

# Package ‘centrifugeR’

April 17, 2020

**Type** Package

**Title** Non-Trivial Balance of Centrifuge Rotors

**Version** 0.1.4

**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

**Encoding** UTF-8

**RoxygenNote** 7.1.0

**NeedsCompilation** no

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

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### 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.

### 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 `rotorSpeed` if RPM/RCF conversion is needed.

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### Author(s)

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rotorCheck      *Check Centrifuge Rotors*

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### 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)
```

**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. 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")
```

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rotorUnequal	<i>Balance Tubes of Unequal Mass</i>
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**Description**

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

**Usage**

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

**Arguments**

n	an integer, the number of rotor buckets.
mass	a numeric vector with optional names attribute, the masses (and optional names) of tubes.

**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:

initial	a vector containing the initial masses of tubes.
required	a vector containing the required masses of tubes.
position	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)
```

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