Package ‘lpsymphony’

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Title  Symphony integer linear programming solver in R
Version  1.32.0
Description  This package was derived from Rsymphony_0.1-17 from CRAN. These packages provide an R in-
terface to SYMPHONY, an open-source linear programming solver written in C++. The main dif-
ference between this package and Rsymphony is that it includes the solver source code (SYM-
PHONY version 5.6), while Rsymphony expects to find header and library files on the users’ sys-
tem. Thus the intention of lpsymphony is to provide an easy to install interface to SYM-
PHONY. For Windows, precompiled DLLs are included in this package.
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License  EPL
Depends  R (>= 3.0.0)
Enhances  slam
Suggests  BiocStyle, knitr, testthat
URL  http://R-Forge.R-project.org/projects/rsymphony,
     https://projects.coin-or.org/SYMPHONY,
     http://www.coin-or.org/download/source/SYMPHONY/
biocViews  Infrastructure, ThirdPartyClient
VignetteBuilder  knitr
NeedsCompilation  yes
SystemRequirements  GNU make
git_url  https://git.bioconductor.org/packages/lpsymphony
**Description**

High level R interface to the COIN-OR SYMPHONY solver for linear as well as mixed integer linear programming problems (MILPs).

**Usage**

```
lpsymphony_solve_LP(obj, mat, dir, rhs, bounds = NULL, types = NULL, 
                    max = FALSE, verbosity = -2, time_limit = -1, 
                    node_limit = -1, gap_limit = -1, first_feasible = FALSE, 
                    write_lp = FALSE, write_mps = FALSE)
```

**Arguments**

- `obj` a vector with the objective coefficients
- `mat` a vector or a matrix of the constraint coefficients
- `dir` a character vector with the directions of the constraints. Each element must be one of "<", "<=", ">", ">=", "==" or "!=".
- `rhs` 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 giving the types of the objective variables, with "C", "I", and "B" corresponding to continuous, integer, and binary, respectively, or NULL (default), 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.
- `verbosity` an integer defining the level of verbosity, -2 (default) means no output.
time_limit  an integer defining the time limit in seconds, -1 (default) means no time limit.
node_limit  an integer defining the limit in number of iterations, -1 (default) means no node limit.
gap_limit  when the gap between the lower and the upper bound reaches this point, the solution process will stop and the best solution found to that point will be returned, -1 (default) means no gap limit.
first_feasible  a logical defining if the solution process should stop after the first feasible solution has been found, FALSE (default) means that the solution process does not stop after the first feasible solution has been found.
write_lp  a logical value indicating if an LP representation of the problem should be written for debugging purposes, FALSE (default) means no LP file is written.
write_mps  a logical value indicating if an MPS representation of the problem should be written for debugging purposes, FALSE (default) means no MPS file is written.

Details
SYMPHONY is an open source solver for solving mixed integer linear programs (MILPs). The current version can be found at https://projects.coin-or.org/SYMPHONY. Package lpsymphony uses the C interface of the callable library provided by SYMPHONY, and supplies a high level solver function in R using the low level C interface.

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: 0 if the optimal solution was found, a non-zero value otherwise.

Author(s)
Reinhard Harter, Kurt Hornik and Stefan Theussl

References
SYMPHONY development home page (https://projects.coin-or.org/SYMPHONY/wiki).

See Also
lp in package lpSolve; Rglpk_solve_LP in package Rglpk.

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 + x_3 <= 40
## \[ x_1 + 3 \, x_2 + 2 \, x_3 \leq 80 \]
## \[ x_1, x_2, x_3 \text{ are non-negative real numbers} \]

\[
\text{obj} \leftarrow c(2, 4, 3) \\
\text{mat} \leftarrow \text{matrix}(c(3, 2, 1, 4, 1, 3, 2, 2), \text{nrow} = 3) \\
\text{dir} \leftarrow c("\leq", \"\leq", \"\leq") \\
\text{rhs} \leftarrow c(60, 40, 80) \\
\text{max} \leftarrow \text{TRUE} \\
\text{lpsymphony\_solve\_LP}(\text{obj}, \text{mat}, \text{dir}, \text{rhs}, \text{max} = \text{max})
\]

## Simple mixed integer linear program.
## maximize: \[ 3 \, x_1 + 1 \, x_2 + 3 \, x_3 \]
## subject to:
## \[ -1 \, x_1 + 2 \, x_2 + x_3 \leq 4 \]
## \[ 4 \, x_2 - 3 \, x_3 \leq 2 \]
## \[ x_1 - 3 \, x_2 + 2 \, x_3 \leq 3 \]
## \[ x_1, x_3 \text{ are non-negative integers} \]
## \[ x_2 \text{ is a non-negative real number} \]

\[
\text{obj} \leftarrow c(3, 1, 3) \\
\text{mat} \leftarrow \text{matrix}(c(-1, 0, 1, 2, 4, -3, 1, -3, 2), \text{nrow} = 3) \\
\text{dir} \leftarrow c("\leq", \"\leq", \"\leq") \\
\text{rhs} \leftarrow c(4, 2, 3) \\
\text{max} \leftarrow \text{TRUE} \\
\text{types} \leftarrow c("I", \"C", \"I") \\
\text{lpsymphony\_solve\_LP}(\text{obj}, \text{mat}, \text{dir}, \text{rhs}, \text{types} = \text{types}, \text{max} = \text{max})
\]

## Same as before but with bounds replaced by
## \[ -\infty < x_1 \leq 4 \]
## \[ 0 \leq x_2 \leq 100 \]
## \[ 2 \leq x_3 < \infty \]

\[
\text{bounds} \leftarrow \text{list}(\text{lower} = \text{list}(\text{ind} = c(1L, 3L), \text{val} = c(-\infty, 2))) \\
\text{upper} \leftarrow \text{list}(\text{ind} = c(1L, 2L), \text{val} = c(4, 100))) \\
\text{lpsymphony\_solve\_LP}(\text{obj}, \text{mat}, \text{dir}, \text{rhs}, \text{types} = \text{types}, \text{max} = \text{max}, \\
\text{bounds} = \text{bounds})
\]
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