

Package ‘kriens’

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Type Package

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Description Provides basic functions for Continuation-Passing Style development.

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`compose`*Continuation Passing Style Function Composition*

Description

It allows to compose two functions of the form $f(x, \text{ret})$ and $g(x, \text{ret})$ returning a function $h(x, \text{ret})$ which is the composition $f \circ g$. It implements the composition operator of the Continuation category.

The the composition has the following properties:

1. Associativity: $h \circ (f \circ g) = (h \circ g) \circ f$
2. Unity: $f \circ \text{identity2} = f = \text{identity2} \circ f$

In order for these relations to hold, the function f and g must not deal with global mutable states.

Usage

```
compose(f, g)
```

Arguments

<code>f</code>	The first function that must be composed
<code>g</code>	The first function that must be composed

Value

Returns the composite function of f and g

Note

The composition is performed from left to right i.e. such that the first function executed is f .

Author(s)

Matteo Provenzano
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See Also

[forget](#)

Examples

```
# Example 1

# define an arrow in the Continuation category.
# this function applies the continuation to the
# increment of its argument and then decrements it.
one <- function(x, ret) {
  return(ret(x+1) - 1)
}

# define another arrow in the Continuation category.
# this function doubles its argument.
two <- function(x, ret) {
  return(ret(2*x))
}

# create the composition
# this is exactly the same as one %.% two
composite <- compose(one, two)

# build the function (forget the continuation)
execute1 <- forget(composite)
execute1(1)
# returns 3

# Example 2
# compose the function further to loop over an array of elements
# lapply and sapply are already arrow in the Continuation category
loop <- compose(lapply, composite)

# build the function
execute2 <- forget(loop)
execute2(1:10)
```

do

Compose and Forget in one go.

Description

do allows to specify the list of function directly as its arguments. It return a function which is the composition of every argument with the continuation already forgotten.

Usage

```
do(...)
```

Arguments

... The functions that must be composed together.

Value

A function of the type $g(x)$ which can be directly used on the input.

Author(s)

Matteo Provenzano
<http://www.alephdue.com>

See Also

[path](#), [forget](#)

Examples

```
# define a function that doubles its argument
times.two <- function(x, ret) {
  ret(x*2)
}

# define a function that loops over a list of list and double every element
loop <- do(lapply, lapply, times.two)

#returns list(list(2, 4, 6), list(8,10,12))
loop(list(list(1,2,3),list(4,5,6)))
```

forget

Forgets the Continuation

Description

This function takes a function of the form $f(x, ret)$ and forgets the `ret` part returning a function of the form $g(x)$.

Usage

```
forget(f)
```

Arguments

`f` a function of the form $f(x, ret)$.

Value

a function of the form $f(x)$.

Author(s)

Matteo Provenzano
<http://www.alephdue.com>

See Also[compose](#)**Examples**

```
# forget the FUN part in lapply
to.list <- forget(lapply)

# returns the list of the natural numbers from 1 to 10
to.list(1:10)
```

`identity2`*The Identity Arrow*

Description

The identity arrow for the Continuation category for which holds: $f \%.\% \text{identity2} = f = \text{identity2} \%.\% f$

Usage

```
identity2(x, ret)
```

Arguments

<code>x</code>	The value on which the function operates
<code>ret</code>	The following computation

Value

This function always returns the original arrow.

Author(s)

Matteo Provenzano
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`monoid`*Creates the monoid binary operator*

Description

Creates the monoid binary operator for a monoid in the Continuation category.

Usage

```
monoid(op)
```

Arguments

`op` The binary operator to be insert in the monoid (multiplication).

Value

It returns a function of the type $h(f, g)$ where f and g must be elements of the monoid and objects in the Continuation category. The function h will return a function of the type $t(x, ret)$ which can be used in the Continuation category.

Note

The developer must make sure that the function f and g are elements of a monoid and of the Continuation category. The developer must also ensure that the operator op is the monoid's binary operator.

Author(s)

Matteo Provenzano
<http://www.alephdue.com>

References

[https://en.wikipedia.org/wiki/Monoid_\(category_theory\)](https://en.wikipedia.org/wiki/Monoid_(category_theory))

See Also

[do](#)

Examples

```
# A list is a monoid
replicate.10 <- function(x, ret) {
  ret(rep(x, 10))
}

# concatenation is the binary operator for the list monoid
# the empty list is the unit
```

```
`%et%` <- monoid(c)

replicate.20 <- do(replicate.10 %et% replicate.10)

# returns a list of 20 "a"s
replicate.20("a")
```

path

Compose all the function in a list

Description

It applies the compose operator recursively on all the elements of the list provided as argument

Usage

```
path(fs)
```

Arguments

fs The list of the functions that must be composed together (e.g: list(f1, f2, f3, ...)).

Value

A function of the type `g(x, ret)` result of the pairwise composition of each element in the list.

Author(s)

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Examples

```
# define a function that doubles its argument
times.two <- function(x, ret) {
  ret(x*2)
}

# define a function that loops over a list of list and double every element
loop <- forget(path(list(lapply, lapply, times.two)))

#returns list(list(2, 4, 6), list(8,10,12))
loop(list(list(1,2,3),list(4,5,6)))
```

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