

# Package ‘pci’

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**Title** A Collection of Process Capability Index Functions

**Version** 1.0.1

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**Description** A collection of process capability index functions, such as `C_p()`, `C_pk()`, `C_pm()`, and others, along with metadata about each, like 'LaTeX' equations and 'R' expressions. Its primary purpose is to form a foundation for other quality control packages to build on top of, by providing basic resources and functions. The indices belong to the field of statistical quality control, and quantify the degree to which a manufacturing process is able to create items that adhere to a certain standard of quality. For details see Montgomery, D. C. (2019, ISBN:978-1-119-39930-8).

**License** GPL-3

**Encoding** UTF-8

**RoxygenNote** 7.3.1

**Imports** vek ( $\geq 1.0.0$ )

**Depends** R ( $\geq 4.0.0$ )

**LazyData** true

**Suggests** tinytest ( $\geq 1.4.1$ ), devtools ( $\geq 2.4.5$ )

**URL** <https://github.com/samsemegne/pci>

**NeedsCompilation** no

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**Repository** CRAN

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`C_p``C_p`

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## Description

$$C_p = \frac{USL - LSL}{L\sigma}$$

Only vectors of length 1 are recycled.

NA's take precedence over NaN's, e.g. NaN + NA will output NA.

Yields NaN if sigma equals 0.

## Usage

```
C_p(sigma, lsl, usl, dl)
```

## Arguments

<code>sigma</code>	numeric.
<code>lsl</code>	numeric.
<code>usl</code>	numeric.
<code>dl</code>	numeric. $L$ , conventionally set to 6. Must be greater than 0.

## Value

double.

## References

Montgomery, D. C. (2019). *Introduction to statistical quality control* (8th ed.). Wiley. ISBN: 978-1-119-39930-8

## Examples

```
set.seed(1L)
data = rnorm(n = 30L, mean = 3., sd = 1.)
C_p(sigma = sd(data), lsl = 0., usl = 6., dl = 6.)
# [1] 1.08211
```

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C <sub>pk</sub>	C <sub>pk</sub>
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**Description**

$$C_{pk} = \min(C_{pl}, C_{pu})$$

Note. This function allows for negative  $C_{pk}$  values.

Only vectors of length 1 are recycled.

NA's take precedence over NaN's, e.g. NaN + NA will output NA.

Yields NaN if sigma equals 0.

**Usage**

```
C_pk(mu, sigma, lsl, usl, dl)
```

**Arguments**

mu	numeric.
sigma	numeric.
lsl	numeric.
usl	numeric.
dl	numeric. Conventionally set to 6. Must be greater than 0.

**Value**

double.

**References**

Montgomery, D. C. (2019). *Introduction to statistical quality control* (8th ed.). Wiley. ISBN: 978-1-119-39930-8

**See Also**

[C\\_pl\(\)](#), [C\\_pu\(\)](#)

**Examples**

```
set.seed(1L)
data = rnorm(n = 30L, mean = 3., sd = 1.)
C_pk(mu = mean(data), sigma = sd(data), lsl = 0., usl = 6., dl = 6.)
# [1] 1.052367
```

C\_pl

 $C_{pl}$ **Description**

$$C_{pl} = \frac{\mu - LSL}{L\sigma}$$

Note. This function allows for negative  $C_{pl}$  values.

Only vectors of length 1 are recycled.

NA's take precedence over NaN's, e.g. NaN + NA will output NA.

Yields NaN if sigma equals 0.

**Usage**

```
C_pl(mu, sigma, lsl, l)
```

**Arguments**

mu	numeric.
sigma	numeric.
lsl	numeric.
l	numeric. Conventionally set to 3. Must be greater than 0.

**Value**

double.

**References**

Montgomery, D. C. (2019). *Introduction to statistical quality control* (8th ed.). Wiley. ISBN: 978-1-119-39930-8

**See Also**

[C\\_pu\(\)](#), [C\\_pk\(\)](#)

**Examples**

```
set.seed(1L)
data = rnorm(n = 30L, mean = 3., sd = 1.)
C_pl(mu = mean(data), sigma = sd(data), lsl = 0., l = 3.)
# [1] 1.111853
```

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`C_pm` $C_{pm}$ 

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**Description**

$$C_{pm} = \frac{USL - LSL}{L\sqrt{\sigma^2 + (\mu - T)^2}}$$

Only vectors of length 1 are recycled.

NA's take precedence over NaN's, e.g. NaN + NA will output NA.

Yields NaN if  $\sigma == 0$  and  $\mu == \text{target}$ .

**Usage**

```
C_pm(mu, sigma, target, lsl, usl, dl)
```

**Arguments**

<code>mu</code>	numeric.
<code>sigma</code>	numeric.
<code>target</code>	numeric. $T$ .
<code>lsl</code>	numeric.
<code>usl</code>	numeric.
<code>dl</code>	numeric. $L$ , conventionally set to 6. Must be greater than 0.

**Value**

double.

**References**

Montgomery, D. C. (2019). *Introduction to statistical quality control* (8th ed.). Wiley. ISBN: 978-1-119-39930-8

**Examples**

```
set.seed(1L)
data = rnorm(n = 30L, mean = 3., sd = 1.)
C_pm(mu = mean(data), sigma = sd(data), target = 3., lsl = 0., usl = 6., dl = 6.)
# [1] 1.077827
```

C<sub>pu</sub>C<sub>pu</sub>**Description**

$$C_{pu} = \frac{USL - \mu}{L\sigma}$$

Note. This function allows for negative  $C_{pu}$  values.

Only vectors of length 1 are recycled.

NA's take precedence over NaN's, e.g. NaN + NA will output NA.

Yields NaN if sigma equals 0.

**Usage**

```
C_pu(mu, sigma, usl, l)
```

**Arguments**

mu	numeric.
sigma	numeric.
usl	numeric.
l	numeric. Conventionally set to 3. Must be greater than 0.

**Value**

double.

**References**

Montgomery, D. C. (2019). *Introduction to statistical quality control* (8th ed.). Wiley. ISBN: 978-1-119-39930-8

**See Also**

[C\\_pl\(\)](#), [C\\_pk\(\)](#)

**Examples**

```
set.seed(1L)
data = rnorm(n = 30L, mean = 3., sd = 1.)
C_pu(mu = mean(data), sigma = sd(data), usl = 6., l = 3.)
# [1] 1.052367
```

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pci_info	<i>pci_info</i>
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## Description

Metadata about the process capability indices (PCIs).

## Format

`pci_info`:

**pci\_id** character. The ID of the PCI. Corresponds to the row name of the data.frame in R.

**name\_r** character. The variable name of the PCI, as may be referred to by other metadata fields that contain R code.

**name\_latex** character. The name of the PCI in LaTeX format.

**name\_r\_expr** character. The name of the PCI in R expression format, useful for working with plot labels or texts in R. To be used with `str2expression(text)` in R.

**expr\_r** character. An R expression of the PCI, in expanded form. Variable names match parameter names of the PCI's function provided by the package. Can be used with `str2expression(text)` in R.

**eq\_latex** character. An equation of the PCI in LaTeX format.

**attributes** AsIs. The attributes column is essentially an unnamed list, thus being a nested data structure. Each element belonging to a PCI is again an unnamed list, which holds the actual attributes for that PCI. Each attribute is a named list. Attributes detail additional technical information about the PCI or its related concepts, e.g. the bounds of the PCI. Note, all information pertains to the PCI's function provided by the package. Each actual attribute has a 'type' (single character) field, may have a 'target' (character) field, followed by fields specific to that attribute type. The 'target' field indicates which entity the attribute belongs to, e.g. the PCI or one of its terms.

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