STAT171

Statistical Data Analysis

S1 Day 2019

Dept of Mathematics and Statistics

Contents

General Information

Unit convenor and teaching staff
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Credit points
3

Prerequisites
(HSC Mathematics Extension 1 or Extension 2) or (3cp from MATH130-MATH136(P)) or admission to BActStud or BActStudBSc or BAppFinBActStud or BActStudBProfPrac

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 the statistical package Minitab. 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:

Understand the concepts of populations and samples, and be able to apply suitable statistical techniques for different types of variables.

Understand basic probability concepts, and be able to apply these to both discrete and continuous variables.

Understand 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.

General Assessment Information

HURDLES: Attendance at, and reasonable engagement in, small group teaching activities in all first year mathematics and statistics units is compulsory. Participation will be assessed via rosters and observation of students' work during classes. 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 miss a class, you can apply for a Special Consideration via ask.mq.edu.au.

LATE SUBMISSION OF WORK: All assignments and assessment tasks must be submitted by the official due date and time. No marks will be given for 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.

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 STAT171. 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 or who are in the Advanced Mathematics intake have STAT171 as a compulsory unit. For all other students either STAT170 (for general students) or STAT150 (for Faculty of Business and Economics students) is equivalent in terms of prerequisites.

WEB QUIZZES: are accessed via the WebAssign website. These are related to the text book,

which students are required to purchase in combination with the WebAssign access code from the University Co-op bookshop. Some "equity" access codes will be available, with the method of application to be outlined on iLearn. The quiz questions have been selected to reinforce material introduced in lectures and to give students practice. They are set at two levels with identical questions (but randomly generated numeric components are used):

1. **Practice** (non compulsory) - many attempts are allowed, with interactive help available. These are available on the WebAssign website, and a specific set of sample questions with check answers are available on the STAT171 iLearn site.
2. **Assessment** (part of assessment) - the highest mark of (up to) three attempts is used (no interactive help available). Students should use practice quizzes to become familiar with the questions and confident they understand the concepts prior to completing the assessment quizzes. Please note that at both levels, the quizzes may be saved mid attempt and resumed later (within the available time).

TESTS: These will be of 45 minute duration during a lecture time in week 7 and 11. For each test you may take in one A4 page (written on one or both sides) of summary notes into the tests. All statistical tables will be supplied. Further information will be supplied in the week prior to each test.

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
Small Group Teaching Activity	0%	Yes	Weeks 2-13

Name	Weighting	Hurdle	Due
Test One	15%	No	Week 7
Test Two	15%	No	Week 11
Web Quizzes	10%	No	Weekly from week 4
Final Exam	60%	No	University exam period

Small Group Teaching Activity

Due: **Weeks 2-13**
Weighting: **0%**
This is a hurdle assessment task (see assessment policy for more information on hurdle assessment tasks)

Attendance at and reasonable engagement in Small Group Teaching Activities (SGTA), in at least 10 out of 12 classes, is a requirement to pass the unit. This is a hurdle requirement. Participation will be assessed by instructors via rosters and observation of students' work during classes.

On successful completion you will be able to:

- Understand the concepts of populations and samples, and be able to apply suitable statistical techniques for different types of variables.
- Understand basic probability concepts, and be able to apply these to both discrete and continuous variables.
- Understand 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.

Test One

Due: **Week 7**
Weighting: **15%**

Covers Topics 1, 2 and 3.

On successful completion you will be able to:

- Understand the concepts of populations and samples, and be able to apply suitable statistical techniques for different types of variables.
- Understand basic probability concepts, and be able to apply these to both discrete and

continuous variables.

Test Two

Due: **Week 11**
Weighting: **15%**

Covers Topics 4, 5, 6, 7 and 8.

On successful completion you will be able to:

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

Web Quizzes

Due: **Weekly from week 4**
Weighting: **10%**

There are eleven quizzes, due at approximately weekly intervals. The total of the 11 percentages is used, with the final being capped at 10 (out of 10).

On successful completion you will be able to:

- Understand the concepts of populations and samples, and be able to apply suitable statistical techniques for different types of variables.
- Understand basic probability concepts, and be able to apply these to both discrete and continuous variables.
- Understand application of the scientific method through estimation and statistical inference for means, proportions, categorical data and linear regression.

Final Exam

Due: **University exam period**
Weighting: **60%**

A formal examination held during the University's examination period. You may take two A4 pages (written on one or both sides) of summary notes into the exam. Only non-programmable calculators with no text retrieval may be used.

On successful completion you will be able to:

- Understand the concepts of populations and samples, and be able to apply suitable statistical techniques for different types of variables.
- Understand basic probability concepts, and be able to apply these to both discrete and continuous variables.
- Understand application of the scientific method through estimation and statistical

inference for means, proportions, categorical data and linear regression.

Delivery and Resources

Lectures

There are three lectures per week. Students should bring to each lecture a copy of the pdf file of the lecture slides on which to make notes - these will be made available on iLearn in advance of each topic. Some "pop-ups" will be presented in the lectures which are not available in advance. All lectures will have an audio and visual recording made, accessible by students via the Echo-360 facility in iLearn.

Small Group Teaching Activities (SGTAs)

SGTA classes will start in week 1. Students are required to attend one SGTA class per week in the class that they are registered in, and must participate in a minimum of ten (10) of the twelve (12) classes from week 2, to obtain a passing grade. If you are unavailable for your SGTA class in a particular week, you may attend a different class to count as participation in that week. If you are unable to attend an SGTA class for the entire week, you must submit a Special Consideration application (see General Assessment Information for further details). Participation exercises will be handed out and collected during the class time.

The SGTA exercises to be completed prior to class will be available on iLearn by the end of the previous week and will consist of:

- questions which should have been attempted prior to the SGTA class - solutions will be discussed;
- questions denoted (**) indicating “difficult”;
- selected exercises from the textbook and other questions which will normally not be discussed during the SGTA class, but a fully worked solution will be made available on iLearn at the end of each week.

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.

Textbook

"Introduction to Probability and Statistics" Edition 15 (2019) ISBN : 9780357114469

(Cengage Learning) William Mendenhall, Robert J. Beaver, Barbara M. Beaver

This is the prescribed text book for STAT171, and is available as print (RRP $177.95) from the Co-op bookshop on campus or from the Cengage website or as an eBook (RRP $74.95) from the Cengage website. Coop bookshop members receive a discount, and information will be given in lectures regarding a 10% discount for on-line purchases. The text book is exceedingly

useful as a source of supplementary material. An access code to the online WebAssign quizzes will be provided when a purchase is made from the Co-op bookshop or the Cengage website (if purchased elsewhere, no access code will be provided).

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

Previous editions of the text book QA276.M425/2009

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

McClave, J. and Sincich, T. 'Statistics' (Ed12). (This was the text book from 2010-2014) QA276.12 .M4 2009

Ryan, B.F. & Joiner, B.L., 'Minitab Handbook', (Ed 4) QA276.4.R9/2001

Devore, Jay L. 'Probability and Statistics for Engineering and the Sciences' (Ed 4) QA273.D46/1995

Devore, Jay L. 'Statistics: the exploration and analysis of data' (Ed 5) QA273.D48 2005

Moore D.S. & McCabe G.P., 'Introduction to the Practice of Statistics' (Ed 5) QA276.12.M65 2006

Griffiths D. et al, (1998) 'Understanding Data - Principles and Practice of Statistics' QA276.G75

Mendenhall, W. & Ott, L., 'Understanding Statistics' (Ed 3) QA276.12.M46/1980

Hamilton, Lawrence C. 'Modern Data Analysis: a first course in applied statistics' QA276.12.H355/1990

Clarke, G.M. & Cooke D. 'A Basic Course in Statistics' (Ed 5) QA276.12.C57 2004

Koopmans L.H., 'Introduction to Contemporary Statistical Methods', (Ed 2) QA276.K65/1987

Chatfield, C., 'Statistics for technology: a course in applied statistics' (Ed 3) TA340.C45/1983

Huntsberger D.V. & Billingsley, P., 'Elements of Statistical Inference', (Ed 6) QA276.12 .H86/1987

Agresti, A. & Franklin, C. 'Statistics: the art and science of learning from data' QA276.12 .A37 2009

Computing and Software

Students will regularly need access to a computer with internet access. There are 160 computers available in rooms 17 Wally's Walk (C5C) Rooms 218 and 219 on the ground floor. The Help Desk is close by at 17 WW 244 for assistance with any IT problems. There are some student computers available also in the Student Connect area of MUSE. You can also access any of the 200 computers in the Library, Levels 1 and 2. Please see the website below for further information such as opening hours and conditions of use: http://www.mq.edu.au/about_us/offices_and_units/information_technology/help/

The following software will be used in STAT171:

Minitab (Version 18, although Versions 17 or 16 are fine): Macquarie University has a license agreement with Minitab which allows students to download a version of Minitab for their computer. Information and instructions for downloading are available from the student portal: https://my.mq.edu.au/ . Click on “Software Downloads” and select “Minitab”. NOTE: you will need to download the *license file* as well as the Minitab software. "Minitab Express" is available for users of Macintosh computers. See the separate document available on iLearn for detailed download instructions.

RStudio (and R): These are freely freely available to download from the Web - RStudio will be used as an optional package for data analysis.

Web quizzes are accessed via the WebAssign website. Basic internet access is needed for these, which will first become available in Week 3 of teaching. All students need an access code available with purchase of the text book or e-book (see above).

Unit Schedule

Topics covered:

1.	**Sample Descriptives** Visual and numerical summaries for both categorical and measured variables (univariate and bivariate). The effects of linear transforms on numeric summary statistics.
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 (standard and non-standard), polynomial based probability distributions and the normal distribution (standard and non-standard).
5.	**Sampling distributions** Distributions of sample statistics: the sample mean and total. 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.	**Inference for proportions** Large-sample inference procedures regarding proportions (for one and two populations). Hypothesis testing, confidence intervals and sample size requirements.
10.	**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.
11.	**Categorical Data Analysis** 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://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

Please note that the University Numeracy Centre, 14 Sir Christopher Ondaatje Avenue Room 188 (14 SCOA 188), can be of assistance with general background mathematics issues, and may be able to assist with some STAT171 content. For assistance with specific STAT171 issues, please use the STAT171 staff consultation hours. These will be posted in iLearn as soon as possible.

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.

This website is also available via the Macquarie home page and clicking on “Students” then “OneHelp – IT Help”. You have the choice of:

* lodging a One Help ticket;

* obtaining assistance over the phone (9850-4357);

* in person at the Helpdesk in C5C244.

Graduate Capabilities

Commitment to Continuous Learning

Our graduates will have enquiring minds and a literate curiosity which will lead them to pursue knowledge for its own sake. They will continue to pursue learning in their careers and as they participate in the world. They will be capable of reflecting on their experiences and relationships with others and the environment, learning from them, and growing - personally, professionally and socially.

This graduate capability is supported by:

Learning outcome

- Demonstrate foundational learning skills including active engagement in their learning process.

Assessment task

- Small Group Teaching Activity

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 the concepts of populations and samples, and be able to apply suitable statistical techniques for different types of variables.
- Understand basic probability concepts, and be able to apply these to both discrete and continuous variables.
- Understand application of the scientific method through estimation and statistical inference for means, proportions, categorical data and linear regression.

Assessment tasks

- Small Group Teaching Activity
- Test One
- Test Two
- Web Quizzes
- 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:

Assessment task

- Small Group Teaching Activity

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:

Assessment task

- Small Group Teaching Activity

Changes from Previous Offering

The text book is now Edition 15 (Edition 14 will not enable access to the web based quizzes).