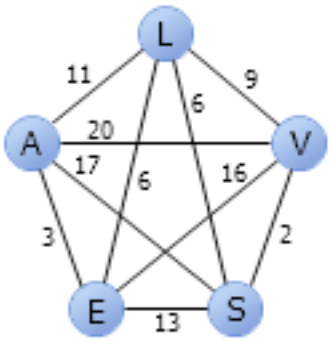
LAVES

User Guide

Logistics
Algorithms
Visualization and
Education
Software



Contents

1. Introduction

Dear user,

thank you for choosing LAVES – **L**ogistics **A**lgorithms **V**isualization and **E**ducation **S**oftware!

LAVES is an open source educational software that aids students or pupils in understanding the basic concepts of algorithms and supports the teaching staff in visualizing them.

By use of didactical methods like algorithm visualization in combination with exercises, LAVES helps to comprehend the functionality of algorithms.

LAVES was created during a project seminar at the University of Siegen in spring semester 2014 and was originally developed as an educational support for the lecture „Logistik“ („Logistics“) in the Bachelor program „Wirtschaftsinformatik“ (business informatics) at the Departement of Management Information Science.

LAVES is based on a Software Development Kit (LAVESDK) and has a plugin architecture.
Therefore it is possible that teaching staff can extend LAVES with own algorithm visualizations and integrate them into the software or to customize LAVES for their individual lectures. Click here to get started.

We wish you much fun with LAVES!
We appreciate your feedback, suggestions and improvement proposals. Please tell us your user experience and mail to jan.dornseifer@student.uni-siegen.de or dominik.kress@uni-siegen.de.

1.1 System Requirements

LAVES is platform independent and can be used on every system (e.g. Windows, Linux or Mac OS X). Only a Java Runtime Environment (JRE) of version 1.7 or higher is required.
You can find the download for the Java SE Runtime Environment 7 here.

Recommended system requirements:

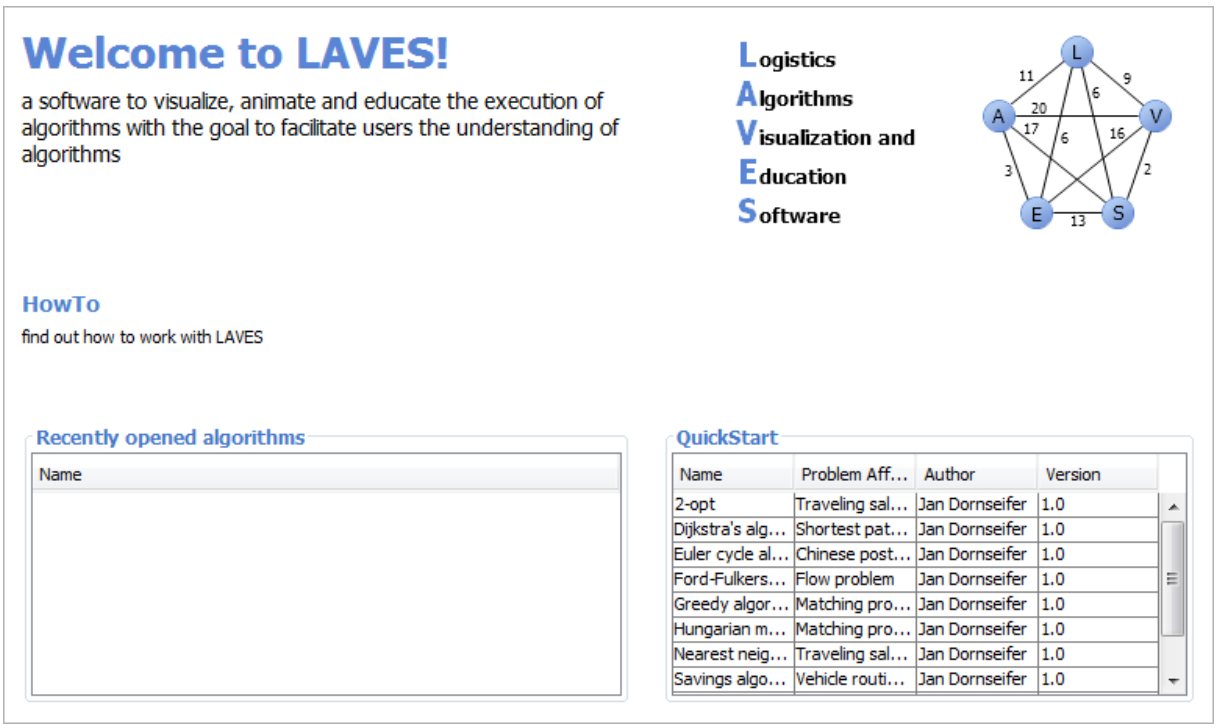
Processor:	Intel Core i5
Main memory:	4GB RAM

2. User Interface

In the following section the functionality and the graphical user interface (GUI) of LAVES will be outlined. Please look at section 5 with a brief explanation to frequently asked questions.

2.1 Welcome Screen

The welcome screen appears if LAVES is opened but only if you have not closed it before. If the welcome screen is closed it will only be displayed again if you select the corresponding option in the preferences (see 2.5.1).

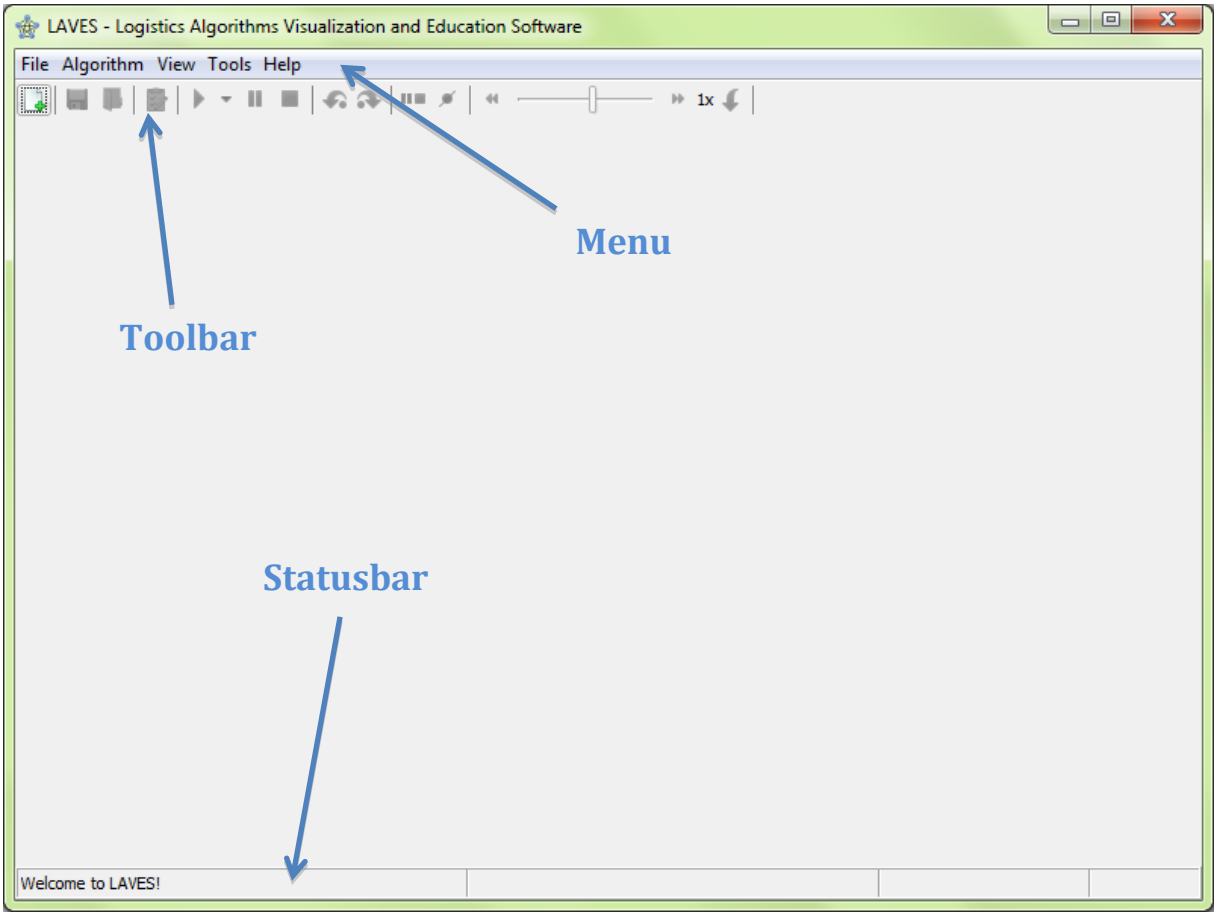


The welcome screen presents useful information like a HowTo article to have a quick start into LAVES.
In addition it displays the recently opened algorithms and a complete list of all installed algorithms (plugins). So you can recommence your work as quickly as possible.

To open an algorithm from the welcome screen you have to double click onto the corresponding entry in the particular list.

When you choose a recently opened algorithm then this algorithm is restored with ist recently used preferences. When you open an algorithm using the QuickStart panel then the default preferences are applied. If you would like to make changes to the preferences by yourself then you have to open the algorithm with „File“ → „New...“.

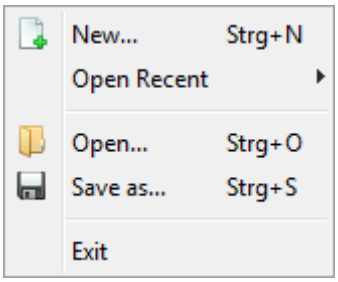
2.2 Main Window



2.2.1 Menu

2.2.1.1 File

The menu „File“ contains options to open new algorithms, to open and save files and to exit the program.



„New...“:
Click on „New...“ to select a new algorithm. It opens the dialog „New“.

„Open Recent“:
The submenu of „Open Recent“ lists the recently opened algorithms in their opening order. Click on an entry to open the algorithm (with its last preferences). The number of recently opened algorithms can be adjusted in the dialog „Preferences“.

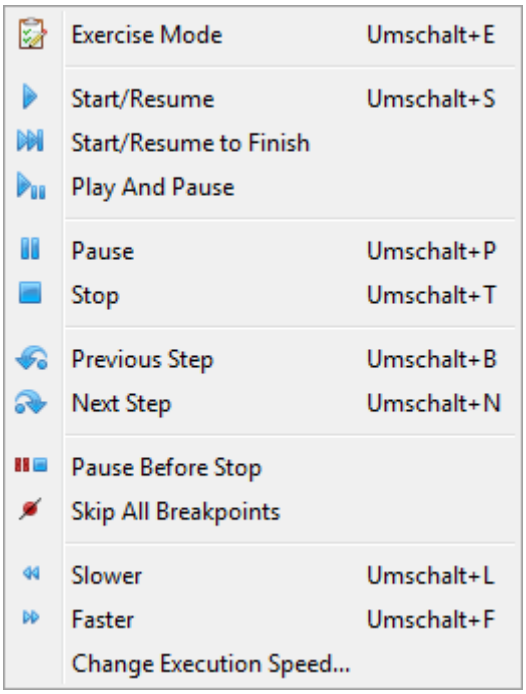
„Open...“:
With „Open...“ it is possible to open files from your hard drive in the currently selected algorithm, as far as this is allowed. It opens the file chooser dialog where you have to select the file you want to open. Afterwards click on „Ok“.

„Save as...“:
With „Save as...“ you can save the data of the algorithm onto your hard drive so that you can display it at a later time or to share it with other users. It opens the file chooser dialog where you have to select the location and the name of the file. Afterwards click on „Ok“.

„Exit“:
With „Exit“ you close the program.

2.2.1.2 Algorithm

With the menu „Algorithm“ you control the execution of the currently selected algorithm.



„Exercise Mode“:
Enable the exercise mode to learn the algorithm in an interactive way. If the algorithm does not have an exercise mode then the entry is disabled.
The exercise mode of an algorithm can only be activated or deactivated if the algorithm is not started yet. If the algorithm is already started you have to stop it first.
For further information about the exercise mode please see here.

„Start/Resume“:
With „Start/Resume“ you can start the algorithm or you can resume its execution if you have paused the algorithm previously.

„Start/Resume to finish“:
With „Start/Resume to finish“ it is possible to execute the algorithm without waiting sequences (because of the visualization). By way of example this feature is useful if you want to compare the result of the algorithm with your notes. *Tip: Enable the checkmark at the option „Pause Before Stop“*.

„Play And Pause“:
Click on „Play And Pause“ to visualize the current step of the algorithm. If the step is executed the algorithm is paused automatically at the next step.

„Pause“:
With „Pause“ you can suspend the algorithm. Please select one of the starting options to continue with the algorithm.

„Stop“:
With „Stop“ you can terminate the current execution of the algorithm. Afterwards the starting condition is restored.

„Previous Step“:
With „Previous Step“ you can jump to the previous step in the algorithm. That can be done during the execution or if the algorithm is paused.

„Next Step“:
With „Next Step“ you can skip the current step in the execution and go to the next step. That can be done during the execution or if the algorithm is paused.

„Pause Before Stop“:
Enable the option „Stop Before Pause“ so that the algorithm passes into pause state before the algorithm is terminated. This feature is useful if you want to see the final visualization because there can be views that restore their initial state if the algorithm is terminated (stopped).

„Skip All Breakpoints“:
Enable the option „Skip All Breakpoints“ so that the algorithm is executed without suspending although there are breakpoints in the algorithm.
Learn more about adding and removing breakpoints in an algorithm under 2.2.5.

„Slower“:
With „Slower“ you can decrease the execution speed of the algorithm. *Tip: Slow down the execution so that you can follow the visualization more easily*.

„Faster“:
With „Faster“ you can increase the execution speed of the algorithm.

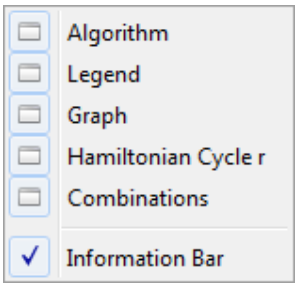
„Change Execution Speed…“:
Click on „Change Execution Speed...“ to switch to a specific execution speed. In the following dialog you can select the speed from a list and confirm the dialog with „Ok“. A number greater one means „x times faster than normal“ and a number less than one means „1/x times slower than normal“. For example „2x“ means that the execution is

twice as fast and „0.5x“ means that the algorithm is executed only half as fast respectively two times slower than normal.

2.2.1.3 View

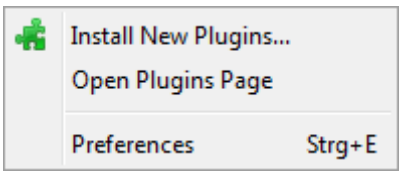
In the menu „View“ you have the possibility to open previously closed views of an algorithm again. Views with a cross („X“) in the top right corner can be closed to make the user interface of an algorithm clearer if you do not need a certain view.

Beside the views of an algorithm you can enable or disable the informationbar of an algorithm. The informationbar shows the assumptions of an algorithm and can be closed as a view if you do not need these information.
If you want to disable the informationbar permanently please look at the preferences.



2.2.1.4 Tools

In the menu „Tools“ you can find the options to extend the software with new algorithms (plugins) or to open the preferences where you can customize LAVES to fit your individual needs.



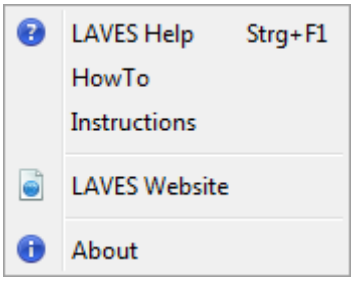
„Install New Plugins...“:
With „Install New Plugins...“ you can open the plugin manager where you can install new algorithms or remove (deinstall) already existing ones.

„Open Plugins Page“:
With „Open Plugins Page“ you can go to the plugins section of the LAVES website that lists the available plugins for LAVES.
If you want to install a plugin please download the plugin (JAR file) and go to „Install New Plugins...“.
For further information see here.

„Preferences“:
With „Preferences“ you open the preferences dialog where you can customize the software.

2.2.1.5 Help

The menu „Help“ provides options that give you support in working with LAVES.



„LAVES Help “:
Click on „LAVES Help“ to open the user guide.

„HowTo“:
Click on „HowTo“ to view an article about working with LAVES. The article demonstrates a typical workflow. If you start LAVES the first time it is recommended that you read the HowTo.

„Instructions“:
Click on „Instructions“ to display a dialog with instructions about the currently opened algorithm.

„LAVES Website “:
Click on „LAVES Website“ to open the website of the software with information and extensions.

„About“:
Opens the „About“ dialog with information about the software, the contributors and the license.

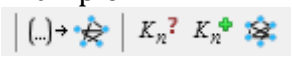
2.2.2 Toolbar

The toolbar of LAVES contains the basic features of the software.
That includes to

- open a new algorithm (see also here)
- save the data of an algorithm (see also here)
- open existing data (see also here)
- enable/disable the exercise mode (see also here)
- start the algorithm (see also here)
  ➔ open the dropdown menu to choose another start option
- pause the algorithm
- stop (terminate) the algorithm
- go to the previous step
- skip the current step and go to the next one

- enable/disable the option „Pause Before Stop“ (see also here)
- enable/disable the option „Skip All Breakpoints“ (see also here)
- slow down the execution speed of an algorithm
- change the execution speed of an algorithm
  ➔ move the slider to slow done (left) or to increase (right) the execution speed of the algorithm
- increase the execution speed
- reset the execution speed to normal

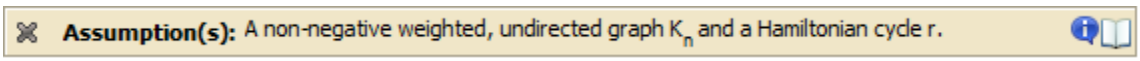
Hint:
Pay attention to the toolbar that can be extended with new features when you open an algorithm.
Example:



Features to create a graph by use of an adjacency matrix, to check whether a graph is complete, to create a complete graph and to arrange the vetrices of a graph in a circle.

These features can aid you in working with the algorithm.

2.2.3 Informationbar

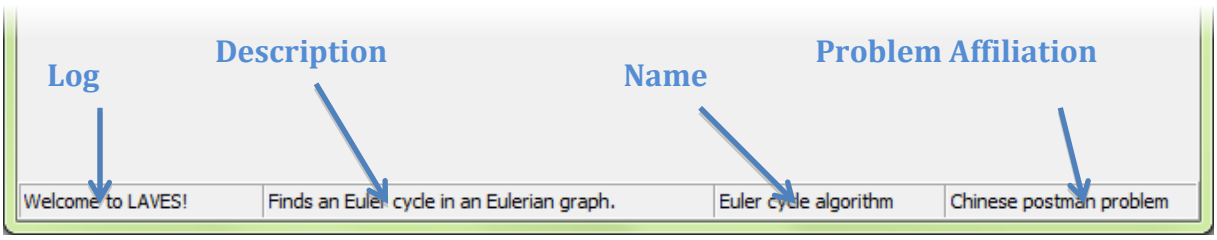


The information bar shows the assumptions of an algorithm. The problem entity that you have created has to fulfill these assumptions to start the algorithm.

If you want to disable the informationbar then click on the cross („X“) to close the bar. With the button on the right side of the informationbar you can open a dialog with instructions that give you useful information about the algorithm. You can also use the menu „Help“ → „Instructions“ to show the instructions.

To disable the informationbar permanently please go to the preferences.

2.2.4 Statusbar



The statusbar displays information about the currently opened algorithm as well as the program state.

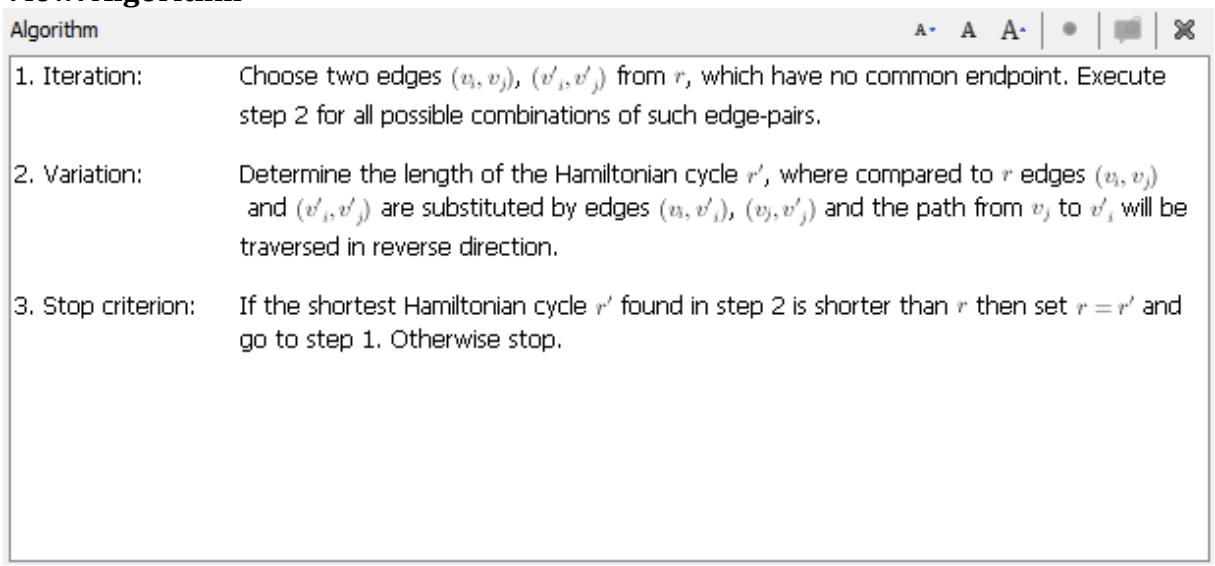
If errors occur during the runtime these errors are displayed in field 1. You can identify error messages by the red coloring of the text.

Field 2 shows the description of the algorithm while field 3 contains the algorithm's name and field 4 the problem affiliation.

2.2.5 Default Views

An algorithm can have several views that aim at supporting the understanding of the algorithm.
In this section we want to present two of the default views.

View: Algorithm



The algorithm text view displays the text of an algorithm in pseudocode.
Pseudocode simplifies the understanding and is much more compact because it closely resembles the natural language. Furthermore it is not necessary to speak the syntax of a concrete programming language.

Beside the algorithm itself the view can additionally provide meta information like breakpoints. By use of breakpoints you can specify whether the execution of the algorithm should be suspended at a certain point.
Before you can define a breakpoint you have to select the related step in the algorithm. For that you have to move the mouse cursor over the corresponding section in the algorithm and click with the left mouse button. Afterwards the step will be highlighted. Then you can open the context menu by right-clicking with the mouse button or you can double click onto the step to add a breakpoint.

In addition to the breakpoints it is also possible that a step of an algorithm has an annotation. If the selected step of an algorithm has an annotation then the corresponding option in the context menu or the toolbar of the view (see below) is enabled.

The toolbar of the algorithm view contains buttons to show annotations or toggle breakpoints of a step and furthermore buttons to change the font size of the algorithm to increase the readability of the text.

View: Graph

The graph view provides features to create a graph (graph theory).

You can create vertices in the graph by selecting the corresponding option ( ) in the toolbar of the view and afterwards you click at the position in the graph area where the vertex should be placed.
Activate the option ( ) to connect vertices by edges. You create an edge between two vertices by clicking on the first vertex with the left mouse button and press the button again on the second vertex.
It is also possible to connect more than two vertices consecutively. For that to happen, you have to click on the first vertex with the left mouse button and press the right mouse button on the following ones. Use the left mouse button again on the last vertex to create the connection path.

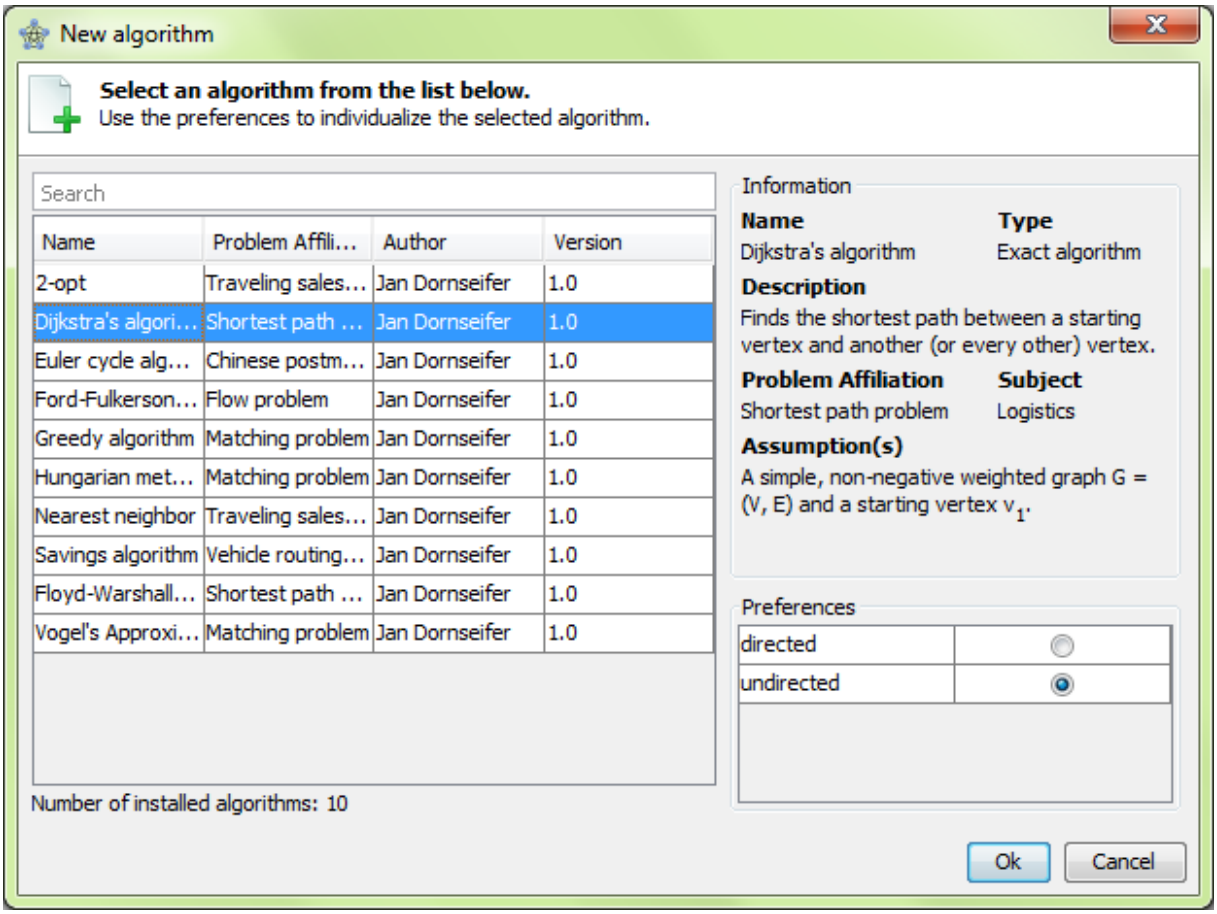
Activate the mouse cursor to select vertices or edges.

You can remove selected vertices or edges by clicking on the cross ( ) in the toolbar.
Furthermore you can modify the properties of vertices and edges. You can do that by selecting a vertex or edge and clicking on the properties option ( ). Click the „Ok“ button in the pop-up to apply the modified properties.
The caption of vertices and the weight of edges can directly be entered using the keyboard after you have selected the object in the graph.

With the remaining options it is possible to zoom the view.

2.3 Dialog: New

The dialog „New“ is accessible on „File“ → „New...“ or by use of the corresponding button in the toolbar.



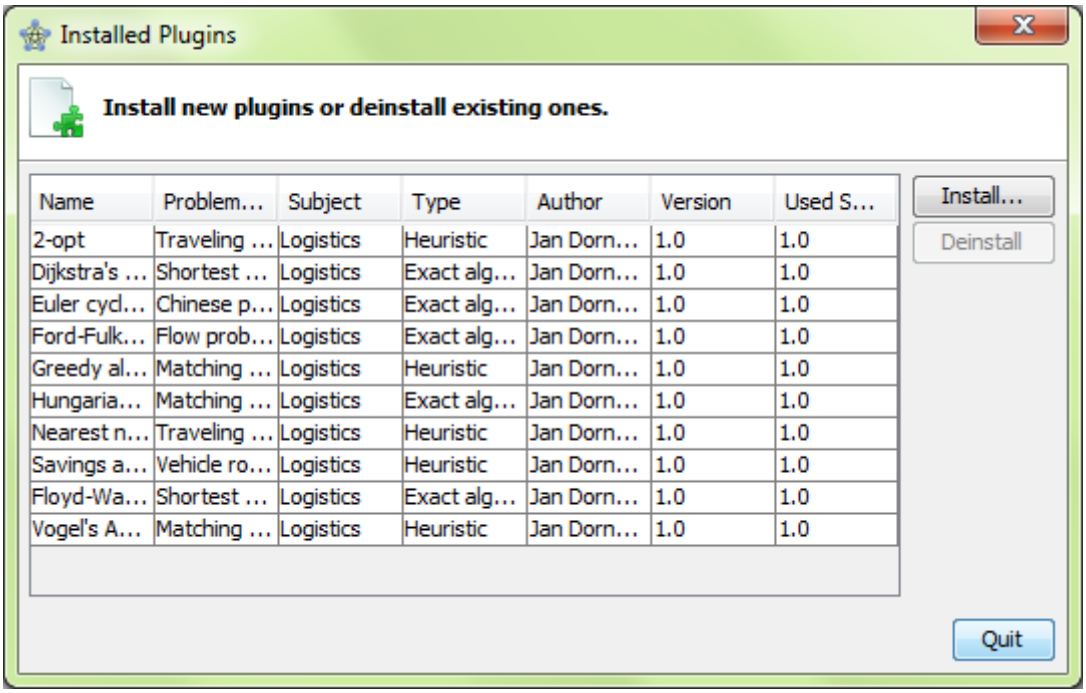
The dialog lists all installed algorithms (plugins). You have to select an algorithm from the list and press „Ok“ to open the algorithm.
Before you open an algorithm you can make preferences. With the preferences you can individualize the selected algorithm. The preferences can refer to the problem entity you have to create, the look and feel of the algorithm, its behavior or something like that.

In addition to the preferences the dialog displays information about the algorithm.

You can use the search field above the list to find an algorithm more quickly. Enter the search word and afterwards all applicable entries are shown filtered in the list.

2.4 Dialog: Installed Plugins

The dialog „Installed Plugins“ is accessible on „Tools“ → „Install New Plugins...“.



The dialog lists all installed plugins in a table.

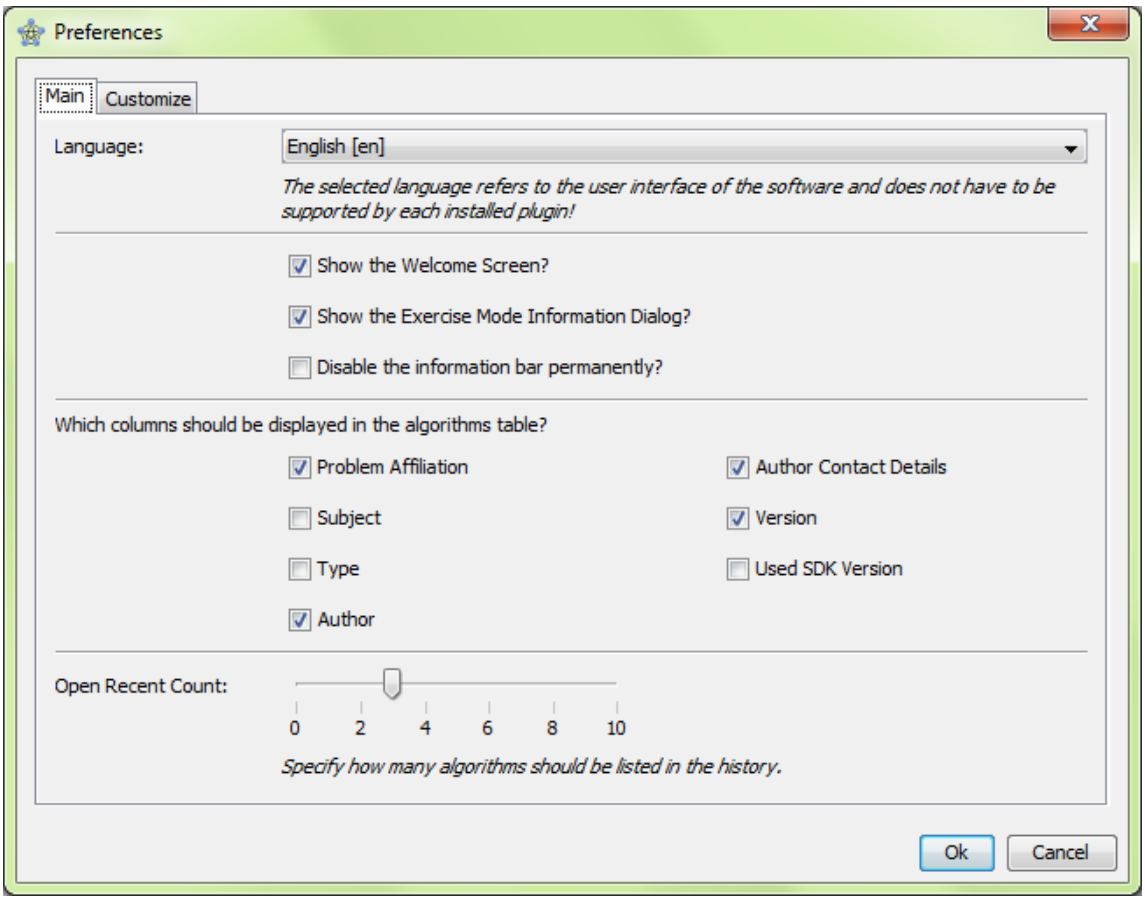
Installation of new plugins:
Click on „Install...“ to install a new plugin and afterwards choose the plugin from your hard drive. The plugin has to be a Java Archiv (JAR file). Confirm the file chooser dialog with „Ok“.
If the plugin could not be installed then a message with the description of the error is displayed. In case of failure please contact the plugin developer.

Deinstallation of existing plugins:
Select the corresponding entry of the plugin in the table and click on „Deinstall“ to remove (deinstall) the plugin. Afterwards the plugin is no longer available.

2.5 Dialog: Preferences

The dialog „Preferences“ is accessible on „Tools“ → „Preferences“.

2.5.1 Main



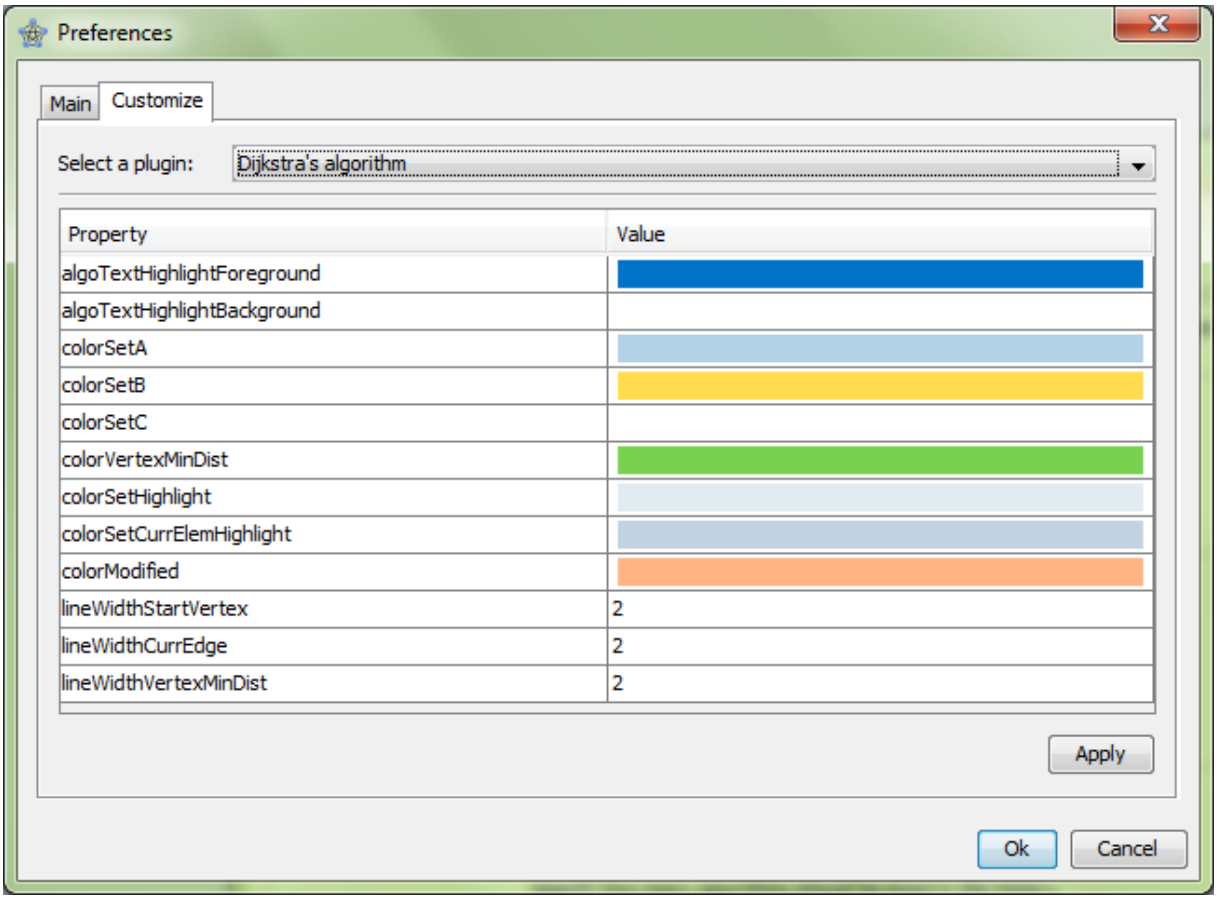
In the tab „Main“ you can specify general settings of the software.

You can determine which language the user interface of LAVES should use. The available languages are presented to you in a list.
Hint: The selected language refers to the user interface of the software and must not be available at every installed plugin. Although each plugin reverts to the configured language settings the plugin must not support this language. If the language is not supported by a plugin then the plugin should load the default language settings.

In addition you have the possibility to reactivate the welcome screen if you have closed it before or you can disable the informationbar permanently. You can also activate the exercise mode information dialog again if you have chosen the „do not show this dialog again“-opion previously in the dialog.

Furthermore you can configure which columns should be shown in the table of the dialog „New“ and how many recently opened algorithms should be listed in the history.

2.5.2 Customize



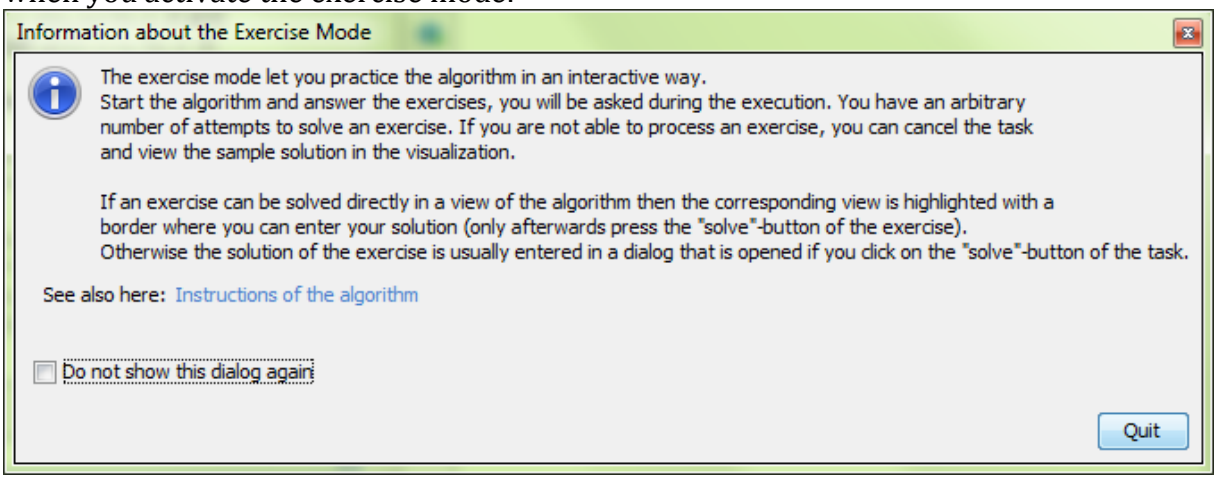
In the tab „Customize“ you can customize the installed plugins to fit your individual needs.

Firstly select a plugin from the list. Afterwards you can modify the customizable properties of the plugin.
To apply the modifications to the plugin please click on the „Apply“ button.

3. Exercise Mode

After you have activated the exercise mode the exercises area is opened. This area is divided into the exercises list and the evaluation panel.
If you start an algorithm with an activated exercise mode then exercises are presented during the execution of the algorithm that you have to solve.

An explanation oft he exercise mode is display in a related information dialog that opens when you activate the exercise mode:



If the dialog should be disabled permanently then you have to check the corresponding option in the dialog. If you want to show this dialog again you have to go to the preferences.

To process an exercise the options „Solve Exercise“ and „Give Up Exercise“ are available.
If an exercise can be solved directly in a view of the algorithm then the corresponding view is highlighted with a colored border. There you can enter your solution and only after you have entered the solution press the „Solve Exercise“ button.
If an exercise is not related to a specific view (meaning there is no highlighted view) , you can usally press the button immediate to solve the exercise which opens a dialog where you can enter your solution.

Depending on the exercise it could be shown further options. Look at the image above where you can see two additional options, the „Input Hint“-Option and the „Annotation“-Option.
The „Input Hint“-button displays information about how and where the exercise has to be solved.
If the related step of the exercise contains an annotation then you can click on the „Show Annotation“ button to display the annotation. This annotation may be helpful in solving the exercise.

In the lower part of an exercise you get informed about additional information like how many attempts you have taken to solve the exercise, your last solution and the result of

the exercise. The result is visualized by a status icon. The meaning of the icons are shown in the table below.

	**You have passed the exercise on the first attempt.**
	**You have required several attempts to solve the exercise. The achievable credits are divided by the number of attempts.**
	**You could not solve the exercise.**
	**Your last solution was wrong, but you can click onto the icon to show a hint that should answer why the exercise has failed.**

4. Language

In this section we want to explain how LAVES can be extended by additional languages.

Please see here if you want to configure the language of the user interface.

The language information of LAVES is located in the subfolder „/lang“. Beside the language file „lang.txt“ their are located further subfolders for multilingual documents that are included with LAVES. That covers the user guide and the HowTo article.

It is recommended that you update the language file and the subfolders with multilingual documents when you want to integrate a new language (see below).

Update the language file:
Open the file „lang.txt“ with a text editor.

Syntax:

//	**Comment** **If a line begins with a comment character then the line is ignored. A comment can only be an entire row.**
$	**Label** **The dollar character introduces a language label. The language file contains all labels that are supported by the software. It cannot be added new language labels.**
#	**Language ID** **The hash tag introduces a language entry of a label and serves as an identificator. If you would like to implement a new language entry then you have to add a new language ID with the corresponding token and its description in the corresponding language.**

If you want to add a new language then adjust the label „LANGUAGES“ first by adding the corresponding language ID.
Example: #fr = Français

Afterwards every other label has to be completed with the new language id by simply adding the ID to the already existing ones.
Example:
$WELCOME_MESSAGE
#en = ...
#de = ...
#fr = Bienvenue en LAVES!

Save the language file at the same location and with the same name and pay attention to the text file encoding which may not be modified. In general you have to save the file in „UTF-8“ encoding.

Update subfolders:

As mentioned above the subfolders have to be updated too because they also contain language information.
For that you create a new folder in the subfolders with the name of the language id you have added to the language file and insert the content in the new language.
Tip: Use the already existing language data from the other subfolders and change the content to the new language.
You have to consider that the file names may not changed and have to be the same in all subfolders.

Do you extend LAVES by a new language? We would appreciate if you mail to jan.dornseifer@student.uni-siegen.de or dominik.kress@uni-siegen.de and send us the language data so that we can add the language to the base package of LAVES.

5. FAQs – Frequently Asked Questions

1. **Question**: LAVES does not run – Error: Main class not found – What can I do?
   Answer: Ensure that your Java Runtime Environment (JRE) complies with the requirements and if necessary, update the JRE. For further information see here.
2. **Question**: The welcome screen is not displayed any more – Why and what can I do to make it visible again?
   Answer: The welcome screen will not be displayed if you have closed it before. To make the welcome screen visible again you have to go to the preferences and enable the corresponding option. After a restart the screen is visible again. See also here.
3. **Question**: How can I open a (new) algorithm?
   Answer: Go to „File“ → „New...“. Choose the algorithm you would like to open from the list. Specify the preferences (optional). Click on „Ok“.
4. **Question**: The algorithm is executed too fast – What can I do?
   Answer: You can specify the execution speed of every algorithm individually. Use the slider in the toolbar or go to „Algorithm“ → „Change Execution Speed...“.
5. **Question**: I have closed a view of the algorithm – How can I reopen the view?
   Answer: Go to „View“ and activate the corresponding view in the menu.
6. **Question**: I want to customize the colors or the look and feel of an algorithm – Is that possible?
   Answer: As far as the corresponding algorithm provides customization you can go to „Tools“ → „Preferences“ → „Customize“ and adjust the algorithm.
7. **Question**: I want to install a downloaded plugin – How can I do that?
   Answer: Go to „Tools“ → „Install New Plugins...“. Click on „Install...“. Choose the plugin from your hard drive and click on „Ok“.
8. **Question**: I cannot install a downloaded plugin – What can I do?
   Answer: If the installation of a plugin fails then the downloaded plugin is damaged. Please contact the plugin developer and inform him about the error.
9. **Question**: LAVES crashed – What happened?
   Answer: A crash can have several reasons. Please send us an expressive error description, the log file of the program (located in the subfolder „/log“) and

possibly images of the crash to jan.dornseifer@student.uni-siegen.de or dominik.kress@uni-siegen.de so that we can investigate the crash.

10. **Question**: I have changed the language settings but there are algorithms (plugins) that do not use the configured language – Why?
    Answer: If you change the language settings then the language must not be supported by every algorithm. If a configured language cannot be displayed in an algorithm and it is shown another language or a missing language then the algorithm does not support the language that you have set up. Please contact the plugin developer and offer that you can extend the algorithm by the requested language!