

# Package: pg (via r-universe)

September 19, 2024

**Title** Polya Gamma Distribution Sampler

**Version** 0.2.4

**Description** Provides access to a series of highly performant random distribution samplers for the Polya Gamma Distribution as described by Polson, Scott, and Windle (2013) <[arXiv:1205.0310](https://arxiv.org/abs/1205.0310)> using either 'C++' headers for 'Rcpp' or 'RcppArmadillo' and 'R'. The 'C++' header approach was developed to enable computations in Balamuta (2021) <<https://www.ideals.illinois.edu/items/121209>>.

**URL** <https://tmsalab.github.io/pg/>, <https://github.com/tmsalab/pg>

**BugReports** <https://github.com/tmsalab/pg/issues>

**License** GPL (>= 3)

**LinkingTo** Rcpp, RcppArmadillo

**Imports** Rcpp

**Encoding** UTF-8

**Roxygen** list(markdown = TRUE)

**RoxygenNote** 7.2.3

**Suggests** testthat (>= 2.1.0)

**Repository** <https://tmsalab.r-universe.dev>

**RemoteUrl** <https://github.com/tmsalab/pg>

**RemoteRef** HEAD

**RemoteSha** 348b5d499ea75da9565488d64d532420802e84e2

## Contents

pg_mean . . . . .	2
rpg_scalar . . . . .	3
<b>Index</b>	<b>5</b>

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pg\_mean

*Theoretical Polya Gamma Distribution's Mean and Variance*

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### Description

Compute the theoretical mean and variance for a Polya Gamma variable.

### Usage

```
pg_mean(h, z)
```

```
pg_var(h, z)
```

### Arguments

**h** A single integer value corresponding to the "shape" parameter.  
**z** A single numeric value corresponding to the "scale" parameter.

### Value

Either the theoretical mean or theoretical variance for a Polya Gamma distribution.

### Examples

```
# Fixed parameter distribution simulation ----  
  
## Parameters ----  
h = 1; z = .5  
## Attempt distribution recovery ----  
vector_of_pg_samples = rpg_vector(1e6, h, z)  
  
head(vector_of_pg_samples)  
length(vector_of_pg_samples)  
  
## Obtain the empirical results ----  
empirical_mean = mean(vector_of_pg_samples)  
empirical_var = var(vector_of_pg_samples)  
  
## Take the theoretical values ----  
theoretical_mean = pg_mean(h, z)  
theoretical_var = pg_var(h, z)  
  
## Form a comparison table ----  
  
# empirically sampled vs. theoretical values  
rbind(c(empirical_mean, theoretical_mean),  
      c(empirical_var, theoretical_var))
```

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`rpg_scalar`*Sample from the Polya Gamma distribution  $PG(h, z)$* 

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**Description**

Chooses the most efficient implemented method to sample from a Polya Gamma distribution. Details on algorithm selection presented below.

**Usage**`rpg_scalar(h, z)``rpg_vector(n, h, z)``rpg_hybrid(h, z)``rpg_gamma(h, z, trunc = 1000L)``rpg_devroye(h, z)``rpg_sp(h, z)``rpg_normal(h, z)`**Arguments**

<code>h</code>	integer values corresponding to the "shape" parameter.
<code>z</code>	numeric values corresponding to the "scale" parameter.
<code>n</code>	The number of samples to taken from a $PG(h, z)$ . Used only by the vector sampler.
<code>trunc</code>	Truncation cut-off. Only used by the gamma sampler.

**Details**

The following sampling cases are enabled:

- $h > 170$ : Normal approximation method
- $h > 13$ : Saddlepoint approximation method
- $h = 1$  or  $h = 2$ : Devroye method
- $h > 0$ : Sum of Gammas method.
- $h < 0$ : Result is automatically set to zero.

**Value**

A single numeric value.

**Examples**

```
# Fixed parameter distribution simulation ----

## Parameters ----
h = 1; z = .5

## Sample only one value ----
single_value = rpg_scalar(h, z)
single_value

## Attempt distribution recovery ----
vector_of_pg_samples = rpg_vector(1e6, h, z)

head(vector_of_pg_samples)
length(vector_of_pg_samples)

## Obtain the empirical results ----
empirical_mean = mean(vector_of_pg_samples)
empirical_var = var(vector_of_pg_samples)

## Take the theoretical values ----
theoretical_mean = pg_mean(h, z)
theoretical_var = pg_var(h, z)

## Form a comparison table ----

# empirically sampled vs. theoretical values
rbind(c(empirical_mean, theoretical_mean),
      c(empirical_var, theoretical_var))

# Varying distribution parameters ----

## Generate varying parameters ----
u_h = 20:100
u_z = 0.5*u_h

## Sample from varying parameters ----
x = rpg_hybrid(u_h, u_z)
```

# Index

`pg_mean`, [2](#)

`pg_var (pg_mean)`, [2](#)

`rpg_devroye (rpg_scalar)`, [3](#)

`rpg_gamma (rpg_scalar)`, [3](#)

`rpg_hybrid (rpg_scalar)`, [3](#)

`rpg_normal (rpg_scalar)`, [3](#)

`rpg_scalar`, [3](#)

`rpg_sp (rpg_scalar)`, [3](#)

`rpg_vector (rpg_scalar)`, [3](#)