

Package ‘centrifugeR’

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Type Package

Title Non-Trivial Balance of Centrifuge Rotors

Version 0.1.5

Description Find the numbers of tubes that can be loaded in centrifuge rotors in a single operation and show how to balance these tubes in cases of equal or unequal masses. Refer to Pham (2020) <doi:10.31224/osf.io/4xs38> for more information on package functionality.

Depends R (>= 3.6.0)

Imports pracma (>= 2.2.9), grDevices, graphics, utils

License GPL-3

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R topics documented:

centrifugeR-package	2
rotorCheck	2
rotorEqual	3
rotorSpeed	4
rotorUnequal	5
rotorVerify	7

Index	8
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centrifugeR-package *centrifugeR: Non-Trivial Balance of Centrifuge Rotors*

Description

Find the numbers of tubes that can be loaded in centrifuge rotors in a single operation and show how to balance these tubes in cases of equal or unequal masses. Refer to Pham (2020) <https://doi.org/10.31224/osf.io/4xs38> for more information on package functionality.

Guidelines

centrifugeR helps obtain the perfect centrifuge balance. First, call [rotorCheck](#) to know how many tubes can be loaded into the rotor in a single operation. Use [rotorEqual](#) to balance these tubes given that they have the same mass. If their masses are not the same, use [rotorUnequal](#) to know which tubes must be increased in mass before they can be loaded. Also, call [rotorVerify](#) to verify pre-existing tube configurations and [rotorSpeed](#) if RPM/RCF conversion is needed.

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rotorCheck *Check Centrifuge Rotors*

Description

rotorCheck returns the numbers of tubes that can and cannot be loaded in a single operation.

Usage

```
rotorCheck(n, k = NULL)
```

Arguments

n an integer, the number of rotor buckets.
k an integer, the number of tubes.

Details

The number of rotor buckets n ranges from 4 to 48.

If k is specified, rotorCheck will check whether the input number of tubes can be loaded or not.

Value

rotorCheck returns a list with two components:

valid a vector containing the numbers of tubes that can be loaded.
invalid a vector containing the numbers of tubes that cannot be loaded.

References

Sivek G. On vanishing sums of distinct roots of unity. *Integers*. 2010;10(3):365-8.

See Also

[rotorEqual](#) for balancing tubes of equal mass and [rotorUnequal](#) for balancing tubes of unequal mass.

Examples

```
rotorCheck(30)  
rotorCheck(30, 19)
```

rotorEqual

Balance Tubes of Equal Mass

Description

rotorEqual returns the positions of rotor buckets that must be loaded or empty to balance tubes of equal mass.

Usage

```
rotorEqual(n, k, seed = 2019)
```

Arguments

n	an integer, the number of rotor buckets.
k	an integer, the number of tubes.
seed	an integer, the seed for random number generation. Setting a seed ensures the reproducibility of the result. See set.seed for more details.

Details

The number of rotor buckets n ranges from 4 to 48. The number of tubes k must be greater than 0 and smaller than the number of rotor buckets n .

Value

rotorEqual returns a list with two components:

loaded	a vector containing the positions of rotor buckets that must be loaded.
empty	a vector containing the positions of rotor buckets that must be empty.

rotorEqual also plots a schematic diagram of the centrifuge rotor.

References

Sivek G. On vanishing sums of distinct roots of unity. *Integers*. 2010;10(3):365-8.

Peil O, Hauryliuk V. A new spin on spinning your samples: balancing rotors in a non-trivial manner. arXiv preprint arXiv:1004.3671. 2010 Apr 21.

See Also

[rotorCheck](#) for checking centrifuge rotors and [rotorUnequal](#) for balancing tubes of unequal mass.

Examples

```
rotorEqual(30, 11)
rotorEqual(30, 19)
```

rotorSpeed

Calculate RPM/RCF

Description

rotorSpeed converts rotational speed to relative centrifuge force and vice versa.

Usage

```
rotorSpeed(radius, value, type)
```

Arguments

radius	a numeric, the centrifugal radius in millimeters.
value	a numeric, the rotational speed in revolutions per minute or the relative centrifuge force in $\times g$.
type	the type of the above-mentioned value, "rpm" for rotational speed or "rcf" for relative centrifuge force.

Value

rotorSpeed returns a numeric that is the rotational speed in revolutions per minute or the relative centrifuge force in $\times g$.

References

Rickwood D, editor. Centrifugation: a practical approach. London: Information Retrieval Ltd; 1978. 224 p.

Examples

```
rotorSpeed(100, 12000, "rpm")
rotorSpeed(100, 6000, "rcf")
```

rotorUnequal *Balance Tubes of Unequal Mass*

Description

rotorUnequal returns the required masses and the positions of tubes of unequal initial mass.

Usage

```
rotorUnequal(n, mass = NULL, seed = 2019)
```

Arguments

n	an integer, the number of rotor buckets.
mass	a numeric vector with optional names attribute, the masses (and optional names) of tubes.
seed	an integer, the seed for random number generation. Setting a seed ensures the reproducibility of the result. See set.seed for more details.

Details

The number of rotor buckets n ranges from 4 to 48. The number of tubes (i.e. `length(mass)`) should not be greater than the number of rotor buckets n .

If `mass` is not specified, the names and the masses of tubes must then be taken from the keyboard. In case `mass` has no `names` attribute, tubes will be named automatically (i.e. S1, S2, S3, etc.).

Value

`rotorUnequal` returns a data frame with three columns:

<code>initial</code>	a vector containing the initial masses of tubes.
<code>required</code>	a vector containing the required masses of tubes.
<code>position</code>	a vector containing the bucket positions of tubes.

`rotorUnequal` also plots a schematic diagram of the centrifuge rotor.

References

Sivek G. On vanishing sums of distinct roots of unity. *Integers*. 2010;10(3):365-8.

Peil O, Hauryliuk V. A new spin on spinning your samples: balancing rotors in a non-trivial manner. arXiv preprint arXiv:1004.3671. 2010 Apr 21.

See Also

[rotorCheck](#) for checking centrifuge rotors and [rotorEqual](#) for balancing tubes of equal mass.

Examples

```
# Call the function then input the names and the masses of tubes
rotorUnequal(30)
liver
10.05
gill
9.68
muscle
9.88

# Prepare the masses of tubes then call the function
samples <- round(rnorm(19, mean = 10, sd = 0.5), 2)
rotorUnequal(30, samples)

# Prepare the masses and the names of tubes then call the function
small.samples <- c(10.05, 9.68, 9.88)
names(small.samples) <- c("liver", "gill", "muscle")
rotorUnequal(30, small.samples)
```

`rotorVerify`*Verify Centrifuge Balance*

Description

`rotorVerify` checks whether the rotor is balanced given the positions of tubes of equal mass.

Usage

```
rotorVerify(n, pos)
```

Arguments

<code>n</code>	an integer, the number of rotor buckets.
<code>pos</code>	an integer vector, the positions of tubes.

Details

The number of rotor buckets `n` ranges from 4 to 48. The positions of tubes `pos` ranges from 1 to `n`.

Value

`rotorVerify` returns 1 if the rotor is balanced and 0 if the rotor is unbalanced.

References

Johnsson M. Balancing a centrifuge. R-bloggers. 2016. Available from: <https://www.r-bloggers.com/2016/06/balancing-a-centrifuge/>.

See Also

[rotorCheck](#) for checking centrifuge rotors.

Examples

```
rotorVerify(30, c(10, 20, 30))  
rotorVerify(30, c(1, 11, 21, 4, 28))
```

Index

centrifugeR-package, [2](#)

rotorCheck, [2](#), [2](#), [4](#), [6](#), [7](#)

rotorEqual, [2](#), [3](#), [3](#), [6](#)

rotorSpeed, [2](#), [4](#)

rotorUnequal, [2-4](#), [5](#)

rotorVerify, [2](#), [7](#)

set.seed, [4](#), [5](#)