Table of Content

Table of Content 2
General Information 3
  Convenor and teaching staff 3
  Credit Points 3
  Prerequisites 3
  Corequisites 3
  Co-badged status 3
  Unit Description 3
List of changes since first version was published 4
Learning Outcomes 5
Assessment Tasks 6
  Weekly Tutorial assessment 6
  Test 1 6
  Test 2 6
  Test 3 6
  Quiz during the tutorial hour 7
  Final Examination 7
Unit Schedule 8
  Lectures and assessment timetable 8
Delivery and Resources 11
  Changes made to previous offerings 11
  Classes 11
  Required and Recommended Texts and/or Materials 11
  Technology Used and Required 11
  Teaching and Learning Strategy 12
Policies and Procedures 13
  Misadventure and Special Consideration process 13
  Academic Honesty Policy 13
  Student Support 14
    UniWISE provides: 14
    Student Enquiry Service 14
    Equity Support 14
    IT Help 14
Graduate Capabilities 15
  Discipline Specific Knowledge and Skills 15
    Learning Outcome 15
  Critical, Analytical and Integrative Thinking 15
    Learning Outcome 15
  Problem Solving and Research Capability 16
    Learning Outcome 16
  Creative and Innovative 16
    Learning Outcome 16
  Commitment to Continuous Learning 16
    Learning Outcome 16
General Information

Convenor and teaching staff

Unit Convenor: Maurizio Manuguerra
Email: maurizio.manuguerra@mq.edu.au
Phone: +612 9850 7838
Office: E4A 452
Consultation Hours: To be advised

Credit Points
3

Prerequisites

[(STAT170(P) or STAT171(P)) and (HSC Mathematics or 3cp from MATH123-MATH339) and (STAT175(P) or GPA of 1.50)] or admission to GradCertSc

Corequisites
N/A

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.
## List of changes since first version was published

<table>
<thead>
<tr>
<th>Date</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>25/02/13</td>
<td>Updated dead line of tutorial quizzes (from 2pm to 3 pm Friday).</td>
</tr>
<tr>
<td>22/11/12</td>
<td>The Prerequisites was updated.</td>
</tr>
</tbody>
</table>
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>Task</th>
<th>Weight</th>
<th>Due Date</th>
<th>Linked Learning Outcomes</th>
<th>Linked Graduate Capabilities</th>
<th>Brief Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Weekly Tutorial assessment</strong></td>
<td>10%</td>
<td>1 hour before the next lecture</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Test 1</strong></td>
<td>10%</td>
<td>15 March</td>
<td>1, 3, 8</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Test 2</strong></td>
<td>10%</td>
<td>12 April</td>
<td>1, 2, 3, 4, 8</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Test 3</strong></td>
<td>10%</td>
<td>17 May</td>
<td>2, 3, 4, 8</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Quiz during the tutorial hour</strong></td>
<td>10%</td>
<td>7 June</td>
<td>1, 2, 3, 4, 7, 8</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Final Examination</strong></td>
<td>50%</td>
<td>TBA</td>
<td>1, 2, 3, 4, 5, 6, 7, 8</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Weekly Tutorial assessment

**Due Date:** 1 hour before the next lecture  
**Weight:** 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.

### Test 1

**Due Date:** 15 March  
**Weight:** 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.

### Test 2

**Due Date:** 12 April  
**Weight:** 10%

### Test 3
Due Date: 17 May  
Weight: 10%

Quiz during the tutorial hour

Due Date: 7 June  
Weight: 10%

Final Examination

Due Date: TBA  
Weight: 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.

The University Examination period for First Half Year 2013 is from Tuesday 11th to Friday 28th June 2013. 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

If for any reason students need an extension for their assessment tasks, they have to contact the lecturer in advance. Late submissions won't be accepted unless satisfactory documentation outlining illness or misadventure is submitted (see Policies and Procedures section).
Unit Schedule

**Lecture:** Friday 3-6pm, E4B 314
**Tutorial:** Friday 2-3pm, E4B 214

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></td>
<td></td>
<td></td>
<td>• Tutorial quizzes must be submitted on iLearn before the next lecture (Friday 3pm)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Tests are done during the first hour of the lecture</td>
</tr>
</tbody>
</table>

*Module 1: Introduction to first probability concepts*

| W1   | Experiments, sample spaces, Probability Rules, Permutations and Combinations Theoretical vs. Empirical probability | - | - |

| W2   | Conditional Probability Independence, Bayes’ Theorem | Introduction Software setup and first exercises | Tutorial 1: no assessment. Drop-in class on 8 March |

*Module 2: Discrete random variables*

<p>| W3   | Random Variables Probability Functions, Discrete Probability Distributions, Cumulative Distribution W1, W2 | Tutorial 2: Online quizzes due date and drop-in class on 15 March |</p>
<table>
<thead>
<tr>
<th>Week</th>
<th>Topic</th>
<th>Tutorial/Quiz Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>W4</td>
<td>Important Discrete Distributions</td>
<td>W3</td>
</tr>
<tr>
<td></td>
<td>Bernoulli, Binomial, Geometric and Poisson D.</td>
<td>Tutorial 3: Online quizzes due date and drop-in class on 22 March</td>
</tr>
<tr>
<td>W5</td>
<td>Public Holiday</td>
<td>-</td>
</tr>
<tr>
<td>W6</td>
<td>More Discrete Distributions</td>
<td>W4</td>
</tr>
<tr>
<td></td>
<td>Negative Binomial and Hypergeometric D.</td>
<td>Tutorial 4: Online quizzes due date and drop-in class on 5 April</td>
</tr>
<tr>
<td></td>
<td><strong>Module 3: Continuous random variables</strong></td>
<td></td>
</tr>
<tr>
<td>W7</td>
<td>Introduction to Continuous random variables</td>
<td>W6</td>
</tr>
<tr>
<td></td>
<td>Cumulative distribution function</td>
<td>Tutorial 5: Online quizzes due date and drop-in class on 12 April</td>
</tr>
<tr>
<td></td>
<td><strong>Test on Module 2</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Mid semester Break</strong></td>
<td></td>
</tr>
<tr>
<td>W8</td>
<td>Important Continuous Distributions</td>
<td>W7</td>
</tr>
<tr>
<td></td>
<td>Uniform, Exponential and Normal D.</td>
<td>Tutorial 6: Online quizzes due date and drop-in class on 3 May</td>
</tr>
<tr>
<td>W9</td>
<td>More Continuous Distributions</td>
<td>W8</td>
</tr>
<tr>
<td></td>
<td>Gamma and Beta Distributions</td>
<td>Tutorial 7: Online quizzes due date and drop-in class on 10 May</td>
</tr>
<tr>
<td></td>
<td>Tchebycheff's Theorem</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Module 4: Samples and tests</strong></td>
<td></td>
</tr>
<tr>
<td>W10</td>
<td>Functions of Random Variables</td>
<td>W9</td>
</tr>
<tr>
<td></td>
<td>Model checking, Central Limit Theorem, Normal Approximations</td>
<td>Tutorial 8: Online quizzes due date and drop-in class on 17 May</td>
</tr>
<tr>
<td></td>
<td><strong>Test on Module 3</strong></td>
<td></td>
</tr>
<tr>
<td>W11</td>
<td>Chi-squared Distribution, Distribution of</td>
<td>W10</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tutorial 9: Online</td>
</tr>
<tr>
<td>Sample variance, F-Distribution, Test for Equality of Variance, t-Distribution, Distribution of sample mean (σ unknown)</td>
<td>quizzes due date and drop-in class on 24 May</td>
<td></td>
</tr>
<tr>
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<tr>
<td><strong>Module 5: Joints distribution and Markov chains</strong></td>
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</tr>
<tr>
<td><strong>W12</strong> Joint Distributions: Discrete and Continuous cases</td>
<td><strong>W11</strong> Tutorial 10: Online quizzes due date and drop-in class on 31 May</td>
<td></td>
</tr>
<tr>
<td><strong>W13</strong> Introduction to Markov Chains States, Transition probabilities, State vectors, Equilibrium Absorbing States</td>
<td><strong>W12</strong> In-class assessment on tutorial topics (7 June tutorial hour, quizzes format)</td>
<td></td>
</tr>
</tbody>
</table>
Delivery and Resources

Changes made to previous offerings

The First Offering 2013 will be similar to the First Offering 2012. The unit is now divided in 5 modules. At the end of the first 3 modules, students are asked to seat a class test to verify their preparation. Each class test is worth 10 marks. In 2012 there were tests at the end of modules 4 and 5, while this semester they have been replaced by a single quiz during the tutorial hour in week 13. The quiz will be on topics covered during the year and techniques learnt during the tutorials.

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.

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.
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://www.mq.edu.au/policy/docs/academic_honesty/policy.html


Special Consideration Policy http://www.mq.edu.au/policy/docs/special_consideration/policy.html

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

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

- Assessment
- Feedback and unit evaluation
- Special consideration
- 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 website 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 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.mq.edu.au/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 Enquiry Service

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

Equity Support

Students with a disability are encouraged to contact the Disability Support Unit who can provide appropriate help with any issues that arise during their studies.

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

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

1. 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,
2. For bivariate probability distributions (discrete and continuous), find o Joint, marginal and conditional probabilities, o Covariance,
3. Understand basic anatomy of homogeneous Markov Chains and o Find stationary distribution, if one exists, o Manipulate and interpret Markov Chains with absorbing states.

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

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. 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.
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:

<table>
<thead>
<tr>
<th>Learning Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. 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.</td>
</tr>
</tbody>
</table>

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:

<table>
<thead>
<tr>
<th>Learning Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. 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.</td>
</tr>
</tbody>
</table>

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: