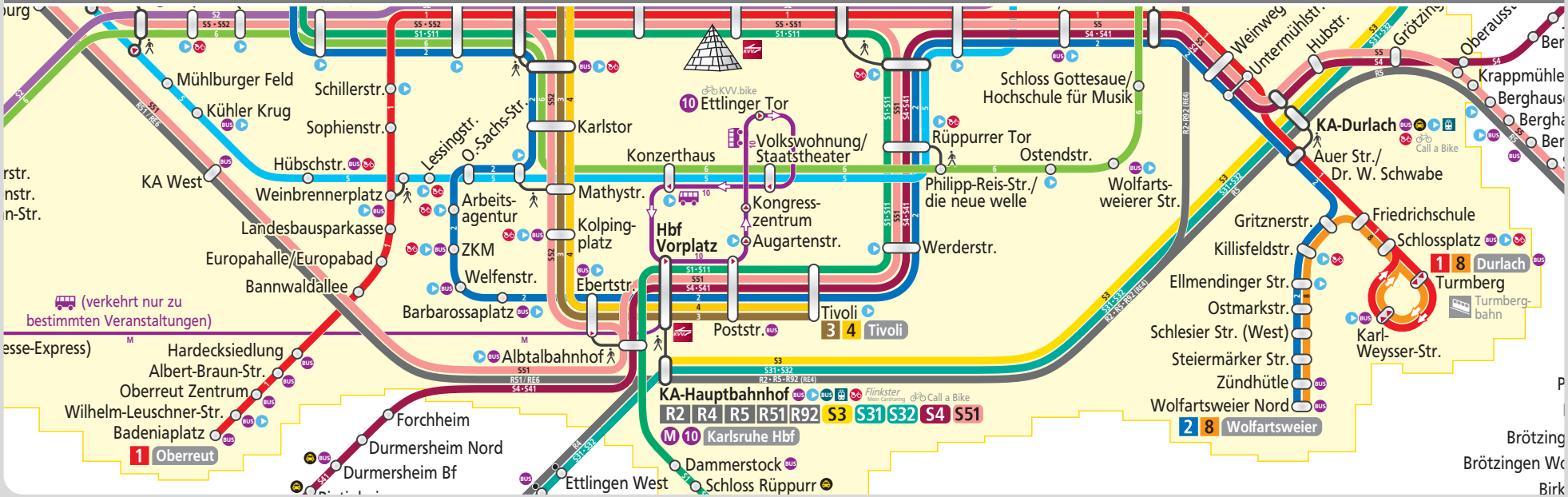
Karlsruher Institut für Technologie

Graph Algorithms

Schedule and Presentation of Topics, October 21, 2016

Institute for Theoretical Computer Science



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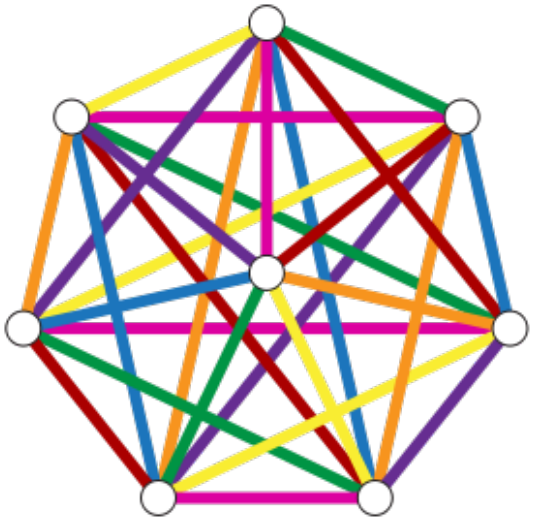
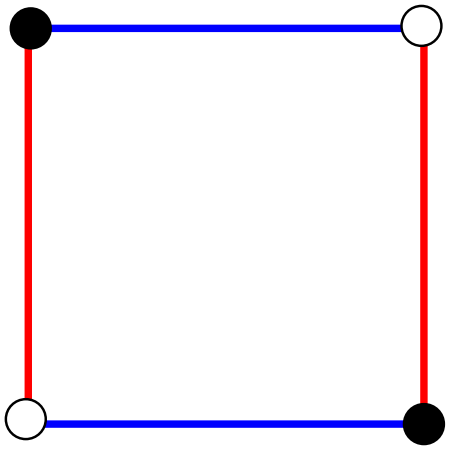
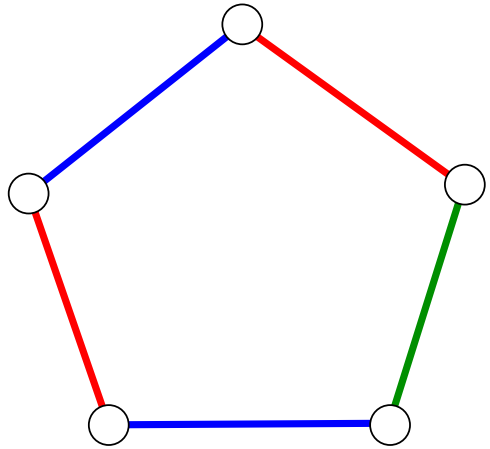
- December 21: Deadline for written summary

Theorems by König und Vizing on Edge Chromatic Number

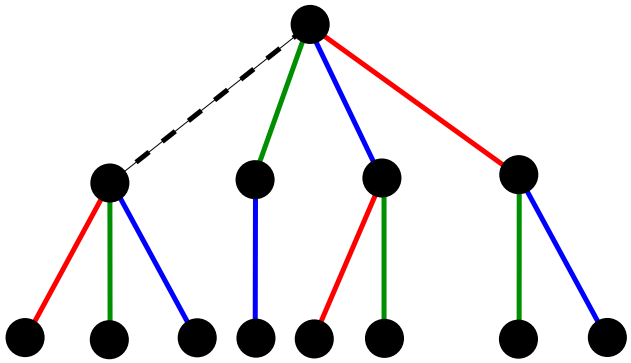




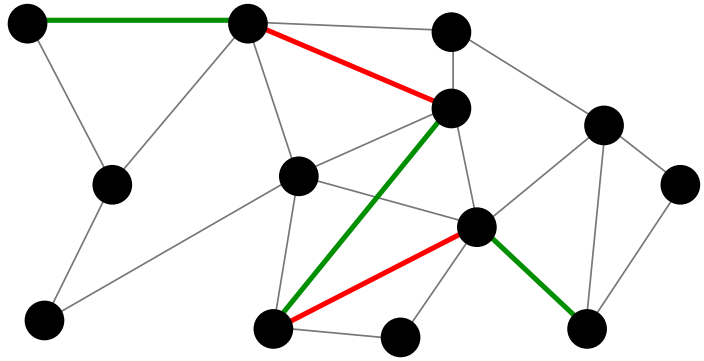


- $\chi'(G) = \Delta(G)$ for bipartitie graphs [1]
- $\chi'(G) \leq \Delta(G) + 1$ in general [1]
- More on class one and class two graphs

Edge Coloring by Misra and Gries



fan

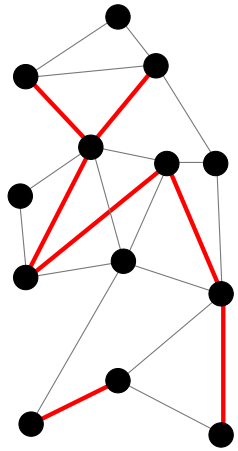


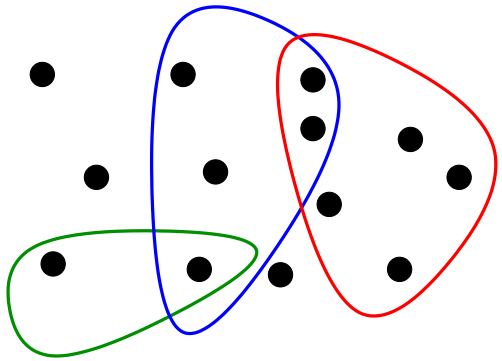
alternating path

- The algorithm [8]
- Proof of correctness and complexity [8]

Greedy Graph Algorithms / Matroids

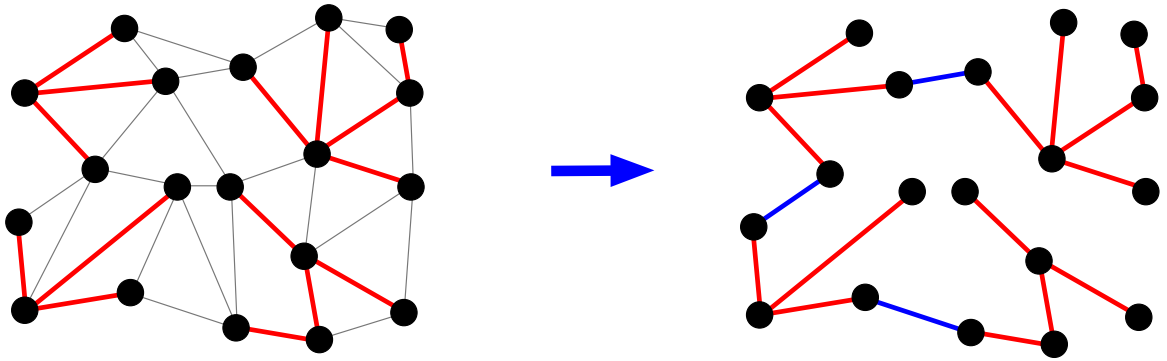
$$\begin{pmatrix}1\\1\\1\\1\\1\end{pmatrix}\quad\begin{pmatrix}1\\2\\1\\2\\1\end{pmatrix}\quad\begin{pmatrix}0\\0\\0\\0\\0\end{pmatrix}\quad\begin{pmatrix}1\\1\\1\\0\\0\end{pmatrix}$$





- Definition and examples of matroids [9, 7]
- Greedy algorithm on matroids [9, 7]
- From greedy algorithms to matroids [9, 7]

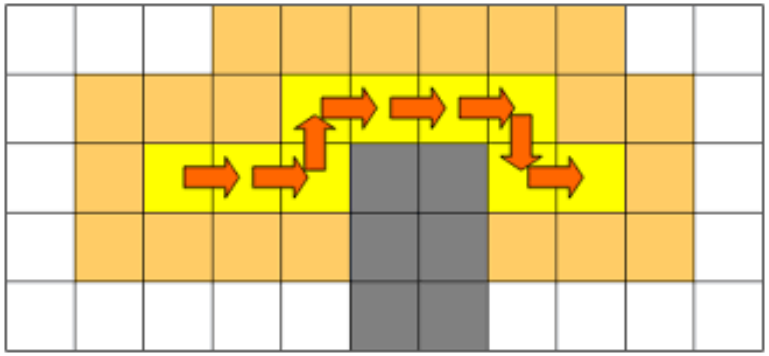
Fast MST by Fredman and Tarjan



From trees to trees of trees

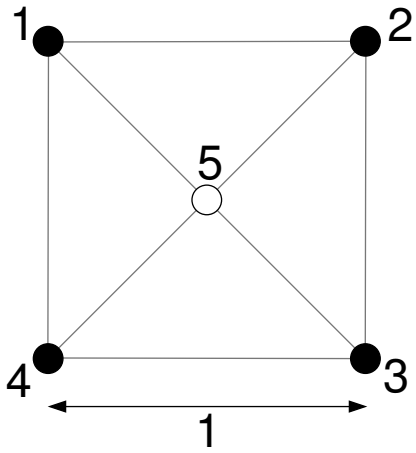
- Remind us of Prim's algorithm [7]
- Drawbacks of Prim's algorithm [7, 3]
- Algorithm by Fredman and Tarjan [7, 3]
- Running time [7]

A^* Algorithm for Shortest Paths

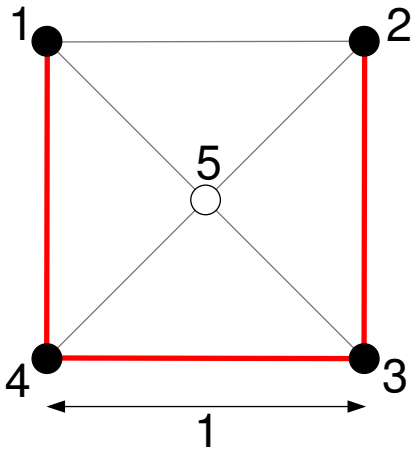


- Original A^* algorithm [5]
- Use of A^* algorithm in route planning [4]

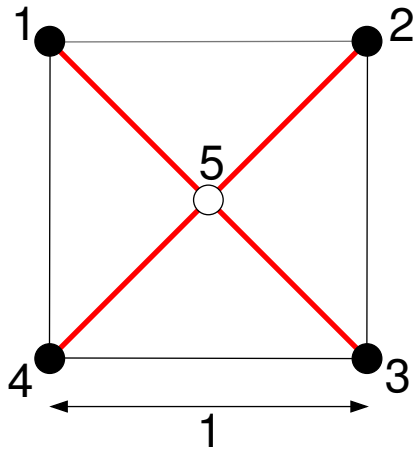
Approximation of Min-Steiner-Trees



$K = \{1, 2, 3, 4\}$



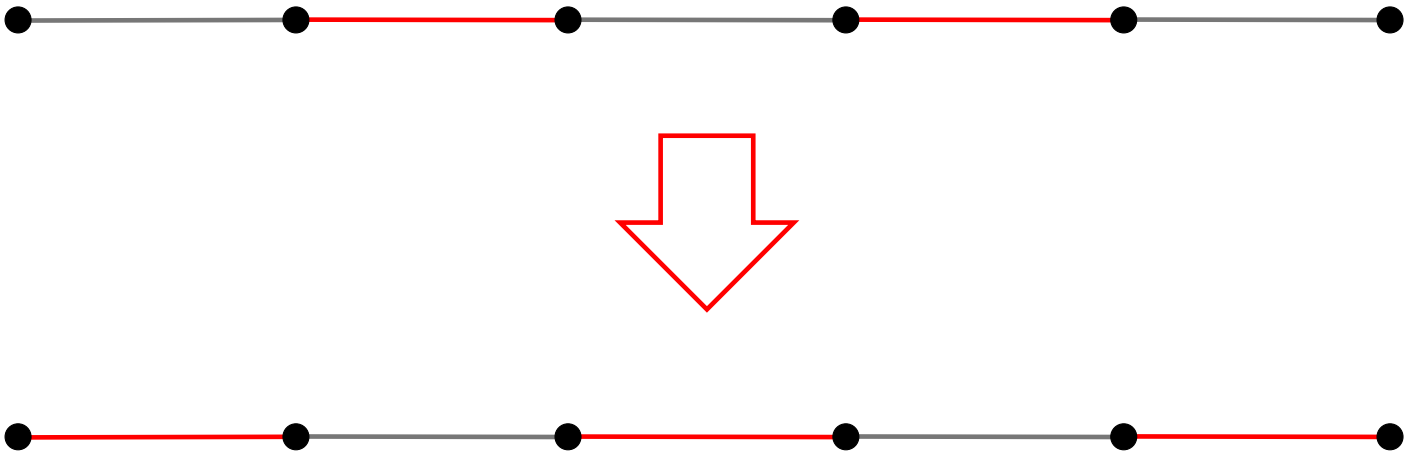
MST



Steiner tree

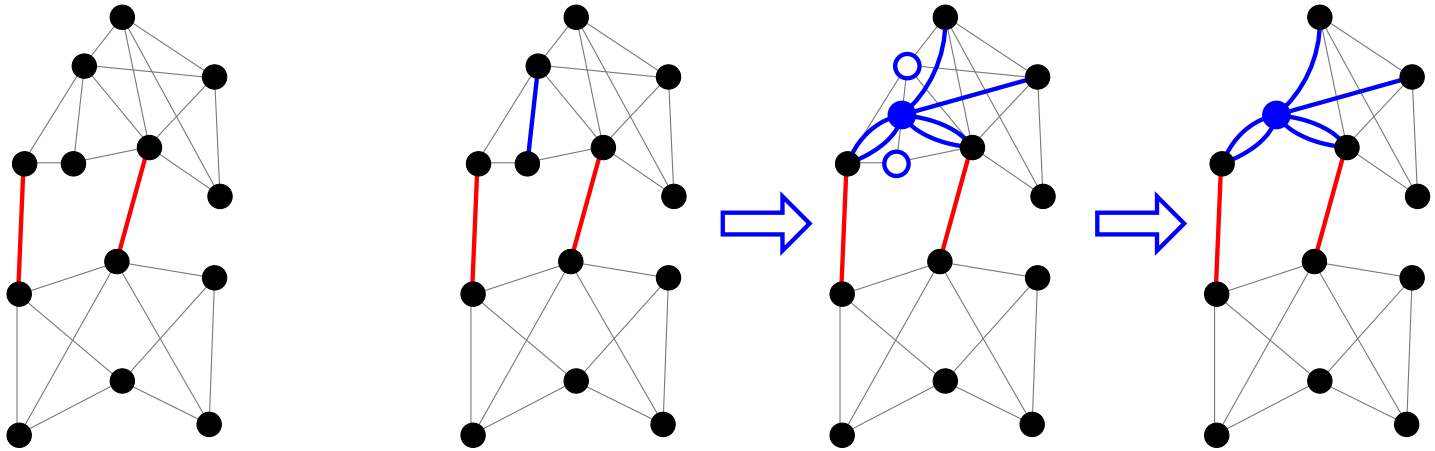
- Definitions, examples [7]
- Approximation algorithm for Steiner trees, correctness [7]

Blossom Algorithm for Maximum Matching



- Augmenting paths [2]
- Blossoms and blossom contraction [2]
- The complete algorithm [2]

Minimum Cuts by Karger and Stein

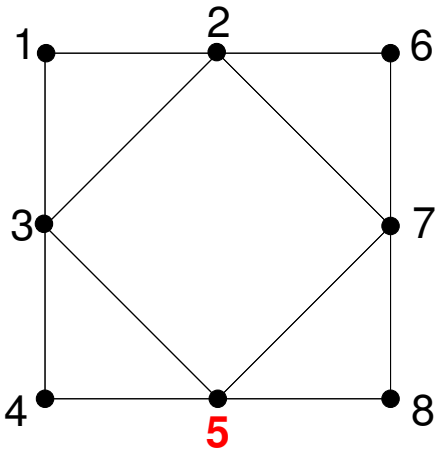


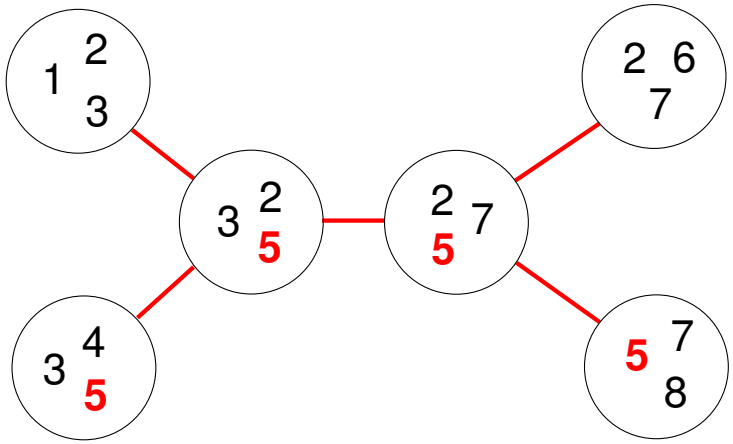
minimum cut

contraction

- Edge contraction: definition and implementation [6]
- Statistics [6]
- Sequential Karger-Stein algorithm [6]

Tree Decomposition





- Definition and examples [7]
- Tree decompositions of trees [7]
- Properties of tree decompositions (cliques, minors) [7]
- Calculating tree decompositions of (chordal) graphs [7]

References (1)

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4. A. V. Goldberg and C. Harrelson.
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References (2)

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7. S.O. Krumke and H. Noltemeier.
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9. J.G. Oxley.
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