

**MACQUARIE UNIVERSITY**  
**ACST211 : COMBINATORIAL PROBABILITY**  
**UNIT OUTLINE SECOND SEMESTER 2006**

**1 About this unit**

**1.1 Content**

Much of the work that actuaries do relates to the assessment and management of the financial consequences of risk. This analysis typically requires calculations involving probability. This unit is a study of probability, its nature and meaning, and a range of techniques for determining a numeric measure of the probability that a specific event will occur. The unit has a practical emphasis, focusing on applications of theory to evaluate probabilities of defined events.

**1.2 Timetable**

<b>Week Number</b>	<b>Week Beginning</b>	<b>Topic</b>
1	31 July	1. Permutations
2	7 August	2. Combinations
3	14 August	3. Evaluating Probabilities by Enumeration of Cases
4	21 August	4. Probability Theorems
5	28 August	5a. Bayes' Theorem 5b. Generating Functions
6	4 September	6a. Linear Difference Equations 6b. Random Variables – Reading Topic
7	11 September	7. Expected Values
2 week study break		
8	2 October	9. Volumes by Double Integrals – Public holiday on Monday
9	9 October	8. Recursive Methods
10	16 October	10. Probabilities by Nested Integrals
11	23 October	11. Introduction to Markov Chains
12	30 October	12. Long Run Behaviour of Markov Chains
13	6 November	Free for revision

The order of topics 8 and 9 has been reversed to accommodate the lost lecture in week 8.

If you wish to read ahead, try topic 6b. This has nominally been placed in week 6 because you need to understand all that material before starting topic 7. However, most of topic 6b is merely revision of the random variable material from STAT171. The reading may give a little more theoretical background than was given in STAT171, but the practical skills you need to acquire in this topic add nothing to STAT171. Hence you should be able to cope with all the reading material in this topic now, though a few of the tute exercises require some knowledge from topics 1 to 4.

**1.3 Unit Objectives – Learning Outcomes**

By the end of this unit you should:

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

Throughout the unit you should also be able to demonstrate ethical behaviour by complying with examination rules and assessment task rules, and by not colluding on assessment tasks.

## 2 Teaching Staff

The unit convenor and lecturer, Jim Farmer, can be contacted by the mail tool in the unit's web site. Further details are in the Student Guide. Tutors cannot be contacted other than at tutorials.

## 3 Classes

Class times can be found at: <http://www.timetables.mq.edu.au/>

## 4 Assessment

### 4.1 The Grading Process

Macquarie University uses the grades HD, D, Cr, P, PC and F for grading the achievements of students in units of study. The meaning of each symbol is explained in section 10 of the Bachelor Degree Rules in the current Macquarie University Handbook of Undergraduate Studies.

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 indicating your approximate position amongst students assigned that grade.

In ACST211, 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 examination will consist of 2 papers, each of 90 minutes duration with no reading time. The questions in the first paper of the final exam are short routine questions while those in the second paper allow you to demonstrate your deeper understanding. There are also online quizzes to complete. More detail on accessing the quizzes is given in the Student Guide.

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', 'Conceded Pass' and 'Pass or Better'.

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. 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.

To earn a clear pass you need to demonstrate competence in solving the short routine problems encountered in the quizzes and Paper 1 of the exam. It may be possible to gain a Pass grade merely by memorising and reproducing the formulae and methods encountered in the lectures and tutorial exercises. To obtain a grade of credit or better you will need to demonstrate that you have come to terms with the **meaning** behind the mathematics by making progress on some of the problems in Paper 2 of the exam.

If you do not want a grade better than 'Pass', you need not attempt the second paper of the final examination.

The following table gives an indication of the relative weighting of the assessment components for the two steps of this process:

	Step 1	Step 2
Quizzes	10%	5%
Exam - Paper 1	90%	45%
Exam - Paper 2	–	50%

#### 4.2 Dangerous misunderstandings are penalised

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 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 negative probability or a probability exceeding 1, and you fail to state that you realise this answer is unreasonable, this would be regarded as a dangerous misunderstanding.

## 5 Final Exam

### 5.1 Examination Rules

Prior to the exam you should familiarise yourself with the rules shown under the heading "Rules governing student's conduct in examinations" on p43 of the 2006 Handbook of Undergraduate Studies.

### 5.2 Material in Exam

You may not bring any notes or dictionaries into the exam.

The exam may include multiple choice questions. You should bring several 2B pencils and an eraser.

Calculators are allowed in the exam, but calculators that have a text-retrieval capacity, whether or not they have a full alphabet on the keyboard, are not allowed. Calculators may be checked during the exam, and the make and model may be recorded.

Communication devices, including but not restricted to mobile phones, text message receivers, pagers and wireless-equipped calculators, may not be brought into the examination room. If a student is found to have brought such a device into the examination room, the argument that the device was turned off will NOT be regarded as an acceptable excuse.

### 5.3 Exam Dates

The University Examination period in second semester 2006 is from Wednesday 15 November to Friday 1 December.

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. It will be available at:

<http://www.timetables.mq.edu.au/exam>

The only exception for 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.reg.mq.edu.au/Forms/APSCon.pdf>

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. More detail on the procedure for applying for Special Consideration is available in the Student Guide.

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 official examination period.

## **6 Teaching and Learning Strategy**

This unit is taught via lectures and tutorials.

In this unit attendance at lectures has generally been high but attendance at tutorials has been poor after the first few weeks. Failing to attend the tutorials is a poor strategy. The tutorials are more important than the lectures. If you miss a lecture you can always obtain the full lecture notes from the unit's web site after that week's lectures are over. However, the tutorials are your opportunity to get feedback on your level of understanding. They are also an opportunity to present your solutions on the board. If you are seeking a grade better than a pass, you should make full use of this opportunity for obtaining feedback on your methods and the style of your answers.

If your result in this unit is unsatisfactory, you should not expect any assistance in diagnosing the problem if you did not regularly attend and actively participate in tutorials.

## **7 Unit Web Page**

The unit web page can be accessed via the logon facility at <http://online.mq.edu.au/student/>

## **8 Textbooks**

The "Unit Notes", available from the Co-Op Bookshop, contain lecture outlines and exercises. No textbooks are prescribed for this unit. We have not found a book of reasonable quality which covers all or most of the unit content. You are encouraged to browse the library's collection. Some relevant subject areas are combinatorics, discrete mathematics, combinatorial mathematics, probability and stochastic processes. (Use the library catalogue to perform a search by subject.)

## **9 Cheating and Plagiarism**

To cheat in the context of university assignments, tests and examinations is to attempt to gain an unfair advantage by violating the principles of intellectual and scholarly integrity. Cheating also encompasses plagiarism.

The University defines plagiarism in its rules: "Plagiarism involves using the work of another person and presenting it as one's own." Plagiarism is a serious breach of the University's rules and carries significant penalties. You must read the University's practices and procedures on plagiarism. These can be found in the *Handbook of Undergraduate Studies* or on the web at: <http://www.student.mq.edu.au/plagiarism/>

The policies and procedures explain what plagiarism is, how to avoid it, the procedures that will be taken in cases of suspected plagiarism, and the penalties if you are found guilty. Penalties may include a deduction of marks, failure in the unit, and/or referral to the University Discipline Committee.