



STAT810

Statistical Theory

S1 External 2016

Dept of Statistics

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General Information

Unit convenor and teaching staff

Tutor

Gigi Busayasachee Puang-Ngern

busayasachee.puang-ngern@mq.edu.au

Contact via busayasachee.puang-ngern@mq.edu.au

AHH Level 2

Credit points

4

Prerequisites

Admission to MAppStat or PGDipAppStat or PGCertAppStat or GradDipAppStat or (ACST601 and ACST602 and ACST604)

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 situations 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

Name	Weighting	Due
<u>Assignment 1</u>	15%	29 March 2016
<u>Assignment 2</u>	15%	10 May 2016
<u>Assignment 3</u>	15%	31 May 2016
<u>Mid-year examination</u>	55%	To be determined

Assignment 1

Due: **29 March 2016**

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 situations 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: **10 May 2016**

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: **31 May 2016**

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

Mid-year examination

Due: **To be determined**

Weighting: **55%**

Mid-year 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 situations 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

LECTURE NOTES AND OTHER MATERIALS

Lecture notes and audio recordings of lectures will be made available to external students via the

unit's iLearn website (see Internet Resources below).

TEXTBOOKS

The material and lecture notes are heavily based on the recent 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

Lecturers are available for consultation through iLearn and email, as well as during published consultation hours. For all administrative communications external students should contact:

Lesley Mooney

(02) 9850-8550

lesley.mooney@mq.edu.au

AHH Building Level 2

ASSIGNMENT SUBMISSION

Students must submit assignments via the iLearn website.

Unit Schedule

Weeks 1-12 will involve the study of 9 topics, each of which will be consist of 1-2 lectures.

Week 13 will involve revision.

The 9 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

Topic 9: Introduction to some further inference topics

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.mq.edu.au.

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://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
- Mid-year 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 situations 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
- Mid-year 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
- Mid-year 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 situations 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
- Mid-year 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
- Mid-year examination

Changes from Previous Offering

The 2016 offering of STAT810 has similar content to the 2015 offering.