Julius-Maximilians-
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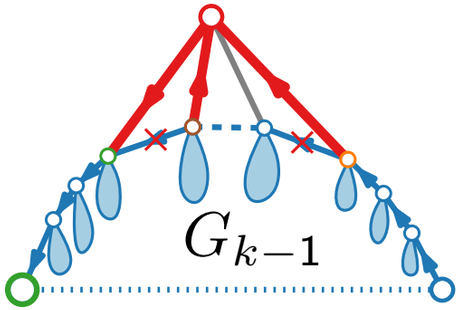
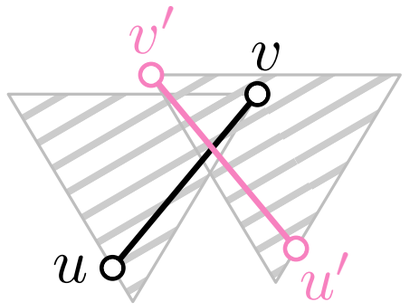
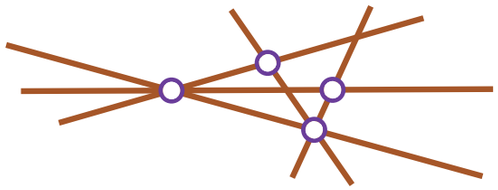
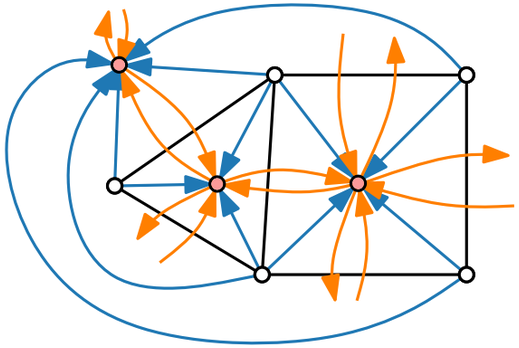


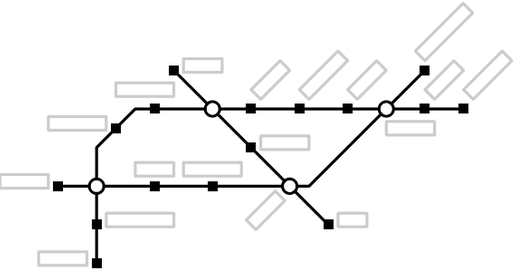


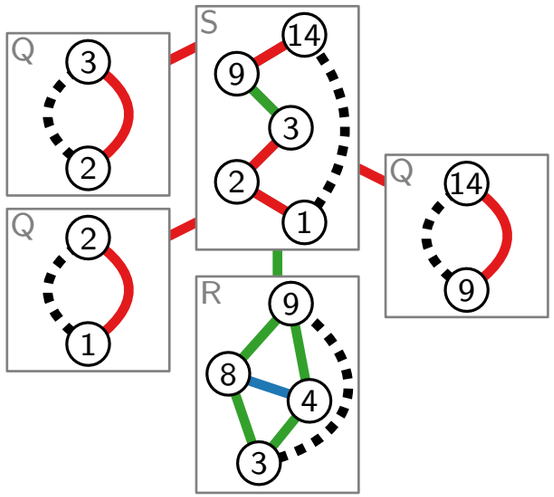




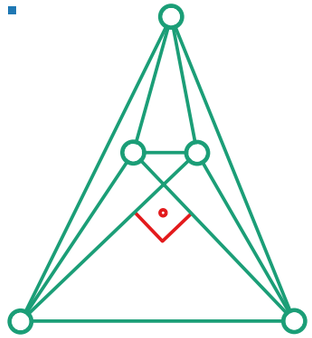
Visualization of Graphs

Summary:
Drawing styles, problems, frameworks, algorithms, . . .

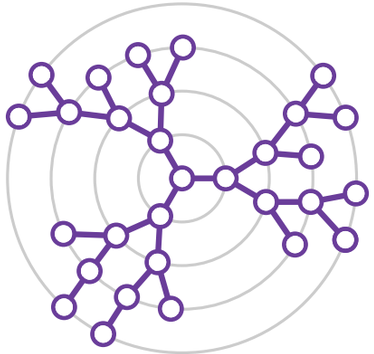


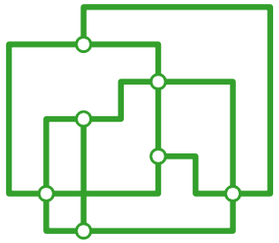


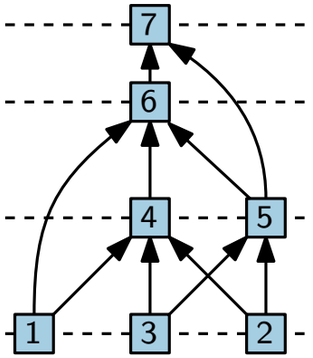
Jonathan Klawitter



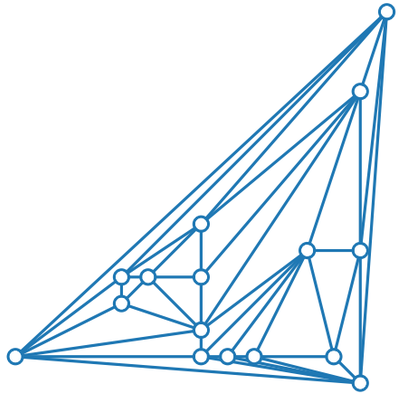
Drawing styles





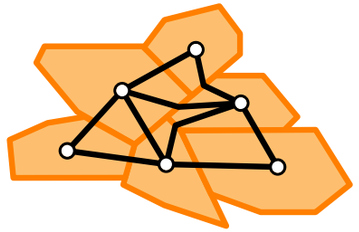


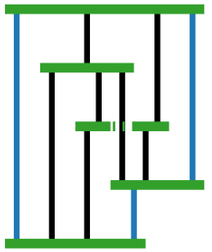
- Radial, HV-drawing
- Orthogonal (two different slopes)
- Hierarchical, layered, upward and upward planar
- Planar, 1-planar, k-planar



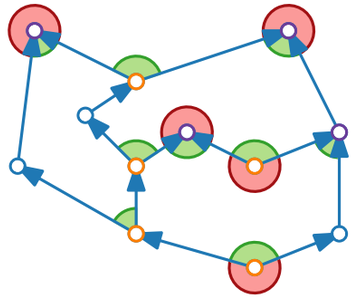
- Edge styles:
  - Straight-line
  - With curves or circular arcs
  - With or without bends
  - Using k slopes (rectilinear, octilinear, hexalinear, . . .)
- Non-planar, e.g. RAC drawings, bundle crossings
- Minimum angle resolution, maximum . . . (some parameter)
- Contact representations (triangles, Ts, Ys, rectangles, . . .)
- Visibility representations (bar visibility)

- Fixed vs. variable embedding
- In the plane, on the sphere, on the donut, in 3D, . . .

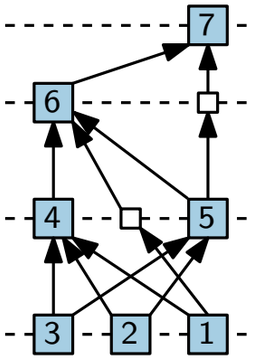




Problems



- **Graph Layout Problem**
- Recognition (Does a graph admit such a drawing/belong to that class?)
- Construction (If yes, then please construct a drawing.)
- Optimisation (minimisation/maximisation) problems:
  - crossings, bundle crossings, drawing in low beyond planarity class
  - area, width, height
  - bends
  - edge lengths
  - angular resolution, . . .



- Is it NP-hard? (Reduction from SAT-variant, reduction from other drawing style, . . .)
- Can we do it in polynomial time?
- Bounds on properties (Crossing Lemma)
- Partial representation extension (and simultaneous representation)

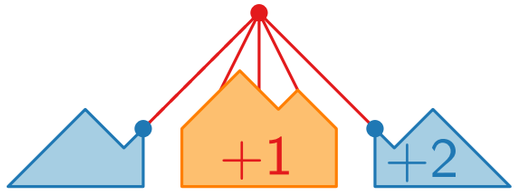
Frameworks, methods, tools

Frameworks

- Sugiyama framework
- Topology-Shape-Metric
- Force-based 

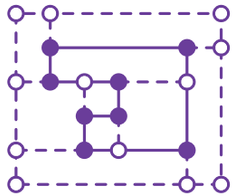
Dynammic programming + decomposition methods

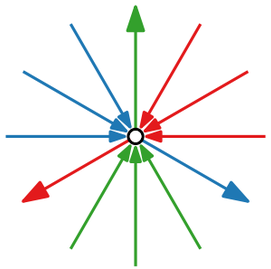
- Post-order (for trees)
- SPQ-tree (for series-parallel graphs)
- SPQR-tree (for biconnected graphs, partial bar visibility representation extension)
- Block-cut tree (for connected graphs)

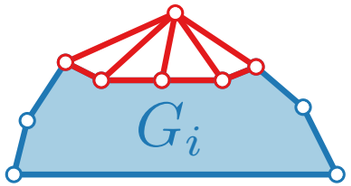


Combinatorial descriptions + other tools

- Canonical order (for plane triangulations, planar 3-connected) + shift method
- Refined canonical order (for planar 4-connected)
- Barycentric method, Tutte embedding
- Schnyder forest, regular edge labeling, orthogonal representation
- Draw “maximal” graph, remove dummy parts later
- Hierarchical clustering
- Flow network







Graph classes

- graphs and digraphs
- st-digraphs, DAGs
- trees and series-parallel graphs
- planar, k-planar and other beyond planar classes
- triangulated, internally triangulated
- upward planar
- biconnected, 3-connected
- bipartite graphs
- metro maps

and graph parameters

- crossing number
- beyond-planarity things...