

# Package ‘poisbinom’

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**Type** Package

**Title** A Faster Implementation of the Poisson-Binomial Distribution

**Version** 1.0.2

**Date** 2025-06-02

**Description** Provides the probability, distribution, and quantile functions and random number generator for the Poisson-Binomial distribution. This package relies on FFTW to implement the discrete Fourier transform, so that it is much faster than the existing implementation of the same algorithm in R.

**License** GPL (>= 2)

**Imports** Rcpp (>= 0.12.10)

**SystemRequirements** fftw3 (>= 3)

**LinkingTo** Rcpp

**NeedsCompilation** yes

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**Repository** CRAN

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**Description**

Probability mass, distribution, quantile and function, and random number generator for the Poisson-Binomial distribution with parameter vector `pp` (the probability parameter of the component Binomial random variables).

**Usage**

```
dpoisbinom(x, pp, log_d = FALSE)
ppoisbinom(q, pp, lower_tail = TRUE, log_p = FALSE)
qpoisbinom(p, pp, lower_tail = TRUE, log_p = FALSE)
rpoisbinom(n, pp)
```

**Arguments**

<code>x, q</code>	vector of quantiles.
<code>p, pp</code>	vector of probabilities.
<code>n</code>	number of random deviates.
<code>log_d, log_p</code>	logical; if TRUE, probabilities are given in the log scale.
<code>lower_tail</code>	logical; if TRUE (default), probabilities are $Pr(X \leq x)$ , otherwise, $Pr(X > x)$ .

**Details**

The Poisson-Binomial distribution is the distribution of a sum of  $n$  independent and *not* identically distributed Binomial random variables. It is parameterized by the vector of  $n$  possibly distinct probability parameters of these Binomial distributions, and is computed using a discrete Fourier transform. See Hong (2013) for details.

**Value**

`dpoisbinom` gives the mass, `ppoisbinom` gives the distribution function, `qpoisbinom` gives the quantile function and `rpoisbinom` generates random deviates.

If `pp` contains values outside of  $[0, 1]$ , an error is returned.

The length of the result is determined by `n` in `rpoisbinom`, and is the length of the first argument for all other functions.

**Author(s)**

Shiraito, Y. and Olivella, S. (2017).

## References

Hong, Y. (2013) “On computing the distribution function for the Poisson binomial distribution”. *Computational Statistics and Data Analysis*, 59, 41–51.

## Examples

```
## Binomial probabilities
pp <- runif(500)

## PMF
dpoisbinom(36, pp)

## CDF
ppoisbinom(36, pp)

## Quantile function
qpoisbinom(0.3, pp)

## Random deviates
rpoisbinom(5, pp)
```

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