Package ‘bignum’

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Title Arbitrary-Precision Integer and Floating-Point Mathematics

Version 0.3.0

Description Classes for storing and manipulating arbitrary-precision integer vectors and high-precision floating-point vectors. These extend the range and precision of the 'integer' and 'double' data types found in R. This package utilizes the 'Boost.Multiprecision' C++ library. It is specifically designed to work well with the 'tidyverse' collection of R packages.

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BugReports https://github.com/davidchall/bignum/issues

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Description

bigfloat() and as_bigfloat() construct a vector designed to store numbers with 50 decimal digits of precision.
is_bigfloat() checks if an object is of class bignum_bigfloat.

Usage

bigfloat(x = character())
as_bigfloat(x)
is_bigfloat(x)

Arguments

x Object to be coerced or tested.

Value

An S3 vector of class bignum_bigfloat.

See Also

NA_bigfloat_ to represent missing values.
format() for pretty printing.
vignette("operations") for supported operations.
Examples

# default options limit displayed precision
bigfloat(1) / 3

# display full precision
format(bigfloat(1) / 3, sigfig = 50, notation = "dec")

biginteger

Arbitrary-Precision Integer Vectors

Description

biginteger() and as_biginteger() construct a vector designed to store any integer.
is_biginteger() checks if an object is of class bignum_biginteger.

Usage

biginteger(x = character())
as_biginteger(x)
is_biginteger(x)

Arguments

x Object to be coerced or tested.

Value

An S3 vector of class bignum_biginteger.

See Also

NA_biginteger_ to represent missing values.
format() for pretty printing.
vignette("operations") for supported operations.

Examples

# default options limit displayed precision
biginteger(2)^50L

# display full precision
format(biginteger(2)^50L, notation = "dec")

# lossy casts raise a warning
biginteger(c(2, 2.5, 3))
# suppress warnings if they are expected
suppressWarnings(biginteger(c(2, 2.5, 3)))

# unsigned integers can be specified as hexadecimal
biginteger("0xffffffff")

---

### bignum-arith

| Description | Arithmetic operations |
---|---|

**bignum** and **bigfloat** vectors support the standard arithmetic operations. The base R documentation can be found at [Arithmetic](#).

**Value**

These arithmetic operations are **type-stable**, which means the output type depends only on the input types (not the input values). A biginteger vector is returned when the result must be an integer (e.g., addition of two integers). Otherwise a bigfloat vector is returned.

The following table summarizes the return type for each combination, where "integer-like" refers to integer and biginteger vectors and "float-like" refers to double and bigfloat vectors.

| Input 1   | Operator | Input 2   | Result   |
---|---|---|---|
Integer-like | +, -, *, ^, %% | Integer-like | biginteger |
Integer-like | +, -, *, ^, %% | Float-like | bigfloat |
Float-like | +, -, *, ^, %% | Integer-like | bigfloat |
Float-like | +, -, *, ^, %% | Float-like | bigfloat |
Any | / | Any | bigfloat |
Any | %/% | Any | biginteger |

**See Also**

Other bignum operations: [bignum-compare](#), [bignum-math](#), [bignum-special](#)

**Examples**

```r
x <- biginteger(5)
y <- bigfloat(2)
+x
-x
x + y
x - y
x * y
x / y
x^y
```
bignum-compare

\[
\begin{align*}
  x \%\% y \\
  x \%/\% y \\
\end{align*}
\]

bignum-compare  
Comparison operations

Description

`biginteger` and `bigfloat` vectors support the standard comparison operations. The base R documentation can be found at Comparison.

Value

A logical vector.

See Also

Other bignum operations: `bignum-arith`, `bignum-math`, `bignum-special`

Examples

```r
x <- biginteger(5)
y <- bigfloat(2)

x < y \\
x > y \\
x <= y \\
x >= y \\
x == y \\
x != y
```

bignum-constants  
Constants

Description

`NA_biginteger_` and `NA_bigfloat_` support missing values.

`bigpi` is a higher precision version of `pi`.

Usage

```r
NA_biginteger_ \\
NA_bigfloat_ \\
bigpi
```
Value

A `biginteger` or `bigfloat` vector of length 1.

See Also

`NA` and `pi` are the base constants.

Examples

```r
NA_biginteger

NA_bigfloat

# default options limit displayed precision
bigpi

# display full precision
format(bigpi, sigfig = 50, notation = "dec")
```

---

**bignum-format**

Format a bignum vector

Description

Customize how a `biginteger` or `bigfloat` vector is displayed. The precision can be controlled with a number of significant figures, or with a maximum or fixed number of digits after the decimal point. You can also choose between decimal, scientific and hexadecimal notations.

The default formatting applied when printing depends on the type of object:

- **standalone vector**: consults “bignum.sigfig” and “bignum.max_dec_width”
- **tibble column**: consults “pillar.sigfig” and “pillar.max_dec_width”

Usage

```r
## S3 method for class 'bignum_biginteger'
format(x, ..., sigfig = NULL, digits = NULL, notation = c("fit", "dec", "sci", "hex")

## S3 method for class 'bignum_bigfloat'
format(x, ..., sigfig = NULL, digits = NULL, notation = c("fit", "dec", "sci"))
```
**Arguments**

- **x**  
  A `biginteger` or `bigfloat` vector.

- **...**  
  These dots are for future extensions and must be empty.

- **sigfig**  
  Number of significant figures to show. Must be positive. Cannot be combined with `digits`.

  If both `sigfig` and `digits` are unspecified, then consults the "bignum.sigfig" option (default: 7).

- **digits**  
  Number of digits to show after the decimal point. Positive values indicate the exact number of digits to show. Negative values indicate the maximum number of digits to show (terminal zeros are hidden if there are no subsequent non-zero digits). Cannot be combined with `sigfig`.

- **notation**  
  How should the vector be displayed? Choices:

  - "fit": Use decimal notation if it fits, otherwise use scientific notation. Consults the "bignum.max_dec_width" option (default: 13).
  - "dec": Use decimal notation, regardless of width.
  - "sci": Use scientific notation.
  - "hex": Use hexadecimal notation (positive `biginteger` only).

**Value**

Character vector

**Examples**

```r
# default uses decimal notation
format(bigfloat(1e12))

# until it becomes too wide, then it uses scientific notation
format(bigfloat(1e13))

# hexadecimal notation is supported for positive integers
format(biginteger(255), notation = "hex")

# significant figures
format(bigfloat(12.5), sigfig = 2)

# fixed digits after decimal point
format(bigfloat(12.5), digits = 2)

# maximum digits after decimal point
format(bigfloat(12.5), digits = -2)
```
bignum-math  

**Mathematical operations**

**Description**

`bignum` and `bigfloat` vectors support many of the standard mathematical operations. The base R documentation can be found by searching for the individual functions (e.g. `mean()`).

**Value**

The returned value depends on the individual function. We recommend reading the base R documentation for a specific function to understand the expected result.

**See Also**

Other bignum operations: `bignum-arith`, `bignum-compare`, `bignum-special`

**Examples**

```r
# summary
x <- bigfloat(1:5)
sum(x)
prod(x)
max(x)
min(x)
range(x)
mean(x)

# cumulative
x <- bigfloat(1:5)
cumsum(x)
cumprod(x)
cummax(x)
cummin(x)

# rounding
x <- bigfloat(1.5)
floor(x)
ceiling(x)
trunc(x)

# miscellaneous
x <- bigfloat(2)
abs(x)
sign(x)
sqrt(x)

# logarithms and exponentials
x <- bigfloat(2)
log(x)
```
log10(x)
log2(x)
log1p(x)
exp(x)
expm1(x)

# trigonometric
x <- bigfloat(0.25)
cos(x)
sin(x)
tan(x)
acos(x)
asin(x)
atan(x)
cospi(x)
sinpi(x)
tanpi(x)

# hyperbolic
x <- bigfloat(0.25)
cosh(x)
sinh(x)
tanh(x)
acosh(bigfloat(2))
asinh(x)
atanh(x)

# special functions
x <- bigfloat(2.5)
gamma(x)
lgamma(x)
digamma(x)
trigamma(x)
factorial(x)
lfactorial(x)

---

bignum-special  Check for special values

Description

biginteger and bigfloat support missing values (via NA_biginteger_ and NA_bigfloat_ respectively).

bigfloat additionally supports positive and negative infinity and 'Not a Number' values. Usually these are the result of a calculation, but they can also be created manually by casting from numeric to bigfloat.

These functions check for the presence of these special values. The base R documentation can be found at is.na() and is.finite().
Value

A logical vector.

See Also

Other bignum operations: bignum-arith, bignum-compare, bignum-math

Examples

```r
x <- bigfloat(c(0, NA, Inf, -Inf, NaN))

is.na(x)
is.finite(x)
is.infinite(x)
is.nan(x)
```

Description

Generate a regular sequence of `biginteger` or `bigfloat` values.

When calling `seq()`, exactly two of the following must be specified:

- to
- by
- Either `length.out` or `along.with`

Usage

```r
## S3 method for class 'bignum_vctr'
seq(from, to = NULL, by = NULL, length.out = NULL, along.with = NULL, ...)
```

Arguments

- `from` Start value of the sequence. Always included in the result.
  A `biginteger` or `bigfloat` scalar.
- `to` Stop value of the sequence. Only included in the result if `by` divides the interval between `from` and to exactly.
  `to` is cast to the type of `from`.
- `by` Amount to increment the sequence by.
  `by` is cast to the type of `from`.
- `length.out` Length of the resulting sequence.
- `along.with` Vector who’s length determines the length of the resulting sequence.
- `...` These dots are for future extensions and must be empty.
Value

A sequence with the type of from.

Examples

seq(biginteger(0), 10, by = 2)

seq(biginteger(0), 10, length.out = 3)

seq(biginteger(0), by = 3, length.out = 3)

seq(bigfloat(0), by = -0.05, length.out = 6)
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