

THE UNIVERSITY OF  
NEW SOUTH WALES



Australian School of Business  
Actuarial Studies

**ACTL5101**  
**PROBABILITY AND STATISTICS FOR ACTUARIES**

**COURSE OUTLINE**  
**SESSION 1, 2009**

© 2009  
**The University of New South Wales**  
Sydney 2052 Australia

The original material prepared for this guide is copyright. Apart from fair dealing for the purposes of private study, research, criticism or review, as permitted under the Copyright Act, no part may be reproduced by any process without written permission. Enquiries should be addressed to the Head of School, Actuarial Studies, UNSW, Sydney 2052

Dear Students,

Welcome to ACTL5101 Probability and Statistics for Actuaries. This course is one of eight courses covering the Core Technical subjects of the Institute of Actuaries offered in the Master of Actuarial Studies. Many of you will also be completing ACTL5101 Financial Mathematics for Actuaries, ACTL5104 Actuarial Statistics and ACTL5105 Life Insurance and Superannuation Models in this session. In the early weeks of the courses you will find that you will have to adjust to the study load in the courses and also take some time to note the links between these courses.

Probability is the branch of science concerned with the mathematical models and techniques for making quantitative inferences about uncertainty. Statistics deals with the collection and the analysis of data. Together, these two disciplines provide us with fundamental tools to analyse risk and manage the financial consequences of future uncertainties. This course provides you with a foundation in the probability models and statistical techniques required for analysing risks in modern financial markets. It provides a foundation for other actuarial courses in the Master of Actuarial Studies at UNSW. I hope you find the course challenging and interesting.

This course outline has details of the course requirements, course aims and learning outcomes, content, teaching methods, assessment tasks, texts and readings, and expectations. Please read it carefully and thoroughly, as it will be assumed that you are familiar with the contents.

If you have any questions about the course at any time then please contact me.

I look forward to guiding your learning through the duration of the course.

Sachi Purcal

|           |                                                                                                                                   |           |
|-----------|-----------------------------------------------------------------------------------------------------------------------------------|-----------|
| <u>1</u>  | <u>STAFF CONTACT DETAILS</u>                                                                                                      | <u>4</u>  |
| <u>2</u>  | <u>COURSE DETAILS</u>                                                                                                             | <u>4</u>  |
| 2.1       | Teaching Times and Locations                                                                                                      | 4         |
| 2.2       | Units of Credit                                                                                                                   | 4         |
| 2.3       | Parallel Teaching in the Course                                                                                                   | 4         |
| 2.4       | Summary of Course                                                                                                                 | 5         |
| 2.5       | Course Aims and Relationship to Other Courses                                                                                     | 5         |
| 2.6       | Student Learning Outcomes (includes objectives of the Institute of Actuaries Subject CT3 Probability and Mathematical Statistics) | 6         |
|           | Graduate Attributes                                                                                                               | 6         |
| <u>3</u>  | <u>LEARNING AND TEACHING ACTIVITIES</u>                                                                                           | <u>7</u>  |
| 3.1       | Approach to Learning and Teaching in the Course                                                                                   | 7         |
| 3.2       | Learning Activities and Teaching Strategies                                                                                       | 7         |
| <u>4</u>  | <u>ASSESSMENT</u>                                                                                                                 | <u>7</u>  |
| 4.1       | Formal Requirements                                                                                                               | 7         |
| 4.2       | Assessment Details                                                                                                                | 8         |
|           | Class Quizzes                                                                                                                     | 8         |
|           | Assignment                                                                                                                        | 9         |
|           | Final Examination                                                                                                                 | 10        |
| 4.3       | Assignment Format                                                                                                                 | 10        |
| 4.4       | Assignment Submission Procedure                                                                                                   | 10        |
| 4.5       | Late Submission                                                                                                                   | 11        |
| <u>5</u>  | <u>ACADEMIC HONESTY AND PLAGIARISM</u>                                                                                            | <u>11</u> |
|           | School of Actuarial Studies Policy on Plagiarism                                                                                  | 11        |
| <u>6</u>  | <u>COURSE RESOURCES</u>                                                                                                           | <u>11</u> |
|           | Textbooks                                                                                                                         | 11        |
|           | Other References                                                                                                                  | 12        |
|           | Formulae & Tables                                                                                                                 | 12        |
|           | Software                                                                                                                          | 12        |
|           | Course WebCT Vista                                                                                                                | 12        |
| <u>7</u>  | <u>COURSE EVALUATION AND DEVELOPMENT</u>                                                                                          | <u>12</u> |
| <u>8</u>  | <u>STUDENT RESPONSIBILITIES AND CONDUCT</u>                                                                                       | <u>13</u> |
| 8.1       | Special Consideration and Supplementary Examinations                                                                              | 13        |
|           | ASB Policy and Process for Special Consideration and Supplementary Exams in Undergraduate Courses                                 | 14        |
|           | Consideration for Missed Assessments (other than final examination)                                                               | 14        |
|           | Review of Results of Assessments (other than final examination)                                                                   | 14        |
| <u>9</u>  | <u>ADDITIONAL STUDENT RESOURCES AND SUPPORT</u>                                                                                   | <u>15</u> |
| <u>10</u> | <u>COURSE SCHEDULE</u>                                                                                                            | <u>15</u> |

## 1 STAFF CONTACT DETAILS

The Course Coordinator and Lecturer of this course is:

| Staff            | E-mail                                                         | Room      | Telephone |
|------------------|----------------------------------------------------------------|-----------|-----------|
| Dr. Sachi Purcal | <a href="mailto:s.purcal@unsw.edu.au">s.purcal@unsw.edu.au</a> | Quad 2070 | 9385 3566 |

He is responsible for the administration and final assessment of the course, as well as the lectures and related grading, teaching and learning.

Sachi will normally be available for consultation on Wednesdays during teaching session from 2 p.m. to 4 p.m. in Quad 2070. For other times, appointments should normally be made in advance using email.

If students have questions about the material covered in the course then consult the Course Coordinator. For administrative matters related to the course including enrolment, tutorial enrolment, assessment, special consideration, and the course web site, students should consult the Course Coordinator or the School Administrator (Bindya Subba).

All non-academic queries should be addressed to:

Bindya Subba

Actuarial Studies Office (Room 2058, 2<sup>nd</sup> Floor Quadrangle Building)

Telephone: 9385 1886

Fax: 9385 1883

E-mail: [b.subba@unsw.edu.au](mailto:b.subba@unsw.edu.au)

## 2 COURSE DETAILS

### 2.1 Teaching Times and Locations

This course will consist of 3 hours of lectures and one hour tutorial per week.

Lecture times and locations are as follows:

Monday          6:00 p.m. – 9:00 p.m.          Australian School of Business 119

Timetables and locations are correct at time of printing. A full timetable of lectures and topics is provided later in this Course study guide. Any alterations to the lecture times or locations will be advised in lectures and via the Course WebCT Vista site.

Students should consult the WebCT Vista site on a regular basis, since assignment questions and other Course materials will be placed there. The web address is:

<http://vista.elearning.unsw.edu.au>

### 2.2 Units of Credit

6

### 2.3 Parallel Teaching in the Course

Although the courses cover very similar material, ACTL5101 and ACTL2002 are taught separately. Students attending ACTL5101 must be enrolled in the Master of Actuarial Studies. Students enrolled in ACTL2002 must attend the undergraduate lectures. Faculty and School policy does not allow undergraduate attendance at postgraduate lectures and vice versa.

## **2.4 Summary of Course**

This course covers probability and statistics topics relevant to actuarial studies. Topics covered include univariate/multivariate random variables, moments, probability generating functions, moment generating functions, marginal and conditional distributions, sampling distributions, estimation methods, hypothesis tests, regression, and analysis of variance. Examples relevant to actuarial studies, finance and insurance are used to illustrate the application of the topics covered.

The course corresponds to the actuarial professional subject CT3 Probability and Mathematical Statistics. Students achieving Credit or higher grades will be recommended for exemption from the professional examination. Exemptions from professional actuarial examinations require above average performance in the equivalent University course.

This course, ACTL5101 Probability and Statistics for Actuaries, along with ACTL5103 Stochastic Models for Actuarial Applications are recognised by the Society of Actuaries for Validation by Education Experience (VEE) for the Applied Statistics subject of the SoA. To receive credit for a subject, candidates will need a grade of CR or better in each of the associated courses.

## **2.5 Course Aims and Relationship to Other Courses**

The aims of this course are to provide students with an understanding of:

- The foundation of probability models including conditional probability and their application to actuarial science
- The different models used for modelling data including discrete and continuous probability models and particularly those used in actuarial science
- The underlying concepts and techniques used to estimate probability and statistical models including regression models
- The underlying concepts and techniques used to test the significance of models and hypotheses
- Problem solving skills using probability and statistical models.

This course covers probability and statistics at an introductory yet mathematically rigorous level with a strong foundation in mathematics. The assumed knowledge of the course is a good understanding of mathematics as covered in a full year of university calculus and linear algebra. Consult the Course Coordinator if you do not have the required mathematical background.

ACTL5101 Probability and Statistics for Actuaries will have applications in other courses in the actuarial major. More advanced models are covered in ACTL5103 Stochastic Models for Actuarial Applications. The course is necessary knowledge for the more advanced coverage in ACTL5104 Actuarial Statistics and ACTL5106 Insurance Risk Models.

Students should have a solid background in mathematics and are assumed to be able to use a computer to analyse financial problems. You should be able to use a word processing package (such as WORD) and a spreadsheet (such as EXCEL). Students should use whatever computer programs they are most familiar with in doing assignments and other assigned tasks.

## **2.6 Student Learning Outcomes (includes objectives of the Institute of Actuaries Subject CT3 Probability and Mathematical Statistics)**

At the end of the course the student should be able to:

1. Demonstrate an understanding of probability theory, including an ability to
  - a. Explain the concepts of probability.
  - b. Explain the concepts of random variable, probability distribution, distribution function, expected value, variance and higher moments, and calculate expected values and probabilities associated with the distributions of random variables.
  - c. Define a probability generating function, a moment generating function, a cumulant generating function and cumulants, derive them in simple cases, and use them to evaluate moments.
  - d. Define basic discrete and continuous distributions, be able to apply them and simulate them in simple cases.
  - e. Explain the concepts of independence, jointly distributed random variables and conditional distributions, and use generating functions to establish the distribution of linear combinations of independent random variables.
  - f. State the central limit theorem, and apply it.
2. Demonstrate an understanding of statistical theory, including an ability to
  - a. Summarise the main features of a data set (exploratory data analysis).
  - b. Explain the concepts of random sampling, statistical inference and sampling distribution, and state and use basic sampling distributions.
  - c. Describe the main methods of estimation and the main properties of estimators, and apply them.
  - d. Construct confidence intervals for unknown parameters.
  - e. Test hypotheses.
  - f. Investigate linear relationships between variables using correlation analysis and regression analysis.
  - g. Explain the concepts of analysis of variance and use them.
  - h. Explain the concepts of conditional expectation and compound distribution, and apply them.
3. Use the software package R to undertake the basic statistical analysis taught in the course.
4. Express his/her views on, and understanding of, an aspect of probability and statistics.

### **Graduate Attributes**

This course contributes to your development of the following Australian School of Business Graduate Attributes, which are the qualities, skills and understanding we want you to have by the completion of your degree. Learning Outcomes 1–3 aim to enhance your capacity for critical thinking and problem solving (Graduate Attribute 1). Learning Outcome 4 aims to develop your written communication skills (Graduate Attribute 2). All Learning Outcomes 1–4 aim to develop your in-depth engagement with relevant disciplinary knowledge (Graduate Attribute 5). Success in the course is indicative of development of ASB Graduate Attribute 6, professional skills, particularly those of task and time management.

### **3 LEARNING AND TEACHING ACTIVITIES**

#### **3.1 Approach to Learning and Teaching in the Course**

The course textbooks, lectures and assessment tasks are designed to provide a framework for your learning. Every student has a different approach to learning. How much time you spend on reading in preparation for lectures, completing assessment tasks, reviewing course objectives, deepening your understanding and preparing for final examinations will depend on your learning approach. Lectures will generally cover the main concepts and issues and will not necessarily cover all the details of the course readings or texts. It is expected that you have read the reading material for the lecture in advance. Students who are successful in this course take an active approach to learning.

#### **3.2 Learning Activities and Teaching Strategies**

The course involves three key components – the lecture, the in-class discussion and your private study.

Each lecture will provide a short overview of topic at hand and will then focus on explaining the difficult concepts and issues. The role of the lecture is to help you understand the context of the topic as well as work through the difficult points.

Each week during class time, time will be set aside for in-class discussion of the most important of the weekly tutorial exercises. To get the most value out of these discussions, you should prepare each week's tutorial exercises and participate in the discussion. The exercises to be covered in each tutorial are available on WebCT. The role of the in-class discussions is to help build your understanding of the topic through the application of what you have learnt to a variety of different problems. They also give you the opportunity to discuss your work with your colleagues, and hence gain an indication of your own progress. In-class discussions also foster development of ASB Graduate Attributes 1, 2 and 5.

Your private study is the most important component of this course. Weekly readings, tutorial exercises, solving problems from the text and your own topic summaries form the basis of an excellent private study regime. Keeping up to date is very important and each week builds on the prior weeks so it is important that you get your study regime organised quickly. In these ways, your self study develops ASB Graduate Attributes 1, 5 and 6.

### **4 ASSESSMENT**

#### **4.1 Formal Requirements**

In order to pass the course students must complete and submit all components of assessment at or before the due times. Late assessment submissions will not be marked. It is important that students be punctual and reliable when submitting assessments. This is an important workplace requirement and students need to ensure they meet deadlines.

## 4.2 Assessment Details

The following table gives the relative weighting of the assessment components:

| Assessment Task      | Weighting | Learning Outcomes Assessed | Due Date                         |
|----------------------|-----------|----------------------------|----------------------------------|
| 1. Class Quizzes     | 15%       | 1, 2, 3 as appropriate     | 30 March<br>& 4 May at<br>6 p.m. |
| 2. Assignment        | 15%       | 1, 2 (a-e), 3, 4           | 22 May at<br>1:55 p.m.           |
| 3. Final Examination | 70%       | 1, 2, 3                    | TBA                              |
| Total                | 100%      |                            |                                  |

In order to pass the course student must perform satisfactorily in all course assessment components.

### Class Quizzes

Technical skills are important in practice and this course provides foundation technical skills that will be useful throughout your working life.

In order to assess your understanding of the technical skills covered in the course aims there will be two 50-minute class quizzes during the session. The quizzes will be administered on a Monday evening. Each quiz will be worth 7.5% of the total assessment for the course. The quizzes will be closed book. Students will only be allowed to bring the text "Formulae and Tables for Actuarial Examinations" into the quizzes.

Normal examination rules apply to the conduct of class quizzes. Calculators will be allowed in the class quizzes and the final examination but a clear indication of all of the steps involved in your calculations must be shown. The University will not supply calculators to students for use in examinations where the provision of calculators has not been requested by the course examiner. It is the student's responsibility to be familiar with the rules governing the conduct of examinations.

The class quizzes require written responses, with students earning marks for correct mathematical working as well as part marks for incorrect responses with correct method and reasoning. They test not only your knowledge of the material, but also the depth of your understanding of it. They assist in the development of ASB Graduate Attributes 1, 5 and 6.

The dates for these quizzes are: (venues to be advised)

|              |                 |           |
|--------------|-----------------|-----------|
| Class Quiz 1 | Monday 30 March | 6:00 p.m. |
| Class Quiz 2 | Monday 4 May    | 6:00 p.m. |

An extensive collection of past quizzes is available on WebCT Vista.

## Assignment

There will be one assignment for this course, worth 15% of your final mark. The assignment offers students the opportunity to engage in independent research, engage in critical analysis, self-reflection and problem-solving, as well as to demonstrate their understanding of the concepts and perspectives that are central to actuarial studies. A solid attempt at the assignment will contribute towards developing ASB Graduate Attributes 1, 2, 5 and 6.

The assignment will involve some theoretical questions of varying degrees of difficulty, a number of practical questions requiring statistical analysis using the software package R, and a written review of a statistical article. The theoretical and practical questions, together with the marks allocated to all components of the assignment, will be made available to students on WebCT Vista progressively. All details will be available by Friday 10 April 2009, at the latest. The article students are required to review is:

Warner, S.L. (1965), 'Randomized response: a survey technique for eliminating evasive answer bias', *Journal of the American Statistical Association*, **60**, pp.63–69.

The assignment is due:

|            |               |           |
|------------|---------------|-----------|
| Assignment | Friday 22 May | 1:55 p.m. |
|------------|---------------|-----------|

Students are reminded that the work they submit must be their own (see section 5 below). While we have no problem with students working together on the assignment problems, the material students submit for assessment must be their own. This means that:

- The mathematical solutions you present are written up by you, without reference to any other student's work.
- The statistical analysis you present is done by your own R code, which you yourself wrote and ran, without reference to any other student's work.
- Any spreadsheet solutions you present are from your own spreadsheets, which you yourself developed, without any reference to any other student's work.

The analytic part of the assignment will be assessed on both technical accuracy and practical application. The marking criteria for the article review will include:

- Summary of the key points in the article
- Clear outline of the arguments/analysis presented
- Evidence of reflection on the article in terms of key issues, common themes and the strengths and weaknesses of the author's argument/approach
- Consistent, clear and well-supported argument/interpretation of the article
- Logical structure, clear written expression, conformity to length
- Essay writing style (not a collection of bullet points)

An example of an article review will be available on WebCT Vista.

## Final Examination

The final examination will assess students understanding of the concepts covered in the course and their ability to apply them to probability and statistics problems. Preparation for the final exam contributes to developing ASB Graduate Attributes 1, 2, 5 and 6.

The final examination will be a three-hour written paper. The final examination will be closed book. Students will only be allowed to bring the text "Formulae and Tables for Actuarial Examinations" into the exam.

## 4.3 Assignment Format

Just as solving the assignment problems is a challenging experience for students, marking the assignment solutions is a challenging experience for staff. In order for us to give you the maximum credit for your efforts, we ask that you abide by the following formatting requirements.

- Number all pages. The first page of your assignment must be the (signed) Actuarial Studies assignment cover sheet.
- Secure the pages of your assignment with a staple (or staples) only in the top left hand corner.<sup>1</sup> Do not submit your assignment in a folder of any sort. Questions should be bound together in ascending order.
- For analytic questions involving no computer resources, neatly write up or type your response and reasoning as clearly as you can.
- For analytic questions requiring you to resort to computer software, use the following example as a guide. Say question 4 of the assignment asks you to calculate the average of a group of numbers appearing in a given dataset, and you went away and wrote thirty different computer programs in five different programming languages to do this which operate on all major operating systems currently in use, and also some that were in vogue in the 1960s. We require that in the main body of your assignment (the 'front'), you answer Question 4 with some text (akin to 'Average is 2'). You should then briefly point out the method you used to achieve this result, and then direct the marker to appendix C (or other) of your assignment (the 'back') where you have carefully detailed and labelled the relevant code and output.
- For written answer questions, like the article review, please type and double space your response. Do not type on both sides of a single page. Cite any sources you use using the Harvard System and include all cited sources in a bibliography at the end of the question. Use an adequate margin on both the left and right hand sides of the page. In general, all quotations should be enclosed with single inverted commas. The exception is quotations of two or more sentences which run to four or more lines—these quotes should be indented. However, long quotes should be avoided where possible.

## 4.4 Assignment Submission Procedure

Assignments must be placed in the box provided outside Quad 2059, Level 2 Quadrangle Building, near the Actuarial Studies office. A cover sheet must accompany these assignments. A copy of the cover sheet is available from the course WebCT site. Additional copies of the cover sheet can be obtained outside Quad 2059

***\*\* Please note that it is School policy that late assignments will **not** be marked \*\****

---

<sup>1</sup> Spiral-bound assignments are acceptable if the assignment, when opened at any double-page layout and simply folded back (so the first and last pages of the assignment are now adjacent, and folded with a minimum of physical exertion), lies flat and there is scant possibility of the pages turning.

Remember to keep a copy of all work submitted for assessment and to keep returned marked assignments.

#### **4.5 Late Submission**

The School of Actuarial Studies has a policy of grading late assignments with a zero mark. We believe this policy fosters development of ASB Graduate Attribute 6. Punctual submission of work is required in order to satisfy the requirements of the course. The assignment may be marked at the discretion of the course co-ordinator if there is a valid reason for late submission and used in cases where your final overall results are marginal.

### **5 ACADEMIC HONESTY AND PLAGIARISM**

The University regards plagiarism as a form of academic misconduct, and has very strict rules regarding plagiarism. For UNSW policies, penalties and information to help you avoid plagiarism see: <http://www.lc.unsw.edu.au/plagiarism/index.html>, as well as the guidelines in the online ELISE tutorial for all new UNSW students: <http://info.library.unsw.edu.au/skills/tutorials/InfoSkills/index.htm>.

To see if you understand plagiarism, do this short quiz:  
<http://www.lc.unsw.edu.au/plagiarism/plagquiz.html>

For information on how to acknowledge your sources and reference correctly, see: <http://www.lc.unsw.edu.au/onlib/ref.html>

For the ASB Harvard Referencing Guide, see:  
[http://www.docs.fce.unsw.edu.au/fce/EDU/harvard\\_ref\\_guide.pdf](http://www.docs.fce.unsw.edu.au/fce/EDU/harvard_ref_guide.pdf)

#### **School of Actuarial Studies Policy on Plagiarism**

The School of Actuarial Studies views any form of plagiarism as unacceptable. The School follows University Procedures in the event of any student plagiarism. In cases of plagiarism for in session assessment the minimum penalty all students involved can expect is to receive a mark of zero for the particular assessment item. The Head of School will be informed, and the School will also keep a record of student Plagiarism cases. Students should familiarise themselves with the University Policy and Procedures and ensure they have consulted The Learning Centre web site so that they are aware of and understand the concepts and practices of academic honesty and plagiarism.

### **6 COURSE RESOURCES**

#### **Textbooks**

The textbooks for the course are:

Wackerly, D.D., Mendenhall, W. & Schaeffer, R.L (2008), 'Mathematical Statistics with Applications', Duxbury, 7<sup>th</sup> ed.

Dalgaard, P (2008), 'Introductory Statistics with R', Springer, 2<sup>nd</sup> ed.

The Faculty of Actuaries and The Institute of Actuaries (2002), 'Formulae and tables for examinations of the Faculty of Actuaries and The Institute of Actuaries'.

## Other References

The following references are useful additional reading to support the course topics.

The Actuarial Education Company, Course CT3 Study Guide.

Rice, J.A. Mathematical Statistics and Data Analysis, Duxbury Press, 3ed, 2007

The text by Rice has been used for this course in the past and is a well regarded and comprehensive text. It is also used by the School of Mathematics for the BSc/BCom courses equivalent to ACTL2002 Probability and Statistics for Actuaries.

Hogg, R.V. & Craig, A.T., Introduction to Mathematical Statistics, 5th Edition, Prentice-Hall, 1995.

Hossack, I., Pollard, J. & Zehnwirth, B. Introductory Statistics with Applications in General Insurance, 2nd Edition, Cambridge University Press, 1999.

## Formulae & Tables

Students will only be allowed to bring into the examinations for the Actuarial courses in the BCom the text "Formulae and Tables for Actuarial Examinations". This text must not be annotated. All students in the actuarial courses should purchase a copy of this text if they wish to use this in the final examinations for this course. The text is available from the UK Institute of Actuaries or from ActEd Australia. Visit the ActEd website at: <http://www.acted.com.au>

## Software

This course will demonstrate many of its principles using the statistical language, R. R is a freely available at: <http://www.r-project.org/>. The ASB Computing Labs also have R available.

## Course WebCT Vista

This course will use WebCT Vista for communication with students. The link therein to 'The Admin Corner' (abbreviated as TAC) will prove invaluable.

The WebCT Vista site for this course will contain the course outline, lecture notes, homework and tutorial exercises, assessment information, and any notices relevant to this course. It is important that you visit the site regularly to see any notices posted there by the course coordinator. The site can be accessed from the WebCT Vista log-in page at: <http://vista.elearning.unsw.edu.au/>

## 7 COURSE EVALUATION AND DEVELOPMENT

Each year feedback is sought from students and other stakeholders about the courses offered in the School and continual improvements are made based on this feedback. UNSW's Course and Teaching Evaluation and Improvement (CATEI) Process is one of the ways in which student evaluative feedback is gathered. Student feedback is taken seriously, and continual improvements are made to the course based on such feedback. Significant changes to the course are communicated to students taking the course. Your input into improving future offerings of the course is highly valued.

As a result of the 2006 evaluation of the course, the previous two assignments were replaced with one assignment. As a result of the 2007 evaluation of the course the previous texts have now been replaced by one that hopefully achieves the course aims in a more 'user-friendly' manner, while not compromising rigour.

## 8 STUDENT RESPONSIBILITIES AND CONDUCT

Students are expected to be familiar with and adhere to university policies in relation to class attendance and general conduct and behaviour, including maintaining a safe, respectful environment; and to understand their obligations in relation to workload, assessment and keeping informed.

Information and policies on these topics can be found in the 'A-Z Student Guide': <https://my.unsw.edu.au/student/atoz/ABC.html>. See especially, information on 'Attendance and Absence', 'Academic Misconduct', 'Assessment Information', 'Examinations', 'Special Consideration', 'Student Responsibilities', 'Workload' and policies such as 'Occupational Health and Safety'.

### 8.1 Special Consideration and Supplementary Examinations

UNSW policy and process for Special Consideration applies (see <https://my.unsw.edu.au/student/atoz/SpecialConsideration.html>). Specifically:

- Applications for special consideration (including supplementary examinations) must go through UNSW Central administration (within 3 working days of the assessment to which it refers) – applications will not be accepted by teaching staff;
- Applying for special consideration does not automatically mean that you will be granted additional assessment or that you will be awarded an amended result;
- If you are making an application for special consideration (through UNSW Central Administration) please notify your Course Coordinator or Lecturer in Charge;
- Please note: a register of applications for Special Consideration is maintained. History of previous applications for Special Consideration is taken into account when considering each case.

Students who believe that their performance in this course, either during session or in an examination, has been adversely affected by sickness, misadventure or other circumstances beyond their control may apply for special consideration for affected assessments. See the University web site for more details: <http://www.student.unsw.edu.au/atoz/atoz-Special.shtml>

Students may be required to sit for an oral or written supplementary examination. Any supplementary examination date will be advised to students after the final examination. In general, a supplementary examination will only be offered to a student who has been prevented from taking the Final Examination who has been placed at a serious disadvantage during the examination, and whose circumstances have improved considerably in the period since the relevant examination was held. Failure to attend a supplementary examination, if you have been granted one, will result in forfeiture of any additional assessment granted to you. Satisfactory performance in any course assessment is required in order to be granted a supplementary examination.

STUDENTS SHOULD NOTE THAT SPECIAL CONSIDERATION WILL NOT BE GRANTED UNLESS PERFORMANCE AND ATTENDANCE AT LECTURES IS SATISFACTORY. THIS WILL USUALLY MEAN THAT YOU WILL HAVE TO PASS ALL ASSESMENT TASKS IN ORDER FOR ANY SPECIAL CONSIDERATION TO BE GIVEN.

### **ASB Policy and Process for Special Consideration and Supplementary Exams in Undergraduate Courses**

In the ASB, requests for special consideration are determined by a Faculty wide panel which will advise the Lecturer in Charge of appropriate action.

If the Faculty panel (see above) grants a special consideration request, this may entitle the student to sit a supplementary examination. In such cases the following procedures will apply:

- Supplementary exams will be scheduled centrally and will be held approximately two weeks after the formal examination period. Actual date will be advised by mid-semester.
- Where a student is granted a supplementary examination as a result of a request for special consideration, the student's original exam (if completed) will not be marked and only the mark achieved in the supplementary examination will count towards the final grade.

Further information concerning supplementary examinations is available on the 'Policies and Guidelines for Current Students' page of the ASB website: <http://www.business.unsw.edu.au/currentstudents>.

### **Consideration for Missed Assessments (other than final examination)**

If you miss a test or are unable to submit your assignment by the due time & date, and you have a valid reason, you need to inform the Actuarial Studies office as soon as possible. You must provide written documentation requesting consideration to the Actuarial Studies office, in the form of a letter explaining your reasons with evidence attached, i.e. medical certificate, police report etc. You should note the course details, your student ID and contact details in your letter as well. As per University rules these considerations must be submitted within 3 working days of the assessment date. If no request is received or it is received after 3 working days you will be awarded a zero mark for that assessment.

### **Review of Results of Assessments (other than final examination)**

As per University rules, if you wish a piece of course assessment to be re-checked, for addition error or incorrect marking, you need to contact the Actuarial Studies office within 15 working days of the assessment being available for collection. You will need to bring in the assessment and provide a note as to the error or reason for review to the Actuarial Studies office. The assessment will be passed onto the relevant academic for review. Students will be able to collect back the assessment from the Actuarial Studies office.

## 9 ADDITIONAL STUDENT RESOURCES AND SUPPORT

The University and the ASB provide a wide range of support services for students, including:

- ASB Education Development Unit (EDU) ([www.business.unsw.edu.au/edu](http://www.business.unsw.edu.au/edu))
- Academic writing, study skills and maths support specifically for ASB students. Services include workshops, online and printed resources, and individual consultations. EDU Office: Room GO7, Ground Floor, ASB Building (opposite Student Centre); Ph: 9385 5584; Email: [edu@unsw.edu.au](mailto:edu@unsw.edu.au)
- UNSW Learning Centre ([www.lc.unsw.edu.au](http://www.lc.unsw.edu.au))
- Academic skills support services, including workshops and resources, for all UNSW students. See website for details.
- Library training and search support services: <http://info.library.unsw.edu.au>
- UNSW IT Service Desk: Technical support for problems logging in to websites, downloading documents etc. Library, Level 2; Ph: 9385 1333. Website: [www.its.unsw.edu.au/support/support\\_home.html](http://www.its.unsw.edu.au/support/support_home.html).
- UNSW Counselling Service (<http://www.counselling.unsw.edu.au>)
- Free, confidential service for problems of a personal or academic nature; and workshops on study issues such as 'Coping With Stress' and 'Procrastination'. Office: Level 2, Quadrangle East Wing; Ph: 9385 5418
- Student Equity & Disabilities Unit (<http://www.studentequity.unsw.edu.au>). Advice regarding equity and diversity issues, and support for students who have a disability or disadvantage that interferes with their learning. Office: Ground Floor, John Goodsell Building; Ph: 9385 4734

## 10 COURSE SCHEDULE

This timetable may change. Revisions will be advised as they occur through the course web site.

| Week Number                                                        | Week Beginning           | Topic Covered                                                                                                  | Textbook References*                                     | Assignment /Quiz                                     |
|--------------------------------------------------------------------|--------------------------|----------------------------------------------------------------------------------------------------------------|----------------------------------------------------------|------------------------------------------------------|
| 1                                                                  | 9 March                  | Probability<br>Random Variables<br>Distributions                                                               | W+: Chap 2<br>JR: Chaps 1, 2<br>D: Chap 3                |                                                      |
| 2                                                                  | 16 March                 | Summarising Data<br>Expected Values<br>Moments Moment Generating Functions<br>Probability Generating Functions | W+: Chaps 1, 2, 3 or<br>JR: Chaps 4, 10<br>D: Chap 4     |                                                      |
| 3                                                                  | 23 March                 | Special Distributions<br>Distributions in Insurance                                                            | W+: Chaps 3, 4<br>JR: Chap 2<br>HPZ: Chap 5<br>D: Chap 3 |                                                      |
| 4                                                                  | 30 March                 | Joint Distributions<br>Multivariate Distributions                                                              | W+: Chap 5<br>JR: Chap 3<br>D: Section 6.4               | <b>Quiz 1<br/>this week<br/>(Mon 6pm)</b>            |
| 5                                                                  | 6 April                  | Distributions of Functions                                                                                     | W+: Chap 6<br>JR: Chap 3<br>D: Chaps 1, 3                |                                                      |
| <b>13 – 19 April Mid-session break</b>                             |                          |                                                                                                                |                                                          |                                                      |
| 6                                                                  | 20 April<br><br>26 April | Special Sampling Distributions<br>Limit Theorems<br><br>Last day to discontinue without<br>Academic penalty    | W+: Chap 7<br>JR: Chaps 5, 6<br>HPZ: Chap 5<br>D: Chap 3 |                                                      |
| 7                                                                  | 27 April                 | Sampling<br>Parameter Estimation                                                                               | W+: Chap 8<br>JR: Chaps 7, 8<br>HPZ: Chap 6<br>D: Chap 3 |                                                      |
| 8                                                                  | 4 May                    | Evaluating Estimators<br>Interval Estimation                                                                   | W+: Chaps 8, 9<br>JR: Chaps 8, 9<br>D: Chaps 3, 5        | <b>Quiz 2<br/>this week<br/>(Mon 6pm)</b>            |
| 9                                                                  | 11 May                   | Statistical Tests                                                                                              | W+: Chap 10<br>JR: Chaps 8, 9<br>D: Chaps 5, 9           |                                                      |
| 10                                                                 | 18 May                   | Evaluating Tests<br>Analysis of Categorical Data                                                               | W+: Chap 10, 14<br>JR: Chaps 9, 13<br>D: Chaps 5, 9, 8   | <b>Assignment<br/>due this week<br/>(Fri 1:55pm)</b> |
| 11                                                                 | 25 May                   | Regression Analysis<br>Multiple Linear Regression                                                              | W+: Chap 11<br>JR: Chap 14<br>D: Chaps 6, 11             |                                                      |
| 12                                                                 | 1 June                   | Analysis of Variance                                                                                           | W+: Chap 13<br>JR: Chap 14<br>D: Chap 7                  |                                                      |
| <b>6 – 11 June Study period<br/>12 June – 27 June Examinations</b> |                          |                                                                                                                |                                                          |                                                      |

**Lecture Timetable (Any changes will be advised through the WebCT Vista Course Web Site)**

| <b>Week</b> | <b>Lecture</b>                                                                        | <b>Topics and Reading</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|-------------|---------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1           | Monday 9 March<br>6:00 p.m. – 9:00 p.m.<br>Australian School of Business<br>Room 119  | <p><b>Course introduction</b></p> <p><b>Introduction to Probability</b></p> <ul style="list-style-type: none"> <li>• Sample Spaces/Events</li> <li>• Probability Set Function</li> <li>• Computing Probabilities</li> <li>• Conditional Probability</li> <li>• Independence</li> </ul> <p><b>Random Variables</b></p> <ul style="list-style-type: none"> <li>• Discrete</li> <li>• Continuous</li> </ul> <p><b>Readings</b><br/>Wackerly et al., Chapter 2<br/>Rice, Chapter 1; Hogg &amp; Craig, Chapter 1 (1.1 – 1.6)<br/>Dalgaard, Chapter 3</p>                          |
|             |                                                                                       | <p><b>Topics</b></p> <p><b>Distribution Functions</b></p> <ul style="list-style-type: none"> <li>• Properties</li> <li>• Density/Probability Mass Function</li> </ul> <p><b>Readings</b><br/>Wackerly et al., Chapter 2<br/>Rice, Chapter 2 (2.1 – 2.2)<br/>Dalgaard, Chapter 3</p>                                                                                                                                                                                                                                                                                          |
| 2           | Monday 17 March<br>6:00 p.m. – 9:00 p.m.<br>Australian School of Business<br>Room 119 | <p><b>Topics</b></p> <p><b>Summary Statistics</b></p> <ul style="list-style-type: none"> <li>• Measures of Location, Dispersion</li> </ul> <p><b>Methods of Summarizing Data</b></p> <ul style="list-style-type: none"> <li>• Methods based on CDF</li> <li>• Graphical Methods (e.g. histogram)</li> </ul> <p><b>Expectations</b></p> <ul style="list-style-type: none"> <li>• Expectations of Functions of Random Variables</li> </ul> <p><b>Readings</b><br/>Wackerly et al., Chapters 1, 2, 3<br/>Rice, Chapter 10<br/>Dalgaard, Chapter 4 (1 &amp; 2 is background)</p> |
|             |                                                                                       | <p><b>Topics</b></p> <p><b>Some Special Expectations</b></p> <ul style="list-style-type: none"> <li>• Moments (means, variances)</li> <li>• Moment Generating Functions (MGF)</li> <li>• Probability Generating Function (PGF)</li> </ul> <p><b>Readings</b><br/>Wackerly et al., Chapter 3<br/>Rice, Chapter 4</p>                                                                                                                                                                                                                                                          |

|   |                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|---|---------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 3 | Monday 24 March<br>6:00 p.m. – 9:00 p.m.<br>Australian School of Business<br>Room 119 | <b>Topics</b><br><b><i>Special Discrete/Continuous Distributions</i></b> <ul style="list-style-type: none"> <li>• Binomial &amp; Related Distributions</li> <li>• The Poisson Distribution</li> <li>• The Hypergeometric Distribution</li> <li>• The Exponential/ Gamma/ Chi-Square Distribution</li> <li>• The Normal Distribution</li> </ul> <b>Readings</b><br>Wackerly et al., Chapters 3, 4<br>Rice, Chapter 2<br>Dalgaard, Chapter 3                                                                           |
|   |                                                                                       | <b>Topics</b><br><b><i>Applications in General Insurance</i></b> <ul style="list-style-type: none"> <li>• Log-normal/Pareto Distributions</li> </ul> <b>Readings</b><br>Hossack, et al., Chapter 5 (5.1, 5.3 – 5.6, 5.8 - 5.9)<br>Dalgaard, Chapter 3                                                                                                                                                                                                                                                                |
| 4 | Monday 30 March<br>6 p.m.–7 p.m.<br>T.B.A.                                            | <b>Quiz 1</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|   | Monday 31 March<br>6:00 p.m. – 9:00 p.m.<br>Australian School of Business<br>Room 119 | <b>Topics</b><br><b><i>Joint/Multivariate Distributions</i></b> <ul style="list-style-type: none"> <li>• Discrete/Continuous Random Vectors</li> <li>• Independent Random Variables</li> <li>• Joint &amp; Marginal Distributions</li> </ul> <b>Readings</b><br>Wackerly et al., Chapter 5<br>Rice, Chapter 3 (3.1 – 3.5)                                                                                                                                                                                            |
| 5 | Monday 7 April<br>6:00 p.m. – 9:00 p.m.<br>Australian School of Business<br>Room 119  | <b>Topics</b><br><b><i>Joint/Multivariate Distributions</i></b> (continued) <ul style="list-style-type: none"> <li>• Conditional Distributions</li> <li>• Expectations, Covariance, Correlation Coefficients</li> </ul> <b>Readings</b><br>Wackerly et al., Chapter 5<br>Rice, Chapter 3 (3.1 – 3.5)<br>Dalgaard, Section 6.4                                                                                                                                                                                        |
|   |                                                                                       | <b>Topics</b><br><b><i>Distributions of Functions of Random Variables</i></b> <ul style="list-style-type: none"> <li>• Transformations of Random Variables</li> <li>• The Jacobian Transformation Method, Change-of-Variable Technique</li> <li>• The Moment-Generating-Function Technique</li> <li>• Sums, Quotients</li> <li>• Order Statistics, Extrema</li> <li>• Taylor Series Approximation</li> </ul> <b>Readings</b><br>Wackerly et al., Chapter 6<br>Rice, Chapter 3 (3.6 – 3.7)<br>Dalgaard, Chapters 1, 3 |

| Mid-semester break |                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|--------------------|-------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 6                  | <p>Monday 21 April<br/>6:00 p.m. – 9:00 p.m.<br/>Australian School of Business<br/>Room 119</p> | <p><b>Topics</b></p> <p><b>Special Sampling Distributions</b></p> <ul style="list-style-type: none"> <li>• The <math>t</math> and <math>F</math> distributions</li> <li>• The Chi-square Distribution</li> <li>• Distributions of Sample Mean and Sample Variance</li> </ul> <p><b>Limit Theorems</b></p> <ul style="list-style-type: none"> <li>• Law of Large Numbers</li> <li>• Convergence in Distribution</li> <li>• Limiting Moment Generating Functions</li> </ul> <p><b>Readings</b><br/>Wackerly et al., Chap 6<br/>Rice, Chapters 5, 6<br/>Dalgaard, Chapter 3</p> |
|                    |                                                                                                 | <p><b>Limit Theorems</b> (continued)</p> <ul style="list-style-type: none"> <li>• The Central Limit Theorem</li> <li>• Applications</li> <li>• Normal Approximation to the Binomial</li> </ul> <p><b>Readings</b><br/>Wackerly et al., Chapter 7<br/>Rice, Chapter 5; Hossack, et al., Chapter 5 (5.2, 5.7)<br/>Dalgaard, Section 8.1</p>                                                                                                                                                                                                                                    |
| 7                  | <p>Monday 28 April<br/>6:00 p.m. – 9:00 p.m.<br/>Australian School of Business<br/>Room 119</p> | <p><b>Topics</b></p> <p><b>Sampling</b></p> <ul style="list-style-type: none"> <li>▪ Basic concepts</li> <li>▪ Population parameters</li> <li>▪ Simple Random Sampling</li> <li>▪ Sampling from the Normal Distribution</li> </ul> <p><b>Readings</b><br/>Wackerly et al., Chapter 8<br/>Rice, Chapter 7 (7.1 – 7.4)<br/>Dalgaard, Chapter 3</p>                                                                                                                                                                                                                             |
|                    |                                                                                                 | <p><b>Topics</b></p> <p><b>Parameter Estimation</b></p> <ul style="list-style-type: none"> <li>▪ Method of Moments</li> <li>▪ Method of Maximum Likelihood: Large Sample Properties of MLEs</li> <li>▪ Introduction to Bayes Estimation</li> </ul> <p><b>Readings</b><br/>Wackerly et al., Chapters 9, 16<br/>Rice, Chapter 8 (8.1 – 8.5);<br/>Hossack, et al., Chapter 6 (6.2 – 6.3)</p>                                                                                                                                                                                    |
| 8                  | <p>Monday 4 May<br/>6 p.m.–7 p.m.<br/>T.B.A</p>                                                 | <p><b>Quiz 2</b></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |

|    |                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|----|---------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|    | <p><i>Monday 4 May</i><br/> 7:00 p.m. – 9:00 p.m.<br/> Australian School of Business<br/> Room 119</p>  | <p><b>Topics</b></p> <p><b><i>Evaluating Estimators</i></b></p> <ul style="list-style-type: none"> <li>▪ Unbiased Estimates</li> <li>▪ Efficiency and the Cramer-Rao Lower Bound (CRLB)</li> <li>▪ Sufficient Statistics, Rao-Blackwell Theorem</li> </ul> <p><b><i>Interval Estimation</i></b></p> <ul style="list-style-type: none"> <li>▪ Method of Constructing Confidence Intervals</li> <li>▪ Confidence Intervals for Means</li> <li>▪ Confidence Intervals for Differences of Means</li> <li>▪ Confidence Intervals for Variances</li> <li>▪ Confidence Intervals for Ratio of Variances</li> <li>▪ Some Applications</li> </ul> <p><b>Readings</b><br/> Wackerly et al., Chapter 9<br/> Rice, Chapter 8 (8.6 – 8.7)<br/> Dalgaard, Chapters 3, 5</p> |
| 9  | <p><i>Monday 12 May</i><br/> 6:00 p.m. – 9:00 p.m.<br/> Australian School of Business<br/> Room 119</p> | <p><b>Topics</b></p> <p><b><i>Theory of Statistical Tests</i></b></p> <ul style="list-style-type: none"> <li>▪ Finding Tests</li> <li>▪ Optimal Tests: Neyman-Pearson Lemma</li> <li>▪ Uniformly Most Powerful Tests</li> <li>▪ Likelihood Ratio Tests</li> <li>▪ Other Large Sample Tests</li> </ul> <p><b>Readings</b><br/> Wackerly et al., Chapter 10<br/> Rice, Chapter 9<br/> Dalgaard, Chapters 5, 9</p>                                                                                                                                                                                                                                                                                                                                               |
|    |                                                                                                         | <p><b>Topics</b></p> <p><b><i>Evaluating Tests</i></b></p> <ul style="list-style-type: none"> <li>▪ Error Probabilities</li> <li>▪ Power Function</li> <li>▪ Inferences from Normal Distribution</li> </ul> <p><b>Readings</b><br/> Wackerly et al., Chapter 10<br/> Dalgaard, Chapters 5, 9</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| 10 | <p><i>Monday 19 May</i><br/> 6:00 p.m. – 9:00 p.m.<br/> Australian School of Business<br/> Room 119</p> | <p><b>Topics</b></p> <p><b><i>The Analysis of Categorical Data</i></b></p> <ul style="list-style-type: none"> <li>▪ Fisher's Exact Test</li> <li>▪ Chi-Square Test of Homogeneity</li> <li>▪ Chi-Square Test of Independence</li> </ul> <p><b>Readings</b><br/> Wackerly et al., Chapter 14<br/> Rice, Chapters 9, 13<br/> Dalgaard, Chapter 8</p>                                                                                                                                                                                                                                                                                                                                                                                                            |

|    |                                                                                     |                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                       |
|----|-------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|    |                                                                                     |                                                                                                                                                                                                                                                                                                                                                           | <b>Topics</b><br><b>Regression Analysis</b> <ul style="list-style-type: none"> <li>▪ Introduction</li> <li>▪ Simple Linear Regressions</li> <li>▪ Method of Least Squares Estimation</li> </ul> <b>Readings</b><br>Wackerly et al., Chapter 11<br>Rice, Chapter 13<br>Dalgaard, Chapter 6                             |
|    |                                                                                     |                                                                                                                                                                                                                                                                                                                                                           | <b>Friday 22 May Assignment due (1:55 p.m.)</b>                                                                                                                                                                                                                                                                       |
| 11 | Monday 26 May<br>6:00 p.m. – 9:00 p.m.<br>Australian School of Business<br>Room 119 | <b>Topics</b><br><b>Regression Analysis</b> (continued) <ul style="list-style-type: none"> <li>▪ Method of Least Squares Estimation</li> <li>▪ Matrix Approach to Linear Least Squares</li> <li>▪ Statistical Properties of Least Squares Estimates</li> </ul> <b>Readings</b><br>Wackerly et al., Chapter 11<br>Rice, Chapter 14<br>Dalgaard, Chapter 11 |                                                                                                                                                                                                                                                                                                                       |
|    |                                                                                     |                                                                                                                                                                                                                                                                                                                                                           | <b>Topics</b><br><b>Multiple Linear Regression</b> <ul style="list-style-type: none"> <li>• Introduction/Example</li> <li>• Assessing Model Fit</li> <li>• Assessing Significance of Regressor Variables</li> </ul> <b>Readings</b><br>Wackerly et al., Chapter 11<br>Rice, Chapter 14 (14.4)<br>Dalgaard, Chapter 11 |
| 12 | Monday 2 June<br>6:00 p.m. – 9:00 p.m.<br>Australian School of Business<br>Room 119 | <b>Topics</b><br><b>Analysis of Variance</b> <ul style="list-style-type: none"> <li>• One-Way ANOVA</li> <li>• Model/Distribution Assumptions</li> <li>• Inferences</li> </ul> <b>Readings</b><br>Wackerly et al., Chapter 13<br>Rice, Chapter 14 (14.5)<br>Dalgaard, Chapter 7                                                                           |                                                                                                                                                                                                                                                                                                                       |
|    |                                                                                     |                                                                                                                                                                                                                                                                                                                                                           | <b>Topics</b><br><b>Analysis of Variance</b> (continued) <ul style="list-style-type: none"> <li>• Two-Way ANOVA</li> <li>• Re-Parameterisation</li> <li>• Normal Theory</li> </ul> <b>Readings</b><br>Wackerly et al., Chapter 13<br>Rice, Chapter 12 (12.3)<br>Dalgaard, Chapter 7                                   |