

STAT3030: Generalised Linear Models

Callaghan

Semester 1 - 2024



THE UNIVERSITY OF
NEWCASTLE
AUSTRALIA

OVERVIEW

Course Description	How do we model data of very different types in a consistent way? This course explores generalized linear models and illustrates how methods for analysing continuous and categorical data fit into this framework.
Academic Progress Requirements	Nil
Assumed Knowledge	STAT1300 Fundamentals of Statistics, STAT2000 Applied Statistics and Research Methods
Contact Hours	Callaghan Computer Lab Face to Face On Campus 2 hour(s) per week(s) for 13 week(s) starting Week 1 Lecture Face to Face On Campus 2 hour(s) per week(s) for 13 week(s) starting Week 1
Unit Weighting Workload	10 Students are required to spend on average 120-140 hours of effort (contact and non-contact) including assessments per 10 unit course.

COURSE OUTLINE

CONTACTS

Course Coordinator **Callaghan**
Dr Yang Yang
Yang.Yang10@newcastle.edu.au
(02) 4921 8622
Consultation: TBA on Canvas.

Teaching Staff Other teaching staff will be advised on the course Canvas site.

School Office **School of Information and Physical Sciences**
SR233, Social Sciences Building
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9am-5pm (Mon-Fri)

SYLLABUS

Course Content Topics include:

- Linear models for continuous data (regression and ANOVA)
- Model fitting as an approach to statistical analysis
- Least squares estimation
- Maximum likelihood estimation
- Inference methods based on model fitting
- Exponential family of distributions
- Generalised Linear Models
- Models for categorical data (logistic regression for nominal and ordinal data, Poisson regression and log-linear models)
- Generalised Additive models

Course Learning Outcomes **On successful completion of this course, students will be able to:**

1. Understand and use the principles of statistical modelling;
2. Have a unified conceptual and theoretical framework for many of the most commonly used statistical methods including multiple linear regression, analysis of variance and logistic regression;
3. Develop skills in statistical computing, specifically in the R statistical programming language and R graphics.
4. Write up a report/project on an analysis of a data set and provide a clear report of results with critical interpretation as based on R code, R outputs and theoretical understanding of theory given in the lectures.

Course Materials **Other Resources:**

- Comprehensive course notes and other resources are available on Canvas.
- Materials for tutorials/labs will be provided to students via Canvas.
- The statistical package/language R will be used throughout the course. This package can be accessed for free from <https://www.r-project.org>. R is available in all the computer labs.
- The RStudio front-end will be used in this course. It is strongly recommended you install

RStudio and R on your own computer as well.

Recommended Text:

- Annette J. Dobson and Adrian G Barnett, 2018. *An introduction to generalized linear models*, Chapman and Hall/CRC.
- Julian J. Faraway, 2016. *Extending the linear model with R: generalized linear, mixed effects and nonparametric regression models*, Chapman and Hall/CRC.

SCHEDULE

Week	Week Begins	Topic	Learning Activity	Assessment Due
1	26 Feb	Linear regression, Least Squares, Linear Models, Likelihood, Exploratory Data Analysis, Introduction to R and RStudio	Lecture and Lab	
2	4 Mar	Linear Models Continued, MLE for Linear Models, Estimators, Factors and Levels, Matrix Methods for Linear Models, Model Diagnostics	Lecture and Lab	
3	11 Mar	One-way Analysis of Variance (ANOVA) Models	Lecture and Lab	
4	18 Mar	Two-way ANOVA Models, Analysis of Covariance (ANCOVA) Models	Lecture and Lab	Assignment 1 (March 24)
5	25 Mar	Modelling Binary Data with Logistic Regression. Introduction to GLM Framework	Lecture and Lab	
6	1 Apr	GLMs Theory: Model Specification, Link Functions, Likelihood Inference	Lecture and Lab	
7	8 Apr	GLMs Theory Continued, Modelling Binomial and Proportional Responses	Lecture and Lab	
Mid-Semester Recess				
Mid-Semester Recess				
8	29 Apr	Gamma Response Models	Lecture and Lab	Assignment 2 (May 5)
9	6 May	Poisson GLMs, Overdispersion and Zero-inflated Models	Lecture and Lab	
10	13 May	Generalised Additive Models	Lecture and Lab	
11	20 May	Odds Ratios and Loglinear Models for Contingency Tables	Lecture and Lab	Oral Presentation (May 22) Written Project (June 2)
12	27 May	Additional GLM topics if time permits	Lecture and Lab	
13	3 Jun	Revision	Lecture	
Examination Period				
Examination Period				

ASSESSMENTS

This course has 5 assessments. Each assessment is described in more detail in the sections below.

	Assessment Name	Due Date	Involvement	Weighting	Learning Outcomes
1	Assignment 1	11:59 PM Sunday, 24th March (Week 4), 2024	Individual	10%	1, 2, 3
2	Assignment 2	11:59 PM Sunday, 5th of May (Week 8), 2024	Individual	15%	1, 2, 3
3	Oral for Project	Wednesday, 22nd of May (Week 11), during Lecture	Individual	10%	2, 3
4	Written Project	11:59 PM, Sunday, 2nd of June (Week 11), 2024	Individual	15%	2, 3, 4
5	Examination - Formal	Final Exam Period	Individual	50%	1, 2, 3, 4

Late Submissions The mark for an assessment item submitted after the designated time on the due date, without an approved extension of time, will be reduced by 10% of the possible maximum mark for that assessment item for each day or part day that the assessment item is late. Note: this applies equally to week and weekend days.

Assessment 1 - Assignment 1

Assessment Type Written Assignment
Purpose Assesses understanding of content and communication skills.
Description Assignment will involve using R to analyse data from a case study, then organising and editing the R output and preparing a written report on your analyses in R Markdown. This assignment covers topics of statistics basics, regression and ANOVA models.
Weighting 10%
Due Date 11:59 PM Sunday, 24th March (Week 4), 2024
Submission Method Online
Assessment Criteria Correctness of analysis, clarity of writing, conciseness
Return Method Online
Feedback Provided Returned Work - Within 2 weeks.

Assessment 2 - Assignment 2

Assessment Type Written Assignment
Purpose Assesses understanding of content and communication skills.
Description Assignment will involve using R to analyse data from a case study, then organising and editing the R output and preparing a written report on your analyses in R Markdown.
Weighting 15%
Due Date 11:59 PM Sunday, 5th of May (Week 8), 2024
Submission Method Online
Assessment Criteria Correctness of analysis, clarity of writing, conciseness
Return Method Online
Feedback Provided Returned Work - Within 2 weeks.

Assessment 3 - Oral for Project

Assessment Type Presentation
Purpose Develop understanding of data analysis and communication skills
Description An oral presentation on your project
Weighting 10%
Due Date Wednesday, 22nd of May (Week 11), during Lecture
Submission Method In Class
Assessment Criteria Ambition in data collection, Correctness of analysis, speaking skills
Return Method Not Returned
Feedback Provided In Class - .

Assessment 4 - Written Project

Assessment Type	Project
Purpose	Assesses understanding of content and communication skills.
Description	Written report on data analysis project
Weighting	15%
Due Date	11:59 PM, Sunday, 2nd of June (Week 11), 2024
Submission Method	Online
Assessment Criteria	Ambition in data collection, Correctness of analysis, clarity of writing, conciseness
Return Method	Online
Feedback Provided	Returned Work - within 2 weeks.

Assessment 5 - Examination - Formal

Assessment Type	Formal Examination
Purpose	Assess understanding of theory, and data analysis skills
Description	A data analysis exam consists of multiple choice and written-response sections.
Weighting	50%
Due Date	Final Exam Period
Submission Method	Formal Exam
Assessment Criteria	Correctness of analysis, clarity of writing, conciseness
Return Method	Not Returned
Feedback Provided	No Feedback - .

ADDITIONAL INFORMATION

Grading Scheme

This course is graded as follows:

Range of Marks	Grade	Description
85-100	High Distinction (HD)	Outstanding standard indicating comprehensive knowledge and understanding of the relevant materials; demonstration of an outstanding level of academic achievement; mastery of skills*; and achievement of all assessment objectives.
75-84	Distinction (D)	Excellent standard indicating a very high level of knowledge and understanding of the relevant materials; demonstration of a very high level of academic ability; sound development of skills*; and achievement of all assessment objectives.
65-74	Credit (C)	Good standard indicating a high level of knowledge and understanding of the relevant materials; demonstration of a high level of academic achievement; reasonable development of skills*; and achievement of all learning outcomes.
50-64	Pass (P)	Satisfactory standard indicating an adequate knowledge and understanding of the relevant materials; demonstration of an adequate level of academic achievement; satisfactory development of skills*; and achievement of all learning outcomes.
0-49	Fail (FF)	Failure to satisfactorily achieve learning outcomes. If all compulsory course components are not completed the mark will be zero. A fail grade may also be awarded following disciplinary action.

*Skills are those identified for the purposes of assessment task(s).

Communication Methods

Communication methods used in this course include:

- Canvas Course Site: Students will receive communications via the posting of content or announcements on the Canvas course site.
- Email: Students will receive communications via their student email account.
- Face to Face: Communication will be provided via face to face meetings or supervision.

Course Evaluation	Each year feedback is sought from students and other stakeholders about the courses offered in the University for the purposes of identifying areas of excellence and potential improvement.
Oral Interviews (Vivas)	As part of the evaluation process of any assessment item in this course an oral examination (viva) may be conducted. The purpose of the oral examination is to verify the authorship of the material submitted in response to the assessment task. The oral examination will be conducted in accordance with the principles set out in the Oral Examination (viva) Procedure . In cases where the oral examination reveals the assessment item may not be the student's own work the case will be dealt with under the Student Conduct Rule .
Academic Misconduct	All students are required to meet the academic integrity standards of the University. These standards reinforce the importance of integrity and honesty in an academic environment. Academic Integrity policies apply to all students of the University in all modes of study and in all locations. For the Student Academic Integrity Policy, refer to https://policies.newcastle.edu.au/document/view-current.php?id=35 .
Adverse Circumstances	<p>The University acknowledges the right of students to seek consideration for the impact of allowable adverse circumstances that may affect their performance in assessment item(s). Applications for special consideration due to adverse circumstances will be made using the online Adverse Circumstances system where:</p> <ol style="list-style-type: none">1. the assessment item is a major assessment item; or2. the assessment item is a minor assessment item and the Course Co-ordinator has specified in the Course Outline that students may apply the online Adverse Circumstances system;3. you are requesting a change of placement; or4. the course has a compulsory attendance requirement. <p>Before applying you must refer to the Adverse Circumstance Affecting Assessment Items Procedure available at: https://policies.newcastle.edu.au/document/view-current.php?id=236</p>
Important Policy Information	The Help button in the Canvas Navigation menu contains helpful information for using the Learning Management System. Students should familiarise themselves with the policies and procedures at https://www.newcastle.edu.au/current-students/respect-at-uni/policies-and-procedures that support a safe and respectful environment at the University.

This course outline was approved by the Head of School. No alteration of this course outline is permitted without Head of School approval. If a change is approved, students will be notified and an amended course outline will be provided in the same manner as the original.

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