Package ‘Rdice’

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Type Package
Title A Collection of Functions to Experiment Dice Rolls
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Description A collection of functions to simulate
dice rolls and the like. In particular, experiments and exercises can
be performed looking at combinations and permutations of values in dice
rolls and coin flips, together with the corresponding frequencies of
occurrences. When applying each function, the user has to input the
number of times (rolls, flips) to toss the dice. Needless to say, the more
the tosses, the more the frequencies approximate the actual probabilities.
Moreover, the package provides functions to generate non-transitive sets
of dice (like Efron’s) and to check whether a given set of dice is non-transitive
with given probability.
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R topics documented:

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Description
Simulates a coin flip.

Usage
coin.flip(coins = 5, flips = 100, weights = c(0.5, 0.5), getExact)

Arguments
- **coins**: The number of coins to flip. If unspecified, it defaults to 5.
- **flips**: The number of flips. If missing, it defaults to 100.
- **weights**: A vector of probability weights to assign to each face of the coin; if unspecified, it defaults to a fair coin with equally likely faces. If specified, its length must obviously be a vector of length two whose values sum up to 1.
- **getExact**: A vector containing values to be matched exactly, namely the function returns only those combinations containing all the above mentioned variables. Since this is a coin flip, values must be specified in the form c("H", "H", "T") as head and tails (make sure to provide the labels in quotation marks).

Details
The function is a particular case of dice.roll, namely a roll with 2 faces and 1 die.

Value
A table containing the frequencies for each of the two occurrences (head and tail) after the specified number of flips.

Examples
coin.flip(coins = 5, flips = 100)
Description
Calculates all possible combinations as result of rolling a set of dice. Similar permutations are identified under the same combination and counted as many times as many occurrences. The user can choose whether to match exact values or to perform partial matches.

Usage
dice.combinations(faces, dice, rolls, weights, getPartial, getExact, toSum = FALSE)

Arguments
- faces: The number of faces the dice have; if unspecified, it defaults to 6.
- dice: The number of dice to roll; if unspecified, it defaults to 2.
- rolls: The number of times to roll the die; if unspecified, it defaults to 5.
- weights: A vector of probability weights to assign to each face of the die; if unspecified, it defaults to a fair die with weights $1/N$. If specified, its length must obviously be equals to the number of faces and all the single weights must sum up to 1.
- getExact: A vector containing values to be matched exactly, namely the function returns only those combinations containing all the above mentioned variables.
- getPartial: A vector containing values to be matched partially, namely the function returns only those combinations containing at least one of the above mentioned variables. If missing, it defaults to c(1:faces), namely the function returns all combinations.
- toSum: A logical value, defaulting to FALSE. If TRUE, the function returns the sum of the frequencies of the matches (to be used together with getExact or getPartial)

Details
The function returns an object of class diceRoll, namely a list whose values are themselves data.table objects, in turn, so that one can directly apply any data.table function thereupon.

Value
- values: If toSum = FALSE, a list of all possible combinations rolled, together with corresponding frequencies. If toSum = TRUE, the function returns the sum of all frequencies in correspondence of matched values.

Note
The case face = 2 corresponds to the coin.flip.
dice.roll

Description

Simulates rolling of a set of dice.

Usage

dice.roll(faces, dice, rolls, weights)

Arguments

- `faces`: The number of faces the dice have; if unspecified, it defaults to 6.
- `dice`: The number of dice to roll; if unspecified, it defaults to 2.
- `rolls`: The number of times to roll the die; if unspecified, it defaults to 5.
- `weights`: A vector of probability weights to assign to each face of the die; if unspecified, it defaults to a fair die with weights $1/N$. If specified, its length must obviously be equals to the number of faces and all the single weights must sum up to 1.

Details

The function returns an object of class `diceRoll`, namely a list whose values are themselves `data.table` objects, in turn, so that one can directly apply any `data.table` function thereupon.

Value

- `results`: The numerical results rolled.
- `frequencies`: A table containing each single occurrence (permutation) of results and the corresponding frequencies.
- `sums_freq`: A table containing the frequencies of the sums of the values obtained in each single roll by all the dice. A cumulative sum is provided too.
- `exp_value_sum`: The expectation value of the sum of the values obtained.

Examples

dice.roll(faces = 6, dice = 3, rolls = 5)
The standard set of Efron’s dice

Description
A dataset containing the four standard Efron’s dice, non-transitive set of dice with winning probabilities of 2/3.

Usage
data(efron)

Format
A data table with 4 columns. Each column represents a die with six faces.

Examples
data(efron)
is.nonTransitive(efron, prob = 2/3)

is.nonTransitive Checks truth value of non-transitive sets of dice.

Description
Checks whether a given set of dice is non-transitive with given probability. If no probability is given, checks whether a given set of dice is generally non-transitive.

Usage
is.nonTransitive(df, prob)

Arguments
df A data.frame containing the set of dice to be checked.
prob The non-transitive probability according to which to check for non-transitivity. If unspecified, the function checks for general non-transitivity.

Value
A logical value: TRUE or FALSE.

See Also
See also nonTransitive.generator.
Examples

df <- data.frame(
  die1 = c(5,4,6,15),
  die2 = c(3,6,16,2),
  die3 = c(0,2,14,15),
  die4 = c(8,10,1,9)
)

is.nonTransitive(df, prob = 9/16)

miwin

Miwin set of dice.

Description

A dataset containing the Miwin set of dice. This set is non-transitively losing, with losing probabilities of 17/36.

Usage

data(miwin)

Format

A data table with 3 columns. Each column represents a die with six faces.

Examples

data(miwin)

is.nonTransitive(miwin, prob = 17/36)

nonTransitive.generator

Non-transitive dice generator.

Description

This function generates Z random non-transitive dice given the number faces and the corresponding non-transitive probabilities.

Usage

nonTransitive.generator(dice, faces, max_value = faces, prob, error = 0.001)
Arguments

- **dice**: The number $Z$ of non-transitive dice to generate.
- **faces**: The number of faces of each die.
- **max_value**: The maximum integer allowed as nominal value for the faces. Standard choices are usually $\text{max\_value} = \text{faces}$ (default) or $\text{max\_value} = \text{faces}^2$.
- **prob**: The probability one wants the set of dice to be non-transitive. If unspecified, a set of dice with different non-transitive probabilities for each pairing will be generated.
- **error**: Computational error to check for machine precision equality. It defaults to 0.001: no need to be specified.

Details

The function randomly generates sets of dice and stops as soon as a non-transitive set of dice matching the specified conditions is found and only if so. As such, it might happen that it never returns any value, should the condition for non-transitive dice not be matched. One may need to manually interrupt the run (time delay is provided, one could set it as max threshold.)

Value

A data.table containing the set of non-transitive dice matching the specified conditions.

See Also

See also `is.nonTransitive`.

Description

A dataset containing the Oskar van Deventer dice, non-transitive set of dice where A beats B,C,E; B beats C,D,F; C beats D,E,G; D' beats A,E,F; E beats B,F,G; F beats A,C,G; G beats A,B,D. Consequently, for arbitrarily chosen two dice there is a third one that beats both of them.

Usage

data(oskar)

Format

A data table with 6 columns. Each column represents a die with six faces.

Examples

data(oskar)
is.nonTransitive(oskar)
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