

Collective risk

Ignacio Gómez, Gonzalo Pato, Gonzalo Prats

April 2023

Contents

Statement	1
Introduction	1
The project	2
Results	2
Conclusions	2
References	2

Statement

The clients of an insurance company generate claims according to independent (homogeneous) Poisson processes with common rate λ . The claims are independent and the amount of each of them follows a distribution with cdf $F(x) = 1 - (100/x)^{2.5}$ if $x > 100$. New clients enroll the company according to another (homogeneous) Poisson process with rate ν and the time they stay in the company follows an exponential distribution with rate μ . Each policyholder pays a fixed amount a every year to the company. If the policyholder stays in the company only during a fraction of the year, she will pay the corresponding fraction of a which is assumed to be paid on a continuous manner.

If the initial capital is c_0 and the initial number of clients is n_0 , we want to compute the probability that the capital of the company remains positive during some given time t_l .

Introduction

Project explanation with your own words.

Each policyholder has a fixed amount a to pay every year, so the capital of the company will increase by a times de number of clients every fraction of year.

On the other hand, they also hold the right to claim the premium on the policy, which happens according to a Poisson process with common rate λ . The amount of is this premium is distributed according to a Pareto distribution with parameters $\alpha = 2.5$ and $\beta = 100$.

The clients of the company can leave the company at any time, and the time they stay in the company follows an exponential distribution with rate μ .

Clients come and go according to independent (homogeneous) Poisson processes with common rates ν and μ respectively.

So in general, the capital of the company at any time t will be:

$$C(t) = c_0 + at(n_0 + N_A(t) - N_D(t)) - \sum_{j=1}^{N_C(t)} X_j$$

where $N_A(t)$ is the number of clients that arrive by time t , $N_D(t)$ is the number of clients that leave by time t , $N_C(t)$ is the number of claims that arrive by time t , X_j is the amount of the j -th claim, and $n(t)$ is the number of clients at time t .

The project

Project development including the code and emphasizing the main difficulties and most important parts.

First, to simulate the amount of the claims we will define a function with the inverse of the cdf of the Pareto distribution. Mathematically, this function is:

$$F^{-1}(x) = \frac{\beta}{\sqrt[\alpha]{1-x}} = \frac{100}{\sqrt[2.5]{1-x}}$$

Results

Numerical results, quality assessment of the approximations, and time efficiency of the algorithms.

Conclusions

About the results, how the difficulties were solved, and possible alternative approaches. Keep the focus, the conclusions must be as brief as possible.

References

Including textbooks, webpages, and class notes.