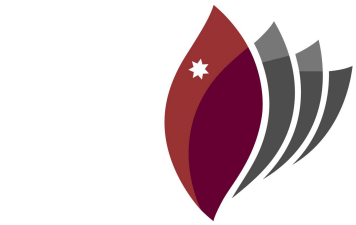

Faculty of Science

Department of Statistics

STAT371/STAT810: Statistical Theory

Unit Outline

Semester 1

2009

Unit convenor: Dr Nino Kordzakhia

Students in this unit should read this unit outline carefully at the start of semester. It contains important information about the unit. If anything in it is unclear, please consult one of the teaching staff in the unit.

ABOUT THIS UNIT

STAT371: Statistical Theory is an undergraduate 3 credit point unit and
STAT810: Statistical Theory is a postgraduate 4 credit point unit offered by Department of Statistics
STAT371/STAT810 aims to familiarise students with foundations of science areas dealing with randomness and chances, in particular **Probability** and **Statistics**. You will learn fundamental theorems of Probability and Statistics showing why and how it is possible to extract significant information from noisy data. You will learn how to use the relevant statistical procedures knowledgably.

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.
Assignment 1 due April 6

Weeks 4 – 7: Laws of Large Numbers, Central Limit Theorem, Fundamental Theorem of Statistics, Empirical Functionals, Exploratory Data Analysis, Asymptotic Theory.

Weeks 8 – 9: Estimation and properties of estimators.

Week 10 – 11: Hypotheses testing and properties of tests. Analysis of Variance.
Assignment 2 due May 18

Week 12 – 13: Linear Models and properties of the Least Squares Estimators.

LECTURES

Mondays, 6pm - 9pm in E5A 119.

TUTORIALS

Mondays commencing in Week 2, 5pm - 6pm in E4B 111, 9pm - 10pm in E4B 102.

UNIT WEB PAGE

URL to access the unit via Blackboard is: `http://learn.mq.edu.au`

TEACHING STAFF

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TEACHING AND LEARNING STRATEGY

Students in Stat371/Stat810 will attend **3 hour lecture every week.** Lecture notes, assignment problems, and their solutions (after the due date) will be available from the Blackboard. Make sure you got the Blackboard password at the enrollment. If you have problems with access to the Blackboard please contact the helpdesk. Lecture notes are delivered by mail to distance students. Students are expected to attend all classes and return all assignments. There will be **two assignments** which should help students to control their progress in preparing for the examination. The assignments aim to provide students feedback on their study. In tutorials problems similar to assignment problems will be solved and discussed.

Independent Work. In Stat371-Stat810 you are also expected to spend some time each week working on your own. This includes revision of lecture and tutorial material, attempts at extra examples (from lectures, your textbook or other text books) and completion of assignments. At Macquarie University it is expected that the average student would spend approximately 3 - 4 hours per week for each credit point in a unit.

ASSESSMENT

- There will be two assignments due in tutorial class. The assignments are worth 15% each,

- Mid-Year Examination is worth 70% (3 hours)

Students may and should benefit from discussing assignment work with other students. However, the actual work submitted must be a student's personal effort, and copying or plagiarism
`http://www.student.mq.edu.au/plagiarism/`
will result in a disciplinary action. Disciplinary proceedings will be taken against offenders without any further warning being given.

RECOMMENDED TEXTS AND/OR MATERIALS

Textbook : Mathematical Statistics with Applications, D.D. Wackerly, W. Mendenhall, R.L. Scheaffer, 7th Edition
Duxbury Press, distributed by Cengage Learning, ISBN-10: 0495110817 ISBN-13: 9780495110811

Software: Scientific Notebook.^{TM}, Release 3.5 is available in E4B labs. **Scientific Notebook provides invaluable help in manipulating algebra and calculus formulae, solving equations and plotting graphs**. A one month free evaluation copy of Scientific Notebook is available from MacKichan Software Inc. http://licensing.mackichan.com/index.html

Reading books :

- Rao, C.R., Linear statistical inference and its applications, (QA276.R36/1973)
- Serfling, R.J. Approximation theorems of mathematical statistics (QA276.S45)
- Ferguson, T.S. Mathematical statistics : a decision theoretic approach, (QA276.F45)
- Ferguson, T.S. A course in large sample theory (QA276.6.F47)
- Lehmann, E.L. Theory of point estimation (QA276.8.L43/1991)
- Lehmann, E.L. Testing statistical hypotheses (QA277.L425)
- Lehmann, E.L. Elements of Large-Sample Theory (QA276.6.L45)
- Lindgren, B.W. Statistical theory (QA276.L546)
- McCabe, B. and Tremayne, A. Elements of Modern asymptotic theory with statistical applications (QA277.M376)
- Hogg, R.V., McKean, J.W. and Craig, A.T. Introduction to Mathematical Statistics, Sixth Edition, (QA276.H59/2004)
- Zacks, S. The theory of statistical inference. (QA276.Z26)

- Freund J.E. and Walpole R.E. Mathematical Statistics, Fifth Edition, (QA276.F692/1992)
- Larson, H. Introduction to probability theory and statistical inference (QA273.L352)

Nonparametric Statistics:

- Bradley, J.V. Distribution free statistical tests (QA278.8.B7)
- Conover, W.J. Practical nonparametric statistics (QA278.8.C65)
- Daniel, W.W. Applied nonparametric statistics (QA278.8.D35)
- Lehmann, E.L. Nonparametrics: statistical methods based on ranks (QA278.8.L43)

LEARNING OUTCOMES

By the end of the unit, students should

- 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 principles of optimal estimation and testing hypotheses, including tests of Analysis of Variance and be able to derive optimal estimators and tests,
- understand principles of linear models, be able to test if the models are adequate and estimate and test parameters of these models.
- understand tests of fit and be able to test if parametric models are adequate.

In addition to the discipline-based learning objectives, all academic programs at Macquarie seek to develop students generic skills in a range of areas. One of the aims of this unit is that students develop their skills in the following:

- Foundation skills of literacy, numeracy and information technology
- Communication skills

- Critical analysis skills
- Problem-solving skills

The University's academic policy outlining the code of practice in relation to the conduct and management of assessment is available at:
http://www.mq.edu.au/policy/docs/assessment/policy_code_of_practice.html
Stat371 and Stat810 are based on the same course material, however undergraduate students in Stat371 and postgraduate students in Stat810 will be assessed independently. Postgraduate students are expected to show on assignments and on the final exam better and deeper understanding of the course material than the undergraduate students.
You are expected to present yourself for examination at the time and place designated in the University Examination Timetable. The timetable will be available in Draft form approximately eight weeks before the commencement of the examinations and in Final form approximately four weeks before the commencement of the examinations at
http://www.timetables.mq.edu.au/exam
The only exception to not sitting an examination at the designated time is because of documented illness or unavoidable disruption. In these circumstances you may wish to consider applying for Special Consideration. Information about unavoidable disruption and the special consideration process is available at
http://www.reg.mq.edu.au/Forms/APScons.pdf
A supplementary examination will only be granted if a student has satisfactory coursework (ie. at least 15 marks out of 30). If a Supplementary Examination is granted as a result of the Special Consideration process the examination will be scheduled after the conclusion of the official examination period. Note that there is a University policy regarding requests for Special Consideration for examinations and the granting of supplementary examinations, which can be found at:
http://www.mq.edu.au/policy/docs/special_consideration/policy.html.
You are advised that it is Macquarie University policy not to set early examinations for individuals or groups of students. All students are expected to ensure that they are available until the end of the teaching semester, that is the final day of the official examination period.

PLAGIARISM

The University defines plagiarism in its rules: "Plagiarism involves using the work of another person and presenting it as one's own." Plagiarism is a serious breach of the University's rules and carries significant penalties. You must read

the University's practices and procedures on plagiarism. These can be found in the Handbook of Undergraduate Studies or on the web at:
http://www.student.mq.edu.au/plagiarism/.
The policies and procedures explain what plagiarism is, how to avoid it, the procedures that will be taken in cases of suspected plagiarism, and the penalties if you are found guilty. Penalties may include a deduction of marks, failure in the unit, and/or referral to the University Discipline Committee.

UNIVERSITY POLICY ON GRADING

Academic Senate has a set of guidelines on the distribution of grades across the range from fail to high distinction. Your final result will include one of these grades plus a standardised numerical grade (SNG).
For an explanation of the policy see GUIDELINES FOR GRADING - Brief Explanation and GUIDELINES FOR GRADING - Detailed Explanation at
http://www.mq.edu.au/senate/rules/Guidelines2003.doc

STUDENT SUPPORT SERVICES

Macquarie University provides a range of Academic Student Support Services. Details of these services can be accessed at
http://www.student.mq.edu.au.