STAT273
Introduction to Probability
S1 Day 2014

Statistics

Contents

General Information .............................................. 2
Learning Outcomes ............................................. 3
Assessment Tasks .............................................. 3
Delivery and Resources ....................................... 7
Unit Schedule .................................................... 9
Learning and Teaching Activities ............................. 11
Policies and Procedures ....................................... 12
Graduate Capabilities ......................................... 14
Changes since First Published ............................... 18

Disclaimer
Macquarie University has taken all reasonable measures to ensure the information in this publication is accurate and up-to-date. However, the information may change or become out-dated as a result of change in University policies, procedures or rules. The University reserves the right to make changes to any information in this publication without notice. Users of this publication are advised to check the website version of this publication [or the relevant faculty or department] before acting on any information in this publication.
General Information

Unit convenor and teaching staff
Hilary Green
hilary.green@mq.edu.au
Contact via hilary.green@mq.edu.au

Unit Convenor
Maurizio Manuguerra
maurizio.manuguerra@mq.edu.au
Contact via maurizio.manuguerra@mq.edu.au
E4A 452
TBA

Credit points
3

Prerequisites
[(STAT170(P) or STAT171(P)) and (HSC Mathematics or 3cp from MATH123-MATH339) and
(STAT175(P) or GPA of 1.5)] or admission to GCertSc

Corequisites

Co-badged status
Co-badged with STAE273

Unit description
This unit consolidates and expands upon the material on probability introduced in statistics
units at 100 level. The emphasis is on the understanding of probability concepts and their
application. Examples are taken from areas as diverse as biology, medicine, finance, sport,
and the social and physical sciences. Topics include: the foundations of probability; probability
models and their properties; some commonly used statistical distributions; relationships and
association between variables; distribution of functions of random variables and sample
statistics; approximations including the central limit theorem; and an introduction to the
behaviour of random processes. Simulation is used to demonstrate many of these concepts.

Important Academic Dates
Information about important academic dates including deadlines for withdrawing from units are
available at https://students.mq.edu.au/important-dates
Learning Outcomes

1. Have a solid understanding of introductory probability theory,
2. Understand the difference between discrete and continuous random variables,
3. Understand the difference between theoretical and empirical probability,
4. For various discrete and continuous random variables, o Be familiar with the distributions, o Write the function and the cumulative distribution functions, o Graph the distribution and the cumulative distribution function, o Calculate probabilities, expected values, variances and standard deviations, o Generate Distributions, o Generate random numbers from Distributions, o Solve probability problems,
5. For bivariate probability distributions (discrete and continuous), find o Joint, marginal and conditional probabilities, o Covariance,
6. Understand basic anatomy of homogeneous Markov Chains and o Find stationary distribution, if one exists, o Manipulate and interpret Markov Chains with absorbing states.
7. Be able to generate probability distributions and cumulative distributions, and graph these distributions; Be able to simulate random numbers from probability distributions; Be able to organise and summarize random data; Determine whether random data fits a particular model; Be able to find probabilities, expected values etc, using an appropriate statistical package.
8. Students will build their knowledge starting from the basic idea of probability. At the end, they will be able to solve complex problems in a creative way.

Assessment Tasks

<table>
<thead>
<tr>
<th>Name</th>
<th>Weighting</th>
<th>Due</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weekly Tutorial assessment</td>
<td>10%</td>
<td>End of tutorial classes.</td>
</tr>
<tr>
<td>Test 1</td>
<td>10%</td>
<td>Week 3 lecture</td>
</tr>
<tr>
<td>Test 2</td>
<td>10%</td>
<td>Week 6 lecture</td>
</tr>
<tr>
<td>Assignment</td>
<td>10%</td>
<td>End of week 9</td>
</tr>
<tr>
<td>PC-Lab test</td>
<td>10%</td>
<td>Week 12 tutorial</td>
</tr>
<tr>
<td>Final Examination</td>
<td>50%</td>
<td>TBA</td>
</tr>
</tbody>
</table>
Weekly Tutorial assessment

Due: **End of tutorial classes.**
Weighting: **10%**

Every week students must submit the results of their work through iLearn. *Students may submit their results anytime during the 7-days after the lecture (the due date is Friday at 3pm).* Attendance to tutorial classes is recommended but not compulsory. Late submissions won’t be accepted by the automated system.

Marking: every tutorial quiz will have the same weight; the total will be scaled to the 10% of the unit assessment.

This Assessment Task relates to the following Learning Outcomes:

- Have a solid understanding of introductory probability theory,
- Understand the difference between theoretical and empirical probability,
- For various discrete and continuous random variables, o Be familiar with the distributions, o Write the function and the cumulative distribution functions, o Graph the distribution and the cumulative distribution function, o Calculate probabilities, expected values, variances and standard deviations, o Generate Distributions, o Generate random numbers from Distributions, o Solve probability problems,
- For bivariate probability distributions (discrete and continuous), find o Joint, marginal and conditional probabilities, o Covariance,
- Understand basic anatomy of homogeneous Markov Chains and o Find stationary distribution, if one exists, o Manipulate and interpret Markov Chains with absorbing states.
- Be able to generate probability distributions and cumulative distributions, and graph these distributions; Be able to simulate random numbers from probability distributions; Be able to organise and summarize random data; Determine whether random data fits a particular model; Be able to find probabilities, expected values etc, using an appropriate statistical package.

Test 1

Due: **Week 3 lecture**
Weighting: **10%**

You are allowed to bring in one A4 page of handwritten notes, written on both sides. All necessary statistical tables and formulae will be provided.

An electronic calculator is essential. Text-returnable calculators are not permitted in the tests or exam.
This Assessment Task relates to the following Learning Outcomes:

- Have a solid understanding of introductory probability theory,
- Understand the difference between theoretical and empirical probability,
- Students will build their knowledge starting from the basic idea of probability. At the end, they will be able to solve complex problems in a creative way.

**Test 2**

Due: **Week 6 lecture**

Weighting: **10%**

This Assessment Task relates to the following Learning Outcomes:

- Have a solid understanding of introductory probability theory,
- Understand the difference between discrete and continuous random variables,
- Understand the difference between theoretical and empirical probability,
- For various discrete and continuous random variables, o Be familiar with the distributions, o Write the function and the cumulative distribution functions, o Graph the distribution and the cumulative distribution function, o Calculate probabilities, expected values, variances and standard deviations, o Generate Distributions, o Generate random numbers from Distributions, o Solve probability problems,
- Students will build their knowledge starting from the basic idea of probability. At the end, they will be able to solve complex problems in a creative way.

**Assignment**

Due: **End of week 9**

Weighting: **10%**

This Assessment Task relates to the following Learning Outcomes:

- Understand the difference between discrete and continuous random variables,
- Understand the difference between theoretical and empirical probability,
- For various discrete and continuous random variables, o Be familiar with the distributions, o Write the function and the cumulative distribution functions, o Graph the distribution and the cumulative distribution function, o Calculate probabilities, expected values, variances and standard deviations, o Generate Distributions, o Generate random numbers from Distributions, o Solve probability problems,
- Students will build their knowledge starting from the basic idea of probability. At the end, they will be able to solve complex problems in a creative way.
PC-Lab test

Due: **Week 12 tutorial**

Weighting: **10%**

This Assessment Task relates to the following Learning Outcomes:

- Have a solid understanding of introductory probability theory,
- Understand the difference between discrete and continuous random variables,
- Understand the difference between theoretical and empirical probability,
- For various discrete and continuous random variables, o Be familiar with the distributions, o Write the function and the cumulative distribution functions, o Graph the distribution and the cumulative distribution function, o Calculate probabilities, expected values, variances and standard deviations, o Generate Distributions, o Generate random numbers from Distributions, o Solve probability problems,
- Be able to generate probability distributions and cumulative distributions, and graph these distributions; Be able to simulate random numbers from probability distributions; Be able to organise and summarize random data; Determine whether random data fits a particular model; Be able to find probabilities, expected values etc, using an appropriate statistical package.
- Students will build their knowledge starting from the basic idea of probability. At the end, they will be able to solve complex problems in a creative way.

Final Examination

Due: **TBA**

Weighting: **50%**

This will be of 3 hours duration with 10 minutes reading time.

For the Final examination you are allowed to bring in one A4 page of handwritten notes, written on both sides. All necessary statistical tables and formulae will be provided.

An electronic calculator is essential and will be required. Text-returnable calculators are not permitted in the tests or exam.

You are expected to present yourself for examination at the time and place designated in the University Examination Timetable. The timetable will be available in Draft form approximately eight weeks before the commencement of the examinations and in Final form approximately four weeks before the commencement of the examinations (http://www.exams.mq.edu.au)

**Extension requests for assessments**

No extensions will be granted. Students who have not submitted the task prior to the deadline will be awarded a mark of 0 for the task, except for cases in which an application for special consideration is made.
This Assessment Task relates to the following Learning Outcomes:

• Have a solid understanding of introductory probability theory,
• Understand the difference between discrete and continuous random variables,
• Understand the difference between theoretical and empirical probability,
• For various discrete and continuous random variables, o Be familiar with the
distributions, o Write the function and the cumulative distribution functions, o Graph the
distribution and the cumulative distribution function, o Calculate probabilities, expected
values, variances and standard deviations, o Generate Distributions, o Generate random
numbers from Distributions, o Solve probability problems,
• For bivariate probability distributions (discrete and continuous), find o Joint, marginal and
conditional probabilities, o Covariance,
• Understand basic anatomy of homogeneous Markov Chains and o Find stationary
distribution, if one exists, o Manipulate and interpret Markov Chains with absorbing
states.
• Be able to generate probability distributions and cumulative distributions, and graph
these distributions; Be able to simulate random numbers from probability distributions;
Be able to organise and summarize random data; Determine whether random data fits a
particular model; Be able to find probabilities, expected values etc, using an appropriate
statistical package.
• Students will build their knowledge starting from the basic idea of probability. At the end,
they will be able to solve complex problems in a creative way.

Delivery and Resources

Changes made to previous offerings
No changes.

Classes
STAT273 is delivered by lectures and tutorials.

The timetable for classes can be found on the University web site at:

http://www.timetables.mq.edu.au

Required and Recommended Texts and/or Materials
There is no set textbook for this subject. Lecture notes will be available from iLearn at least the
night before the lecture. Students should read the lecture notes before the lecture. All teaching
materials will be available via iLearn.

References that may be useful


Copies of these books are held in the Reserve section of the library.

**Technology Used and Required**

**iLearn**

There will be an iLearn site for this unit where weekly information, online discussions, lecture notes, iLectures, practice exercises, quizzes and solutions will be posted.

Students are required to login to iLearn using their Student ID Number and myMQ Portal Password (note, information about how to get hold of your password is provided by the weblink http://ilearn.mq.edu.au).

The website for the iLearn login is https://ilearn.mq.edu.au/login/MQ/. You can only access the material if you are enrolled in the unit.

**Software**

We will be using Microsoft Office for Windows (especially Excel) and Wolfram Alpha, freely available online.

Audio/Video recordings of lectures will be available on iLearn soon after the lecture is delivered.

Course notes are available on iLearn before the lecture. Students should familiarise themselves with the notes before the lecture and bring a copy (in paper or electronic form) to class.

**Teaching and Learning Strategy**

**Lectures**

Lectures begin in Week 1. STAT273 students should attend 3 hours per week. The lecture notes must be brought to the lectures each week. These will be available on iLearn the night before the lecture.

**Tutorials**

Tutorials begin in Week 2 and are based on work from the previous week’s lecture. The aim of tutorials is to apply techniques learnt in lectures to solve problems using a statistical package. The material is available on iLearn.
Unit Schedule

Students are free to attend ONE 1-hour tutorial a week. Students must submit their work on iLearn before the due date indicated in the assessment page on iLearn.

Additional Exercises

Additional exercises will also be made available on iLearn. It is expected that students will attempt all the questions. The exercises will not be discussed during the tutorial, although some may be discussed during the lectures. A solution will be made available on the website.

Unit Schedule

Lecture and Tutorial: Please check timetables.mq.edu.au

Students are expected to attend lectures and tutorials weekly.

Lectures and assessment timetable

<table>
<thead>
<tr>
<th>WEEK</th>
<th>LECTURE TOPIC</th>
<th>TUTORIAL TOPIC</th>
<th>ASSESSMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>W1</td>
<td>Experiments, sample spaces, Probability Rules, Permutations and Combinations, Theoretical vs. Empirical probability</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

- Tutorial quizzes can be submitted on iLearn in the week that goes from the lecture to the tutorial drop-in class, when they are due.

- Tests 1 and 2 are done during the first hour of the lecture. Test 4 is done during the tutorial hour.
<table>
<thead>
<tr>
<th>Module 1: Conditional Probability</th>
<th>Tutorial 1: Introduction. Software setup and first exercises.</th>
<th>Online quizzes on tutorial 1 due (not compulsory and not assessed).</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module 2: Discrete random variables</td>
<td>W3 Random Variables Probability Functions, Discrete Probability Distributions, Cumulative Distribution functions, Expected value and Variance</td>
<td>Tutorial 2: W1, W2 Online quizzes on tutorial 2 due. <strong>Test on Module 1</strong></td>
</tr>
<tr>
<td>W5 More Discrete Distributions Negative Binomial and Hypergeometric D.</td>
<td>Tutorial 4: W4 Online quizzes on tutorial 4 due.</td>
<td></td>
</tr>
<tr>
<td><strong>Module 3: Continuous random variables</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>W6 Introduction to Continuous random variables Cumulative distribution function</td>
<td>Tutorial 5: W5 Online quizzes on tutorial 5 due. <strong>Test on Module 2</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Mid semester Break</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>W7 Important Continuous Distributions Uniform, Exponential and Normal D.</td>
<td>Tutorial 6: W6 Online quizzes on tutorial 6 due.</td>
<td></td>
</tr>
<tr>
<td>W8 More Continuous Distributions Gamma and Beta Distributions Tchebysheff’s Theorem</td>
<td>Tutorial 7: W7 Online quizzes on tutorial 7 due.</td>
<td></td>
</tr>
<tr>
<td><strong>Module 4: Samples and tests</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>W9 Functions of Random Variables Model checking, Central Limit Theorem, Normal Approximations</td>
<td>Tutorial 8: W8 Online quizzes on tutorial 8 due. <strong>Assignment on Module 3</strong></td>
<td></td>
</tr>
</tbody>
</table>
Learning and Teaching Activities

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.

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.

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.

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.

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.

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.

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/)

Of interest to students are the policies and associated procedures on:

- Assessment
- Feedback and unit evaluation
- Special consideration

https://unitguides.mq.edu.au/unit_offers/7714/unit_guide/print
Student Support

• Appeal Against Final Grade Policy / Procedures / Guidelines
• Academic honesty

You should in particular familiarise yourself with University policy on Special Consideration and Academic Honesty.

Misadventure and Special Consideration process

The only exception to not sitting an examination at the designated time is because of documented illness or unavoidable disruption. In these circumstances you may wish to consider applying for Special Consideration. Information about unavoidable disruption and the special consideration process is available at: http://www.mq.edu.au/policy/docs/special_consideration/policy.html

Information on how to submit a student requests to the Faculty of Science can be found at: http://web.science.mq.edu.au/undergraduate_programs/current/admin_central/

As a result of a granted Special Consideration, students can be required to undertake additional assessable work, or receive an extension of the due date of tutorial assessment. If a Supplementary Examination is granted as a result of the Special Consideration process the examination will be scheduled after the conclusion of the official examination period.

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.

Academic Honesty Policy

Academic honesty is an integral part of the core values and principles contained in the Macquarie University Ethics Statement. Its fundamental principle is that all staff and students act with integrity in the creation, development, application and use of ideas and information. You must read the University's policy on Academic Honesty. This can be found on the MQ web site at: http://www.mq.edu.au/policy/docs/academic_honesty/policy.html. Penalties may include a deduction of marks, failure in the unit, and/or referral to the University Discipline Committee.

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
Student Enquiry Service
For all student enquiries, visit Student Connect at ask.mq.edu.au

Equity 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.

IT Help
For help with University computer systems and technology, visit 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.

Graduate Capabilities

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 outcomes

• Have a solid understanding of introductory probability theory,
• Understand the difference between discrete and continuous random variables,
• Understand the difference between theoretical and empirical probability,
• Be able to generate probability distributions and cumulative distributions, and graph these distributions; Be able to simulate random numbers from probability distributions; Be able to organise and summarize random data; Determine whether random data fits a particular model; Be able to find probabilities, expected values etc, using an appropriate statistical package.

Assessment tasks

• Weekly Tutorial assessment
• Test 1
• Test 2
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
- Final Examination

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:

**Assessment tasks**

- Assignment
- Final Examination

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**

- For various discrete and continuous random variables, o Be familiar with the distributions, o Write the function and the cumulative distribution functions, o Graph the
distribution and the cumulative distribution function, calculate probabilities, expected values, variances and standard deviations, generate distributions, generate random numbers from distributions, solve probability problems,

- For bivariate probability distributions (discrete and continuous), find joint, marginal and conditional probabilities, covariance,
- Understand basic anatomy of homogeneous Markov Chains and find stationary distribution, if one exists, manipulate and interpret Markov Chains with absorbing states.

**Assessment tasks**

- Weekly Tutorial assessment
- Test 1
- Test 2
- Assignment
- PC-Lab test
- Final Examination

**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**

- Be able to generate probability distributions and cumulative distributions, and graph these distributions; be able to simulate random numbers from probability distributions; be able to organise and summarise random data; determine whether random data fits a particular model; be able to find probabilities, expected values etc, using an appropriate statistical package.

**Assessment tasks**

- Weekly Tutorial assessment
- Test 1
- Test 2
- Assignment
- PC-Lab test
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

• Students will build their knowledge starting from the basic idea of probability. At the end, they will be able to solve complex problems in a creative way.

Assessment tasks

• Weekly Tutorial assessment
• Test 1
• Test 2
• Assignment
• PC-Lab test
• Final Examination

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

• Students will build their knowledge starting from the basic idea of probability. At the end, they will be able to solve complex problems in a creative way.

Assessment tasks

• Weekly Tutorial assessment
• Test 1
• Test 2
• Assignment
• PC-Lab test
• Final Examination

https://unitguides.mq.edu.au/unit_offerings/7714/unit_guide/print
# Changes since First Published

<table>
<thead>
<tr>
<th>Date</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>16/01/2014</td>
<td>The Prerequisites was updated.</td>
</tr>
</tbody>
</table>