STAT394

Probability, Random Processes and Statistics for Engineers

S1 Day 2016

Dept of Statistics

Contents

General Information

Unit convenor and teaching staff
Convenor
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Credit points
3

Prerequisites
MATH235(P)

Corequisites

Co-badged status

Unit description
This unit develops the probabilistic and statistical ideas needed to apply the theory of random processes to engineering fields such as signal processing and communications. Topics covered include probability, random variables, expectation, random processes, stationarity, ergodicity, spectral density, limit theorems, markov chains, estimation theory.

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:

Understand and compute probabilities, conditional probabilities, random variables.
Understand and work with probability density functions, expectations, moment generating functions.
Be able to compute the joint distributions and expectations of functions of more than one random variable.
Understand and use the concepts of hypothesis testing, probability of false alarm.
Be able to compute the likelihood and maximum likelihood estimators.

Assessment Tasks

Name	Weighting	Due
Assignment 1	8%	Thursday 24th March
Assignment 2	8%	Thursday 28th April
Assignment 3	9%	Thursday 26th May
Class Test	15%	5th May
Tutorial Participation	10%	Week 2 to 13
Final Examination	50%	TBA

Assignment 1

Due: **Thursday 24th March**
Weighting: **8%**

Submit to Prof Barry Quinn by 1pm on the due date. There is no “group work” assessment in this unit. All work is to be the student’s own. 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 disruption to studies is made and approved.

On successful completion you will be able to:

- Understand and compute probabilities, conditional probabilities, random variables.
- Understand and work with probability density functions, expectations, moment generating functions.

Assignment 2

Due: **Thursday 28th April**
Weighting: **8%**

Submit to Prof Barry Quinn by 1pm on the due date. There is no “group work” assessment in this unit. All work is to be the student’s own. 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 disruption to studies is made and approved.

On successful completion you will be able to:

- Understand and work with probability density functions, expectations, moment generating functions.
- Be able to compute the joint distributions and expectations of functions of more than one

random variable.

Assignment 3

Due: **Thursday 26th May**
Weighting: **9%**

Submit to Prof Barry Quinn by 1pm on the due date. There is no “group work” assessment in this unit. All work is to be the student’s own. 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 disruption to studies is made and approved.

On successful completion you will be able to:

- Be able to compute the joint distributions and expectations of functions of more than one random variable.
- Understand and use the concepts of hypothesis testing, probability of false alarm.
- Be able to compute the likelihood and maximum likelihood estimators.

Class Test

Due: **5th May**
Weighting: **15%**

The first class test will take place during the 12pm Thursday class on 5th May. It will take place under exam conditions. The test is 'closed book'. Students may take into the test **TWO** A4 pages of notes **handwritten (not typed)** on **BOTH** sides. Calculators may be used but must not be of the text/programmable type. Students who do not attend the test will be awarded a mark of 0, unless they apply for disruption to studies and this is approved.

On successful completion you will be able to:

- Understand and compute probabilities, conditional probabilities, random variables.
- Understand and work with probability density functions, expectations, moment generating functions.
- Be able to compute the joint distributions and expectations of functions of more than one random variable.

Tutorial Participation

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

To obtain full marks you must participate in every tutorial.

On successful completion you will be able to:

- Understand and compute probabilities, conditional probabilities, random variables.
- Understand and work with probability density functions, expectations, moment generating functions.
- Be able to compute the joint distributions and expectations of functions of more than one random variable.
- Understand and use the concepts of hypothesis testing, probability of false alarm.
- Be able to compute the likelihood and maximum likelihood estimators.

Final Examination

Due: **TBA**
Weighting: **50%**

The final Examination will be held during the mid-year Examination period. The final Examination is 3 hours long (with an additional 10 minutes' reading time). It will cover all topics in the unit. The final examination is closed book. Students may take into the final Exam **TWO** A4 pages of notes **handwritten (not typed)** on **BOTH** sides. Calculators will be needed but must not be of the text/ programmable type.

Students MUST perform satisfactorily in the final examination in order to pass the unit regardless of their performance throughout the semester.

The University Examination timetable will be available in Draft form approximately 8 weeks before the commencement of the examinations and in Final form approximately 4 weeks before the commencement of the examinations at: http://www.timetables.mq.edu.au/exam

The only exception to not sitting an examination on the designated date is because of documented illness or unavoidable disruption. In these circumstances you may wish to consider applying for disruption to studies.

Your final grade in STAT394 will be based on your work during the semester and in the final examination. You need to achieve the same standards both during the semester assessments and the final exam to be awarded a particular grade as set out in the Grading Policy (http://www.mq.edu.au/policy/docs/grading/policy.html).

On successful completion you will be able to:

- Understand and compute probabilities, conditional probabilities, random variables.
- Understand and work with probability density functions, expectations, moment generating functions.
- Be able to compute the joint distributions and expectations of functions of more than one random variable.
- Understand and use the concepts of hypothesis testing, probability of false alarm.
- Be able to compute the likelihood and maximum likelihood estimators.

Delivery and Resources

There are four contact hours per week, comprised of three lectures and one tutorial. Check the timetable for the times and locations of classes.

Please consult iLearn or the Unit webpage for details of consultation hours.

Learning and Teaching Activities

Lecture

Three hours per week

Tutorial

One hour per week

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

New Assessment Policy in effect from Session 2 2016 http://mq.edu.au/policy/docs/assessment/policy_2016.html. For more information visit http://students.mq.edu.au/events/2016/07/19/new_assessment_policy_in_place_from_session_2/

Assessment Policy prior to Session 2 2016 http://mq.edu.au/policy/docs/assessment/policy.html

Grading Policy prior to Session 2 2016 http://mq.edu.au/policy/docs/grading/policy.html

Grade Appeal Policy http://mq.edu.au/policy/docs/gradeappeal/policy.html

Complaint Management Procedure for Students and Members of the Public http://www.mq.edu.au/policy/docs/complaint_management/procedure.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/

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.m

q.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

- Understand and compute probabilities, conditional probabilities, random variables.

- Understand and work with probability density functions, expectations, moment generating functions.
- Be able to compute the joint distributions and expectations of functions of more than one random variable.
- Understand and use the concepts of hypothesis testing, probability of false alarm.
- Be able to compute the likelihood and maximum likelihood estimators.

Assessment tasks

- Assignment 1
- Assignment 2
- Assignment 3
- Class Test
- Tutorial Participation
- Final Examination

Learning and teaching activities

- Three hours per week
- One hour per week

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

- Understand and compute probabilities, conditional probabilities, random variables.
- Understand and work with probability density functions, expectations, moment generating functions.
- Be able to compute the joint distributions and expectations of functions of more than one random variable.
- Understand and use the concepts of hypothesis testing, probability of false alarm.
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- Final Examination

Learning and teaching activities

- Three hours per week
- One hour per week

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

- Understand and compute probabilities, conditional probabilities, random variables.
- Understand and work with probability density functions, expectations, moment generating functions.
- Be able to compute the joint distributions and expectations of functions of more than one random variable.
- Understand and use the concepts of hypothesis testing, probability of false alarm.
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Learning and teaching activities

- Three hours per week
- One hour per week

Effective Communication

We want to develop in our students the ability to communicate and convey their views in forms effective with different audiences. We want our graduates to take with them the capability to read, listen, question, gather and evaluate information resources in a variety of formats, assess, write clearly, speak effectively, and to use visual communication and communication technologies as appropriate.

This graduate capability is supported by:

Assessment tasks

- Class Test
- Tutorial Participation

Learning and teaching activities

- Three hours per week
- One hour per week

Changes from Previous Offering

Some previous topics in MATH396 have been omitted. The topics in 2016 will be more 'in depth'.

Grading in this unit

Your final SNG and grade in STAT394 will be based on your work during semester and in the final examination as specified in the ‘Assessment’ section. The determination of your final SNG and Grade will be based on an assessment of your performance on individual assessment tasks against identified criteria and standards as set out in the section titled ‘Assessment Criteria’, and an assessment of overall performance in the unit. Final grades will be awarded on the basis of your overall performance and the extent to which you demonstrate fulfilment of the learning outcomes listed for this unit.

The relationship between SNGs and Final Grades is shown in the table below:

SNG.Range	Grade	Standard
85 - 100	High Distinction (HD)	Provides consistent evidence of deep and critical understanding in relation to the learning outcomes. There is substantial originality and insight in identifying,generating and communicating competing arguments, perspectives or problem solving approaches; critical evaluation of problems, their solutions and their implications; creativity in application as appropriate to the discipline.
75 - 84	Distinction (D)	Provides evidence of integration and evaluation of critical ideas, principles and theories, distinctive insight and ability in applying relevant skills and concepts in relation to learning outcomes. There is demonstration of frequent originality in defining and analysing issues or problems and providing solutions; and the use of means of communication appropriate to the discipline and the audience.
65 - 74	Credit (Cr)	Provides evidence of learning that goes beyond replication of content knowledge or skills relevant to the learning outcomes. There is demonstration of substantial understanding of fundamental concepts in the field of study and the ability to apply these concepts in a variety of contexts; convincing argumentation with appropriate coherent justification; communication of ideas fluently and clearly in terms of the conventions of the discipline.

50 - 64	Pass (P)	Provides sufficient evidence of the achievement of learning outcomes. There is demonstration of understanding and application of fundamental concepts of the ield of study; routine argumentation with acceptable justification;communication of information and ideas adequately in terms of the conventions of the discipline. The learning attainment is considered satisfactory or adequate or competent or capable in relation to the specified outcomes.
0 - 49	Fail (F)	Does not provide evidence of attainment of learning outcomes. There is missing or partial or superficial or faulty understanding and application of the fundamental concepts in the field of study; missing, undeveloped, inappropriate or confusing argumentation; incomplete, confusing or lacking communication of ideas in ways that give little attention to the conventions of the discipline.

Please note that a student must meet the performance standard outlined above in **both** the coursework **and** the examination sections of this unit in order to be awarded a particular grade.

Textbooks and other reference material

The prescribed textbook is

Richard H. Williams, *Probability, Statistics, and Random Processes for Engineers*, Cengage Learning, 2003.

Other good references are

A. Leon-Garcia, *Probability, Statistics, and Random Processes for Electrical Engineering*, 3 ed. Upper Saddle River, New Jersey: Prentice-Hall, 2008

and

A. Papoulis, *Probability, Random Variables, and Stochastic Processes*. New York: McGraw-Hill, 2002.

There are many introductory mathematical statistics and/or random (stochastic) processes books, and many are suitable references.

The notes in iLearn will be fairly exhaustive, and will be put up approximately one week in advance of their delivery.