# STAT271

## Statistics I

S2 Day 2019

*Dept of Mathematics and Statistics*

## Contents


| | |
|---|---|
| General Information | 2 |
| Learning Outcomes | 3 |
| General Assessment Information | 3 |
| Assessment Tasks | 4 |
| Delivery and Resources | 6 |
| Unit Schedule | 7 |
| Policies and Procedures | 7 |
| Graduate Capabilities | 9 |

# General Information

Unit convenor and teaching staff
Lecturer in charge
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See iLearn for consultation hours

Lecturer
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Credit points
3

Prerequisites
STAT272

Corequisites

Co-badged status

Unit description
This is a unit in statistical methods for the analysis of data in which attention is given to the theoretical structure underlying the techniques. It aims to equip students with a wide understanding of statistics such that they are able to employ appropriate methods of analysis in various circumstances. The techniques learned are widely used in the sciences, social sciences, business and many other fields of study. This unit is designed for students majoring in statistics and/or actuarial studies.
Topics include: inference about one and two sample problems using normal theory and non-parametric methods; analysis of variance; multiple comparisons; and regression.

## 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:

Understand and apply the concepts of parameter estimation (point and interval), including asymptotic properties.

Correctly identify and implement standard normal and nonparametric inference procedures for one, two and multiple populations.

Understand basic analysis of categorical data (binomial, multinomial and bivariate).

Understand the theory and uses of simple and multiple linear regression with practical application using RStudio.

# General Assessment Information

**HURDLES**: This unit has no hurdle requirements.

**ATTENDANCE and PARTICIPATION:** Please contact the unit convenor as soon as possible if you have difficulty attending and participating in any classes. There may be alternatives available to make up the work. If there are circumstances that mean you miss a class, you can apply for a Special Consideration.

**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 scanned 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 submitting 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 assignments or assessments must be submitted by the official due date and time. No marks will be given to late work unless an extension has been granted following a successful application for Special Consideration. Please contact the unit

convenor for advice as soon as you become aware that you may have difficulty meeting any of the assignment deadlines. It is in your interests to make frequent submissions of your partially completed work. Note that later submissions completely replace any earlier submission, and so only the final submission made before the due date will be marked.

**FINAL EXAM POLICY:** 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.

**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. You can check the supplementary exam information page on FSE101 in iLearn (https://bit.ly/FSESupp) for dates, and 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 | Due in week 5 |
| Assignment 2 | 15% | No | Due in week 10 |
| Test | 20% | No | Week 8 |
| Exam | 50% | No | University Examination Period |

## Assignment 1

Due: **Due in week 5**
Weighting: **15%**

This assignment will cover the lecturing materials for weeks 1 - 5.

On successful completion you will be able to:

- Understand and apply the concepts of parameter estimation (point and interval), including asymptotic properties.
- Correctly identify and implement standard normal and nonparametric inference procedures for one, two and multiple populations.

## Assignment 2

Due: **Due in week 10**
Weighting: **15%**

This assignment covers the lecturing materials from weeks 6 - 9.

On successful completion you will be able to:

- Understand and apply the concepts of parameter estimation (point and interval), including asymptotic properties.
- Correctly identify and implement standard normal and nonparametric inference procedures for one, two and multiple populations.
- Understand basic analysis of categorical data (binomial, multinomial and bivariate).

## Test

Due: **Week 8**
Weighting: **20%**

This is a 45 min Class Test. It covers material from weeks 1 - 7 lectures.

Students are permitted to take into the test room one (1) A4 page of personal summary of formulae or notes, hand-written on one or both sides of the page. Students will be permitted to keep this sheet with them at the completion of the tests. Some formulae will be provided (as per statistical tables available on iLearn); all necessary statistical tables will be provided.

On successful completion you will be able to:

- Understand and apply the concepts of parameter estimation (point and interval), including asymptotic properties.
- Correctly identify and implement standard normal and nonparametric inference procedures for one, two and multiple populations.
- Understand basic analysis of categorical data (binomial, multinomial and bivariate).

## Exam

Due: **University Examination Period**
Weighting: **50%**

This is a 3-hour written exam and it is to be scheduled in the university exam period and it covers all the materials told in the semester. For this exam, students are allowed to bring into the exam room TWO A4 paper written on both sides; photocopies **are not** allowed. Only non-programmable calculators that do not have text retrieval capacity are allowed. Students who apply Supplementary Exams must make themselves available during the supplementary exam period.

On successful completion you will be able to:

- Understand and apply the concepts of parameter estimation (point and interval), including asymptotic properties.
- Correctly identify and implement standard normal and nonparametric inference procedures for one, two and multiple populations.
- Understand basic analysis of categorical data (binomial, multinomial and bivariate).
- Understand the theory and uses of simple and multiple linear regression with practical application using RStudio.

# Delivery and Resources

**Lectures:** STAT271 is delivered by lectures (3 per week), commencing in week 1. All teaching material will be available on iLearn.

**SGTAs**: Students are to attend one SGTA per week starting in week 2, as per the class allocated at enrolment. SGTA Exercises will be available from iLearn prior to the SGTA. Students are expected to have attempted these prior to the SGTA. Solutions will be explained, with emphasis on any area students had trouble with. At the end of the week, these solutions will then be placed on iLearn.

**Software:** The supported statistical software for this unit is R/RStudio. Students need to practice how to use the software and be expected to conduct their analyses using R/RStudio for the assignments. Students should also note that the final examination may involve data analysis that contains inline R codes and output that students need to interpret to answer the exam questions.

**Required and Recommended Texts and/or Materials** Recommended: Mendenhall W, Wackerly D and Scheaffer R. “Mathematical Statistics with Applications”, Seventh Edition QA276 .M426 2008 Copies of this book are held in Special Reserve in the University Library. The Library also holds copies of the sixth and previous editions as well as the Student solutions manual. The following books are useful references for this unit:

| Authors | Title | Library Call No. |
|---|---|---|
| Bain, L.J. & Engelhardt, M | Introduction to Probability and Mathematical Statistics | QA273.B2546/1992 |
| Conover, W.J. | Practical Nonparametric Statistics | QA278.8.C65/1999 |
| Hogg, R.V. & Craig, A.T. | Introduction to Mathematical Statistics | QA276.H59 / 1995 |
| Larson, H.J. | Introduction to Probability Theory and Statistical Inference | QA273.L352/1982 |
| Walpole, R.E. & Myers, R.H. | Probability and Statistics for Engineers and Scientists | TA340.W35/1993 |

# Unit Schedule

| Topic | Description |
|---|---|
| 1 | **Parameter Estimation:** Point estimation methods, including the method of moments and maximum likelihood. Properties of estimators. Asymptotic (large sample) properties. |
| 2 | **Sampling distributions**: Properties of and distributions of sample statistics. Definition and derivation of t, F and chi-squared distributions etc. |
| 3 | **Interval estimation**: Pivotal quantities and confidence intervals. |
| 4 | **Inference Theory**: Principles of hypothesis testing. Type I and Type II errors. Power. Comparison of competing tests. Relationship between confidence intervals and hypothesis testing. |
| 5 | **Binomial**: Confidence intervals and hypothesis testing for the probability parameter in the binomial distribution. |
| 6 | **Single population inference:** Confidence intervals and hypothesis testing (for location and scale), including related samples (paired comparisons). Classical (normal theory) and nonparametric procedures are considered. |
| 7 | **Two populations inference**: Confidence intervals and hypothesis testing (for location and scale). Classical (normal theory) and nonparametric procedures are considered. |
| 8 | **Categorical data inference:** goodness of fit tests; tests of association; and tests of homogeneity (chi-squared tests). |
| 9 | **Correlation and linear regression:** Model fitting and inference for simple and multiple linear regression. |
| 10 | **k populations inference:** One-way analysis of variance and nonparametric techniques. Multiple comparisons and contrasts. |
| 11 | **Inference for two factor designs:** normal theory (two-way analysis of variance) and nonparametric techniques. Multiple comparisons and contrasts. |

# Policies and Procedures

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

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.

# Graduate Capabilities

## 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

- Understand and apply the concepts of parameter estimation (point and interval), including asymptotic properties.
- Correctly identify and implement standard normal and nonparametric inference procedures for one, two and multiple populations.
- Understand basic analysis of categorical data (binomial, multinomial and bivariate).
- Understand the theory and uses of simple and multiple linear regression with practical application using RStudio.

### Assessment tasks

- Assignment 1
- Assignment 2
- Test
- 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:

### Assessment task

- Assignment 2

## 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:

### Assessment task

- Assignment 2

## 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 outcomes

- Understand and apply the concepts of parameter estimation (point and interval), including asymptotic properties.
- Correctly identify and implement standard normal and nonparametric inference procedures for one, two and multiple populations.
- Understand basic analysis of categorical data (binomial, multinomial and bivariate).
- Understand the theory and uses of simple and multiple linear regression with practical application using RStudio.

### Assessment tasks

- Assignment 1
- Test
- Exam