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Risk Theory

The main goal is to provide an understanding of the fundamental concepts of risk theory, and how those concepts are applied in computing premiums using various methods, in constructing adequate models for the aggregate claim for a portfolio of insurance policies including individual and collective models, and in grasping various ways of generating new distributions.

Table of contents

1. A review on probability distributions with insurance applications
2. Utility theory and insurance
 1. Actuarial risk, insurance policy,
 2. net premium,
 3. premium using different utility functions,
 4. premium approximation,
 5. reinsurance and stop-loss premium.
3. Individual models
 1. Mixed distributions.
 2. Convolution product.
 3. Transformations:
 1. Moment generating functions,
 2. Probability generating functions
 3. Cumulant generating functions.
 4. Approximation:
 1. normal approximation,
 2. normal power approximation.
 5. Application to reinsurance.

4. Collective models.
 1. Compound distribution.
 2. Convolution formula.
 3. Compound Poisson distribution and Sparse vector algorithm.
 4. Panjer recursive formula.
 5. Application to stop-loss premium.
 6. Approximation of compound Poisson distribution.
5. Generating new distributions
 1. Scalar multiplication.
 2. Power.
 3. Exponentiation.
 4. Limiting distributions.
 5. Linear exponential family.
 6. The $(a,b,0)$ -class of discrete distributions.
 7. Zero-modified and zero-truncated distributions.
 8. The $(a,b,1)$ -class of discrete distributions.
 9. Extended truncated Negative-Binomial distribution.

Text book: Dickson D.C.M. Insurance risk and ruin 2006

Other references:

1. S.A. Klugman , H.H. Panjer, and G.E. Willmot, Loss Models from Data to Decisions, 2nd Edition (2008), Wiley.
2. Marcel B. Finan, An Introductory Guide in the Construction of Actuarial Models: A Preparation for the Actuarial Exam C/4, 2016.

Course Materials

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