

actuar: an
R package
for Actuarial
Science

Vincent
Goulet

A quick word
on R

The actuar
package

Loss
distributions

Risk theory

Credibility
theory

actuar: an R package for Actuarial Science

Vincent Goulet

École d'actuariat, Université Laval
Québec, Canada

Summary

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What is R?

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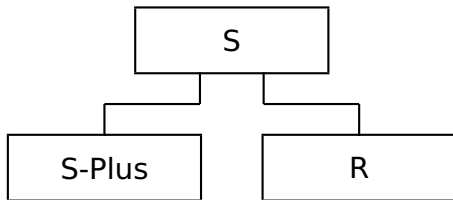
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R is a language and environment for statistical computing and graphics *not unlike S-Plus*



- Designed around a true programming language
- Comprehensive statistical system

Advantages

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- Programming language with strong mathematical orientation
- Extensive collection of tools for data analysis
- Outstanding graphical facilities
- Very active project
- High quality and cutting edge code
- Runs on Windows, Linux and MacOS
- Free

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Package

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- Coherent collection of functions, data sets and documentation
- Distributed through the Comprehensive R Archive Network (CRAN)
- **actuar:** collection of functions typically used in actuarial science

What's in there for me?

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New probability laws

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- Support for 17 probability laws not in base R
 - Transformed beta family (9)
 - Transformed gamma family (5)
 - Loggamma
 - Single parameter Pareto
 - Generalized beta
- **Plus!** Functions to compute the k^{th} moment
- **Plus!** Functions to compute the k^{th} limited moment

New probability laws

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Support for grouped data

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- Creation and manipulation of grouped data objects
- Calculation of empirical moments
- Plot of the ogive, histogram

Estimation

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- Function `emm()` to compute the k^{th} empirical moment
- Function `elev()` to compute the empirical limited expected value
- Function `mde()` for minimum distance estimation
- Function `coverage()` to compute the density function under coverage modifications

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Two functions for one problem

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- Calculation of the aggregate claim amount distribution
- Discretization of continuous distributions
- Supported methods:
 - recursive (Panjer algorithm)
 - convolutions
 - simulation
 - normal approximation
 - normal power approximation
- Output is a **function** to compute the cumulative distribution function of S at any point

Two functions for one problem

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One function to rule them all

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- `cm()`
- Currently supports Bühlmann, Bühlmann–Straub and hierarchical models
- Use function `predict()` to get credibility premiums
- Function `simpf()` to simulate portfolios of data

Example for simpf

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$$S_{ijt} = C_{ijt1} + \dots + C_{ijtN_{ijt}},$$

with

$$N_{ijt} | \Lambda_{ij}, \Phi_i \sim \text{Poisson}(w_{ijt} \Lambda_{ij})$$

$$\Lambda_{ij} | \Phi_i \sim \text{Gamma}(\Phi_i, 1)$$

$$\Phi_i \sim \text{Exponential}(2)$$

$$C_{ijtu} | \Theta_{ij}, \Psi_i \sim \text{Lognormal}(\Theta_{ij}, 1)$$

$$\Theta_{ij} | \Psi_i \sim N(\Psi_i, 1)$$

$$\Psi_i \sim N(2, 0.1)$$

For more information

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- <http://www.r-project.org>
- <http://www.actuar-project.org>