STAT680

Applied Statistics

S1 External 2018

Dept of Statistics

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General Information

Unit convenor and teaching staff
Unit Convenor
Justin Wishart
justin.wishart@mq.edu.au
Contact via justin.wishart@mq.edu.au
Room 6.39, Level 6, 12 Wally's Walk (E7A)
9:30-11:30am Monday

Credit points
4

Prerequisites
Admission to MAppStat or GradCertAppStat or GradDipAppStat or MSc or MDataSc or MLabQAMgt or PGCertLabQAMgt or GradDipLabQAMgt or GradCertLabQAMg

Corequisites
STAT670

Co-badged status

Unit description
This unit aims to extend and broaden statistical experience from STAT670, with a focus on application to real-world analysis. It covers relationships between categorical or continuous explanatory variables and a continuous response variable using the techniques of one-way and two-way analysis of variance and simple and multiple linear regression. Data management, report writing, graphical presentation of results, and power analysis are described.

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:

> Produce and interpret appropriate visual displays and numerical summaries
>
> Understand and apply appropriate statistical methods and models to provide answers to research questions. Models include one way ANOVA, two way ANOVA, simple regression, and multiple regression.

Understand the assumptions underlying the models, and how they can be checked and, if invalid, how to modify the analysis.

Use statistical software to fit the models.

Understand and apply the nonparametric regression method of kernel smoothing for data where simple linear and multiple regression methods are inappropriate.

General Assessment Information

The supported statistical software for this unit is R/RStudio. Students will be given guidance on how to use this software and be expected to conduct their analyses using R/RStudio for the in-session assessments. Students should also note that the final examination will involve data analysis that contains inline R code that students need to interpret to answer the exam questions.

Serious and unavoidable disruption to studies and special consideration

Late submissions, extensions to assessment due dates or alternative assessments are not possible unless a student experienced a **serious and unavoidable** disruption to their studies or had a documented illness. In this case, students are required to notify the Faculty on the ask.mq.edu.au system and apply for special consideration. This special consideration process needs to be approved before any alternative assessment is offered.

Specific late assessment submission/completion policies

iLearn Quiz: The iLearn quiz will be unavailable after Monday Week 4 and late attempts are not possible unless the student is granted special consideration (see above).

Assignment: In the case of a late submission for the assignment, if no special consideration has been granted, 10% of the earned mark will be deducted for each 24 hour period or part thereof that the submission is late (for example, 25 hours late in submission - 20% penalty), up to a maximum of 50%. After 5 days, including weekends and public holidays, a mark of 0% will be awarded for the assignment.

NOTE: It is not the intention of this late penalty policy to cause a student to fail the unit when they have submitted their assignment no more than 5 days after the due date and they would have otherwise passed. In this case, if deductions for late assignments result in the final unit mark for a student being less than 50, when otherwise it would have been 50 or greater, the student's final mark will be exactly 50.

Final Exam policy

You are advised that 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.

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 the 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) 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.

Assessment Tasks

Name	Weighting	Hurdle	Due
iLearn Quiz	5%	No	Week 4
Mid Semester Exam	10%	No	Week 7
Assignment	15%	No	Week 12
Assignment 2	10%	No	Week 13
Final exam	60%	No	Examination period

iLearn Quiz

Due: **Week 4**
Weighting: **5%**

The quiz will become available Wednesday 12pm in Week 3 and due by 9am Monday Week 4. The duration of the test will be 30 minutes. The exercises will assess:

- The material covered in Weeks 1-2 of lectures (material covered in tutorials held in weeks 2-3).
- Ability to use statistical software to conduct statistical analyses.

The only excuse for not attempting the iLearn Quiz is due to a serious and unavoidable disruption. In these special circumstances you may apply for special consideration via ask.mq.edu.au.

On successful completion you will be able to:

- Produce and interpret appropriate visual displays and numerical summaries
- Understand and apply appropriate statistical methods and models to provide answers to research questions. Models include one way ANOVA, two way ANOVA, simple

regression, and multiple regression.
- Understand the assumptions underlying the models, and how they can be checked and, if invalid, how to modify the analysis.
- Use statistical software to fit the models.

Mid Semester Exam

Due: **Week 7**
Weighting: **10%**

In Week 7 a 40-minute test will be available on iLearn. The test will be available from Wednesday 5pm in Week 7 until Monday 9am the following week.

The test will cover material from lectures Weeks 1 - 5 (Tutorial Weeks 2 -- 6)

The only excuse for not sitting the mid-semester exam 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.

On successful completion you will be able to:
- Produce and interpret appropriate visual displays and numerical summaries
- Understand and apply appropriate statistical methods and models to provide answers to research questions. Models include one way ANOVA, two way ANOVA, simple regression, and multiple regression.
- Understand the assumptions underlying the models, and how they can be checked and, if invalid, how to modify the analysis.
- Use statistical software to fit the models.

Assignment

Due: **Week 12**
Weighting: **15%**

The Assignment will be due 5pm on Wednesday in Week 12. The assignment will cover all learning outcomes and focus mainly on the material covered in lectures from Weeks 7-10.

On successful completion you will be able to:
- Produce and interpret appropriate visual displays and numerical summaries
- Understand and apply appropriate statistical methods and models to provide answers to research questions. Models include one way ANOVA, two way ANOVA, simple regression, and multiple regression.
- Understand the assumptions underlying the models, and how they can be checked and,

if invalid, how to modify the analysis.
- Use statistical software to fit the models.

Assignment 2

Due: **Week 13**
Weighting: **10%**

The third Assignment will be due 5pm on Wednesday in Week 13. It will be based on the additional nonparametric regression material available on iLearn. The assignment will cover:

- Nonparametric kernel smoothing regression methods.
- Ability to use statistical software to conduct statistical analyses.

This Assessment Task relates to the following Learning Outcomes:

- Understand and apply the nonparametric regression method of kernel smoothing for data where simple linear and multiple regression methods are inappropriate.
- Use statistical software to fit the models.

On successful completion you will be able to:
- Use statistical software to fit the models.
- Understand and apply the nonparametric regression method of kernel smoothing for data where simple linear and multiple regression methods are inappropriate.

Final exam

Due: **Examination period**
Weighting: **60%**

The Final Examination will be a three hour written exam (plus ten minutes reading time) and will be held during the examination period. The relevant statistical tables will be attached to the examination paper. Students will be permitted to take **one A4 sheet, handwritten** into the final examination. This sheet can be one-sided or two sided. This sheet **must** be submitted with your final exam paper at the conclusion of the final exam. The final exam will assess all topics of STAT270. This Assessment Task relates to the following Learning Outcomes:

- Produce and interpret appropriate visual displays and numerical summaries
- Understand and apply appropriate statistical methods and models to provide answers to research questions. Models include one way ANOVA, two way ANOVA, simple regression, and multiple regression.
- Understand the assumptions underlying the models, and how they can be checked and, if invalid, how to modify the analysis.

The University Examination timetable will be available in draft form approximately eight weeks

before the commencement of the examinations and in final form approximately four weeks before the commencement of the examinations.

On successful completion you will be able to:

- Produce and interpret appropriate visual displays and numerical summaries
- Understand and apply appropriate statistical methods and models to provide answers to research questions. Models include one way ANOVA, two way ANOVA, simple regression, and multiple regression.
- Understand the assumptions underlying the models, and how they can be checked and, if invalid, how to modify the analysis.

Delivery and Resources

Textbook

There is no prescribed textbook.

Software

You are required to use R/RStudio to perform data analyses. You will use R/RStudio as part of the tutorials, and you can use the software in the E4B labs when they are not booked for classes. You can find more information on RStudio at their web site: https://www.rstudio.com/. The software is freely available to download at no cost for all standard operating systems (Windows, Mac OS and Linux) at https://www.rstudio.com/products/rstudio/download/.

Additional References

These recommended books are available in Reserve at the library.

- Moore, D.S., McCabe, G. P. and Craig, B.A. (2014) Introduction to the Practice of Statistics, Eighth Edition (W.H. Freeman)
- De Veaux, R.D., Velleman, P.F. and Bock, D.E. (2004) Stats Data and Models (Pearson)
- Ramsay, F.L. and Schafer, D.W. (2002) The Statistical Sleuth (Wadsworth)

There are other books that are useful but not guaranteed to be available in Reserve at the library.

- Anderson, J. and Poole, M. (2002) Thesis and Assignment Writing (Wiley)
- Chatterjee, S. Hadi, A. and Price, B. (2006) Regression Analysis By Example (Wiley)
- Devore, J. and Peck, R (2005) Statistics The Exploration and Analysis of Data (Brooks/Cole)
- Utts, J.M. and Heckard, R. F. (2004) Mind on Statistics, (Duxbury Press)
- Utts, J.M. and Heckard, R. F. (2006) Statistical Ideas and Methods, (Duxbury Press)

Online Textbooks

- SurfStat at http://surfstat.anu.edu.au/surfstat-home/surfstat.html is a complete introductory statistics course.
- HyperStat Online at http://davidmlane.com/hyperstat/index.html is at an intermediate level stats course covering ANOVA.
- StatSoft Electronic Textbook at http://www.statsoft.com/textbook/stathome.html is more advanced and material is covered in sections called ANOVA/MANOVA and Linear Regression.

Unit Schedule

Week (begins)	Lectures	Work due
1 (26 Feb)	Review: One sample tests and one sided tests;	
2 (5 Mar)	Review: Two sample tests and validation and report writing	
3 (12 Mar)	One way ANOVA	
4 (19 Mar)	One way ANOVA, Multiple comparisons and Transformations	iLearn quiz
5 (26 Mar)	Transformations; Non-parametrics; Power and Sample Size	
6* (3 Apr)	Data collection and management; Rmarkdown	
7 (9 Apr)	Simple linear regression and transformations	Mid Semester Exam
	Mid-Semester Break	
8 (30 Apr)	Multiple regression	
9 (7 May)	Multiple regression	
10 (14 May)	Two-way ANOVA	
11 (21 May)	Two-way ANOVA continued and Multiple comparisons	
12 (28 May)	ANOVA - Regression connection	Assignment
13 (4 Jun)	Revision	
	**Public Holiday Monday 2nd April*	

Policies and Procedures

Macquarie University policies and procedures are accessible from Policy Central (https://staff.m

q.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.)*

Undergraduate students seeking more policy resources can visit the 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 (https://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 shown in *iLearn*, 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.

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) provides academic writing resources and study strategies to improve your marks and take control of your study.

- Workshops
- StudyWise
- Academic Integrity Module for Students
- Ask a Learning Adviser

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

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.

Graduate Capabilities

Capable of Professional and Personal Judgement and Initiative

We want our graduates to have emotional intelligence and sound interpersonal skills and to demonstrate discernment and common sense in their professional and personal judgement. They will exercise initiative as needed. They will be capable of risk assessment, and be able to handle ambiguity and complexity, enabling them to be adaptable in diverse and changing environments.

This graduate capability is supported by:

Learning outcomes

- Produce and interpret appropriate visual displays and numerical summaries
- Understand and apply appropriate statistical methods and models to provide answers to research questions. Models include one way ANOVA, two way ANOVA, simple regression, and multiple regression.
- Understand the assumptions underlying the models, and how they can be checked and, if invalid, how to modify the analysis.
- Use statistical software to fit the models.

Assessment tasks

- iLearn Quiz
- Mid Semester Exam
- Assignment
- Final exam

Discipline Specific Knowledge and Skills

Our graduates will take with them the intellectual development, depth and breadth of knowledge, scholarly understanding, and specific subject content in their chosen fields to make them competent and confident in their subject or profession. They will be able to demonstrate, where relevant, professional technical competence and meet professional standards. They will be able to articulate the structure of knowledge of their discipline, be able to adapt discipline-specific knowledge to novel situations, and be able to contribute from their discipline to inter-disciplinary solutions to problems.

This graduate capability is supported by:

Learning outcomes

- Produce and interpret appropriate visual displays and numerical summaries
- Understand and apply appropriate statistical methods and models to provide answers to research questions. Models include one way ANOVA, two way ANOVA, simple regression, and multiple regression.
- Understand the assumptions underlying the models, and how they can be checked and, if invalid, how to modify the analysis.
- Use statistical software to fit the models.
- Understand and apply the nonparametric regression method of kernel smoothing for data where simple linear and multiple regression methods are inappropriate.

Assessment tasks

- iLearn Quiz
- Mid Semester Exam
- Assignment
- Assignment 2
- Final exam

Critical, Analytical and Integrative Thinking

We want our graduates to be capable of reasoning, questioning and analysing, and to integrate and synthesise learning and knowledge from a range of sources and environments; to be able to critique constraints, assumptions and limitations; to be able to think independently and systemically in relation to scholarly activity, in the workplace, and in the world. We want them to have a level of scientific and information technology literacy.

This graduate capability is supported by:

Learning outcomes

- Produce and interpret appropriate visual displays and numerical summaries
- Understand and apply appropriate statistical methods and models to provide answers to

research questions. Models include one way ANOVA, two way ANOVA, simple regression, and multiple regression.
- Understand the assumptions underlying the models, and how they can be checked and, if invalid, how to modify the analysis.
- Use statistical software to fit the models.
- Understand and apply the nonparametric regression method of kernel smoothing for data where simple linear and multiple regression methods are inappropriate.

Assessment tasks

- iLearn Quiz
- Mid Semester Exam
- Assignment
- Assignment 2
- Final exam

Problem Solving and Research Capability

Our graduates should be capable of researching; of analysing, and interpreting and assessing data and information in various forms; of drawing connections across fields of knowledge; and they should be able to relate their knowledge to complex situations at work or in the world, in order to diagnose and solve problems. We want them to have the confidence to take the initiative in doing so, within an awareness of their own limitations.

This graduate capability is supported by:

Learning outcomes

- Understand and apply appropriate statistical methods and models to provide answers to research questions. Models include one way ANOVA, two way ANOVA, simple regression, and multiple regression.
- Understand the assumptions underlying the models, and how they can be checked and, if invalid, how to modify the analysis.
- Use statistical software to fit the models.
- Understand and apply the nonparametric regression method of kernel smoothing for data where simple linear and multiple regression methods are inappropriate.

Assessment tasks

- iLearn Quiz
- Assignment 2
- Final exam

Effective Communication

We want to develop in our students the ability to communicate and convey their views in forms effective with different audiences. We want our graduates to take with them the capability to read, listen, question, gather and evaluate information resources in a variety of formats, assess, write clearly, speak effectively, and to use visual communication and communication technologies as appropriate.

This graduate capability is supported by:

Learning outcome

- Understand and apply the nonparametric regression method of kernel smoothing for data where simple linear and multiple regression methods are inappropriate.

Assessment tasks

- Mid Semester Exam
- Assignment
- Assignment 2

Changes from Previous Offering

Mid-semester test introduced.