Maximum flow in a network

Business Analysis

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History of changes

Version	Date	Author	Description
0.0.1	24.02.2012	Piotr Janaszek	Created document
0.2	25.02.2012	Piotr Janaszek	Created Preface For Management
0.4	26.02.2012	Piotr Janaszek	Created Requirements
0.4.5	26.02.2012	Piotr Janaszek	Added User Interface to Requirements
0.7	28.02.2012	Piotr Janaszek	Created Main User Paths and Basic Sources Of Needed Data
0.9	29.02.2012	Piotr Janaszek	Created Post face
1.0	01.03.2012	Piotr Janaszek	Fixed mistakes and changed document formatting
1.1	06.03.2012	Piotr Janaszek	Fixed formal mistakes

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PREFACE FOR MANAGEMENT

The aim of the project is to develop the application which calculates maximum flow in a network. The analysis should be done using Ford-Fulkerson algorithm. The application is said to visualize input graph and calculate maximum flow depending on values specified by user.

The problem of maximum flow is common in computer science but also is present in other areas of life such as transportation. Hence the application should ease the calculations in a convenient way.

The application is supposed to be user-friendly. Moreover, the user interface should be clear and intuitive in use.

REQUIREMENTS

Input data

- The input data can be read from file.
- Only one network flow is analyzed at once.
- Input file can be reloaded.
- Input data can be added from GUI.
- Whole network is analyzed.
- Input data can be modified.

Processing

- The application uses Ford-Fulkerson algorithm.
- The application is able to calculate maximum flow in a network.
- The application plots the graph of the network in the main window based on the input data (vertices, edges that connect them and add labels showing maximal capacity).
- The application visualize the flows by changing the edges' color from black to red and updating the label showing used capacity.

Results

- The results of a calculation are displayed on the network plot. The resulting graph have edge labels updated showing used and maximal capacity.
- Short summary is shown containing results of calculations in a form of text (i.e. vertices, edges, maximal capacity, used capacity).
- The results of a calculation can be saved into external file. User may want to store the results shown by summary to the hard disk.

User Interface

- The user interface is graphical.
- About 80% of a window is dedicated to graph visualization. The rest 20% is for showing navigation menu panel with buttons.
- Buttons are described in words shortly and precisely. Proposed buttons are: Load file; Add vertex, Add edge, Remove vertex, Remove edge, Create graph, Calculate, Save.
- Description of buttons and functions are clear, easy to understand and do not confuse the user.
- The interface is intuitive.

MAIN USER PATHS

There are two main user paths.

User wants to calculate maximum flow using external file with data:

1. User is pressing *Load file* button and selecting the file with graph data.
2. Application is loading the selected file and analyzing it as well as plotting the visualization graph.
3. User may edit data at this point. Each modification is automatically reflected on the graph.
4. User is pressing *Calculate button*.
5. Application is displaying the results of the calculation in the text form (vertices, edges, maximal/used capacity) and the resulting graph with updated labels showing maximal/used capacity.
6. User may save the results into the external file.

User wants to calculate maximum flow by providing data manually:

1. User is pressing *Create graph* button.
2. Mini editor is opened and then all vertices and edges as well as capacity can be defined.
3. Application is processing provided data as well as plotting the visualization graph.
4. User may edit data at this point. Each modification is automatically reflected on the graph.
5. User is pressing *Calculate button*.
6. Application is displaying the results of the calculation in the text form (vertices, edges, maximal/used capacity) and the resulting graph with updated labels showing maximal/used capacity.
7. User may save the results into the external file.

BASIC SOURCE OF NEEDED DATA

All needed data for the application are values to create a network (graph). They can be provided from external file or manually from the GUI layer. The application uses only this data and processes its content.

POST FACE

The application functionality is rather simple and it is designed to calculate maximum flow in a network, create the graph diagram and display the results which can be saved into the hard disk. It uses well-known Ford-Fulkerson algorithm.