



ACST601

Stochastic Methods in Finance and Insurance

S1 Day 2014

Applied Finance and Actuarial Studies

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General Information

Unit convenor and teaching staff

Unit Convenor

Gillian Heller

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E4A 533

Thursday 12-2 pm

Credit points

4

Prerequisites

Admission to MActPrac or MCom or MAcc(Prof)MCom or MBioTechMCom

Corequisites

Co-badged status

Unit description

This unit covers applications of probability theory to life insurance, general insurance and finance. Topics include: conditional probability; Bayes Theorem; discrete and continuous random variable and distributions, with examples in insurance and finance; mathematical expectation with applications to insurance and finance; measures of variation and risk; moments and their interpretation; sums of independent random variables; discrete and continuous convolutions with applications; distribution of functions of random variables; probability generating functions, moment generating functions and characteristic functions; the central limit theorem; multivariate random variables and normal distribution theory; marginal and conditional distributions; covariance and correlation; and compound distributions.

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.

For various discrete and continuous random variables: a. Be familiar with the

distributions, b. Write the function and the cumulative distribution functions, c. Graph the distribution and the cumulative distribution function, d. Calculate probabilities, expected values, variances and standard deviations, e. Find the distribution of sums of independent random variables; f. Derive and use moment generating functions; g. Generate random numbers from distributions, h. Solve probability problems.

For bivariate probability distributions (discrete and continuous), find: a. Joint, marginal and conditional probabilities, b. Covariance.

Assessment Tasks

Name	Weighting	Due
<u>Assignment 1</u>	15%	Friday 4 April, 9am (week 5)
<u>Class test</u>	20%	2 May, 9-10 am (week 7)
<u>Assignment 2</u>	15%	6 June, 9am (week 12)
<u>Final exam</u>	50%	TBA

Assignment 1

Due: **Friday 4 April, 9am (week 5)**

Weighting: **15%**

There will be two assignments (problem-solving, including use of R).

Marked assignments will be returned 2 weeks after hand-in. Solutions will be given.

On-time submission of all assignments is compulsory. No extensions will be granted. Students who have not submitted the assignment prior to the deadline will be awarded a mark of 0 for the assignment, except for cases in which an application for special consideration is made and approved.

On successful completion you will be able to:

- Have a solid understanding of introductory probability theory.
- For various discrete and continuous random variables: a. Be familiar with the distributions, b. Write the function and the cumulative distribution functions, c. Graph the distribution and the cumulative distribution function, d. Calculate probabilities, expected values, variances and standard deviations, e. Find the distribution of sums of independent random variables; f. Derive and use moment generating functions; g. Generate random numbers from distributions, h. Solve probability problems.

Class test

Due: **2 May, 9-10 am (week 7)**

Weighting: **20%**

The class test will be of 50 minutes duration, held at the usual Friday lecture time in week 7.

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.
- For various discrete and continuous random variables: a. Be familiar with the distributions, b. Write the function and the cumulative distribution functions, c. Graph the distribution and the cumulative distribution function, d. Calculate probabilities, expected values, variances and standard deviations, e. Find the distribution of sums of independent random variables; f. Derive and use moment generating functions; g. Generate random numbers from distributions, h. Solve probability problems.

Assignment 2

Due: **6 June, 9am (week 12)**

Weighting: **15%**

As assignment 1.

On successful completion you will be able to:

- Understand the difference between discrete and continuous random variables.
- For various discrete and continuous random variables: a. Be familiar with the distributions, b. Write the function and the cumulative distribution functions, c. Graph the distribution and the cumulative distribution function, d. Calculate probabilities, expected values, variances and standard deviations, e. Find the distribution of sums of independent random variables; f. Derive and use moment generating functions; g. Generate random numbers from distributions, h. Solve probability problems.
- For bivariate probability distributions (discrete and continuous), find: a. Joint, marginal and conditional probabilities, b. Covariance.

Final exam

Due: **TBA**

Weighting: **50%**

A three-hour final examination for this unit will be held during the University Examination period.

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://students.mq.edu.au/student_admin/exams/

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. The University's policy on special consideration process is available at

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

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.

The Macquarie university examination policy details the principles and conduct of examinations at the University. The policy is available at:

<http://www.mq.edu.au/policy/docs/examination/policy.htm>

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.
- For various discrete and continuous random variables: a. Be familiar with the distributions, b. Write the function and the cumulative distribution functions, c. Graph the distribution and the cumulative distribution function, d. Calculate probabilities, expected values, variances and standard deviations, e. Find the distribution of sums of independent random variables; f. Derive and use moment generating functions; g. Generate random numbers from distributions, h. Solve probability problems.
- For bivariate probability distributions (discrete and continuous), find: a. Joint, marginal and conditional probabilities, b. Covariance.

Delivery and Resources

Classes

Students will attend three one-hour lectures and one one-hour tutorial per week. Lecture notes will be available on iLearn before the lecture.

Tutorial exercises will be set weekly and will be available on iLearn before the tutorial. Students are expected to have attempted all questions before the tutorial.

The timetable for classes can be found on the University web site at: www.timetables.mq.edu.au

Technology used and required

The statistical software R will be used. This is a free software environment for statistical computing and graphics and is downloadable from the website

www.r-project.org

in versions for Windows, MacOS and Unix platforms. R is also available in the computer labs in E4B. It is convenient to bring a memory stick when using these computers.

The R interface RStudio is recommended. This is free and downloadable from

www.rstudio.com

iLearn

All unit materials, including administrative updates, lecture notes, tutorials and assignments, will be posted on the unit website on iLearn.

Required and recommended texts and materials

Mendenhall W., Wackerly, D. and Scheaffer, R. (2007). *Mathematical Statistics with Applications*, 7th edition (library call number QA276.M426) is the recommended textbook for this unit.

References that may be useful:

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

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 some publicly available electronic versions of books and notes will be put on iLearn.

Changes since the last offering of this unit

Weightings of the two assignments and the final examination have changed.

Unit Schedule

Week	Topic	Assessment
1	Experiments; Sample Spaces and Events; Probability; Rules of Probability; Venn Diagrams; Permutations and Combinations; Relative Frequency and Probability	
2	Conditional Probability; Probability Trees; Probability Tables; Independence of Events; Bayes' Rule	

3	Random Variables; Probability Functions; Discrete Probability Distributions; Cumulative Distribution functions; Expected value and Variance of discrete random variables	Assignment 1 handed out
4	Moments; Bernoulli, Binomial, Geometric, Poisson Distributions	
5	More Discrete Distributions; Negative Binomial and Hypergeometric	Assignment 1 handed in
6	Random number generation; Continuous Probability Distributions; Cumulative Distribution functions; Expected value and Variance of continuous random variables	
	Mid semester break	
7	Cumulative distribution function Functions of Random Variables, Uniform and Exponential Distributions	Class test
8	Normal Distribution; Model checking, Central Limit Theorem, Normal Approximations	
9	Change of variable technique; Gamma, Chi-squared, Beta, Lognormal, Weibull Distributions, Chebyshev's Theorem	
10	Convolutions; Distribution of sample variance, F, t, Extreme Value Distributions	Assignment 2 handed out
11	Joint Distributions: Discrete and Continuous cases, correlation, covariance, independence	
12	Moment generating functions	Assignment 2 handed in
13	Revision	

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/

Supplementary Exams Further information regarding supplementary exams, including dates, is available here http://www.businessandconomics.mq.edu.au/current_students/undergraduate/how_do_i/special_consideration

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.

Research and Practice

This unit uses research from external sources. References are given in "Required and recommended texts and materials".

Changes since First Published

Date	Description
11/02/2014	The Prerequisites was updated.