STAT710

Statistical Theory

S1 Evening 2014

Statistics

Contents

Disclaimer

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General Information

Unit convenor and teaching staff
Other Staff
Thomas Fung
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E4A 530
Monday 2 - 4 pm

Unit Convenor
Ian Marschner
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E4A 540
11am Wednesday

Credit points
4

Prerequisites
Admission to MRes

Corequisites

Co-badged status

Unit description
This unit introduces the fundamental principles of statistical inference and estimation theory.
The unit begins with a discussion of probability concepts, including relative frequency, random
variables, distributions and large sample theory. A discussion of estimation concepts is
provided, particularly unbiasedness, consistency and efficiency. Likelihood theory is then
developed, including the concept of sufficiency and the maximum likelihood approach to
estimation. Hypothesis testing concepts and methods are discussed with a particular focus on
likelihood ratio, score and Wald tests. An introduction to Bayesian inference principles is also
provided.

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:

be familiar with techniques to calculate probabilities, expected values and probability, moment and cumulant generating functions for discrete, continuous and multivariate random variables and know how to apply these concepts in practical problems

understand fundamental limit theorems of Probability and Statistics and be able to apply them in practical problems

understand three modes of convergence of random variables and be able to apply them to get practical large sample approximations

understand and know how to use the Delta Method in practical problems

understand the principles and theory of estimation

understand the principles and theory of statistical hypothesis testing

Assessment Tasks

Name	Weighting	Due
Assignment 1	15%	25 March 2014
Assignment 2	15%	29 April 2014
Assignment 3	15%	20 May 2014
Mid-year examination	55%	To be determined

Assignment 1

Due: **25 March 2014**
Weighting: **15%**

Assignment 1

On successful completion you will be able to:

- be familiar with techniques to calculate probabilities, expected values and probability, moment and cumulant generating functions for discrete, continuous and multivariate random variables and know how to apply these concepts in practical problems
- understand fundamental limit theorems of Probability and Statistics and be able to apply them in practical problems

Assignment 2

Due: **29 April 2014**
Weighting: **15%**

Assignment 2

On successful completion you will be able to:
- understand three modes of convergence of random variables and be able to apply them to get practical large sample approximations
- understand and know how to use the Delta Method in practical problems

Assignment 3

Due: **20 May 2014**
Weighting: **15%**

Assignment 3

On successful completion you will be able to:
- understand the principles and theory of estimation
- understand the principles and theory of statistical hypothesis testing

Mid-year examination

Due: **To be determined**
Weighting: **55%**

Mid-year examination

On successful completion you will be able to:
- be familiar with techniques to calculate probabilities, expected values and probability, moment and cumulant generating functions for discrete, continuous and multivariate random variables and know how to apply these concepts in practical problems
- understand fundamental limit theorems of Probability and Statistics and be able to apply them in practical problems
- understand three modes of convergence of random variables and be able to apply them to get practical large sample approximations
- understand and know how to use the Delta Method in practical problems
- understand the principles and theory of estimation
- understand the principles and theory of statistical hypothesis testing

Delivery and Resources

LECTURES

Tuesday 6-9 p.m. in W5C-320.

TUTORIALS (Weeks 2-13)

E5A-150 on Wednesday 6-7 p.m.

E5A-130 on Wednesday 7-8 p.m.

E5A-230 on Wednesday 8-9 p.m.

(note: the number of tutorials will depend on enrollment and may change)

SOFTWARE

The R software package will be used for simulation and graphics. This software is freely available to be downloaded at www.r-project.org

TEXTBOOK

Mathematical Statistics with Applications, Seventh Edition. D.D. Wackerly, W. Mendenhall, R.L. Scheaffer. Duxbury Press.

This textbook will provide additional readings and problems, to supplement the lecture and tutorial material.

INTERNET RESOURCES / TECHNOLOGIES USED

This unit has an iLearn website available at https://ilearn.mq.edu.au/login/MQ/

Lecture notes: these will be available on the iLearn site prior to the lecture.

Audio recordings: all lectures will be recorded and will be available after the lecture.

Consult the iLearn website frequently. Other resources available include a discussion board, assignments, administrative updates etc.

CONSULTATION HOURS

Members of the Statistics Department have consultation hours each week when they are available to help students. These consultation hours are listed on the doors of the Statistics staff located on E4A level 5.

ASSIGNMENT SUBMISSION

Students may submit assignments during the lecture or via the iLearn website.

CHANGES SINCE LAST DELIVERY

No substantive changes since last delivery

Unit Schedule

Week 1: Introduction to Probability and Statistics. Discrete random variables and their probability distributions.

Week 2: Continuous random variables and their probability distributions. Probability, Moment and Cumulant Generating Functions.

Week 3: Multivariate probability distributions. Functions of random variables.

Weeks 4 – 7: Laws of Large Numbers, Central Limit Theorem, Asymptotic Theory.

Weeks 8 – 10: Estimation, properties of estimators, likelihood theory.

Week 11 – 13: Hypotheses testing, properties of tests, likelihood-based inference methods, Bayesian inference.

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/

Policy on Late submission of Assignments

No extensions will be granted. Students who have not submitted an assignment 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.

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.