STAT710

Statistical Theory

S1 Evening 2018

Dept of Statistics

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General Information

Unit convenor and teaching staff Unit Convenor Ian Marschner ian.marschner@mq.edu.au Contact via Email Room 5.25, Level 5, 12 Wally's Walk (E7A) 10am Wed
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 probability concepts, including random variables and probability distributions for discrete, continuous and multivariate situtations and know how to apply these concepts in the context of statistical inference and sampling

understand fundamental large sample concepts in probability, including modes of

convergence and the central limit theorem and be able to apply these concepts to practical problems

understand the principles and theory of estimation, including unbiasedness, consistency and relative efficiency, as well as the likelihood function and maximum likelihood estimation

understand the principles and theory of statistical hypothesis testing, including likelihood ratio tests, score tests and Wald tests

understand the principles of Bayesian inference

General Assessment Information

ASSIGNMENT SUBMISSION

Students must submit assignments via the iLearn website.

LATE SUBMISSION OF ASSIGNMENTS

In case of late submission of an assignment, if no special consideration has been granted, 10% of the earned mark will be deducted for each day that the assignment is late, up to a maximum of 50%. After 5 days, including weekends and public holidays, a mark of 0% will be awarded for the assignment.

SUPPLEMENTARY EXAMS

If you receive special consideration for the final exam, a supplementary exam will be scheduled in the interval between the regular exam period and the start of the next session. By making a special consideration application for the final exam you are declaring yourself available for a resit during the supplementary examination period and will not be eligible for a second special consideration approval based on pre-existing commitments. Please ensure you are familiar with the policy prior to submitting an application. You can check the supplementary exam information page on FSE101 in iLearn (bit.ly/FSESupp) for dates, and approved applicants will receive an individual notification one week prior to the exam with the exact date and time of their supplementary examination.

SPECIAL CONSIDERATION

The only excuse for not sitting an examination at the designated time is because of documented illness of unavoidable disruption. In these special circumstances you may apply for special consideration via ask.mq.edu.au.

Assessment Tasks

Name	Weighting	Hurdle	Due
Assignment 1	15%	No	03/04/2018
Assignment 2	15%	No	15/5/2018
Assignment 3	15%	No	05/06/2018
Final examination	55%	No	To be determined

Assignment 1

Due: **03/04/2018**
Weighting: **15%**

Assignment 1

On successful completion you will be able to:

- be familiar with probability concepts, including random variables and probability distributions for discrete, continuous and multivariate situtations and know how to apply these concepts in the context of statistical inference and sampling
- understand fundamental large sample concepts in probability, including modes of convergence and the central limit theorem and be able to apply these concepts to practical problems

Assignment 2

Due: **15/5/2018**
Weighting: **15%**

Assignment 2

On successful completion you will be able to:

- understand the principles and theory of estimation, including unbiasedness, consistency and relative efficiency, as well as the likelihood function and maximum likelihood estimation

Assignment 3

Due: **05/06/2018**
Weighting: **15%**

Assignment 3

On successful completion you will be able to:

- understand the principles and theory of statistical hypothesis testing, including likelihood ratio tests, score tests and Wald tests
- understand the principles of Bayesian inference

Final examination

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

Final examination

On successful completion you will be able to:

- be familiar with probability concepts, including random variables and probability distributions for discrete, continuous and multivariate situtations and know how to apply these concepts in the context of statistical inference and sampling
- understand fundamental large sample concepts in probability, including modes of convergence and the central limit theorem and be able to apply these concepts to practical problems
- understand the principles and theory of estimation, including unbiasedness, consistency and relative efficiency, as well as the likelihood function and maximum likelihood estimation
- understand the principles and theory of statistical hypothesis testing, including likelihood ratio tests, score tests and Wald tests
- understand the principles of Bayesian inference

Delivery and Resources

LECTURES

Monday 6-8 p.m. in Room G240, EMC Building (3 Innovation Road).

TUTORIALS (Weeks 2-13)

There are three tutorials held on Monday evening that are held in the same location as the lecture Room G240, EMC Building (3 Innovation Road).

- 4-5pm
- 5-6pm
- 8:30-9:30pm (variable start time, shortly after the lecture concludes after 8pm)

TEXTBOOKS

The material and lecture notes are heavily based on the book:

Inference Principles for Biostatisticians. I.C. Marschner. Chapman and Hall / CRC Press (2015).

This book is recommended as additional reading beyond the lecture notes, but is not a compulsory text.

Additional readings and problems are also available in the following book:

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

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 available from the Statistics Department in Level 6 of 12WW (E7A).

Unit Schedule

Weeks 1-12 will involve the study of 8 topics, each of which will be consist of 1-2 lectures.

Week 13 will involve revision.

The 8 topics to be studied in this unit are as follows:

Topic 1: Probability and random samples

Topic 2: Large sample probability concepts

Topic 3: Estimation concepts

Topic 4: Likelihood

Topic 5: Estimation methods

Topic 6: Hypothesis testing concepts

Topic 7: Hypothesis testing methods

Topic 8: Bayesian inference

Policies and Procedures

Macquarie University policies and procedures are accessible from Policy Central (https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policy-central). Students should be aware of the following policies in particular with regard to Learning and Teaching:

- Academic Appeals Policy
- Academic Integrity Policy
- Academic Progression Policy
- Assessment Policy
- Fitness to Practice Procedure
- Grade Appeal Policy
- Complaint Management Procedure for Students and Members of the Public
- Special Consideration Policy *(**Note:** The Special Consideration Policy is effective from 4 December 2017 and replaces the Disruption to Studies Policy.)*

Undergraduate students seeking more policy resources can visit the Student Policy Gateway (https://students.mq.edu.au/support/study/student-policy-gateway). It is your one-stop-shop for the key policies you need to know about throughout your undergraduate student journey.

If you would like to see all the policies relevant to Learning and Teaching visit Policy Central (https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/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/study/getting-started/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.

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

PG - Capable of Professional and Personal Judgment and Initiative

Our postgraduates will demonstrate a high standard of discernment and common sense in their professional and personal judgment. They will have the ability to make informed choices and decisions that reflect both the nature of their professional work and their personal perspectives.

This graduate capability is supported by:

Learning outcomes

- understand the principles and theory of estimation, including unbiasedness, consistency and relative efficiency, as well as the likelihood function and maximum likelihood estimation
- understand the principles and theory of statistical hypothesis testing, including likelihood ratio tests, score tests and Wald tests
- understand the principles of Bayesian inference

Assessment tasks

- Assignment 3
- Final examination

PG - Discipline Knowledge and Skills

Our postgraduates will be able to demonstrate a significantly enhanced depth and breadth of knowledge, scholarly understanding, and specific subject content knowledge in their chosen fields.

This graduate capability is supported by:

Learning outcomes

- be familiar with probability concepts, including random variables and probability distributions for discrete, continuous and multivariate situtations and know how to apply these concepts in the context of statistical inference and sampling
- understand fundamental large sample concepts in probability, including modes of convergence and the central limit theorem and be able to apply these concepts to practical problems
- understand the principles and theory of estimation, including unbiasedness, consistency and relative efficiency, as well as the likelihood function and maximum likelihood estimation
- understand the principles and theory of statistical hypothesis testing, including likelihood ratio tests, score tests and Wald tests
- understand the principles of Bayesian inference

Assessment tasks

- Assignment 1
- Assignment 2
- Assignment 3
- Final examination

PG - Critical, Analytical and Integrative Thinking

Our postgraduates will be capable of utilising and reflecting on prior knowledge and experience, of applying higher level critical thinking skills, and of integrating and synthesising learning and knowledge from a range of sources and environments. A characteristic of this form of thinking is the generation of new, professionally oriented knowledge through personal or group-based critique of practice and theory.

This graduate capability is supported by:

Learning outcomes

- understand the principles and theory of estimation, including unbiasedness, consistency and relative efficiency, as well as the likelihood function and maximum likelihood estimation

- understand the principles and theory of statistical hypothesis testing, including likelihood ratio tests, score tests and Wald tests
- understand the principles of Bayesian inference

Assessment tasks

- Assignment 3
- Final examination

PG - Research and Problem Solving Capability

Our postgraduates will be capable of systematic enquiry; able to use research skills to create new knowledge that can be applied to real world issues, or contribute to a field of study or practice to enhance society. They will be capable of creative questioning, problem finding and problem solving.

This graduate capability is supported by:

Learning outcomes

- be familiar with probability concepts, including random variables and probability distributions for discrete, continuous and multivariate situtations and know how to apply these concepts in the context of statistical inference and sampling
- understand fundamental large sample concepts in probability, including modes of convergence and the central limit theorem and be able to apply these concepts to practical problems

Assessment tasks

- Assignment 1
- Assignment 2
- Final examination

PG - Effective Communication

Our postgraduates will be able to communicate effectively and convey their views to different social, cultural, and professional audiences. They will be able to use a variety of technologically supported media to communicate with empathy using a range of written, spoken or visual formats.

This graduate capability is supported by:

Learning outcomes

- understand the principles and theory of estimation, including unbiasedness, consistency and relative efficiency, as well as the likelihood function and maximum likelihood estimation

- understand the principles and theory of statistical hypothesis testing, including likelihood ratio tests, score tests and Wald tests
- understand the principles of Bayesian inference

Assessment tasks

- Assignment 3
- Final examination

PG - Engaged and Responsible, Active and Ethical Citizens

Our postgraduates will be ethically aware and capable of confident transformative action in relation to their professional responsibilities and the wider community. They will have a sense of connectedness with others and country and have a sense of mutual obligation. They will be able to appreciate the impact of their professional roles for social justice and inclusion related to national and global issues

This graduate capability is supported by:

Learning outcomes

- understand the principles and theory of estimation, including unbiasedness, consistency and relative efficiency, as well as the likelihood function and maximum likelihood estimation
- understand the principles and theory of statistical hypothesis testing, including likelihood ratio tests, score tests and Wald tests
- understand the principles of Bayesian inference

Assessment tasks

- Assignment 3
- Final examination

Changes from Previous Offering

The 2018 offering of STAT710 has similar content to the 2017 offering.

Changes since First Published

Date	Description
26/04/2018	Unit convenor details updated
02/03/2018	Extra tutorial and times updated.
27/02/2018	Unit Convenor details updated Tutorial times updated