Maximum flow in a network

User Guide

Piotr Janaszek

Faculty of Mathematics and Information Science
Warsaw University of Technology

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0.1	16.05.2012	Piotr Janaszek	Created document
0.2	16.05.2012	Piotr Janaszek	Created Preface
0.4	17.05.2012	Piotr Janaszek	Created Interface Overview
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0.9	20.05.2012	Piotr Janaszek	Added Graph Manipulation and Troubleshooting
1.0	23.05.2012	Piotr Janaszek	Fixed mistakes and changed document formatting

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PREFACE

Developed application presents three maximum flow algorithms, mainly Ford-Fulkerson, Edmonds-Karp and Dinitz Blocking.

Program is able to retrieve necessary data about graph manually by user input via GUI (Graphical User Interface) and/or automatically from external XML file.

The application graphically presents structure of the graph to the user. Result of calculations of maximum flow algorithms are also visualized by marking the path from source to the target node. Application exports graphs and results to external XML file.

LAUNCH

Before launching the application, make sure that in the same directory there are:

- application executable file,
- NetworkFlow.Provider DLL library (necessary for application startup) and Microsoft.GLEE, Microsoft.GLEE.Drawing, Microsoft.GLEE.GraphViewerGDI DLL libraries (needed for displaying graph).

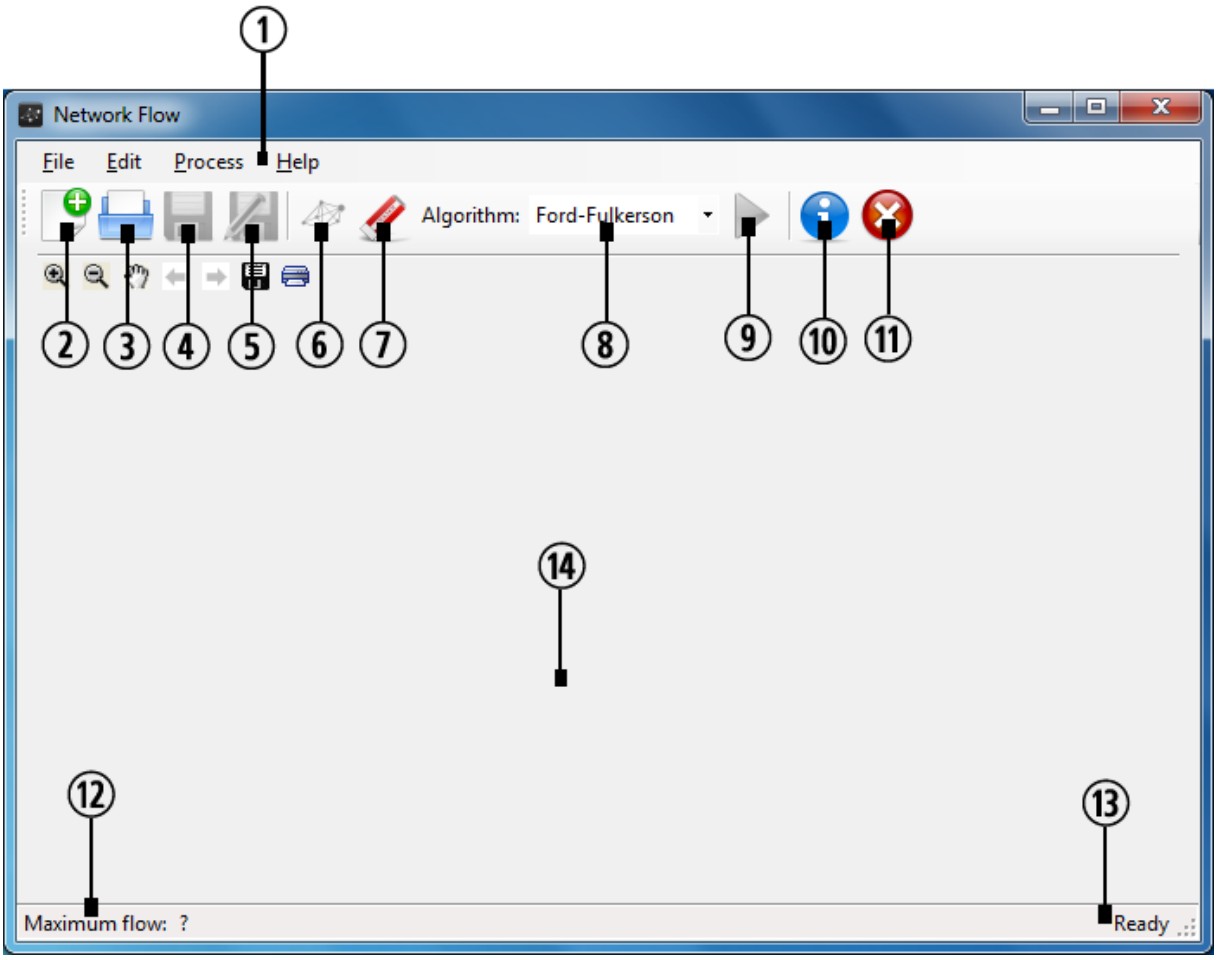
INTERFACE OVERVIEW

In this section the reader can get to know the application interface layout. This will help to use the application and understand description of steps in next sections.

The main window of the running program consists of four parts.

- On the top, there is a menu strip with four items, which provide main functionalities of the program.
- Below, there is a tool strip consisting of nine buttons with icons on them and one combo box. These buttons correspond to items under menu, but they provide faster access and intuitiveness as well as the combo box containing the list of available algorithms.
- The biggest part is prescribed for displaying the graph, manipulating it via point-and-click technique and presenting results.
- At the bottom, there is a status bar displaying the state of the program, and current calculated or maximum flow in displayed graph.

MAIN WINDOW



1. Menu strip. Consists of four items: File, Edit, Process, Help
2. New Graph button.
3. Load From XML button.
4. Export Graph to XML button.
5. Export Results button.
6. Graph Summary button.
7. Reset Graph button.
8. Algorithms combo box.
9. Calculate Maximum Flow button.
10. About button.
11. Exit button.
12. Maximum flow label.
13. Status label.
14. Drawing area.

USAGE

CREATE NEW GRAPH

To create a new graph manually the user should:

- click New Graph button on tool strip or
- select File -> New Graph.

If the application detects that the user is currently working with another graph a message box will appear with confirmation. At this stage the user can select Yes to create new one or No to resign and continue to work with the current graph.

LOAD GRAPH FROM FILE

To load graph from XML file the user should:

- click Load From XML button on tool strip or
- select File -> Load From XML.

Open File dialog will appear in which user should select file to import. Please note that files are filtered so that only XML files are visible.

Previously disabled Export Graph to XML, Graph Summary and Calculate Maximum Flow buttons will be enabled. If the file is processed correctly the graph will be drawn in the drawing area. In case of large graphs in the status bar the user will see progress bar and state Opening. When import is finished the state is set back to Ready.

EXPORT GRAPH TO XML

To export a graph to XML file the user should:

- create a graph first,
- click Export Graph to XML button on tool strip or
- select File -> Export Graph to XML

Save File dialog will appear in which user should type file name to export. The default value is specified in order to do a quick save. Please note that files are filtered so that the exported file will have XML extension by default.

EXPORT RESULTS

To export results to XML file the user should:

- do some calculations on a graph,
- click Export Results button on tool strip or
- select File -> Export Results

Save File dialog will appear in which user should type file name to export. The default value is specified in order to do a quick save. Please note that files are filtered so that the exported file will have XML extension by default.

GRAPH SUMMARY

To see graph summary the user should:

- click on Graph Summary button on tool strip or
- select Edit -> Graph

A new dialog box will appear containing information about current graph such as number of nodes, number of edges, source, sink, maximum flow etc.

RESET GRAPH

To reset a graph (clear edges' capacity usage, and calculated maximum flow) the user should:

- click on Reset Graph button on tool strip or
- select Edit -> Reset Graph

The edges' capacity usage as well as calculated maximum flow will be cleared which will be reflected in the drawing area (update).

CALCULATE MAXIMUM FLOW

To calculate maximum flow the user should:

- choose mode: at once or Step by Step.
- To change mode please select Edit -> Step by Step. If there is a tick near this option that means the Calculate Maximum Flow button works in step by step mode.
- click Calculate Maximum Flow button (once or many times till it is greyed-out, it is dependent on the chosen mode) on tool strip or
- select Process -> Calculate Maximum Flow

When the maximum flow is calculated a message box will appear presenting results of the calculations.

ABOUT

To see info about the author and application the user should:

- click on About button on tool strip or
- select About -> Help

A new dialog box is displayed showing information about the author and the application (version, description etc.).

NOT ALLOWED ACTIONS

While using the application, the user can attempt to perform not allowed actions. In such cases, program blocks execution of the action and informs the user why it is not allowed by tool-tip pop-up or error message.

GRAPH MANIPULATION

Graph manipulation is done via point-and-click technique. It highly increases the ease of usage and makes the application meet modern user interface design standards.

ADD NODE

To add new node the user should:

- right click on a free space in the drawing area,
- select Add Node. A new dialog box will appear in which Vertex ID must be specified.
- accept by clicking OK button
- newly added node will appear in the drawing area

Please note that there can be only one node with a given ID.

EDIT NODE

To edit an existing node the user should:

- select (hover) the node to edit. Then the node will change color.
- right click on it and select Edit Node. A new dialog box will appear in which Vertex ID can be edited as well as node mode (source, sink, normal)
- accept by clicking OK button
- edited node will be shown in the drawing area

Please note that there can be only one node with a given ID. To calculate maximum flow there must be a node with set mode to Source and a node with set mode to Sink.

REMOVE NODE

To remove an existing node the user should:

- select (hover) the node to remove. Then the node will change color.
- right click on it and select Remove Node.
- drawing area will be updated

Please note that all edges that were coming to the removed node as well as coming out ones will be also removed.

ADD EDGE

To add new edge the user should:

- right click on a free space in the drawing area,
- select Add Edge. A new dialog box will appear in which source Vertex ID, target Vertex ID and flow must be specified.
- accept by clicking OK button
- newly added edge will appear in the drawing area

Please note that the application will not allow to create edges going from and to the same node.

EDIT FLOW

To edit an existing edge's flow the user should:

- select (hover) the edge to edit. Then the edge will change color.
- right click on it and select Edit Flow. A new dialog box will appear in which flow can be edited.
- accept by clicking OK button
- edited edge will be shown in the drawing area

REMOVE EDGE

To remove an existing edge the user should:

- select (hover) the edge to remove. Then the edge will change color.
- right click on it and select Remove Edge.
- drawing area will be updated

TROUBLESHOOTING

MORE HELP

In case of problems you cannot solve, e-mail the author with as much information as possible as it is possible.

Contact:

Piotr Janaszek – janaszekp@student.mini.pw.edu.pl