STAT273

Introduction to Probability

S2 Day 2018

Dept of Statistics

Contents

General Information

Unit convenor and teaching staff

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Credit points
3

Prerequisites
(STAT170(P) or STAT171 or STAT150) and ((HSC Mathematics Band 2 or Extension 1 or Extension 2) or 3cp from MATH111-MATH339)

Corequisites

Co-badged status
This unit is co-taught with STAT683.

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:

Be able to describe a probabilistic model for an experiment, calculate probability and conditional probability of an event. Understand the independence of events.
Understand the difference between discrete and continuous random variables.
For discrete or continuous random variables be able to calculate probabilities of events, their expected values and variances. Graph the probability distributions or probability density functions and the cumulative distribution functions. Using moment generating functions for finding of moments of random variables. Generate random numbers from distributions and use these numbers for solving probability problems.
Understand a bivariate probability distribution, joint, marginal, conditional probabilities and covariance. Understand a bivariate Normal distribution.
Be familiar with limit theorems: the Law of Large Numbers (LLN) and the Central Limit Theorem (CLT).
Be able to generate random data. Be able to organise and summarise any random data.
Determine whether a particular model fits random data.
Understand a Markov Chain (MC), a stationary distribution of MC and interpretation of MCs with absorbing states.

General Assessment Information

You are expected to present yourself for examination at the time and place designated in the University examination timetable, which will be available at https://timetables.mq.edu.au.

Only documented illness or unavoidable disruption may be used as reasons for not sitting an examination at the designated time. In these circumstances you may wish to consider applying for special consideration via ask.mq.edu.au.

Information about the Special Consideration Policy is available at:

https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policies/special-consideration

Assessment Tasks

Name	Weighting	Hurdle	Due
Tutorial Participation	10%	No	Weeks 2 to 13
Test 1	10%	No	Week 4 lecture

Name	Weighting	Hurdle	Due
Assignment	10%	No	Week 8
Test 2	10%	No	Week 11 lecture
Final Examination	60%	No	University Examination Period

Tutorial Participation

Due: **Weeks 2 to 13**
Weighting: **10%**

To obtain the full mark (10% of the unit assessment), students must participate in at least 10 out of the 12 tutorials. Participation and engagement in the class activities will be assessed by the tutor via rosters and observation of students' work during classes. The tutorial participation marks are equally weighted.

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- Be familiar with limit theorems: the Law of Large Numbers (LLN) and the Central Limit Theorem (CLT).
- Be able to generate random data. Be able to organise and summarise any random data. Determine whether a particular model fits random data.

Test 1

Due: **Week 4 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. Non-programmable calculators with no text-retrieval capacity are allowed in the tests or exam.

On successful completion you will be able to:

- Be able to describe a probabilistic model for an experiment, calculate probability and conditional probability of an event. Understand the independence of events.
- Understand the difference between discrete and continuous random variables.
- For discrete or continuous random variables be able to calculate probabilities of events, their expected values and variances. Graph the probability distributions or probability density functions and the cumulative distribution functions. Using moment generating functions for finding of moments of random variables. Generate random numbers from distributions and use these numbers for solving probability problems.

Assignment

Due: **Week 8**
Weighting: **10%**

Students will be given two weeks to complete the assignment.

In the case of the late submission of the assignment, if no special consideration has been granted, 10% of the earned mark will be deducted for each day that the assignment is late, up to a maximum of 50%. After 5 days, including weekends and public holidays, a mark of 0% will be awarded for the assignment.

NOTE: It is not the intention of this late penalty policy to cause a student to fail the unit when they have submitted their assignment no more than 5 days after the due date and they would have otherwise passed. In this case, if deductions for late assignments result in the final unit mark for a student being less than 50, when otherwise it would have been 50 or greater, the student's final mark will be exactly 50.

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- Be able to generate random data. Be able to organise and summarise any random data. Determine whether a particular model fits random data.

Test 2

Due: **Week 11 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. Non-programmable calculators with no text-retrieval capacity are allowed in the tests or exam.

On successful completion you will be able to:

- Be able to describe a probabilistic model for an experiment, calculate probability and conditional probability of an event. Understand the independence of events.
- Understand the difference between discrete and continuous random variables.
- For discrete or continuous random variables be able to calculate probabilities of events, their expected values and variances. Graph the probability distributions or probability density functions and the cumulative distribution functions. Using moment generating functions for finding of moments of random variables. Generate random numbers from distributions and use these numbers for solving probability problems.
- Be familiar with limit theorems: the Law of Large Numbers (LLN) and the Central Limit Theorem (CLT).

Final Examination

Due: **University Examination Period**
Weighting: **60%**

The examination 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. Non-programmable calculators with no text-retrieval capacity are allowed in the tests or exam.

If you receive special consideration for the final exam, a supplementary exam will be scheduled in the week of December 17-21. By making a special consideration application for the final exam you are declaring yourself available for a resit during the supplementary examination period and will not be eligible for a second special consideration approval based on pre-existing commitments. Please ensure you are familiar with the Special Consideration Policy prior to submitting an application. You can check the supplementary exam information page on FSE101 in iLearn (bit.ly/FSESupp) for dates, and approved applicants will receive an individual notification one week prior to the exam with the exact date and time of their supplementary examination.

On successful completion you will be able to:

- Be able to describe a probabilistic model for an experiment, calculate probability and conditional probability of an event. Understand the independence of events.
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- Understand a bivariate probability distribution, joint, marginal, conditional probabilities and covariance. Understand a bivariate Normal distribution.
- Be familiar with limit theorems: the Law of Large Numbers (LLN) and the Central Limit Theorem (CLT).
- Be able to generate random data. Be able to organise and summarise any random data. Determine whether a particular model fits random data.
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Delivery and Resources

Classes

STAT273 is delivered by lectures and tutorials.

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

https://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. D., Mendenhall, W., Scheaffer, R. L. Mathematical Statistics with Applications (4th,5th, 6th or 7th Editions)
- Ross, S. A First Course in Probability, Pearson (5th, 6th, 7th, 9th or 9th Editions)
- Ward, M. D. and Gundlach, E. (2016) Introduction to Probability, W. H. Freeman and Company
- Kinney, J.J. (1997) Probability - An Introduction with Statistical Applications, John Wiley and Sons

- Scheaffer R.L. (1994) Introduction to Probability and Its Applications, (2nd Edition) Duxbury Press
- Sincich,T., Levine, D.M., Stephan, D. (1999) Practical Statistics by Example using Microsoft Excel

Technology Used and Required

iLearn

There will be an iLearn site for this unit where weekly information, online discussions, lecture notes, iLectures, practice exercises 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 https://ilearn.mq.edu.au). You can only access the material if you are enrolled in the unit.

Software

We will be using Microsoft Office for Windows (especially Excel), R 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 will be available on iLearn 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.

Additional Exercises

Additional exercises may also be made available on iLearn. It is expected that students will attempt all 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

WEEK	LECTURE TOPIC
W1	Experiments, sample spaces, Probability Rules, Permutations and Combinations
W2	Conditional Probability. Independence, Bayes' Theorem
W3	Random Variables. Probability Functions, Discrete Probability Distributions, Cumulative Distribution functions, Expected value and Variance. Moments.
W4	Important Discrete Distributions: Bernoulli, Binomial, Geometric and Poisson
W5	Moment generating functions. More Discrete Distributions: Negative Binomial and Hypergeometric.
W6	Introduction to Continuous random variables. Cumulative distribution function.
W7	Continuous Distributions: Uniform, Exponential.
	Mid-semester break
W8	Public holiday. No lecture or tutorial.
W9	Normal distribution.
W10	Continuous Distributions: Gamma and Beta Distributions. Chebyshev's Theorem.
W11	Sampling Distributions.
W12	Joint Distributions: Discrete and Continuous cases.
W13	Introduction to Markov Chains. States, Transition probabilities, State vectors, Equilibrium, Absorbing States and Revision

Policies and Procedures

Macquarie University policies and procedures are accessible from Policy Central (https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policy-central). Students should be aware of the following policies in particular with regard to Learning and Teaching:

- Academic Appeals Policy
- Academic Integrity Policy

- Academic Progression Policy
- Assessment Policy
- Fitness to Practice Procedure
- Grade Appeal Policy
- Complaint Management Procedure for Students and Members of the Public
- Special Consideration Policy *(**Note:** The Special Consideration Policy is effective from 4 December 2017 and replaces the Disruption to Studies Policy.)*

Undergraduate students seeking more policy resources can visit the Student Policy Gateway (https://students.mq.edu.au/support/study/student-policy-gateway). It is your one-stop-shop for the key policies you need to know about throughout your undergraduate student journey.

If you would like to see all the policies relevant to Learning and Teaching visit Policy Central (https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/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/study/getting-started/student-conduct

Results

Results shown in *iLearn*, or released directly by your Unit Convenor, are not confirmed as they are subject to final approval by the University. Once approved, final results will be sent to your student email address and will be made available in eStudent. For more information visit ask.mq.edu.au.

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://www.mq.edu.au/about_us/offices_and_units/information_technology/help/.

When using the University's IT, you must adhere to the Acceptable Use of IT Resources Policy. The policy applies to all who connect to the MQ network including students.

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 outcomes

- Be able to describe a probabilistic model for an experiment, calculate probability and conditional probability of an event. Understand the independence of events.
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Determine whether a particular model fits random data.

- Understand a Markov Chain (MC), a stationary distribution of MC and interpretation of MCs with absorbing states.

Assessment tasks

- Tutorial Participation
- Test 1
- Assignment
- Test 2
- Final Examination

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

- Be able to describe a probabilistic model for an experiment, calculate probability and conditional probability of an event. Understand the independence of events.
- Understand the difference between discrete and continuous random variables.
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- Understand a Markov Chain (MC), a stationary distribution of MC and interpretation of MCs with absorbing states.

Assessment tasks

- Tutorial Participation
- Test 1
- Assignment
- Test 2
- 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 random data. Be able to organise and summarise any random data. Determine whether a particular model fits random data.

Assessment tasks

- Tutorial Participation
- Assignment
- Final Examination