

Package ‘listcompr’

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Title List Comprehension for R

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Description Syntactic shortcuts for creating synthetic lists, vectors,
data frames, and matrices using list comprehension.

URL <https://github.com/patrickroocks/listcompr>

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gen.list	<i>Generate Lists, Vectors, Data Frames and Matrices with List Comprehension</i>
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Description

Functions to transform a base expression containing free variables into a list, a vector, a data frame, or a matrix based on variable ranges and additional conditions.

Usage

```
gen.list(.expr, ...)

gen.vector(.expr, ...)

gen.data.frame(.expr, ..., byrow = FALSE)

gen.matrix(.expr, ..., byrow = FALSE)
```

Arguments

.expr	<p>A base expression containing free variables which is evaluated for all combinations of variables, where the combinations of variables are given by the ranges and conditions (see ... parameters).</p> <p>Expected structure of .expr:</p> <ul style="list-style-type: none"> • For <code>gen.list</code> it may have arbitrary structure (including a list). • For <code>gen.vector</code> a value (i.e., a vector of length 1) is expected. • For <code>gen.data.frame</code> a (named) vector or list is expected which describes exactly one row of the data frame. Use <code>list(name = val)</code> if <code>val</code> is a non-fundamental type like <code>difftime</code>. • For <code>gen.matrix</code> either a (named) vector/list (like <code>gen.data.frame</code>) or a scalar is expected. In the first case, we expect the same as for <code>gen.data.frame</code>. In the latter case we expect exactly two variables (inducing rows and columns where the order depends on <code>byrow</code>) within the ... arguments. <p>Within .expr it is allowed to use functions and predefined constants from the parent environment.</p>
...	<p>Arbitrary many variable ranges and conditions. For all free variables occurring in .expr a range must be assigned, e.g., <code>x = 1:3</code>, <code>y = 1:5</code> for an expression <code>x + y</code>. At least one variable range is required. The ranges may depend on each other, e.g., <code>x = 1:3</code>, <code>y = x:3</code> or a substitution like <code>x = 1:3</code>, <code>y = 2 * x</code> is allowed. The generated values can be further restricted by conditions like <code>x <= y</code>.</p>
byrow	<p>Logical. If <code>FALSE</code> (the default), the elements of a vector within .expr are taken as columns. Otherwise, they are taken as rows.</p>

Value

The result of `gen.list` is a list (a vector for `gen.vector`) containing an entry for each combination of the free variables (i.e., the Cartesian product), where all the free variables in `.expr` are substituted. The function `gen.vector` returns a vector while `gen.list` may contain also more complex substructures (like vectors or lists).

The output of `gen.data.frame` is a data frame where each substituted `.expr` entry is one row. The base expression `.expr` should contain a (named) vector or list, such that each entry of this vector becomes a column of the returned data frame. If the vector contains a single literal without a name, this is taken as column name. For instance, `gen.data.frame(a, a = 1:5)` returns the same as `gen.data.frame(c(a = a), a = 1:5)`. Default names 'V1', 'V2', ... are used, if no names are given and names can't be automatically detected.

The result of `gen.matrix`:

- It's similar to `gen.data.frame`, if `.expr` evaluates to a vector of length > 1 , or row/column names are given. Each substituted `.expr` entry is one row of the matrix. In contrast to `gen.data.frame`, column names are not auto-generated, e.g., `gen.matrix(c(a_1, a_2), a_1 = 1:2)` is an unnamed matrix. If the `.expr` argument has explicit names (e.g., `c(a_1 = a_1, a_2 = a_2)`), these column names are assigned to the resulting matrix.
- It's a matrix where the rows and columns are induced by the two variables within `...`, if `.expr` is a scalar, and no names or conditions are given. If `byrow` is `FALSE`, the second variable (i.e., the inner loop) refers to the columns, otherwise it refers to the rows. For instance, `gen.matrix(i + j, i = 1:3, j = 1:2)` is a matrix with 3 rows and 2 columns. For `gen.matrix(i + j, i = 1:3, j = 1:2, byrow = TRUE)` we get 2 rows and 3 columns.

All expressions and conditions are applied to each combination of the free variables separately, i.e., they are applied row-wise and not vector-wise. For instance, the term `sum(x, y)` (within `.expr` or a condition) is equivalent to `x+y`.

Indices for variables

A range for a variable ending with an underscore (like `x_`) defines a set of ranges affecting all variables named `{varname}_index`, e.g. `x_1`. For instance, in `gen.vector(x_1 + x_2 + x_3, x_ = 1:5)` the variables `x_1`, `x_2`, `x_3` are all ranging in 1:5. This can be overwritten for each single `x_i`, e.g., an additional argument `x_3 = 1:3` assigns the range 1:3 to `x_3` while `x_1` and `x_2` keep the range 1:5. A group of indexed variables is kept always sorted according to the position of the main variable `{varname}_`. For instance, the two following statements produce the same results:

- `gen.vector(x_1 + x_2 + a, x_ = 1:5, a = 1:2, x_1 = 1:2)`
- `gen.vector(x_1 + x_2 + a, x_1 = 1:2, x_2 = 1:5, a = 1:2)`

Folded expressions

Expressions and conditions support a `...`-notation which works as follows:

- A vector like `c(x_1, ..., x_4)` is a shortcut for `c(x_1, x_2, x_3, x_4)`.
- A named vector like `c(a_1 = x_1, ..., a_3 = x_3)` is a shortcut for `c(a_1 = x_1, a_2 = x_2, a_3 = x_3)`.

- A n-ary function argument like `sum(x_1, ..., x_4)` is a shortcut for `sum(x_1, x_2, x_3, x_4)`.
- Repeated expressions of binary operators can be abbreviated with the `...` expressions as follows: `x_1 + ... + x_4` is a shortcut for `x_1 + x_2 + x_3 + x_4`. Note that, due to operator precedence, `1 + x_1 + ... + x_4` will not work, but `1 + (x_1 + ... + x_4)` works as expected.
- For non-commutative operators, `x_1 - ... - x_4` is a shortcut for `x_1 - x_2 - x_3 - x_4` which is evaluated as `((x_1 - x_2) - x_3) - x_4`.

The conditions may contain itself list comprehension expressions, e.g., `gen.logical.and` to compose and-connected logical expressions.

Character patterns

In expression there may occur characters with `{}`-placeholders. The content of these placeholders is evaluated like any other part of an expression and converted to a character. For example, `"a{x}"` is transformed into `"a1"` for `x = 1`. Double brackets are transformed into a single bracket without evaluating the inner expression. For instance, `"var{x+1}_{a}"` is transformed into `"var2_{a}"` for `x = 1`.

See Also

`gen.named.list` to generate named structures, `gen.list.expr` to generate expressions to be evaluated later, `gen.logical.and` to generate logical and/or conditions, and `listcompr` for an overview of all list comprehension functions.

Examples

```
# Sum of 1:x
gen.vector(sum(1:x), x = 1:10)

# Same as above, but return as text
gen.list("sum of 1 to {x} is {sum(1:x)}", x = 1:5)

# A list containing vectors [1], [1, 2], [1, 2, 3], ...
gen.list(gen.vector(i, i = 1:n), n = 1:10)

# A data frame of tuples (x_1, x_2, x_3) summing up to 10
gen.data.frame(c(x_1, ..., x_3), x_ = 1:10, x_1 + ... + x_3 == 10)

# Same as above, but restrict to ascending tuples with x_i <= x_(i+1)
gen.data.frame(c(x_1, ..., x_3), x_1 = 1:10, x_2 = x_1:10, x_3 = x_2:10,
               x_1 + ... + x_3 == 10)

# A data frame containing the numbers in 2:20, the sum of their divisors
# and a flag if they are "perfect" (sum of divisors equals the number)
gen.data.frame(list(n, sumdiv, perfect = (n == sumdiv)), n = 2:20,
               sumdiv = sum(gen.vector(x, x = 1:(n-1), n %% x == 0)))

# A diagonal matrix with (1, ..., 5) on the diagonal
gen.matrix(if (i == j) i else 0, i = 1:5, j = 1:5)
```

gen.list.expr

*Generate List and Vector Expressions with List Comprehension***Description**

Functions to transform a base expression containing free variables into a list or a vector of expressions, based on variable ranges and additional conditions.

Usage

```
gen.list.expr(.expr, ...)
```

```
gen.vector.expr(.expr, ...)
```

```
gen.named.list.expr(.str, .expr, ...)
```

```
gen.named.vector.expr(.str, .expr, ...)
```

Arguments

.expr	A base expression which is partially evaluated for all combinations of variables. It may still contain free variables.
...	Arbitrary many variable ranges and conditions.
.str	A character pattern, containing expressions to be evaluated in {}-brackets.

Details

See [gen.list](#) for more details on the .expr and ... parameters.

See [gen.named.list](#) for more details on the .str parameter.

For variables with underscores additionally the evaluation of indices in ()-brackets is supported. For example, an expression x_(i+1) is evaluated as x_3 for i = 2.

Value

Returns an expression containing a list or a vector which might be evaluated later. The argument .expr is partially evaluated, where all free variables are substituted for which a range is given. The other variables remain untouched.

See Also

[gen.list](#) to generate lists, [gen.named.list](#) to generate named lists, and [listcompr](#) for an overview of all list comprehension functions.

Examples

```
# An expression which is partially evaluated
gen.list.expr(a_i + 2 * i, i = 1:4)

# Generate an expression with placeholders a_i,
# generate data for a_1, ..., a_4 and finally evaluate it
expr <- gen.vector.expr(a_i + a_(j+1), i = 1:3, j = 1:3, i != j)
data <- gen.data.frame(c(a_1 = a_1, ..., a_4 = a_4), a_ = 1:2)
eval(expr, data)
```

gen.logical.and

Generate Logical Conditions with List Comprehension

Description

Functions to compose and-/or-connected logical conditions, based on variable ranges and additional conditions.

Usage

```
gen.logical.and(.expr, ...)
```

```
gen.logical.or(.expr, ...)
```

Arguments

.expr	A base expression which is partially evaluated for all combinations of variables. It may still contain free variables.
...	Arbitrary many variable ranges and conditions.

Details

See [gen.list](#) for more details on the .expr and ... parameters.

For variables with underscores additionally the evaluation of indices in ()-brackets is supported. For example, an expression x_(i+1) is evaluated as x_3 for i = 2.

Value

Returns an expression `expr_1 & ... & expr_n` or `expr_1 | ... | expr_n` where `expr_i` is generated from .expr, where all free variables are substituted for which a range is given. The other variables remain untouched.

The generated condition may be used within the the conditions of [gen.list](#) and similar functions from this package.

See Also

[gen.list](#) to generate lists and thereby make use of the generated logical conditions, and [listcompr](#) for an overview of all list comprehension functions.

Examples

```
# Returns a_1 == 1 & a_2 == 2 & a_3 == 3
gen.logical.and(a_i == i, i = 1:3)

# A data frame of tuples (x_1, x_2, x_3, x_4) summing up to 10 with x_i <= x_(i+1)
gen.data.frame(c(x_1, ..., x_4), x_ = 1:10, x_1 + ... + x_4 == 10,
               gen.logical.and(x_i <= x_(i+1), i = 1:3))

# Get all permutations of 1:4
gen.data.frame(c(a_1, ..., a_4), a_ = 1:4,
               gen.logical.and(a_i != a_j, i = 1:4, j = (i+1):4))

# Get again the permutations of 1:4, using filter from dplyr
df <- gen.data.frame(c(a_1, ..., a_4), a_ = 1:4)
dplyr::filter(df, !!gen.logical.and(a_i != a_j, i = 1:3, j = (i+1):4))
```

gen.named.list	<i>Generate Named Lists, Vectors, Data Frames, and Matrices with List Comprehension</i>
----------------	---

Description

Functions to transform patterns with placeholders into characters or into names of lists, vectors, data frames or matrices, based on variable ranges and additional conditions.

Usage

```
gen.named.list(.str, .expr, ...)

gen.named.vector(.str, .expr, ...)

gen.named.data.frame(.str, .expr, ..., byrow = FALSE)

gen.named.matrix(.str, .expr, ..., byrow = FALSE)
```

Arguments

.str	A character, containing expressions to be evaluated in {}-brackets, e.g., "a{x}" is transformed into "a1" for x = 1. Double brackets are transformed into a single bracket without evaluating the inner expression. For instance, "var{x + 1}_{a}" is transformed into "var2_{a}" for x = 1.
------	--

<code>.expr</code>	A base expression containing free variables which is evaluated for all combinations of variables.
<code>...</code>	Arbitrary many variable ranges and conditions.
<code>byrow</code>	Logical. If FALSE (the default), the elements of an <code>.expr</code> vector are taken as columns. Otherwise, they are taken as rows.

Details

The free variables in the inner expressions (i.e., the content of the `{}`-brackets) of `.expr` are evaluated in the same way as expressions in [gen.list](#).

See [gen.list](#) for more details on the `.expr` and `...` parameters.

Value

These functions return lists, vectors, data frames, and matrices. They work very similar to their counterparts without `".named"`. Additionally the vector of characters, induced by `.str`, serves as a vector of names for the generated structures. In case of lists or vectors, the result is a named list or a named vector. For data frames and matrices, the names are taken as row names.

See Also

[gen.list](#) for explanations on list and vector comprehension, and [listcompr](#) for an overview of all list comprehension functions.

Examples

```
# sum up 1:i for i in 1:5
gen.named.list("sum_to_{x}", sum(1:x), x = 1:5)

# matrix with named columns and rows
gen.named.matrix("row{i}", gen.named.vector("col{j}", i+j, j = 1:3), i = 1:3)

# a matrix where the expression refers to the rows and not the columns
gen.named.matrix("col{i}", c(row1 = i, row2 = 10 * i, row3 = 100 * i), i = 1:10,
                        byrow = TRUE)
```

Description

The `listcompr` package offers some syntactic shortcuts to create lists, vectors and data frames containing values within a given range with given conditions. It is a light-weight package written in base R without any compiled code or dependencies to other packages.

Functions

- The main functionality of listcompr: generate lists, vectors, and data frames: [gen.list](#)
- Generate named lists, vectors, and data frames: [gen.named.list](#)
- Generate expressions containing lists and vectors: [gen.list.expr](#)
- Generate conditions to be used in other functions of listcompr: [gen.logical.and](#)

Vignettes

To learn the basics of listcompr, start with the vignette:

```
vignette("introduction", package = "listcompr")
```

Contact

To submit bugs, feature requests or other comments, feel free to write a mail to me.

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