

# Package ‘nCopula’

June 12, 2017

**Type** Package

**Title** Copula Construction Tools

**Version** 0.1.0

**Description**

Construct and use hierarchical Archimedean copulas with multivariate compound distributions

**Depends** R ( $\geq 3.3$ ), copula

**Imports** Deriv, gtools, mgcv, stringr, stringi, compiler, gsl, Ryacas,  
methods, Matrix, stabledist

**License** GPL ( $\geq 2$ )

**LazyData** FALSE

**RoxygenNote** 5.0.1

**Suggests** knitr, rmarkdown

**VignetteBuilder** knitr

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 AMH

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*Construction of an Archimedean Copula Class Object*


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### Description

Constructs an archm class object with a given parameter and dimension.

### Usage

```
AMH(param, dim = 2L)
```

### Arguments

param	Parameter of the copula
dim	Dimension of the copula ( $\geq 2$ ), which is, by default, 2
density	Should the expression of the density be computed ?

### Author(s)

Simon-Pierre Gadoury

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 Clayton

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*Construction of an Archimedean Copula Class Object*


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### Description

Constructs an archm class object with a given parameter and dimension.

### Usage

```
Clayton(param, dim = 2L, density = FALSE)
```

### Arguments

param	Parameter of the copula
dim	Dimension of the copula ( $\geq 2$ ), which is, by default, 2
density	Should the expression of the density be computed ?

### Author(s)

Simon-Pierre Gadoury

dCop

*Density for Archimedean Copulas Objects***Description**

Density for Archimedean Copulas Objects

**Usage**

```
dCop(copula, vector = TRUE, express = FALSE, code = FALSE,
      operator = "")
```

**Arguments**

copula	An Archimedean copula class object
vector	If false, returns a function with (x_1, x_2, ..., x_dim, alpha) as arguments.
express	If true, returns an expression.
code	If true, copies the LaTeX code to clipboard.
operator	Type of computer used (only necessary in the case of internal problem)

**Value**

Either an expression, function or code.

**Author(s)**

Simon-Pierre Gadoury

Frank

*Construction of an Archimedean Copula Class Object***Description**

Constructs an archm class object with a given parameter and dimension.

**Usage**

```
Frank(param, dim = 2L)
```

**Arguments**

param	Parameter of the copula
dim	Dimension of the copula ( $\geq 2$ ), which is, by default, 2
density	Should the expression of the density be computed ?

**Author(s)**

Simon-Pierre Gadoury

**Description**

Constructs a Child class object for a given parameter and arguments

**Usage**

```
GAMMA(par, unif, struc = NULL)
```

**Arguments**

par	Dimension of the distribution
unif	Uniform structure, a numeric vector of grouped numbers. i.e. c(1,2,3) is translated as being c(u1, u2, u3).
struc	Nesting structure of the form X(par1, c(i,...), list(Y(par2, c(j,...), NULL), Z(par3, c(k,...), NULL))), where X, Y, and Z are compatible functions (see 'details'). It is to note that if struc is NULL, the function will automatically be of class Child. For continuous distributions (i.e. GAMMA), struc is always NULL.

**Slots**

Param	The name of the parameter used
parameter	The value of the parameter
dimension	The dimension
type	The type of function (either child or mother)
arguments	The corresponding arguments (ex.: arguments 1 and 2 imply 'u1' and 'u2')
structure	The structure below the node of type 'Mother'
Laplace	Expression of the LST
LaplaceInv	Expression of the inverse LST
PGF	Expression of the pgf
PGFInv	Expression of the inverse pgf
simul	Fonction to sample from the distribution
theta	I don't know honestly
cop	Construct an Archimedean copula with this distribution
Der	Fonction to compute the expression of the 'k'th derivative of either the 'PGF', 'PGFInv', 'Laplace' or 'LaplaceInv'
FUN	Fonction to compute the function of the 'k'th derivative of either the 'PGF', 'PGFInv', 'Laplace' or 'LaplaceInv'

**Author(s)**

Simon-Pierre Gadoury

**Examples**

```
GEO(0.5, NULL, list(GAMMA(1/30, c(5,6), NULL),
                   GEO(0.1, NULL, list(GAMMA(1/30, c(1,2), NULL),
                                       GAMMA(1/30, c(3,4), NULL))))))
```

GeneticCodes

*Obtain the genetic codes of a structure***Description**

Obtain the genetic codes of a structure

**Usage**

```
GeneticCodes(str)
```

**Arguments**

str                      The structure

**Value**

A list of of the structure's genetic codes.

**Author(s)**

Simon-Pierre Gadoury

GEO

*Construction of a Mother or Child Class Object***Description**

Constructs either a Mother or Child class object for a given parameter, arguments, and nesting structure.

**Usage**

```
GEO(par, unif, struc)
```

**Arguments**

par                      Dimension of the distribution

unif                      Uniform structure, a numeric vector of grouped numbers.  
i.e. c(1,2,3) is translated as being c(u1, u2, u3).

struc                      Nesting structure of the form  
X(par1, c(i,...), list(Y(par2, c(j,...), NULL), Z(par3, c(k,...), NULL))),  
where X, Y, and Z are compatible functions (see 'details'). It is to note that if  
struc is NULL, the function will automatically be of class Child. For continuous  
distributions (i.e. GAMMA), struc is always NULL.

**Slots**

Param The name of the parameter used  
 parameter The value of the parameter  
 dimension The dimension  
 type The type of function (either child or mother)  
 arguments The corresponding arguments (ex.: arguments 1 and 2 imply 'u1' and 'u2')  
 structure The structure below the node of type 'Mother'  
 Laplace Expression of the LST  
 LaplaceInv Expression of the inverse LST  
 PGF Expression of the pgf  
 PGFInv Expression of the inverse pgf  
 simul Fonction to sample from the distribution  
 theta I don't know honestly  
 cop Construct an Archimedean copula with this distribution  
 Der Fonction to compute the expression of the 'k'th derivative of either the 'PGF', 'PGFInv', 'Laplace' or 'LaplaceInv'  
 FUN Fonction to compute the function of the 'k'th derivative of either the 'PGF', 'PGFInv', 'Laplace' or 'LaplaceInv'

**Author(s)**

Simon-Pierre Gadoury

**Examples**

```
GEO(0.5, NULL, list(GAMMA(1/30, c(5,6), NULL),
                    GEO(0.1, NULL, list(GAMMA(1/30, c(1,2), NULL),
                                        GAMMA(1/30, c(3,4), NULL))))))
```

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Gumbel

*Construction of an Archimedean Copula Class Object*

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**Description**

Constructs an archm class object with a given parameter and dimension.

**Usage**

```
Gumbel(param, dim = 2L)
```

**Arguments**

param	Parameter of the copula
dim	Dimension of the copula ( $\geq 2$ ), which is, by default, 2
density	Should the expression of the density be computed ?

**Author(s)**

Simon-Pierre Gadoury

**Description**

Constructs either a Mother or Child class object for a given parameter, arguments, and nesting structure.

**Usage**

```
LOG(par, unif, struc)
```

**Arguments**

par	Dimension of the distribution
unif	Uniform structure, a numeric vector of grouped numbers. i.e. c(1,2,3) is translated as being c(u1, u2, u3).
struc	Nesting structure of the form X(par1, c(i,...), list(Y(par2, c(j,...), NULL), Z(par3, c(k,...), NULL))), where X, Y, and Z are compatible functions (see 'details'). It is to note that if struc is NULL, the function will automatically be of class Child. For continuous distributions (i.e. GAMMA), struc is always NULL.

**Slots**

Param	The name of the parameter used
parameter	The value of the parameter
dimension	The dimension
type	The type of function (either child or mother)
arguments	The corresponding arguments (ex.: arguments 1 and 2 imply 'u1' and 'u2')
structure	The structure below the node of type 'Mother'
Laplace	Expression of the LST
LaplaceInv	Expression of the inverse LST
PGF	Expression of the pgf
PGFInv	Expression of the inverse pgf
simul	Fonction to sample from the distribution
theta	I don't know honestly
cop	Construct an Archimedean copula with this distribution
Der	Fonction to compute the expression of the 'k'th derivative of either the 'PGF', 'PGFInv', 'Laplace' or 'LaplaceInv'
FUN	Fonction to compute the function of the 'k'th derivative of either the 'PGF', 'PGFInv', 'Laplace' or 'LaplaceInv'

**Author(s)**

Simon-Pierre Gadoury

**Examples**

```
GEO(0.5, NULL, list(GAMMA(1/30, c(5,6), NULL),
                   GEO(0.1, NULL, list(GAMMA(1/30, c(1,2), NULL),
                                       GAMMA(1/30, c(3,4), NULL))))))
```

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Node	<i>Obtain a node with its genetic code</i>
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**Description**

Obtain a node with its genetic code

**Usage**

```
Node(path, str)
```

**Arguments**

path	Genetic code of the node
str	The structure

**Author(s)**

Simon-Pierre Gadoury

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pCompCop	<i>Density, Cdf, and Random Number Generator for Copulas Constructed Through Compounding</i>
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**Description**

Density, Cdf, and Random Number Generator for Copulas Constructed Through Compounding

**Usage**

```
pCompCop(FUN, func = FALSE, code = FALSE, operator = "")
```

**Arguments**

FUN	Object of class Mother
func	If true, returns a function
code	If true, copies the LaTeX code to the clipboard
operator	Type of computer used (only necessary in the case of internal problem)

**Details**

rCompCop2 is more general (and easier to use) than rCompCop, but is slower.

**Author(s)**

Simon-Pierre Gadoury



pCop

*Cdf, and Random Number Generator for Copulas***Description**

Cdf, and Random Number Generator for Copulas

**Usage**

```
pCop(copula, vector = TRUE, express = FALSE, code = FALSE,
      operator = "")
```

**Arguments**

copula	An Archimedean copula class object
vector	If false, returns a function with (x_1, x_2, ..., x_dim, alpha) as arguments.
express	If true, returns an expression.
code	If true, copies the LaTeX code to clipboard.
operator	Type of computer used (only necessary in the case of internal problem)

**Value**

Either an expression, function, code, or sampled data.

**Author(s)**

Simon-Pierre Gadoury

rCompCop

*Density, Cdf, and Random Number Generator for Copulas Constructed Through Compounding***Description**

Density, Cdf, and Random Number Generator for Copulas Constructed Through Compounding

**Usage**

```
rCompCop(n, FUN, level)
```

**Arguments**

n	Number of realisations
FUN	Object of class Mother
level	Number of imbrications

**Details**

rCompCop2 is more general (and easier to use) than rCompCop, but is slower.

**Author(s)**

Simon-Pierre Gadoury

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rCompCop2*Density, Cdf, and Random Number Generator for Copulas Constructed Through Compounding*

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**Description**

Density, Cdf, and Random Number Generator for Copulas Constructed Through Compounding

**Usage**

rCompCop2(n, str)

**Arguments**

n	Number of realisations
str	Object of class Mother

**Details**

rCompCop2 is more general (and easier to use) than rCompCop, but is slower.

**Author(s)**

Simon-Pierre Gadoury

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rCop*Density, Cdf, and Random Number Generator for Copulas*

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**Description**

Density, Cdf, and Random Number Generator for Copulas

**Usage**

rCop(n, copula)

**Arguments**

n	Number of realisations
copula	An Archimedean copula class object

**Value**

Sampled data.

**Author(s)**

Simon-Pierre Gadoury

**Description**

Constructs either a Mother or Child class object for a given parameter, arguments, and nesting structure.

**Usage**

```
SIBUYA(par, unif, struc)
```

**Arguments**

par	Dimension of the distribution
unif	Uniform structure, a numeric vector of grouped numbers. i.e. c(1,2,3) is translated as being c(u1, u2, u3).
struc	Nesting structure of the form X(par1, c(i,...), list(Y(par2, c(j,...), NULL), Z(par3, c(k,...), NULL))), where X, Y, and Z are compatible functions (see 'details'). It is to note that if struc is NULL, the function will automatically be of class Child. For continuous distributions (i.e. GAMMA), struc is always NULL.

**Slots**

Param	The name of the parameter used
parameter	The value of the parameter
dimension	The dimension
type	The type of function (either child or mother)
arguments	The corresponding arguments (ex.: arguments 1 and 2 imply 'u1' and 'u2')
structure	The structure below the node of type 'Mother'
Laplace	Expression of the LST
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PGF	Expression of the pgf
PGFInv	Expression of the inverse pgf
simul	Fonction to sample from the distribution
theta	I don't know honestly
cop	Construct an Archimedean copula with this distribution
Der	Fonction to compute the expression of the 'k'th derivative of either the 'PGF', 'PGFInv', 'Laplace' or 'LaplaceInv'
FUN	Fonction to compute the function of the 'k'th derivative of either the 'PGF', 'PGFInv', 'Laplace' or 'LaplaceInv'

**Author(s)**

Simon-Pierre Gadoury

## Examples

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