THE UNIVERSITY OF
NEW SOUTH WALES

Australian School of Business
Actuarial Studies

ACTL3001
ACTUARIAL STATISTICS

COURSE OUTLINE
SESSION 1, 2009

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The University of New South Wales
Sydney 2052 Australia

Dear Students,

Welcome to ACTL3001 Actuarial Statistics. This course is one of eight courses for the BCom Actuarial major.

In this course outline, you will find the 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.

Jinxia Zhu

1. STAFF CONTACT DETAILS

The Course Coordinator and Lecturer of this course is:

Staff	E-mail	Room	Telephone
Dr. Jinxia Zhu	jinxia.zhu@unsw.edu.au	Quad 2073	9385 7385

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

Tutors for this course are:

Staff	E-mail	Room	Telephone
Andy Tang	Z3157976@student.unsw.edu.au	Quad 2082A	9385 8005
Neo Tang	z3174529@student.unsw.edu.au	Quad 2082A	9385 8005

They are responsible for the tutorials and grading of tests and assignment assessment tasks.

1.1 Communication with Staff

Jinxia will normally be available for consultation on Tuesdays during teaching session from 10:30 a.m. to 12:00 p.m. and 4:00 p.m. to 5:20 p.m. in Quad 2073. For other times, appointments should normally be made in advance.

Tutors are also available for consultation. Times and locations will be posted on WebCT Vista.

If students have questions about the material covered in lectures then consult the Course Lecturer. For tutorial problems or other problems with assignments and course material students should consult the tutor. 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, Quadrangle Building
Telephone: 9385 1886
Fax: 9385 1883
E-mail: b.subba@unsw.edu.au

2. COURSE DETAILS

2.1 Teaching times and Locations
Lectures
This course will consist of 3 hours of lectures and 1 hour of tutorial per week.

Lecture times and locations are as follows:

Tuesday	2:00 p.m. – 4:00 p.m.	Biomedical Theatre B
Thursday	9:00 a.m. – 10:00 a.m.	Electrical Eng G25

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.

Tutorials
Tutorials will begin in Week 1.

Normal tutorials will be held in the following locations:

H11A	Thu	11:00 a.m.–12:00 p.m.	Quad G052
H12A	Thu	12:00 p.m.– 1:00 p.m.	Quad G027
H14A	Thu	2:00 p.m.– 3:00 p.m.	Quad G027
H15A	Thu	3:00 p.m.– 4:00 p.m.	Quad G027
H16A	Thu	4:00 p.m.– 5:00 p.m.	EE 225

Tutorials in Weeks 1, 4, 5, 12 will be held in computer labs. These sessions are designed to further develop your skills in the application of modern software packages in actuarial problem solving, tutorials. **The location of the computer lab sessions is _Quad 1030_.**

Students must attend the tutorial for which they are enrolled. Attendance will be recorded and count towards meeting the requirements to pass the course. If you wish to change your tutorial then you must lodge an application to change your tutorial time with the Actuarial Studies office.

In tutorials, we will implement interactive learning where active learning and participation will be a key tool to enhance your understanding of the material.

To get the most out of the tutorials, it is important that students complete assigned homework problems in advance of the tutorial. This may also include reading lecture notes and textbooks and references.

2.2 Units of Credit
6

2.3 Parallel teaching in the course
Although the courses cover very similar material, ACTL3001 and ACTL5104 are taught separately. Students enrolled in ACTL3001 must attend the undergraduate lectures. Students attending ACTL5104 must be enrolled in the Master of Actuarial Studies. Faculty and School policy does not allow undergraduate attendance at postgraduate lectures.

2.4 Summary of Course

This course covers survival models and their estimation as well as applications in insurance and finance. Specific topics include: the concept of survival models and actuarial notation; estimation of lifetime distributions; multiple state models; maximum likelihood estimation of transition intensities; the binomial model of mortality and its estimation; models with transition intensities depending on age and duration; the census approximation and formulae; statistical comparison of crude rates with a standard table; graduation of crude estimates and tests of fidelity and smoothness; analysis of mortality/morbidity and the main forms of selection. The analysis of data using a numerical computer package will be introduced.

This course corresponds to Subject CT4 Models of The Institute of Actuaries, where we cover Units 5-13 of CT4 through the UNSW course ACTL3001. CT4 exemption is determined by a weighted average of ACTL2003 and ACTL3001 marks. This average will have to be 65% or higher in order to be recommended for exemptions.

2.5 Course Aims and Relationship to other courses

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

1. How to assess the properties of a data set and to model real-life data for insurance and finance applications.
2. Actuarial statistics techniques and its application in assessing probability models and data.
3. Modern statistical modelling via a statistical computer program.
4. Professional application of statistical methods to practical problems.

This course covers the development and application of statistical techniques to practical actuarial problems. Examples will be drawn from the insurance and financial markets. Students are assumed to have a good knowledge of ACTL 1001, ACTL2002 and ACTL2003.

Particularly important is the material on statistical estimation and regression techniques covered in ACTL2002. If you knowledge on this topic area requires revision it is important that you revise this material as soon as possible.

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. Particularly relevant will be the statistical package R.

2.6 Student Learning Outcomes (includes objectives of the Institute of Actuaries Subject CT4 Models)

At the end of this course students should be able to:

1. Explain the concept of survival models.
2. Describe estimation procedures for lifetime distributions.
3. Describe statistical models of transfers between multiple states, including processes with single or multiple decrements, and relationships between probabilities of transfer and transition intensities.

4. Derive maximum likelihood estimators for the transition intensities in models of transfers between states with piecewise constant transition intensities.
5. Describe the Binomial model of mortality, derive a maximum likelihood estimator for the probability of death, and compare the Binomial model with the multiple state models.
6. Describe how to estimate transition intensities depending on age, exactly or using the census approximation.
7. Describe how to test crude estimates for consistency with a standard table or a set of graduated estimates, and the process of graduation.
8. Describe the principal forms of mortality and morbidity heterogeneity in a population and the ways in which selection can occur.
9. Use the software package R to undertake modern statistical modelling.

and should have

10. Developed communication skills for the presentation of complex statistical models in written report form.
11. Developed Teamwork and discussion skills.

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 1–9 aim to enhance your capacity for critical thinking and problem solving (Graduate Attribute 1). Learning Outcome 10 aims to develop your written communication skills (Graduate Attribute 2). All Learning Outcomes 1–11 aim to develop your in-depth engagement with relevant disciplinary knowledge (Graduate Attribute 5). Learning Outcome 11 aims to develop your teamwork and leadership capacity (Graduate Attribute 3). 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 tutorial 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. Students will need to read the prescribed readings prior to the lecture.

Each tutorial will involve a number of exercises that relate to the current week's topic. You are required to prepare for each tutorial and the tutorial will require your participation. The exercises to be covered in each tutorial are available on WebCT. The role of the tutorial 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. Tutorials 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 on or before the due date. 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 Tests	20%	1,2,3, 4,5,6,7,8	2 April & 14 May at 9:00 am
2. Assignment	10%	1,2,3,4,5,6,7,8,9,10,11	7 May at 11:55 am
3. Final Examination	70%	1,2,3, 4,5,6,7,8	TBA
Total	100%		

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

Class Tests
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 class tests during the session. The class tests will be administered during lectures. Each class test will be worth 10% of the total assessment for the course. The class tests will be closed book. Students will only be allowed to bring the text "Formulae and Tables for Actuarial Examinations" into the class tests.

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.

Class tests will be held in the lecture theatre at the scheduled lecture time:

Class Test 1	Thursday 2 April	9:00 a.m. - 9:50 a.m.
Class Test 2	Thursday 14 May	9:00 a.m. - 9:50 a.m.

Assignments

The practical application of the course concepts based on actual data from insurance and financial markets is an important graduate attribute that employers require and this course aims to provide at least some introductory exposure to this. Writing skills for technical material are also important.

There will be one Assignment for this course worth 10% in total. The assignment will involve the practical application of course concepts to actuarial problems.

To enhance the development your teamwork and communication skills assignments will be of a group form, where teams of TWO students combine their skills to tackle a practical problem applying the techniques learned in this course. This will provide students with an opportunity to also develop communication and teamwork skills.

The assignment will be assessed on technical accuracy, how well it is written, and the quality of the assignment presentation.

The assignment is to be submitted in the assignment box outside Quad 2059 near the Actuarial Studies school office. Due date is:

    Assignment   Thursday, 7 May 11:55 a.m.

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.

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.[1] 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 that 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.

4.5 Late Submission

The School of Actuarial Studies has a policy of grading late assignments with a zero mark. 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

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[1] 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.

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://wwwdocs.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:

> *Course Notes and Core Reading for Subject CT4 Models* published by The Institute of Actuaries.

The above text provides the best combination of reading material required for the material of this course. Extensive exercises are also included.

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

> London, Dick, *Survival Models and Their Estimation*, Third Edition, ACTEX Publications, Winsted, Connecticut, 1997. (This text was used by the Society of Actuaries for its Survival models subject).

> Klein, J. P., and Moeschberger, M. L. Survival Analysis: Techniques for Censored and Truncated Data, Springer-Verlag, New York, 1997. (This text is being used by the Society of Actuaries).

Other references that may assist you in understanding concepts covered in this course are:

> Kleinbaum, D. G., *Survival Analysis: A Self-Learning Text*, Springer, New York, 1995. Chapters 1 to 3.

> Dalgaard, P., *Introductory Statistics with R*, Second Edition, Springer, New York, 2008.

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 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)
- Academic writing, study skills and maths support specifically for ASB students. Services include workshops, online and printed resources, and individual consultations. EDU Office: Room G07, Ground Floor, ASB Building (opposite Student Centre); Ph: 9385 5584; Email: edu@unsw.edu.au
- UNSW Learning Centre (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
- 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 is tentative and may change. Revisions will be advised as they occur through the course web site.

Week No	Week Beginning	Topics Covered	Textbook References*	Assignment, Quiz & Notes
1	9 March	Survival Models and the Life Table;	CT4 Chap 7	Tutorial-Lab
2	16 March	Kaplan-Meier and Nelson-Aalen Models; Comparing Survival Functions;	CT4 Chap 8 K&M 3.1-3.4, 4.2* K&M 7.3*	
3	23 March	Comparing Survival Functions; Log-linear Regression Model; Cox Regression Model	K&M 7.3* CT4 Chap 9 Der & Everitt Chap 12 K&M Chap 8, 11.2, 11.4*	
4	30 March	Cox Regression Model;	CT4 Chap 9 Der & Everitt Chap 12 K&M Chap 8, 11.2, 11.4*	**Class Test 1 Thur 9:00 am** Tutorial-Lab
5	6 April	Parametric Models; Markov Models	CT4 Chap 4, 5, 3*	Tutorial-Lab
13–19 April Mid-session break				
6	20 April / 26 April	Markov Models / Last day to discontinue without Academic penalty	CT4 Chap 4, 5, 3*	
7	27 April	Markov Models; Binomial and Poisson Models;	CT4 Chap 10	
8	4 May	Traditional Actuarial Methods: Exposed to Risk	CT4 Chap 11	**Assignment due Thur 11:55 am**
9	11 May	Graduation and Statistical tests	CT4 Chap 12	**Class Test 2 Thur 9:00 am**
10	18 May	Graduation and Statistical tests; Methods of Graduation	CT4 Chap 12, 13 London: Graduation: The revision of Estimates 6.5*	
11	25 May	Methods of Graduation	CT4 Chap 13 London: Graduation: The revision of Estimates 6.5*	
12	1 June	Selection and Standardization		Tutorial-Lab
6 – 11 June Study period **12 June – 27 June Examinations**				

Lecture Timetable

(Any Changes will be advised through the WebCT Vista Course Web Site)

Week	Lecture	Topics and Readings
1	Tuesday 10 March 2:00 p.m.– 4:00 p.m. Biomedical Theatre B	**Topics** ***Survival Models*** • Mortality-Random variables and probabilities • Actuarial Notation **Readings** CT4 Chap 7
	Thursday 12 March 9:00 a.m.– 10:00 a.m. Electrical Eng G25	**Topics** ***Survival Models*** *(continued)* • Life tables • Simple laws of mortality **Readings** CT4 Chap 7
2	*Tuesday 17 March* 2:00 p.m.– 4:00 p.m. Biomedical Theatre B	**Topics** ***Estimating lift-time distributions*** • Censoring • Kaplan-Meier estimate • Nelson-Aalen estimate CT4 Chap 8 K & M 3.1-3.4, 4.2*
	Thursday 19 March 9:00 a.m.– 10:00 a.m. Electrical Eng G25	**Topics** ***Comparing survival functions*** • Log-rank test **Readings** K & M 7.3*
3	*Tuesday 24 March* 2:00 p.m.– 4:00 p.m. Biomedical Theatre B	**Topics** ***Comparing survival functions*** *(continued)* • Wilcoxon statistic ***Regression and Estimation*** • Least squares regression • Regression with life data • Maximum likelihood estimation **Readings** K & M 7.3
	Thursday 26 March 9:00 a.m.– 10:00 a.m. Electrical Eng G25	**Topics** ***Cox regression model*** • Cox regression model: theory **Readings** CT4 Chap 9, Der & Everitt Chap 12 K & M Chap 8, 11.2, 11.4*

4	*Tuesday 31 March* 2:00 p.m.– 4:00 p.m. Biomedical Theatre B	**Topics** *Cox regression model* (continued) • Estimating parameters of the Cox model • Applications using R • Model building and assumption checking **Readings** CT4 Chap 9, Der & Everitt Chap 12 K & M Chap 8, 11.2, 11.4*
	Thursday 2 April 9:00 a.m.– 10:00 a.m. Electrical Eng G25	**Class Test 1**
5	*Tuesday 7 April* 2:00 p.m.– 4:00 p.m. Biomedical Theatre B	**Topics** *Parametric models* • Parametric models • Regression with parametric models
	Thursday 9 April 9:00 a.m.– 10:00 a.m. Electrical Eng G25	**Topics** *Markov models* • Introduction to Markov models • Two state model **Readings** CT4 Chap 4, 5 CT4 Chap 3*
	Mid-semester break	
6	*Tuesday 21 April* 2:00 p.m.– 4:00 p.m. Biomedical Theatre B	**Topics** *Markov models* (continued) • Estimating the model • General Markov model **Readings** CT4 Chap 4, 5 CT4 Chap 3*
	Thursday 23 April 9:00 a.m.– 10:00 a.m. Electrical Eng G25	**Topics** *Markov models* (continued) • Computing transition probabilities **Readings** CT4 Chap 4, 5 CT4 Chap 3*

7	*Tuesday 28 April* 2:00 p.m.– 4:00 p.m. Biomedical Theatre B	**Topics** ***Markov models*** *(continued)* • Applications ***Binomial and Poisson models*** • Binomial model **Readings** CT4 Chap 4, 5 CT4 Chap 3* CT4 Chap 10
	Thursday 30 April 9:00 a.m.– 10:00 a.m. Electrical Eng G25	***Binomial and Poisson models*** *(continued)* • Poisson model • Model choice **Readings** CT4 Chap 10
8	*Tuesday 5 May* 2:00 p.m.– 4:00 p.m. Biomedical Theatre B	**Topics** ***Exposed to risk*** ▪ Principle of correspondence ▪ Complete data, census data ▪ Age definitions ▪ Rate intervals: life year **Readings** CT4 Chap 11
	Thursday 7 May 9:00 a.m.– 10:00 a.m. Electrical Eng G25	**Topics** ***Exposed to risk*** *(continued)* ▪ Other rate intervals: calendar year, policy year **Readings** CT4 Chap 11
11:55 a.m., Thursday 7 May Assignment due	
9	*Tuesday 12 May* 2:00 p.m.– 4:00 p.m. Biomedical Theatre B	**Topics** ***Graduation and statistical tests*** ▪ The need for graduation ▪ Smoothness criteria **Reading**s CT4 Chap 12
	Thursday 14 May 9:00 a.m.– 10:00 a.m. Electrical Eng G25	**Class Test 2**

10	*Tuesday 19 May* 2:00 p.m.– 4:00 p.m. Biomedical Theatre B	**Topics** ***Graduation and statistical tests*** *(continued)* ▪ Statistical criteria ***Methods of Graduation*** ▪ Parametric formula **Reading**s CT4 Chap 12 CT4 Chap 13 London: Graduation: The revision of Estimates 6.5*
	Thursday 21 May 9:00 a.m.– 10:00 a.m. Electrical Eng G25	**Topics** ***Methods of Graduation*** *(continued)* ▪ Reference to standard table ▪ Graphical graduation **Reading**s CT4 Chap 13 London: Graduation: The revision of Estimates 6.5*
11	*Tuesday 26 May* 2:00 p.m.– 4:00 p.m. Biomedical Theatre B	**Topics** ***Methods of Graduation*** *(continued)* ▪ Statistical tests of a graduation ▪ Duplicate policies ▪ Graduation using Splines **Reading**s CT4 Chap 13 London: Graduation: The revision of Estimates 6.5*
	Thursday 28 May 9:00 a.m.– 10:00 a.m. Electrical Eng G25	**Topics** ***Methods of Graduation*** *(continued)* ▪ Graduation using Splines **Reading**s CT4 Chap 13 London: Graduation: The revision of Estimates 6.5*
12	*Tuesday 2 June* 2:00 p.m.– 4:00 p.m. Biomedical Theatre B	**Topics** ***Selection and Standardization*** ● Heterogeneity ● Methods of standardization/comparing populations ● New developments: Lee-Carter model and LifeMetrics
	Thursday 4 June 9:00 a.m.– 10:00 a.m. Electrical Eng G25	Review