Package `MCDM`

September 22, 2016

**Type**  Package

**Title**  Multi-Criteria Decision Making Methods for Crisp Data

**Version**  1.2

**Date**  2016-09-21

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**Description**  Implementation of several MCDM methods for crisp data for decision making problems. The methods that are implemented in this package are RIM, TOPSIS (with two normalization procedures), VIKOR, Multi-MOORA and WASPAS. In addition, MetaRanking function calculates a new ranking from the sum of the rankings calculated, as well as an aggregated ranking.

**Imports**  RankAggreg

**License**  LGPL (>= 3)


**LazyData**  true

**RoxygenNote**  5.0.1

**NeedsCompilation**  no

**Repository**  CRAN

**Date/Publication**  2016-09-22 16:50:45

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MetaRanking **Implementation of MetaRanking function for Multi-Criteria Decision Making Problems.**

Description

The MetaRanking function internally calls functions MOORA, RIM, TOPSISLinear, TOPSISVector, VIKOR and WASPAS and then calculates a sum of the their rankings and an aggregated ranking by applying the RankAggreg package.

Usage

MetaRanking(decision, weights, cb, lambda, v, AB, CD)

Arguments

decision The decision matrix (m x n) with the values of the m alternatives, for the n criteria.
weights A vector of length n, containing the weights for the criteria. The sum of the weights has to be 1.
cb A vector of length n. Each component is either cb(i)='max' if the i-th criterion is benefit or cb(i)='min' if the i-th criterion is a cost.
lambda A value in [0,1]. It is used in the calculation of the W index for WASPAS method.
v A value in [0,1]. It is used in the calculation of the Q index for VIKOR method.
AB A matrix (2 x n). AB[1,] corresponds with the A extrem, and AB[2,] represents the B extrem of the domain of each criterion.
CD A matrix (2 x n). CD[1,] corresponds with the C extrem, and CD[2,] represents the D extrem of the ideal reference of each criterion.

Value

MetaRanking returns a data frame which contains the rankings of the Multi-MOORA, RIM, TOPSISLinear, TOPSISVector, VIKOR, WASPAS Methods and the both MetaRankings of the alternatives.

Examples

d <- matrix(c(1,2,5,3000,3750,4500),nrow = 3,ncol = 2)
w <- c(0.5,0.5)
cb <- c('min','max')
lambda <- 0.5
v <- 0.5
AB <- matrix(c(1,5,3000,4500),nrow = 2,ncol=2)
CD <- matrix(c(1,1,4500,4500),nrow = 2,ncol=2)
MetaRanking(d,w,cb,lambda,v,AB,CD)
**MMOORA**


**Description**

The MMOORA function implements both the Multi-Objective Optimization by Ration Analysis (MOORA) and the "Full Multiplicative Form" (MULTIMOORA).

**Usage**

```r
MMOORA(decision, weights, cb)
```

**Arguments**

- **decision**: The decision matrix \((m \times n)\) with the values of the \(m\) alternatives, for the \(n\) criteria.
- **weights**: A vector of length \(n\), containing the weights for the criteria. The sum of the weights has to be 1.
- **cb**: A vector of length \(n\). Each component is either \(cb(i) = \text{'max'}\) if the \(i\)-th criterion is benefit or \(cb(i) = \text{'min'}\) if the \(i\)-th criterion is a cost.

**Value**

`MMOORA` returns a data frame which contains the scores and the four rankings calculated (Ratio System, Reference Point, Multiplicative Form and Multi-MOORA ranking).

**References**


**Examples**

```r
d <- matrix(c(60, 6.35, 6.8, 10, 2.5, 4.5, 3, 0.4, 0.15, 0.1, 0.2, 0.1, 0.08, 0.1, 2540, 1016, 1727.2, 1000, 560, 1016, 1778, 500, 3000, 1500, 2000, 500, 350, 1000, 990, 1041, 1676, 965, 915, 508, 920), nrow=7, ncol=5)
w <- c(0.036, 0.192, 0.326, 0.326, 0.12)
cb <- c('max', 'min', 'max', 'max', 'max')
MMOORA(d, w, cb)
```
RIM


Description

The RIM function implements the Reference Ideal Method (RIM).

Usage

RIM(decision, weights, AB, CD)

Arguments

decision The decision matrix \((m \times n)\) with the values of the \(m\) alternatives, for the \(n\) criteria.
weights A vector of length \(n\), containing the weights for the criteria. The sum of the weights has to be 1.
AB A matrix \((2 \times n)\). \(AB[1,]\) corresponds with the A extrem, and \(AB[2,]\) represents the B extrem of the domain of each criterion.
CD A matrix \((2 \times n)\). \(CD[1,]\) corresponds with the C extrem, and \(CD[2,]\) represents the D extrem of the ideal reference of each criterion.

Value

RIM returns a data frame which contains the score of the R index and the ranking of the alternatives.

References


Examples

d <- matrix(c(30,40,25,27,45,0,9,0,0,15,2,1,3,5,2,3,3,1,3,2,3,2,3,3,2,2,1,4),
nrow = 5, ncol = 6)
w <- c(0.2262,0.2143,0.1786,0.1429,0.119,0.119)
AB = matrix(c(23,60,0,15,0,10,1,3,1,3,1,5),nrow = 2,ncol = 6)
CD = matrix(c(30,35,10,15,0,0,3,3,3,3,4,5),nrow = 2,ncol = 6)
RIM(d,w,AB,CD)
Description

The TOPSISLinear function implements the Technique for Order of Preference by Similarity to
Ideal Solution (TOPSIS) Method with the linear transformation of maximum as normalization
procedure.

Usage

TOPSISLinear(decision, weights, cb)

Arguments

decision The decision matrix \((m \times n)\) with the values of the \(m\) alternatives, for the \(n\) criteria.
weights A vector of length \(n\), containing the weights for the criteria. The sum of the
weights has to be 1.
cb A vector of length \(n\). Each component is either \(cb(i) = 'max'\) if the \(i\)-th criterion
is benefit or \(cb(i) = 'min'\) if the \(i\)-th criterion is a cost.

Value

TOPSISLinear returns a data frame which contains the score of the R index and the ranking of the
alternatives.

References

Garcia Cascales, M.S.; Lamata, M.T. On rank reversal and TOPSIS method. Mathematical and
Computer Modelling. 56(5-6), 123-132, 2012.

Examples

d <- matrix(c(1,4,3,5,2,3),nrow = 3,ncol = 2)
w <- c(0.5,0.5)
cb <- c('max','max')
TOPSISLinear(d,w,cb)
TOPSISVector


Description

The TOPSISVector function implements the Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS) Method with the vectorial normalization procedure.

Usage

TOPSISVector(decision, weights, cb)

Arguments

decision: The decision matrix \((m \times n)\) with the values of the \(m\) alternatives, for the \(n\) criteria.

weights: A vector of length \(n\), containing the weights for the criteria. The sum of the weights has to be 1.

cb: A vector of length \(n\). Each component is either \(\text{cb}(i)=\text{'max'}\) if the \(i\)-th criterion is benefit or \(\text{cb}(i)=\text{'min'}\) if the \(i\)-th criterion is a cost.

Value

TOPSISVector returns a data frame which contains the score of the R index and the ranking of the alternatives.

References


Examples

d <- matrix(c(6,7,10,2,2,75,3.5),nrow = 3,ncol = 2)
w <- c(0.5,0.5)
cb <- c('min','max')
TOPSISVector(d,w,cb)
Description

The VIKOR function implements the "VIseKriterijumska Optimizacija I Kompromisno Resenje" (VIKOR) Method.

Usage

VIKOR(decision, weights, cb, v)

Arguments

decision: The decision matrix (m x n) with the values of the m alternatives, for the n criteria.
weights: A vector of length n, containing the weights for the criteria. The sum of the weights has to be 1.
cb: A vector of length n. Each component is either cb(i)='max' if the i-th criterion is benefit or cb(i)='min' if the i-th criterion is a cost.
v: A value in [0,1]. It is used in the calculation of the Q index.

Value

VIKOR returns a data frame which contains the score of the S, R and Q indexes and the ranking of the alternatives according to Q index.

References


Examples

d <- matrix(c(1,2,5,3000,3750,4500),nrow = 3,ncol = 2)
w <- c(0.5,0.5)
cb <- c('min','max')
v <- 0.5
VIKOR(d,w,cb,v)

Description

The WASPAS function implements the Weighted Aggregated Sum Product ASsessment (WASPAS) Method.

Usage

WASPAS(decision, weights, cb, lambda)

Arguments

decision: The decision matrix \( m \times n \) with the values of the \( m \) alternatives, for the \( n \) criteria.
weights: A vector of length \( n \), containing the weights for the criteria. The sum of the weights has to be 1.
cb: A vector of length \( n \). Each component is either \( \text{cb}(i) = \text{\'max\'} \) if the \( i\)-th criterion is benefit or \( \text{cb}(i) = \text{\'min\'} \) if the \( i\)-th criterion is a cost.
lambda: A value in \([0,1]\). It is used in the calculation of the \( W \) index.

Value

WASPAS returns a data frame which contains the score of the WSM, WPM and the Q index and the ranking of the alternatives.

References


Examples

d <- matrix(c(370, 314, 480, 850, 11, 7, 10, 16, 2.69, 2.37, 3.09, 3.17, 2.75, 3.27, 3.67, 4.10, 5, 35, 30, 50, 1.63, 1.72, 1.87, 1.91, 1.47, 2.07, 1.38, 2.22, 7, 11, 5.60, 7.82, 8.25, 88, 12, 60, 94, 23, 410, 100, 410, 65, 2.93, 2.13, 2.87, 1.10, 1.98, 3.21, 2.94, 4.37), nrow = 4, ncol = 12)
w <- c(0.0626, 0.0508, 0.1114, 0.0874, 0.0625, 0.1183, 0.0784, 0.0984, 0.053, 0.1417, 0.0798, 0.0557)
cb <- c(\'min\', \'min\', \'max\', \'max\', \'max\', \'max\', \'max\', \'min\', \'min\', \'max\', \'max\')
lambda <- 0.5
WASPAS(d, w, cb, lambda)
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