STAT1371

Statistical Data Analysis

Session 1, In person-scheduled-weekday, North Ryde 2022

School of Mathematical and Physical Sciences

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General Information

Unit convenor and teaching staff
Unit Convenor/Lecturer
Thomas Fung
thomas.fung@mq.edu.au
12WW 626
please refer to iLearn

Lecturer
Houying Zhu
houying.zhu@mq.edu.au
12WW 705
please refer to iLearn

Credit points
10

Prerequisites
(HSC Mathematics Extension 1 or Extension 2) or (10cp from MATH1000 or MATH1010-MATH1025 or MATH130-MATH136) or admission to BActStud or BActStudBSc or BAppFinBActStud or BActStudBProfPrac or BActStudProfPrac(Hons) or BMathSc

Corequisites

Co-badged status

Unit description
This unit is intended for students with a high level of proficiency in mathematics. The unit provides an introduction to modern statistical principles and practice with special emphasis on data analytical techniques. The aim of the unit is to promote an understanding of the principles involved in statistical analysis of simple data sets using elementary techniques. Data analysis will be carried out using an appropriate statistical package. The unit includes topics such as numeric and visual summaries of sample data; data quality; basic probability and random variables, including the binomial, Poisson, negative binomial, hypergeometric, uniform and normal distributions. Sampling distributions and their important properties are used to investigate estimates and their accuracy. Statistical inference techniques are considered such as tests of means, proportions, categorical data as well as regression and correlation.

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: explain the difference between populations and samples, and apply appropriate statistical techniques to analyse different types of variables

ULO2: Understand and apply basic probability concepts to both discrete and continuous variables for solving problems

ULO3: evaluate application of the scientific method through estimation and statistical inference for means, proportions, categorical data and linear regression

ULO4: Demonstrate foundational learning skills including active engagement in their learning process.

General Assessment Information

HURDLES: Attendance at, and reasonable engagement in, Small Group Teaching Activities (SGTA) and practical classes in this unit is **compulsory**. Attendance and reasonable engagement in the class activities in at least 10 out of 12 of the classes are requirements to pass the unit. This is a hurdle requirement.

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 will miss a class, you can apply for Special Consideration via ask.mq.edu.au.

WEB QUIZZES: Further information will be made available via iLearn in due course.

TESTS: There will be of one 1 hour online test conducted via iLearn in Week 7. Further information will be supplied in the week prior to the test.

LATE SUBMISSION OF WORK: Online quizzes, in-class activities, or scheduled tests and exam must be undertaken at the time indicated in the unit guide. Should these activities be missed due to illness or misadventure, students may apply for Special Consideration. There is no non-timed assessment in this unit so late submission is not allowed without a successful special consideration request.

FINAL EXAM POLICY: 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 this 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.

Approved applicants will receive an individual notification about one week prior to the exam with the exact date and time of their supplementary examination.

Assessment Tasks

Name	Weighting	Hurdle	Due
SGTA Participation	0%	Yes	Weekly
Practical Participation	0%	Yes	Weekly
Web Quizzes	20%	No	Weekly
Mid-Semester Test	20%	No	Week 7
Final Exam	60%	No	Formal Examination Period

SGTA Participation

Assessment Type [1]: Participatory task
Indicative Time on Task [2]: 0 hours
Due: **Weekly**
Weighting: **0%**
This is a hurdle assessment task (see assessment policy for more information on hurdle assessment tasks)

Attendance and reasonable engagement in at least 80% of the SGTA classes is a requirement to pass the unit.

On successful completion you will be able to:

- explain the difference between populations and samples, and apply appropriate statistical techniques to analyse different types of variables
- Understand and apply basic probability concepts to both discrete and continuous variables for solving problems
- evaluate application of the scientific method through estimation and statistical inference for means, proportions, categorical data and linear regression
- Demonstrate foundational learning skills including active engagement in their learning process.

Practical Participation

Assessment Type [1]: Participatory task
Indicative Time on Task [2]: 0 hours
Due: **Weekly**
Weighting: **0%**
This is a hurdle assessment task (see assessment policy for more information on hurdle assessment tasks)

Attendance and reasonable engagement in at least 80% of the practical classes is a requirement to pass the unit.

On successful completion you will be able to:

- explain the difference between populations and samples, and apply appropriate statistical techniques to analyse different types of variables
- Understand and apply basic probability concepts to both discrete and continuous variables for solving problems
- evaluate application of the scientific method through estimation and statistical inference for means, proportions, categorical data and linear regression
- Demonstrate foundational learning skills including active engagement in their learning process.

Web Quizzes

Assessment Type [1]: Quiz/Test
Indicative Time on Task [2]: 11 hours
Due: **Weekly**
Weighting: **20%**

There are eleven quizzes, due at approximately weekly intervals.

On successful completion you will be able to:

- explain the difference between populations and samples, and apply appropriate statistical techniques to analyse different types of variables
- Understand and apply basic probability concepts to both discrete and continuous variables for solving problems

- evaluate application of the scientific method through estimation and statistical inference for means, proportions, categorical data and linear regression

Mid-Semester Test

Assessment Type [1]: Quiz/Test
Indicative Time on Task [2]: 1 hours
Due: **Week 7**
Weighting: **20%**

Mid-Semester Test

On successful completion you will be able to:

- explain the difference between populations and samples, and apply appropriate statistical techniques to analyse different types of variables
- Understand and apply basic probability concepts to both discrete and continuous variables for solving problems

Final Exam

Assessment Type [1]: Examination
Indicative Time on Task [2]: 3 hours
Due: **Formal Examination Period**
Weighting: **60%**

An invigilated examination held during the University's formal examination period.

On successful completion you will be able to:

- explain the difference between populations and samples, and apply appropriate statistical techniques to analyse different types of variables
- Understand and apply basic probability concepts to both discrete and continuous variables for solving problems
- evaluate application of the scientific method through estimation and statistical inference for means, proportions, categorical data and linear regression
- Demonstrate foundational learning skills including active engagement in their learning process.

[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

Important message to off-shore students

Off-shore students **must** email the convenor as soon as possible to discuss study options.

Lectures

There is one 2-hour lecture per week and they start from Week 1.

Small-Group Teaching Activities (SGTAs)

SGTA classes will start in week 2. Students must attend and participate a minimum of at least 80% of the classes that they are registered in to obtain a passing grade. If you are unavailable for your SGTA class in a particular week, you must submit a Special Consideration application (see General Assessment Information for further details).

Practicals

Practical classes will start in week 2. Students must attend and participate a minimum of at least 80% of the classes that they are registered in to obtain a passing grade. If you are unavailable for your practical class in a particular week, you must submit a Special Consideration application (see General Assessment Information for further details).

Maths Background Quiz

This is a set of questions (pdf format) to allow students to assess whether they have sufficient mathematics in their background for STAT1371. Students are to attempt the quiz in their own time and mark it using the supplied solutions. Only students intending to do an Actuarial Studies degree have STAT1371 as a core unit. For all other students, you should do the one of FOSE1015, STAT1170 or STAT1250 based on your degree requirement.

Calculators

Each student will need a small calculator, preferably one that does simple statistical calculations (it should have at least mean and standard deviation capability). You should bring it to all SGTA classes. A calculator will also be needed for the mid-session tests and the final examination. You will **not** be permitted to use a programmable calculator or one with a full alpha character set in any examination.

Recommended text:

Diez, D.M., Barr, C.D. & Çetinkaya-Rundel, M. (2012) *OpenIntro statistics*. Open Textbook Library (Corporate Author) (ed.). [Online]. OpenIntro. Available from: https://open.umn.edu/

opentextbooks/BookDetail.aspx?bookId=60.

Mendenhall, W. Beaver, R.J. and Beaver, B.M. (2019) Introduction to Probability and Statistics. Metric Edition. Cengage Learning Custom P.

Hadley Wickham (2017) *R for data science : import, tidy, transform, visualize, and model data / Hadley Wickham & Garrett Grolemund.* First edition. Garrett Grolemund & ProQuest (Firm) (eds.). Sebastopol, CA : O'Reilly Media.Lisa DeBruine & Dale Barr. (n.d.) *Data Skills for Reproducible Science (Version 1.0.0)*.

Other References (Note that many of the listed books' older editions are also useful references).

Previous editions of the textbook QA276.M425/2009

Johnson, Richard A. and Bhattacharyya Gouri K. (Ed 7, 2014) 'Statistics: Principles and Methods'

McClave, J. and Sincich, T. 'Statistics' (Ed12).

Devore, Jay L. 'Statistics: the exploration and analysis of data' (Ed 5)

Moore D.S. & McCabe G.P., 'Introduction to the Practice of Statistics' (Ed 5)

Griffiths D. et al., (1998) 'Understanding Data - Principles and Practice of Statistics'

Mendenhall, W. & Ott, L., 'Understanding Statistics' (Ed 3)

Hamilton, Lawrence C. 'Modern Data Analysis: a first course in applied statistics'

Phipps, M.C. & Quine, M.P. 'A Primer of Statistis' (Ed 4).

Clarke, G.M. & Cooke D. 'A Basic Course in Statistics' (Ed 5)

Koopmans L.H., 'Introduction to Contemporary Statistical Methods' (Ed 2)

Chatfield, C., 'Statistics for technology: a course in applied statistics' (Ed 3)

Huntsberger D.V. & Billingsley, P., 'Elements of Statistical Inference', (Ed 6)

Agresti, A. & Franklin, C. 'Statistics: the art and science of learning from data'

Computing and Software

R and RStudio: These are freely available to download from the Web, and they will be used for data analysis in this unit. See Topic 1 for more info.

Unit Schedule

Topics covered:

1.	**Sample Descriptives** Visual and numerical summaries for both categorical and measured variables.

2.	**Probability** Basic probability concepts and applications: events, sets, joint probability, conditional probability, independence and Bayes' Theorem.
3.	**Discrete random variables** Evaluation of general expectation and variance. Properties of sums of random variables. Specific distributions covered: Bernoulli, Binomial, Poisson, Geometric, Negative Binomial and Hypergeometric. Poisson approximation to the binomial distribution.
4.	**Continuous random variables** Evaluation of general expectation and variance (using calculus). Specific distributions covered: uniform, polynomial based probability distributions and the normal distribution.
5.	**Sampling distributions** Distributions of sample statistics: the sample total and sample mean. Mean and variance of linear transforms of a random variable. The Central Limit Theorem, including normal approximation for continuous and discrete random variables, with particular applications to the Binomial, Poisson and Negative Binomial distributions (with continuity correction).
6.	**Introduction to inference** The scientific method, with particular application to hypothesis testing for a single population mean (one-sample z-test). Type I and Type II errors. Confidence interval, sample size and power.
7.	**Inference for one population mean** Application of the one-sample t-test and confidence interval. Investigating normality, particularly normal scores plots.
8.	**Inference for two population means** The two-sample t-test (and evaluate confidence intervals) for the difference in two population means. The "modified" two-sample t-test. Basics of experimental design, with particular application to the paired t-test.
9.	**Correlation and Regression** Correlation for two measured variables. The difference between correlation and causation. Simple linear regression, including estimation and inference for the coefficients, the mean function and prediction intervals. Assumption diagnostics.
10.	**Categorical Data Analysis** Large-sample inference procedures regarding proportions (for one and two populations). Hypothesis testing, confidence intervals and sample size requirements. Inference for categorical data, including goodness of fit tests, independence tests for contingency tables, pooling of variable levels.

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 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.