

Visualisierung von Graphen

Wintersemester 2019/2020

Einführungsveranstaltung am 15. Oktober 2019

Lehrstuhl für Informatik I

Steven Chaplick Philipp Kindermann Alexander Wolff

Agenda

1. Thema und Konzept
2. Ablauf des Seminars
3. Vorstellung der Vortragsthemen
4. Themenverteilung

Konzept

„Forschungsseminar“ – Was heißt das?

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Ziel: SeminarteilnehmerInnen einen Eindruck von Forschungsarbeit vermitteln

Kursraum in Moodle

WS19:Seminar Visualisierung von Graphen

Startseite

Meine Kurse

WS19_Sem_GraphVis

 Ankündigungen

 Diskussionsforum

Seminar: Visualisierung von Graphen

Umfang: 5 ECTS, 2 SWS

Zeit & Ort: dienstags, 14:15–15:45 Uhr, SE III

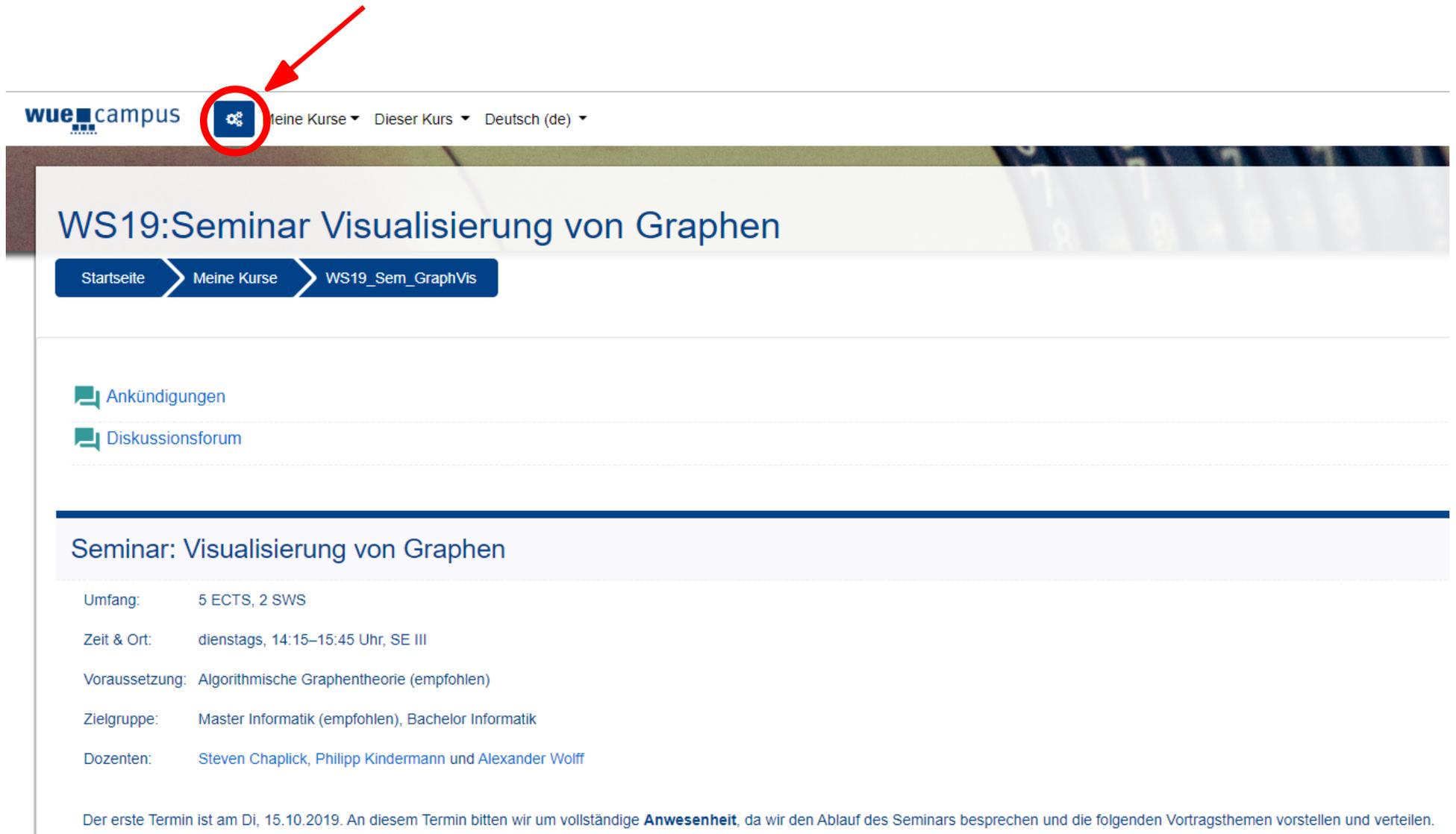
Voraussetzung: Algorithmische Graphentheorie (empfohlen)

Zielgruppe: Master Informatik (empfohlen), Bachelor Informatik

Dozenten: Steven Chaplick, Philipp Kindermann und Alexander Wolff

Der erste Termin ist am Di, 15.10.2019. An diesem Termin bitten wir um vollständige **Anwesenheit**, da wir den Ablauf des Seminars besprechen und die folgenden Vortragsthemen vorstellen und verteilen.

Kursraum in Moodle



wue campus  Meine Kurse ▾ Dieser Kurs ▾ Deutsch (de) ▾

WS19:Seminar Visualisierung von Graphen

Startseite > Meine Kurse > WS19_Sem_GraphVis

-  Ankündigungen
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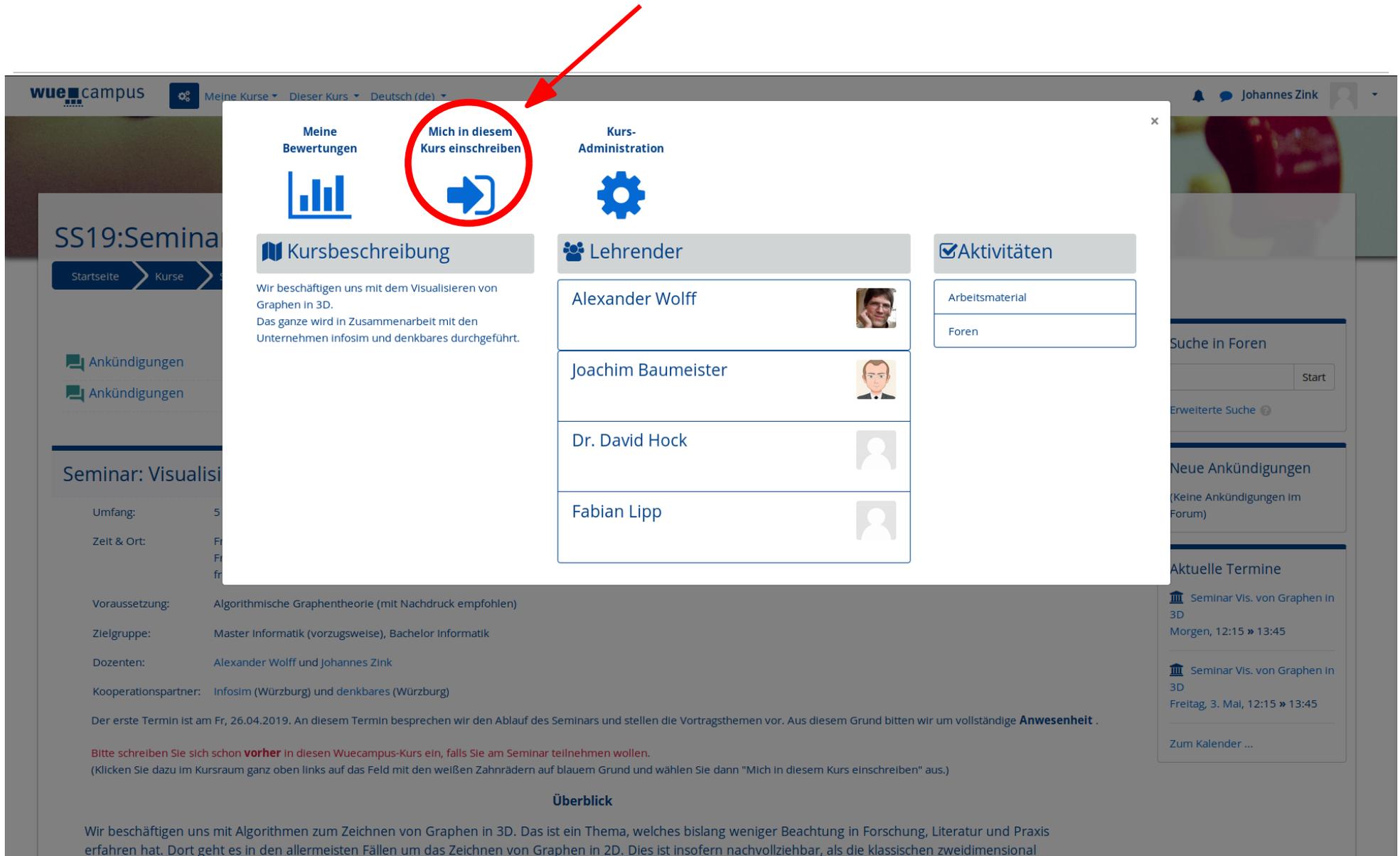
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Kursraum in Moodle



The screenshot shows a Moodle course page for 'SS19:Seminar' with a modal menu open. The modal menu contains several options: 'Meine Bewertungen', 'Mich in diesem Kurs einschreiben' (highlighted with a red circle and a red arrow), and 'Kurs-Administration'. Below these are sections for 'Kursbeschreibung', 'Lehrender' (listing Alexander Wolff, Joachim Baumeister, Dr. David Hock, and Fabian Lipp), and 'Aktivitäten' (listing Arbeitsmaterial and Foren). The background shows course details for 'Seminar: Visualisi...', including a description, prerequisites, and a list of current terms.

Meine Bewertungen

Mich in diesem Kurs einschreiben

Kurs-Administration

Kursbeschreibung

Wir beschäftigen uns mit dem Visualisieren von Graphen in 3D. Das ganze wird in Zusammenarbeit mit den Unternehmen Infosim und denkbare durchgeführt.

Lehrender

- Alexander Wolff
- Joachim Baumeister
- Dr. David Hock
- Fabian Lipp

Aktivitäten

- Arbeitsmaterial
- Foren

SS19:Seminar

Startseite > Kurse >

Ankündigungen

Ankündigungen

Seminar: Visualisi...

Umfang: 5

Zeit & Ort: Fr

Voraussetzung: Algorithmische Graphentheorie (mit Nachdruck empfohlen)

Zielgruppe: Master Informatik (vorzugsweise), Bachelor Informatik

Dozenten: Alexander Wolf und Johannes Zink

Kooperationspartner: Infosim (Würzburg) und denkbare (Würzburg)

Der erste Termin ist am Fr, 26.04.2019. An diesem Termin besprechen wir den Ablauf des Seminars und stellen die Vortragsthemen vor. Aus diesem Grund bitten wir um vollständige **Anwesenheit**.

Bitte schreiben Sie sich schon **vorher** in diesen Wuecampus-Kurs ein, falls Sie am Seminar teilnehmen wollen.
(Klicken Sie dazu im Kursraum ganz oben links auf das Feld mit den weißen Zahnrädern auf blauem Grund und wählen Sie dann "Mich in diesem Kurs einschreiben" aus.)

Überblick

Wir beschäftigen uns mit Algorithmen zum Zeichnen von Graphen in 3D. Das ist ein Thema, welches bislang weniger Beachtung in Forschung, Literatur und Praxis erfahren hat. Dort geht es in den allermeisten Fällen um das Zeichnen von Graphen in 2D. Dies ist insofern nachvollziehbar, als die klassischen zweidimensional

Aktuelle Termine

- Seminar Vis. von Graphen In 3D
Morgen, 12:15 » 13:45
- Seminar Vis. von Graphen In 3D
Freitag, 3. Mai, 12:15 » 13:45

Zum Kalender ...

Kursraum in Moodle

WS19:Seminar Visualisierung von Graphen

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- Ausblick auf den eigentlichen Vortrag geben
- Problem motivieren
- Wichtigste Resultate vorstellen

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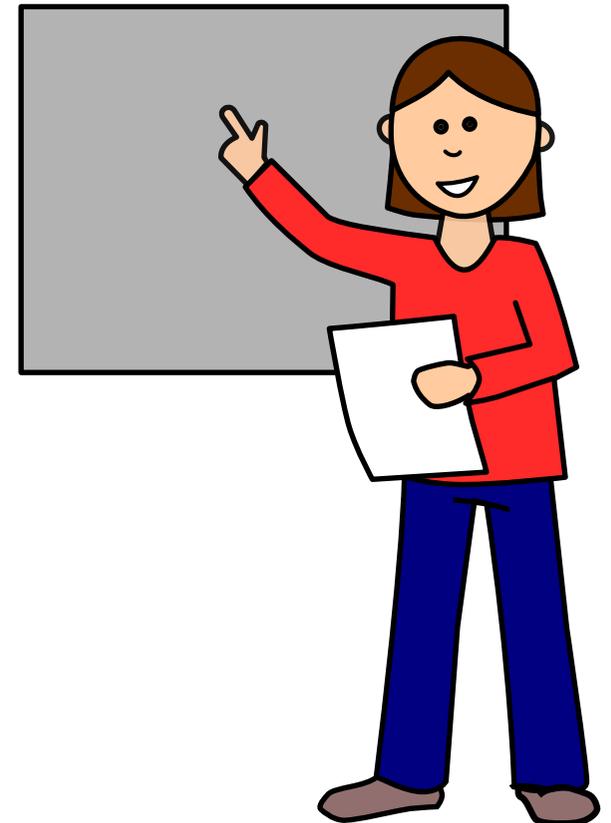
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Ziele:

- Zeitnah einarbeiten
- Themenauswahl prüfen
- Vortrag üben
- Feedback bekommen ohne Bewertung

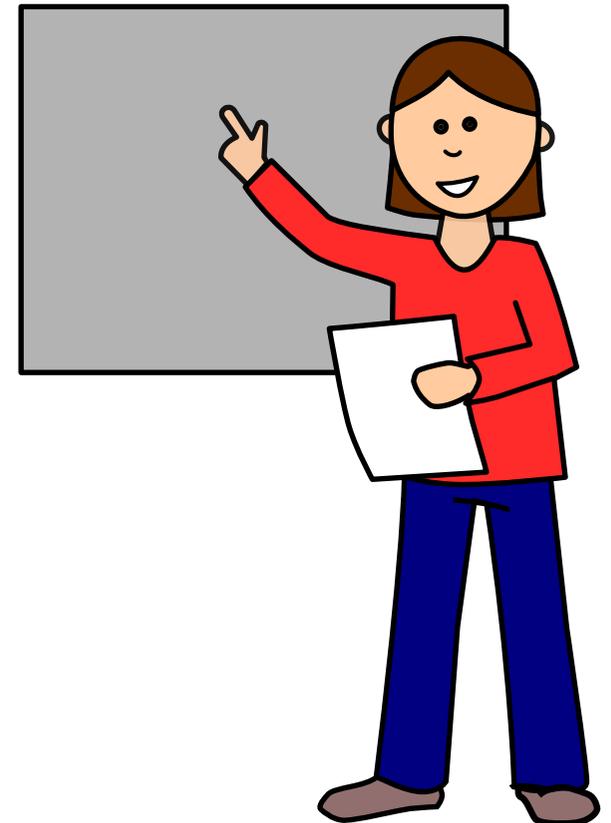
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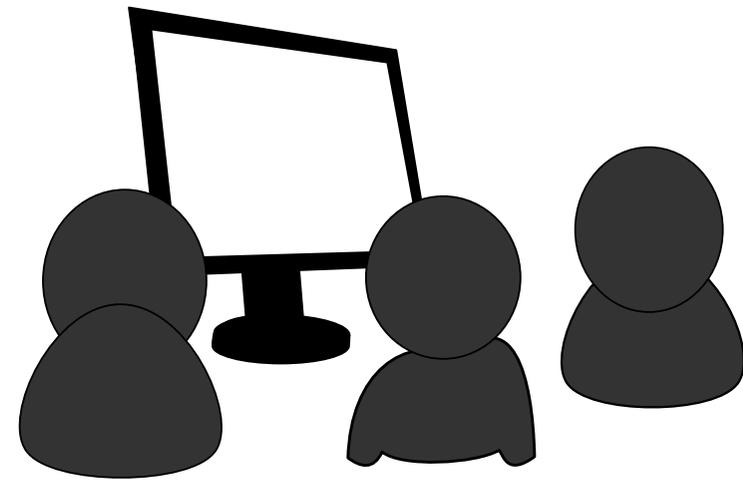
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(einer pro Woche)
- anschließend:
Treffen zur weiteren **Forschung**
Abgabe der **Ausarbeitungen**



Vorträge

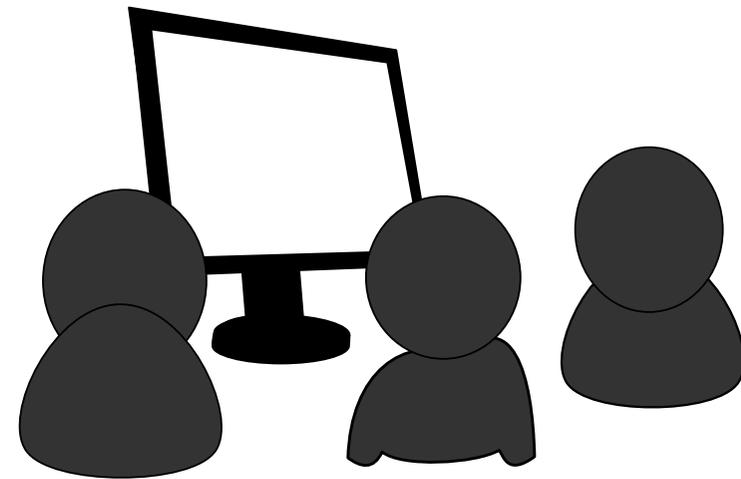
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Anregungen und Ideen aus der Diskussion in die Ausarbeitung mitaufnehmen!



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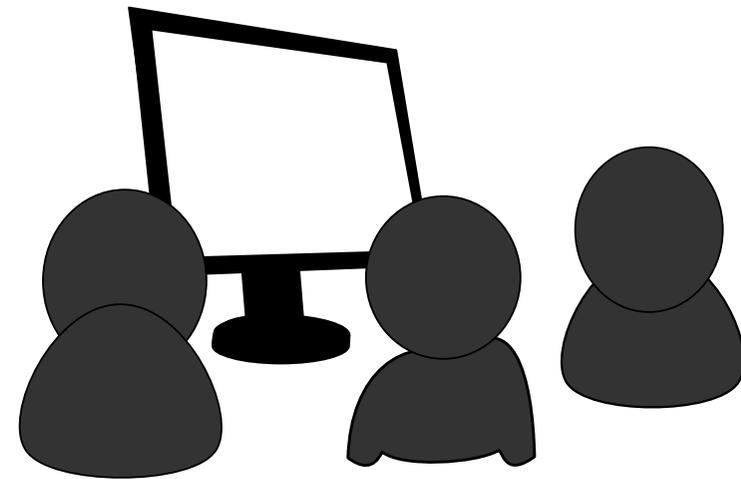
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- **Drei Wochen** vor dem Vortrag:
Besprechung des **Inhaltsverzeichnisses** mit eurem Betreuer

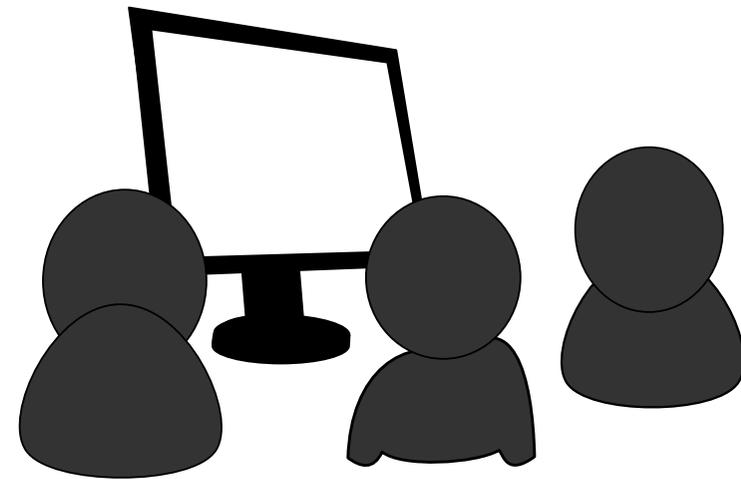


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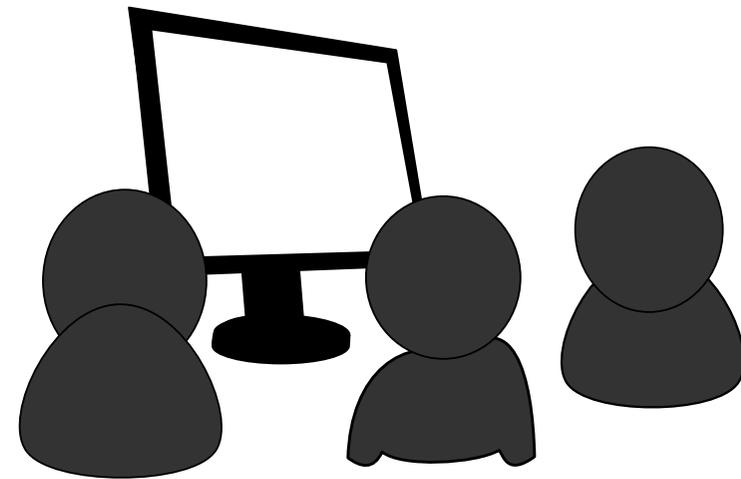
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**Diese Termine sind strikt
(außer für den 1. Vortrag)!**

Ausarbeitung

- etwa 10 Seiten



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- keine reine Zusammenfassung des Artikels; z.B. Beweise ausführlicher



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- L^AT_EX-Vorlage
- Abgabe: **Di, 14.01.2020 (?)**



Forschung

Wie soll das etwa ablaufen?

- wöchentliche Treffen
- Diskussion von Lösungsansätzen
- Hausaufgaben:
 - Lösungen aufschreiben
 - Durchdenken von weiteren Lösungsansätzen
 - Weiterdenken
- ggf. nach dem Ende der Vorlesungszeit: Aufschreiben der Resultate als Artikel

$$X_3 - \sum_{i=0, k=2}^{i=2} X_{ik} - X_{11} + \sum_{i=3, k=i+n}^{i=2} X_{ik} + X_1$$

$$\Omega(r) = \frac{T(z)}{\epsilon_{\max}(z)}$$

$$P(u) = \frac{\int_{+\infty}^{3+} G(t) dt}{\int_{+\infty}^{3+} H(t) dt}$$

$$\frac{F'}{F(t)} = \frac{t^n + 2c}{t^n} \Leftrightarrow F(t) = 2t/t^n + \alpha$$

$$F(x) = \frac{5x^2}{3} + 7x^2 + k$$

$$G(x) = x^2 - \frac{3x^2}{4} + 1$$

$$H(x) = 6x^2 + \frac{x^2}{7} - 5k$$

$$\int \frac{A + B(x)}{[a - b - 2c]^2} = \frac{A}{[ax + B(x)]}$$

$$U(t) = \frac{1 - X(Y)}{D Y}$$

$$\ln(a) = \ln(k) + \ln(m)$$

$$\ln(c) = \ln(k) - \ln(f)$$

Vergangenheit

- Z.B. WS 2015/16:

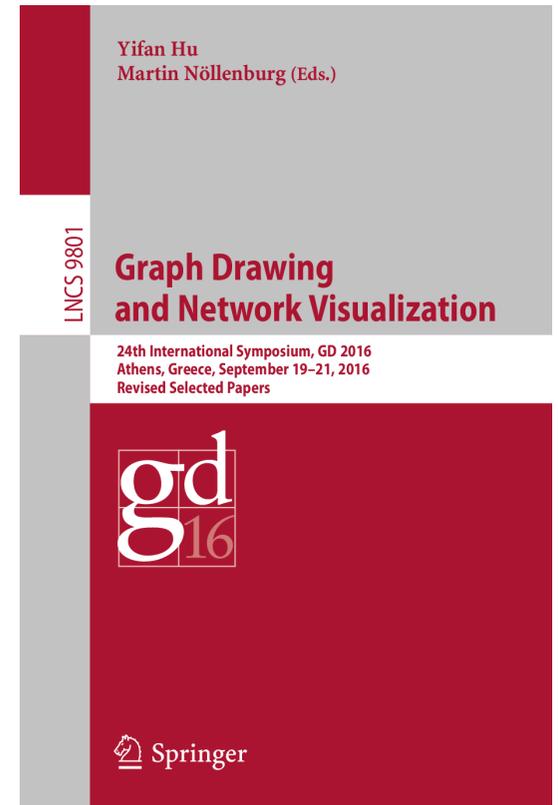
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Ergebnis: Paper bei der GD 2016

Block Crossings in Storyline Visualizations

<https://go.uniwue.de/storyline>



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**Best
Paper
Award**

Yifan Hu
Martin Nöllenburg (Eds.)

LNCS 9801

**Graph Drawing
and Network Visualization**

24th International Symposium, GD 2016
Athens, Greece, September 19–21, 2016
Revised Selected Papers

gd
16

 Springer

Vergangenheit

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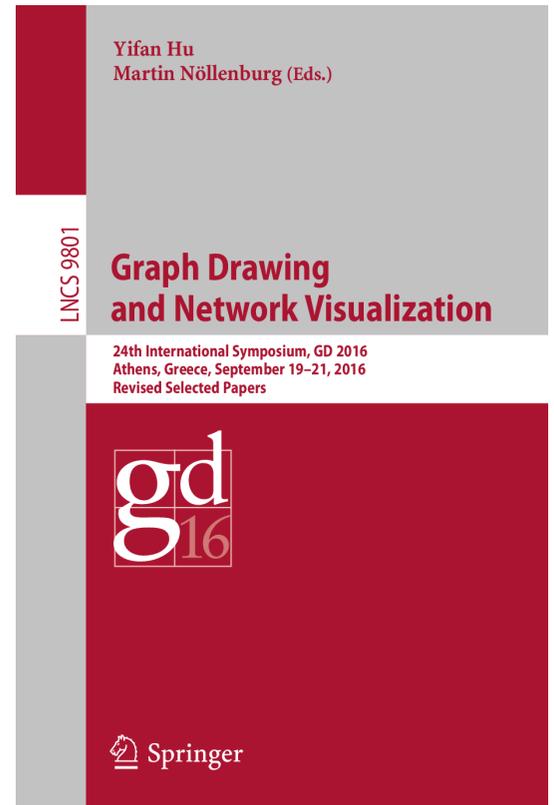
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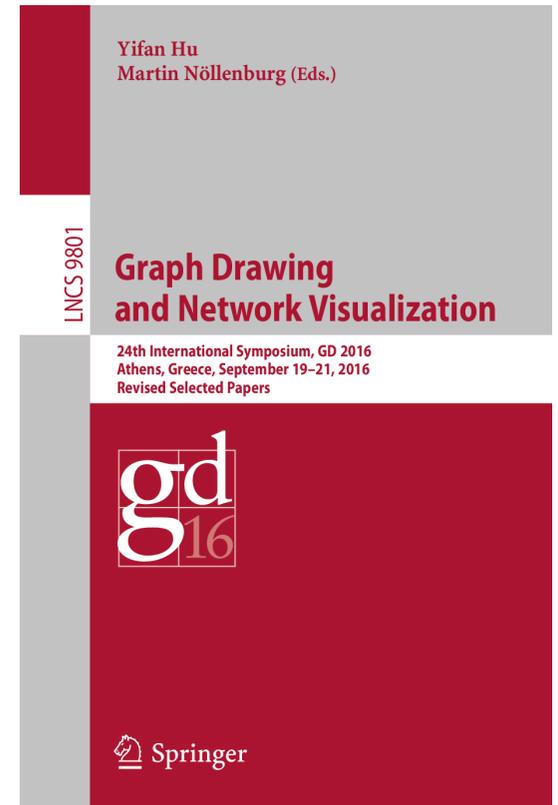
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Stick Graphs with Length Constraints

Inklusive Einladung zum Special Issue



Bestehen & Bewertung

Voraussetzungen für das Bestehen des Seminars

- Halten einer Präsentation zum gewählten Thema
- Anfertigen einer Ausarbeitung
- Teilnahme an den anderen Vorträgen
- Einmaliges Fehlen ist erlaubt

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Bewertung

- Vortrag (Inhalte, Gestaltung der Folien, Verständlichkeit)
- Ausarbeitung (Inhalte, sprachliche Darstellung, Rechtschreibung, Verbindungen zu anderen Vortragsthemen)
- 50 : 50

Vortragsthemen

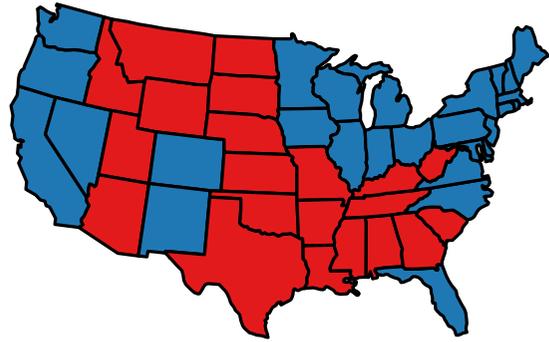
Allgemeines

- Wir geben für jedes Thema ein Buchkapitel/einen Artikel vor.
- Eigene Literaturrecherche
- Ausgangspunkt können Referenzen im Artikel sein.

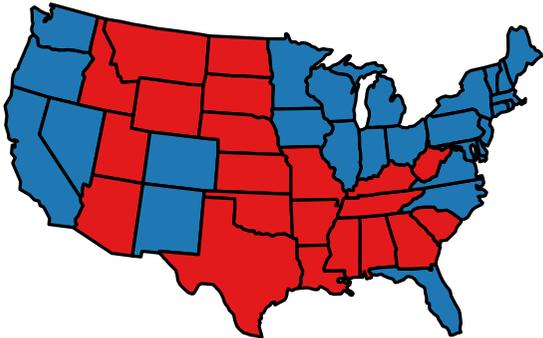
Themenübersicht

1. Computing Stable Demers Cartograms (PK)
2. Parameterized Algorithms for Book Embedding Problems (PK)
3. Local and Union Page Numbers (PK)
4. Level-Planar Drawings with Few Slopes (PK)
5. Optimal Morphs of Planar Orthogonal Drawings II (SC)
6. Exact Crossing Number Parameterized by Vertex Cover (SC)
7. Homotopy Height, Grid-Major Height and Graph-Drawing Height (SC)
8. On the Edge-Length Ratio of (Outer-)Planar Graphs (AW)
9. ChordLink: A New Hybrid Visualization Model (AW)
10. 4-Connected Triangulations on Few Lines (AW)

Computing Stable Demers Cartograms



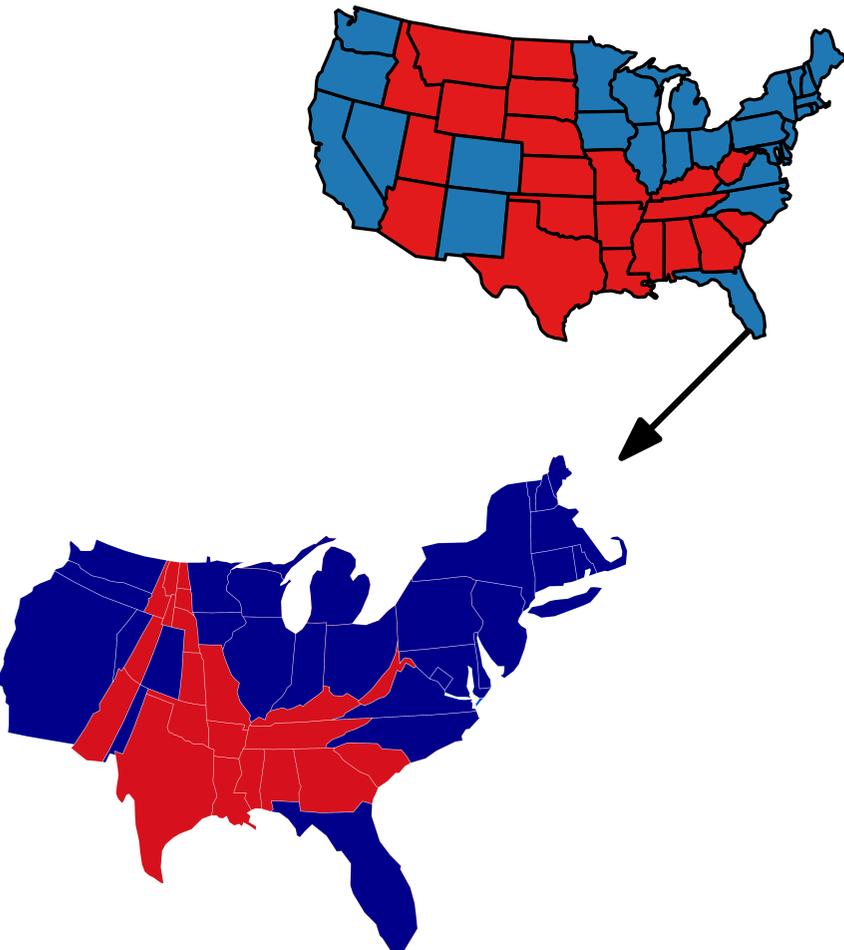
Computing Stable Demers Cartograms



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State	2007	2008	2009	2010
Alabama	169678.4	172686.8	168348	17475
Arizona	262322	259366.7	243929.4	24821
Arkansas	96948.2	98955.3	97058.9	10169
California	1955856	1990678.2	1920061.8	1974614.5
Colorado	246043.5	255566.8	248593.6	255140.8
Connecticut	237542.7	240910.9	236393.2	237653
Delaware	56278.5	This is	real data!	57447
Florida	768661	750501.6	724582.2	737791
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Idaho	53852.1	55546	53775	55170.7
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Kansas	122453.3		124346	127

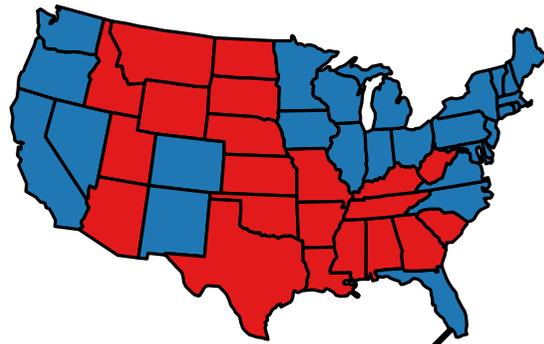
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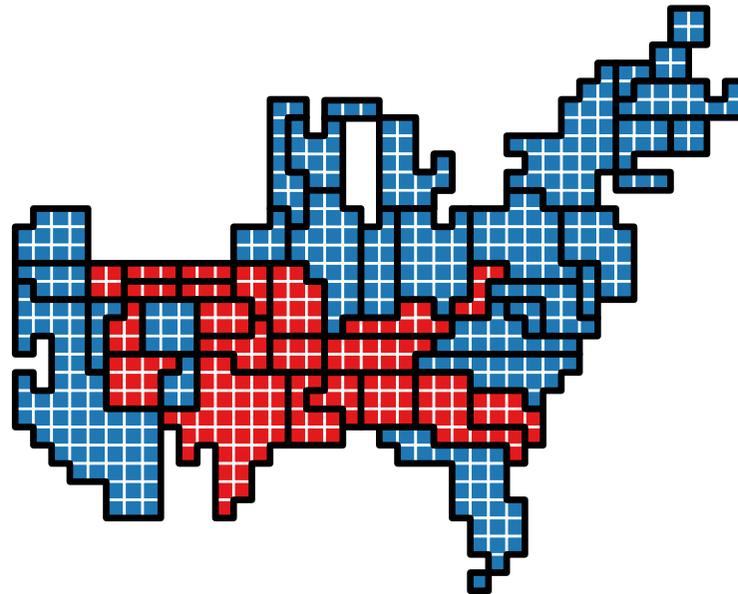
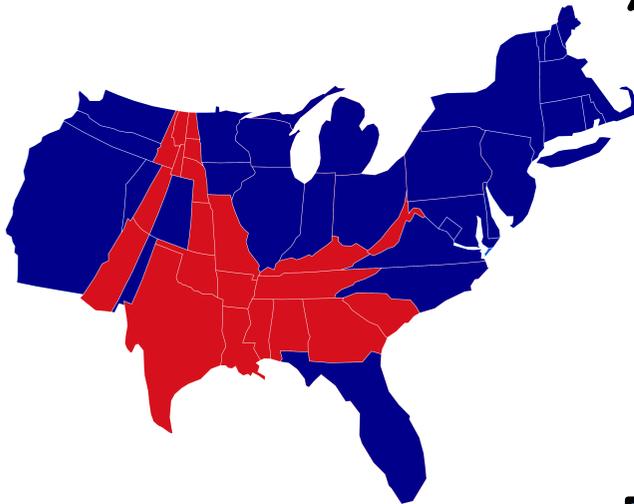
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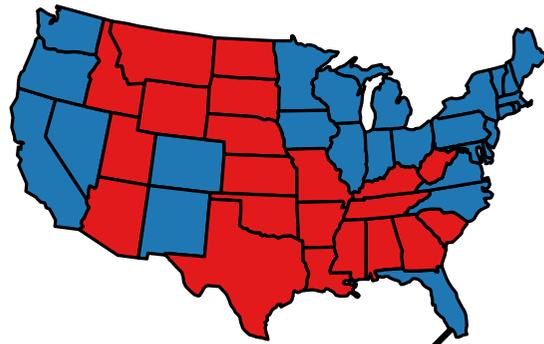


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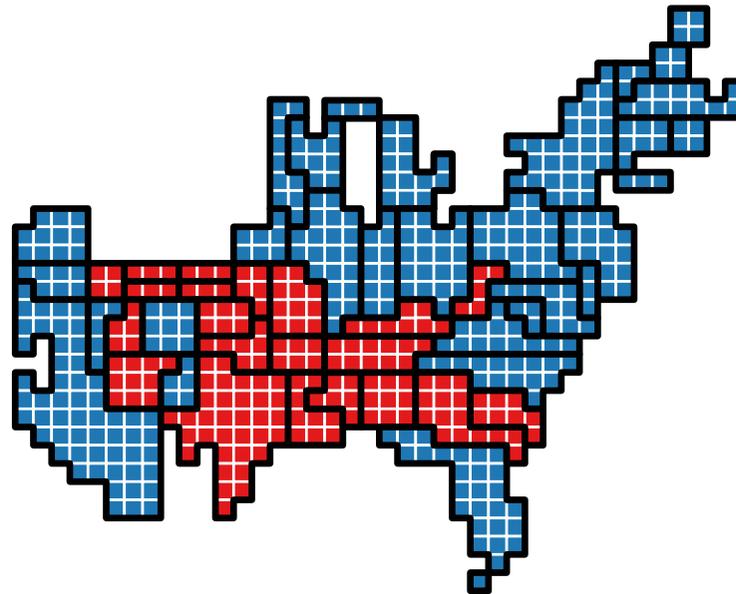
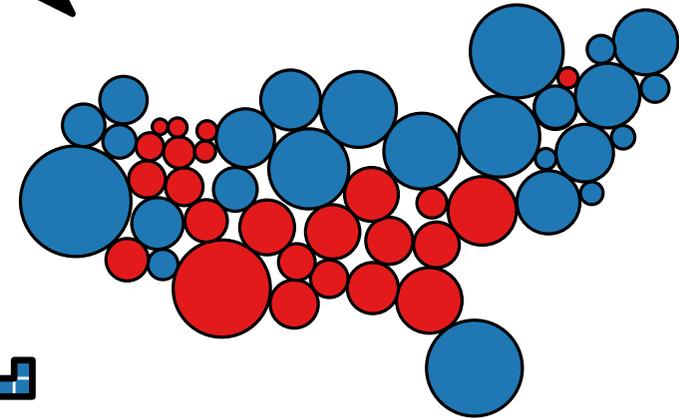
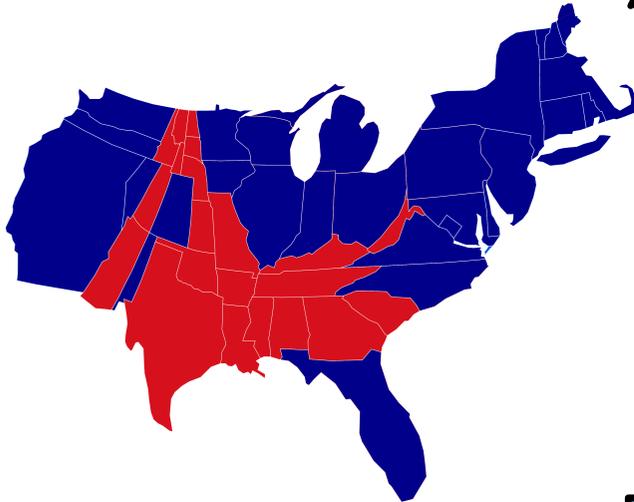


Computing Stable Demers Cartograms



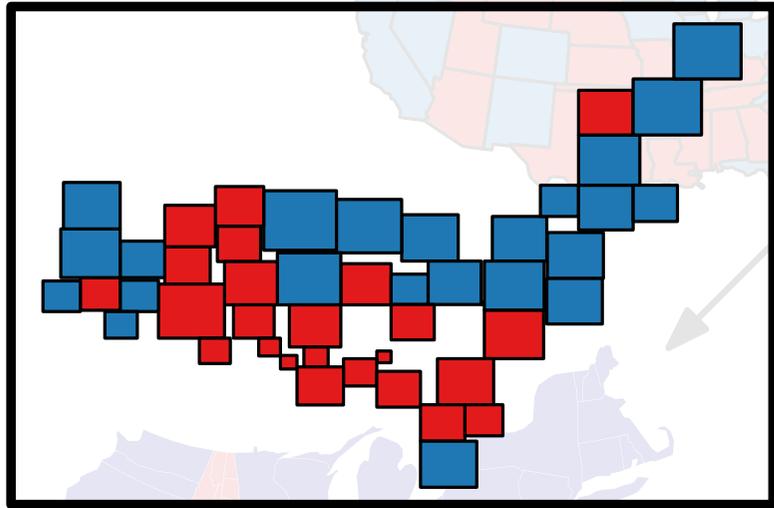
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State	2007	2008	2009	2010
Alabama	169678.4	172686.8	168348	17475
Arizona	262322	259366.7	243929.4	24821
Arkansas	96948.2	98955.3	97058.9	10169
California	1955856	1990678.2	1920061.8	1974614.5
Colorado	246043.5	255566.8	248593.6	255140.9
Connecticut	237542.7	240910.9	236393.2	237653
Delaware	56278.5	This is	real data!	57447
Florida	768661	750501.6	724582.2	737791
Georgia	415131.9	412911.9	No	seriously!
Idaho	53852.1	55546	53775	55170.7
Illinois	647862.1	646366.6	644690.1	662637
Indiana	269053.6	272845.6	261238.3	280120
Iowa	136977	136553.6	136251.2	14148
Kansas	122453.3	124346	124346	127

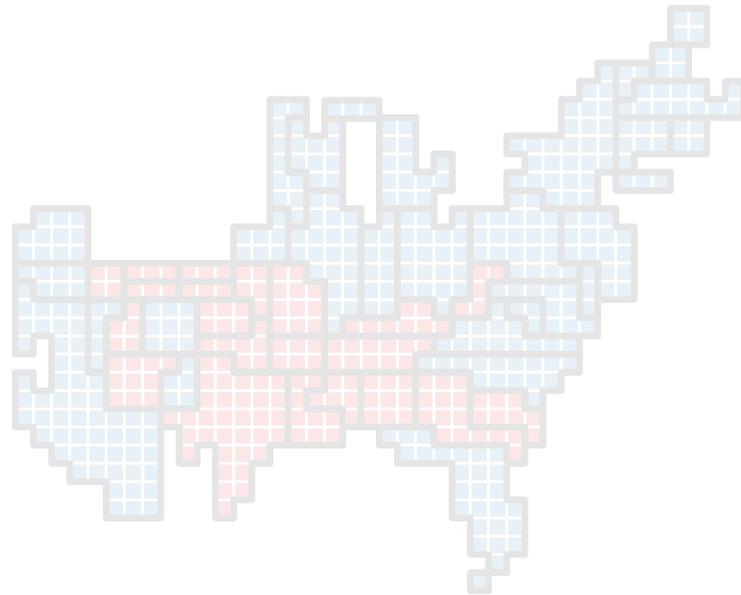
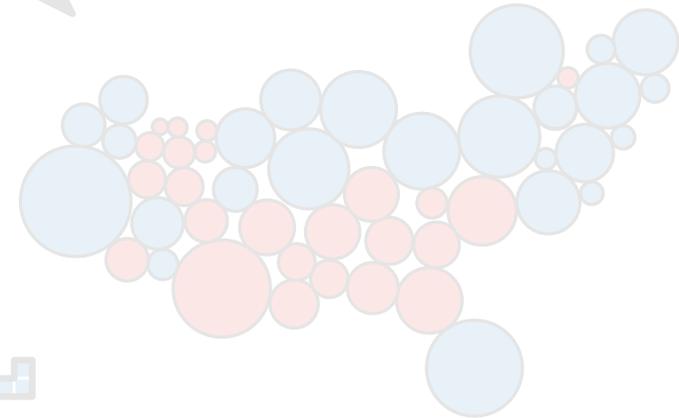


Computing Stable Demers Cartograms

Demers Cartograms [Demers et al., 2002]

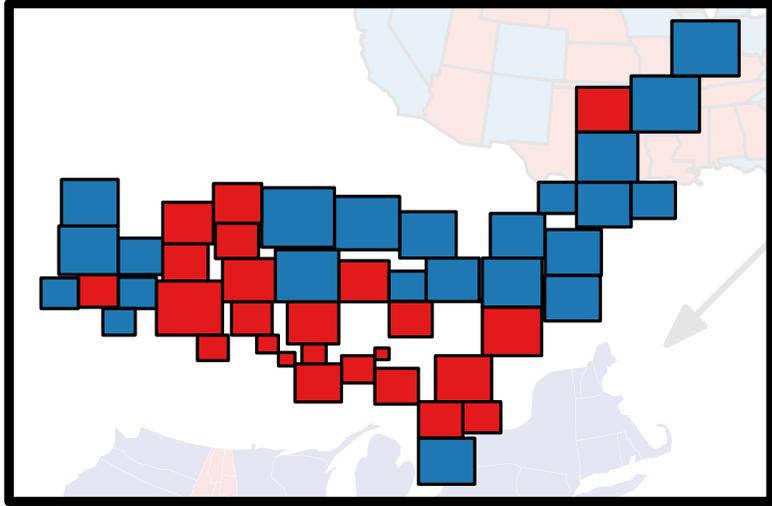


State	2007	2008	2009	201
Alabama	69678.4	172686.8	168348	17475
Arizona	262322	259366.7	243929.4	24821
Arkansas	96948.2	98955.3	97058.9	10169
California	1955856	1990678.2	1920061.8	1974614.5
Colorado	246043.5	255566.8	248593.6	255140.
Connecticut	237542.7	240910.9	236393.2	237653
Delaware	56278.5	This is	real data!	57447
Florida	768661	750501.6	724582.2	737791.
Georgia	415131.9	412911.9	No	seriously!
Idaho	53852.1	55546	53775	55170.7
Illinois	647862.1	646366.6	644690.1	662637.
Indiana	269053.5	272845.6	261238.3	280120.
Iowa	136977	136553.6	136251.2	14148
Kansas	122453.3		124340	127



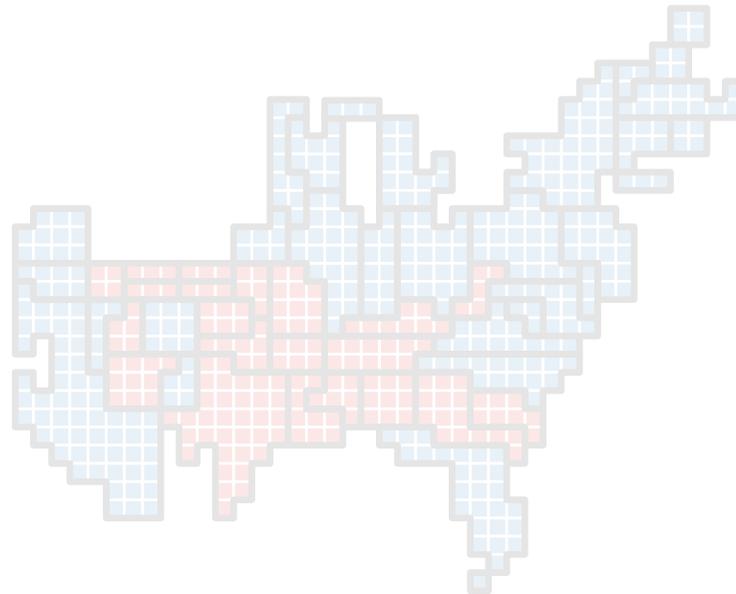
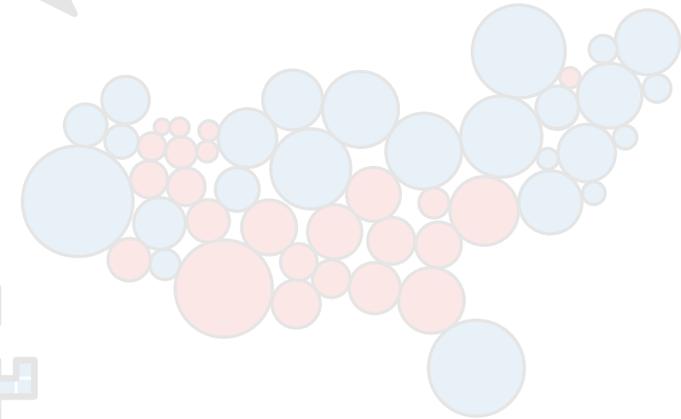
Computing Stable Demers Cartograms

Demers Cartograms [Demers et al., 2002]



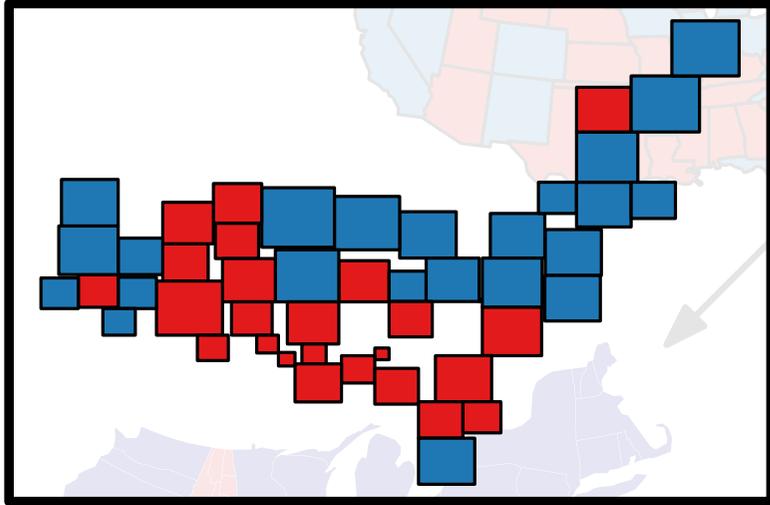
- Regions: non-overlapping squares

State	2007	2008	2009	201
Alabama	69678.4	172686.8	168348	17475
Arizona	262322	259366.7	243929.4	24821
Arkansas	96948.2	98955.3	97058.9	10169
California	1955856	1990678.2	1920061.8	1974614.5
Colorado	246043.5	255566.8	248593.6	255140.1
Connecticut	35276.3	35276.3	35276.3	35276.3
Delaware	55276.3	55276.3	55276.3	55276.3
Florida	768661	750501.6	724582.2	737791
Georgia	415131.9	412911.9	No seriously!	
Idaho	53852.1	55546	53775	55170.7
Illinois	647862.1	646366.6	644690.1	662637
Indiana	269053.5	272845.6	261238.3	280120
Iowa	136977	136553.6	136251.2	14148
Kansas	122453.3		124340	122



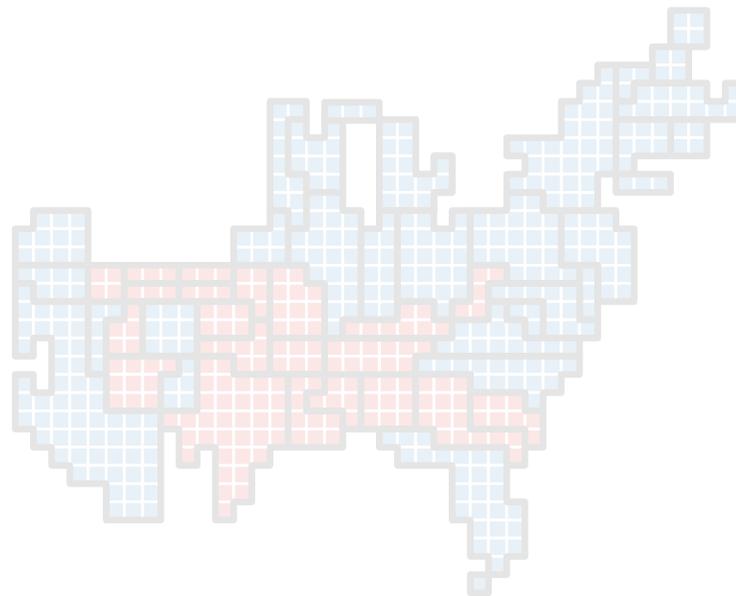
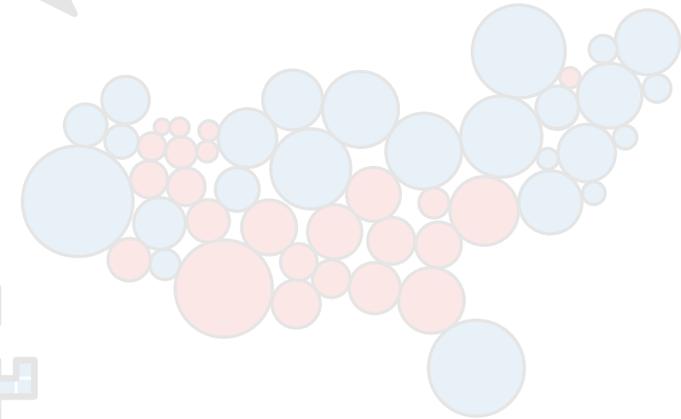
Computing Stable Demers Cartograms

Demers Cartograms [Demers et al., 2002]



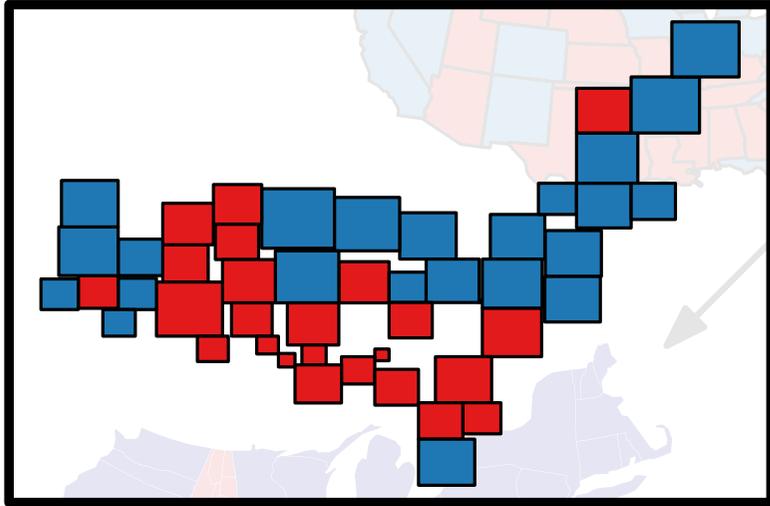
- Regions: non-overlapping squares
- Size proportional to data

State	2007	2008	2009	2010
Alabama	69678.4	172686.8	168348	17475
Arizona	262322	259366.7	243929.4	24821
Arkansas	96948.2	98955.3	97058.9	10169
California	1955856	1990678.2	1920061.8	1974614.5
Colorado	246043.5	255566.8	248593.6	255140.1
Connecticut	53276.3	53276.3	53276.3	53276.3
Delaware	53276.3	53276.3	53276.3	53276.3
Florida	768661	750501.6	724582.2	737791.1
Georgia	415131.9	412911.9	No seriously!	No seriously!
Idaho	52771.1	55541.1	55377.5	55111.2
Illinois	177777.7	177777.7	177777.7	177777.7
Indiana	269053.5	272845.6	261238.3	280120.1
Iowa	136977	136553.6	136251.2	14148
Kansas	122453.3	122453.3	124340	122453.3



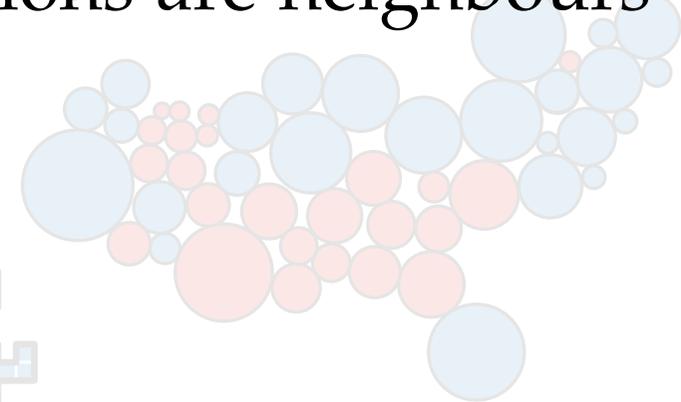
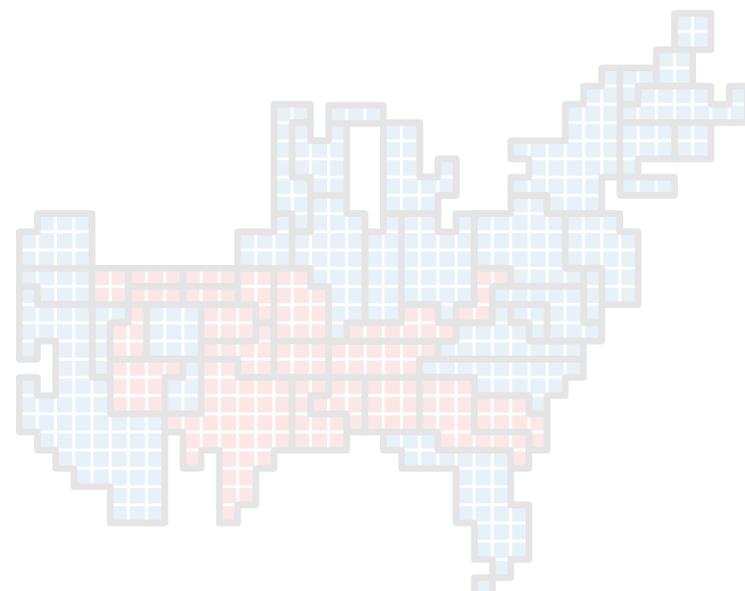
Computing Stable Demers Cartograms

Demers Cartograms [Demers et al., 2002]



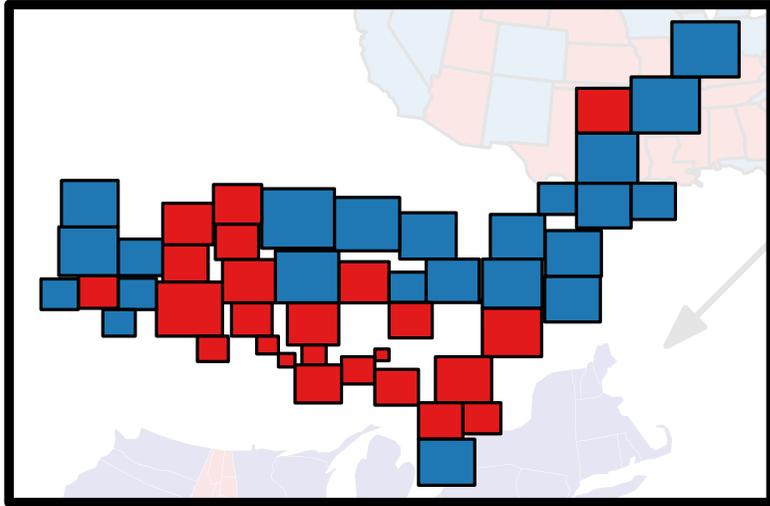
- Regions: non-overlapping squares
- Size proportional to data
- Contact if regions are neighbours

State	2007	2008	2009	201
Alabama	69678.4	172686.8	168348	17475
Arizona	262322	259366.7	243929.4	24821
Arkansas	96948.2	98955.3	97058.9	10169
California	1955856	1990678.2	1920061.8	1974614.5
Colorado	246043.5	255566.8	248593.6	255140.
Connecticut	33276.3	33276.3	33276.3	33276.3
Delaware	5276.3	5276.3	5276.3	5276.3
Florida	768661	750501.6	724582.2	737791.
Georgia	415131.9	412911.9	No seriously!	
Idaho	5276.3	5276.3	5276.3	5276.3
Illinois	6276.3	6276.3	6276.3	6276.3
Indiana	269053.5	272845.6	261238.3	280120.
Iowa	136977	136553.6	136251.2	14148
Kansas	122453.3	122453.3	124340	122453.3



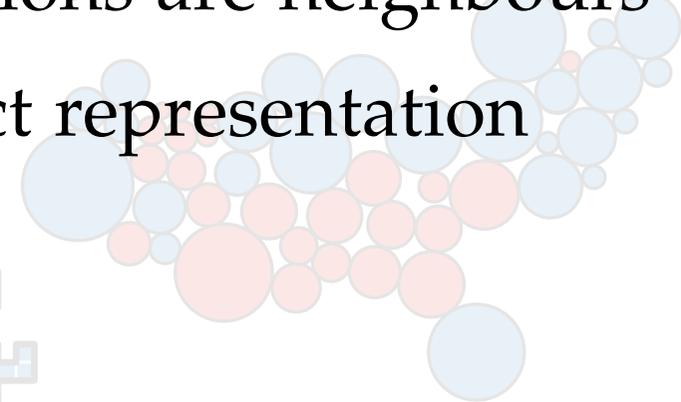
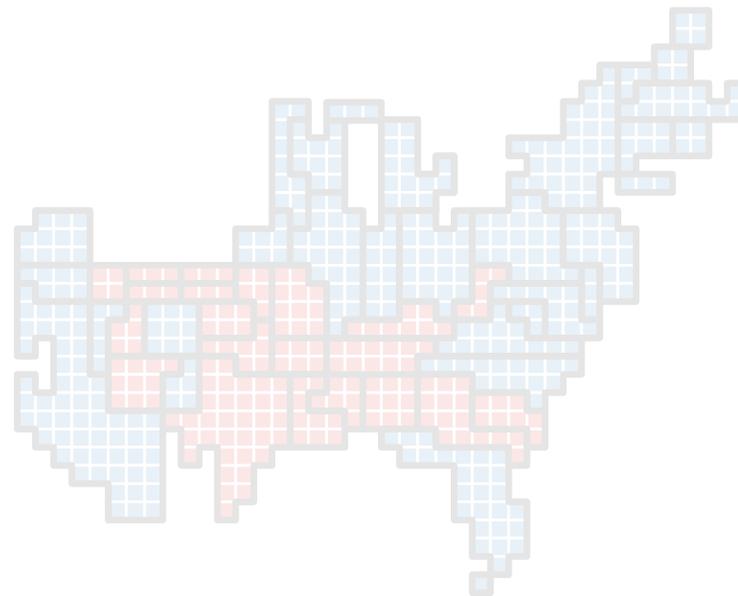
Computing Stable Demers Cartograms

Demers Cartograms [Demers et al., 2002]



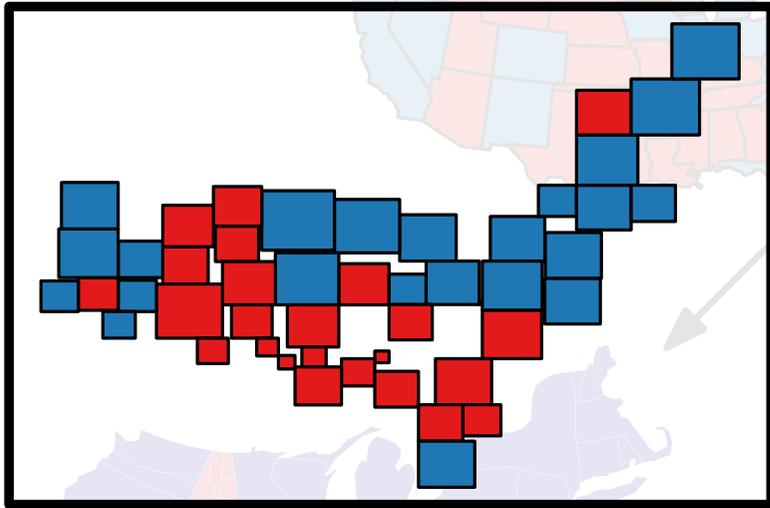
- Regions: non-overlapping squares
- Size proportional to data
- Contact if regions are neighbours
- Square contact representation

State	2007	2008	2009	2010
Alabama	69678.4	172686.8	168348	17475
Alaska	262322	259366.7	243929.4	24821
Arkansas	96948.2	98955.3	97058.9	10169
California	1955856	1990678.2	1920061.8	1974614.5
Colorado	246043.5	255566.8	248593.6	255440
Connecticut	35276.3	35276.3	35276.3	35276.3
Delaware	55276.3	55276.3	55276.3	55276.3
Florida	768661	750501.6	724582.2	737791
Georgia	415131.9	412911.9	No seriously	
Idaho	5276.3	55276.3	55276.3	55276.3
Illinois	122453.3	122453.3	122453.3	122453.3
Indiana	269053.5	272845.6	261238.3	280120
Iowa	136977	136553.6	136251.2	14148
Kansas	122453.3	122453.3	122453.3	122453.3



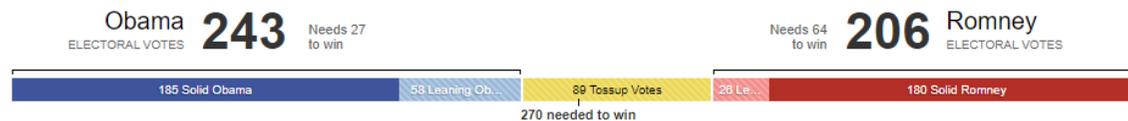
Computing Stable Demers Cartograms

Demers Cartograms [Demers et al., 2002]

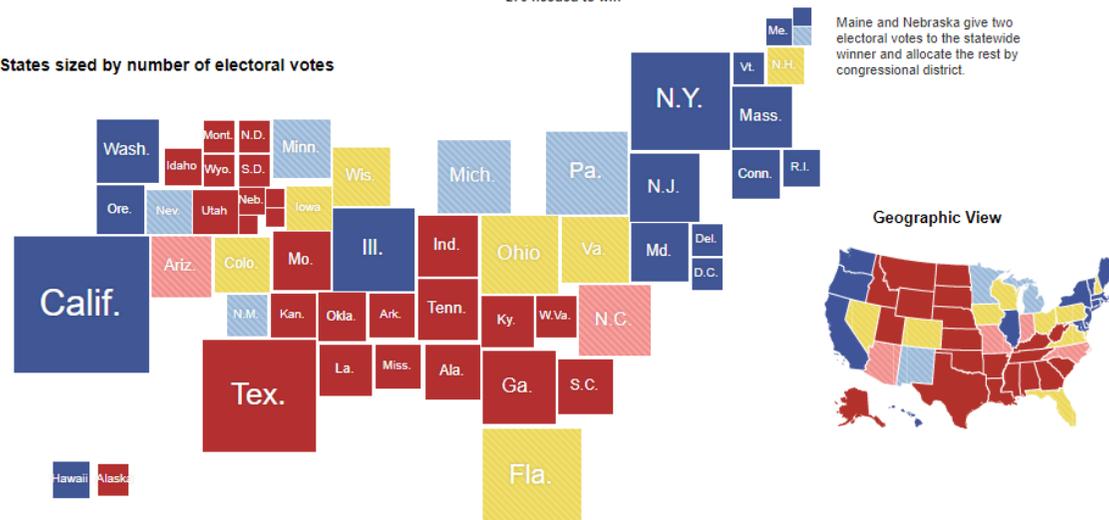


- Regions: non-overlapping squares
- Size proportional to data
- Contact if regions are neighbours
- Square contact representation

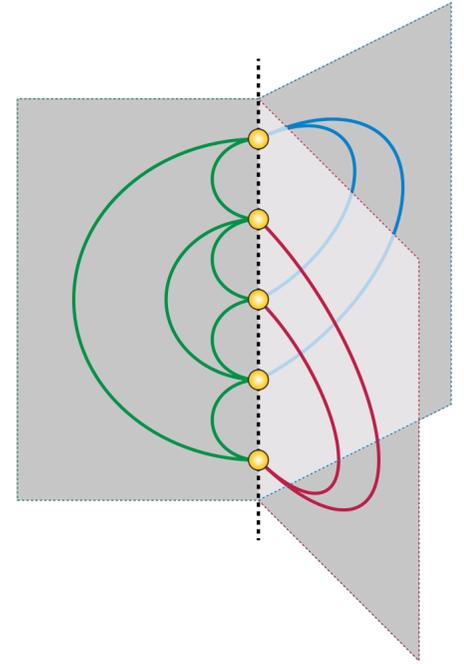
State	2007	2008	2009	201
Alabama	69678.4	172686.8	168348	17475
Arizona	262322	259366.7	243929.4	24821
Arkansas	96948.2	98955.3	97058.9	10169
California	1955856	1990678.2	1920061.8	1974614.5
Colorado	246043.5	255566.8	248593.6	255440.
Connecticut	35276.3	35276.3	35276.3	35276.3
Delaware	56276.3	56276.3	56276.3	56276.3
Florida	768661	750501.6	724582.2	737791.
Georgia	415131.9	412911.9	No seriously	
Idaho	5276.3	5276.3	5276.3	5276.3
Indiana	269053.5	272845.6	261238.3	280120.
Iowa	136977	136553.6	136251.2	14148
Kansas	122453.3	122453.3	122453.3	122453.3



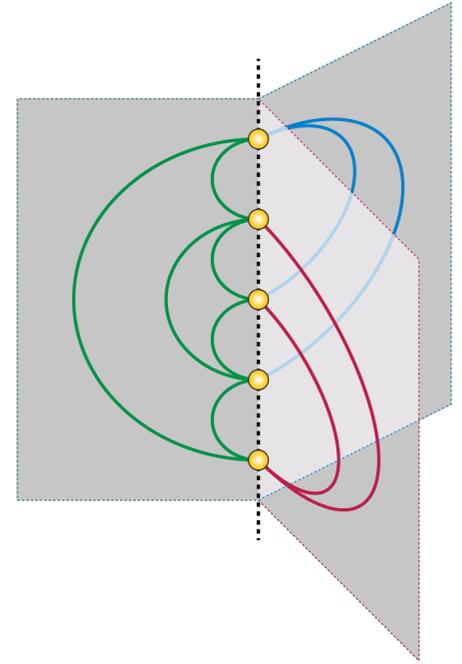
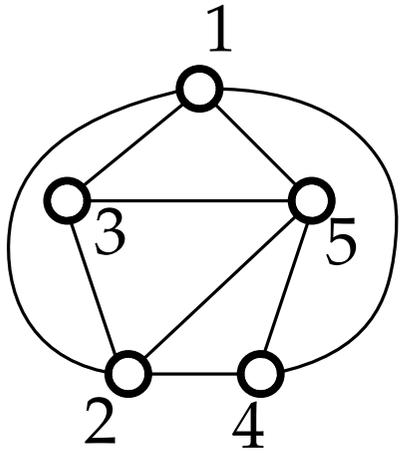
States sized by number of electoral votes



Parameterized Algorithms for Book Embedding Problems

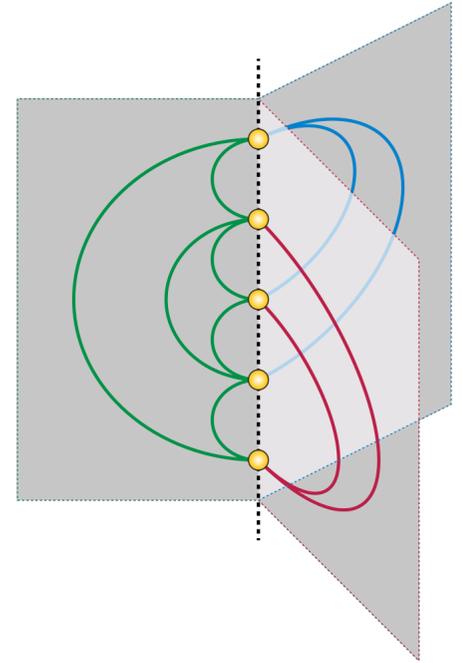
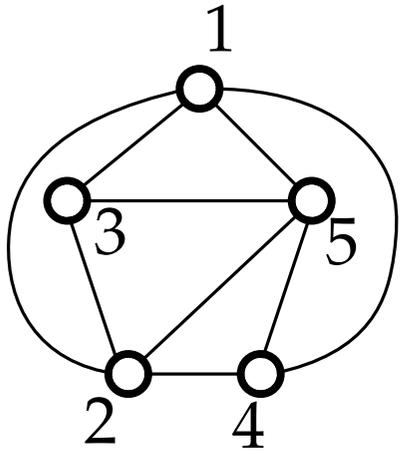


Parameterized Algorithms for Book Embedding Problems



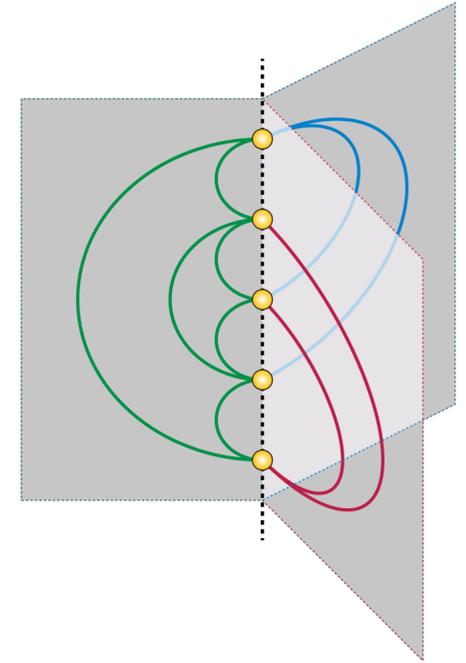
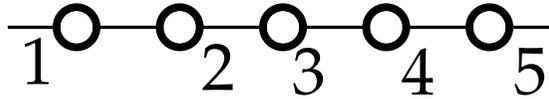
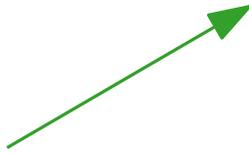
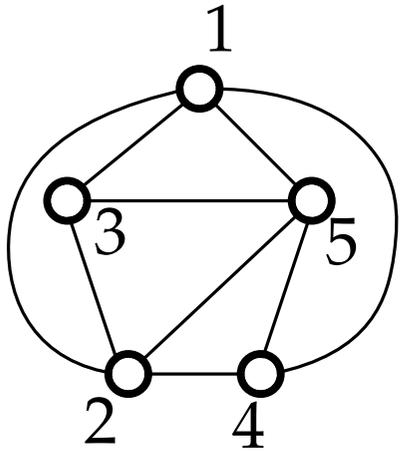
Parameterized Algorithms for Book Embedding Problems

Fixed-order book thickness:



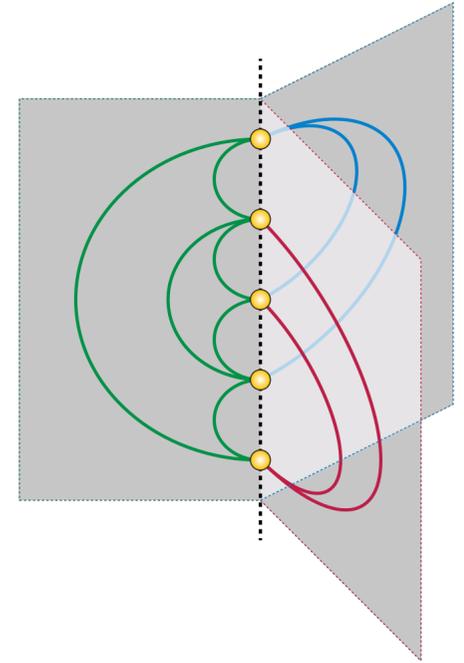
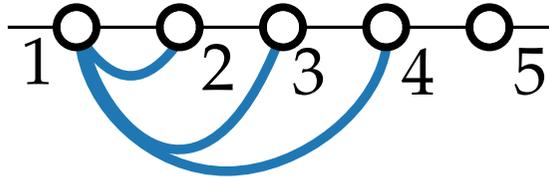
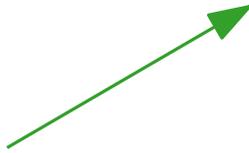
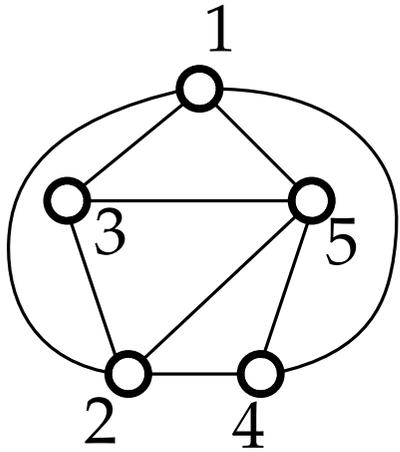
Parameterized Algorithms for Book Embedding Problems

Fixed-order book thickness:



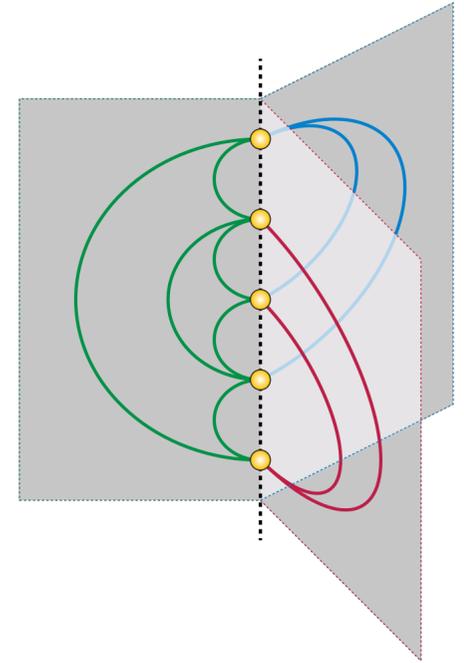
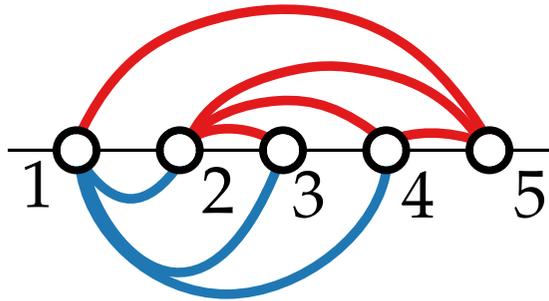
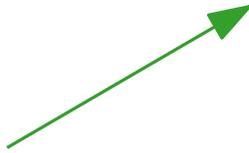
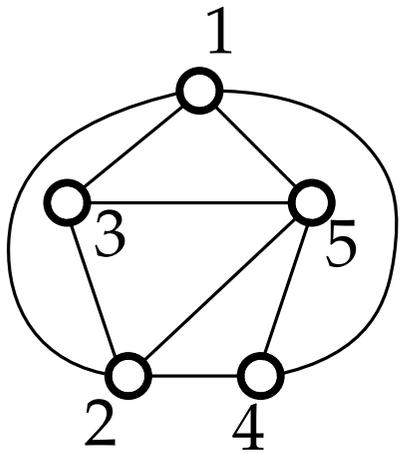
Parameterized Algorithms for Book Embedding Problems

Fixed-order book thickness:



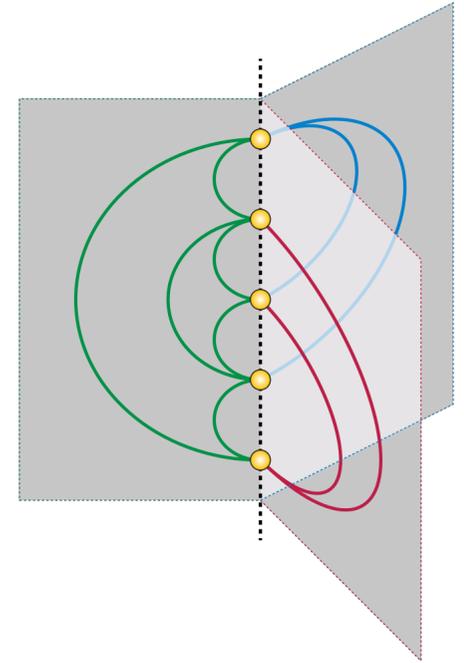
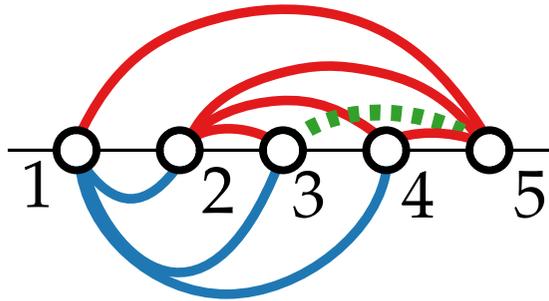
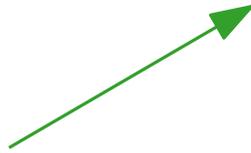
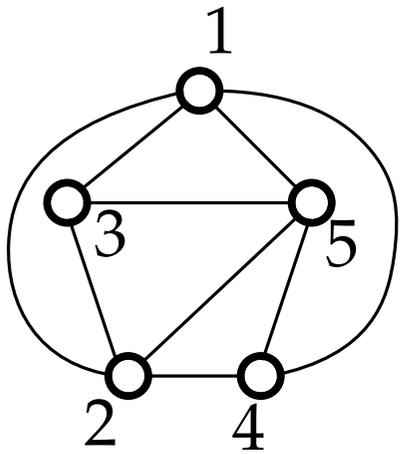
Parameterized Algorithms for Book Embedding Problems

Fixed-order book thickness:



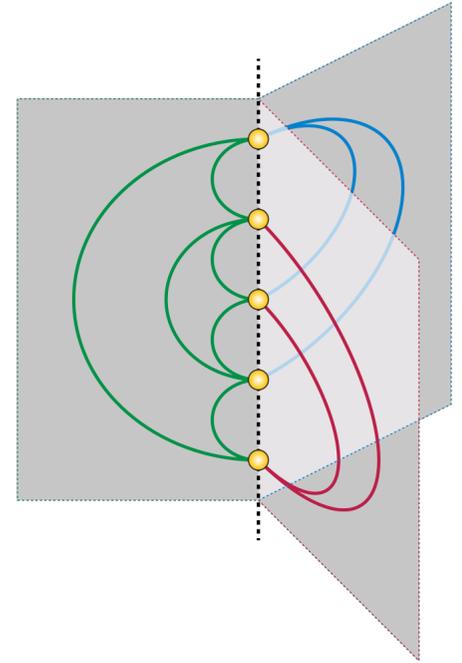
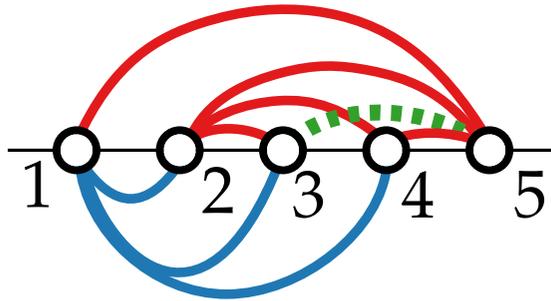
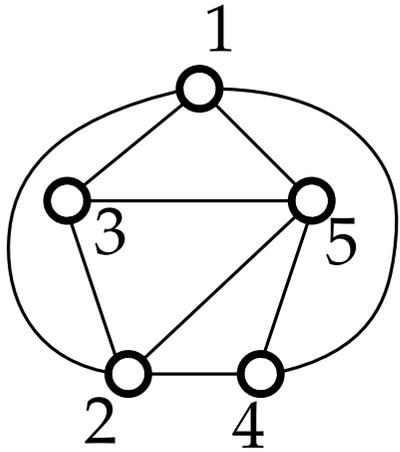
Parameterized Algorithms for Book Embedding Problems

Fixed-order book thickness:



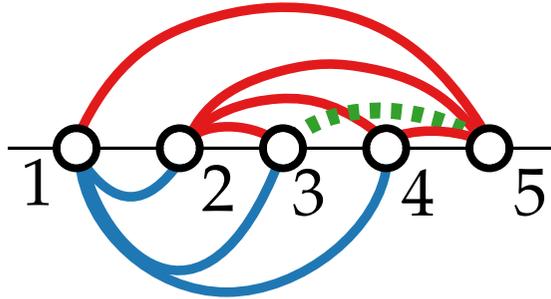
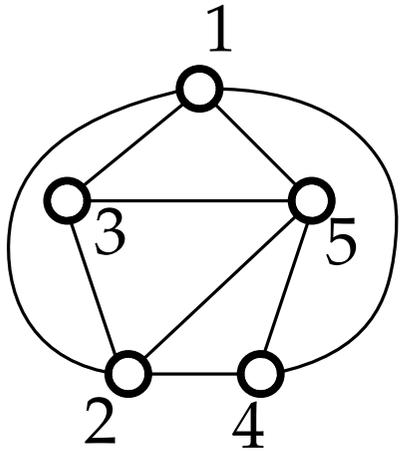
Parameterized Algorithms for Book Embedding Problems

Fixed-order book thickness: 3

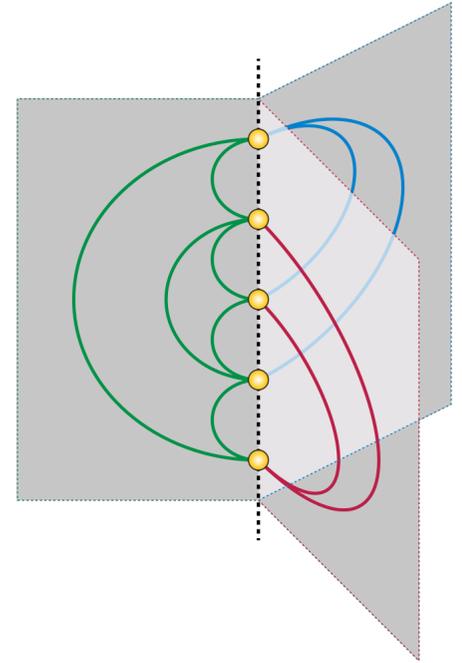


Parameterized Algorithms for Book Embedding Problems

Fixed-order book thickness: 3

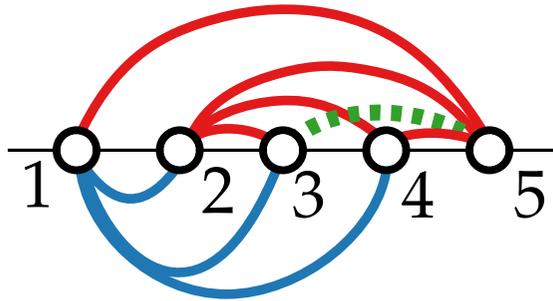
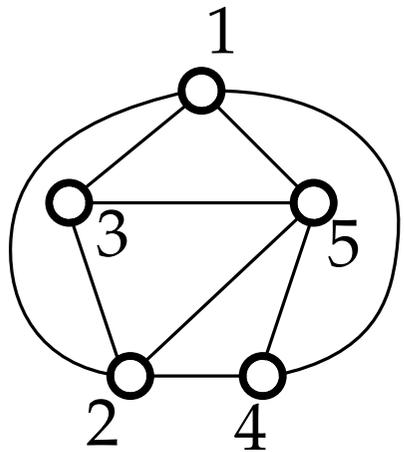


Book thickness:

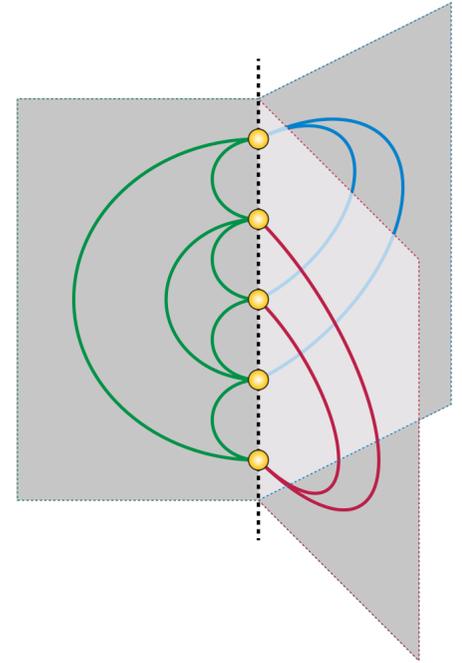


Parameterized Algorithms for Book Embedding Problems

Fixed-order book thickness: 3

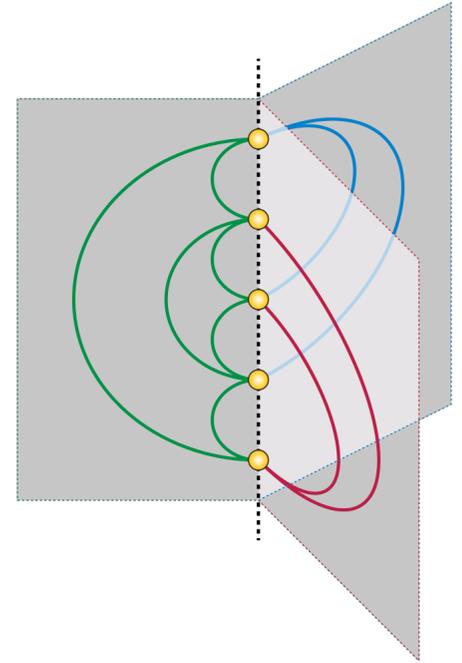
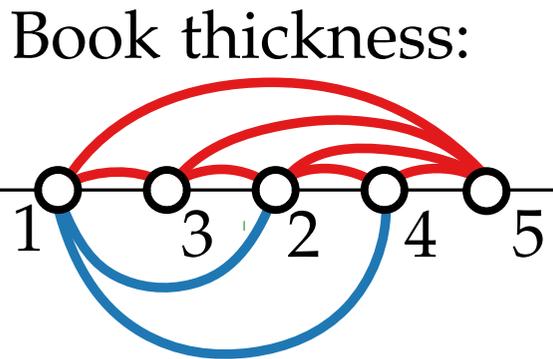
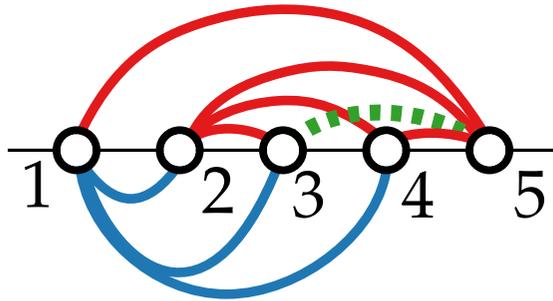
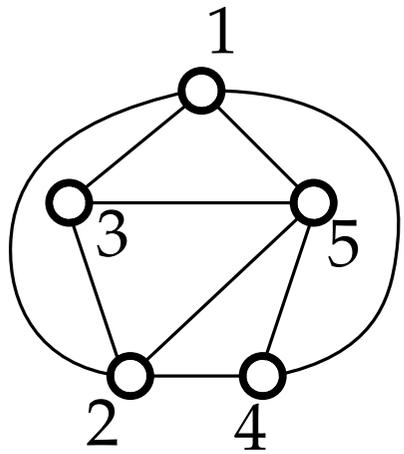


Book thickness:



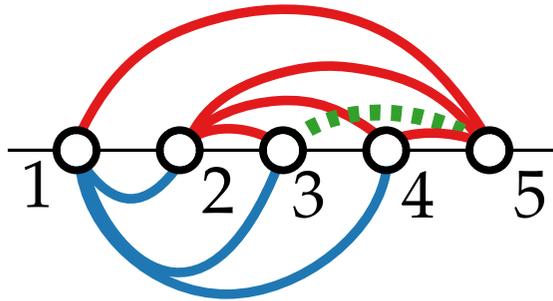
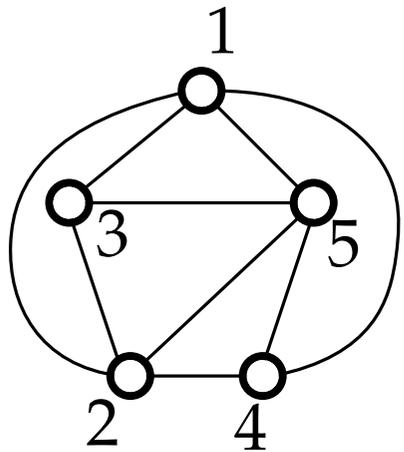
Parameterized Algorithms for Book Embedding Problems

Fixed-order book thickness: 3

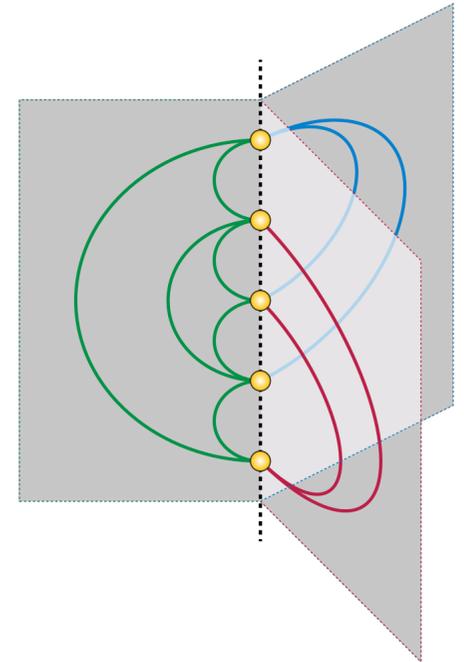
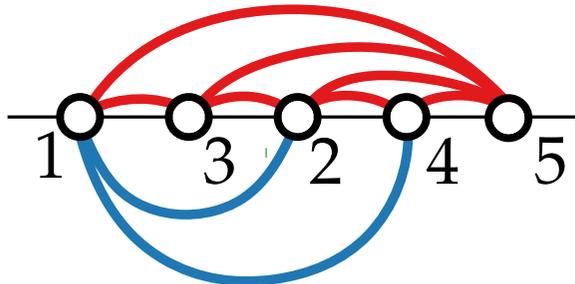


Parameterized Algorithms for Book Embedding Problems

Fixed-order book thickness: 3

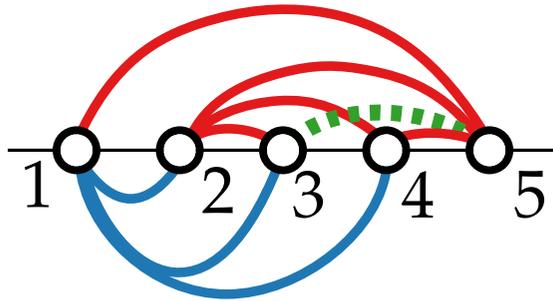
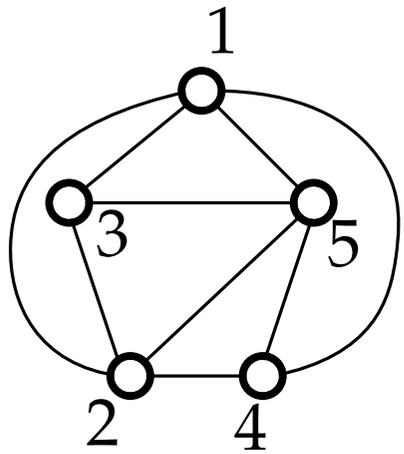


Book thickness: 2

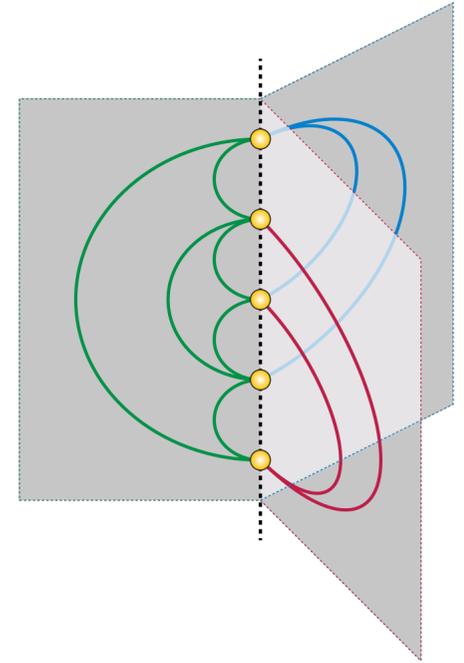
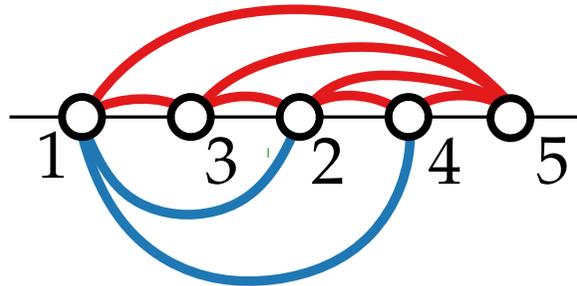


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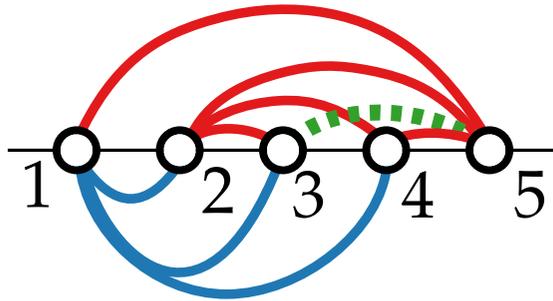
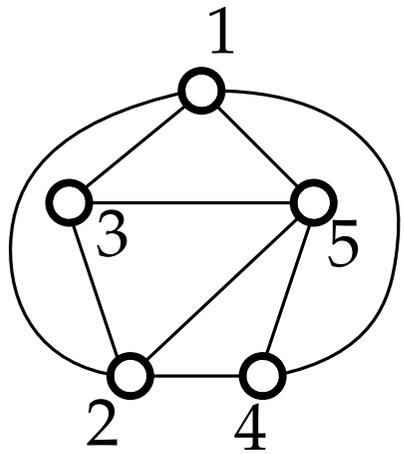
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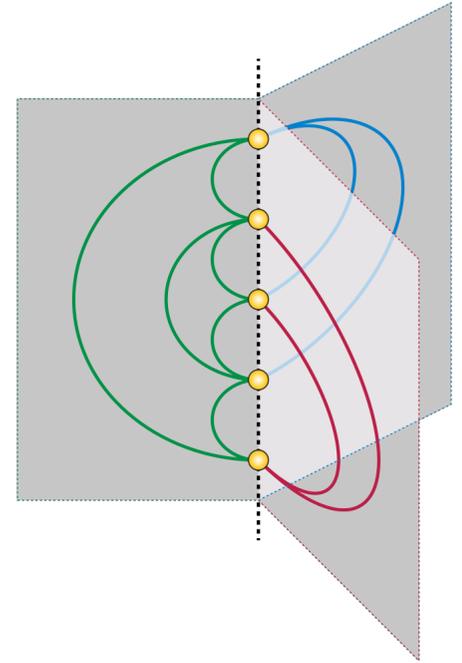
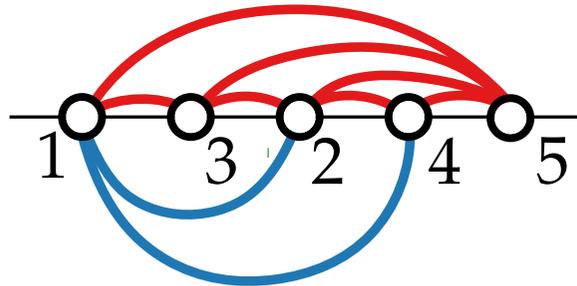
Both NP-complete \Rightarrow FPT algorithms

Local and Union Page Numbers

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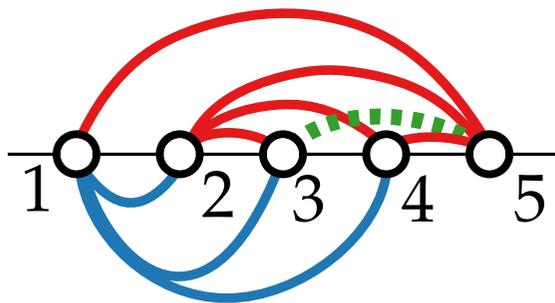
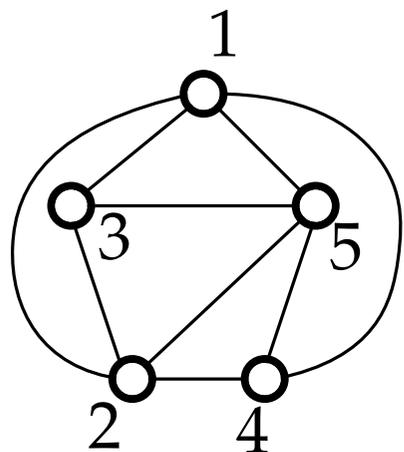


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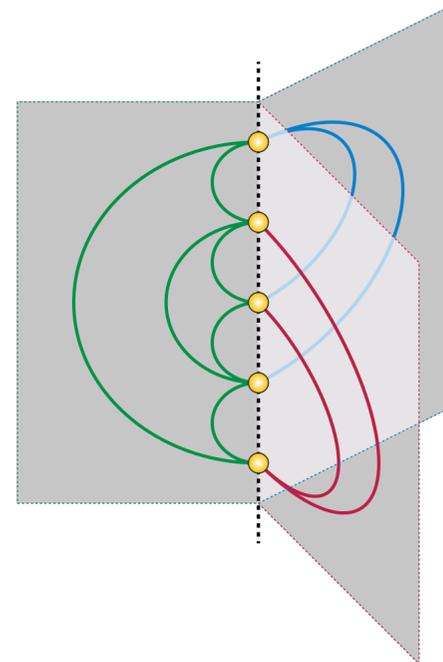
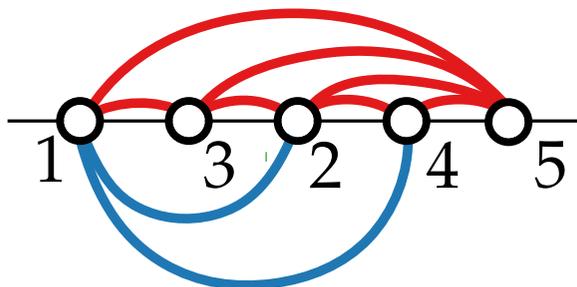


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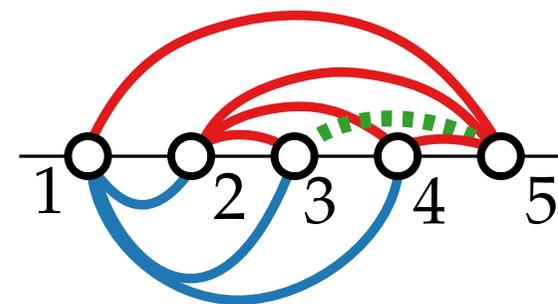
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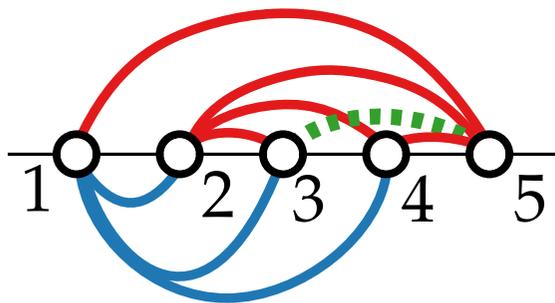
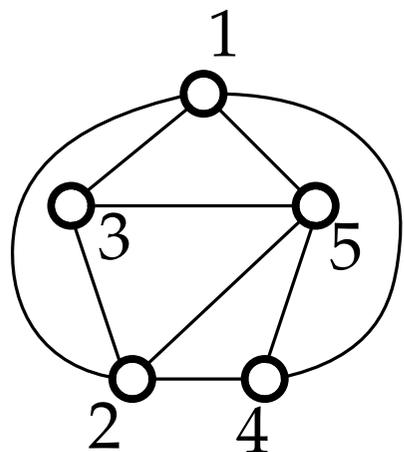


local book thickness: num. of pages per vertex

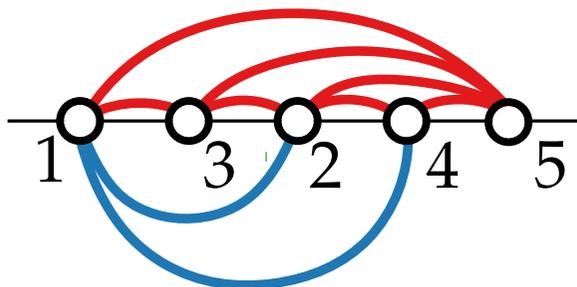


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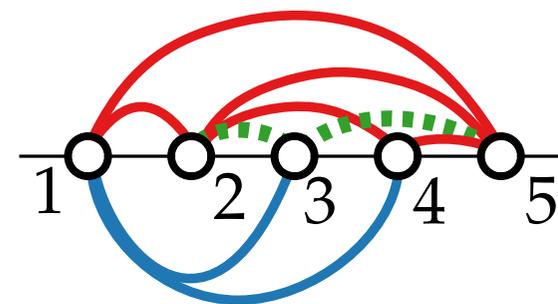
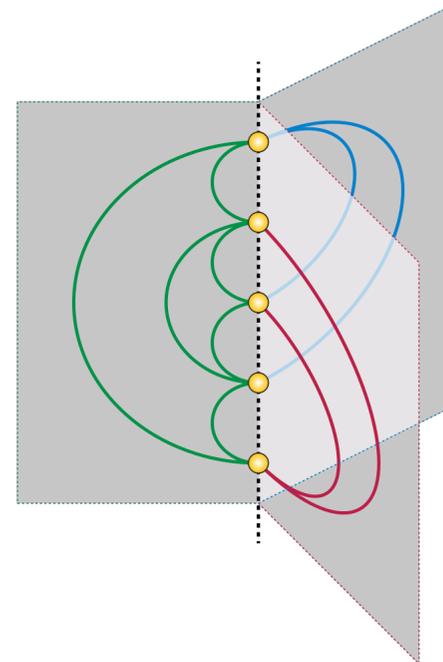
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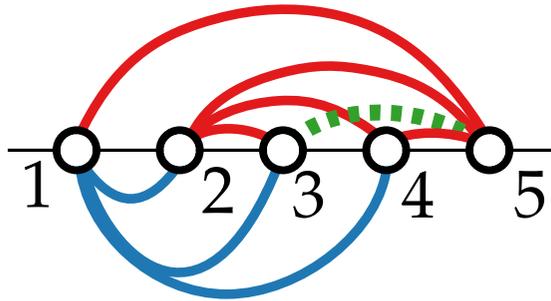
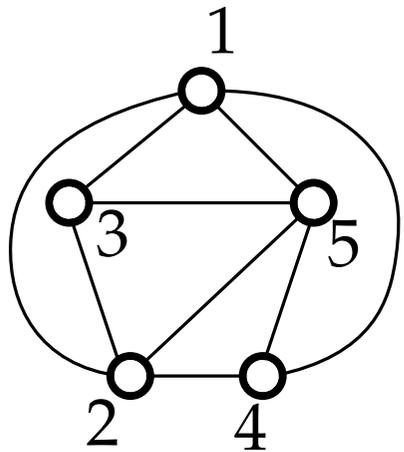


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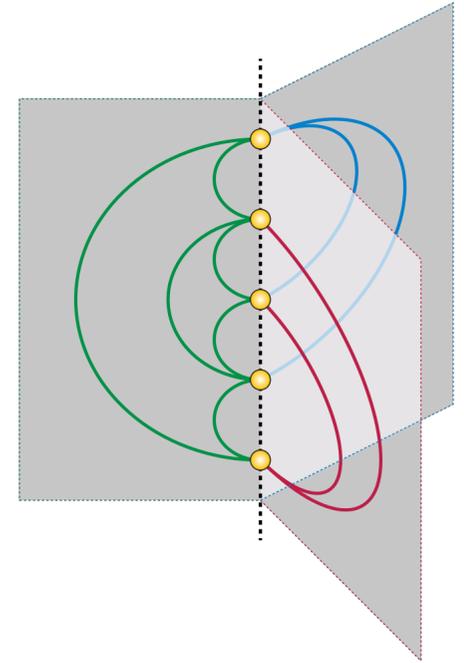
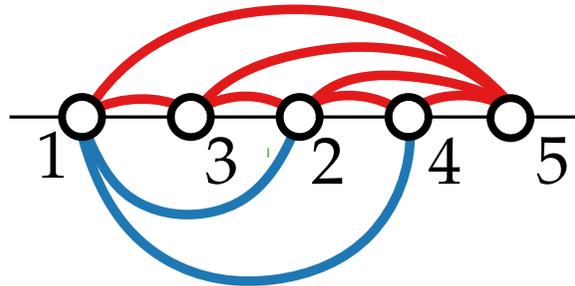


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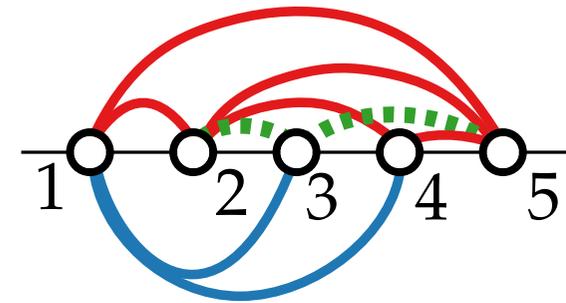
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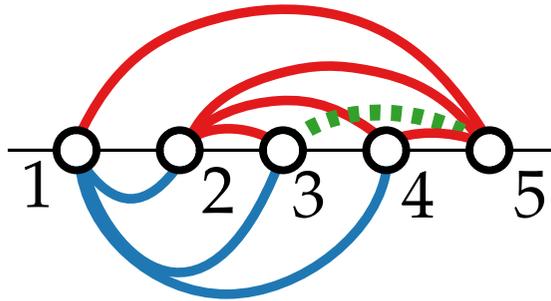
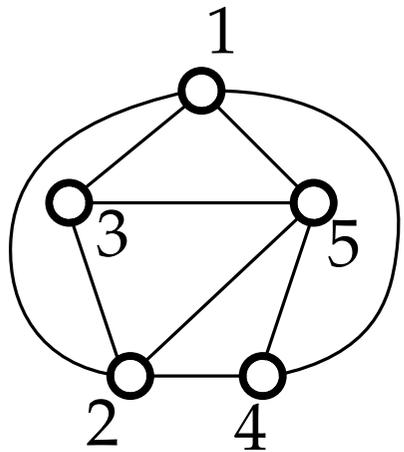
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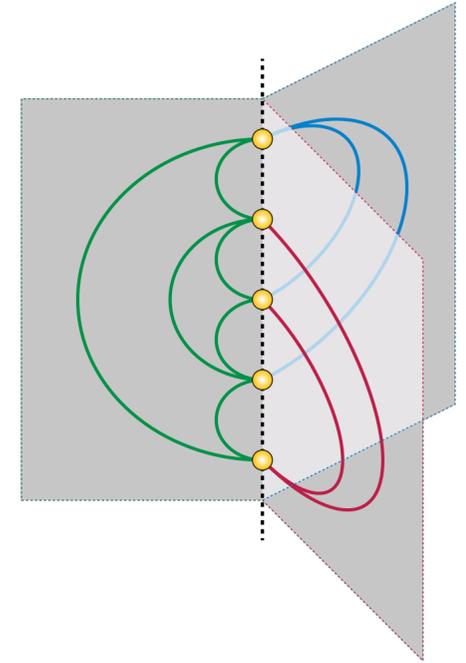
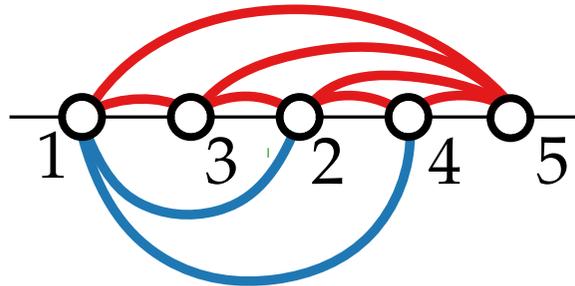
union book thickness: only conn. components planar

Local and Union Page Numbers

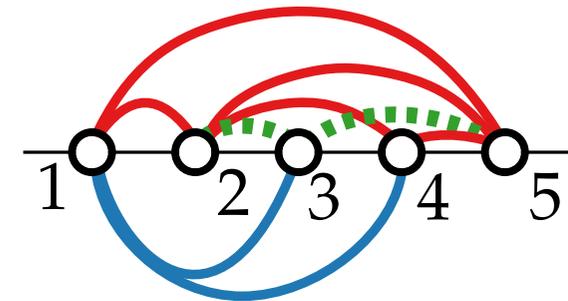
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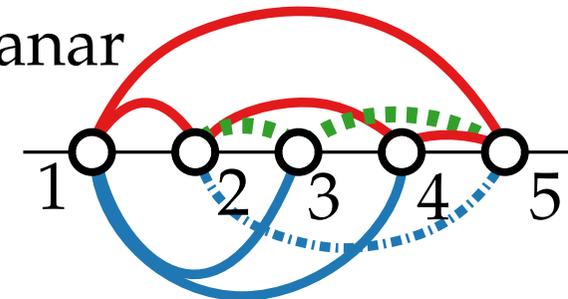
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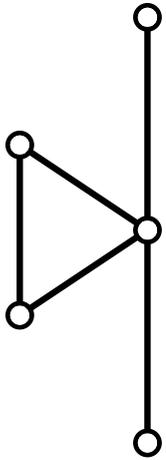
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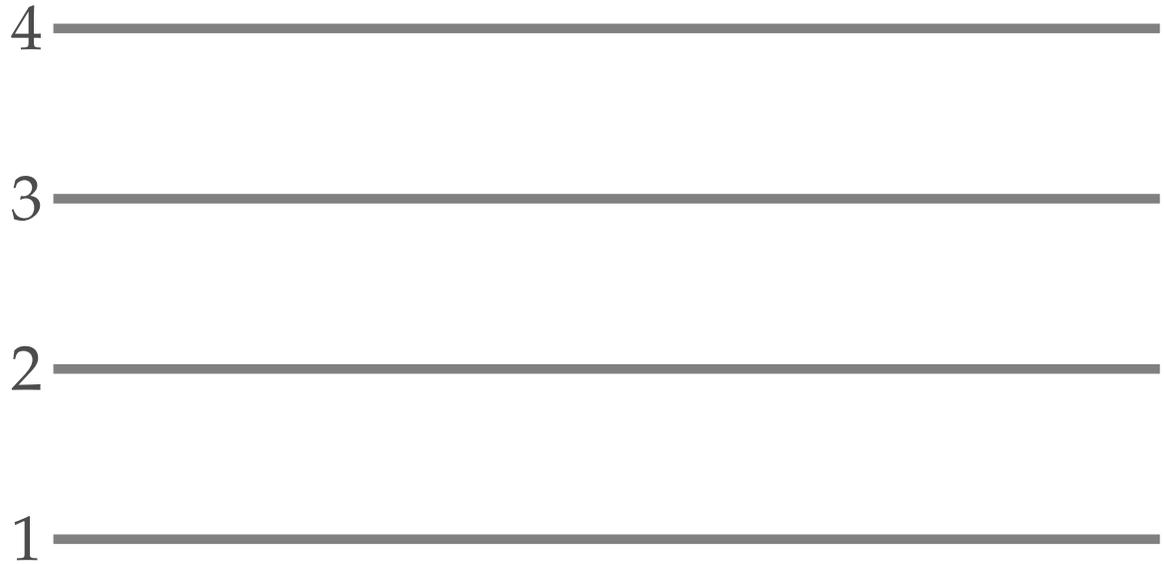
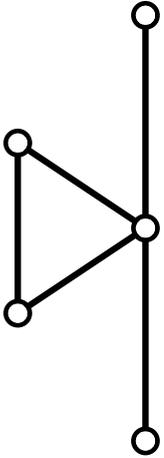


Level-Planar Drawings with Few Slopes



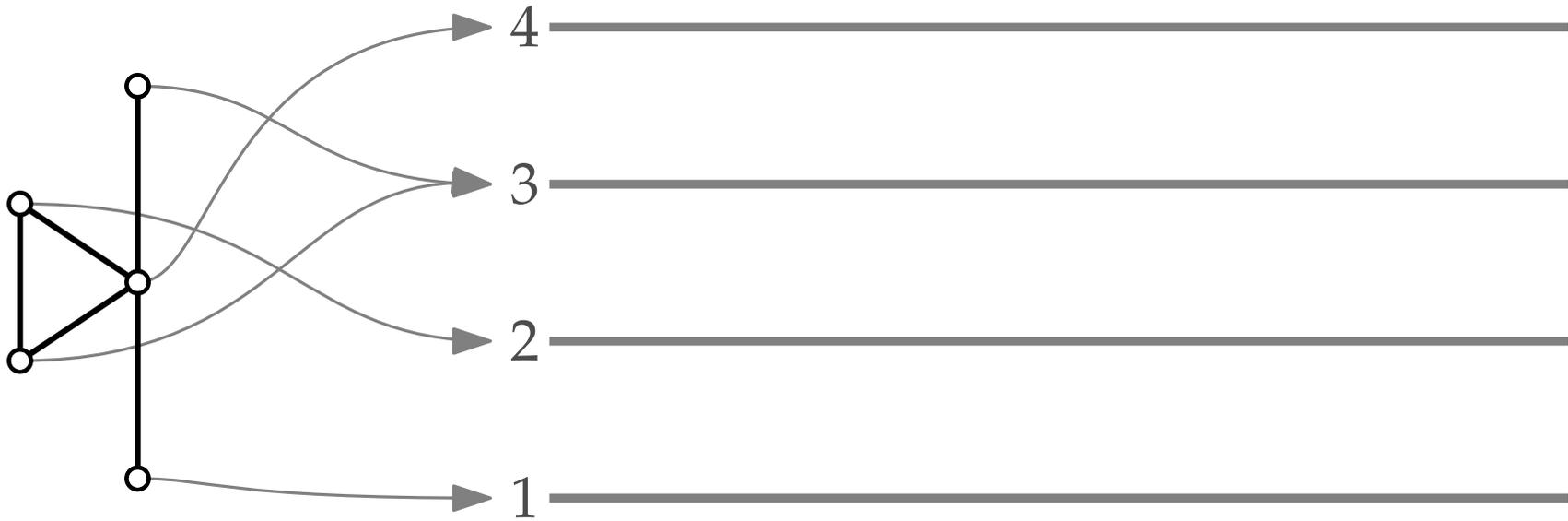
Given: • planar graph

Level-Planar Drawings with Few Slopes



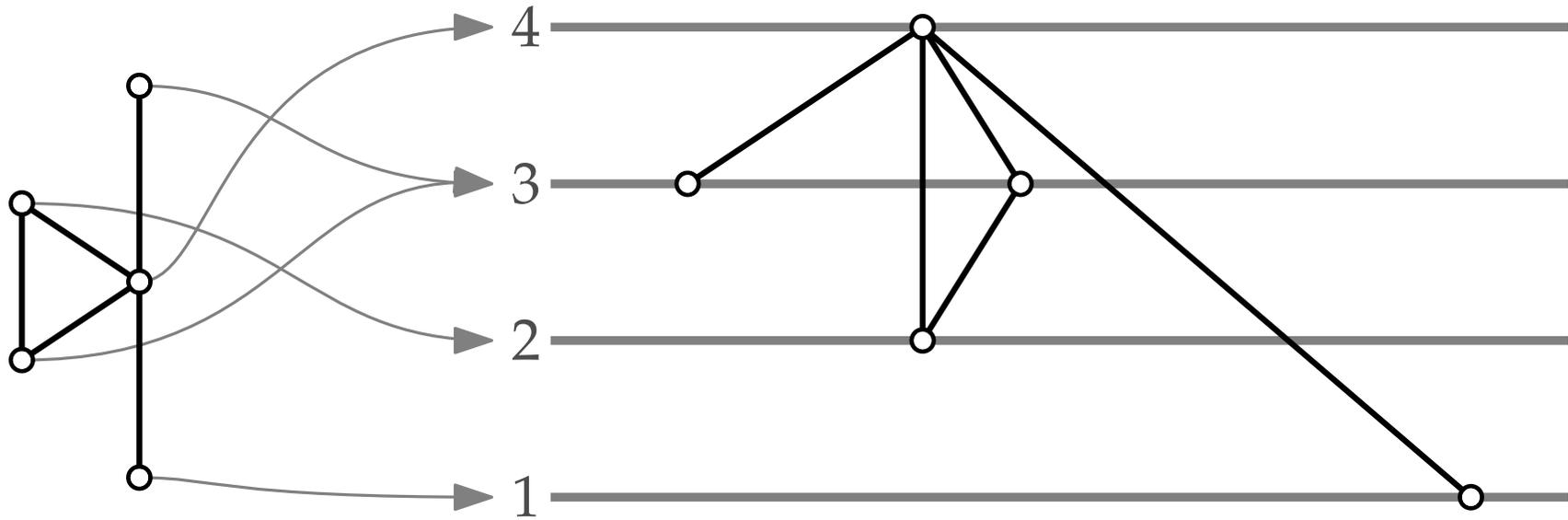
- Given:
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 - levels

Level-Planar Drawings with Few Slopes



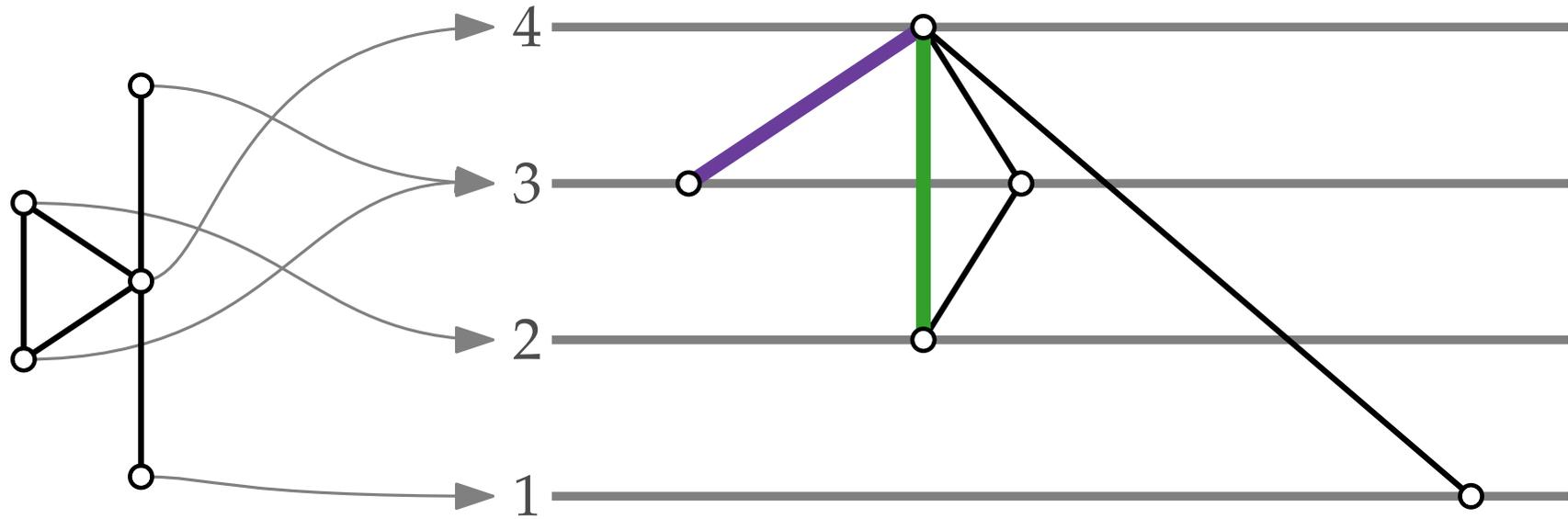
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 - level assignment

Level-Planar Drawings with Few Slopes



Given: • planar graph \Rightarrow level-planar drawing
 • levels
 • level assignment

Level-Planar Drawings with Few Slopes

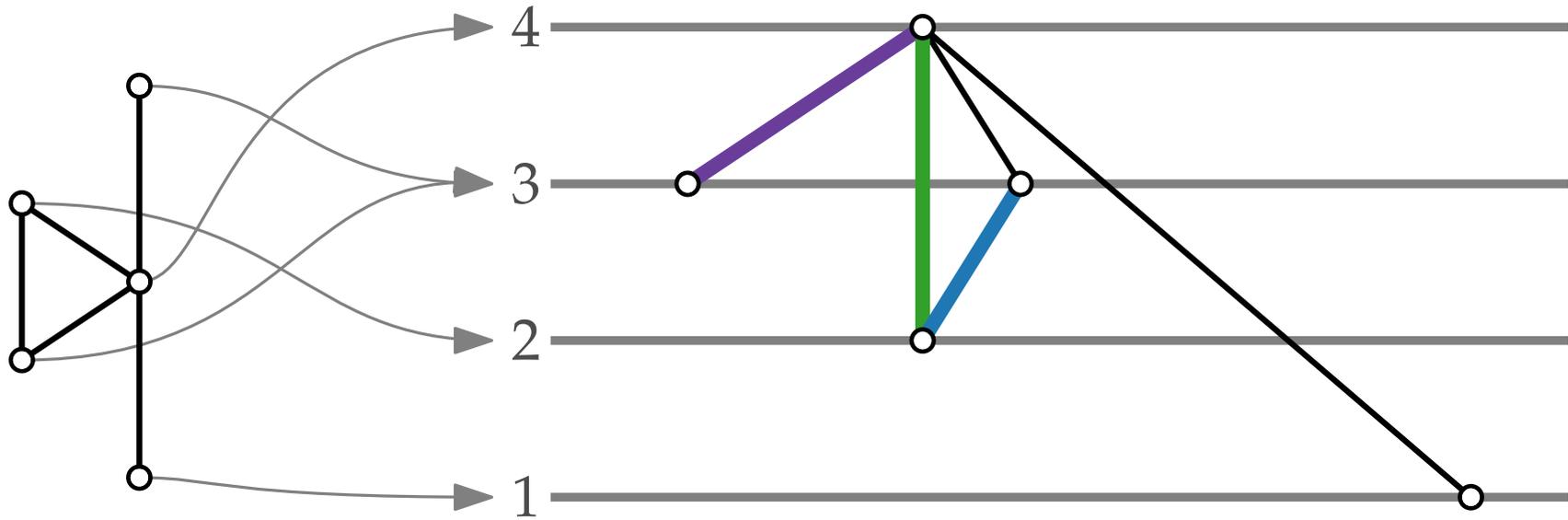


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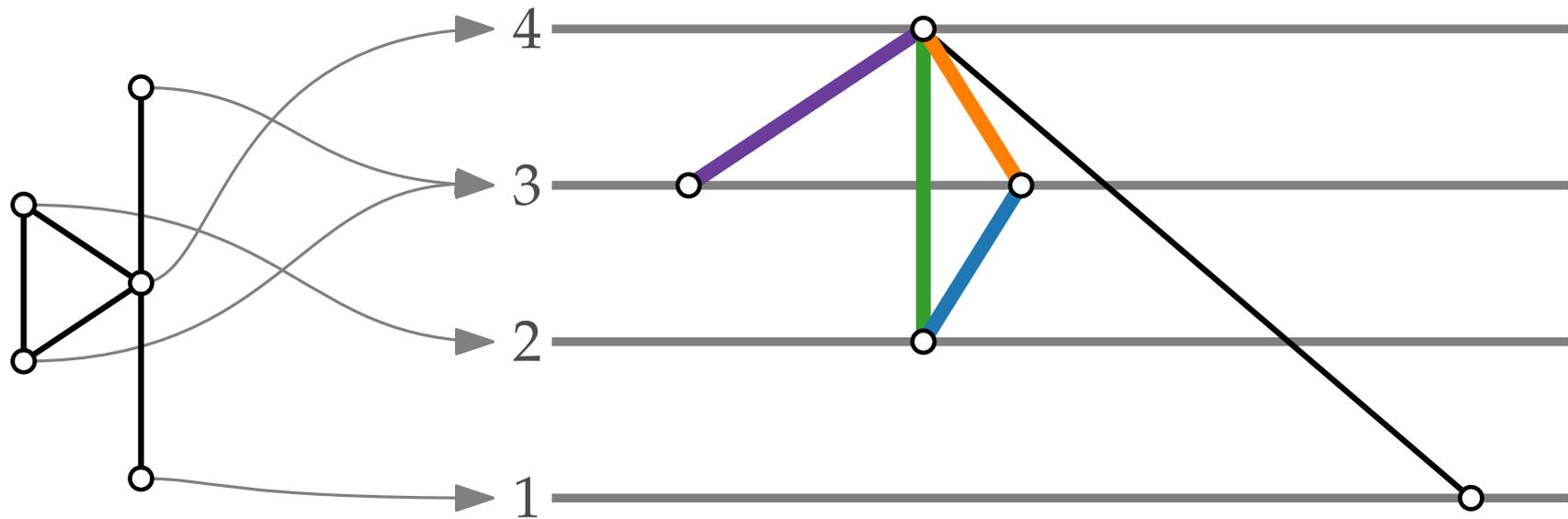


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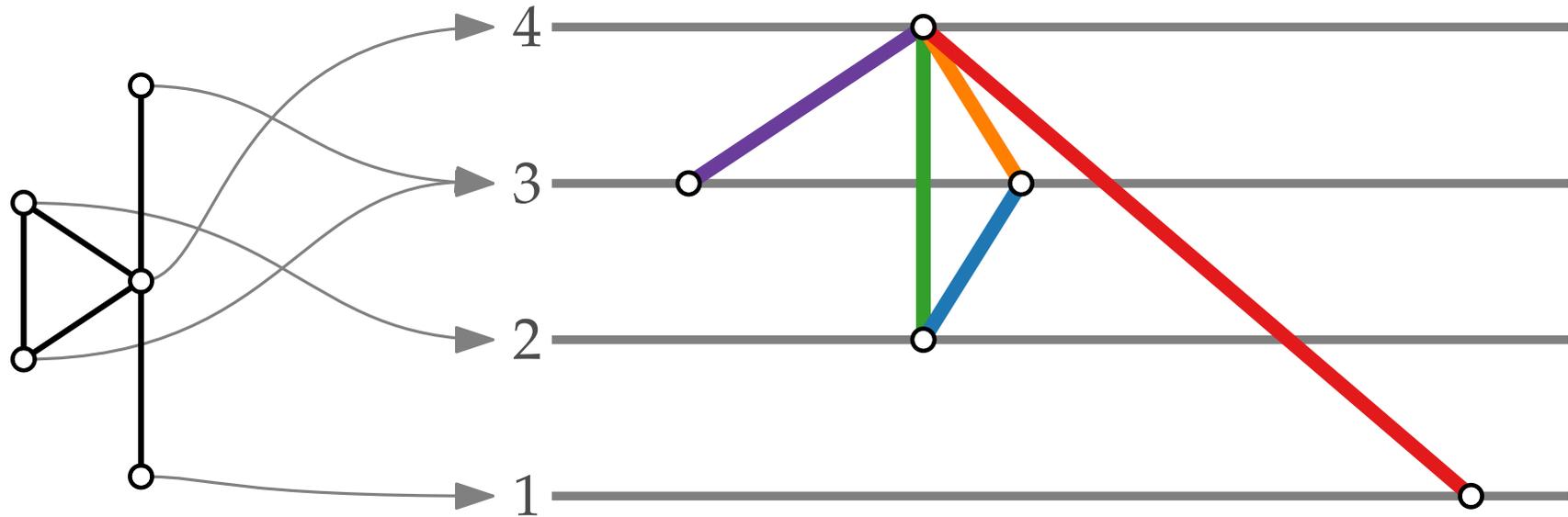


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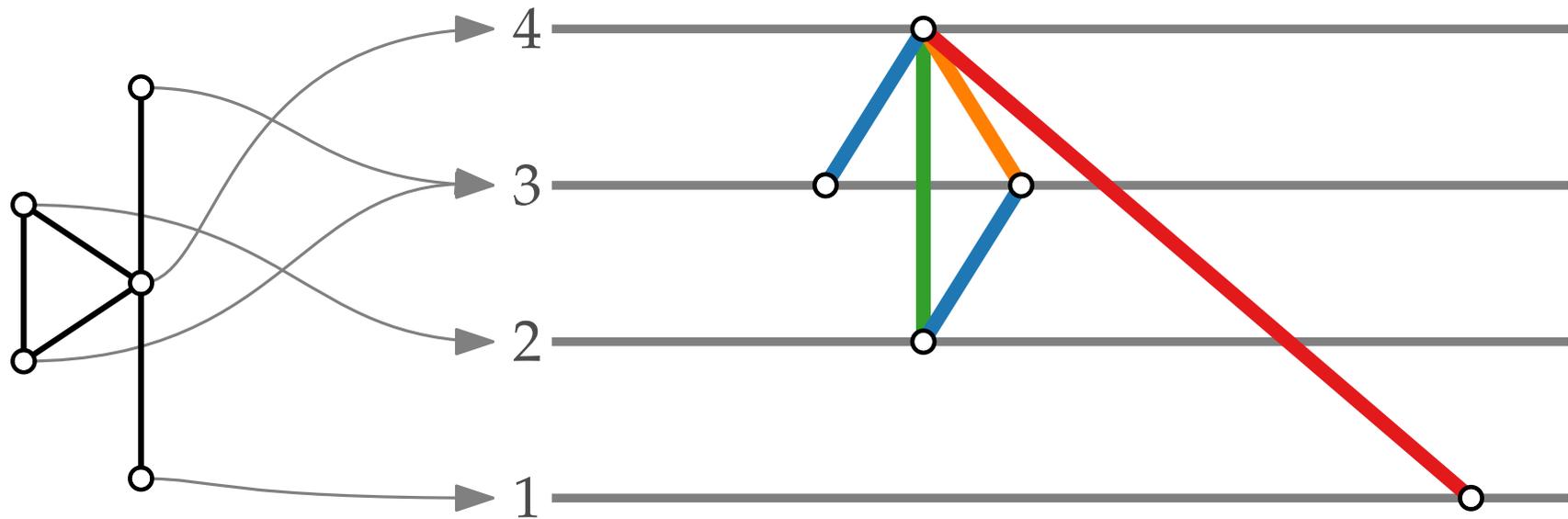


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Optimal Morphs of Planar Orthogonal Drawings II

<https://youtu.be/n0ZaPtfg9TM>

Exact Crossing Number Parameterized by Vertex Cover

For a graph G , and number k .

Def. $\text{CR}(G, k) :=$ can G be drawn with $\leq k$ edge crossings?

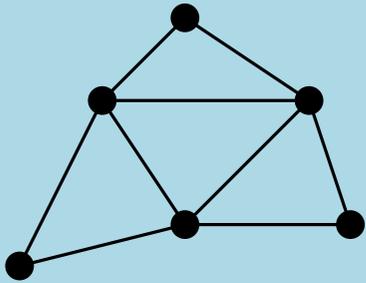
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Planar graphs:

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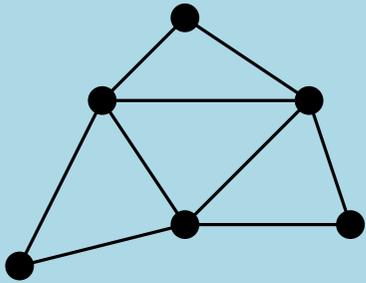
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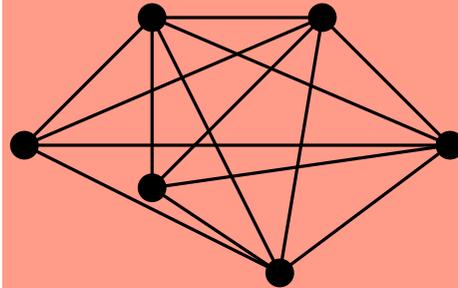
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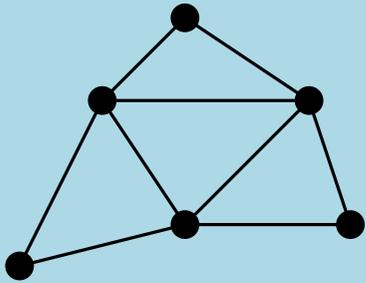
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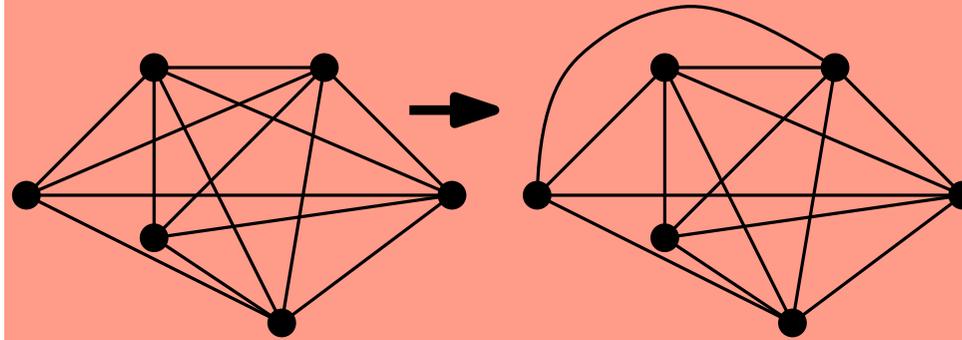
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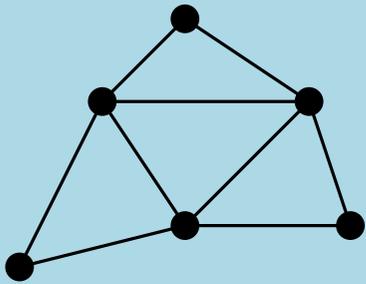
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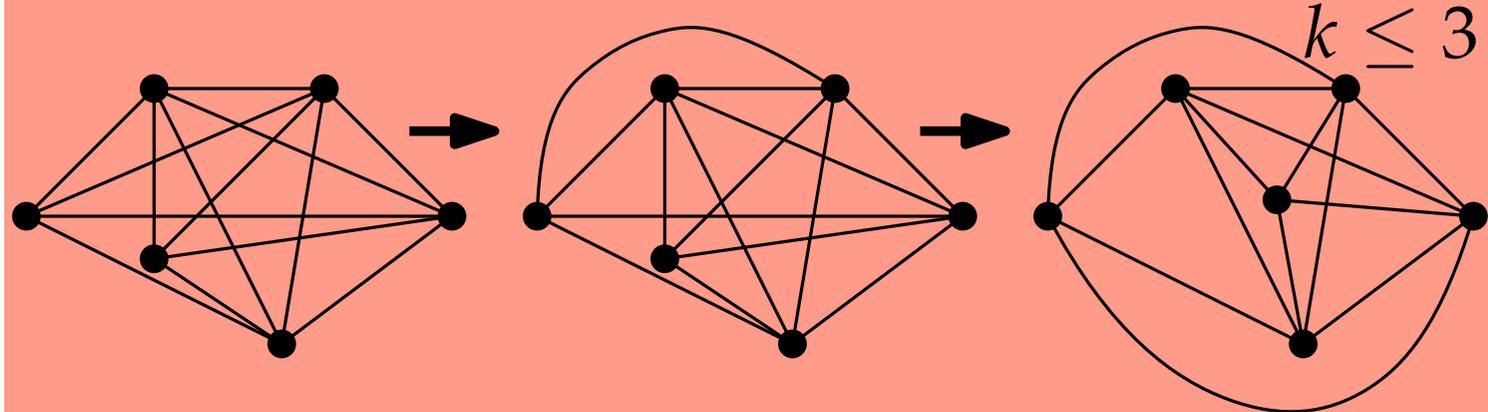
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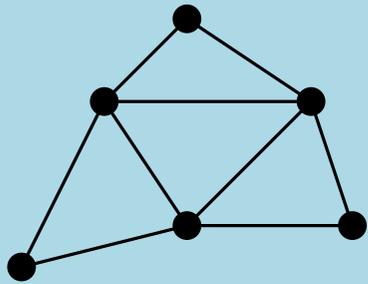
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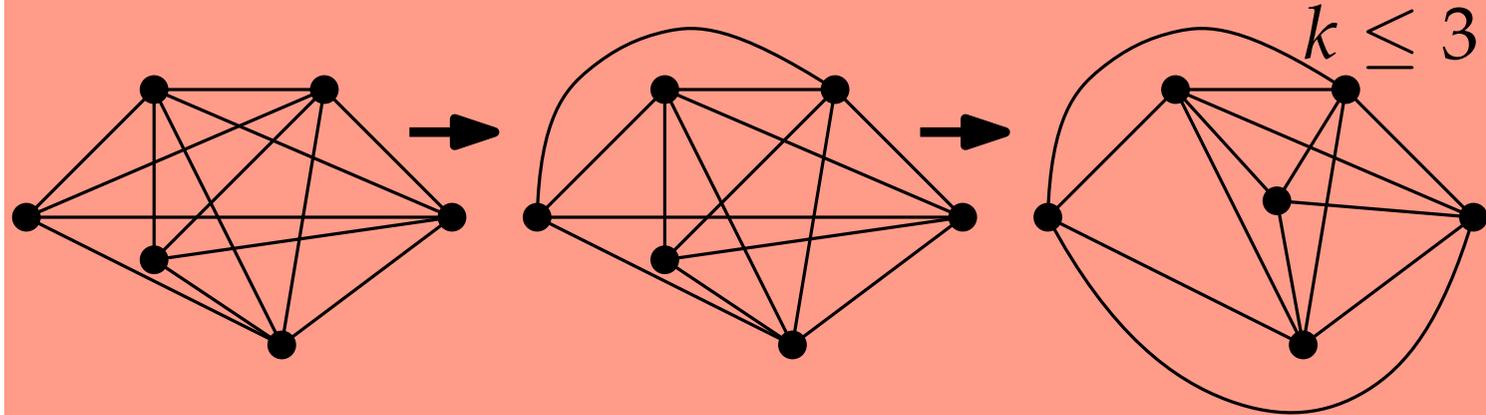
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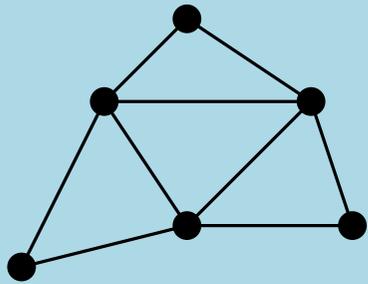
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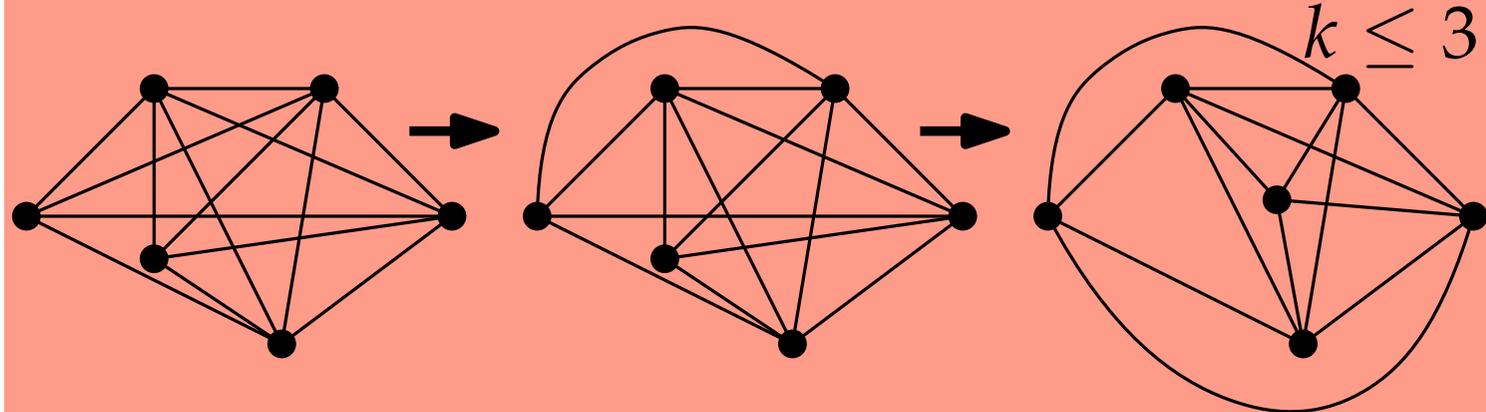
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runtime $O(f(t) \cdot \|G\|^c)$, const. c , function $f : \mathbb{N} \rightarrow \mathbb{Q}_{\geq 0}$.

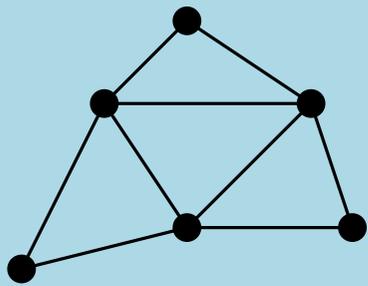
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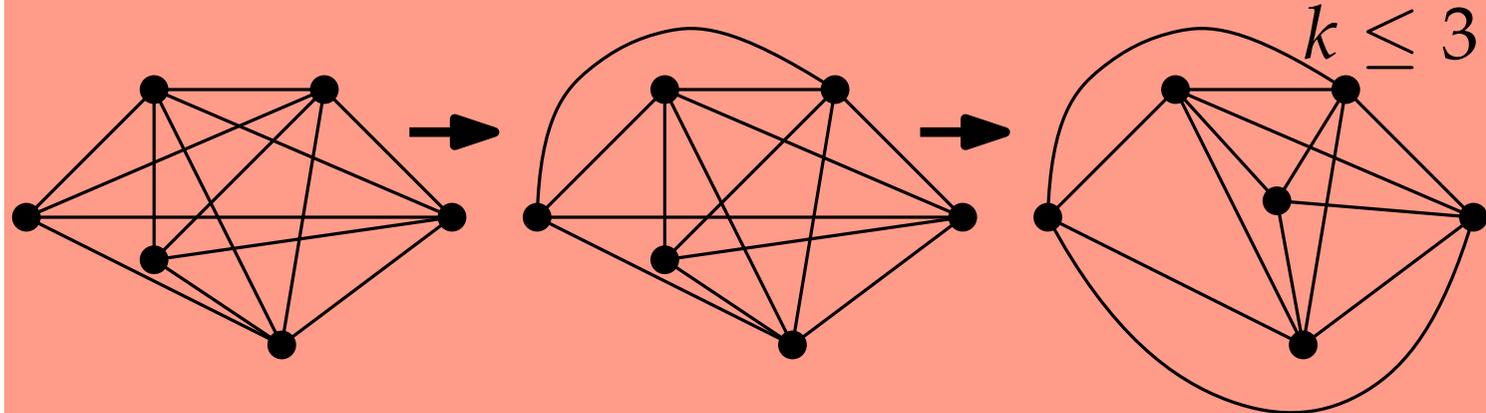
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Main result: when G has a **vertex cover** of size t ,
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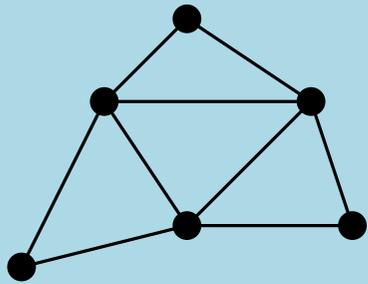
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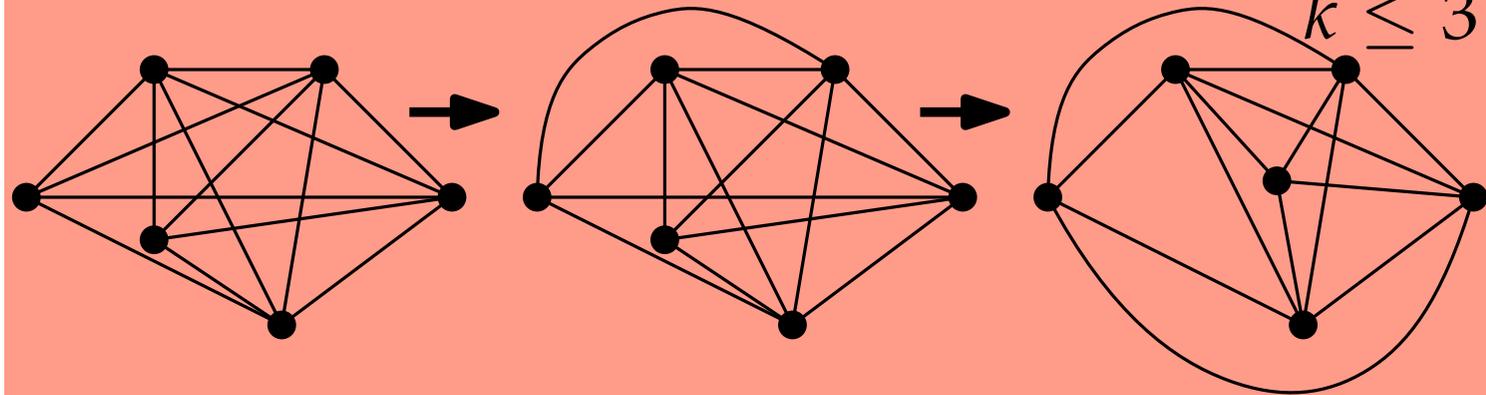
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Goes via *Integer Quadratic Programming*, for more, pick this paper!

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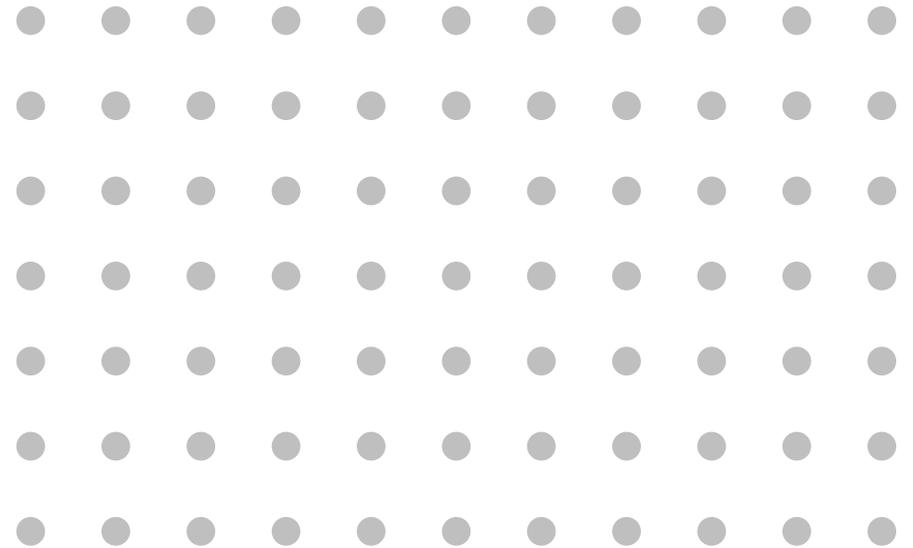
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Homotopy Height, Grid-Major Height and Graph-Drawing Height

Grid-major height *NEW!*

$W \times H$ gridpoints

$$\{1, \dots, W\} \times \{1, \dots, H\}$$



Homotopy Height, Grid-Major Height and Graph-Drawing Height

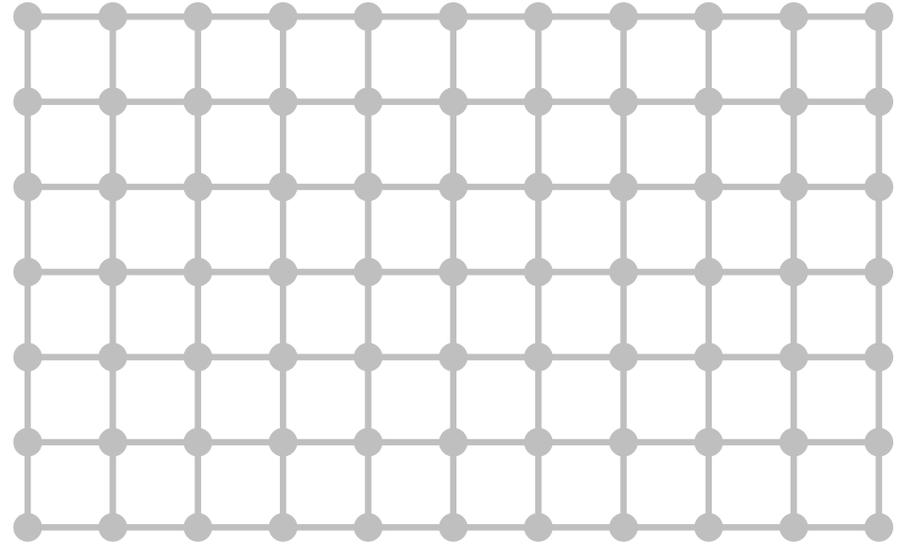
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graph on gridpoints, edges between points at distance 1



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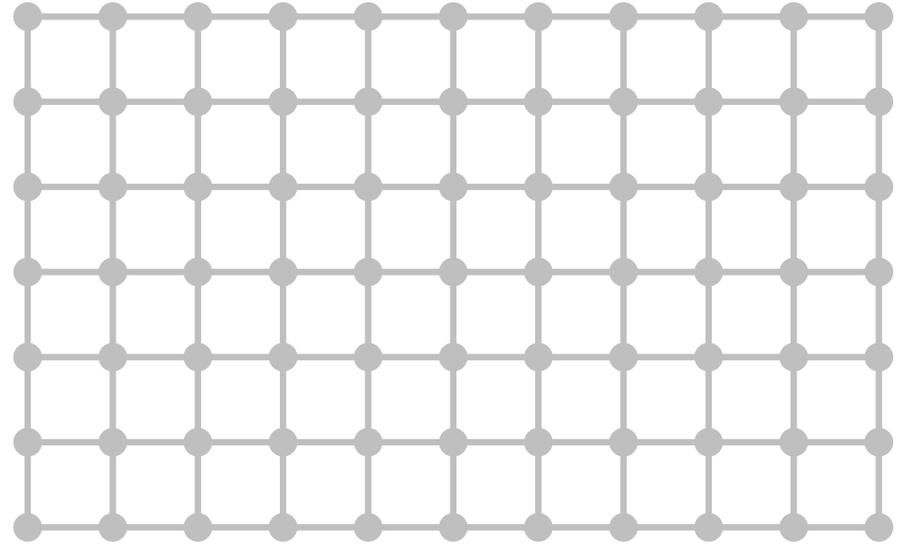
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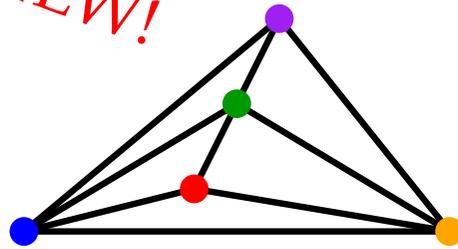
Grid-major height (of a planar graph G)

minimum h s.t. G is a minor of $W \times h$ grid



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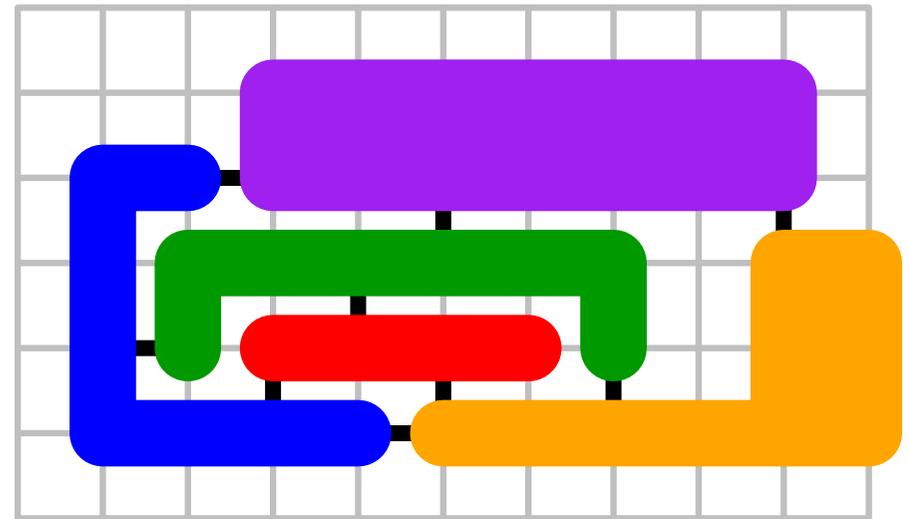


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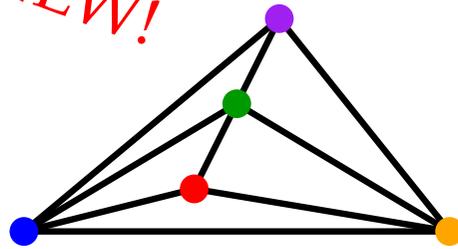
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Minor (of graph H)

graph obtained from H by
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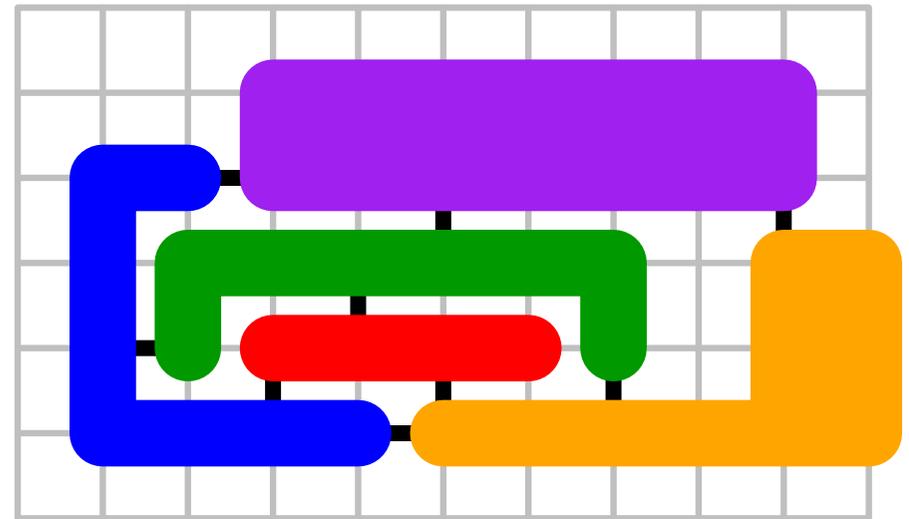


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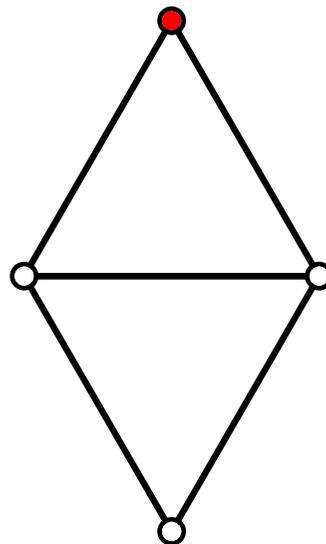
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To see how to use this, and
the other concept
(Homotopy-Height) to draw
graphs, pick this paper!

Edge-Length Ratio of (Outer-)Planar Graphs

Def. Sei G ein (planarer) Graph.

Sei Z eine geradlinige (planare) Zeichnung von G .

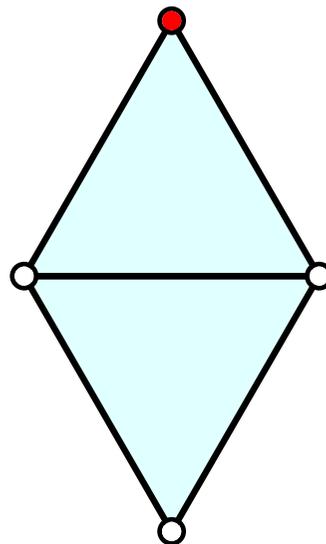


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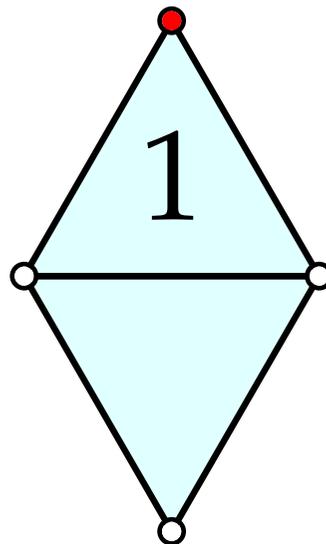


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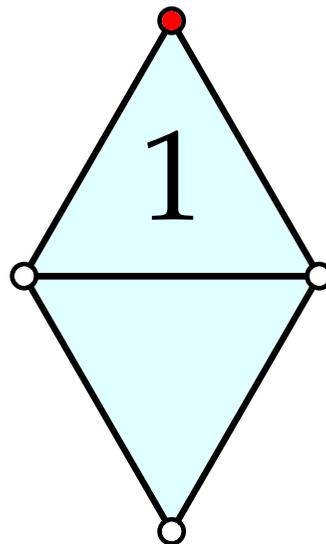
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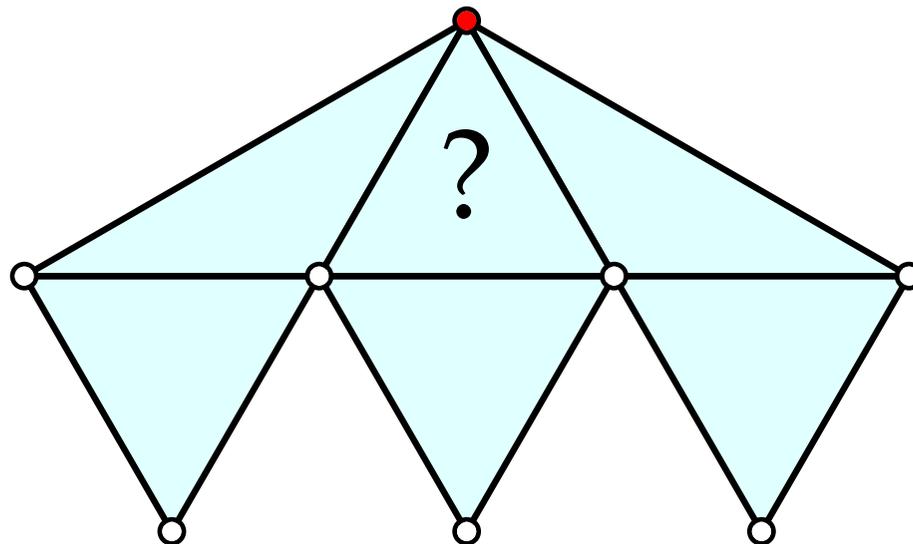
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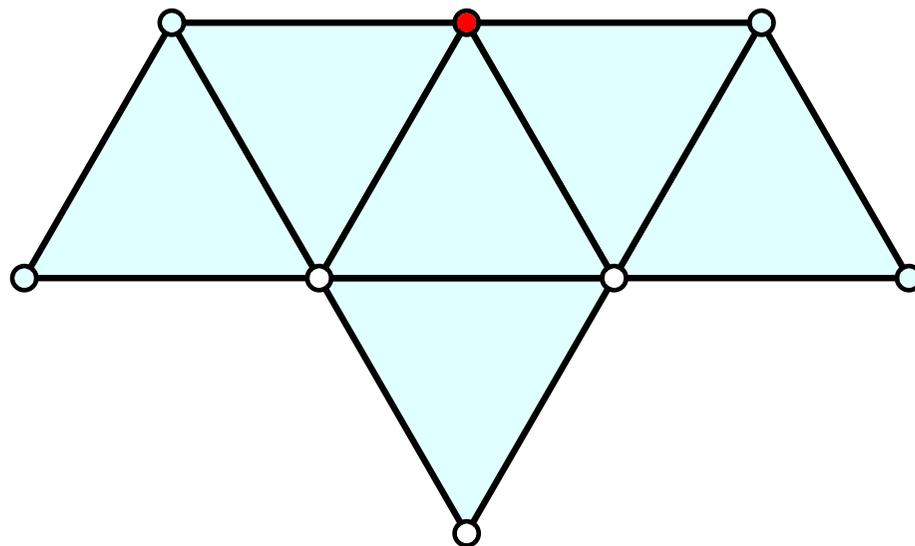
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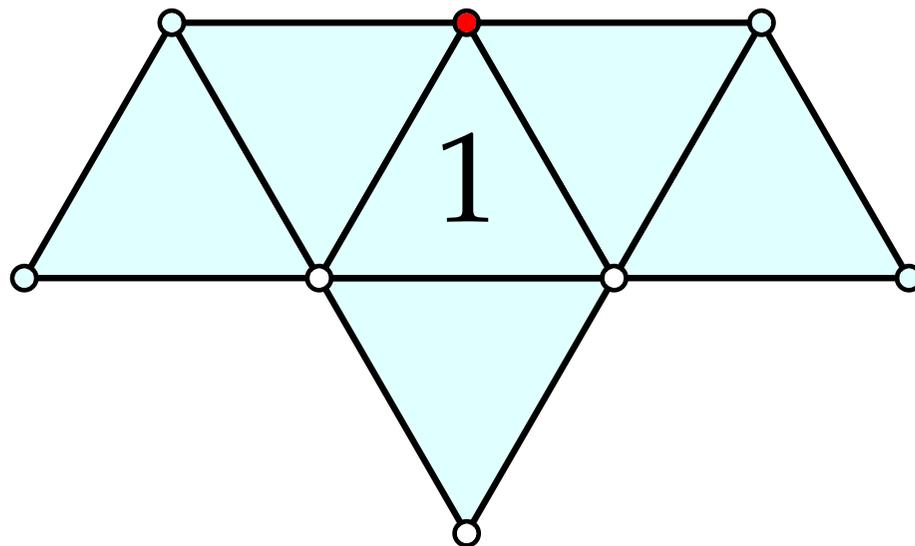
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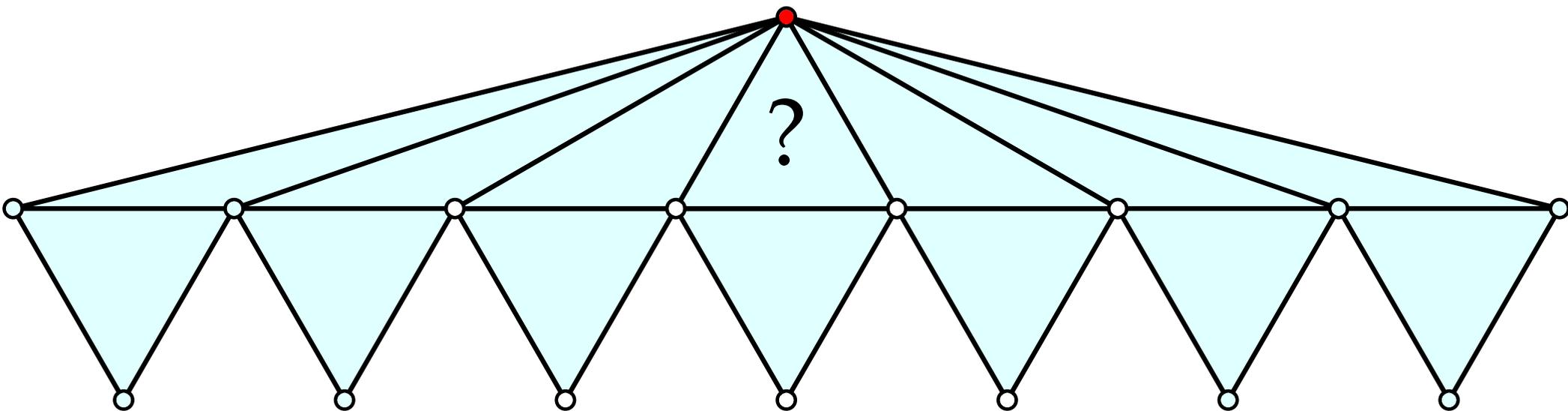
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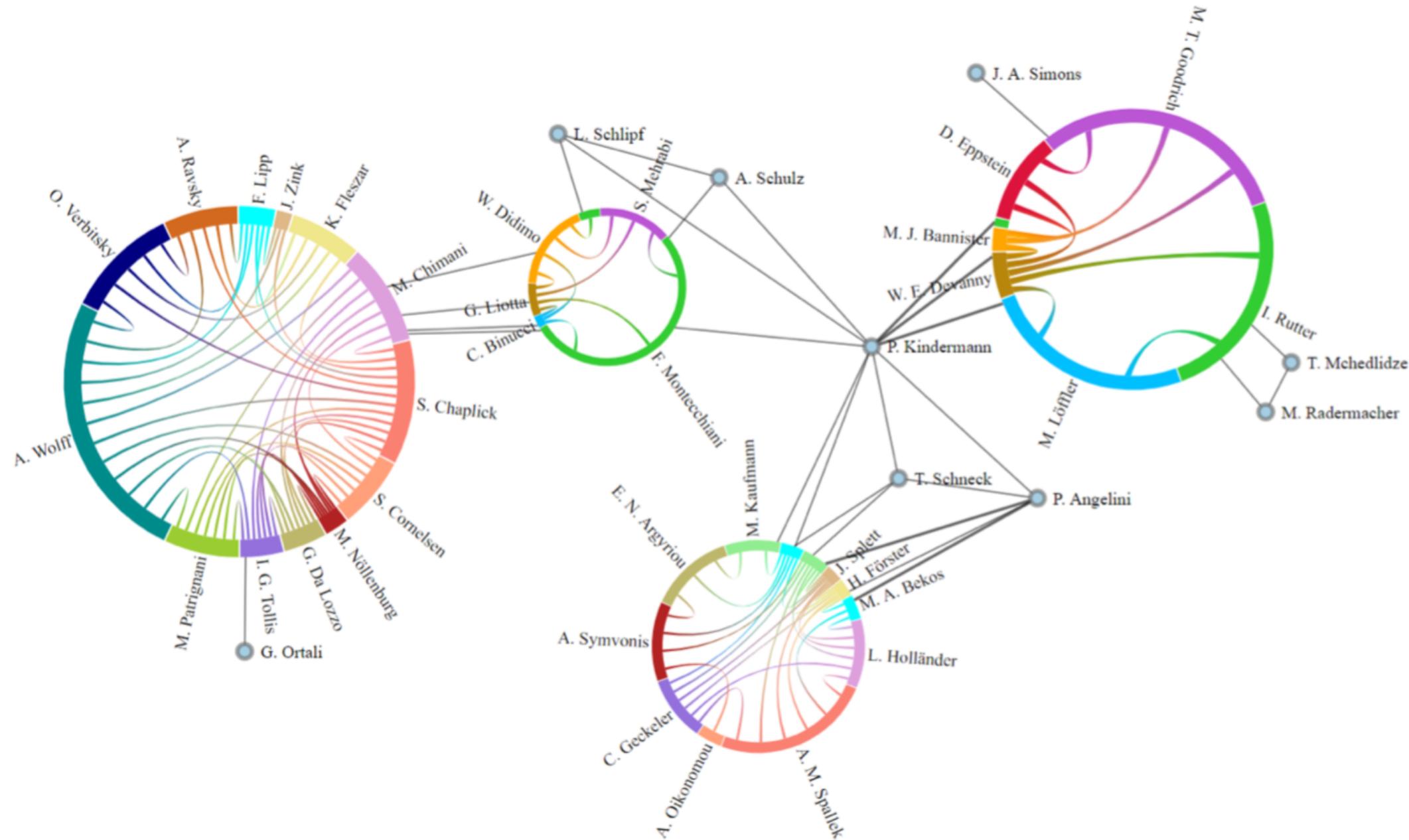
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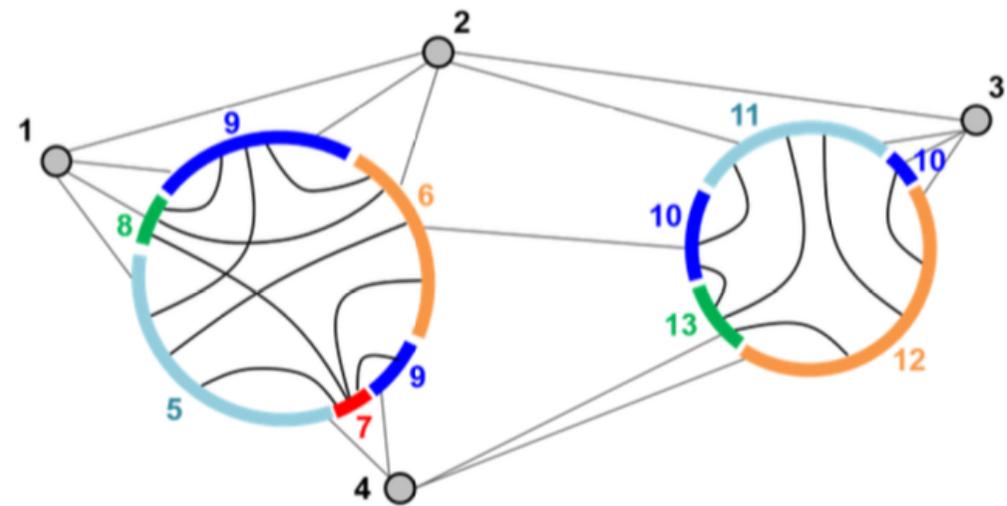
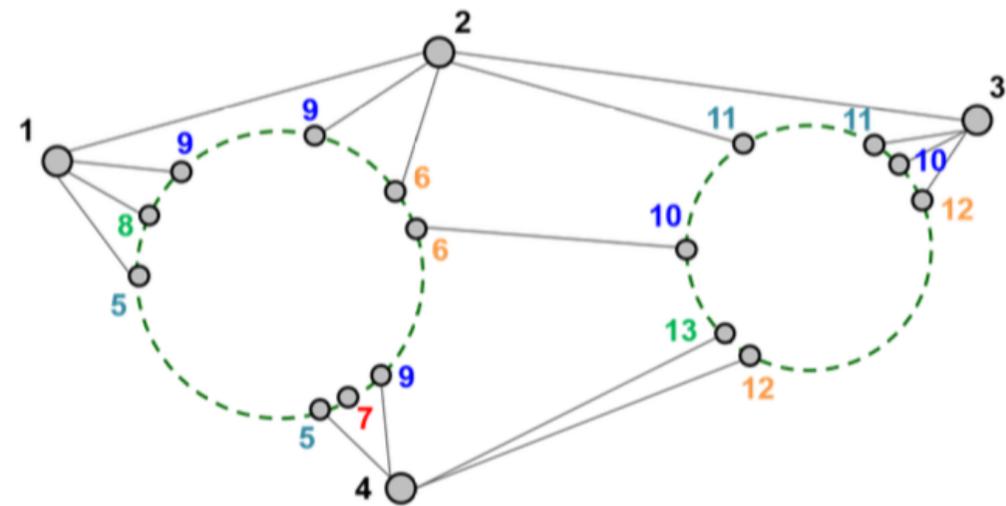
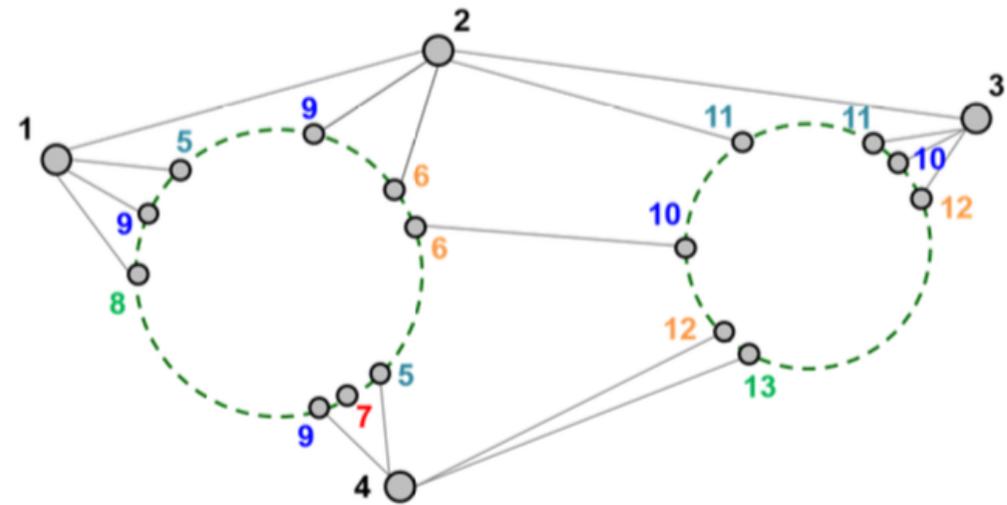
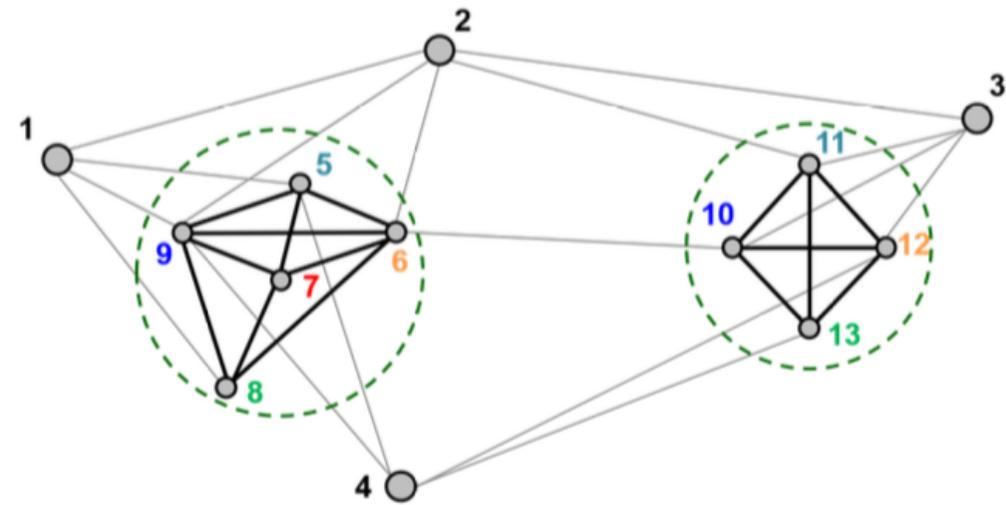
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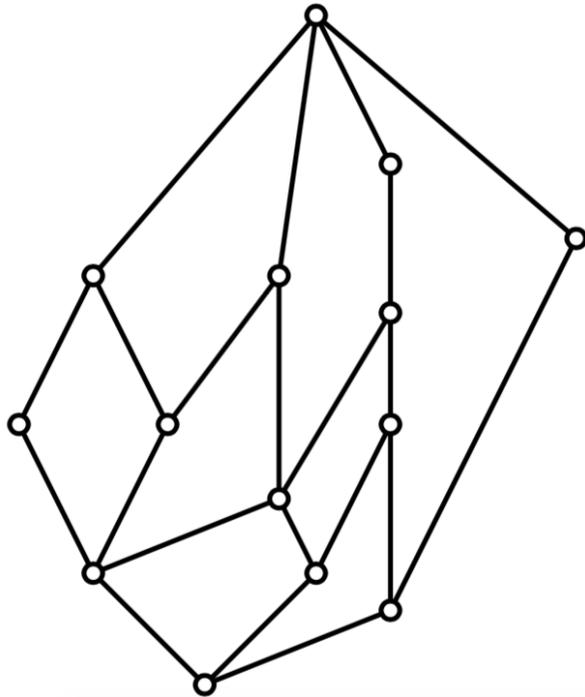
ChordLink: A New Hybrid Visualization Model



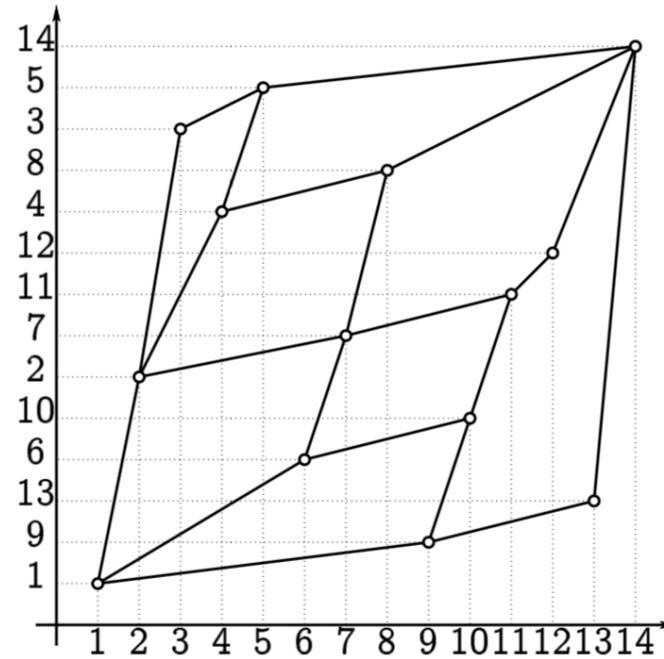
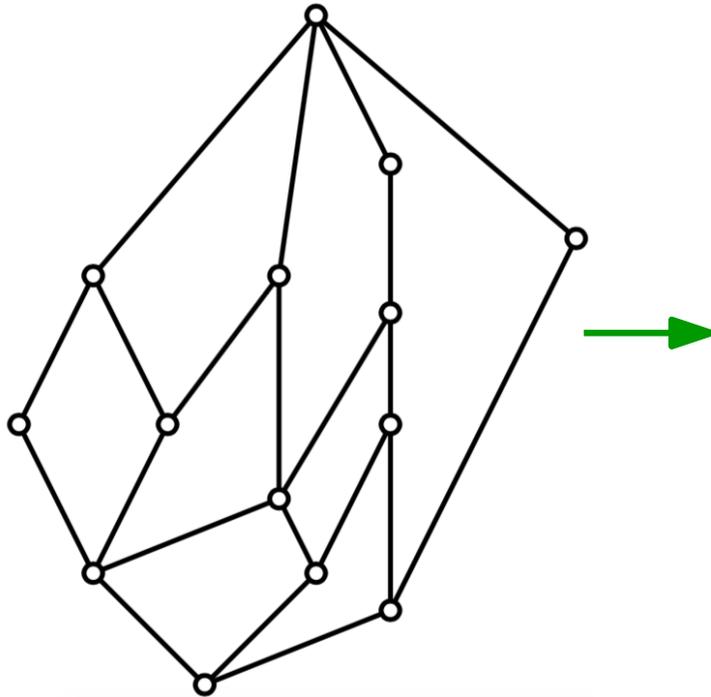
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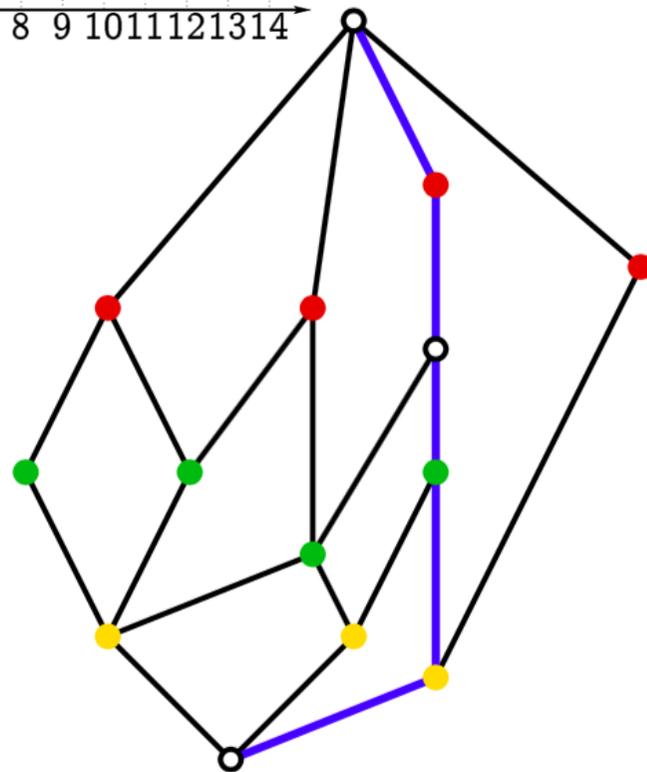
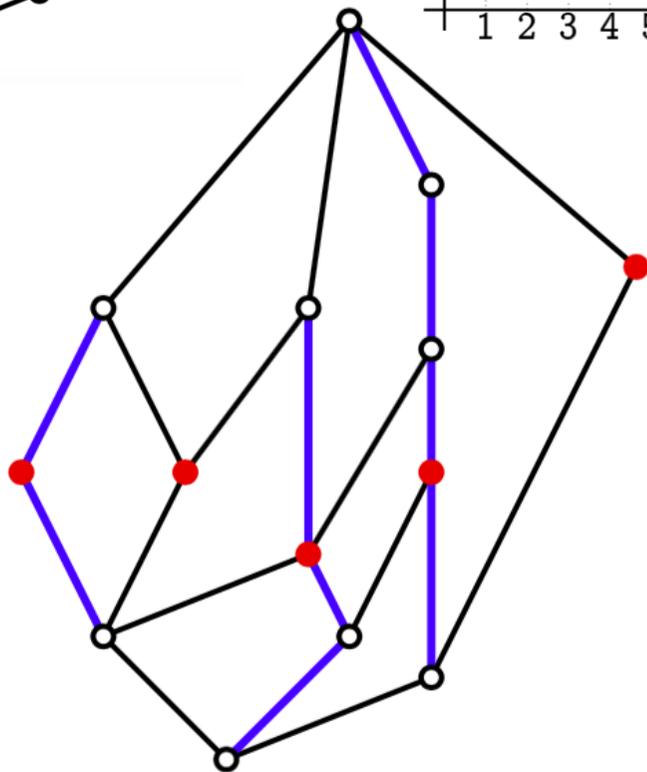
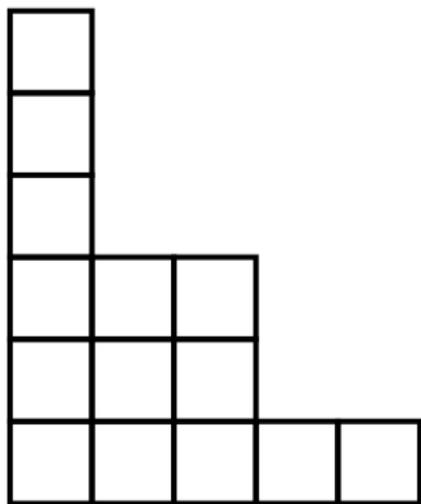
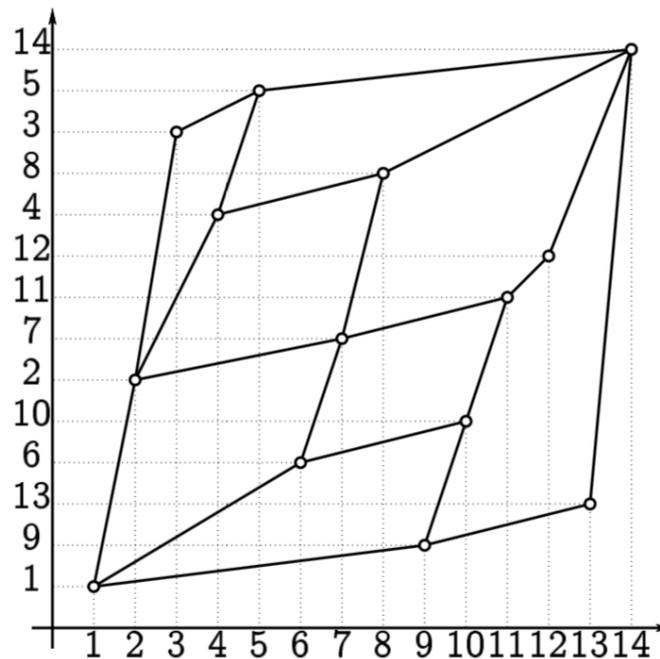
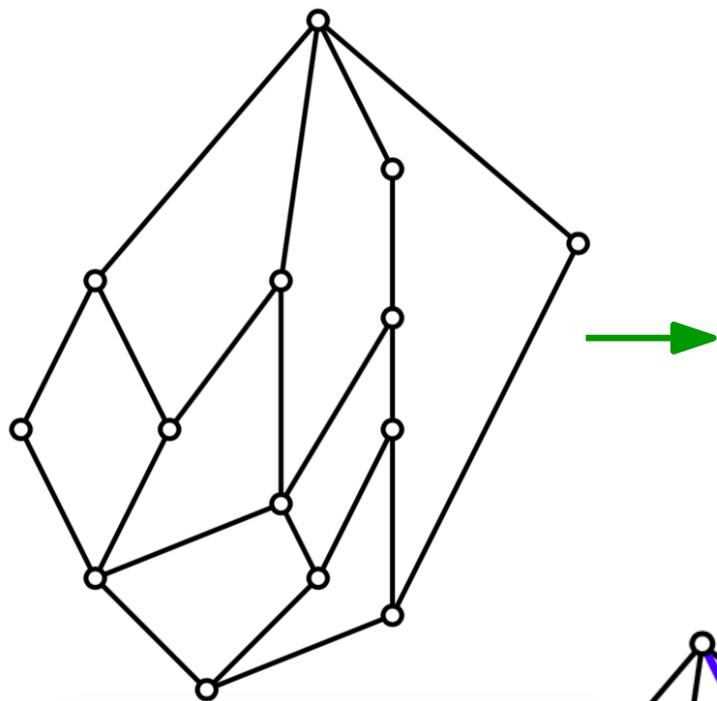
4-Connected Triangulations on Few Lines



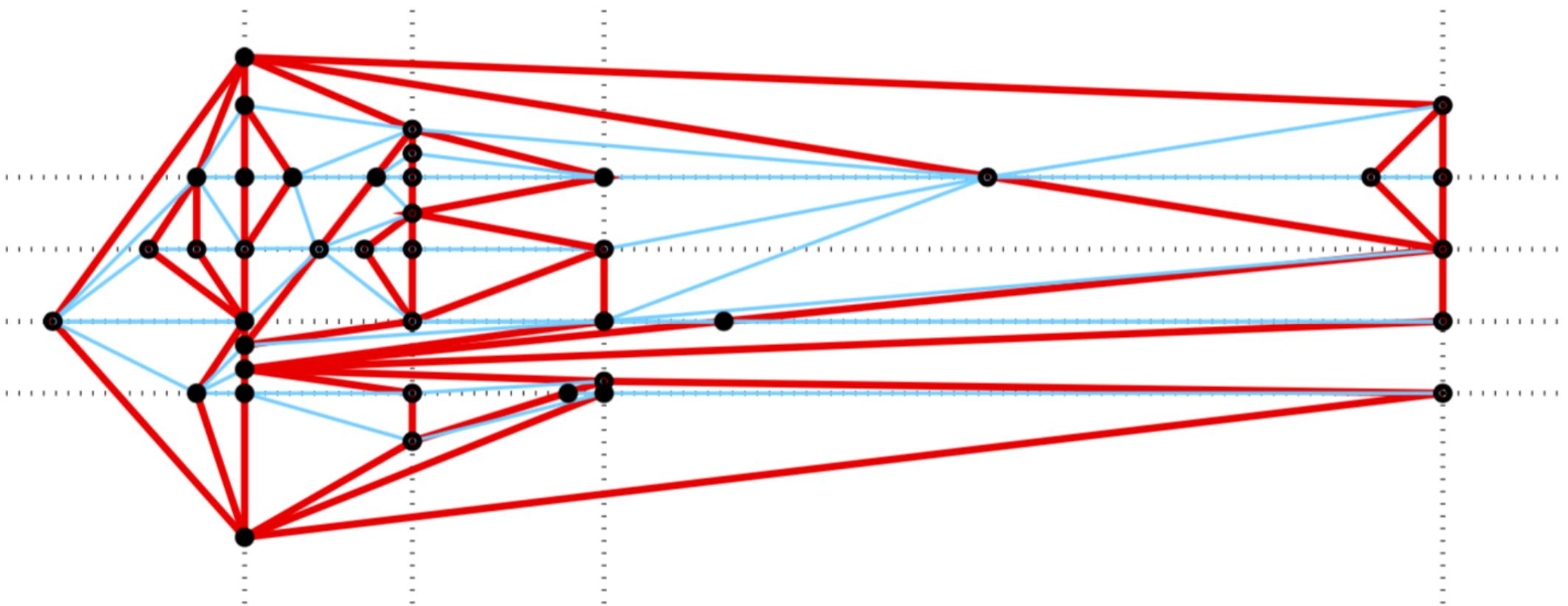
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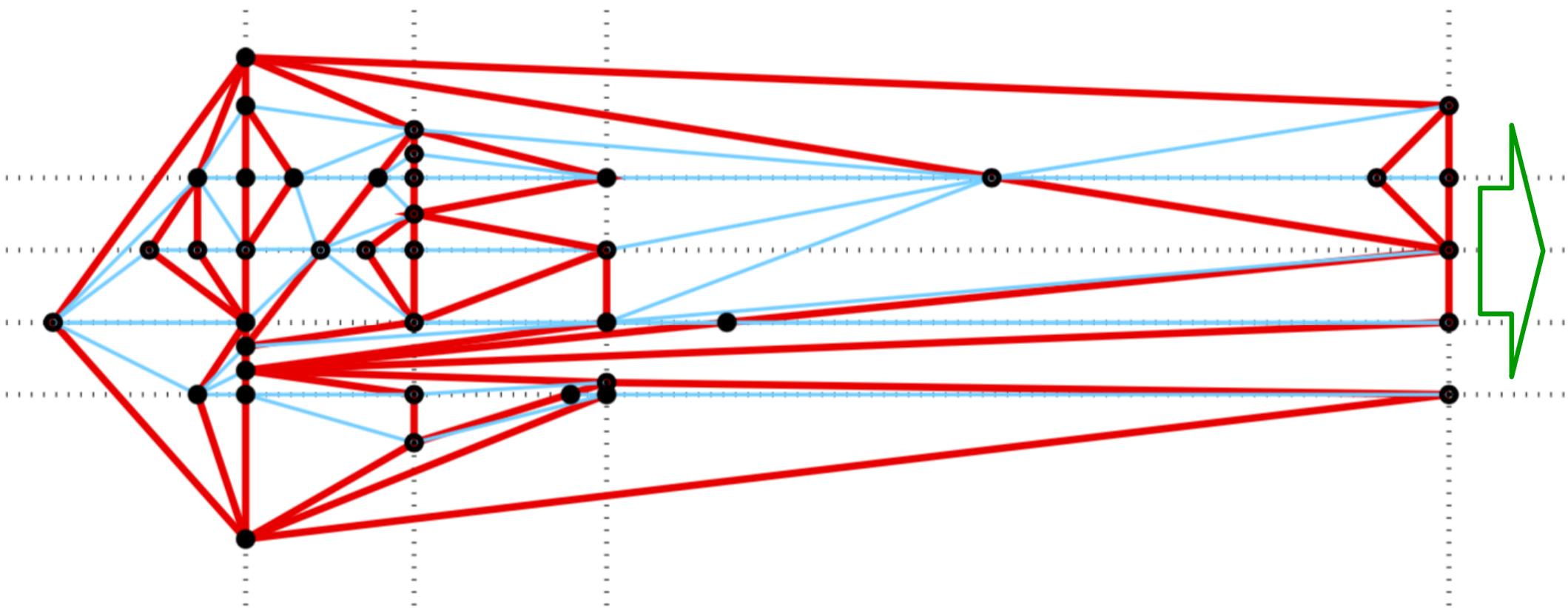
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Themenübersicht

1. Computing Stable Demers Cartograms (PK)
2. Parameterized Algorithms for Book Embedding Problems (PK)
3. Local and Union Page Numbers (PK)
4. Level-Planar Drawings with Few Slopes (PK)
5. Optimal Morphs of Planar Orthogonal Drawings II (SC)
6. Exact Crossing Number Parameterized by Vertex Cover (SC)
7. Homotopy Height, Grid-Major Height and Graph-Drawing Height (SC)
8. On the Edge-Length Ratio of (Outer-)Planar Graphs (AW)
9. ChordLink: A New Hybrid Visualization Model (AW)
10. 4-Connected Triangulations on Few Lines (AW)