qsopt_ex-interface

An Interface to QSopt exact LP solver

1.0

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Chapter 1

Introduction

`qsopt_ex-interface` is a GAP package that provides an interface to *QSopt* exact rational linear program solver [ACDE09] by Applegate,Cook,Dash and Espinoza. This is a minimalist package exposing parts of qsopt to GAP. The particular version of QSopt-exact solver this package currently follows is 2.5.10-patch 3 of a fork of the original software maintained by Jon Lund Steffenson [Ste15], which removes certain dependencies and makes the software easier to build. `qsopt_ex-interface` provides a C wrapper qsinterface.c to the solver. It is currently available for Unix/Linux systems running GAP 4.5+.

Chapter 2

Installation

Assuming you already have GAP 4.5+ installed, you can follow the steps below to install the package:

- To get the newest version of `qsopt_ex-interface`, download the .zip archive from https://github.com/jayant91089/qsopt_ex-interface and unpack it using `unzip qsopt_ex-interface-x.zip` in the terminal. Do this preferably inside the *pkg* subdirectory of your GAP 4 installation. It creates a subdirectory called `qsopt_ex-interface`. If you do not know the whereabouts of the *pkg* subdirectory, invoke the following in GAP:

Code

```
GAPInfo.("RootPaths");
```

Look for pkg directory inside any of the paths returned.

- Once unpacked, go to `qsopt_ex-interface` directory and run the install script `unix-install.sh` from the terminal as `sh unix-install.sh`. This locally installs qsopt exact and its dependencies (GMP [GtGdt15],libz and libbz2) in lib and include folders. Alternatively, if you have qsopt-exact and GMP already installed on your system, you can edit the Makefile inside `qsopt_ex-interface` directory so that gcc finds the .so libraries. In latter case, you must manually '\texttt{make all}' from the terminal inside `qsopt_ex-interface` directory.

- Above step creates an executable \texttt{qsi} inside the `qsopt_ex-interface` directory, which serves as the interface. Note that before using the package in GAP, one must edit either the environment variable `LD_LIBRARY_PATH` or the so that \texttt{qsi} finds the locally installed libraries.

- One can now start using `qsopt_ex-interface` by invoking

Code

```
LoadPackage( "qsopt_ex-interface");
```

from within GAP.

Chapter 3

Usage

3.1 Available functions

In this section we shall look at the functions provided by qsopt_ex-interface.

3.1.1 SolveLPQS

▷ `SolveLPQS(obj, A, b, linrows, qs_exec, optargs)` (function)

Returns: A list

This function solves an LP by involking external qsopt-exact LP solver process. It accepts following arguments:

- *obj* - Objective function coefficients, provided as a list
- *A* - A list of lists corresponding to constraints
- *b* - Right hand side of constraints
- *linrows* - A list of indices of members of *A* that are equalities
- *qs_exec* - A string describing complete path to 'qsi' executable

* Returns a list $[rval, val\_rval, val, x\_rval, x]$

References

[ACDE09] David Applegate, William Cook, Sanjeeb Dash, and Daniel Espinoza. QSopt-ex 2.6 — A computer algebra system for polynomial computations, 2009. 3

[GtGdt15] Torbörn Granlund and the GMP development team. GNU MP: The GNU Multiple Precision Arithmetic Library 6.0.0, 2015. 4

[Ste15] Jon Lund Steffensen. QSopt-ex 2.5.10 patch 3 - a fork adding improvements to the build system, library and a python interface, 2015. 3

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