to:

- Formulate a generalized linear model and derive its maximum likelihood estimators.
- Perform model selection and test hypothesis.
- Answer research questions by exploring data graphically; selecting and applying appropriate modelling techniques; appraising underlying model assumptions and goodness of fit, and modifying the analysis if required.
- Use statistical software to create model output and interpret them.

Assignment 3

Assessment Type [1]: Quantitative analysis task
Indicative Time on Task [2]: 10 hours
Due: **Week 13**
Weighting: **30%**

Assignment

On successful completion you will be able to:

- Formulate a generalized linear model and derive its maximum likelihood estimators.
- Perform model selection and test hypothesis.
- Answer research questions by exploring data graphically; selecting and applying appropriate modelling techniques; appraising underlying model assumptions and goodness of fit, and modifying the analysis if required.
- Apply the generalized additive model to incorporate nonlinear forms of the predictors and use random effects or generalized estimating equations to model correlated data.
- Use statistical software to create model output and interpret them.

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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

Lectures: There is 1 x 2 hr lecture each week.

SGTAs: There is 1 x 1 hr SGTA class each week.

Course notes

Course notes are available on iLearn, prior to the lecture. SGTA solutions are posted on iLearn.

Required and recommended resources

There is no prescribed text for this unit. The following are useful references:

1. Fahrmeir, L., Kneib, T., Lang, S. and Marx, B. (2013). **Regression: Models, Methods and Applications**, Springer.
2. Faraway, J. J. (2016). **Extending the linear model with R: generalized linear, mixed effects and nonparametric regression models**. CRC Press.
3. De Jong, P. and Heller, G.Z. (2008). **Generalized Linear Models for Insurance Data**, Cambridge University Press.
4. Wood, Simon N. (2017). **Generalized additive models: an introduction with R,** 2nd edition**.** CRC Press.
5. Stasinopoulos M. D., Rigby R. A., Heller G. Z., Voudouris V., De Bastiani F. (2017). **Flexible Regression and Smoothing: Using GAMLSS in R**. CRC Press.
6. Dobson, A. J. and Barnett, A. G. (2018). **An Introduction to Generalized Linear Models**, 4th edition, Chapman & Hall.
7. Lindsey, J.K. (1997). **Applying Generalized Linear Models**, Springer.
8. McCullagh, P. and Nelder, J.A. (1989). **Generalized Linear Models**, 2nd edition, Chapman & Hall.

Recommended web sites

A comprehensive list of online resources for self-learning R, is given on iLearn.

www.gamlss.com

www.statsci.org/glm/

en.wikipedia.org/wiki/Generalized_linear_model

Technology used

We will be using R, which is freely downloadable from the CRAN website. We recommend the use of the RStudio interface, also freely downloadable.

iLearn

We will be using iLearn for posting course notes, assignments, solutions and data sets, and online discussions. You are encouraged to use the forums for discussions on the course material. Remember that if you are confused about something, the chances are that other students are also confused. Everybody benefits from the discussions, and you should not be embarrassed to admit that you do not understand a concept.

Audio recordings of lectures

Audio recordings of the lectures (Echo) will be available on the iLearn site.

Unit Schedule

Unit Schedule

Week	Topics	
1	The classical normal linear model	
2	Introduction to GLMs: The framework of generalized linear models is introduced, and the theory behind maximum likelihood estimation of the parameters started.	
3	Maximum likelihood estimation of the parameters; Poisson regression for count data	
4	Inference; comparison of models The deviance as a measure of fit; hypothesis testing	Assignment 1 due
5	Model checking: Definition of residuals in GLMs; checking for violation of model assumptions	
6	Model selection; overdispersion: Selection of models via AIC; the phenomenon of overdispersion; compound Poisson models to overcome it; the negative binomial model for counts	
7	Binary responses: logistic regression	
	Session 2 Break	
8	Logistic regression contd; Zero-inflated models; Generalized additive models	
9	No Lecture (Labour Day Public Holiday)	Assignment 2 due

10	Regression models for ordinal and categorical responses	
11	Correlated data: Models for longitudinal data, and other data structures in which there is clustering or correlation between observations	
12	Correlated data	
13	Correlated data	Assignment 3 due

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
- 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). 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

Student Support

Macquarie University provides a range of support services for students. For details, visit http://stu

dents.mq.edu.au/support/

Learning Skills

Learning Skills (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

If you are a Global MBA student contact 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/.

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

The final examination has been removed from this unit.