

Package ‘promethee123’

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Type Package

Title PROMETHEE I, II, and III Methods

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Author Miguel Angelo Lellis Moreira [aut, cre],
Marcos dos Santos [aut],
Carlos Francisco Simoes Gomes [aut]

Maintainer Miguel Angelo Lellis Moreira <miguelllellis@hotmail.com>

Description The PROMETHEE method is a multi-criteria decision-making method addressing with outranking problems. The method establishes a preference structure between the alternatives, having a preference function for each criterion. IN this context, three variants of the method is carried out: PROMETHEE I (Partial Outranking), PROMETHEE II (Total Outranking), and PROMETHEE III (Outranking by Intervals).

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Description

The PROMETHEE method is a multi-criteria decision-making method addressing with outranking problems. The method establishes a preference structure between the alternatives, having a preference function for each criterion. IN this context, three variants of the method is carried out: PROMETHEE I (Partial pre-ordering), PROMETHEE II (Total pre-ordering), and PROMETHEE III (pre-ordering by intervals).

Usage

```
promethee123(alternatives, criteria, decision_matrix, min_max,
normalization_function, q_indifference, p_preference, s_curve_change, criteria_weights)
```

Arguments

alternatives	The names respective to set of alternatives in evaluation
criteria	The names respective to set of criteria in evaluation
decision_matrix	A matrix where rows correspond to the criteria and columns correspond to alternatives, there is inputed the performance of alternatives in each criterion
min_max	A vector with objectives, minimize or maximize, to each criteria.
normalization_function	Numerical description relative to each type of normalization function to each criterion
q_indifference	Indifference threshold
p_preference	Preference threshold
s_curve_change	Threshold of changing in the curve
criteria_weights	Numerical representation of the respective importance for each criterion

Details

- For normalization function we have six types: [1] for USUAL (0 or 1) — [2] for U-SHAPE (0 or 1) q [3] for V-SHAPE (x/p or 1) p [4] for LEVEL (0, 0.5 or 1) q , p [5] for V-SHAPE I (0, (x-q)/(p-q) or 1) q , p [6] for GAUSSIAN (0 or $1 - e^{(-x^2/2*s^2)}$) s $\frac{q}{s}$ q = indifference parameter p = preference parameter s = parameter to indicate change in the preference curve
- The input of thresholds depends of the type of preference function used;
- The sum of weights must be 1;

Value

- Performance in each criterion;
- Global Index of Importance;
- Importance Flows (Positive, Negative, and Net);
- Preference relations in PROMETHEE I;
- Total Outranking in PROMETHEE II;
- Preference relations in PROMETHEE III;
- Graphical representations of PROMETHEE I, II, and III.

Author(s)

Miguel Angelo Lellis Moreira <miguelllellis@hotmail.com>, Marcos dos Santos <marcosdossantos_doutorado_uff@yahoo.com>, Carlos Francisco Simoes Gomes <cfsg1@bol.com.br>

References

BRANS, Jean-Pierre; DE SMET, Yves. PROMETHEE methods. In: Multiple criteria decision analysis. Springer, New York, NY, 2016. p. 187-219. DOI: 10.1007/978-1-4939-3094-4_6. <https://link.springer.com/chapter/10.1007/978-1-4939-3094-4_6>

Examples

```
alternatives <- c("SARP", "ORAC", "TOTS", "MICRO", "IBRP")

criteria <- c("Price", "Complexity", "Security", "Performance")

decision_matrix <- matrix(c(15, 29, 38, 24, 25.5,
                          7.5, 9, 8.5, 8, 7,
                          1, 2, 4, 3, 3,
                          50, 110, 90, 75, 85),
                          ncol = length(alternatives), nrow = length(criteria), byrow = TRUE)

min_max <- c("min", "min", "max", "max")

normalization_function <- c(5, 5, 5, 5)
q_indifference <- c(2, 0.5, 1, 10)
p_preference <- c(5, 1, 2, 20)
s_curve_change <- c("", "", "", "")

criteria_weights <- c(0.2, 0.2, 0.3, 0.3)

promethee123(alternatives, criteria, decision_matrix, min_max, normalization_function,
             q_indifference, p_preference, s_curve_change, criteria_weights)
```

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