The Cramér–Lundberg model

Keywords: Cramér–Lundberg model, asymptotic behaviors.

Context of the project

Risks processes are probabilistic models that describes the wealth of an insurance company who experience two opposing cash flows: the premium income and the claim amount, and the main goal about these models is to study the probability that the company goes ultimately bankrupt.

In this project, we will focus on the Cramér–Lundberg model, which is the most classical model in risk theory. It is defined by

$$R_t = u + ct - \sum_{n=1}^{N_t} X_n, \quad t \in \mathbb{R}_+,$$

where $u > 0$ and $c > 0$ are constants, $(X_n)_{k=1}^{\infty}$ is a sequence of i.i.d. random variables representing the claims, and N_t is a Poisson point process with intensity $\lambda > 0$ independent of the claims. We will study the asymptotic behaviors of the model, such as: the central limit theorem of this model, the ruin probability of the process, etc.

Work to be performed

The work asked to the students goes in two different directions.

Theoretical results

The first part is to have sufficient amount of backgrounds of the risk theory by for example: reading the notes of Nina Gantert's note on acturial risk theory. The participants should learn the definition of model, the ruin probability, and other relevant terminology of the project.

Numerical results

The second types of results is to simulate the classical risk process, and see the asymptotic behaviors of the model. For example, the students will be ask how the evolution of the process depends on the parameters λ, $\mu = \mathbb{E}[X_1]$, and c. The simulations can be done either in R or in Python.

References

[1] Nina Gantert, *Actuarial Risk Theory*, Summer Term 2013, Lecture Notes.