STAT806

Statistical Inference

S1 Day 2018

Dept of Statistics

Contents

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General Information

Unit convenor and teaching staff Lecturer Nino Kordzakhia nino.kordzakhia@mq.edu.au Contact via nino.kordzakhia@mq.edu.au Level 6, 12 Wally's Walk TBA Jun Ma jun.ma@mq.edu.au Frank Schoenig frank.schoenig@mq.edu.au	
Credit points 4	
Prerequisites	
Corequisites ((Admission to MAppStat or GradDipAppStat or Msc) and (MATH604 and STAT670 and STAT680 and STAT683)) or (admission to MActPrac)	
Co-badged status	
Unit description This unit provides an introduction to likelihood-based statistical inference. After a brief discussion of the multivariable calculus concepts needed, students will study (multivariate) change of variable, the likelihood function and maximum likelihood estimation, using examples from a range of distributions. The theory of estimation and hypothesis testing will be discussed, including most powerful tests, large sample theory, the sufficiency principle, the likelihood ratio principle, and sequential probability ratio tests.	

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 able to understand the theoretical reasons why various estimators and tests are

used.

Be familiar with the derivations of estimators and tests.

Be able to derive estimators and their theoretical small sample and asymptotic properties.

Be able to generate tests for various statistical hypotheses, and establish their properties.

Assessment Tasks

Name	Weighting	Hurdle	Due
Assignment 1	10%	No	23rd March
Assignment 2	10%	No	4th May
Assignment 3	10%	No	1st June
Tutorial Participation	10%	No	Weeks 2 to 13
Final Exam	60%	No	TBA

Assignment 1

Due: **23rd March**
Weighting: **10%**

Submit to the lecturer by 4pm on the due date. There is no "group work" assessment in this unit. All work is to be the student's own. In the case of the 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.

On successful completion you will be able to:
- Be able to understand the theoretical reasons why various estimators and tests are used.
- Be familiar with the derivations of estimators and tests.
- Be able to derive estimators and their theoretical small sample and asymptotic properties.

Assignment 2

Due: **4th May**
Weighting: **10%**

Submit to the lecturer by 4pm on the due date. There is no "group work" assessment in this unit.

All work is to be the student's own. In the case of the 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.

On successful completion you will be able to:

- Be able to understand the theoretical reasons why various estimators and tests are used.

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- Be able to derive estimators and their theoretical small sample and asymptotic properties.

- Be able to generate tests for various statistical hypotheses, and establish their properties.

Assignment 3

Due: **1st June**
Weighting: **10%**

Submit to the lecturer by 4pm on the due date. There is no "group work" assessment in this unit. All work is to be the student's own. In the case of the 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.

On successful completion you will be able to:

- Be able to understand the theoretical reasons why various estimators and tests are used.

- Be familiar with the derivations of estimators and tests.

- Be able to derive estimators and their theoretical small sample and asymptotic properties.

- Be able to generate tests for various statistical hypotheses, and establish their properties.

Tutorial Participation

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

Students will contribute to discussions and hand in at least one handwritten page of tutorial problem solutions per tutorial.

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Final Exam

Due: **TBA**
Weighting: **60%**

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.

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

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.

On successful completion you will be able to:
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• Be able to generate tests for various statistical hypotheses, and establish their properties.

Delivery and Resources

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

Please consult iLearn or the Departmental webpages for details of consultation hours.

Technologies used and required

Lecture material will be placed on iLearn.

Students will need to use a calculator for the final examination and some of the other assessments.

Unit Schedule

Topic	Material covered
1	Probability, expectation, change of variable, moment generating functions, multivariate distributions, conditional expectation.
2	Estimation, the likelihood function, the maximum likelihood principle, properties of estimators, asymptotic properties of maximum likelihood estimators, the Cramér-Rao lower bound.
3	Statistics, sufficient statistics, completeness, minimum variance unbiased estimators, Rao-Blackwell theorem.
4	Hypothesis testing: simple, composite hypotheses, the Neyman-Pearson lemma, asymptotic properties.
5	The Sequential Probability Ratio Test
6	Confidence intervals and regions

Learning and Teaching Activities

Lecture

Three hours a week.

Tutorial

One hour a week.

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 - 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 able to understand the theoretical reasons why various estimators and tests are used.
- Be familiar with the derivations of estimators and tests.
- Be able to derive estimators and their theoretical small sample and asymptotic properties.
- Be able to generate tests for various statistical hypotheses, and establish their properties.

Assessment tasks

- Assignment 1
- Assignment 2
- Assignment 3
- Tutorial Participation
- Final Exam

Learning and teaching activities

- Three hours a week.
- One hour a week.

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

- Be able to understand the theoretical reasons why various estimators and tests are used.
- Be familiar with the derivations of estimators and tests.
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- Be able to generate tests for various statistical hypotheses, and establish their properties.

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Learning and teaching activities

- Three hours a week.
- One hour a week.

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 able to understand the theoretical reasons why various estimators and tests are used.
- Be familiar with the derivations of estimators and tests.
- Be able to derive estimators and their theoretical small sample and asymptotic properties.

- Be able to generate tests for various statistical hypotheses, and establish their properties.

Assessment tasks

- Assignment 1
- Assignment 2
- Assignment 3
- Tutorial Participation
- Final Exam

Learning and teaching activities

- Three hours a week.
- One hour a week.

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:

Assessment tasks

- Tutorial Participation
- Final Exam

Learning and teaching activities

- Three hours a week.
- One hour a week.

Changes from Previous Offering

The Assignment 4 assessment task has been replaced by Tutorial Participation.

Textbooks and other reference material

There is no prescribed textbook for the Unit. Any book with a title such as "Introduction to Mathematical Statistics" will be suitable as a reference. The reference for STAT273, Wackerly, D., Mendenhall W., and Scheaffer, R.L. Mathematical Statistics with Applications (4th, 5th or 6th Editions), would be useful. The lecture notes will be extensive and fairly self-contained.