JNORMALIZ 1.4

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ABSTRACT. This is the release of the version 1.4 of jNormaliz, a graphical interface for Normaliz version 2.9. Normaliz is a program for the computation of Hilbert bases of rational cones and the normalizations of affine monoids. It may also be used for solving diophantine linear systems of inequalities, equations and congruences.

1. INTRODUCTION

jNormaliz 1.4 [1] is a graphical interface for Normaliz compatible with version 2.9. The program Normaliz [5] is mainly a tool for computing Hilbert bases. It may also be used for solving diophantine linear systems of inequalities, equations and congruences.

Several related computations are also integrated. Using Normaliz, one may compute the following:

(1) the Hilbert basis and the support hyperplanes of a rational cone. The cone may be given by:
    (i) a system of generators;
    (ii) a linear system of inequalities, equations and congruences;
    (iii) the binomial equations of the (monoid) generators.
(2) the lattice points and the support hyperplanes of an integral polytope;
(3) the generators of the integral closure of the Rees algebra of a monomial ideal $I \subseteq K[X_1, \ldots, X_n]$ and the generators of the integral closure of I.

If the associated monoid is homogeneous in a certain sense or a specific grading is added to the input file, then one may also compute the Hilbert series and the Hilbert quasipolynomial of the monoid.

The graphical interface jNormaliz offers a text editor for the input files, visualization of the output files and facilities to run or stop Normaliz without having to deal with the command-line details. The software also allows keeping track of how computation evolves, through a console where the verbose output of Normaliz is displayed, a timer and a memory gauge. The interface is written in Java. That allowed us to combine the

good portability (on different operating systems) of the graphical elements provided by Java with the computational advantages of the C++ implementation of Normaliz.

For the algorithms implemented by Normaliz see [8] (starting with version 1.0), [3] (introduced in version 2.0), [2] (describing changes in version 2.5) and [7] (the additions in version 2.8). A full description of the user interface (version 2.2) is contained in [4] and the changes to version 2.5 are available in [6].

2. Installation and system requirements

jNormaliz should work on all platforms were Java can run. It has been tested on Windows, Linux and MacOS. To run jNormaliz, it is necessary to have Java runtime version 1.6.0 (or a newer version). If the operating system architecture is 64 bits, the Java runtime used should also be 64 bits; otherwise, the information about the memory usage might be displayed incorrectly. Notice that jNormaliz requires an installed reader of PDF files in order to view the associated documentation files.

If you intend to use jNormaliz 1.4, you should also have installed Normaliz version 2.9.

jNormaliz should be installed over an existing installation of Normaliz, unzipping the contents of the file `jnormaliz.zip` inside the directory where Normaliz is installed. jNormaliz depends on this, as it assumes that the executable files are in the same directory where the file `jnormaliz.jar` is.

jNormaliz is composed by a Java executable (the file `jnormaliz.jar`), some third-party libraries (in the folder `lib/`), the source files (in the folder `source/jNormaliz`) and this documentation (in the folder `doc/`).

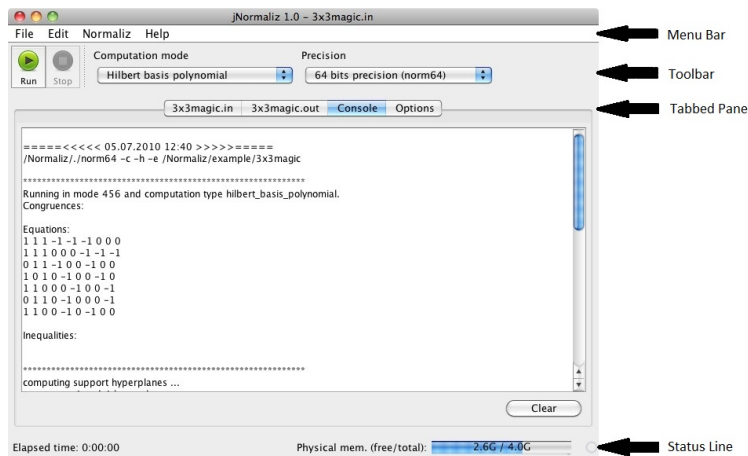
Figure 1. Interface with input file loaded

3. Overview of the graphical interface

The interface jNormaliz (see Fig. 1) is divided into four main areas: the menu bar, the toolbar, the tabbed panel and the status line. Follows a brief description of each element.

The **menu bar** contains the following submenus.

(i) The **File** menu presents to the user the next options.
   (a) *Open.* Opens an existing input file. If the user tries to open a file without the extension .in (that is a input file for Normaliz), jNormaliz will refuse it and will display an error message.
   (b) *New.* Creates a new input file and loads it in jNormaliz. Associated with this option there is a *New file dialog* (Fig. 2) which allows the user to specify the name of the new file, the dimensions of the input matrix and the *mode* (see also the Normaliz manual for information on the available modes). The generated input file will contain a matrix in the specified dimensions filled up with zeros.
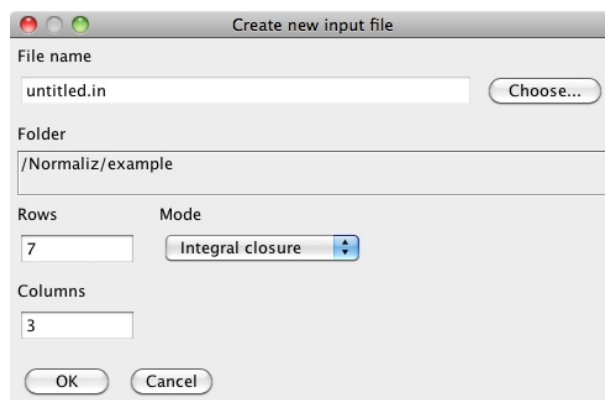

Figure 2. The new file dialog

   (c) *Close.* Closes the currently opened input file, interrupting ongoing calculations.
   (d) *Save.* Saves the input file. Notice that this option will only be available if the input file has been modified. Also remark that when a file suffers any modification in the editor, jNormaliz appends a ∗ to its name in the title bar.
   (e) *Save as.* Allows saving the currently opened input file under another name.
   (f) *Print.* Prints the contents of the currently selected tab in the tabbed panel (input file, output file or console).
   (g) *Exit.* Exits the application, offering the option of interrupting ongoing calculations.

(ii) The **Edit** menu contains standard functions for editing text files.
  (a) *Undo.* Undoes the most recent editing operation in the input file.
  (b) *Cut.* Cuts the selected text from the input file.
  (c) *Copy.* Copies the selected text into the clipboard. It is active on input files, output files and on the console.
  (d) *Paste.* Pastes the text from the clipboard into the input file.
(iii) The **Normaliz** menu has just two commands used for starting (*Run*) and interrupting (*Stop*) computations with Normaliz. The same commands are also available in the toolbar.
(iv) The **Help** menu gives the user fast access to the documentation distributed together with Normaliz.
  (a) *Help.* Opens this file.
  (b) *Open Normaliz manual.* Opens the PDF file containing the full user documentation of Normaliz.
  (c) *Open Normaliz website.* Opens the Normaliz homepage in the default web browser.
  (d) *Mathematical background.* Opens a dialog containing a short description and a link to some of the articles describing the algorithms used by Normaliz.
  (e) *About.* Displays a box containing information about jNormaliz.

The **toolbar** gives the user fast access to the most used commands.

  (i) **Run** button. Starts computations on the currently opened input file. After a successful execution, the content of the output file is updated with the results.
 (ii) **Stop** button. Interrupts computations.
(iii) **Computational mode** box. Allows choosing which computations will be performed the next time Normaliz will run. For details, see Normaliz manual (available from the Help menu).
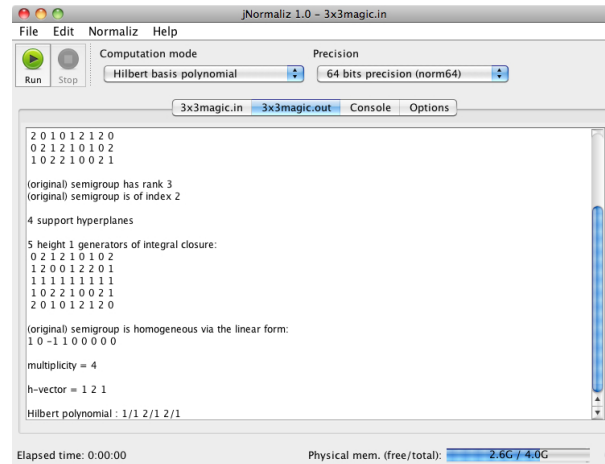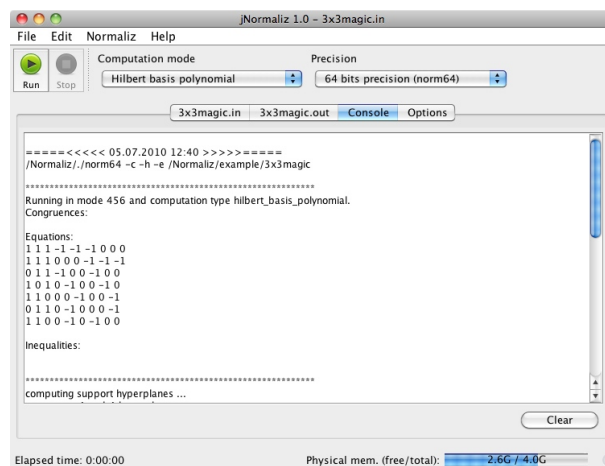

FIGURE 3. Output file tab

Figure 4. Console tab

(iv) **Precision** box. Allows choosing the arithmetic precision to be used while running Normaliz (64 bits or infinite precision). For details on arithmetic limitations, see Normaliz manual (available from the Help menu).

The **tabbed panel** presents the user the following four tabs.

(i) **Input** tab (Fig. 1). It shows the currently open input file. Notice that this tab is only shown when there is an open input file.

(ii) **Output** tab (Fig. 3). Contains the output file (if available).

(iii) **Console** tab (Fig. 4). This tab shows the console output of Normaliz, together with some extra information (the command line commands, the date and time of each Normaliz call). With this tab is is possible to track Normaliz execution, as it is updated in real-time. The user can also select and copy the contents of the console to some other application.

(iv) **Options** tab (Fig. 5). This tab groups some options regarding Normaliz, jNormaliz and NmzIntegrate.

   (a) *Output options.* This group controls which output files are generated by Normaliz. Notice that only the .out file is displayed by jNormaliz. For more details about this grup of options consult Normaliz manual.

   (b) *Run tests for arithmetic overflow.* When checked, Normaliz will try to detect arithmetic errors (see Normaliz manual).

   (c) *Control the number of parallel threads.* When checked, the user controls the maximum number of parallel threads generated by Normaliz. When not, Normaliz will generate the maximum number (depending on the particular system where it is running). The maximum number of parallel threads allowed can be set in the box below.

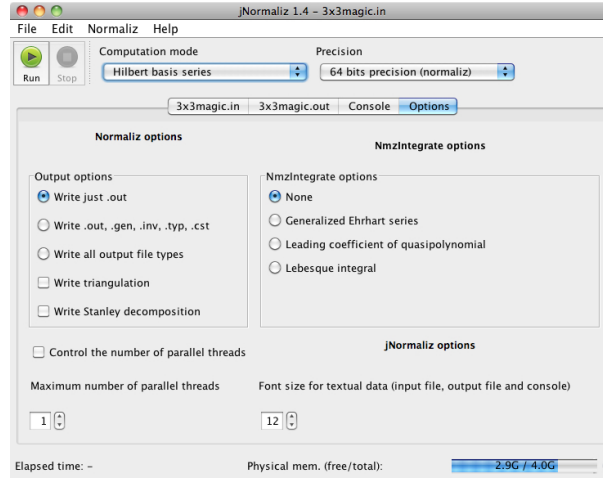   (d) *Font size.* Changes the font size used to show and print the input file, the output file and the console.

FIGURE 5. Options tab

(e) *NmzIntegrate options.* This group controls the option for NmzIntegrate called by Normaliz. For more details about this group of options consult Normaliz manual and NmzIntegrate manual.

Remark that below the text box there is a link for the folder where the input and output files are. Clicking this link opens the folder in the systems default file manager.

The **status line** displays three useful pieces of information.

(i) **Elapsed time** of the current or last Normaliz execution.
(ii) A gauge displaying how much **physical memory** is currently available, and also the total physical memory available.
(iii) An icon indicating that there is a currently **running computation**.

4. LIMITATIONS

Only one input file can be loaded at one time in jNormaliz. However, the user can run other instances of jNormaliz in order to deal with multiple input files simultaneously.

5. INFORMATION FOR DEVELOPERS

jNormaliz was developed using Netbeans version 6.8. It uses the following third-party libraries:

(1) A modified version of JavaSysMon 0.3.1, from Jez Humble (available at http://wiki.github.com/jezhumble/javasysmon/).
(2) Jakarta Commons Exec 1.0.1 (available at http://commons.apache.org/exec/)

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jNormaliz should always be distributed together with the corresponding version of Normaliz. Please refer to Normaliz in the following manner in any publication or related work for which it has been used:

W. Bruns, B. Ichim and C. Söger: Normaliz. Algorithms for rational cones and affine monoids. Available from http://www.math.uos.de/normaliz.

It is now customary to evaluate mathematicians by such data as numbers of publications, citations and impact factors. The data bases on which such dubious evaluations are based do not list mathematical software. Therefore we ask you to cite the article [7] in addition. This is very helpful for the younger members of the team.

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