STAT273

Introduction to Probability

S1 Day 2014

Statistics

Contents

General Information

Unit convenor and teaching staff
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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://www.mq.edu.au/study/calendar-of-dates

Learning Outcomes

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

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.

Assessment Tasks

Name	Weighting	Due
Weekly Tutorial assessment	10%	End of tutorial classes.
Test 1	10%	Week 3 lecture
Test 2	10%	Week 6 lecture
Assignment	10%	End of week 9
PC-Lab test	10%	Week 12 tutorial
Final Examination	50%	TBA

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.

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- 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.

On successful completion you will be able to:

- 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%**

On successful completion you will be able to:

- 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%**

On successful completion you will be able to:

- 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%**

On successful completion you will be able to:

- Have a solid understanding of introductory probability theory,
- Understand the difference between discrete and continuous random variables,
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- 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 and approved.

On successful completion you will be able to:

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- Understand the difference between theoretical and empirical probability,
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- 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

• Wackerly, D., Mendenhall W. Scheaffer. Mathematical Statistics with Applications (4th,5th or 6th Editions) QA276 .M426 2002

• Kinney, J.J. (1997) Probability - An Introduction with Statistical Applications, John Wiley and Sons QA273.K493/1997

• Scheaffer R.L. (1994) Introduction to Probability and Its Applications, (2nd Edition) Duxbury Press, QA273.S357

• Sincich,T., Levine, D.M., Stephan, D. (1999) Practical statistics by example using Microsoft Excel QA276.12 .S554

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.

Unit Schedule

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

Students are expected to attend lectures and tutorials weekly.

Lectures and assessment timetable

WEEK	LECTURE TOPIC	TUTORIAL TOPIC	ASSESSMENT
			• *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.*
	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	Tutorial 1: Introduction. Software setup and first exercises.	Online quizzes on tutorial 1 due (not compulsory and not assessed).
	Module 2: Discrete random variables		
W3	Random Variables Probability Functions, Discrete Probability Distributions, Cumulative Distribution functions, Expected value and Variance	Tutorial 2: W1, W2	Online quizzes on tutorial 2 due. **Test on Module 1**
W4	Important Discrete Distributions Bernoulli, Binomial, Geometric and Poisson D.	Tutorial 3: W3	Online quizzes on tutorial 3 due.
W5	More Discrete Distributions Negative Binomial and Hypergeometric D.	Tutorial 4: W4	Online quizzes on tutorial 4 due.
	Module3:Continuous random variables		
W6	Introduction to Continuous random variables Cumulative distribution function	Tutorial 5: W5	Online quizzes on tutorial 5 due. **Test on Module 2**
	Mid semester Break		
W7	Important Continuous Distributions Uniform, Exponential and Normal D.	Tutorial 6: W6	Online quizzes on tutorial 6 due.
W8	More Continuous Distributions Gamma and Beta Distributions Tchebysheff's Theorem	Tutorial 7: W7	Online quizzes on tutorial 7 due.
	Module4: Samples and tests		
W9	Functions of Random Variables Model checking, Central Limit Theorem, Normal Approximations	Tutorial 8: W8	Online quizzes on tutorial 8 due. **Assignment on Module 3**

W10	Chi-squared Distribution, Distribution of sample variance, F-Distribution, Testfor Equality of Variance, t-Distribution, Distribution of sample mean (σ unknown)	Tutorial 9: W9	Online quizzes on tutorial 9 due.
	Module 5: Joints distribution and Markov chains		
W11	Joint Distributions: Discrete and Continuous cases	Tutorial 10: W10	Online quizzes on tutorial 10 due.
W12	Introduction to Markov Chains States, Transition probabilities, State vectors, Equilibrium, Absorbing States	-	**Test on tutorial topics.**
W13	Public holiday	-	-

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:

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

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

Grading Policy http://mq.edu.au/policy/docs/grading/policy.html

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

Grievance Management Policy http://mq.edu.au/policy/docs/grievance_management/policy.html

Disruption to Studies Policy 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/

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 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

- Academic Integrity Module for Students
- Ask a Learning Adviser

Student Services and Support

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

Student Enquiries

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

IT Help

For help with University computer systems and technology, visit http://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

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

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

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.

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Learning outcomes

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Assessment tasks

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

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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 summarize random data; Determine whether random data fits a

particular model; Be able to find probabilities, expected values etc, using an appropriate statistical package.

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- Test 1
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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

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

Changes since First Published

Date	Description
16/01/2014	The Prerequisites was updated.