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## Insurance statistics and Risk Theory

PROF. NINO SAVELLI; PROF. DIEGO ZAPPA

### Course aims and intended learning outcomes

I MODULE (Prof. Nino Savelli) TBC

II MODULE (Prof. Diego Zappa)

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.

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

### Course content

*MODULE I: Theory del Risk (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 GAM 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 II

Notes available at the corresponding Blackboard 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 II: lectures will benefit of codes written in the R language and applications by using ad hoc software.



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### Assessment method and criteria

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

### Notes and prerequisites

Further information can be found on 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.