



# ACST212

## Combinatorial Probability

S2 Day 2015

*Dept of Applied Finance and Actuarial Studies*

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#### **Disclaimer**

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## General Information

Unit convenor and teaching staff

Unit Convenor

Jim Farmer

[jim.farmer@mq.edu.au](mailto:jim.farmer@mq.edu.au)

Contact via Dialog in Administration section of this unit's web site

E4A 616

Refer to the unit's web site

Credit points

3

Prerequisites

Admission to BActStud and STAT171(Cr)

Corequisites

MATH133

Co-badged status

Unit description

This unit is a study of techniques for assigning probabilities to events, with a particular emphasis on techniques involving combinatorics. Topics include: permutations and combinations; enumeration of equally likely cases; probability theorems; Bayes' Theorem; expected values; recurrence relations; generating functions; the principle of inclusion and exclusion; and application of calculus to probability. Concepts are often developed using simple examples, such as games of chance, but once understood, the concepts can be applied to many of the traditional actuarial problems examined in several 300-level actuarial units.

## 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:

You should understand the fundamental concepts and principles of the range of probability approaches examined.

You should be able to confidently apply those concepts and principles in determining

probabilities for defined events and solving probability-based problems.

You should be able to explain the concepts, principles and processes you are using, in clear, simple non-technical language, so that another student of the unit could follow your explanation.

You should be able to clearly explain why a problem solution is correct (or not correct), so that another student of the unit could follow your explanation.

You should have further developed your problem-solving skills.

## General Assessment Information

Macquarie University uses the grades HD, D, Cr, P and F for grading the achievements of students in units of study. The meaning of each symbol is explained in the University's grading policy, available at <http://www.mq.edu.au/policy/docs/grading/policy.html>

The numerical marks resulting from assessment of your work in this unit will be used as an initial indicator of the quality of your learning and understanding. The use of these numerical marks is, however, only a starting point in determining the appropriate grade. In particular, note that the "Standardised Numerical Grades" (SNGs) appearing on your results are not raw marks. To obtain a grade you must satisfy the qualitative definition of that grade. Once your grade has been determined, you are allocated a SNG in the appropriate range for that grade.

In ACST212, quality of learning is interpreted in terms of **understanding**, which can be demonstrated by:

- applying concepts and principles to solve problems which are not necessarily of exactly the same type as problems encountered previously; and
- explaining, in clear, simple, non-technical language the concepts, processes and rationale behind the mathematical symbols.

The final exam consists of 2 papers each of 90 minutes duration.

To earn a clear pass you should demonstrate competence in solving short routine problems for all topics in this unit. The tutorial questions labelled "routine" are indicative of the standard.

To earn a grade of credit or higher you should demonstrate understanding by being able to apply concepts and principles to solve problems which are not necessarily of exactly the same type as problems encountered previously or to explain in clear, simple, non-technical language the concepts, processes and rationale behind the mathematical symbols.

Paper 1 of the final exam contains only routine questions and paper 2 contains only harder questions.

In Step 1 of the grading process, the quizzes and paper 1 of the final exam will be used to subdivide students into the categories of 'Fail' and 'Pass or Better'. In carrying out this process, the quizzes are weighted at 40% and paper 1 of the final exam is weighted at 60%.

In Step 2 of the grading process, the quizzes and both papers of the final examination will be

used to subdivide students in the 'Pass or Better' category into 'High Distinction', 'Distinction', 'Credit' and 'Pass' categories. In this process, the quizzes are weighted at 25%, paper 1 of the final exam is weighted at 25% and paper 2 at 50%. If Step 1 resulted in you being placed in the 'Pass or Better' category, you cannot be awarded a grade less than Pass in Step 2. That is, you cannot reduce your grade by sitting Paper 2. If you do not want a grade better than 'Pass', you need not attempt the second paper of the final examination.

When you work as an actuary or in any other profession, if you have a dangerous misunderstanding of a concept you may provide incorrect advice to a client, possibly with severe financial consequences for your client and yourself. However, if you realise that you don't understand a concept you may refrain from giving advice on it until you have filled the gaps in your knowledge. That is, dangerous misunderstandings have more serious consequences than a recognised lack of knowledge.

The grading philosophy and marking scales adopted in this unit (and in many other university units) reflect this situation. Correct relevant statements earn marks. Statements revealing dangerous misunderstandings result in the deduction of marks. If your answers reveal that your misunderstandings are very severe or numerous, you might earn a negative mark for a question. If a part of a question is worth  $x$  marks, the smallest mark you can be allocated for that part is  $-x$  marks.

As an example, a minor error when keying numbers into your calculator is not usually regarded as a dangerous error provided the resulting incorrect answer is plausible. However, if a calculator error results in an obviously unreasonable answer, such as a probability outside the range 0 to 1, or an expected value outside the range of possible outcomes for the random variable, and you fail to state that you realise this answer is unreasonable, this would be regarded as a dangerous misunderstanding.

## Assessment Tasks

| Name   | Weighting | Due                          |
|--|-----------|------------------------------|
| <a href="#"><u>Online Quizzes - Basics</u></a>       | 20%       | Various. See iLearn Calendar |
| <a href="#"><u>Online Quizzes - Applications</u></a> | 20%       | Various. See iLearn Calendar |
| <a href="#"><u>Final Examination</u></a>             | 60%       | Normal Examination period    |

### Online Quizzes - Basics

Due: **Various. See iLearn Calendar**

Weighting: **20%**

You should complete these quizzes online. They are on this unit's iLearn web site.

In answering the assessable quizzes, you may consult your notes or any textbooks you like, but you may not seek assistance from any humans in any way whatsoever. This includes seeking assistance in interpreting what the questions mean. You should not discuss any of the quiz questions with any of your class mates until after the deadline for submitting the quiz has

passed, even if you have already submitted the quiz and so can no longer change your answers, because you cannot be sure whether your class mates have submitted their quiz.

There are 6 quizzes, 3 covering basics (topics 0 to 2) and 3 covering application (topics 3 to 5).

Once you start a quiz, you have a maximum of 2 hours to complete it. Tutorials occur on Friday. The quiz for a topic becomes available at 12:01 am on the Saturday after the tutorial and becomes unavailable at 11:59pm on the following Tuesday. That is, the quiz is available for 2 minutes less than 4 days. (We are avoiding using midnight as a cutoff time due to confusion as to whether "midnight Wednesday" means "midnight at the start of Wednesday" or "midnight at the end of Wednesday".) You may start the quiz anytime within that range, but if you start it within 2 hours of the end of that range then it still closes at the end of that range, meaning you get less than 2 hours to complete it. The days on which the quizzes open and close can also be viewed on the calendar tool within iLearn.

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:

- You should understand the fundamental concepts and principles of the range of probability approaches examined.
- You should be able to confidently apply those concepts and principles in determining probabilities for defined events and solving probability-based problems.
- You should have further developed your problem-solving skills.

## Online Quizzes - Applications

Due: **Various. See iLearn Calendar**

Weighting: **20%**

See the description of "Online Quizzes - Basics" for full description of the online quizzes.

"Online Quizzes - Applications" consists of 3 quizzes covering topics 3 to 5.

On successful completion you will be able to:

- You should understand the fundamental concepts and principles of the range of probability approaches examined.
- You should be able to confidently apply those concepts and principles in determining probabilities for defined events and solving probability-based problems.
- You should have further developed your problem-solving skills.

## Final Examination

Due: **Normal Examination period**

Weighting: **60%**

Students may NOT bring any notes or textbooks into the final examination.

Students are permitted to use non-programmable calculators with no text-retrieval capacity.

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>

In the exam, you are required to write your answers on the ruled (right hand) pages of the answer booklet provided. Anything written on the unruled (left hand) pages will not be marked.

On successful completion you will be able to:

- You should understand the fundamental concepts and principles of the range of probability approaches examined.
- You should be able to confidently apply those concepts and principles in determining probabilities for defined events and solving probability-based problems.
- You should be able to explain the concepts, principles and processes you are using, in clear, simple non-technical language, so that another student of the unit could follow your explanation.
- You should be able to clearly explain why a problem solution is correct (or not correct), so that another student of the unit could follow your explanation.
- You should have further developed your problem-solving skills.

## **Delivery and Resources**

### **Classes**

There are 4 hours of face-to-face teaching per week consisting of 2 hours of lectures and 2 hours of tutorial.

Since all tutorials are held in the same timeslot, we take the opportunity to stream tutorials by performance. Ignore the tute location showing in eStudent. Consult the list of tute locations that will appear on the unit's web site on Wednesday of Week 1 of classes.

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**

No textbook are prescribed for this unit. Detailed notes and exercises are available on the unit's web site.

### **Technology Used and Required**

While mathematical in nature, this unit is about thinking rather than using technology. The only technology required is a calculator. For the test and the final exam, you may only use non-programmable calculators which are not able to store text. Sometimes it will be possible to verify solutions by using a spreadsheet or programming language to apply a “brute force” method, but this is not required.

### Unit Web Page

The web page for this unit can be accessed via the “login” button on <http://ilearn.mq.edu.au>

### Teaching and Learning Strategy

This unit is taught via lectures and tutorials. However, a significant amount of the lecture time will be spent on attempting problems. The emphasis is on learning by doing.

## Unit Schedule

The schedule of topics is provided in a printer-friendly format in the administration section of the unit's web site.

## 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](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](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](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/](https://students.mq.edu.au/support/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](http://ask.mq.edu.au).

### Supplementary Exams



Further information regarding supplementary exams, including dates, is available here

[http://www.businessandconomics.mq.edu.au/current\\_students/undergraduate/how\\_do\\_i/disruption\\_to\\_studies](http://www.businessandconomics.mq.edu.au/current_students/undergraduate/how_do_i/disruption_to_studies)

## 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](http://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](http://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

### 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

- You should understand the fundamental concepts and principles of the range of probability approaches examined.
- You should be able to confidently apply those concepts and principles in determining probabilities for defined events and solving probability-based problems.
- You should be able to explain the concepts, principles and processes you are using, in clear, simple non-technical language, so that another student of the unit could follow your explanation.
- You should be able to clearly explain why a problem solution is correct (or not correct), so that another student of the unit could follow your explanation.
- You should have further developed your problem-solving skills.

## Assessment tasks

- Online Quizzes - Basics
- Online Quizzes - Applications
- 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

- You should understand the fundamental concepts and principles of the range of probability approaches examined.
- You should be able to confidently apply those concepts and principles in determining probabilities for defined events and solving probability-based problems.
- You should have further developed your problem-solving skills.

## Assessment task

- 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 outcomes**

- You should understand the fundamental concepts and principles of the range of probability approaches examined.
- You should be able to confidently apply those concepts and principles in determining probabilities for defined events and solving probability-based problems.
- You should have further developed your problem-solving skills.

## **Assessment tasks**

- Online Quizzes - Basics
- Online Quizzes - Applications
- Final Examination

## **Changes from Previous Offering**

Added: Conditional Expectation Theorem. Removed: Principle of Inclusion and Exclusion.

## **Research and Practice, Global and Sustainability**

This unit uses research from external sources. The subject of probability has a long history. Most of the techniques used in this unit were developed over a century ago. Hence you can find the research we are using in textbooks on probability and combinatorics rather than needing to source recent research papers.

The mathematical concepts in this unit are independent of any legislative constraints and so do not recognise national or planetary boundaries.