Karlsruhe Institute of Technology

Algorithms for graph visualization

Project - Orthogonal Grid Layout with Small Area

WINTER SEMESTER 2013/2014

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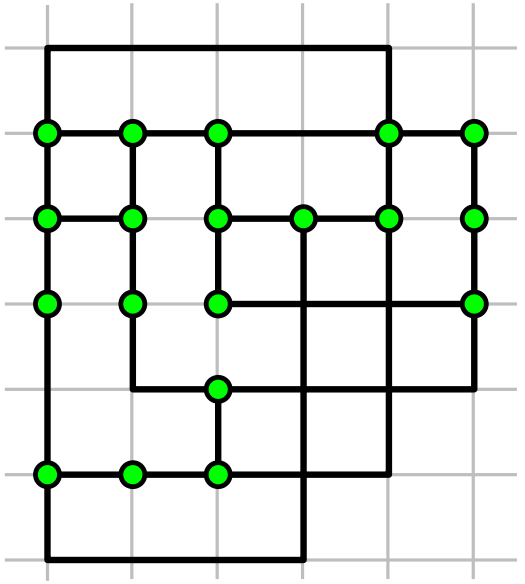
Orthogonal Grid Layout with Small Area

Let $G = (V, E)$ be a graph with maximum degree 4.
An **orthogonal grid layout** is a drawing of G such that:

- Vertices are on distinct grid points
- Edges are **orthogonal**, (sequence of vertical and horizontal segments)
- Bends lie on grid. No limit on the number of bends.
- Crossings are allowed. They occupy grid points. No limit on the number of crossings.
- Overlaps are forbidden.



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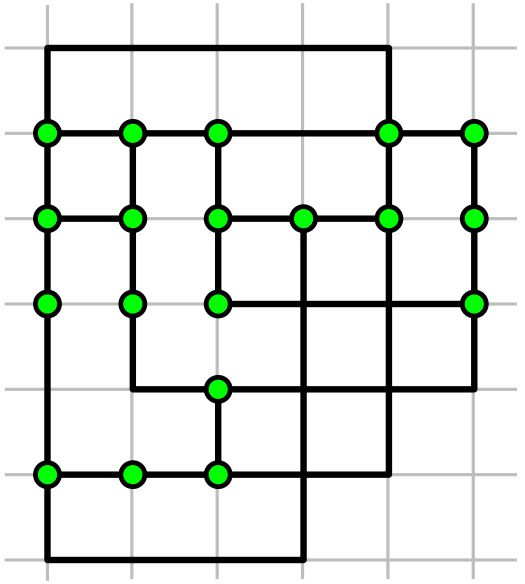

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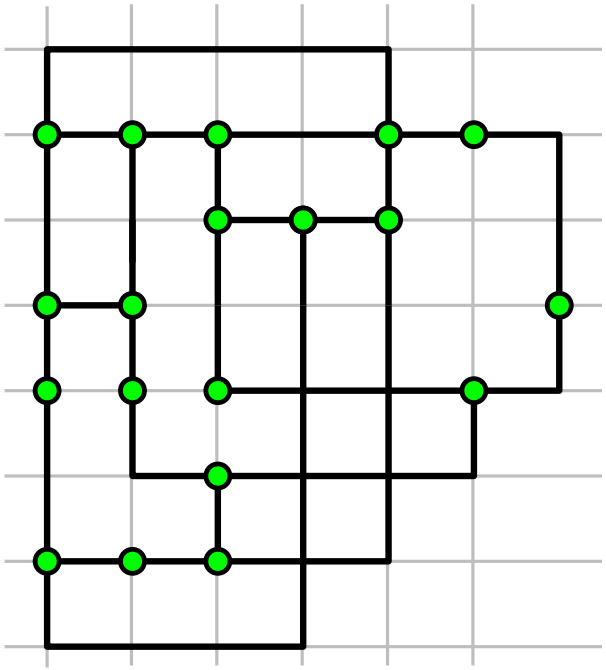
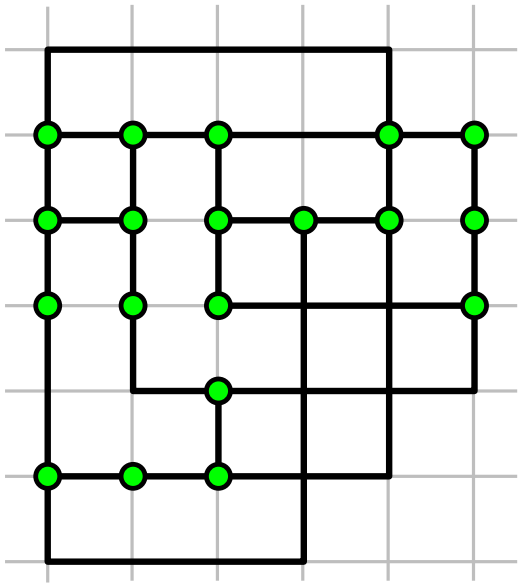
We are looking for orthogonal grid drawings with small area.

Orthogonal Grid Layout with Small Area

Given an orthogonal layout of G one can do the following to reduce the area:

- Move vertices
- Move edges
- Redraw/re-route edges





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Demo

Orthogonal Grid Layout with Small Area

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- **Input and output** format:

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5                                  ← Number of vertices

4 2                                ← Vertex 0
2 4
4 4
6 4
4 6

1 0 [ 2 2 ]                        ← Edge (1, 0)
0 3 [ 6 2 ]
2 1 []
0 2 []          Sequence of bend
1 4 [ 2 6 ]     coordinates
4 3 [ 6 6 ]          ↓
0 4 [ 4 0 0 0 0 8 4 8 ]
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- **Our target**: A program that takes as input a graph layout and outputs a layout with as small area as possible.
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- **What are you expected to do?**
  - Come up with your own algorithm, heuristics, interactive approach
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- **Input and output** format:
- **What are you expected to do?**
  - Come up with your own algorithm, heuristics, interactive approach
  - Use existing algorithms, their combination, modifications
- **What can you use?**
  - Any library freely available for academic use
  - Any graph drawing algorithm, whether included in the lecture material or not

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Some Available Tools

- **OGDF**- Open Graph Drawing Framework
  - C++ library with implementations of graph drawing algorithms
  - open-source, free
  - Contains an implementation of orthogonal layout algorithm
- **yFiles**
  - Java library with implementations of graph drawing algorithms
  - Version 2.9 can be provided
  - Implementation of orthogonal layout algorithm
  - Compaction algorithm for orthogonal layout
- **JUNG**-Java Universal Network/Graph Framework
  - Java library with algorithms for analysis and visualization of graphs
  - open-source, free
- **Gephi**-Interactive Visualization and Exploration Platform
  - open-source, free
  - Plugin using Gephi API
  - Existing plugin?

Data

- You will be provided with several data files to test your algorithms
- An application that displays this data format and allowes manual modifications

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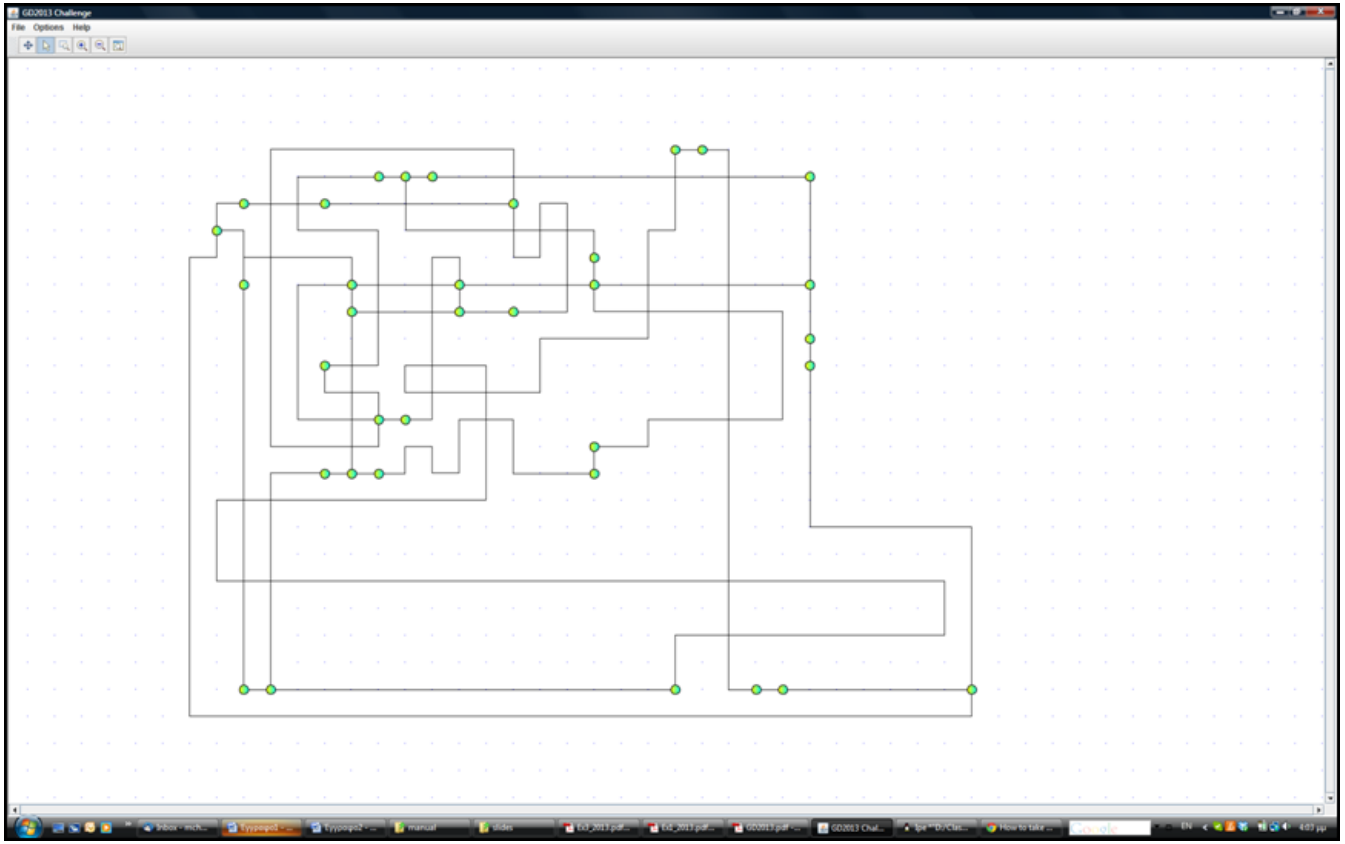

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- Think but have your mind open in the upcomming lectures to get further ideas!

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  - **2nd Meeting** - Finalize Ideas: **Mid January**
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  - **4th Meeting** -1st Version: **February**
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Presentation

- 20 min presentation (including questions) of the ideas behind your approach
- Competition:
  - Teams will receive a new collection of graphs
  - After one hour, all teams will submit their final drawings
  - The team with the highest cumulative score wins