Package ‘FuzzyLP’
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Type Package
Description Provides methods to solve Fuzzy Linear Programming Problems with fuzzy constraints (following different approaches proposed by Verdegay, Zimmermann, Werners and Tanaka), fuzzy costs, and fuzzy technological matrix.
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Author Carlos A. Rabelo [aut, cre], Pablo J. Villacorta [ctb]
Maintainer Carlos A. Rabelo <carabelo@gmail.com>
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crispLP

Solves a crisp linear programming problem.

Description

crispLP use the classic solver (simplex) to solve a crisp linear programming problem:

\[ \text{Max } f(x) \text{ or Min } f(x) \]

\[ s.t.: \ A x \leq b \]

Usage

crispLP(objective, A, dir, b, maximum = TRUE, verbose = TRUE)

Arguments

- **objective**: A vector \((c_1, c_2, \ldots, c_n)\) with the objective function coefficients \(f(x) = c_1x_1 + \ldots + c_nx_n\).
- **A**: Technological matrix of Real Numbers.
- **dir**: Vector of strings with the direction of the inequalities, of the same length as \(b\). Each element of the vector must be one of "=", ">="", "<="", "<" or ">".
- **b**: Vector with the right hand side of the constraints.
- **maximum**: TRUE to maximize the objective function, FALSE to minimize the objective function.
- **verbose**: TRUE to show aditional screen info, FALSE to hide aditional screen info.

Value

crispLP returns the solution if the solver has found it or NULL if not.

Examples

```r
## maximize: 3*x1 + x2
## s.t.: 1.875*x1 - 1.5*x2 <= 4
##        4.75*x1 + 2.125*x2 <= 14.5
## x1, x2 are non-negative real numbers

obj <- c(3, 1)
A <- matrix(c(1.875, 4.75, -1.5, 2.125), nrow = 2)
dir <- c("<=", "<=")
b <- c(4, 14.5)
max <- TRUE

crispLP(obj, A, dir, b, maximum = max, verbose = TRUE)
```
FCLP.classicObjective  Solves a Fuzzy Linear Programming problem with fuzzy constraints trying to assure a minimum (maximum) value of the objective function.

**Description**

The goal is to solve a linear programming problem having fuzzy constraints trying to assure a minimum (or maximum) value of the objective function.

\[ Max f(x) \text{ or } Min f(x) \]
\[ s.t.: \quad Ax <= b + (1 - \beta) \cdot t \]

Where \( t \) means we allow not to satisfy the constraint, exceeding the bound \( b \) at most in \( t \).

FCLP.classicObjective solves the problem trying to assure a minimum (maximum) value \( z_0 \) of the objective function \( (f(x) >= z_0 \text{ in maximization problems}, f(x) <= z_0 \text{ in minimization problems}) \).

FCLP.fuzzyObjective solves the problem trying to assure a minimum (maximum) value \( z_0 \) of the objective function with tolerance \( t_0 \) \( (f(x) >= z_0 - (1 - \beta)t_0 \text{ in maximization problems}, f(x) <= z_0 + (1 - \beta)t_0 \text{ in minimization problems}) \).

FCLP.fuzzyUndefinedObjective solves the problem trying to assure a minimum (maximum) value of the objective function with tolerance but the user doesn’t fix the bound nor the tolerance. The function estimate a bound and a tolerance and call FCLP.fuzzyObjective using them.

FCLP.fuzzyUndefinedNormObjective solves the problem trying to assure a minimum (maximum) value of the objective function with tolerance but the user doesn’t fix the bound nor the tolerance. The function normalize the objective, estimate a bound and a tolerance and call FCLP.fuzzyObjective using them.

**Usage**

FCLP.classicObjective(objective, A, dir, b, t, z0 = 0, maximum = TRUE, verbose = TRUE)

FCLP.fuzzyObjective(objective, A, dir, b, t, z0 = 0, t0 = 0, maximum = TRUE, verbose = TRUE)

FCLP.fuzzyUndefinedObjective(objective, A, dir, b, t, maximum = TRUE, verbose = TRUE)

FCLP.fuzzyUndefinedNormObjective(objective, A, dir, b, t, maximum = TRUE, verbose = TRUE)

**Arguments**

- **objective**
  A vector \((c_1, c_2, \ldots, c_n)\) with the objective function coefficients \( f(x) = c_1x_1 + \ldots + c_nx_n \).
A  Technological matrix of Real Numbers.

dir  Vector of strings with the direction of the inequalities, of the same length as b and t. Each element of the vector must be one of "=", ">="", "<="", "<" or ">".

b  Vector with the right hand side of the constraints.

t  Vector with the tolerance of each constraint.

z₀  The minimum (maximum in a minimization problem) value of the objective function to reach. Only used in FCLP.classicObjective and FCLP.fuzzyObjective.

maximum  TRUE to maximize the objective function, FALSE to minimize the objective function.

verbose  TRUE to show additional screen info, FALSE to hide additional screen info.

t₀  The tolerance value to the minimum (or maximum) bound for the objective function. Only used in FCLP.fuzzyObjective.

Value

FCLP.classicObjective returns a solution reaching the given minimum (maximum) value of the objective function if the solver has found it (trying to maximize $\beta$) or NULL if not. Note that the found solution may not be the optimum for the $\beta$ returned, trying $\beta$ in FCLP.fixedBeta may obtain better results.

FCLP.fuzzyObjective returns a solution reaching the given minimum (maximum) value of the objective function if the solver has found it (trying to maximize $\beta$) or NULL if not. Note that the found solution may not be the optimum for the $\beta$ returned, trying $\beta$ in FCLP.fixedBeta may obtain better results.

FCLP.fuzzyUndefinedObjective returns a solution reaching the estimated minimum (maximum) value of the objective function if the solver has found it (trying to maximize $\beta$) or NULL if not.

FCLP.fuzzyUndefinedNormObjective returns a solution reaching the estimated minimum (maximum) value of the objective function if the solver has found it (trying to maximize $\beta$) or NULL if not.

References


See Also

FCLP.fixedBeta, FCLP.sampledBeta
FCLP.fixedBeta

Solves a Fuzzy Linear Programming problem with fuzzy constraints.

Examples

```r
## maximize: 3*x1 + x2 >= 0
## s.t.: 1.875*x1 - 1.5*x2 <= 4 + (1-beta)*5
##       4.75*x1 + 2.125*x2 <= 14.5 + (1-beta)*6
## x1, x2 are non-negative real numbers

obj <- c(3, 1)
A <- matrix(c(1.875, 4.75, 1.5, 2.125), nrow = 2)
dir <- c("<=", "<=")
b <- c(4, 14.5)
t <- c(5, 6)
max <- TRUE

# Problem with solution
FCLP.classicObjective(obj, A, dir, b, t, z0=11, maximum=max, verbose = TRUE)

# This problem has a bound impossible to reach
FCLP.classicObjective(obj, A, dir, b, t, z0=14, maximum=max, verbose = TRUE)

# This problem has a fuzzy bound impossible to reach
FCLP.fuzzyObjective(obj, A, dir, b, t, z0=14, t0=1, maximum=max, verbose = TRUE)

# This problem has a fuzzy bound reachable
FCLP.fuzzyObjective(obj, A, dir, b, t, z0=14, t0=2, maximum=max, verbose = TRUE)

# We want the function estimates a bound and a tolerance
FCLP.fuzzyUndefinedObjective(obj, A, dir, b, t, maximum=max, verbose = TRUE)

# We want the function estimates a bound and a tolerance
FCLP.fuzzyUndefinedNormObjective(obj, A, dir, b, t, maximum=max, verbose = TRUE)
```

Description

The goal is to solve a linear programming problem having fuzzy constraints.

\[
\begin{align*}
\text{Max } f(x) \text{ or Min } f(x) \\
\text{s.t.: } Ax & \leq b + (1 - \beta) \cdot t \\
\end{align*}
\]

Where \( t \) means we allow not to satisfy the constraint, exceeding the bound \( b \) at most in \( t \).

FCLP.fixedBeta uses the classic solver (simplex) to solve the problem with a fixed value of \( \beta \).

FCLP.sampledBeta solves the problem in the same way than FCLP.fixedBeta but using several \( \beta \)'s taking values in a sample of the \([0, 1]\) interval.
Usage

FCLP.fixedBeta(objective, A, dir, b, t, beta = 0.5, maximum = TRUE, verbose = TRUE)

FCLP.sampledBeta(objective, A, dir, b, t, min = 0, max = 1, step = 0.25, maximum = TRUE, verbose = TRUE)

Arguments

- **objective**: A vector \((c_1, c_2, \ldots, c_n)\) with the objective function coefficients \(f(x) = c_1x_1 + \ldots + c_nx_n\).
- **A**: Technological matrix of Real Numbers.
- **dir**: Vector of strings with the direction of the inequalities, of the same length as \(b\) and \(t\). Each element of the vector must be one of “=”, “>=”, “<”, or “>”.
- **b**: Vector with the right hand side of the constraints.
- **t**: Vector with the tolerance of each constraint.
- **beta**: The value of \(\beta\) to be used.
- **maximum**: TRUE to maximize the objective function, FALSE to minimize the objective function.
- **verbose**: TRUE to show additional screen info, FALSE to hide additional screen info.
- **min**: The lower bound of the interval to take the sample.
- **max**: The upper bound of the interval to take the sample.
- **step**: The sampling step.

Value

FCLP.fixedBeta returns the solution for the given beta if the solver has found it or NULL if not. FCLP.sampledBeta returns the solutions for the sampled \(\beta'\)s if the solver has found them. If the solver hasn’t found solutions for any of the \(\beta'\)s sampled, return NULL.

References


See Also

FCLP.classicObjective, FCLP.fuzzyObjective
FCLP.fuzzyUndefinedObjective, FCLP.fuzzyUndefinedNormObjective
Examples

```r
## maximize: 3*x1 + x2
## s.t.: 1.875*x1 - 1.5*x2 <= 4 + (1-beta)*5
##       4.75*x1 + 2.125*x2 <= 14.5 + (1-beta)*6
## x1, x2 are non-negative real numbers

obj <- c(3, 1)
A <- matrix(c(1.875, 4.75, -1.5, 2.125), nrow = 2)
dir <- c("<=", "<=")
b <- c(4, 14.5)
t <- c(5, 6)
valbeta <- 0.5
max <- TRUE

FCLP.fixedBeta(obj, A, dir, b, t, beta=valbeta, maximum = max, verbose = TRUE)
FCLP.sampledBeta(obj, A, dir, b, t, min=0, max=1, step=0.25, maximum = max, verbose = TRUE)
```

FOLP.multiObj

Solves a fuzzy objective linear programming problem using Representation Theorem.

Description

The goal is to solve a linear programming problem having Trapezoidal Fuzzy Numbers as coefficients in the objective function \( f(x) = c^T x_1 + \ldots + c^T x_n \).

\[
\begin{align*}
\text{Max } f(x) \text{ or Min } f(x) \\
\text{s.t.: } Ax &\leq b
\end{align*}
\]

FOLP.multiObj uses a multiobjective approach. This approach is based on each \( \beta \)-cut of a Trapezoidal Fuzzy Number is an interval (different for each \( \beta \)). So the problem may be considered as a Parametric Linear Problem. For a value of \( \beta \) fixed, the problem becomes a Multiobjective Linear Problem, this problem may be solved from different approaches, FOLP.multiObj solves it using weights, the same weight for each objective.

FOLP.interv uses an intervalar approach. This approach is based on each \( \beta \)-cut of a Trapezoidal Fuzzy Number is an interval (different for each \( \beta \)). Fixing an \( \beta \), using interval arithmetic and defining an order relation for intervals is possible to compare intervals, this transforms the problem in a biobjective problem (involving the minimum and the center of intervals). Finally FOLP.interv use weights to solve the biobjective problem.

FOLP.strat uses a stratified approach. This approach is based on that \( \beta \)-cuts are a sequence of nested intervals. Fixing an \( \beta \) two auxiliary problems are solved, the first replacing the fuzzy coefficients by the lower limits of the \( \beta \)-cuts, the second doing the same with the upper limits. The results of the two auxiliary problems allows to formulate a new auxiliary problem, this problem tries to maximize a parameter \( \lambda \).
Usage

FOLP.multiObj(objective, A, dir, b, maximum = TRUE, min = 0, max = 1, step = 0.25)

FOLP.interv(objective, A, dir, b, maximum = TRUE, w1 = 0.5, min = 0, max = 1, step = 0.25)

FOLP.strat(objective, A, dir, b, maximum = TRUE, min = 0, max = 1, step = 0.25)

Arguments

objective A vector \((c_1^f, c_2^f, ..., c_n^f)\) of Trapezoidal Fuzzy Numbers with the objective function coefficients \(f(x) = c_1^f x_1 + ... + c_n^f x_n\). Note that any of the coefficients may also be Real Numbers.

A Technological matrix of Real Numbers.

dir Vector of strings with the direction of the inequalities, of the same length as b. Each element of the vector must be one of ",=", ">=", "<=", "<" or ">".

b Vector with the right hand side of the constraints.

maximum TRUE to maximize the objective function, FALSE to minimize the objective function.

min The lower bound of the interval to take the sample.

max The upper bound of the interval to take the sample.

step The sampling step.

w1 Weight to be used, \(w_2 = 1 - w_1\). \(w_1\) must be in the interval \([0,1]\). Only used in FOLP.interv.

Value

FOLP.multiObj returns the solutions for the sampled \(\beta\)'s if the solver has found them. If the solver hasn’t found solutions for any of the \(\beta\)'s sampled, return NULL.

FOLP.interv returns the solutions for the sampled \(\beta\)'s if the solver has found them. If the solver hasn’t found solutions for any of the \(\beta\)'s sampled, return NULL.

FOLP.strat returns the solutions and the value of \(\lambda\) for the sampled \(\beta\)'s if the solver has found them. If the solver hasn’t found solutions for any of the \(\beta\)'s sampled, return NULL. A greater value of \(\lambda\) may be interpreted as the obtained solution is better.

References


See Also

FOLP.ordFun, FOLP.posib

Examples

```r
## maximize:  [0,2,3]*x1 + [1,3,4,5]*x2
## s.t.:        x1 + 3*x2 <= 6
##             x1 + x2 <= 4
##             x1, x2 are non-negative real numbers

obj <- c(FuzzyNumbers::TrapezoidalFuzzyNumber(0,2,3),
         FuzzyNumbers::TrapezoidalFuzzyNumber(1,3,4,5))
A<--matrix(c(1L, 1L, 3L, 1L), nrow = 2)
dir <- c("<=", "<=")
b <- c(6L, 4)
max <- TRUE

# Using a Multiobjective approach.
FOLP.multiObj(obj, A, dir, b, maximum = max, min=0, max=1, step=0.2)

# Using a Intervalar approach.
FOLP.interv(obj, A, dir, b, maximum = max, w1=0.3, min=0, max=1, step=0.2)

# Using a Stratified approach.
FOLP.strat(obj, A, dir, b, maximum = max, min=0, max=1, step=0.2)
```

---

**FOLP.ordFun**

Solves a fuzzy objective linear programming problem using ordering functions.

**Description**

The goal is to solve a linear programming problem having Trapezoidal Fuzzy Numbers as coefficients in the objective function \( f(x) = c_1^f x_1 + \ldots + c_n^f x_n \).

\[
\text{Max } f(x) \text{ or Min } f(x)
\]

\[
s.t.: \quad Ax \leq b
\]

FOLP.ordFun uses ordering functions to compare Fuzzy Numbers.
Usage

FOLP.ordFun(objective, A, dir, b, maximum = TRUE, ordf = c("Yager1", "Yager3", "Adamo", "Average", "Custom"), ..., FUN = NULL)

Arguments

objective A vector \((c_1^f, c_2^f, ..., c_n^f)\) of Trapezoidal Fuzzy Numbers with the objective function coefficients \(f(x) = c_1^f x_1 + \ldots + c_n^f x_n\). Note that any of the coefficients may also be Real Numbers.

A Technological matrix of Real Numbers.

dir Vector of strings with the direction of the inequalities, of the same length as b. Each element of the vector must be one of ":", ":="", ":<="", ":<" or ":>".

b Vector with the right hand side of the constraints.

maximum TRUE to maximize the objective function, FALSE to minimize the objective function.

ordf Ordering function to be used, ordf must be one of "Yager1", "Yager3", "Adamo", "Average" or "Custom". The "Custom" option allows to use a custom linear ordering function that must be placed as FUN argument. If a non linear function is used the solution may not be optimal.

... Additional parameters to the ordering function if needed.

- Yager1 doesn’t need any parameters.
- Yager3 doesn’t need any parameters.
- Adamo needs a alpha parameter which must be in the interval \([0, 1]\).
- Average needs two parameters, lambda must be in the interval \([0, 1]\) and t that must be greater than \(0\).
- If Custom function needs parameters, put them here. Although not required, it is recommended to name the parameters.

FUN Custom linear ordering function to be used if the value of ordf is "Custom". If any of the coefficients of the objective function are Real Numbers, the user must assure that the function FUN works well not only with Trapezoidal Fuzzy Numbers but also with Real Numbers.

Value

FOLP.ordFun returns the solution if the solver has found it or NULL if not.

References


See Also

FOLP.multiObj, FOLP.interv, FOLP.strat, FOLP.posib

Examples

```r
## maximize: [0,2,3]*x1 + [1,3,4,5]*x2
## s.t.: x1 + 3*x2 <= 6
##       x1 + 2*x2 <= 4
## x1, x2 are non-negative real numbers

obj <- c(FuzzyNumbers::TrapezoidalFuzzyNumber(0,2,3),
         FuzzyNumbers::TrapezoidalFuzzyNumber(1,3,4,5))
A <- matrix(c(1, 1, 3, 1), nrow = 2)
dir <- c("<=", "<=")
b <- c(6, 4)
max <- TRUE

FOLP.ordFun(obj, A, dir, b, maximum = max, ordf="Yager1")
FOLP.ordFun(obj, A, dir, b, maximum = max, ordf="Yager3")
FOLP.ordFun(obj, A, dir, b, maximum = max, ordf="Adamo", lambda=0.5)
FOLP.ordFun(obj, A, dir, b, maximum = max, ordf="Average", lambda=0.8, t=3)

# Define a custom linear function
av <- function(tfn) {
  mean(FuzzyNumbers::core(tfn))
}
FOLP.ordFun(obj, A, dir, b, maximum = max, ordf="Custom", FUN=av)

# Define a custom linear function
avp <- function(tfn, a) {
  a*mean(FuzzyNumbers::core(tfn))
}
FOLP.ordFun(obj, A, dir, b, maximum = max, ordf="Custom", FUN=avp, a=2)
```

---

**FOLP.posib**

Solves a fuzzy objective linear programming problem using Representation Theorem.

**Description**

The goal is to solve a linear programming problem having Trapezoidal Fuzzy Numbers as coefficients in the objective function \( f(x) = c_1 x_1 + \ldots + c_n x_n \).

\[
\begin{align*}
\text{Max } f(x) \text{ or Min } f(x) \\
\text{s.t. : } Ax \leq b
\end{align*}
\]

FOLP.posib uses a possibilistic approach. This approach is based on Trapezoidal Fuzzy Numbers arithmetic, so the whole objective may be considered as a Fuzzy Number itself. Defining a notion of maximum for this kind of numbers (a weighted average of the minimum and maximum of the support of the Trapezoidal number).
Usage

FOLP.posib(objective, A, dir, b, maximum = TRUE, w1 = 0.5)

Arguments

objective A vector \((c_f^1, c_f^2, ..., c_f^n)\) of Trapezoidal Fuzzy Numbers with the objective function coefficients \(f(x) = c_{f1}x_1 + ... + c_{fn}x_n\). Note that any of the coefficients may also be Real Numbers.

A Technological matrix of Real Numbers.

dir Vector of strings with the direction of the inequalities, of the same length as b. Each element of the vector must be one of "="", ">="", "<<="", "<<" or ">".

b Vector with the right hand side of the constraints.

maximum TRUE to maximize the objective function, FALSE to minimize the objective function.

w1 Weight to be used, \(w_2\) is calculated as \(w_2 = 1 - w_1\). \(w_1\) must be in the interval \([0, 1]\).

Value

FOLP.posib returns the solution for the given weights if the solver has found it or NULL if not.

References


See Also

FOLP.ordFun, FOLP.multiObj, FOLP.interv, FOLP.strat

Examples

```r
## maximize: [0,2,3]*x1 + [1,3,4,5]*x2
## s.t.: x1 + 3*x2 <= 6
##       x1 + x2 <= 4
##       x1, x2 are non-negative real numbers

obj <- c(FuzzyNumbers::TrapezoidalFuzzyNumber(0,2,3),
         FuzzyNumbers::TrapezoidalFuzzyNumber(1,3,4,5))
A <- matrix(c(1, 1, 3, 1), nrow = 2)
dir <- c("<=", "<=")
b <- c(6, 4)
max <- TRUE
FOLP.posib(obj, A, dir, b, maximum = max, w1=0.2)
```
**Description**

FuzzyLP is a package to solve fuzzy linear programming problems.

**Details**

FuzzyLP implements several algorithms for solving fuzzy linear programming, the algorithms are fundamentally based in the book of...

**References**


**GFLP**

Solves a maximization (minimization) problem having fuzzy coefficients in the constraints, the objective function and/or the technological matrix.

**Description**

The goal is to solve a linear programming problem having Trapezoidal Fuzzy Numbers as coefficients in the constraints, the objective function and/or the technological matrix.

$$Max \ f(x) \ or \ Min \ f(x)$$

s.t. : \hspace{1cm} \tilde{A}x \leq \tilde{b} + (1 - \beta) \ast \tilde{t}$$

This function uses different ordering functions for the objective function and for the constraints.

**Usage**

GFLP(objective, A, dir, b, t, maximum = TRUE, ordf_obj = c("Yager1", "Yager3", "Adamo", "Average"), ordf_obj_param = NULL, ordf_res = c("Yager1", "Yager3", "Adamo", "Average"), ordf_res_param = NULL, min = 0, max = 1, step = 0.25)
Arguments

**objective**  A vector \((c_{f_1}^l, c_{f_2}^l, \ldots, c_{f_n}^l)\) of Trapezoidal Fuzzy Numbers with the objective function coefficients \(f(x) = c_{f_1}^l x_1 + \ldots + c_{f_n}^l x_n\). Note that any of the coefficients may also be Real Numbers.

**A**  Technological matrix containing Trapezoidal Fuzzy Numbers and/or Real Numbers.

**dir**  Vector of strings with the direction of the inequalities, of the same length as \(b\) and \(t\). Each element of the vector must be one of ",="`, `">="`, `"<="`, `"<"` or `">"`.

**b**  Vector with the right hand side of the constraints. \(b\) may contain Trapezoidal Fuzzy Numbers and/or Real Numbers.

**t**  Vector with the tolerance of each constraint. \(t\) may contain Trapezoidal Fuzzy Numbers and/or Real Numbers.

**maximum**  TRUE to maximize the objective function, FALSE to minimize the objective function.

**ordf_obj**  Ordering function to be used in the objective function, `ordf_obj` must be one of "Yager1", "Yager3", "Adamo" or "Average".

**ordf_obj_param**  Parameters need by `ordf_obj` function, if it needs more than one parameter, use a named vector. See FOLP.ordfun for more information about the ordering functions parameters.

**ordf_res**  Ordering function to be used in the constraints, `ordf_res` must be one of "Yager1", "Yager3", "Adamo" or "Average".

**ordf_res_param**  Parameters need by `ordf_res` function, if it needs more than one parameter, use a named vector. See FOLP.ordfun for more information about the ordering functions parameters.

**min**  The lower bound of the interval to take the sample.

**max**  The upper bound of the interval to take the sample.

**step**  The sampling step.

Value

GFLP returns the solutions for the sampled \(\beta\)'s if the solver has found them. If the solver hasn’t found solutions for any of the \(\beta\)'s sampled, return NULL.

References


Examples

```r
## maximize:  [1,3,4,5]*x1 + x2
## s.t.:       [0,2,3,3.5]*x1 + [0,1,1,4]*x2 <= [2,2,2,3] + (1-beta)*[1,2,2,3]
##            [3,5,5,6]*x1 + [1.5,2,2,3]*x2 <= 12
## x1, x2 are non-negative real numbers

obj <- c(FuzzyNumbers::TrapezoidalFuzzyNumber(1,3,4,5), 1)
a11 <- FuzzyNumbers::TrapezoidalFuzzyNumber(0,2,2,3.5)
a21 <- FuzzyNumbers::TrapezoidalFuzzyNumber(3,5,5,6)
a12 <- -FuzzyNumbers::TrapezoidalFuzzyNumber(0,1,1,4)
a22 <- FuzzyNumbers::TrapezoidalFuzzyNumber(1.5,2,2,3)
A <- matrix(c(a11, a21, a12, a22), nrow = 2)

dir <- c("<=", "<=")
b<-c(FuzzyNumbers::TrapezoidalFuzzyNumber(2,2,2,3), 12)
t<-c(FuzzyNumbers::TrapezoidalFuzzyNumber(1,2,2,3), 0);
max <- TRUE

GFLP(obj, A, dir, b, t, maximum = max, ordf_obj="Yager1", ordf_res="Yager3")
GFLP(obj, A, dir, b, t, maximum = max, ordf_obj="Adamo", ordf_obj_param=0.5, ordf_res="Yager3")
GFLP(obj, A, dir, b, t, maximum = max, "Average", ordf_obj_param=c(t=3, lambda=0.5),
      ordf_res="Adamo", ordf_res_param = 0.5)
GFLP(obj, A, dir, b, t, maximum = max, ordf_obj="Average", ordf_obj_param=c(t=3, lambda=0.8),
      ordf_res="Yager3", min = 0, max = 1, step = 0.2)
```
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