

Package: Rglpk (via r-universe)

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Title R/GNU Linear Programming Kit Interface

Description R interface to the GNU Linear Programming Kit. 'GLPK' is open source software for solving large-scale linear programming (LP), mixed integer linear programming ('MILP') and other related problems.

Depends slam (>= 0.1-9)

SystemRequirements GLPK library package (e.g., libglpk-dev on Debian/Ubuntu)

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URL <https://R-Forge.R-project.org/projects/rglp/>,
<https://www.gnu.org/software/glpk/>

NeedsCompilation yes

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Rglpk_read_file *Interface to GLPK's file reader*

Description

High level R interface to the CPLEX_LP, MATHPROG and MPS reader of the GNU Linear Programming Kit (GLPK). Example data from the GLPK release is included in the './examples/' sub-directory.

Usage

```
## File reader for various formats
Rglpk_read_file(file, type = c("MPS_fixed", "MPS_free", "CPLEX_LP", "MathProg"),
  ignore_first_row = FALSE, verbose = FALSE)

## print method
## S3 method for class 'MP_data_from_file'
print(x, ...)
```

Arguments

file	a character string specifying the relative or absolute path to the model file.
type	a character string specifying the file format. This can be either "MPS_fixed", "MPS_free", "CPLEX_LP", and GNU "MathProg".
ignore_first_row	a logical indicating whether the first row of the model file should be ignored or not. Default: FALSE.
verbose	a logical for turning on/off additional solver output. Default: FALSE.
x	an object of class "MP_data_from_file".
...	further arguments passed on to the print method.

Details

Rglpk_read_file() takes the path to a file as an argument and calls GLPK's file reader. The description of the linear or mixed integer linear program is returned as an object of class "MP_data_from_file".

Value

Rglpk_read_file() returns the specification of a (mixed integer) linear program defined in file as an object of class "MP_data_from_file". The returned object is a list containing the following components.

objective	a " simple_triplet_matrix " representing the coefficients to x in the objective function.
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constraints	a list with three elements: a " simple_triplet_matrix " of coefficients, a character vector of constraint directions, and a numeric vector representing the right hand side.
bounds	a list containing two elements: lower and upper. Each of which contain a list specifying indices (ind) and corresponding bounds (val).
types	a character vector specifying whether the corresponding objective variable is of type binary ("B"), continuous ("C"), or integer ("I").
maximum	a logical indicating whether a minimum or a maximum is sought.

Further meta data is provided as attributes to the object.

Author(s)

Stefan Theussl

Examples

```
## read a CPLEX LP file
x <- Rglpk_read_file( system.file(file.path("examples", "plan.lp"), package
= "Rglpk"), type = "CPLEX_LP")
x
## optimal solution: 296.2166
Rglpk_solve_LP(x$objective, x$constraints[[1]], x$constraints[[2]],
               x$constraints[[3]], x$bounds, x$types, x$maximum)
## read a MATHPROG file
x <- Rglpk_read_file( system.file(file.path("examples", "assign.mod"), package
= "Rglpk"), type = "MathProg")
x
## optimal solution: 76
Rglpk_solve_LP(x$objective, x$constraints[[1]], x$constraints[[2]],
               x$constraints[[3]], x$bounds, x$types, x$maximum)
## read a MATHPROG file
x <- Rglpk_read_file( system.file(file.path("examples", "plan.mps"), package
= "Rglpk"), type = "MPS_fixed")
x
## optimal solution: 296.2166
Rglpk_solve_LP(x$objective, x$constraints[[1]], x$constraints[[2]],
               x$constraints[[3]], x$bounds, x$types, x$maximum)
```

Rglpk_solve_LP

Linear and Mixed Integer Programming Solver Using GLPK

Description

High level R interface to the GNU Linear Programming Kit (GLPK) for solving linear as well as mixed integer linear programming (MILP) problems.

Usage

```
Rglpk_solve_LP(obj, mat, dir, rhs, bounds = NULL, types = NULL, max = FALSE,
               control = list(), ...)
```

Arguments

obj	a numeric vector representing the objective coefficients.
mat	a numeric vector or a (sparse) matrix of constraint coefficients. If the optimization problem is unconstrained then a matrix of dimension 0 times the number of objective variables is required.
dir	a character vector with the directions of the constraints. For a nonzero number of constraints each element must be one of "<", "<=", ">", ">=", or "==". Note, however, that the GLPK API only allows for non-strict inequalities. Strict inequalities are handled the same way as non-strict inequalities.
rhs	a numeric vector representing the right hand side of the constraints.
bounds	NULL (default) or a list with elements upper and lower containing the indices and corresponding bounds of the objective variables. The default for each variable is a bound between 0 and Inf.
types	a character vector indicating the types of the objective variables. types can be either "B" for binary, "C" for continuous or "I" for integer. By default NULL, taken as all-continuous. Recycled as needed.
max	a logical giving the direction of the optimization. TRUE means that the objective is to maximize the objective function, FALSE (default) means to minimize it.
control	a list of parameters to the solver. See *Details*.
...	a list of control parameters (overruling those specified in control).

Details

GLPK is open source. The current version can be found at <https://www.gnu.org/software/glpk/glpk.html>. Package **Rglpk** provides a high level solver function using the low level C interface of the GLPK solver. R interface packages which port all low level C routines of the GLPK API to R are also available. Consult the ‘See Also’ Section for references.

Matrix `mat` and `obj` may be sparse arrays or matrices (`simple_triplet_matrix`) as provided by the **slam** package.

The `control` argument can be used to set GLPK’s many parameters. See the respective method section of the *GNU Linear Programming Kit Reference Manual* for further details. The following parameters are supported:

verbose: turn GLPK terminal output on (TRUE) or off (FALSE, the default).

presolve: turn presolver on (TRUE) or off (FALSE, the default).

tm_limit: time limit in milliseconds of call to optimizer. Can be any nonnegative integer. Default: 0 (use GLPK default).

canonicalize_status: a logical indicating whether to canonicalize GLPK status codes (on success `Rglpk_solve_LP()` returns code 0) or not (1). Default: TRUE.

Value

A list containing the optimal solution, with the following components.

solution	the vector of optimal coefficients
objval	the value of the objective function at the optimum
status	an integer with status information about the solution returned. If the control parameter <code>canonicalize_status</code> is set (the default) then it will return 0 for the optimal solution being found, and non-zero otherwise. If the control parameter is set to FALSE it will return the GLPK status codes.
solution_dual	variable reduced cost, if available (NA otherwise).
auxiliary	a list with two vectors each containing the values of the auxiliary variable associated with the respective constraint at solution, primal and dual (if available, NA otherwise).

Author(s)

Stefan Theussl and Kurt Hornik

References

GNU Linear Programming Kit (<https://www.gnu.org/software/glpk/glpk.html>).

GLPK Interface to R (<https://cran.R-project.org/package=Rglpk>).

See Also

glpk and **glpkAPI** for C API bindings; **lp** in package **lpSolve**; **ROI_solve** in package **ROI**; **Rsymphony_solve_LP** in package **Rsymphony**.

Examples

```
## Simple linear program.
## maximize:  2 x_1 + 4 x_2 + 3 x_3
## subject to: 3 x_1 + 4 x_2 + 2 x_3 <= 60
##           2 x_1 +   x_2 + 2 x_3 <= 40
##           x_1 + 3 x_2 + 2 x_3 <= 80
##           x_1, x_2, x_3 are non-negative real numbers

obj <- c(2, 4, 3)
mat <- matrix(c(3, 2, 1, 4, 1, 3, 2, 2, 2), nrow = 3)
dir <- c("<=", "<=", "<=")
rhs <- c(60, 40, 80)
max <- TRUE

Rglpk_solve_LP(obj, mat, dir, rhs, max = max)

## Simple mixed integer linear program.
## maximize:   3 x_1 + 1 x_2 + 3 x_3
## subject to: -1 x_1 + 2 x_2 +   x_3 <= 4
##           4 x_2 - 3 x_3 <= 2
```

```

##          x_1 - 3 x_2 + 2 x_3 <= 3
##          x_1, x_3 are non-negative integers
##          x_2 is a non-negative real number

obj <- c(3, 1, 3)
mat <- matrix(c(-1, 0, 1, 2, 4, -3, 1, -3, 2), nrow = 3)
dir <- c("<=", "<=", "<=")
rhs <- c(4, 2, 3)
types <- c("I", "C", "I")
max <- TRUE

Rglpk_solve_LP(obj, mat, dir, rhs, types = types, max = max)

## Same as before but with bounds replaced by
## -Inf < x_1 <= 4
## 0 <= x_2 <= 100
## 2 <= x_3 < Inf

bounds <- list(lower = list(ind = c(1L, 3L), val = c(-Inf, 2)),
               upper = list(ind = c(1L, 2L), val = c(4, 100)))
Rglpk_solve_LP(obj, mat, dir, rhs, bounds, types, max)

## Examples from the GLPK manual
## Solver output enabled

## 1.3.1
## maximize: 10 x_1 + 6 x_2 + 4 x_3
## subject to: x_1 + x_2 + x_3 <= 100
##            10 x_1 + 4 x_2 + 5 x_3 <= 600
##            2 x_1 + 2 x_2 + 6 x_3 <= 300
##            x_1, x_2, x_3 are non-negative real numbers

obj <- c(10, 6, 4)
mat <- matrix(c(1, 10, 2, 1, 4, 2, 1, 5, 6), nrow = 3)
dir <- c("<=", "<=", "<=")
rhs <- c(100, 600, 300)
max <- TRUE

Rglpk_solve_LP(obj, mat, dir, rhs, max = max, control = list("verbose" =
TRUE, "canonicalize_status" = FALSE))

```

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