ACST212

Combinatorial Probability

S2 Day 2014

Applied Finance and Actuarial Studies

Contents

Disclaimer

Macquarie University has taken all reasonable measures to ensure the information in this publication is accurate and up-to-date. However, the information may change or become out-dated as a result of change in University policies, procedures or rules. The University reserves the right to make changes to any information in this publication without notice. Users of this publication are advised to check the website version of this publication [or the relevant faculty or department] before acting on any information in this publication.

General Information

Unit convenor and teaching staff
Unit Convenor
Jim Farmer
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.

Assessment Tasks

Name	Weighting	Due
Online Quiz 0	5%	14/8/2014
Online Quiz 1	9%	21/8/2014
Online Quiz 2	9%	28/8/2014
Onlie Quiz 3	10%	4/9/2014
Online Quiz 4	7%	11/9/2014
Final Examination	60%	Normal Examination period

Online Quiz 0

Due: **14/8/2014**
Weighting: **5%**

There are 5 assessable online quizzes available on the unit's web site covering topcis 0 to 4.

The quiz on a topic becomes available at the end of the tutorial on that topic and closes at 11:59pm on the day before the next tutorial. The dates are also clearly displayed in the calendar tool on the web site.

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 Quiz 1

Due: **21/8/2014**
Weighting: **9%**

See the description of Quiz 0 for full details of the quizzes.

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 Quiz 2

Due: **28/8/2014**
Weighting: **9%**

See the description of Quiz 0 for full details of the quizzes.

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.

Onlie Quiz 3

Due: **4/9/2014**
Weighting: **10%**

See the description of Quiz 0 for full details of the quizzes.

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 Quiz 4

Due: **11/9/2014**
Weighting: **7%**

See the description of Quiz 0 for full details of the quizzes.

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.

Non-programmable calculators with no text-retrieval capacity are allowed.

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

A more compact printer-friendly version of this schedule is available in the administration section of the unit's web site.

Week Number	Week Beginning	Topic
0		0. Revision of Random Variables – Reading Topic
1	4 Aug	1. Permutations
2	11 Aug	2. Combinations
3	18 Aug	3. Evaluating Probabilities by Enumeration of Cases
4	25 Aug	4. Probability Theorems Sun 31 August – Census Date *
5	1 Sep	5. Bayes' Theorem

6	8 Sep	6. Linear Difference Equations
7	15 Sep	7a. Generating Functions 7b. Volumes by Double Integrals
2 week study break		
8	6 Oct	8. Expected Values – introductory material
9	13 Oct	9. Expected Values – further development
10	20 Oct	10. Recursive Methods
11	27 Oct	11. Probabilities by Multiple Integrals
12	3 Nov	12. Revision
13	10 Nov	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.businessandeconomics.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.

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 Quiz 0
- Online Quiz 1
- Online Quiz 2
- Onlie Quiz 3
- Online Quiz 4
- 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 Quiz 0
- Online Quiz 1
- Online Quiz 2
- Onlie Quiz 3
- Online Quiz 4
- Final Examination

Changes from Previous Offering

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

Research and Practice

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.