ACTL 40003
Risk Theory II

SUBJECT GUIDE

Semester 2, 2013

Prepared by
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Centre for Actuarial Studies, Department of Economics
Faculty of Business and Economics
Subject Outline

Introduction

Welcome to ACTL 40003 Risk Theory II which covers some topics in general insurance. This subject is related to Risk Theory I and students who achieve a good mark in RT 1 are encouraged to take RT2.

Subject Aims

The main aim of this subject is to provide a grounding in mathematical techniques that are relevant to actuarial work in non-life insurance.

Prescribed References

[1] Insurance Risk and Ruin by Dickson, Chapters 2, 3, 6, 7, 8, 9

Learning Outcomes

Subject Objectives

On successful completion of this subject students should be able to:

- Apply relevant pre-requisite knowledge of mathematics, probability theory and statistics in the solution of a range of practical problems;
- Describe the basic concepts of utility theory and apply them to insurance problems;
- Explain the concepts of a premium calculation principle and show whether a premium calculation principle satisfies certain properties;
- Find the optimal reinsurance for the insurer and the reinsurer under different optimality criterion;
• Apply properties the Laplace transform to solve some differential and integro-
differential equations;
• Explain the significance of the adjustment coefficient in ruin theory and derive 
Lundberg's inequality;
• Describe the effect of simple reinsurance arrangements on the adjustment 
coefficient;
• Derive explicit solutions for the ruin probability in the classical risk model;
• Calculate approximations to ruin probabilities, explaining the rationale behind 
each approach.

To view the learning goals, generic skills and graduate attributes for your degree, 
please locate the University Handbook entry for your degree at:
http://handbook.unimelb.edu.au/

Generic Skills

In this subject you will have the opportunity to develop important generic skills. These 
include: high level of development: written communication; problem solving; statistical 
reasoning; application of theory to practice; interpretation and analysis.

Prerequisites

• ACTL 40002 Risk Theory I

Academic Staff Contact Details

Subject Coordinator Contact Details

Your coordinator for ACTL 40003 is A/Professor Shuanming Li.

Email: shli@unimelb.edu.au

Room: FBE building 319

Phone: 83445616

Consultation Hours: Tuesday and Thursday 2:00-3:00

Email Protocol

Please note that we are only able to respond to student emails coming from a University 
email address. Please do not use personal email addresses such as Yahoo, Hotmail or even 
business email addresses. Emails from non-University email addresses may be filtered by the
University’s spam filter, which means that we may not receive your email. All correspondence relating to this subject will only be sent to your University email address. Note that you must first activate your University email address before you can send or receive emails at that address. You can activate your email account at this link: http://accounts.unimelb.edu.au/.

While academic staff endeavor to address queries received via email, it is more appropriate to resolve substantive questions during lectures and tutorials and during normal consultation hours. With this in mind, we encourage students to attend all lectures and tutorials and to familiarise themselves with the consultation hours offered by the lecturers and tutors in this subject.

Lectures and Tutorials

Lecture Times

- **Tuesday, 10:30-12:00:** Arts West -115 Prest Theatre
- **Thursday, 10:00-11:30:** Doug McDonell 503

Lecture Participation Requirements

Lecture attendance is very important and good class behaviours are appreciated.

Lecture Slides

Lecture slides can be downloaded from subject page at LMS.

Tutorials

There are no weekly tutorials for this subject. The lecturer will do class tutorials when finish a topic. The tutorial times will be posted on LMS. There will be 4-5 tutorials in the whole semester and the question sheets can be found at LMS. The solutions will be posted to LMS after each tutorial. Tutorials participation is very important.

Subject Contents

1. *Utility Theory*
   Section Contents Reading Notes
   1.1 Introduction IRR 2.1-2.2
   1.2 Decision making IRR 2.3
   1.3 Jensen's inequality IRR 2.4
   1.4 Insurance applications IRR 2.4
   1.5 Types of utility function IRR 2.5
   1.6 Example
   1.7 Concavity and risk aversion
1.8 Applications to reinsurance IRR 9.2
1.9 Optimality of stop-loss reinsurance NAAJ

2. **Principles of Premium Calculation**
Section Contents Reading Notes
2.1 Examples of premium principles IRR 3.2-3.3
2.2 Properties of premium principles IRR 3.2-3.3
2.3 Premium reduction by co-insurance G 5.5

3. **Reinsurance Problems and Optimal reinsurance**
Section Contents Reading Notes
3.1 Global type reinsurance and individualised reinsurance
3.2 Variance as criteria for reinsurance
3.3 Coefficient of variation as criteria for reinsurance BPP 5.1-5.2
3.4 Total variance as criteria for reinsurance
3.5 Relative retention levels B 5.2

4. **Ruin Theory**
Section Contents Reading Notes
4.1 Introduction IRR 7.2-7.4
4.2 Lundberg's inequality IRR 7.5-7.6
4.3 The classical risk model under reinsurance
4.4 Solving for \( \psi(u) \) IRR 7.7
4.5 Laplace transforms IRR 7.8
4.6 Compound geometric structure and recursive calculation of \( \psi(u) \) IRR 7.9.1
4.7 Three approximations to \( \psi(u) \) IRR 7.10, G 8.6
4.8 Barrier problems IRR 8.2
4.9 The probability and severity of ruin IRR 8.3
4.10 The surplus before ruin-Dickson's formula IRR 8.5

IRR is "Insurance Risk and Ruin"
B is Buhlmann's "Mathematical Methods in Risk Theory"
BPP is Beard et al's "Risk Theory, 3rd edition"
G is Gerber's "An Introduction to Mathematical Risk Theory"
NAAJ is North American Actuarial Journal 2(3), p.79

**Assessment**

**Assessment Overview**

Your assessment for this subject comprises the following:

<table>
<thead>
<tr>
<th>Assessment Task</th>
<th>Individual or Group</th>
<th>Due</th>
<th>Weighting</th>
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<tbody>
<tr>
<td></td>
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</tr>
<tr>
<td>Mid-semester exam</td>
<td>Individual</td>
<td>Week 7</td>
<td>20%</td>
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<td>-------------------</td>
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</tr>
<tr>
<td>End-of-semester exam</td>
<td>Individual</td>
<td>Assessment period</td>
<td>80%</td>
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</tbody>
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- The mid-semester exam will take place in the Thursday of week 7. It is 50 minutes long. Two sample exam papers and their solutions will be posted to LMS.

- A 2 hour final exam will be given during exam period. A specimen exam paper with solutions will be posted to LMS at the end of the semester.

**Exam Policy**

The Faculty requires that you are available for the entire examination period. Supplementary exams will not be provided in cases of absence during the examination period, unless the absence is due to serious illness or other serious circumstances. See the Special Consideration web site for more information: [http://fbe.unimelb.edu.au/csc/assistance/special_consideration](http://fbe.unimelb.edu.au/csc/assistance/special_consideration)

The examination period for this semester is from 11 to 29 in November.

**Special Consideration**

Students who have been significantly affected by illness or other serious circumstances during the semester may be eligible to apply for Special Consideration.

The following website contains detailed information relating to who can apply for Special Consideration and the process for making an application:

LMS Discussion Board

The Discussion Board for this subject can be accessed via the LMS subject page and allows you to post messages and read messages at any time. All students are free to communicate with each other using the Discussion Board by posting, reading, and replying to messages.

The discussion forum is organised into threads (conversations within a topic). Messages are posted by starting a new thread or replying to an existing posting. To access the Discussion Board, click on the Discussion Board located in the navigation menu of the LMS page for this subject.

Always be polite when asking questions or posting replies. Impolite language will not be tolerated. The lecturer reserves the right to ban students who use inappropriate/impolite language from using the Discussion Board.

FBE Centre for Excellence in Learning and Teaching

The FBE Centre for Excellence in Learning and Teaching (CELT) provides services and resources to enhance your learning in Business and Economics.

Maximise your academic success by taking part in CELT services that develop:

- Skills in research, referencing and academic writing
- Mastery of different assignment types
- Effective study techniques
- Abilities to learn effectively with your peers
- Transition to the faculty and understanding of academic expectations

The Centre also provides an extensive range of helpsheets that can enhance your academic performance in Business and Economics. These are available or online or at the Centre.

Visit the CELT site [www.fbe.unimelb.edu.au/celt](http://www.fbe.unimelb.edu.au/celt) to learn more and get involved.
Past Exams

One past exam paper with solutions will be provided at LMS.

Subject Prizes

In 2013 a prize of $500 has been sponsored by Tillinghast-Towers Perrin for the best overall performance by an honours student in ACTL 40002 and ACTL 40003.

Other Information

- Expectation sheet will be provided at the end of each unit.

- To login in to LMS, go to web site here: http://www.lms.unimelb.edu.au/. Click on the Access the LMS button located on the right-hand side of the screen. Type in your unimelb email account username and password into the spaces provided. If you have not accessed your university email account before, note that you must activate your email account before you can log into the LMS (or access your email for that matter). Click Login.

- No assignments for this subject.

- Doing problem sets is very important. Problem Sets with Solutions can be founded at LMS