STAT171

Statistical Data Analysis

S1 Day 2017

Dept of Statistics

Contents

General Information

Unit convenor and teaching staff
Lecturer-in-Charge
Ms Suzanne Curtis
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Contact via email or iLearn
Office location: E7A TBA
Consultation hours: TBA

Other teaching staff
Tutors

Credit points
3

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

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 and the 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 basic probability and random variables; data summarisation and display; data quality; and probability models for data including the normal, Poisson, binomial and sampling distributions and their important properties. Statistical inference techniques are considered such as estimates and their accuracy; tests of means; proportions and other characteristics; regression and correlation; and an introduction to the analysis of count data.

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.

General Assessment Information

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 an essential unit. For all other students either STAT170 (for general students) or STAT150 (for Faculty of Business and Economics students) is equivalent in terms of pre-requisites.

Web quizzes are accessed via the WebAssign website: These on-line quizzes are due at approximately weekly intervals. All students will be able to access the on-line quizzes from week 3 of teaching. These are related to the text book, to which students are strongly recommended to have access. The 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.

2. **Assessment** (part of assessment) - the higher mark of 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 One and Two: These will be of 45 minute duration during a lecture time. 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.

Assignments: These will be made available at least one week prior to the due date. Information regarding submission will be specified on each assignment. Late assignments will receive zero marks unless approved under the disruption to studies policy.

Disruption to Studies (final examination): If you notify the University of your disruption to studies for your final examination, you must make yourself available for the week of July 24 – 28, 2017. If you are not available at that time, there is no guarantee an additional examination time will be offered. Specific examination dates and times will be determined at a later date.

Assessment Tasks

Name	Weighting	Hurdle	Due
Web Quizzes	10%	No	Weekly from week 4
Assignment One	5%	No	Week 4
Assignment Two	5%	No	Week 12
Test One	10%	No	Week 6
Test Two	10%	No	Week 11
Exam	60%	No	University exam period

Web Quizzes

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

There are eleven quizzes, due at approximately weekly intervals. The 10 best marks are used and count 1% each in the assessment.

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.

Assignment One

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

Covers Topics 1 and 2.

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.

Assignment Two

Due: **Week 12**
Weighting: **5%**

Covers all Topics so far.

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.

Test One

Due: **Week 6**
Weighting: **10%**

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: **10%**

Covers Topics 4, 5, 6, 7, 8 and 9.

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.

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.

Tutorials

In 2017, optional tutorials in 100-level units have been scheduled for week 1. These are "casual" sessions designed to enable students to get to know their tutors, and mingle in a non formal setting. Further information will be made available in the first lecture in week 1.

Formal tutorials in STAT171 will begin in the **second** week of classes. Students are required to attend one tutorial per week as allocated at enrolment. It is *strongly* recommended that you attend your tutorial each week. You may only attend the tutorial to which you have been assigned. The tutorial exercises 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 tutorial - solutions will be discussed;
- questions denoted (**) indicating “difficult”;
- “discussion” question(s) for consideration during the tutorials (not available in advance);
- selected exercises from the textbook and other questions which will normally not be discussed during the tutorial, 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 tutorials. 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 14 (2013) ISBN 9781133103752 (Cengage Learning) William Mendenhall, Robert J. Beaver, Barbara M. Beaver

This is the prescribed text book for STAT171, and is available from the Co-op bookshop on campus as either Print ($169.95 or member $158.05) or in e-book format ($82.95 or member $78.80). It is exceedingly useful as a source of supplementary material. The on-line quizzes are based on this book.

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 C5C 218 and 219 on the ground floor of Building C5C (Student Computing Labs). The Help Desk is close by (C5C 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 (C3C), 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 17, although Version 16 is 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.

Web quizzes accessed via the WebAssign website: Basic internet access is needed for these. All students will be automatically registered for these in week 3.

Changes from previous delivery

- The sub-topic on odds ratios is no longer covered (as of 2014).
- The Topic on sample size and power has been combined with the topic on introduction to statistical inference.
- The text book (and web-quiz software) has been changed as from 2016.

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. Students should be aware of the following policies in particular with regard to Learning and Teaching:

Academic Honesty Policy http://mq.edu.au/policy/docs/academic_honesty/policy.html

Assessment Policy http://mq.edu.au/policy/docs/assessment/policy_2016.html

Grade Appeal Policy http://mq.edu.au/policy/docs/gradeappeal/policy.html

Complaint Management Procedure for Students and Members of the Public http://www.mq.edu.au/policy/docs/complaint_management/procedure.html

Disruption to Studies Policy (in effect until Dec 4th, 2017): http://www.mq.edu.au/policy/docs/disruption_studies/policy.html

Special Consideration Policy (in effect from Dec 4th, 2017): https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policies/special-consideration

In addition, a number of other policies can be found in the Learning and Teaching Category of 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/support/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

Please note that the University Numeracy Centre (C5A225) 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

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

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.
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Assessment tasks

- Web Quizzes
- Assignment One
- Assignment Two

- Test One
- Test Two
- 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 tasks

- Assignment One
- Assignment Two
- Test One
- Test Two
- 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:

Assessment tasks

- Web Quizzes
- Assignment One
- Assignment Two
- Test One
- Test Two
- 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:

Assessment tasks

- Assignment One
- Assignment Two
- Test Two
- Exam

Changes since First Published

Date	Description
13/02/2017	Added to the "Assessment Tasks" section (as per FSE request): "If you notify the University of your disruption to studies for your final examination, you must make yourself available for the week of July 24 – 28, 2017. If you are not available at that time, there is no guarantee an additional examination time will be offered. Specific examination dates and times will be determined at a later date."