



# STAT171

## Statistical Data Analysis

S1 Day 2016

*Dept of Statistics*

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#### **Disclaimer**

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## General Information

Unit convenor and teaching staff

Unit Convenor

Suzanne Curtis

[suzanne.curtis@mq.edu.au](mailto:suzanne.curtis@mq.edu.au)

Contact via email or iLearn

AHH (Australian Hearing Hub) Level 2

Consultation hours: TBA

Other teaching staff

Tutors

[email\(s\): TBA](#)

Contact via iLearn

Consultation location: TBA

Consultation hours: TBA

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:

Visual and numeric summaries of data (univariate and bivariate , categorical and measured). Linear transform effects on summary statistics.

Probability: events, sets, joint probability, conditional probability, independence, Bayes' Theorem

Discrete random variables: general expectation and variance, sums of random variables, Bernoulli, Binomial, Poisson, Geometric, Negative Binomial, Hypergeometric, Poisson approximation to binomial

Continuous random variables: general expectation and variance (using calculus), uniform (standard and non-standard), polynomial based probability distributions, normal (standard and non-standard)

Sampling distributions: mean and variance of linear transforms and sums of random variables. The Central Limit Theorem: normal approximation for general discrete and continuous random variables, with particular applications to Binomial, Poisson, Negative Binomial

Introduction to Statistical Inference: the scientific method, Confidence Intervals, Hypothesis Testing, Type I and Type II errors, one-sample z-test, sample size and power Inference regarding a single population mean (one sample t-test) and investigating normality (including normal scores plots)

Inference regarding two population means (two-sample z-test, two-sample t-test, paired t-test, modified two-sample t-test)

Inference regarding proportions (for one and two populations) from large samples : hypothesis testing and confidence intervals

Correlation and Regression: sample correlation and inference. Simple linear regression: hypothesis testing and interval estimation for the slope coefficient and mean function, prediction intervals for individuals, assumption diagnostics

Categorical data analysis: goodness of fit tests, independence tests for contingency tables, pooling of variable levels

All Topics

## General Assessment Information

**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. The text book does NOT have to be purchased to access the quizzes. The questions are associated with the text book - they 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).

**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.

## Assessment Tasks

Name	Weighting	Due
<u>Maths Background Quiz</u>	0%	Week 2
<u>Web Quizzes</u>	10%	Weekly from week 4
<u>Assignment One</u>	5%	Week 4
<u>Assignment Two</u>	5%	Week 12
<u>Test 1</u>	10%	Week 6
<u>Test 2</u>	10%	Week 11
<u>Exam</u>	60%	University exam period

## Maths Background Quiz

Due: **Week 2**

Weighting: **0%**

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.

On successful completion you will be able to:

- All Topics

## 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:

- All Topics

## Assignment One

Due: **Week 4**

Weighting: **5%**

Covers Topics 1 and 2.

On successful completion you will be able to:

- Visual and numeric summaries of data (univariate and bivariate , categorical and measured). Linear transform effects on summary statistics.
- Probability: events, sets, joint probability, conditional probability, independence, Bayes' Theorem
- Discrete random variables: general expectation and variance, sums of random variables, Bernoulli, Binomial, Poisson, Geometric, Negative Binomial, Hypergeometric, Poisson approximation to binomial

## Assignment Two

Due: **Week 12**

Weighting: **5%**

Covers all Topics so far.

On successful completion you will be able to:

- Inference regarding a single population mean (one sample t-test) and investigating normality (including normal scores plots)
- Inference regarding two population means (two-sample z-test, two-sample t-test, paired

t-test, modified two-sample t-test)

- Inference regarding proportions (for one and two populations) from large samples : hypothesis testing and confidence intervals
- Correlation and Regression: sample correlation and inference. Simple linear regression: hypothesis testing and interval estimation for the slope coefficient and mean function, prediction intervals for individuals, assumption diagnostics
- Categorical data analysis: goodness of fit tests, independence tests for contingency tables, pooling of variable levels

## Test 1

Due: **Week 6**

Weighting: **10%**

This will be of 45 minute duration during a lecture time. You may take 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 week 5.

On successful completion you will be able to:

- Visual and numeric summaries of data (univariate and bivariate , categorical and measured). Linear transform effects on summary statistics.
- Probability: events, sets, joint probability, conditional probability, independence, Bayes' Theorem
- Discrete random variables: general expectation and variance, sums of random variables, Bernoulli, Binomial, Poisson, Geometric, Negative Binomial, Hypergeometric, Poisson approximation to binomial

## Test 2

Due: **Week 11**

Weighting: **10%**

This will be of 45 minute duration during a lecture time. You may take 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 week 10.

On successful completion you will be able to:

- Continuous random variables: general expectation and variance (using calculus), uniform (standard and non-standard), polynomial based probability distributions, normal (standard and non-standard)
- Sampling distributions: mean and variance of linear transforms and sums of random

variables. The Central Limit Theorem: normal approximation for general discrete and continuous random variables, with particular applications to Binomial, Poisson, Negative Binomial

- Introduction to Statistical Inference: the scientific method, Confidence Intervals, Hypothesis Testing, Type I and Type II errors, one-sample z-test, sample size and power
- Inference regarding a single population mean (one sample t-test) and investigating normality (including normal scores plots)
- Inference regarding two population means (two-sample z-test, two-sample t-test, paired t-test, modified two-sample t-test)
- Inference regarding proportions (for one and two populations) from large samples : hypothesis testing and confidence intervals

## 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:

- All Topics

## 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

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. Tutorials in STAT171 will begin in the **second** week of classes. 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

Purchase of the text book either as Print (\$164.95) or in e-book format (\$76.95) not compulsory, however it is exceedingly useful as a source of supplementary material. It is **not** necessary to bring the textbook to tutorials or lectures. The on-line quizzes are based in 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. Computers are available in C5C rooms 211, 213, 217 and 219 for those students who do not own their own. Please see the website [http://mq.edu.au/about\\_us/offices\\_and\\_units/informatics/help/](http://mq.edu.au/about_us/offices_and_units/informatics/help/) for further information such as opening hours and conditions of use.

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. It is NOT necessary to purchase the text book , as all students enrolled in STAT171 will be automatically registered for these.

## 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 for 2016.

## 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](http://mq.edu.au/policy/docs/academic_honesty/policy.html)

**New Assessment Policy in effect from Session 2 2016** [http://mq.edu.au/policy/docs/assessment/policy\\_2016.html](http://mq.edu.au/policy/docs/assessment/policy_2016.html). For more information visit [http://students.mq.edu.au/events/2016/07/19/new\\_assessment\\_policy\\_in\\_place\\_from\\_session\\_2/](http://students.mq.edu.au/events/2016/07/19/new_assessment_policy_in_place_from_session_2/)

Assessment Policy prior to Session 2 2016 <http://mq.edu.au/policy/docs/assessment/policy.html>

Grading Policy prior to Session 2 2016 <http://mq.edu.au/policy/docs/grading/policy.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](http://www.mq.edu.au/policy/docs/complaint_management/procedure.html)

Disruption to Studies Policy [http://www.mq.edu.au/policy/docs/disruption\\_studies/policy.html](http://www.mq.edu.au/policy/docs/disruption_studies/policy.html) *The Disruption to Studies Policy is effective from March 3 2014 and replaces the Special Consideration Policy.*

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/](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](http://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](http://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](http://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/](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

### Creative and Innovative

Our graduates will also be capable of creative thinking and of creating knowledge. They will be imaginative and open to experience and capable of innovation at work and in the community. We want them to be engaged in applying their critical, creative thinking.

This graduate capability is supported by:

#### Learning outcome

- All Topics

### 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 outcome

- All Topics

## 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

- All Topics

## 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 outcome

- All Topics

### Assessment task

- 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 outcome

- All Topics

## 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 outcome**

- All Topics

## **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**

- All Topics

## **Assessment task**

- Exam

## **Engaged and Ethical Local and Global citizens**

As local citizens our graduates will be aware of indigenous perspectives and of the nation's historical context. They will be engaged with the challenges of contemporary society and with knowledge and ideas. We want our graduates to have respect for diversity, to be open-minded, sensitive to others and inclusive, and to be open to other cultures and perspectives: they should have a level of cultural literacy. Our graduates should be aware of disadvantage and social justice, and be willing to participate to help create a wiser and better society.

This graduate capability is supported by:

## **Learning outcome**

- All Topics

## **Socially and Environmentally Active and Responsible**

We want our graduates to be aware of and have respect for self and others; to be able to work with others as a leader and a team player; to have a sense of connectedness with others and country; and to have a sense of mutual obligation. Our graduates should be informed and active participants in moving society towards sustainability.

This graduate capability is supported by:

## Learning outcome

- All Topics

## Changes since First Published

Date	Description
06/01/2016	The Maths Background Quiz (worth 0% of assessment) has been added, as the item of necessary feedback to students within the first four weeks of teaching.