

# Package ‘finiteruinprob’

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**Type** Package

**Title** Computation of the Probability of Ruin Within a Finite Time Horizon

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**Description** In the Cramér–Lundberg risk process perturbed by a Wiener process, this packages provides approximations to the probability of ruin within a finite time horizon. Currently, there are three methods implemented: The first one uses saddlepoint approximation (two variants are provided), the second one uses importance sampling and the third one is based on the simulation of a dual process. This last method is not very accurate and only given here for completeness.

**License** AGPL-3

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 finiteruinprob-package

*Computation of the Probability of Ruin Within a Finite Time Horizon*


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### Description

In the Cramér–Lundberg risk process perturbed by a Wiener process, this packages provides approximations to the probability of ruin within a finite time horizon. Currently, there are three methods implemented: The first one uses saddlepoint approximation (two variants are provided), the second one uses importance sampling and the third one is based on the simulation of a dual process. This last method is not very accurate and only given here for completeness.

### Author(s)

Benjamin Baumgartner <benjamin@baumgrt.com>

### References

Gatto, R. and Baumgartner, B. (2016) *Saddlepoint approximations to the probability of ruin in finite time for the compound Poisson risk process perturbed by diffusion*. *Methodology and Computing in Applied Probability* **18**(1), pp. 217–235.

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 rriskproc

*Simulation of a risk process that is perturbed by a Wiener process*


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### Description

This function simulates paths of a compound Poisson risk process that is perturbed by a Wiener process. Multiple paths can be simulated simultaneously.

### Usage

```
rriskproc(m = 1001, window = c(0, 1), num = 1,
          sigma = 1, freq = 1, drift = 0, jumpdist, ...)
```

### Arguments

m	Number of sample points for each path
window	Beginning and end of the time window
num	Number of paths to be simulated
sigma	Volatility of the Wiener process
freq	Frequency of the claims
drift	Drift (premium intensity) of the process
jumpdist	A function that returns realizations of the claim distribution
...	Additional arguments for jumpdist

## Details

Possible choices for `jumpdist` include [rexp](#), [rgamma](#) and [rlnorm](#).

It is assumed that the function specified for `jumpdist` interprets its first argument as the vector length of its return value, i. e. the number of simultaneously generated random variables.

The path realizations of the Wiener process are generated using the circulant embedding method (see references).

## Value

A [time-series object](#)/[time-series object](#) containing the simulated sample path(s).

## References

Dietrich, C. and Newsam, G. (1997) *Fast and Exact Simulation of Stationary Gaussian Processes through Circulant Embedding of the Covariance Matrix*. *SIAM Journal on Scientific Computing* **18**(4), pp. 1088–1107

## See Also

[rhypoexp](#)

## Examples

```
require(sdprisk)

rriskproc(m      = 1001,
          window = c(0, 5),
          num     = 1,
          sigma  = sqrt(0.4),
          freq    = 1,
          drift  = 2,
          jumpdist = rhypoexp,
          rate    = c(1, 10))

# The same can be achieved using
#   jumpdist = function(n) rexp(n, 1) + rexp(n, 10)

rriskproc(window = c(0, 10),
          jumpdist = function(n) {
            rexp(n, 1) + rexp(n, 10)
          })
```

---

ruinprob.finite.dsim    *Computation of the probability of ruin within a finite time horizon using a dual process*

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### Description

This function calculates an approximation to the probability of ruin within a finite time horizon for a compound Poisson risk process that is perturbed by a Wiener process. The approximation is based on a dual process to the risk process.

### Usage

```
ruinprob.finite.dsim(Z)
```

### Arguments

Z                    A time-series object, e.g. one generated by [rriskproc](#), containing at least two series

### Details

This function computes an approximation to the probability of ruin within a finite time horizon using a dual process. See the references for more details.

### Value

A function taking one numeric argument, the initial capital. This function returns the approximation for the specified initial reserve and for all values of the time horizon that are sampling points of Z.

### References

Gatto, R. and Baumgartner, B. (2016) *Saddlepoint approximations to the probability of ruin in finite time for the compound Poisson risk process perturbed by diffusion*. Methodology and Computing in Applied Probability **18**(1), pp. 217–235.

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ruinprob.finite.imps    *Approximation of the probability of ruin within a finite time horizon using importance sampling*

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### Description

This function calculates an approximation to the probability of ruin within a finite time horizon for a compound Poisson risk process that is perturbed by a Wiener process. The approximation is based on importance sampling.

**Usage**

```
ruinprob.finite.imps()
```

**Value**

This function is not yet fully implemented. At the moment it invisibly returns NULL.

**References**

Gatto, R. and Baumgartner, B. (2016) *Saddlepoint approximations to the probability of ruin in finite time for the compound Poisson risk process perturbed by diffusion*. Methodology and Computing in Applied Probability **18**(1), pp. 217–235.

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ruinprob.finite.sdp	<i>Approximation of the probability of ruin within a finite time horizon using saddlepoint methods</i>
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**Description**

This function calculates an approximation to the probability of ruin within a finite time horizon for a compound Poisson risk process that is perturbed by a Wiener process. The approximation makes use of saddlepoint methods.

**Usage**

```
ruinprob.finite.sdp(mgf, mgf.d1, mgf.d2, premium, freq, variance,
                    endpoint, verbose = FALSE)
```

**Arguments**

mgf	The moment-generating function of the individual claim amounts
mgf.d1	The first derivative of mgf
mgf.d2	The second derivative of mgf
premium	The premium force
freq	Frequency of the claims
variance	The variance of the Wiener process by which the risk process is perturbed
endpoint	The upper endpoint of mgf, i.e. the position of a pole
verbose	Return additional diagnostic information as an attribute of the output

**Details**

If neither or only the first derivative of mgf is provided, a numerical approximation to the missing derivative(s) will be used instead (see [grad](#) and [hessian](#)).

The argument endpoint is the (smallest) positive pole of mgf. Omitting this information will issue a warning and the value 1.0e+6 will be used instead, possibly yielding unexpected and unreliable output or leading to further errors.

**Value**

A function  $\text{psi}(x, t)$  taking as inputs the initial capital  $x$  and the time horizon  $t$ . This function returns a list, the first element of which contains a Lugannani–Rice-type approximation, the second one contains a Skovgaard-type approximation.

**References**

Gatto, R. and Baumgartner, B. (2016) *Saddlepoint approximations to the probability of ruin in finite time for the compound Poisson risk process perturbed by diffusion*. Methodology and Computing in Applied Probability **18**(1), pp. 217–235.

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