# STAT271

## Statistics I

S2 Day 2013

### Statistics

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### Disclaimer

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## General Information

<table>
<thead>
<tr>
<th>Unit convenor and teaching staff</th>
<th>Other Staff</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kenneth Beath</td>
<td></td>
</tr>
<tr>
<td><a href="mailto:ken.beath@mq.edu.au">ken.beath@mq.edu.au</a></td>
<td></td>
</tr>
<tr>
<td>Contact via <a href="mailto:ken.beath@mq.edu.au">ken.beath@mq.edu.au</a></td>
<td></td>
</tr>
<tr>
<td>E4A 507</td>
<td></td>
</tr>
<tr>
<td>Friday 2-4</td>
<td></td>
</tr>
</tbody>
</table>

### Unit Convenor

| Suzanne Curtis                  |             |
| suzanne.curtis@mq.edu.au       |             |
| Contact via suzanne.curtis@mq.edu.au |         |
| E4A 552                         |             |
| TBA                             |             |

### Credit points

3

### Prerequisites

STAT272(P)

### 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](https://www.mq.edu.au/study/calendar-of-dates)
Learning Outcomes

On successful completion of this unit, you will be able to:

- Point estimation methods, including the method of moments and maximum likelihood.
- Properties of estimators. Asymptotic large sample) properties.
- Sampling distributions and properties of sample statistics. Definition and derivation of t, F and chi-squared distributions etc.
- Interval estimation. Confidence intervals.
- Principles of hypothesis testing. Type I & II errors. Power. Comparison of competing tests. Relationship between confidence intervals and hypothesis testing.
- Confidence intervals and hypothesis testing for the probability parameter in the binomial distribution.
- Confidence intervals and hypothesis testing for location and scale in the single-population case, including related samples (paired comparisons). Classical (normal theory) and nonparametric tests are considered.
- Confidence intervals and hypothesis testing for location and scale in the two-population case. Classical (normal theory) and nonparametric tests are considered.
- Categorical data analysis (chi-squared tests): goodness of fit tests; tests of association; and tests of homogeneity.
- Hypothesis testing for k populations. One-way analysis of variance and nonparametric techniques. Multiple comparisons and contrasts.
- Hypothesis testing for two factor designs (two-way analysis of variance). Contrasts and multiple comparisons.
- Statistical theory and practice as described in learning outcomes 1-11.

Assessment Tasks

<table>
<thead>
<tr>
<th>Name</th>
<th>Weighting</th>
<th>Due</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exam</td>
<td>60%</td>
<td>University Examination Period</td>
</tr>
<tr>
<td>Test</td>
<td>20%</td>
<td>Week 7</td>
</tr>
<tr>
<td>Assignments</td>
<td>20%</td>
<td>Weeks 3, 5, 9, 11, 13</td>
</tr>
</tbody>
</table>

Exam

Due: University Examination Period
Weighting: 60%

The final examination will be of 3 hours duration with 10 minutes reading time. All material covered in the unit is examinable. Students MUST perform satisfactorily in the final examination in order to pass the unit regardless of their performance throughout the semester.

Relevant statistical tables will be provided at the final examination. These will be the same as the ones made available during the teaching of the unit.

For the final examination you will be permitted to take into the exam room a nonprogrammable calculator and two (2) A4 pages of formulae or notes, written on one or both sides of the page. These notes may be hand-written or typed. Students should anticipate that they will not be able to take these sheets with them at the completion of the exam, and it is recommended that a photocopy be made if a student has a desire to retain them.

On successful completion you will be able to:

• Point estimation methods, including the method of moments and maximum likelihood. Properties of estimators. Asymptotic large sample) properties.
• Sampling distributions and properties of sample statistics. Definition and derivation of t, F and chi-squared distributions etc.
• Interval estimation. Confidence intervals.
• Principles of hypothesis testing. Type I & II errors. Power. Comparison of competing tests. Relationship between confidence intervals and hypothesis testing.
• Confidence intervals and hypothesis testing for the probability parameter in the binomial distribution.
• Confidence intervals and hypothesis testing for location and scale in the single-population case, including related samples (paired comparisons). Classical (normal theory) and nonparametric tests are considered.
• Confidence intervals and hypothesis testing for location and scale in the two-population case. Classical (normal theory) and nonparametric tests are considered.
• Categorical data analysis (chi-squared tests): goodness of fit tests; tests of association; and tests of homogeneity.
• Hypothesis testing for k populations. One-way analysis of variance and nonparametric techniques. Multiple comparisons and contrasts.
• Simple linear regression. Correlation. Multiple linear regression.
• Hypothesis testing for two factor designs (two-way analysis of variance). Contrasts and multiple comparisons.
• Statistical theory and practice as described in learning outcomes 1-11.
Test

Due: **Week 7**
Weighting: 20%

The compulsory mid-session test (of 45 minutes duration) will be held during the lecture on Monday 9th September 2013, in Week 7. It will cover all material up to and including Topic 4. The class test should encourage students to consolidate their understanding of the unit material, prior to moving on to the later topics. The test should also give students experience in demonstrating their knowledge in preparation for the final examination.

For the mid-session test students are permitted to take into the test room one (1) A4 page of personal summary of formulae or notes, written on one or both sides of the page. These notes may be hand-written or typed. Some formulae will be provided (as per statistical tables available on iLearn); all necessary statistical tables will be provided. You will be permitted to take this sheet with you at the completion of the test.

On successful completion you will be able to:

- Point estimation methods, including the method of moments and maximum likelihood. Properties of estimators. Asymptotic large sample) properties.
- Sampling distributions and properties of sample statistics. Definition and derivation of t, F and chi-squared distributions etc.
- Interval estimation. Confidence intervals.
- Principles of hypothesis testing. Type I & II errors. Power. Comparison of competing tests. Relationship between confidence intervals and hypothesis testing.

Assignments

Due: **Weeks 3, 5, 9, 11, 13**
Weighting: 20%

There will be five assignments due at 11 am Mondays. Assignments are to be submitted via the STAT271 assignment box in the Science Student Centre (E7A 102). Some marks will be allocated for clarity of reasoning and presentation in each assignment.

The submission requirements will be specified on each assignment. All assignments must be attached to a Science assignment cover sheet, available with the assignment questions from iLearn.

If a student is unable to submit an assignment on time, they must contact one of the lecturers. Late submissions without approval of the lecturer(s) will not be marked (and given a zero mark). All extension requests must be approved by one of the lecturers. Requests for substantial extensions (one week or more) will require documentary evidence.
On successful completion you will be able to:

- Point estimation methods, including the method of moments and maximum likelihood. Properties of estimators. Asymptotic (large sample) properties.
- Sampling distributions and properties of sample statistics. Definition and derivation of t, F and chi-squared distributions etc.
- Interval estimation. Confidence intervals.
- Principles of hypothesis testing. Type I & II errors. Power. Comparison of competing tests. Relationship between confidence intervals and hypothesis testing.
- Confidence intervals and hypothesis testing for the probability parameter in the binomial distribution.
- Confidence intervals and hypothesis testing for location and scale in the single-population case, including related samples (paired comparisons). Classical (normal theory) and nonparametric tests are considered.
- Confidence intervals and hypothesis testing for location and scale in the two-population case. Classical (normal theory) and nonparametric tests are considered.
- Categorical data analysis (chi-squared tests): goodness of fit tests; tests of association; and tests of homogeneity.
- Hypothesis testing for k populations. One-way analysis of variance and nonparametric techniques. Multiple comparisons and contrasts.
- Hypothesis testing for two factor designs (two-way analysis of variance). Contrasts and multiple comparisons.
- Statistical theory and practice as described in learning outcomes 1-11.

Delivery and Resources

Classes
STAT271 is delivered by lectures (3 per week) and tutorials (1 per week, commencing in week 2). All teaching material will be available on iLearn.

Required and Recommended Texts and/or Materials

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:

<table>
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<tr>
<th>Author(s)</th>
<th>Title</th>
<th>Library Call No.</th>
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https://unitguides.mq.edu.au/unit_offerings/13211/unit_guide/print
Tutorial Exercises

Tutorial Exercises will be available from iLearn at least five days prior to the tutorial. Students are expected to take their completed attempts to tutorials for discussion and correction each week.

Technologies Used and Required

Calculators: You will need to equip yourself with a small calculator, preferably one that does simple statistical calculations and/or simple linear regression. You should bring it to all tutorials. You will also need your calculator for the mid-session test 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.

Computing and Software: Students will need access to a computer with internet access on a regular basis. Computers are available at various locations on campus for those students who do not own their own. The following software will be used in STAT271:

Minitab (Version 16): 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/. Details of computer rooms set aside for individual student usage can be found at http://www.efs.mq.edu.au/current/ug/resources/labs.

Microsoft Excel and Word (or any other word processor).

Teaching and Learning Strategy

Whilst you are encouraged to discuss the work extensively with your peers, it is expected that the final material submitted will be your own work. Any work that is copied from another student will result in disciplinary action for all students involved. You should refer to the university web site for the relevant information.

There is no specific word length for any section of the assessment tasks. Students should note, however, that all real-world problems need to be properly answered. Answers should include definitions of any variables used, the specific hypotheses being tested, a brief rationale for the analysing technique and a meaningful conclusion.
Changes from Previous Unit

None.

Unit Schedule

<table>
<thead>
<tr>
<th>Week</th>
<th>Work Due</th>
<th>Submission Details</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
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<tr>
<td>2</td>
<td></td>
<td></td>
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<tr>
<td>3</td>
<td>Assignment 1</td>
<td>Mon 11am</td>
<td>4%</td>
</tr>
<tr>
<td>4</td>
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<td></td>
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<tr>
<td>5</td>
<td>Assignment 2</td>
<td>Mon 11am</td>
<td>4%</td>
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<tr>
<td>6</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>7</td>
<td>Mid-session test</td>
<td>Mon 9 Sep</td>
<td>20%</td>
</tr>
<tr>
<td>Break</td>
<td>Two weeks (Mon 7 Oct = Public Holiday)</td>
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<tr>
<td>8</td>
<td>All students to attend a Wednesday</td>
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<tr>
<td>9</td>
<td>Assignment 3</td>
<td>Mon 11am</td>
<td>4%</td>
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<tr>
<td>10</td>
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<tr>
<td>11</td>
<td>Assignment 4</td>
<td>Mon 11am</td>
<td>4%</td>
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<tr>
<td>12</td>
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<tr>
<td>13</td>
<td>Assignment 5</td>
<td>Mon 11am</td>
<td>4%</td>
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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:


In addition, a number of other policies can be found in the Learning and Teaching Category of Policy Central.

All requests for special consideration regarding the mid-session test or final exam must be
Student Support

Macquarie University provides a range of Academic Student Support Services. Details of these services can be accessed at: http://students.mq.edu.au/support/

UniWISE provides:

- Online learning resources and academic skills workshops http://www.students.mq.edu.au/support/learning_skills/
- Personal assistance with your learning & study related questions.
- The Learning Help Desk is located in the Library foyer (level 2).
- Online and on-campus orientation events run by Mentors@Macquarie.

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

Details of these services can be accessed at http://www.student.mq.edu.au/ses/.

IT Help

If you wish to receive IT help, we would be glad to assist you at http://informatics.mq.edu.au/help/.

When using the university's IT, you must adhere to the Acceptable Use Policy. The policy applies to all who connect to the MQ network including students and it outlines what can be done.

Graduate Capabilities

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**

- Statistical theory and practice as described in learning outcomes 1-11.

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**

- Statistical theory and practice as described in learning outcomes 1-11.

**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**

- Statistical theory and practice as described in learning outcomes 1-11.

**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**

- Statistical theory and practice as described in learning outcomes 1-11.

**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

• Statistical theory and practice as described in learning outcomes 1-11.

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

• Statistical theory and practice as described in learning outcomes 1-11.

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

• Statistical theory and practice as described in learning outcomes 1-11.

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

• Statistical theory and practice as described in learning outcomes 1-11.

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**

- Statistical theory and practice as described in learning outcomes 1-11.