# Insurance Statistics and Advanced Risk Theory

## Prof. Nino Savelli; Prof. Diego Zappa

***COURSE AIMS AND INTENDED LEARNING OUTCOMES***

## I Module (*Prof. Nino Savelli*) TBC

## II Module (*Prof. Diego Z*appa)

In the Insurance Statistics module, by using the standard frequency-severity approach, we will use the Poisson and gamma GLM models to compute the net premiums on the basis of appropriate covariates of the customers. Results will be compared with techniques based upon Generalized additive models and machine/statistical learning algorithms. Hints will be given in case of deviation from standard assumptions.

On successful completion of the module participants are expected to possess:

1. knowledge of concepts, terms and methods of the most used statistical model techniques to fit frequency and severity components and grasp of their strengths and weaknesses (DD1- Knowledge and understanding);
2. ability to correctly apply statistical methods to real insurance problems (DD2- Applying knowledge and understanding);
3. quantitative thinking addressed to make independent judgements, driven by application of statistical learning methods (DD3- Making judgements);
4. ability to present statistical learning arguments and the conclusions from them, by means of the extraction of qualitative information from quantitative data, accuracy and in forms that are suitable for the audiences being addressed, both orally and in writing (DD4-Communication);

At the end of this module students will learn how to handle linear/not linear components to estimate risk components.

***COURSE CONTENT***

Module I*: Risk Theory* (Prof. Nino Savelli)

Module II: *Insurance statistics* (Prof. Diego Zappa)

Remind of linear models, Generalized linear models, Generalized additive models, Classification Trees, Ensemble methods, Neural networks with a special emphasis on their application to insurance datasets. Most of lectures will be provided in the computer lab to offer an introduction to the R language and whereas necessary to other ad hoc statistical software.

On successful completion of the course participants are expected to learn:

– The use of non-linear models and general linear models (GLM) for insurance pricing.

– The use of Neural Network modelling for non linear insurance pricing.

– At least a basic knowledge of machine/statistical learning methods for insurance.

– (Special topic) Stochastic reserving using GLMs.

***READING LIST***

Module I

Module II

Notes available at the corresponding Blackoard course webpage.

*Elective readings*:

P. De Jong-G.Z. Heller, *Generalized Linear Models for Insurance Data,* Cambridge University Press, 2008.

Y. Tse, *Nonlife actuarial models: theory,* *methods and evaluation*, Cambridge University Press, 2009.

M.V. Wuthrich-C. Buser*,* *Data Analytics for Non-Life Insurance Pricing* (February 5, 2019). Swiss Finance Institute Research Paper No. 16-68. Available at SSRN: https://ssrn.com/abstract=2870308 or http://dx.doi.org/10.2139/ssrn.2870308.

***TEACHING METHOD***

Module I:

Module II: lectures will benefit of codes written in the R language and applications by using ad hoc software.

***ASSESSMENT METHOD AND CRITERIA***

*For Module I:*

For *Module II*: for those attending regularly the lectures, the exam will consist of a case study to be solved in the PC lab. For those that cannot attend regularly the lectures, written exam with questions on the methods presented during the course.

The final mark will be the weighted average of tha marks in the 2 modules: I module=6cfu, II module=5cfu. If the final score does not correspont to an integer, the mark will be rounded up to the nearest larger integer.

***NOTES AND PREREQUISITES***

*Module I*:

*Module II*: Further information can be found at the lecturers’ webpages.

Students enrolling in this course should have a good understanding of mathematical, actuarial and statistical techniques taught in the 1st year of the master degree in Actuarial sciences.

*Other information and Office hours*

Further information can be found on the lecturers' webpage