12. **Experience Rating in Non-life insurance**

Proposer: Matthias Winkel

Description: BS4 *Actuarial Science* includes some of the ideas used by insurance companies to set premiums for insurance products. BS3 *Stochastic Modelling* sets up Markov models that can be used as underlying framework for the incorporation of, say, no-claims discounts into premium considerations. This project picks up these threads and considers how past claims experience can be used to set and update premium levels as time evolves.
The focus in on an individual policy in a portfolio. While the policies in the portfolio may offer the same benefits in principle, the policy holders will display a variety of claims patterns. We can model this by a family of claims distributions F_ϑ depending on a parameter ϑ. The idea is that each policy holder generates claims X1, . . . ,X_n according to F_ϑ for some ϑ, which is unknown and can be estimated from X1, . . . ,X_n. Part II of Mikosch's book describes a Bayesian approach due to Bühlmann which considers ϑ, varying across the population, to be randomly sampled from the population (independently for each policy holder). Using a prior distribution for ϑ that reflects the whole population, which is a fair choice in the absence of any further information, claims X1, . . . ,X_n allow to update our belief of the parameter ϑ and calculate a posterior distribution. There is some general theory, there are some parametric models, and further developments exist under various simplifying assumptions. The proposal is to work these out in this dissertation, beginning with Mikosch's textbook treatment and moving further into the literature from there, as appropriate.

References:
T. Mikosch: *Non-life insurance mathematics*. Springer 2004

Prerequisites: BS3 *Stochastic Modelling*, BS4 *Actuarial Science*. The Bayesian part of BS2a *Foundations of Statistical Inference* is useful, but not essential.
Type: Project with possibilities for theoretical study (and simulation, if desired).