Package ‘VC2copula’

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Title Extend the 'copula' Package with Families and Models from 'VineCopula'

Version 0.1.0

Description Provides new classes for (rotated) BB1, BB6, BB7, BB8, and Tawn copulas, extends the existing Gumbel and Clayton families with rotations, and allows to set up a vine copula model using the 'copula' API. Corresponding objects from the 'VineCopula' API can easily be converted.

License GPL-3

Encoding UTF-8

LazyData true

URL https://github.com/tnagler/VC2copula

BugReports https://github.com/tnagler/VC2copula/issues

Depends copula (>= 0.999-19.1)

Imports VineCopula (>= 2.3.0), methods

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`BB1Copula` *Constructors for BB1 copulas*

Description

Constructs an object of the BB1Copula (survival `sur`, 90 degree rotated `r90` and 270 degree rotated `r270`) family for given parameters.

Usage

```
BB1Copula(param = c(1, 1))

surBB1Copula(param = c(1, 1))

r90BB1Copula(param = c(-1, -1))

r270BB1Copula(param = c(-1, -1))
```

Arguments

`param`	The parameter `param` defines the copula through `theta` and `delta`.

Value

One of the respective BB1 copula classes (BB1Copula, surBB1Copula, r90BB1Copula, r270BB1Copula).

References

Joe, H., (1997). Multivariate Models and Dependence Concepts. Monogra. Stat. Appl. Probab. 73, London: Chapman and Hall.

See Also

See also `BB6Copula()`, `BB7Copula()`, `BB8Copula()` and `joeCopula()` for further wrapper functions to the `VineCopula-package()`.

Examples

```
library(copula)

persp(BB1Copula(c(1, 1.5)), dCopula, zlim = c(0, 10))
persp(surBB1Copula(c(1, 1.5)), dCopula, zlim = c(0, 10))
persp(r90BB1Copula(c(-1, -1.5)), dCopula, zlim = c(0, 10))
persp(r270BB1Copula(c(-1, -1.5)), dCopula, zlim = c(0, 10))
```

`BB1Copula-class` *BB1 copula models*

Description

Wrapper classes representing the BB1, survival BB1, 90 degree and 270 degree rotated BB1 copula families (Joe 1997) from `VineCopula-package()`.

Objects from the Classes

Objects can be created by calls of the form `new("BB1Copula",...)`, `new("surBB1Copula",...)`, `new("r90BB1Copula",...)` and `new("r270BB1Copula",...)` or by the functions `BB1Copula()`, `surBB1Copula()`, `r90BB1Copula()` and `r270BB1Copula()`.

References

Joe, H., (1997). Multivariate Models and Dependence Concepts. Monogra. Stat. Appl. Probab. 73, London: Chapman and Hall.

See Also

See also BB6Copula, BB7Copula, BB8Copula and joeCopula for further wrapper classes to the `VineCopula-package()`.

Examples

```
showClass("BB1Copula")
```

BB6Copula *Constructors for BB6 copulas*

Description

Constructs an object of the BB6Copula (survival `sur`, 90 degree rotated `r90` and 270 degree rotated `r270`) family for given parameters.

Usage

```
BB6Copula(param = c(1, 1))

surBB6Copula(param = c(1, 1))

r90BB6Copula(param = c(-1, -1))

r270BB6Copula(param = c(-1, -1))
```

Arguments

`param`	The parameter `param` defines the copula through `theta` and `delta`.

Value

One of the respective BB6 copula classes (BB6Copula, surBB6Copula, r90BB6Copula, r270BB6Copula).

References

Joe, H., (1997). Multivariate Models and Dependence Concepts. Monogra. Stat. Appl. Probab. 73, London: Chapman and Hall.

See Also

See also `BB6Copula()`, `BB7Copula()`, `BB8Copula()` and `joeCopula()` for further wrapper functions to the `VineCopula-package()`.

Examples

```
library(copula)

persp(BB6Copula(c(1, 1.5)), dCopula, zlim = c(0, 10))
persp(surBB6Copula(c(1, 1.5)), dCopula, zlim = c(0, 10))
persp(r90BB6Copula(c(-1, -1.5)), dCopula, zlim = c(0, 10))
persp(r270BB6Copula(c(-1, -1.5)), dCopula, zlim = c(0, 10))
```

BB6Copula-class *BB6 copula models*

Description

Wrapper classes representing the BB6, survival BB6, 90 degree and 270 degree rotated BB6 copula families (Joe 1997) from `VineCopula-package()`.

Objects from the Classes

Objects can be created by calls of the form `new("BB6Copula",...)`, `new("surBB6Copula",...)`, `new("r90BB6Copula",...)` and `new("r270BB6Copula",...)` or by the functions `BB6Copula()`, `surBB6Copula()`, `r90BB6Copula()` and `r270BB6Copula()`.

References

Joe, H., (1997). Multivariate Models and Dependence Concepts. Monogra. Stat. Appl. Probab. 73, London: Chapman and Hall.

See Also

See also BB6Copula, BB7Copula, BB8Copula and joeCopula for further wrapper classes to the `VineCopula-package()`.

Examples

```
showClass("BB6Copula")
```

BB7Copula *Constructors for BB7 copulas*

Description

Constructs an object of the BB7Copula (survival `sur`, 90 degree rotated `r90` and 270 degree rotated `r270`) family for given parameters.

Usage

```
BB7Copula(param = c(1, 1))

surBB7Copula(param = c(1, 1))

r90BB7Copula(param = c(-1, -1))

r270BB7Copula(param = c(-1, -1))
```

Arguments

param	The parameter param defines the copula through theta and delta.

Value

One of the respective BB7 copula classes (BB7Copula, surBB7Copula, r90BB7Copula, r270BB7Copula).

References

Joe, H., (1997). Multivariate Models and Dependence Concepts. Monogra. Stat. Appl. Probab. 73, London: Chapman and Hall.

See Also

See also BB6Copula(), BB7Copula(), BB8Copula() and joeCopula() for further wrapper functions to the VineCopula-package().

Examples

```
library(copula)

persp(BB7Copula(c(1, 1.5)), dCopula, zlim = c(0, 10))
persp(surBB7Copula(c(1, 1.5)), dCopula, zlim = c(0, 10))
persp(r90BB7Copula(c(-1, -1.5)), dCopula, zlim = c(0, 10))
persp(r270BB7Copula(c(-1, -1.5)), dCopula, zlim = c(0, 10))
```

BB7Copula-class *BB7 copula models*

Description

Wrapper classes representing the BB7, survival BB7, 90 degree and 270 degree rotated BB7 copula families (Joe 1997) from VineCopula-package().

Objects from the Classes

Objects can be created by calls of the form new("BB7Copula",...), new("surBB7Copula",...), new("r90BB7Copula",...) and new("r270BB7Copula",...) or by the functions BB7Copula(), surBB7Copula(), r90BB7Copula() and r270BB7Copula().

References

Joe, H., (1997). Multivariate Models and Dependence Concepts. Monogra. Stat. Appl. Probab. 73, London: Chapman and Hall.

See Also

See also BB7Copula, BB7Copula, BB8Copula and joeCopula for further wrapper classes to the `VineCopula-package()`.

Examples

```
showClass("BB7Copula")
```

BB8Copula *Constructors for BB8 copulas*

Description

Constructs an object of the BB8Copula (survival `sur`, 90 degree rotated `r90` and 270 degree rotated `r270`) family for given parameters.

Usage

```
BB8Copula(param = c(1, 1))

surBB8Copula(param = c(1, 1))

r90BB8Copula(param = c(-1, -1))

r270BB8Copula(param = c(-1, -1))
```

Arguments

`param`	The parameter `param` defines the copula through `theta` and `delta`.

Value

One of the respective BB8 copula classes (BB8Copula, surBB8Copula, r90BB8Copula, r270BB8Copula).

References

Joe, H., (1997). Multivariate Models and Dependence Concepts. Monogra. Stat. Appl. Probab. 73, London: Chapman and Hall.

See Also

See also `BB6Copula()`, `BB7Copula()`, `BB8Copula()` and `joeCopula()` for further wrapper functions to the `VineCopula-package()`.

Examples

```
library(copula)

persp(BB8Copula(c(2, 0.9)), dCopula, zlim = c(0, 10))
persp(surBB8Copula(c(2, 0.9)), dCopula, zlim = c(0, 10))
persp(r90BB8Copula(c(-2, -0.9)), dCopula, zlim = c(0, 10))
persp(r270BB8Copula(c(-2, -0.9)), dCopula, zlim = c(0, 10))
```

BB8Copula-class *BB8 copula models*

Description

Wrapper classes representing the BB8, survival BB8, 90 degree and 270 degree rotated BB8 copula families (Joe 1997) from `VineCopula-package()`.

Objects from the Classes

Objects can be created by calls of the form `new("BB8Copula",...)`, `new("surBB8Copula",...)`, `new("r90BB8Copula",...)` and `new("r270BB8Copula",...)` or by the functions `BB8Copula()`, `surBB8Copula()`, `r90BB8Copula()` and `r270BB8Copula()`.

References

Joe, H., (1997). Multivariate Models and Dependence Concepts. Monogra. Stat. Appl. Probab. 73, London: Chapman and Hall.

See Also

See also BB8Copula, BB8Copula, BB8Copula and joeCopula for further wrapper classes to the `VineCopula-package()`.

Examples

```
showClass("BB8Copula")
```

BiCop2copula *Construction of a Copula Object from a VineCopula Family Index*

Description

A VineCopula family index along with its parameters is used to construct a corresponding copula object.

Usage

```
BiCop2copula(family, par, par2 = 0, obj = NULL)

copulaFromFamilyIndex(family, par, par2 = 0)
```

Arguments

family	a family index as defined in `VineCopula-package()`.
par	first parameter.
par2	second parameter.
obj	`BiCop()` object containing the family and parameter specification.

Details

If the family and parameter specification is stored in a [BiCop()] object `obj`, the alternative version

```
BiCop2copula(u1, u2, obj)
```

can be used.

Value

An object inheriting copula corresponding to the specific family.

Examples

```
# normalCopula with parameter 0.5
BiCop2copula(1, 0.5)

# rotated Tawn T2 copula
BiCop2copula(224, -2, 0.5)
```

ddCopula *Partial Derivatives of Copulas*

Description

Similar to dCopula() and pCopula() the function dduCopula evaluates the partial derivative $\frac{\partial}{\partial u} C(u, v)$ and the function ddvCopula evaluates the partial derivative $\frac{\partial}{\partial v} C(u, v)$ of the provided copula.

Usage

```
dduCopula(u, copula, ...)
```

Arguments

u	Pairs of values for which the partial derivative should be evaluated.
copula	The copula object representing the family member of interest.
...	additional arguments can be passed on to the underlying functions.

Value

A vector of the evaluated partial derivatives of the same length as rows in u.

Examples

```
library(copula)

BB1Cop <- BB1Copula()
BB1CopSmpl <- rCopula(100, BB1Cop)

# conditional probabilities of a Gaussian copula given u
BB1GivenU <- dduCopula(BB1CopSmpl, BB1Cop)

# vs. conditional probabilities of a Gaussian copula given v
BB1GivenV <- ddvCopula(BB1CopSmpl[, c(2, 1)], BB1Cop)

plot(BB1GivenU, BB1GivenV)
abline(0, 1)
```

joeBiCopula *Constructors for Joe copulas*

Description

Constructs an object of the (survival `surJoeBiCopula`, 90 degree rotated `r90JoeBiCopula` and 270 degree rotated `r270JoeBiCopula`) family for a given parameter. Note that package `copula-package()` provides a class joeCopula as well.

Usage

```
joeBiCopula(param = 2)

surJoeBiCopula(param = 2)

r90JoeBiCopula(param = -2)

r270JoeBiCopula(param = -2)
```

Arguments

`param`	The parameter `param` defines the copula through `theta`.

Value

One of the respective Joe copula classes (joeBiCopula, surJoeBiCopula, r90JoeBiCopula, r270JoeBiCopula).

References

Joe, H., (1997). Multivariate Models and Dependence Concepts. Monogra. Stat. Appl. Probab. 73, London: Chapman and Hall.

See Also

See also `BB1Copula()`, `BB6Copula()`, `BB7Copula()` and `BB8Copula()` for further wrapper functions to the `VineCopula-package()`.

Examples

```
library(copula)

persp(surJoeBiCopula(1.5), dCopula, zlim = c(0, 10))
persp(r90JoeBiCopula(-1.5), dCopula, zlim = c(0, 10))
persp(r270JoeBiCopula(-1.5), dCopula, zlim = c(0, 10))
```

joeBiCopula-class *Joe copula models*

Description

Wrapper classes representing the bivariate Joe, survival Joe, 90 degree and 270 degree rotated Joe copula families (Joe 1997) from `VineCopula-package()`. Note that package `copula-package()` provides a class joeCopula as well.

Objects from the Classes

Objects can be created by calls of the form `new("joeBiCopula",...)`, `new("surJoeBiCopula",...)`, `new("r90JoeBiCopula",...)` and `new("r270JoeBiCopula",...)` or by the functions `joeBiCopula()`, `surJoeBiCopula()`, `r90JoeBiCopula()` and `r270JoeBiCopula()`.

References

Joe, H., (1997). Multivariate Models and Dependence Concepts. Monogra. Stat. Appl. Probab. 73, London: Chapman and Hall.

See Also

See also BB1Copula, BB6Copula, BB7Copula and BB8Copula for further wrapper classes to the `VineCopula-package()`.

Examples

```
showClass("surJoeBiCopula")
```

surClaytonCopula *Constructors for survival and rotated Clayton Copulas*

Description

These are wrappers to functions from `VineCopula-package()`

Usage

```
surClaytonCopula(param = 1)

r90ClaytonCopula(param = -1)

r270ClaytonCopula(param = -1)
```

Arguments

param	A single parameter defining the Copula.

Value

An object of class surClaytonCopula, r90ClaytonCopula or r270ClaytonCopula respectively.

Examples

```
library(copula)

persp(surClaytonCopula(1.5), dCopula, zlim = c(0, 10))
persp(r90ClaytonCopula(-1.5), dCopula, zlim = c(0, 10))
persp(r270ClaytonCopula(-1.5), dCopula, zlim = c(0, 10))
```

---

surClaytonCopula-class *Survival and rotated Clayton copula models*

Description

A class representing rotated versions of the Clayton copula family (survival, 90 and 270 degree rotated).

Objects from the Class

Objects can be created by calls of the form `new("surClaytonCopula",...)`, `new("r90ClaytonCopula",...)` and `new("r270ClaytonCopula",...)` or by the function `surClaytonCopula()`, `r90ClaytonCopula()` and `r270ClaytonCopula()` respectively.

See Also

`VineCopula-package()`

Examples

```
library(copula)

persp(surClaytonCopula(.5), dCopula, zlim = c(0, 10))
persp(r90ClaytonCopula(-.5), dCopula, zlim = c(0, 10))
persp(r270ClaytonCopula(-.5), dCopula, zlim = c(0, 10))
```

surGumbelCopula *Constructors for survival and rotated Gumbel Copulas*

Description

These are wrappers to functions from `VineCopula-package()`

Usage

```
surGumbelCopula(param = 1)

r90GumbelCopula(param = -1)

r270GumbelCopula(param = -1)
```

Arguments

`param`	A single parameter defining the Copula.

Value

An object of class surGumbelCopula, r90GumbelCopula or r270GumbelCopula respectively.

Examples

```
library(copula)

persp(surGumbelCopula(1.5), dCopula, zlim = c(0, 10))
persp(r90GumbelCopula(-1.5), dCopula, zlim = c(0, 10))
persp(r270GumbelCopula(-1.5), dCopula, zlim = c(0, 10))
```

surGumbelCopula-class *Survival and rotated Gumbel copula models*

Description

A class representing rotated versions of the Gumbel copula family (survival, 90 and 270 degree rotated).

Objects from the Class

Objects can be created by calls of the form `new("surGumbelCopula",...)`, `new("r90GumbelCopula",...)` and `new("r270GumbelCopula",...)` or by the function `surGumbelCopula()`, `r90GumbelCopula()` and `r270GumbelCopula()` respectively.

See Also

VineCopula-package()

Examples

```
library(copula)

persp(surGumbelCopula(5), dCopula, zlim = c(0, 10))
persp(r90GumbelCopula(-5), dCopula, zlim = c(0, 10))
persp(r270GumbelCopula(-5), dCopula, zlim = c(0, 10))
```

---

tawnT1Copula *Constructor for Tawn copulas (type 1)*

Description

Constructs an object of the tawnT1Copula (survival `sur`, 90 degree rotated `r90` and 270 degree rotated `r270`) family for given parameters.

Constructs an object of the tawnT1Copula (survival `sur`, 90 degree rotated `r90` and 270 degree rotated `r270`) family for given parameters.

Usage

```
tawnT1Copula(param = c(2, 0.5))

surTawnT1Copula(param = c(2, 0.5))

r90TawnT1Copula(param = c(-2, 0.5))

r270TawnT1Copula(param = c(-2, 0.5))

tawnT1Copula(param = c(2, 0.5))

surTawnT1Copula(param = c(2, 0.5))

r90TawnT1Copula(param = c(-2, 0.5))

r270TawnT1Copula(param = c(-2, 0.5))
```

Arguments

`param`	The parameter `param` defines the copula through `param1` and `param2`.

Value

One of the Tawn type 1 copula classes (tawnT1Copula, surTawnT1Copula, r90TawnT1Copula, r270TawnT1Copula).

One of the Tawn type 1 copula classes (tawnT1Copula, surTawnT1Copula, r90TawnT1Copula, r270TawnT1Copula).

See Also

`tawnT2Copula()` and the package `VineCopula-package()` for implementation details.

`tawnT1Copula()` and the package `VineCopula-package()` for implementation details.

Examples

```
library(copula)

persp(tawnT1Copula(), dCopula, zlim = c(0, 10))
persp(surTawnT1Copula(), dCopula, zlim = c(0, 10))
persp(r90TawnT1Copula(), dCopula, zlim = c(0, 10))
persp(r270TawnT1Copula(), dCopula, zlim = c(0, 10))
```


```
library(copula)

persp(tawnT1Copula(), dCopula, zlim = c(0, 10))
persp(surTawnT1Copula(), dCopula, zlim = c(0, 10))
persp(r90TawnT1Copula(), dCopula, zlim = c(0, 10))
persp(r270TawnT1Copula(), dCopula, zlim = c(0, 10))
```

`tawnT1Copula-class` *Tawn copula models (type 1)*

Description

S4-class representation of the Tawn Copula family of type 1 and rotated versions there of.

S4-class representation of the Tawn Copula family of type 1 and rotated versions there of.

Objects from the Class

Objects can be created by calls of the form `new("tawnT1Copula", ...)`, or through the explicit constructors `tawnT1Copula()`, `surTawnT1Copula()`, `r90TawnT1Copula()` and `r270TawnT1Copula()` respectively.

Objects can be created by calls of the form `new("tawnT1Copula", ...)`, or through the explicit constructors `tawnT1Copula()`, `surTawnT1Copula()`, `r90TawnT1Copula()` and `r270TawnT1Copula()` respectively.

See Also

tawnT2Copula and the package `VineCopula-package()` for implementation details.

tawnT1Copula and the package `VineCopula-package()` for implementation details.

Examples

```
showClass("tawnT1Copula")

showClass("tawnT1Copula")
```

`tawnT2Copula` *Constructor for Tawn copulas (type 2)*

Description

Constructs an object of the tawnT2Copula (survival `sur`, 90 degree rotated `r90` and 270 degree rotated `r270`) family for given parameters.

Usage

```
tawnT2Copula(param = c(2, 0.5))

surTawnT2Copula(param = c(2, 0.5))

r90TawnT2Copula(param = c(-2, 0.5))

r270TawnT2Copula(param = c(-2, 0.5))
```

Arguments

`param`	The parameter `param` defines the copula through `param1` and `param2`.

Value

One of the Tawn type 2 copula classes (tawnT2Copula, surTawnT2Copula, r90TawnT2Copula, r270TawnT2Copula).

See Also

`tawnT2Copula()` and the package `VineCopula-package()` for implementation details.

Examples

```
library(copula)

persp(tawnT2Copula(), dCopula, zlim = c(0, 10))
persp(surTawnT2Copula(), dCopula, zlim = c(0, 10))
persp(r90TawnT2Copula(), dCopula, zlim = c(0, 10))
persp(r270TawnT2Copula(), dCopula, zlim = c(0, 10))
```

`tawnT2Copula-class` *Tawn copula models (type 2)*

Description

S4-class representation of the Tawn Copula family of type 2 and rotated versions there of.

Objects from the Class

Objects can be created by calls of the form `new("tawnT2Copula", ...)`, or through the explicit constructors `tawnT2Copula()`, `surTawnT2Copula()`, `r90TawnT2Copula()` and `r270TawnT2Copula()` respectively.

See Also

tawnT2Copula and the package `VineCopula-package()` for implementation details.

Examples

```
showClass("tawnT2Copula")
```

`vineCopula` *Constructor of the Class* `vineCopula`.

Description

Constructs an instance of the `vineCopula` class.

Usage

```
vineCopula(RVM, type = "CVine")
```

Arguments

RVM	An object of class RVineMatrix generated from RVineMatrix in the package VineCopula-package or an integer (e.g. 4L) defining the dimension (an independent Gaussian C-vine of this dimension will be constructed).
type	A predefined type if only the dimension is provided and ignored otherwise, the default is a canonical vine

Value

An instance of the vineCopula class.

Author(s)

Benedikt Graeler

References

Aas, K., C. Czado, A. Frigessi, and H. Bakken (2009). Pair-copula constructions of multiple dependence Insurance: Mathematics and Economics 44 (2), 182-198.

Examples

```
# a C-vine of independent copulas
vine <- vineCopula(4L, "CVine")

library(copula)
library(lattice)

cloud(V1 ~ V2 + V3, as.data.frame(rCopula(500, vine)))
```

---

vineCopula-class   *Class* "vineCopula"

Description

A class representing vine copulas in a object oriented implementations. Many functions go back to the package VineCopula-package

Objects from the Class

Objects can be created by calls of the form new("vineCopula",...) or through the function vineCopula.

Author(s)

Benedikt Graeler

References

Aas, K., C. Czado, A. Frigessi, and H. Bakken (2009). Pair-copula constructions of multiple dependence Insurance: Mathematics and Economics 44 (2), 182-198.

See Also

RVineMatrix from package VineCopula-package

Examples

```
showClass("vineCopula")
```

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