UNSW Business School

Risk and Actuarial Studies

ACTL3142 / ACTL5110
Actuarial Data and Analysis

Course Outline
Semester 2, 2017

Course-Specific Information

The Business School expects that you are familiar with the contents of this course outline. You must also be familiar with the Course Outlines Policies webpage which contains key information on:
• Program Learning Goals and Outcomes
• Academic Integrity and Plagiarism
• Student Responsibilities and Conduct
• Special Consideration
• Student Support and Resources

This webpage can be found on the Business School website:
https://www.business.unsw.edu.au/degrees-courses/course-outlines/policies

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COURSE-SPECIFIC INFORMATION

1 STAFF CONTACT DETAILS

The Course Lecturer-in-charge is Dr Andrés Villegas. He is responsible for the teaching and assessment of the course. All administrative and academic (learning) enquiries to do with the course should be directed to Andrés.

Name	Email	Room	Phone
Andrés Villegas	a.villegas@unsw.edu.au	Business School 645	93852647
Bernard Wong	Bernard.wong@unsw.edu.au	Business School 640	93852827

Dr Villegas is the lecturer in charge for the course, and he is responsible for course administration, teaching and final assessment of the course. Associate Professor Bernard Wong will also be delivering some lectures of the course. Consultation times for Andrés and Bernard during the semester will be posted (and updated) on the course website.

The Tutor for the course is:

Staff	Email
Alan Xian	a.xian@unsw.edu.au

The tutor will hold consultation at the front of the School of Risk and Actuarial Studies office (UNSW Business School Building, Level 6) in the week before any in-session assessment. The consultation times will be advertised on the course website.

2 COURSE DETAILS

2.1 Teaching Times and Locations

Lectures
Lectures will be held on **Tuesdays from 2pm to 4pm in CLB6** from week 1 to 3, and from weeks 5 to 13 (excluding public holidays). Additional lecture time on **Thursdays 5-6pm at ColomboThA** has also been reserved to be used as needed. You must **remain available on the Thursday slot** for additional activities should they be organised, but you do not need to come unless we announce you must do so.

Labs (Tutorials)
Lab classes will be held at the following times from week 2 to week 13.

ACTL3142

Tuesday	11am-12noon	Quad G021

Tuesday	12pm-1pm	Quad G021

ACTL5110

Tuesday	9am-10am	Quad G021

Students must attend the lab/tutorial for which they are enrolled. Attendance will be recorded and counts towards meeting the requirements to pass the course; for more information, see the Course Outlines Policies webpage
https://www.business.unsw.edu.au/degrees-courses/course-outlines/policies.
If you wish to change your tutorial then you must lodge an application to change your tutorial time with the Business School Student Centre.

2.2 Units of Credit

The course is worth 6 units of credit. The lectures of ACTL3142 and ACTL5110 are held jointly, although lab sessions are separate.

2.3 Summary of Course

This course covers the techniques in data analysis including techniques for mortality, health, and insurance data used in actuarial analysis and decision-making. Particular focus will be on techniques often referred to by 'predictive analytics' and 'statistical learning', and their applications to actuarial work.

The course covers aspects of data analysis including exploratory data analysis, classification and prediction with regression models; descriptive, inferential and predictive analysis and models; and statistical and machine learning including supervised and unsupervised learning. The course also covers ethical, regulatory and professional issues, and risks and risk management associated with using data and data analysis. A particular focus will be placed on communication of technical results for business applications.

2.4 Course Aims and Relationship to Other Courses

The aims of this course are to provide students with an understanding of the main techniques predictive analytics / data analytics techniques of particular relevance to actuarial work, including
- Regression techniques and classification methods
- Model selection and validation methods including cross validation and dimension reduction.
- Linear and Non-linear models
- Decision Trees and extensions
- Supervised and unsupervised learning techniques

This course is offered as an elective in the undergraduate (ACTL3142) and postgraduate programs (ACTL5110) in the school of risk and actuarial studies.

Students are assumed to have a good mathematics background and a solid understanding of the concepts of probability and statistics, and actuarial modelling, as covered in the combination of courses ACTL2111 and ACTL2131 (for ACTL3142), or the combination ACTL5101 and ACTL5102 (for ACTL5110). These courses are the formal prerequisites for ACTL3142 and ACTL5110, respectively. Students who have done

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MATH2901 and MATH2931 is also deemed to have met the ACTL2131 prereq for this course.

Students need to be able to use a word processing package (such as WORD) and a spreadsheet (such as EXCEL). They should also be able to use the statistical software package R which will be used to implement many of the models discussed in this course, and in particular in the lab classes. Students who are not as familiar with R are highly recommended to go through the module "R U ready" on the ACTL All students site.

2.5 Student Learning Outcomes

The Course Learning Outcomes are what you should be able to DO by the end of this course if you participate fully in learning activities and successfully complete the assessment items.

The Learning Outcomes in this course also help you to achieve some of the overall Program Learning Goals and Outcomes for all undergraduate students in the Business School. Program Learning Goals are what we want you to BE or HAVE by the time you successfully complete your degree (e.g. 'be an effective team player'). You demonstrate this by achieving specific Program Learning Outcomes - what you are able to DO by the end of your degree (e.g. 'participate collaboratively and responsibly in teams').

For more information on Program Learning Goals and Outcomes, see the School's Course Outlines Policies webpage available at
https://www.business.unsw.edu.au/degrees-courses/course-outlines/policies

At the end of the course, you should be able to:

- Understand aspects of the theory and practice of predictive analytics / data analytics for insurance and financial applications as covered in the course aims. [LO1]
- Assess models used for predictive analytics / data analytics in practice and their advantages and shortcomings. [LO2]
- Estimate and apply various statistical learning models for practical applications. [LO3]
- Understand and explain ethical and regulatory issues associated with the use of data and analytic techniques. [LO4]
- Use effective presentation, discussion and report writing skills for explaining risk-modelling concepts used in quantitative risk management. [LO5]

The following table shows how your Course Learning Outcomes relate to the overall Program Learning Goals and Outcomes, and indicates where these are assessed (they may also be developed in tutorials and other activities):

Program Learning Goals and Outcomes	Course Learning Outcomes	Course Assessment Item
This course helps you to achieve the following learning goals for all UNSW Business School	*On successful completion of the course, you should be able to:*	*This learning outcome will be assessed in the following items:*

postgraduate coursework students:			
1	Knowledge	LO1-LO3	• Assignment • Mid-term Exam • Final Exam
2	Critical thinking and problem solving	LO1-LO3	• Assignment • Mid-term Exam • Final Exam
3a	Written communication	LO1-LO3, LO5	• Assignment
3b	Oral communication	n/a	
4	Teamwork	n/a	
5a.	Ethical, environmental and sustainability responsibility	LO4	• Final Exam
5b.	Social and cultural awareness	n/a	• Final Exam

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 learning activities of this course involve three key components – the lecture, the labs, the assignments, 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. To maximize your achievements in each lecture you should read the assigned notes prior to each class. The assignments present you with a practical application of course concepts to a problem in data analytics (see also assessments section, below). Your private study is the most important component of this course. Weekly readings, solving problems, 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.

Students are not permitted to bring into the class any sound or video recording devices.

4 ASSESSMENT

4.1 Formal Requirements

In order to pass this course, you must:
- achieve a composite mark of at least 50;
- make a satisfactory attempt at all assessment tasks (see below).

4.2 Assessment Details

Assessment of your performance in the course will be done through a number of tasks, whose list you will find in the following table with relevant details.

Assessment Task	Weighting	Length	Due Date
Mid Session exam	15%	1 hour	2pm on 22 August, 2017
Assignment	25%		2pm on 18 October, 2017
Final Examination	60%	2 hours	University Examination Period.
TOTAL	**100%**		

4.3 Details of each assessment task:

4.3.1 Assignment
The Assignment is intended to develop your skills in research and your ability to concisely and coherently present your ideas. It is intended to be part of achieving course learning outcomes 1, 2, 3, 4, and 6, and program learning goals 1-3.

There will be one major assignment task involving application of course concepts to data analysis and practical risk management decision-making. Details will be provided through the course Moodle web site. The assignment will allow students the opportunity to develop their understanding of the issues involved in estimating and applying models for various risks and broaden their knowledge of course topics. Marks will be awarded for
- Accuracy of results
- Presentation
- Reasonableness checks applied
- Technical details

The assignment questions will be posted on the course Moodle website on or before 6pm, 25th August 2017. It will be due (submitted via TURNITIN on the course website) by 2pm, 18th October 2017.
Students are reminded that the work they submit must be their own. While we have no problem (and in fact, it is encouraged, to interact with your peers to enhance your

learning) with students working together on the assignment problems, the material students submit for assessment must be their own (including any R code submitted – which cannot be identical).

Full information about the assignment submission procedure will be released with the assignment question.

4.3.2 Mid Session Exam

The mid session exam will assess critical analysis and problem solving skills as well as written communication skills, and corresponds to course learning outcomes 1, 2, 3, 4, 6, and postgraduate program learning goals 1-3. In addition, the class test provides a feedback mechanism for students to gauge their progress in the course.

The date and time for the test is 22th August April, 2017, and will be at the normal lecture location. The test will be administered at 2:00pm, and will be worth 15% of the total assessment for the course. The test will be closed book.

Normal examination rules apply to the conduct of class tests. Calculators will be allowed in the class tests 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 mid session exam requires written responses, with students earning marks for correct explanations of the main concepts and issues examined in each question. Marks for calculation questions will be granted on 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.

4.3.3 Final Exam
The final examination will be a two hour written paper. The examination will aim to assess the achievement of the learning outcomes of the course including the course aims. The examination will assess critical analysis and problem solving skills as well as written communication skills, and correspond to course learning outcomes 1-6, and postgraduate program learning goals 1, 2, 3, 5.

4.4 Special Consideration, Late Submission and Penalties
For information on Special Consideration please refer to the Business School's Course Outlines Policies webpage.

Special consideration and assessments other than the Final Exam in undergraduate and postgraduate courses:
For courses offered by the School of Risk and Actuarial Studies, the weight of the assessment items for which special consideration is granted is re-allocated to the Final Exam. Alternatively, in exceptional cases and only for assessment items with a submission deadline, a delayed deadline may be granted. This may be no more than 5 business days after the initial deadline, and must be before feedback is provided to students.

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Special consideration **does not** entitle students to a supplementary opportunity to complete the assessment item.

Late submission of assessment items
When an assessment item had to be submitted by a pre-specified submission date and time and was submitted late, the School of Risk and Actuarial Studies will apply the following policy.
A penalty of 25% of the mark the student would otherwise have obtained, for each full (or part) day of lateness (e.g., 0 day 1 minute = 25% penalty, 2 days 21 hours = 75% penalty). Students who are late must submit their assessment item to the LIC via e-mail. The LIC will then upload documents to the relevant submission boxes. The date and time of reception of the e-mail determines the submission time for the purposes of calculating the penalty.

4.5   Protocol for viewing final exam scripts

The UNSW Business School has set a protocol under which students may view their final exam script. Please check the protocol here.
Individual Schools within the Faculty may set up a local process providing it is in keeping with the Faculty protocol. The School of Risk and Actuarial Studies implements the abovementioned faculty guidelines in the following way:
1. There will be only one viewing.
2. Students must register (that is, lodge a request to view their final exam script) to rasadmin@unsw.edu.au after results are released, but no later than COB on Wednesday 6 December 2017.
3. The viewing will take place on Monday 11 December 2017, at a time and location to be announced to registered students by COB on Friday 8 December 2017. Student MUST remain available for the WHOLE of 11 December 2017 until the time of their viewing is communicated.

Note that students must make a separate, subsequent appointment with the LIC, should they wish to lodge a formal application for re-assessment.

> **Quality Assurance**
> The Business School is actively monitoring student learning and quality of the student experience in all its programs. A random selection of completed assessment tasks may be used for quality assurance, such as to determine the extent to which program learning goals are being achieved. The information is required for accreditation purposes, and aggregated findings will be used to inform changes aimed at improving the quality of Business School programs. All material used for such processes will be treated as confidential.

5   COURSE RESOURCES

5.1   Course website

The website for this course is on Moodle at:
http://moodle.telt.unsw.edu.au
The course will use various digital resources, but they all will be linked from moodle.

To access the Moodle online support site for students, follow the links from that website to UNSW Moodle Support/Support for Students. Additional technical support can be obtained from itservicecentre@unsw.edu.au (02 9385 1333).

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All course contents will be available from the course website. **It is essential that you visit the site regularly to see any notices posted there by the course coordinator, as it will be assumed that they are known to you within a reasonable time.**

5.2   Textbooks

There are many books of relevance to the course topics. The following book will be the main text references for a substantial part of the course:

James, G., Witten, D., Hastie, T., Tibshirani, R., *An Introduction to Statistical Learning with Applications in R*, Springer, 2013

Additional readings from the professional actuarial literature will also be used to provided additional context, details, and examples. This will be communicated in the course website.

5.3   The Actuaries Institute

The Actuaries Institute allows students to become University Subscribers free of charge. Full time undergraduates studying at an Institute accredited university who are members of a university student actuarial society are eligible. To sign up, go to

https://www.actuaries.asn.au/becoming-an-actuary/becoming-a-university-subscriber

6   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 myExperience survey is one of the ways in which student evaluative feedback is gathered. In this course, we will seek your feedback through end of semester myExperience responses and other informal forums.

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7   COURSE SCHEDULE

This timetable may be altered. Students will be advised of any changes in lectures and via the course web site.

Note that lectures for this course start in Week 1 and end in Week 13 while and lab classes start in Week 2 and end in Week 13.

Week	Week begining	Topic	Text Reference
1	24-Jul	Introduction; Actuaries and Predictive Analytics techniques	1,2
2	31-Jul	Linear Regression techniques: Simple/Multiple; K-Nearest Neighbours	3
3	7-Aug	Classification Methods: Logistic regression, Discriminant Analysis	4
4	14-Aug	*No class*	
5	21-Aug	*Class Test*	
6	28-Aug	Resampling Methods: Cross Validation and Bootstrap	5
7	4-Sep	Linear Model Selection and Regularization: Subsets, Shrinkage, and Dimension Reduction	6
8	11-Sep	Non-Linear methods: Polynomial Regression, Splines, and Generalized Additive Models	7
9	18-Sep	Decision Trees: Bagging and Boosting	8
		Mid Semester Break	
10	2-Oct	Support Vector Machines and Classification	9
11	9-Oct	Unsupervised Learning Methods: PCA and Clustering (i)	10
12	16-Oct	Unsupervised Learning Methods: PCA and Clustering (ii)	10
13	23- Oct	Professional Ethics in Data Modelling	

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