GRAPH DRAWING CONTEST

2019 report

gd19

CONTEST COMMITTEE

Philipp Kindermann
University of Würzburg

Tamara Mchedlidze
Karlsruhe Institute of Technology

Ignaz Rutter
University of Passau

GRAPH DRAWING CONTEST

historic perspective

GRAPH DRAWING CONTEST

historic perspective

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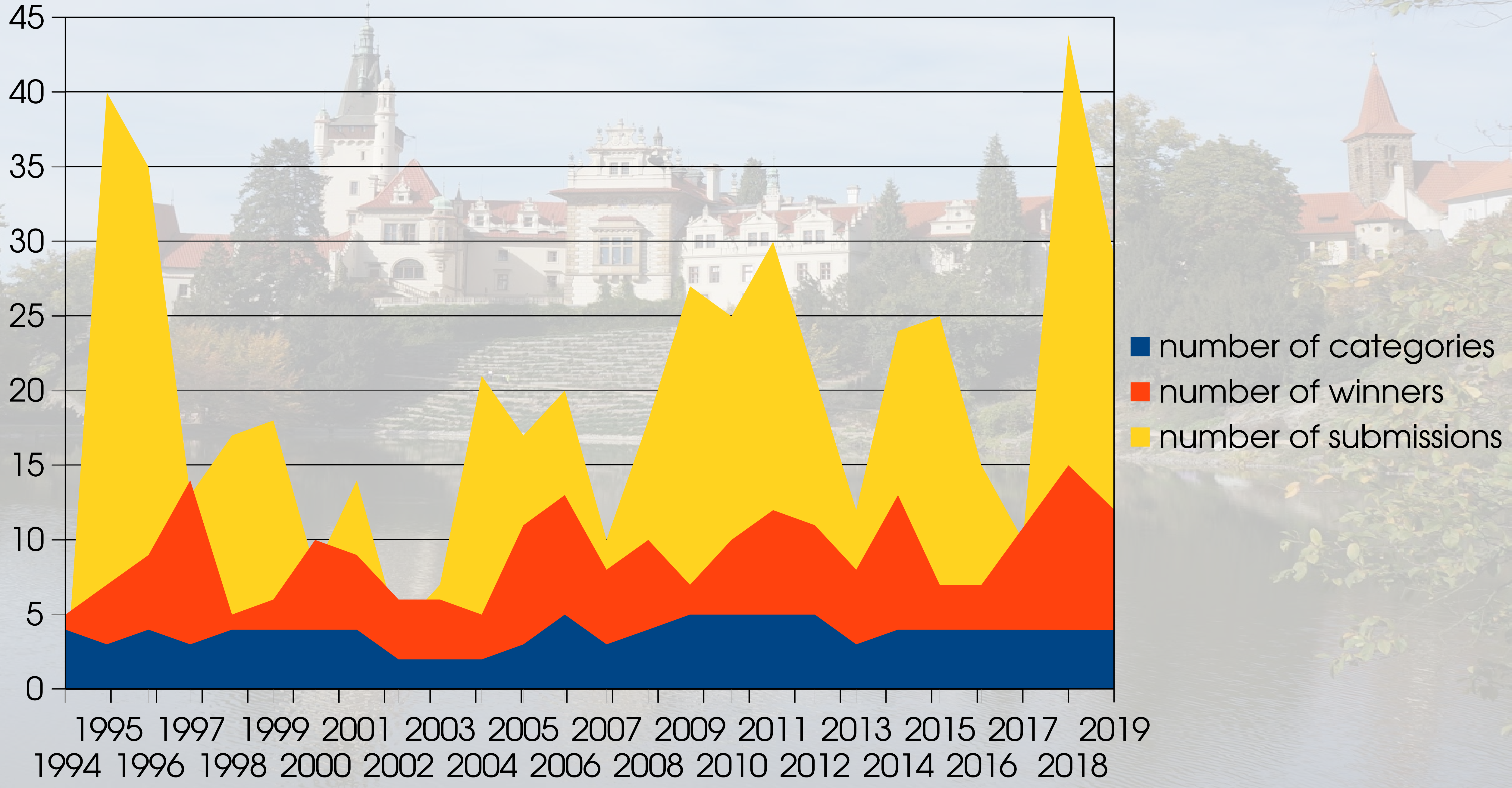


GRAPH DRAWING CONTEST

historic perspective

1994 Uwe Wuerker • Stefan Hougardy • Petra Mutzel & Thomas Odenthal • Georg Sander

1995 Falk Schreiber & Carsten Friedrich • Vladimir Batagelj & Andrej Mrvar • Paulis Kikusts & Peteris Rucevskis • Georg Sander

1996 Ulrich Fößmeier & Michael Kaufmann • Vladimir Batagelj & Andrej Mrvar • Falk Schreiber & Carsten Friedrich • Thomas Kamps, Jörg Kleinz & Thomas Reichenberger

1997 B. Bascary, B. Cattan, A. Cohen-Solal, M. Philip & H. Szigeti • Vladimir Batagelj & Andrej Mrvar • Michael Kaufmann & Gunnar Klau • Thomas Ziegler & Petra Mutzel • Cristian Ghezzi • Falk Schreiber & Carsten Friedrich

1998 Vladimir Batagelj & Andrej Mrvar • Petrus Abri Santoso & Andi Surjanto • Roland Wiese

1999 Vladimir Batagelj & Andrej Mrvar • Ulrik Brandes • Karlis Freivalds & Paulis Kikusts • Rowena Mankelow

2000 Nikola S. Nikolov • Vladimir Batagelj & Andrej Mrvar • Jan Adamec • C. Duncan, P. Gajer, M. Goodrich & S. Kobourov • Robby Schönfeld & Nikola S. Nikolov

2001 Ulrik Brandes & Marco Gärtler • C. Gutwenger, K. Klein, J. Kupke & S. Leipert • Roland Wiese • Carsten Friedrich • Merijam Percan

2002 Daniel Gmach • Paul Holleis & Thomas Zimmermann • Nikola S. Nikolov & Patrick Healey • Christoph Vogt

2003 Daniel Gmach, Paul Holleis & Thomas Zimmermann • Christian Kuklas, Dirk Koschützki & Falk Schreiber

2004 Andrei Grecu & Gunnar Klau • Ulrik Brandes, Daniel Fleischer & Thomas Puppe

2005 Markus Chimani, Carsten Gutwenger & Karsten Klein • V. Batagelj, A. Mrvar, A. Ahmed, X. Fu, S. Hong & D. Merrick • Marco Gärtler & Markus Krug

2006 Michael McGuffin • Adel Admed, Seok-Hee Hong, Quan Nguyen & Donald Taylor • Adel Admed, Xiaoyan Fu, Seok-Hee Hong, Quan Nguyen & Kai Xu • Fabrizio Frati & Markus Geyer • Andreas Gerasch & team

2007 Wolfgang Brunner & Jens Schmidt • Robert Theron, Rodrigo Santamaria, Juan Garcia, Diego Gomez & Vadim Paz-Madrid • Felix Heinen

2008 Yifan Hu & Emden Gansner • Melanie Badent & Pietro Palladino • Melanie Badent, Martin Mader & Christian Piech • Hoi-Ming Wong, Markus Chimani & Karsten Klein

2009 Hui Liu • Nicholas Jefferson • Melanie Badent & Michael Baur • Hoi-Ming Wong & Karsten Klein • Joe Fowler

2010 Quan Nguyen • Sergey Pupyrev • M. Baur, M. Siebenhaller, R. Wiese & Thomas Wurst • Petra Mutzel & Hoi-Ming Wong • Maarten Löffler & Martin Nöllenburg

2011 Hanley Weng • M. Löffler, D. Eppstein, M. Goodrich & S. Kobourov • R. Zelina, S. Bota, S. Houtman & R. Ban • Sergey Pupyrev • Maarten Löffler & Martin Nöllenburg

2012 Roman Prutkin • Sergey Pupyrev • Remus Zelina, S. Bota, S. Houtman & R. Balaban • Tobias Brinkjost • A. Bauer, I. Rutter, J. Vordermeier & M. Kaufmann

2013 Jos de Jong & Giovanni Pazienza • Remus Zelina, Sebastian Bota, Siebren Houtman & Radu Balaban • Thomas Bläsius & Ignaz Rutter

2014 Martin Nöllenburg • Remus Zelina, Sebastian Bota, Siebren Houtman & Radu Balaban • Tamara Mchedlidze, Martin Nöllenburg, Alexander Khomenko, Igor Karlinsky & Denis Knöpfle • Philipp Kindermann, Fabian Lipp & Wadim Reimche

2015 Tamara Mchedlidze • Jennifer Hood & Pat Morin • Boris Klemz, Ulf Rüegg & Fabian Lipp • Josef Cibulka

2016 Fabian Klute • Jonathan Klawitter & Tamara Mchedlidze • Michael Bekos, Thanasis Lianeas & Chrysanthi Raftopoulou • Johan de Ruiter

2017 Steven Shangzhou Wang • Fabian Klute & Irene Parada • Theresa Fröschl, Jonathan Klawitter & Darren Strash • Almut Demel, Dominik Dürrschnabel, Tamara Mchedlidze, Marcel Radermacher & Lasse Wulf

2018 Evmorfia Argyriou, Michael Baur, Anne Eberle & Armin Gufler • Florian Grötschla, Tamar Mirbach, Christian Ortlieb, Tamara Mchedlidze & Marcel Radermacher • Myroslav Kryven & Johannes Zink • Amadäus Spallek, Christian Geckeler, Henry Förster & Michael Bekos

2019 ?

2019 CONTEST
overview

2019 CONTEST

overview

CREATIVE TOPICS

Marvel Cinematic Universe

Draw the graph of appearances of superheroes in the Marvel Cinematic Universe movies as of 2018.

Meal Ingredients

Draw the graph of occurences of ingredients in popular meals.

LIVE CHALLENGE

In one hour, draw a number of directed graphs as straight-line upwards embeddings in the plane, minimizing the number of crossings.

manual category

automatic category

2019 CONTEST *overview*

gd 19

CREATIVE TOPICS

Marvel Cinematic Universe

Draw the graph of appearances of superheroes in the Marvel Cinematic Universe movies as of 2018.

6 submissions

Meal Ingredients

Draw the graph of occurences of ingredients in popular meals.

4 submissions

LIVE CHALLENGE

In one hour, draw a number of directed graphs as straight-line upwards embeddings in the plane, minimizing the number of crossings.

manual category

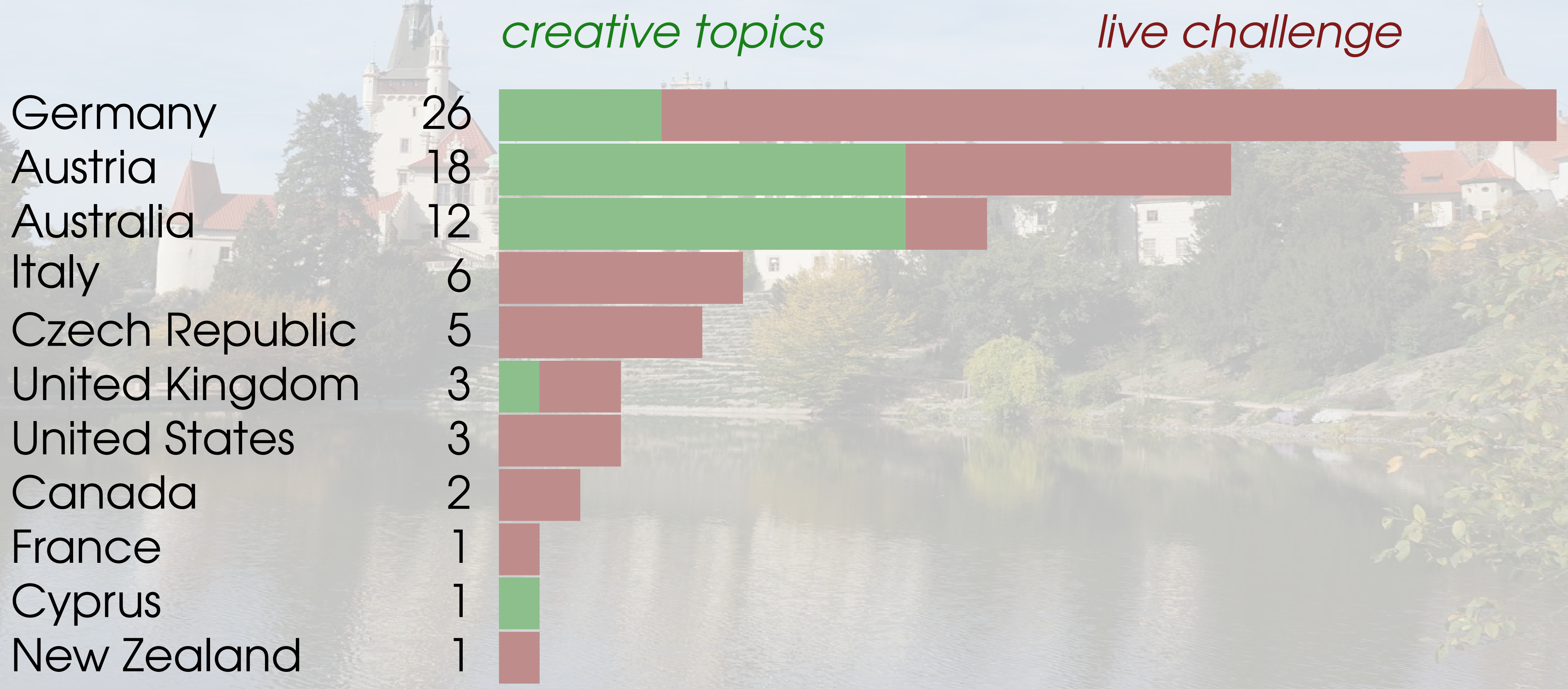
15 submissions

automatic category

4 submissions

2019 CONTEST
overview

Participating individuals per country



CREATIVE TOPICS

Marvel Cinematic Universe

CREATIVE TOPICS
Marvel Cinematic Universe

Marvel Cinematic Universe Graph

- vertices are superheroes and movies
- an edge between a hero and a movie if the hero appeared in the movie
- 28 heroes, 24 movies
- 152 edges

CREATIVE TOPICS
Marvel Cinematic Universe

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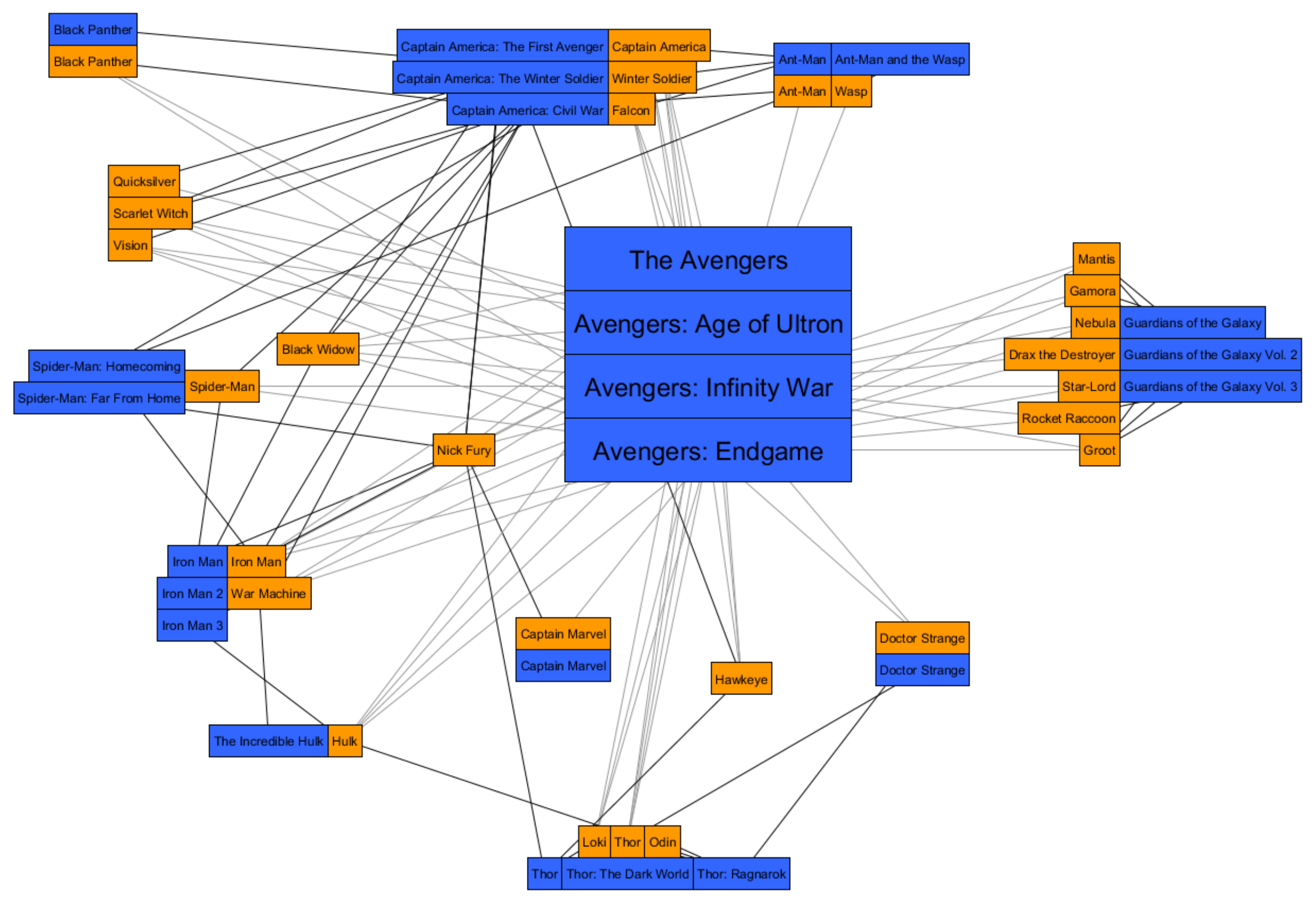
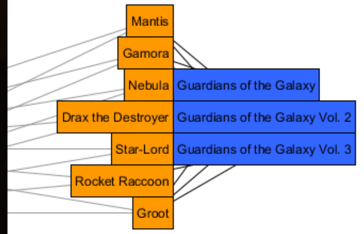


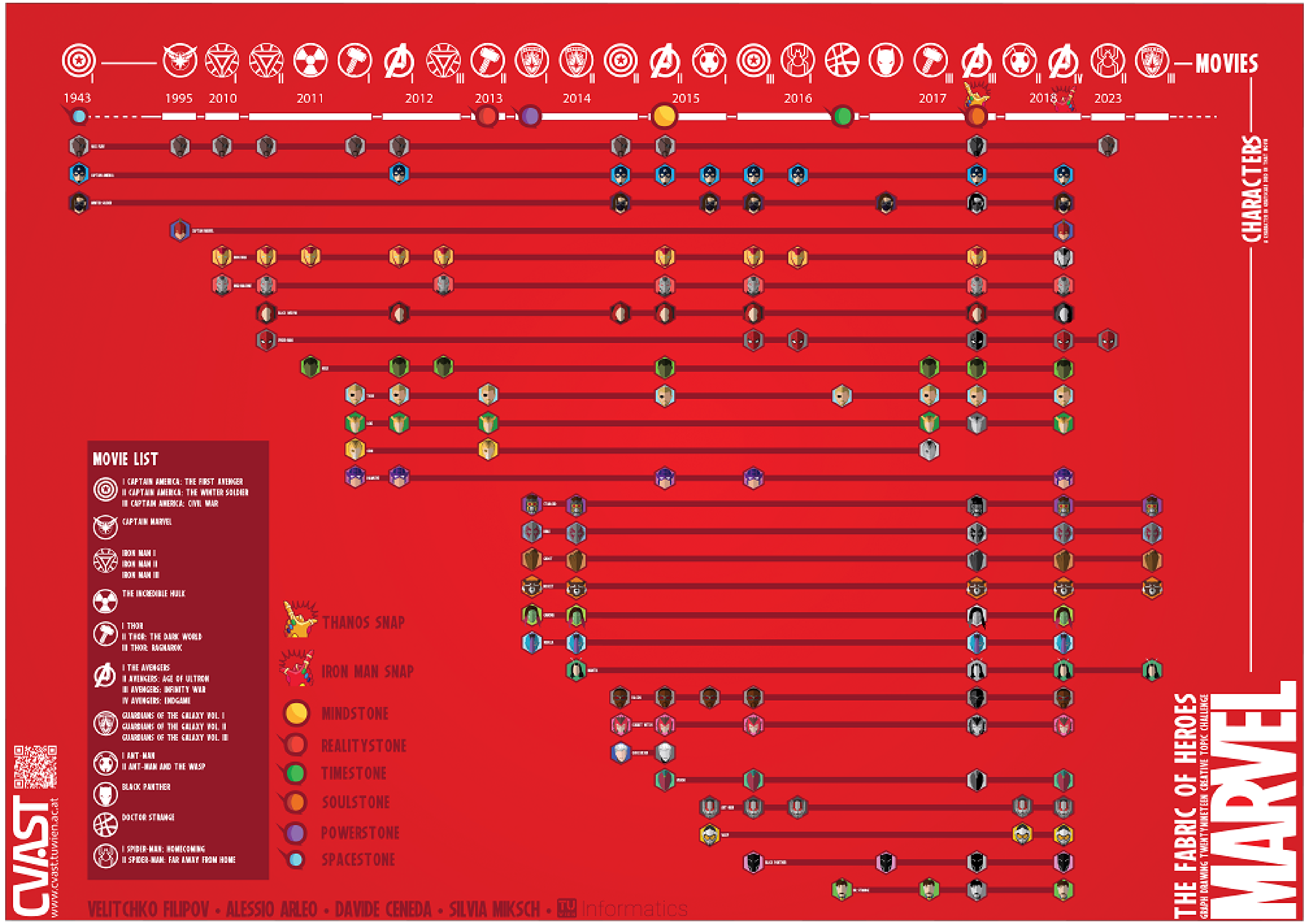
CREATIVE TOPICS
Marvel Cinematic Universe



CREATIVE TOPICS

Marvel Cinematic Universe

3rd Place

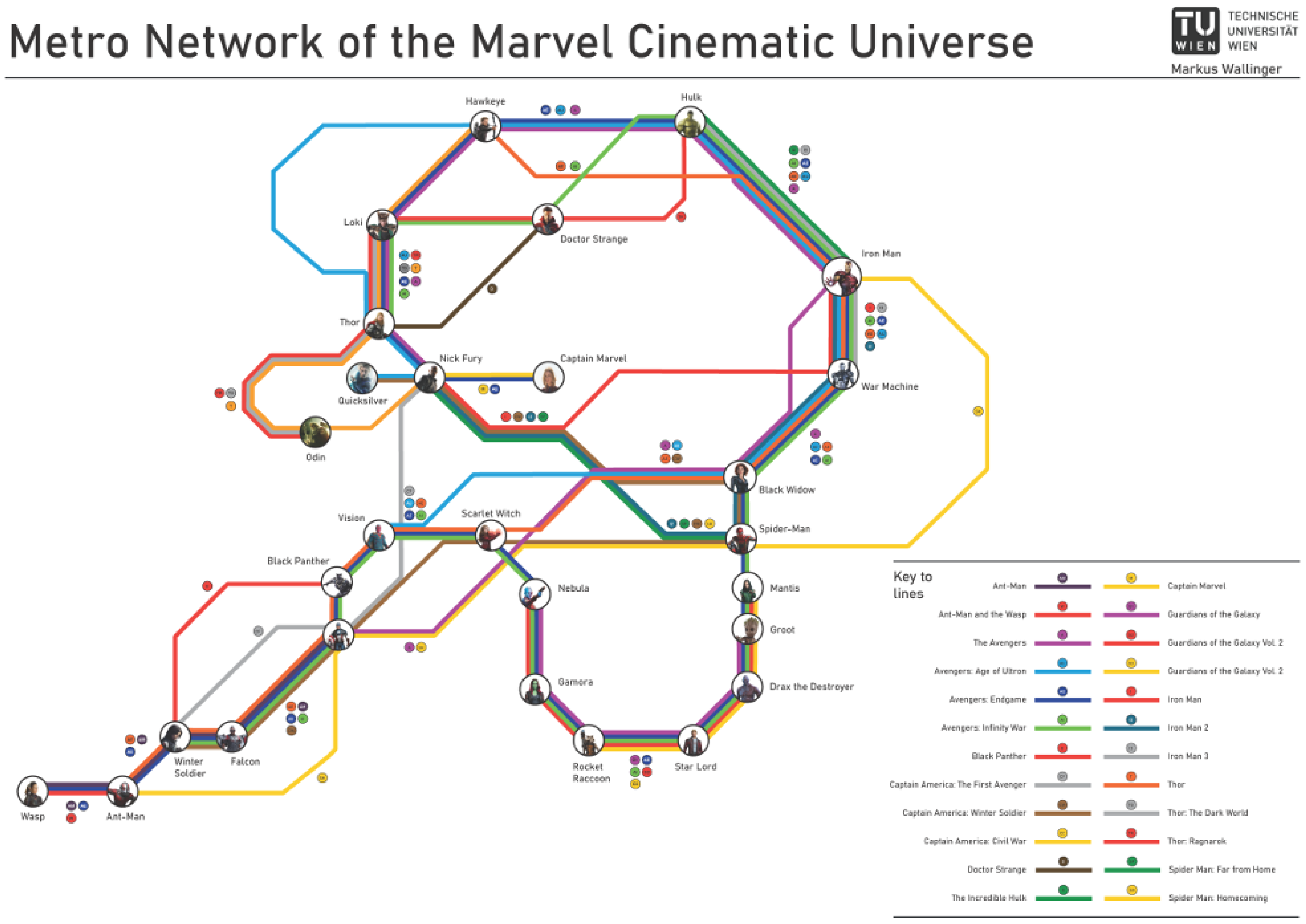


Velitchko Filipov, Alessio Arleo, Davice Ceneda, and Silvia Miksch

CREATIVE TOPICS

Marvel Cinematic Universe

2nd Place

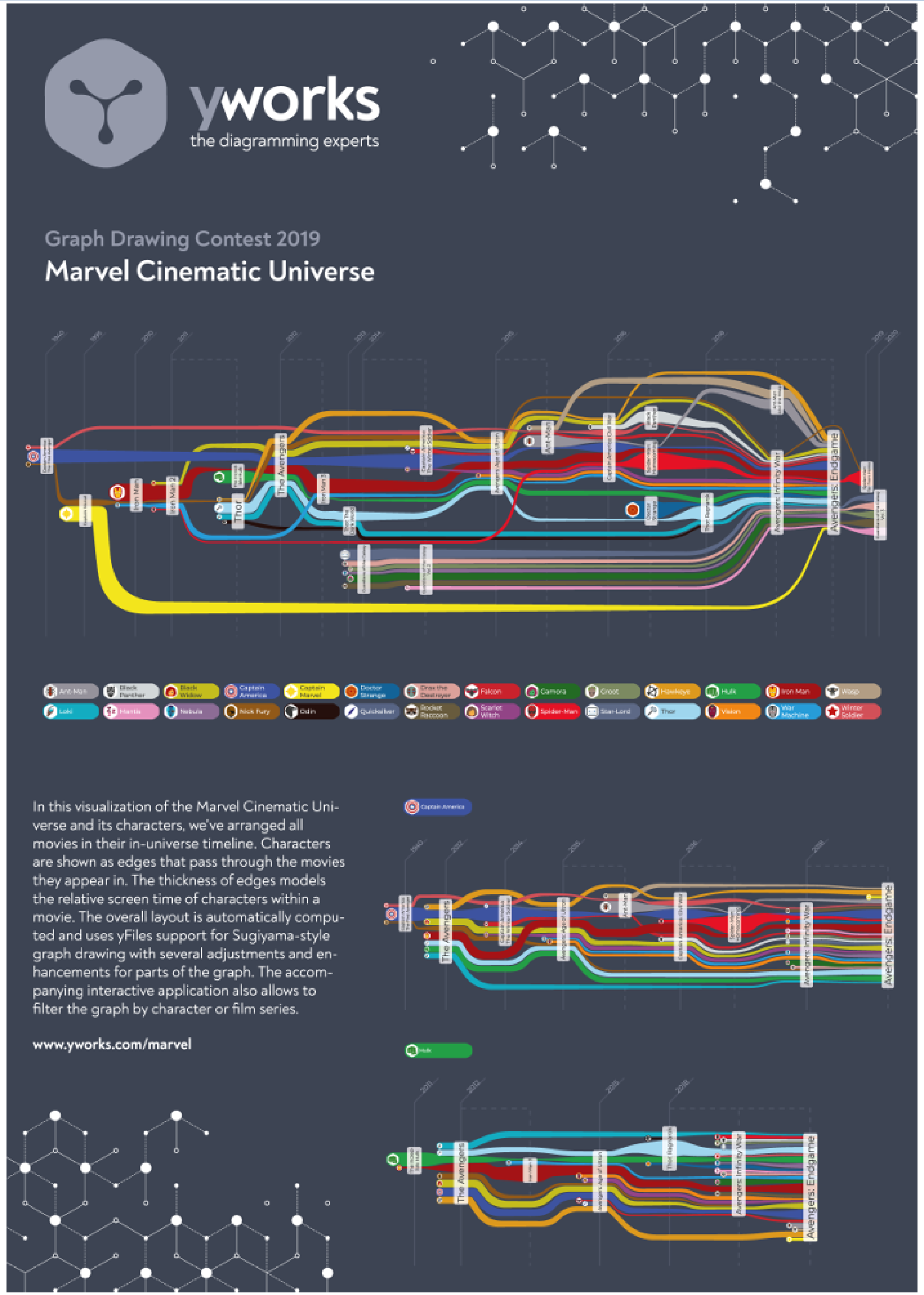


Markus Wallinger

CREATIVE TOPICS

Marvel Cinematic Universe

1st Place



Evmorfia Argyriou
Christian Brunnermeier
Anne Eberle
Johannes Rössel

CREATIVE TOPICS
Meal Ingredients

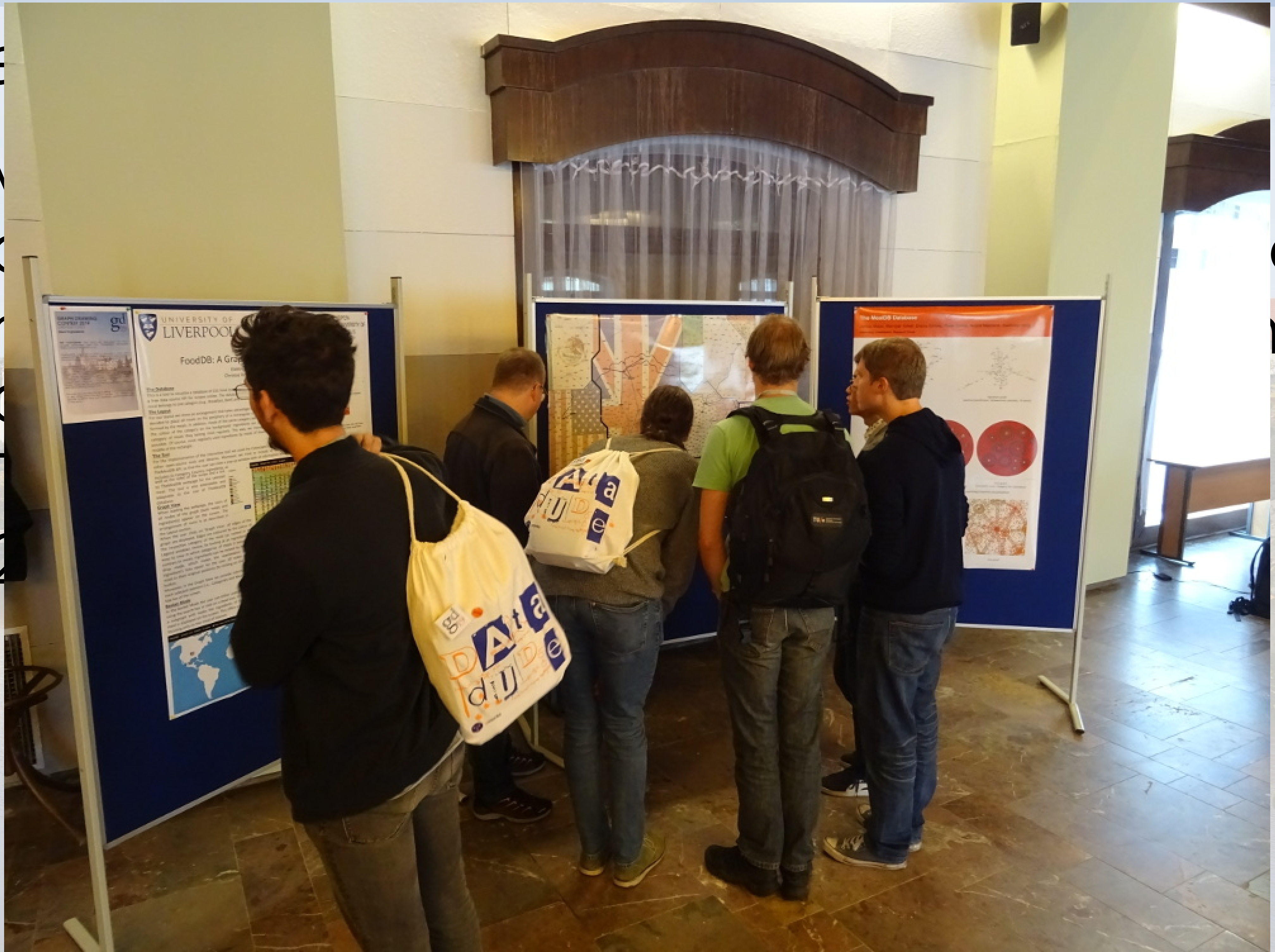
CREATIVE TOPICS
Meal Ingredients

TheMealDB database

- vertices are ingredients and meals
- an edge if an ingredient is part of a meal
- meals have a category (e.g. desert) and an area (e.g. Indian)
- 151 meals and 297 ingredients
- 2115 edges

CREATIVE TOPICS
Meal Ingredients

The



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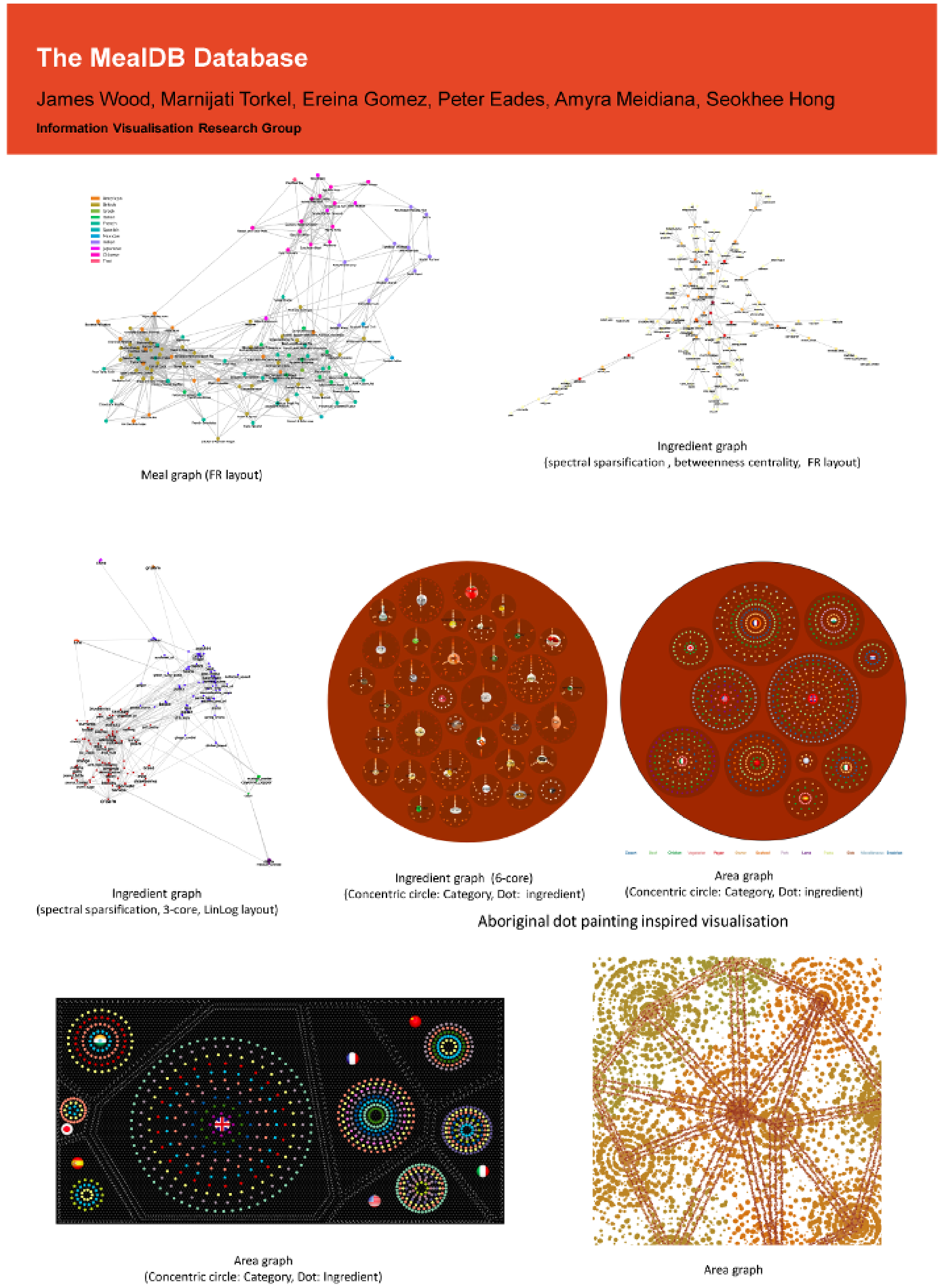
CREATIVE TOPICS

Meal Ingredients

3rd Place



James Wood
Marni Torkel
Ereina Gomez
Amyra Meidiana
Peter Eades
Seok-Hee Hong

CREATIVE TOPICS

Meal Ingredients

2nd Place

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UNIVERSITY OF LIVERPOOL

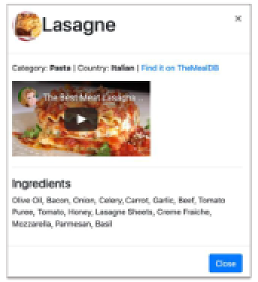
OPEN UNIVERSITY OF CYPRUS
www.ouc.ac.cy

FoodDB: A Graph Visualization Interactive Tool

Elektra Kypridemou (University of Liverpool)
Christos Rodosthenous (Open University of Cyprus)

The Database

This is a tool to visualize a database of 151 food recipes extracted from 'TheMealDB' database, which provides a free data source API for recipes online. The database is composed of 151 meals and 297 ingredients. Each meal belongs to one category (e.g., Breakfast, Beef) and one country.

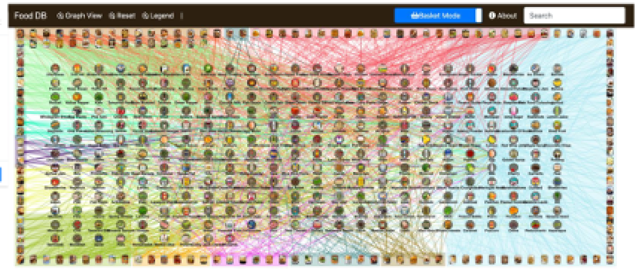


The Layout

For our layout we chose an arrangement that takes advantage of the fact that our graph is bipartite. Hence, we decided to place all meals on the periphery of a rectangular shape, and all ingredients inside the rectangle formed by the meals. In addition, meals of the same category are placed next to each other and marked with the colour of the category on the background. Ingredients are positioned so that they are closer to the category of meals they belong most regularly. This way, we managed to get shorter edge lengths, when possible. Of course, most regularly used ingredients by meals of diverse categories had to be placed in the middle of the rectangle.

The Tool

For the implementation of the interactive tool we used the Cytoscape.js and jQuery frameworks along with other open-source tools and libraries. Moreover, we tried to include all useful information provided by TheMealDB API, so that the user can view a pop-up window with all information about the selected meal. This includes its Category, Country, Ingredients, as well as the video of the recipe and a link to TheMealDB webpage for the selected meal. The tool is also extendable and adaptable to the size of TheMealDB database.

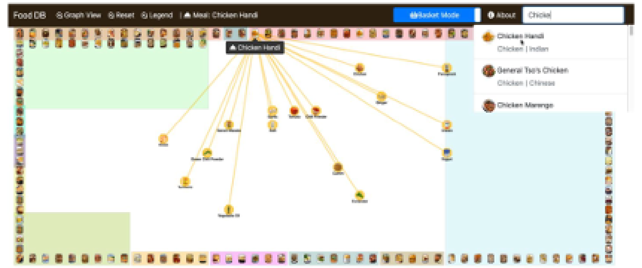


Graph View

When loading the webpage, the icons of all nodes of the graph (both meals and ingredients) appear on the screen. The arrangement of icons is as described in the Layout section.

When the user clicks on 'Graph View', all edges of the graph are displayed. Edges are coloured by the colour of the respective category of the meal (as named in the Legend window). Hence, by looking at an ingredient it is easy to view in which categories of meals it belongs. In contrary to meals, ingredients can be moved by drag and drop mode, which makes the examination of the ingredient's links easier for the user. All nodes can be reset to their original positions by clicking on the 'Reset' button.

Moreover, in the Graph View we provide information for each selected element (i.e., Categories and Meals) on the top bar of the screen.



Basket Mode

In the Basket Mode the user can either search for a meal using the search box or click on a meal icon. In both cases, a subgraph with nodes the ingredients of the selected meal is displayed on the screen. This offers a clearer view, focusing only on the meal of interest.

World Mode

In the World Mode meals are categorized by country. The user can either search for a meal using the search box or can click on a country to see the available meals per category. In both cases the selected meal is displayed, along with its ingredients, as well as its connection to the category and the country it belongs.

http://tiny.cc/gt2acz

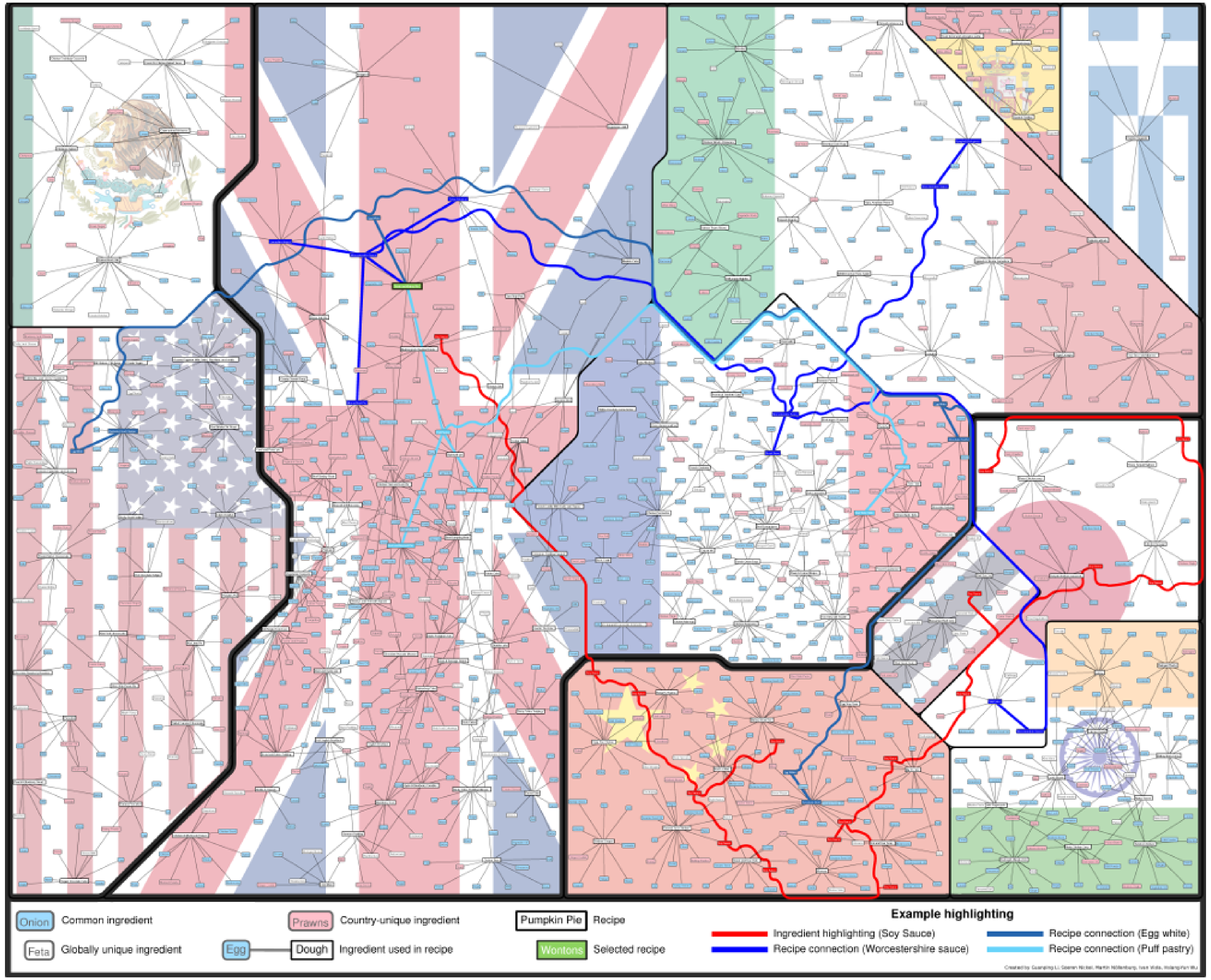
Check it out!

Elektra Kypridemou
Christos Rodosthenous

CREATIVE TOPICS

Meal Ingredients

1st Place



Guangping Li
Soeren Nickel
Martin Nöllenburg
Ivan Viola
Hsiang-Yun Wu

LIVE CHALLENGE

LIVE CHALLENGE

Crossing Minimization in Upward Drawings

input: directed graph and grid size

output: straight-line upward embedding with vertices on grid

must be a proper drawing

objective: minimize the number of crossings

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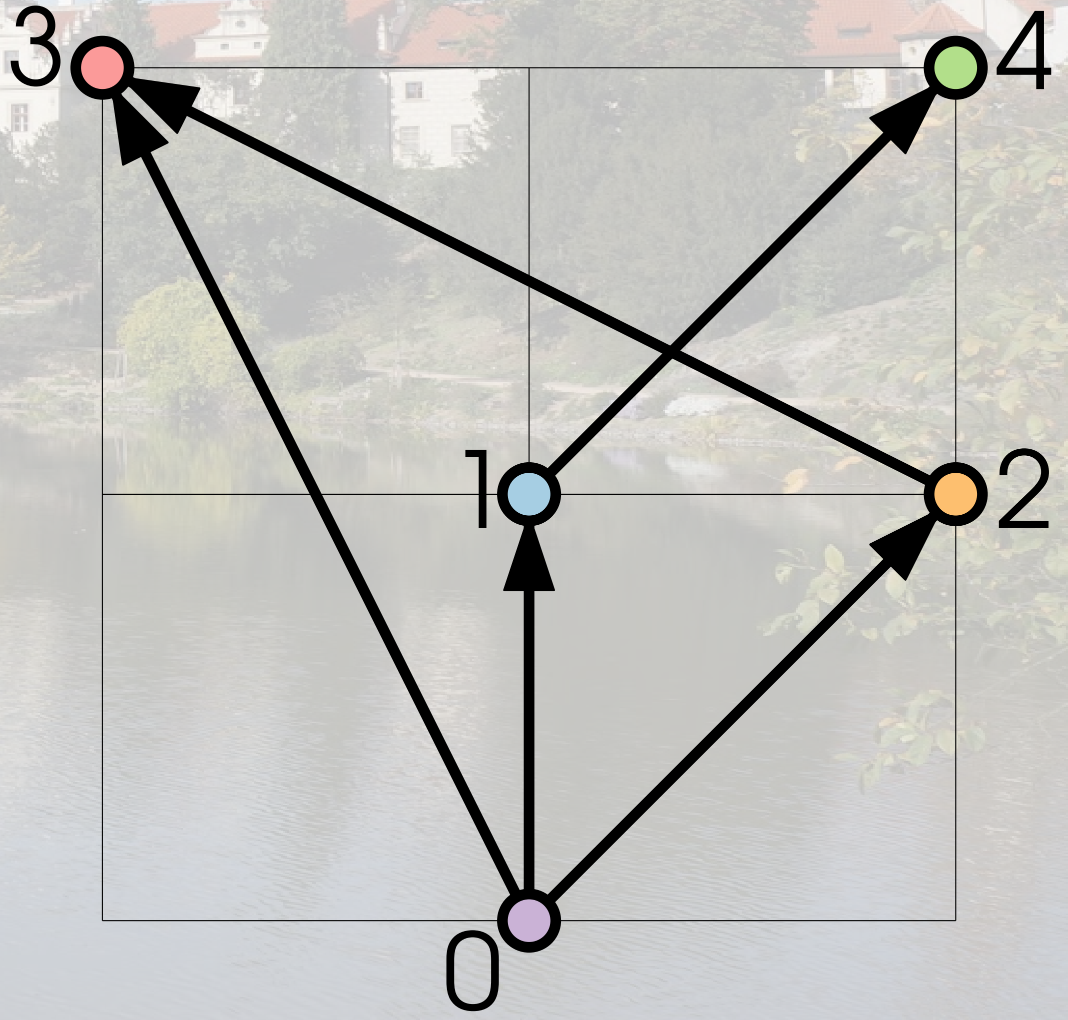

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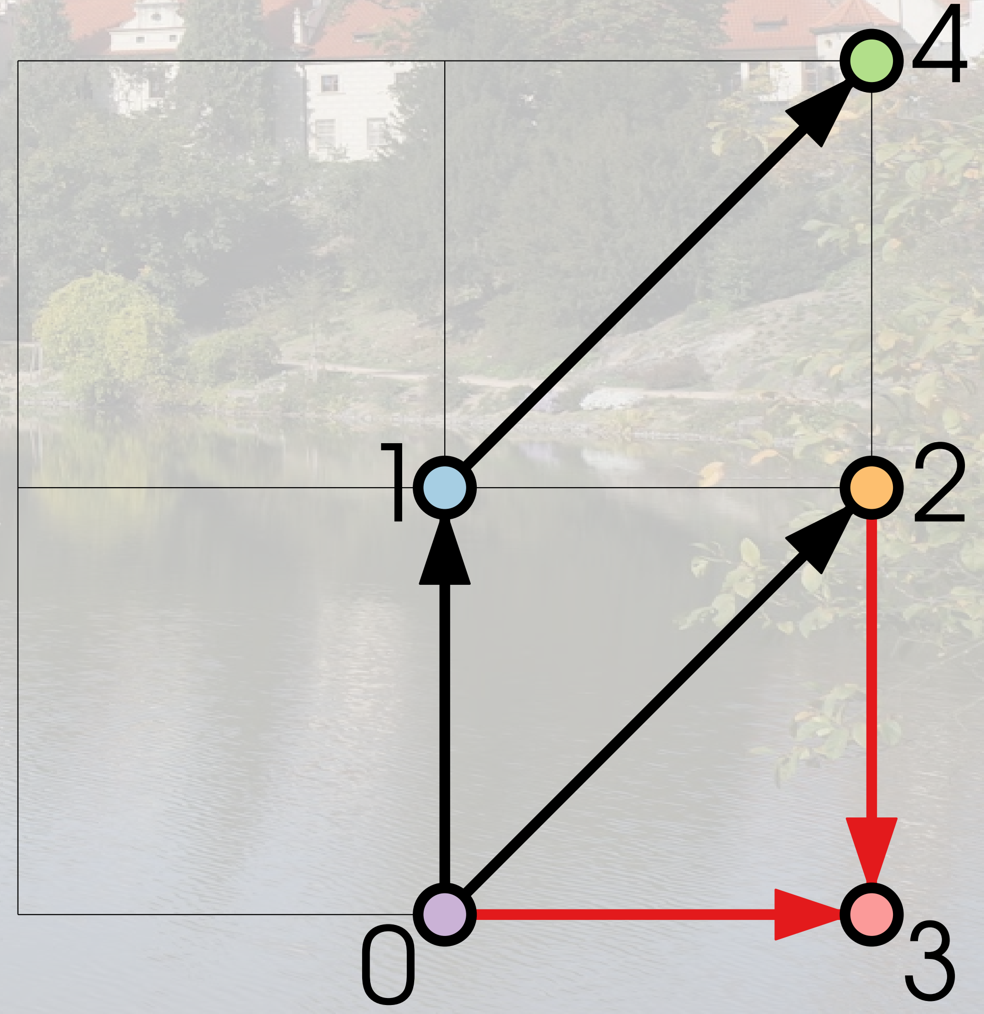

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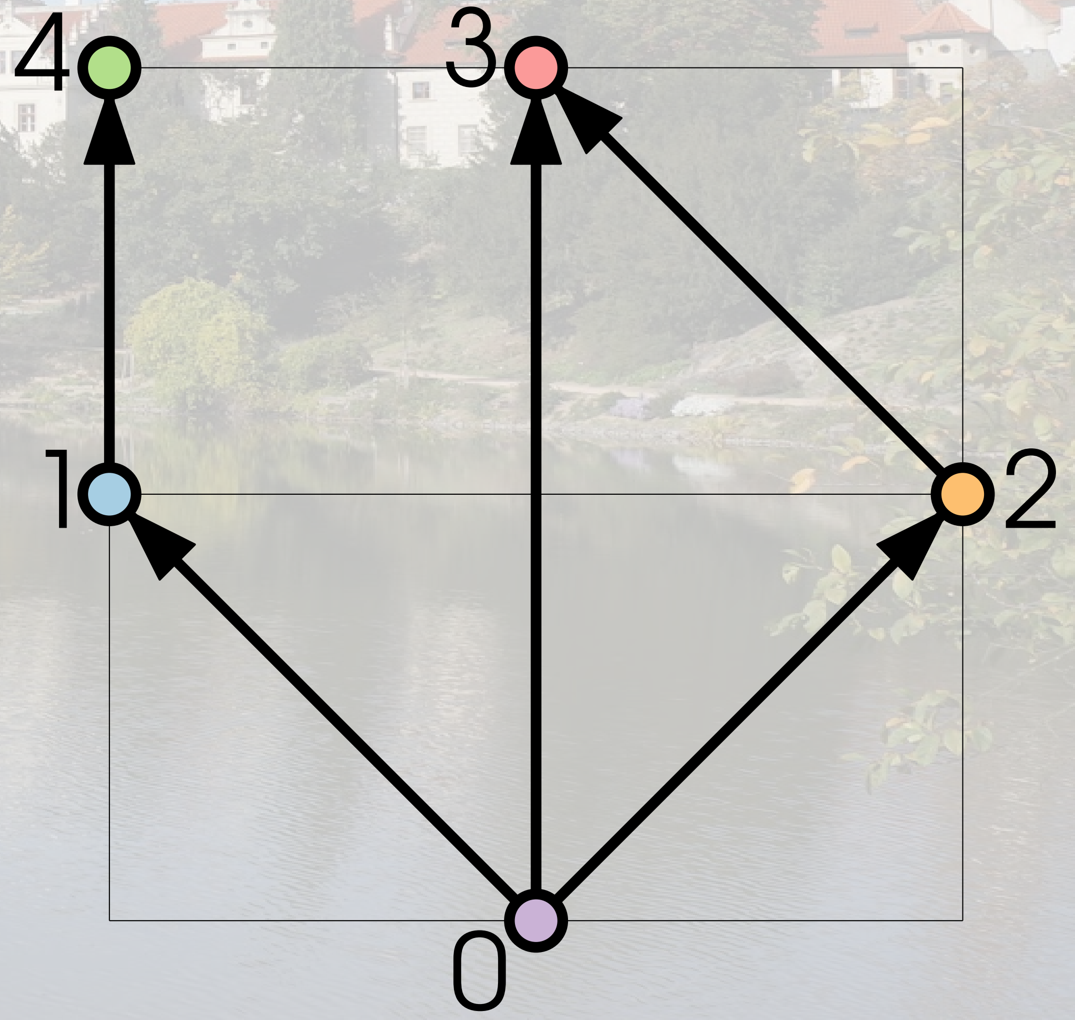

LIVE CHALLENGE

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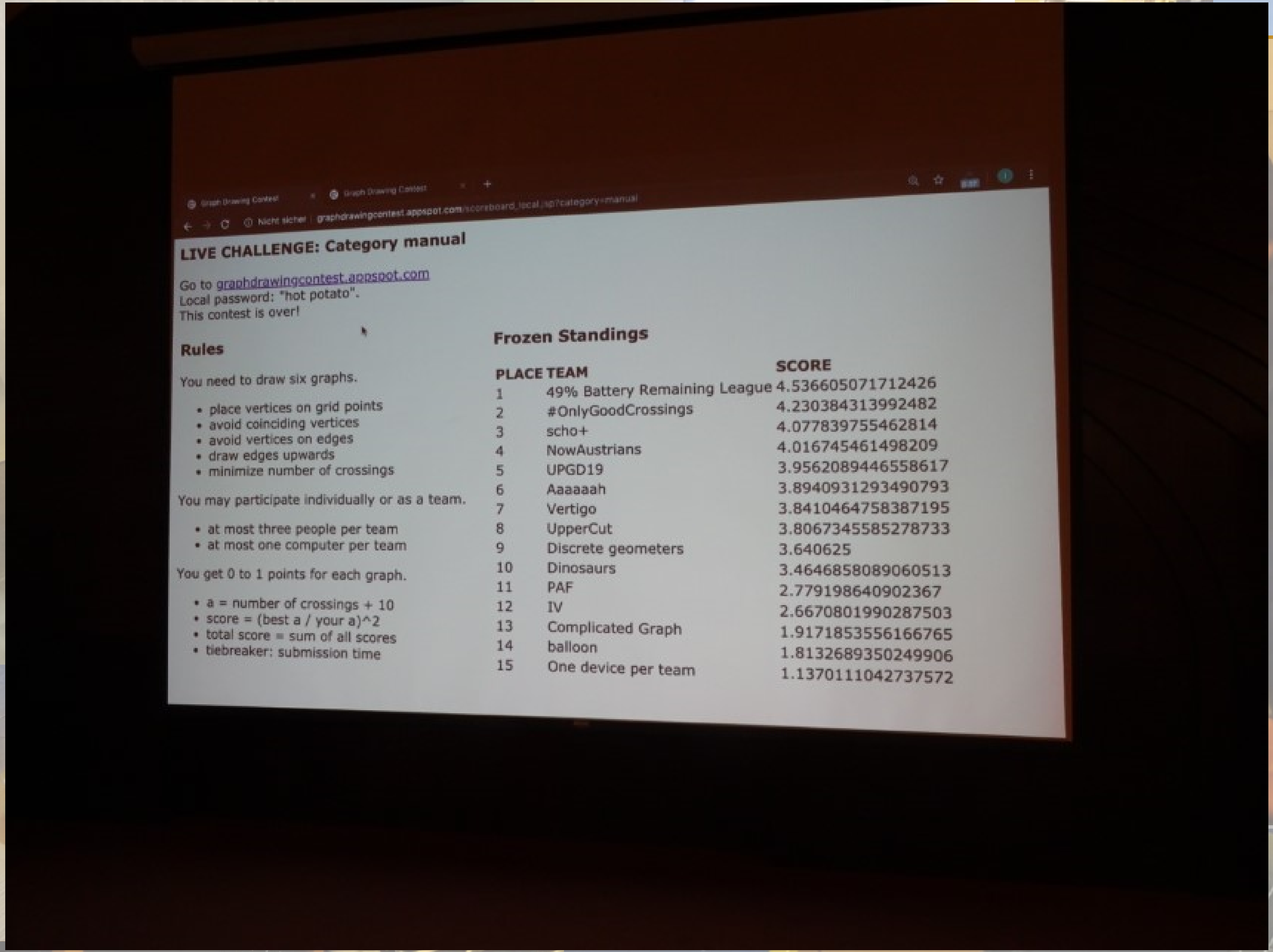
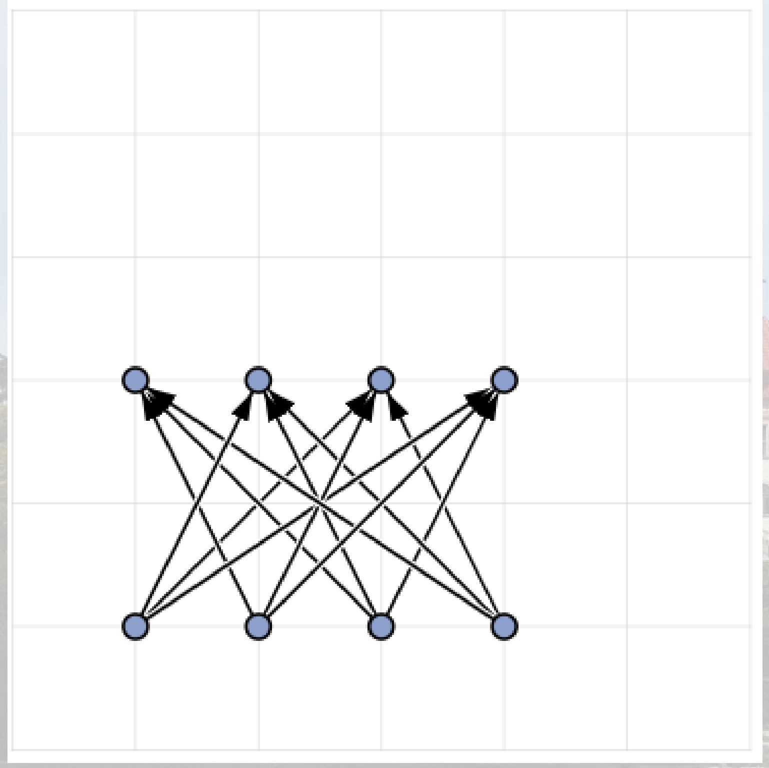


LIVE CHALLENGE

the graphs

LIVE CHALLENGE

the graphs



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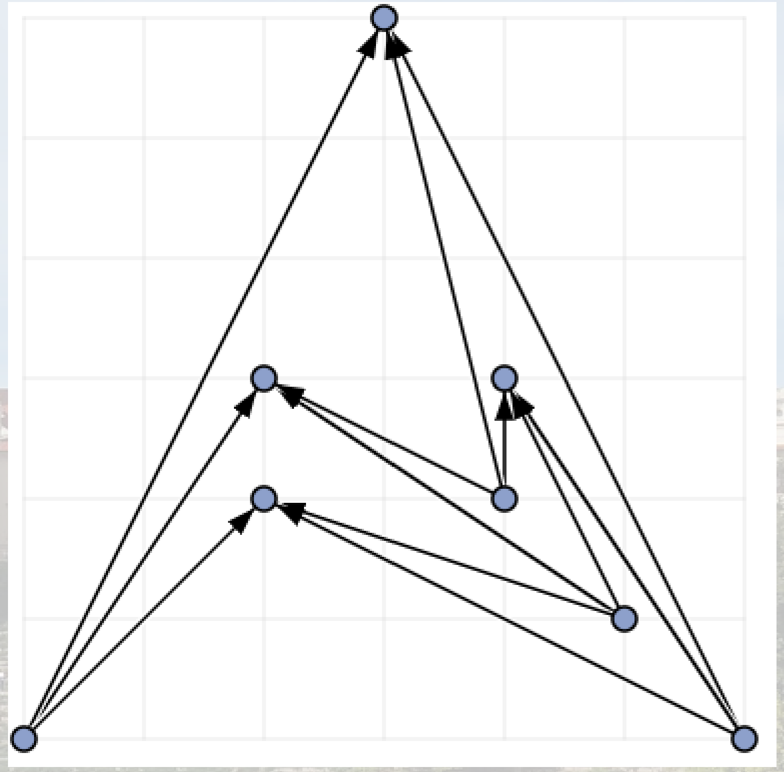
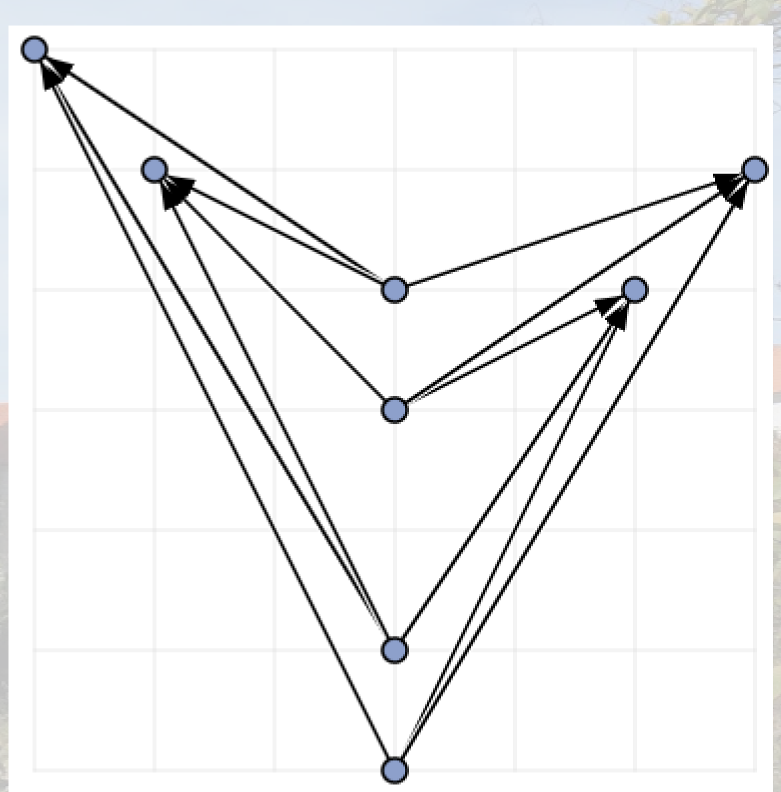


best manual

Aaaaaah

0 crossings

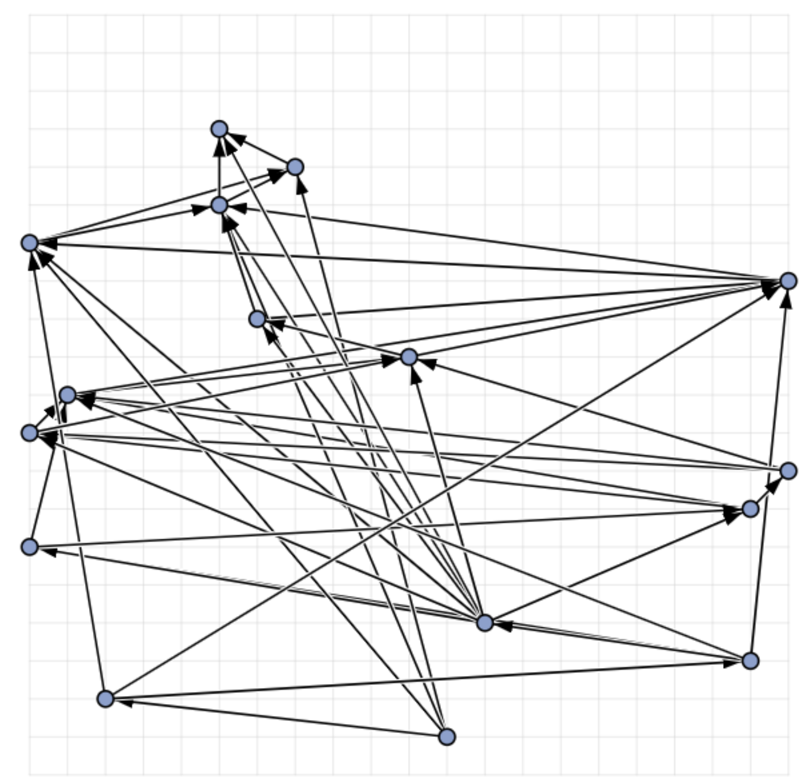


best automatic

0 crossings

graph **1**

LIVE CHALLENGE
the graphs



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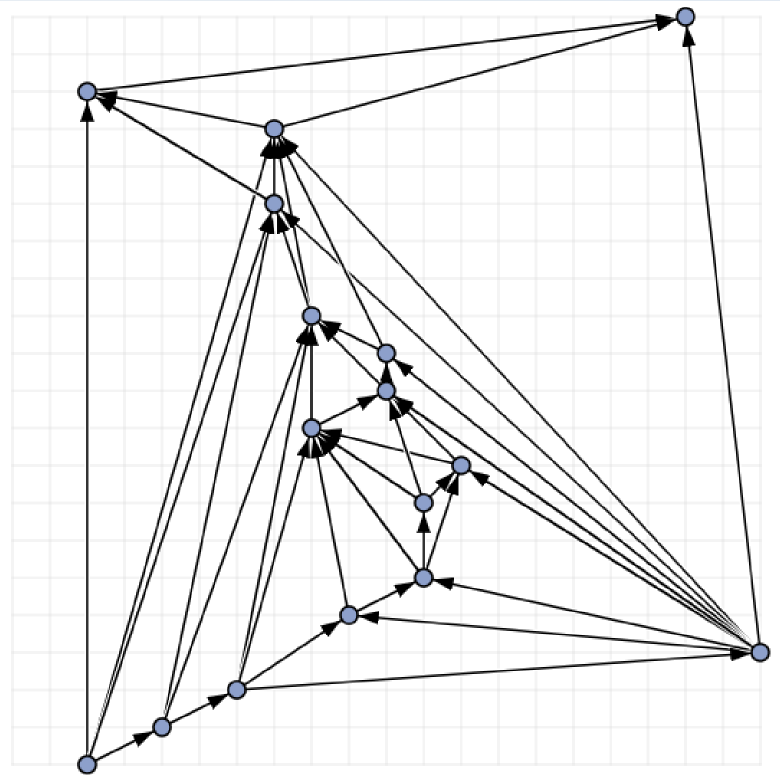
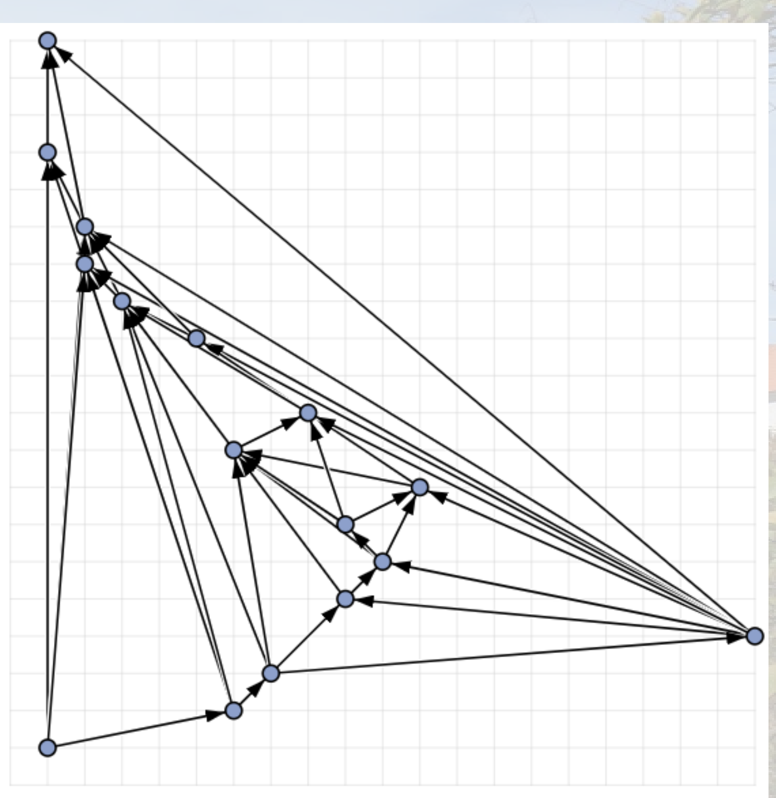


best manual



best automatic

36% Battery Remaining League

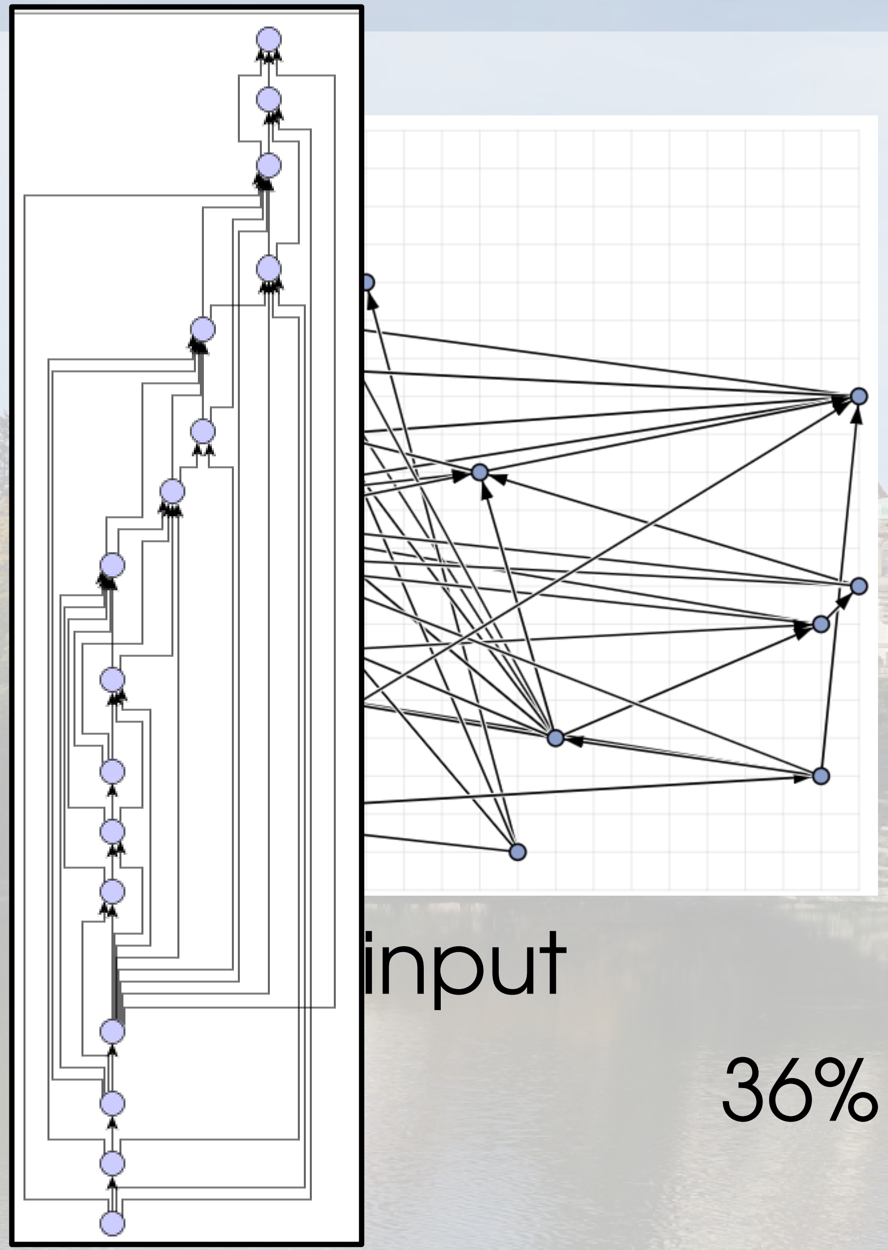
4 crossings

4 crossings

graph **2**

LIVE CHALLENGE

the graphs



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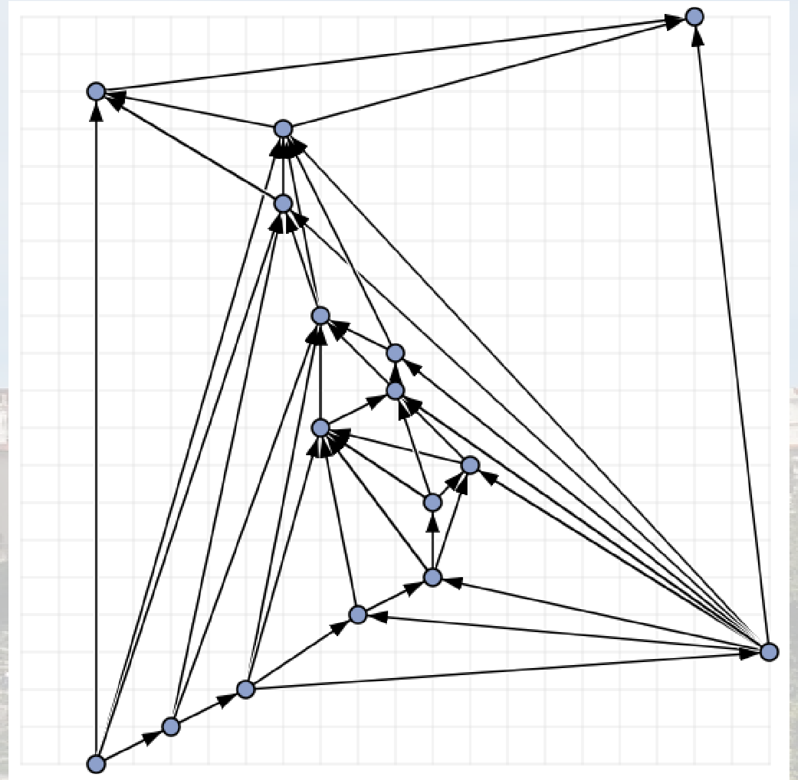
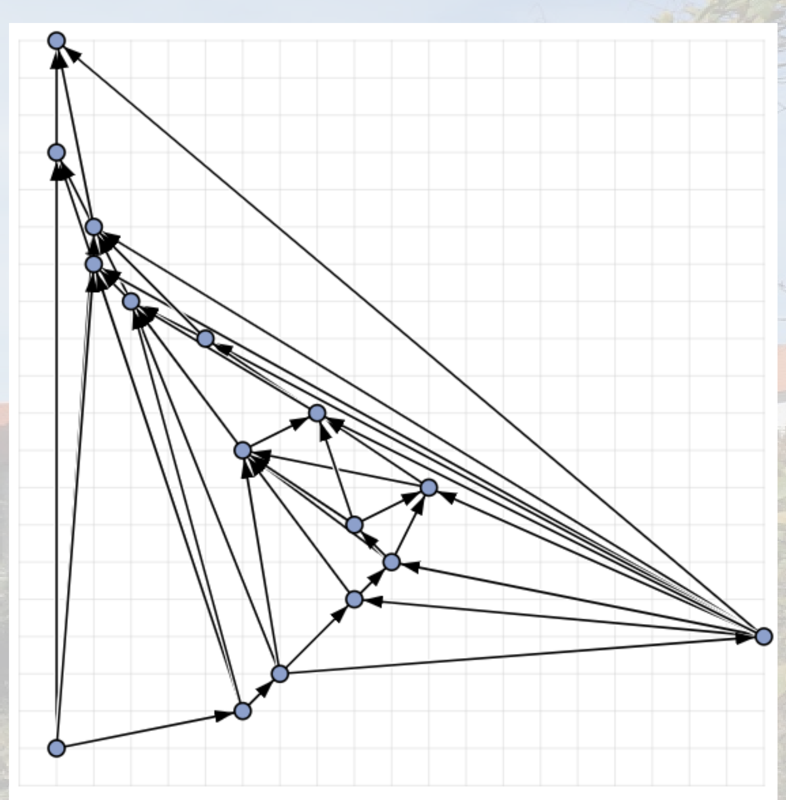


best manual



best automatic

36% Battery Remaining League

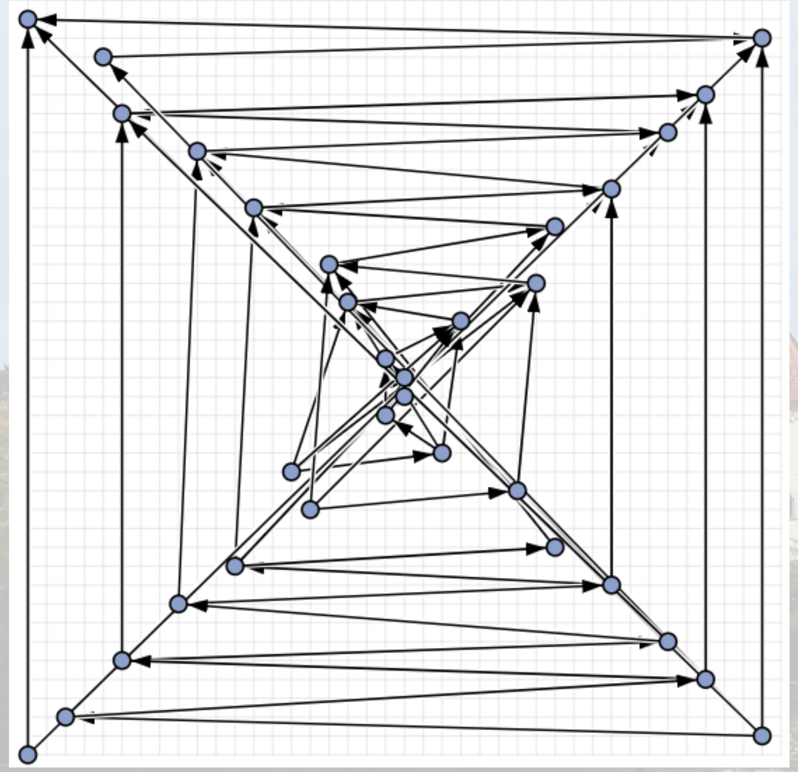
4 crossings

4 crossings

graph **2**

LIVE CHALLENGE

the graphs



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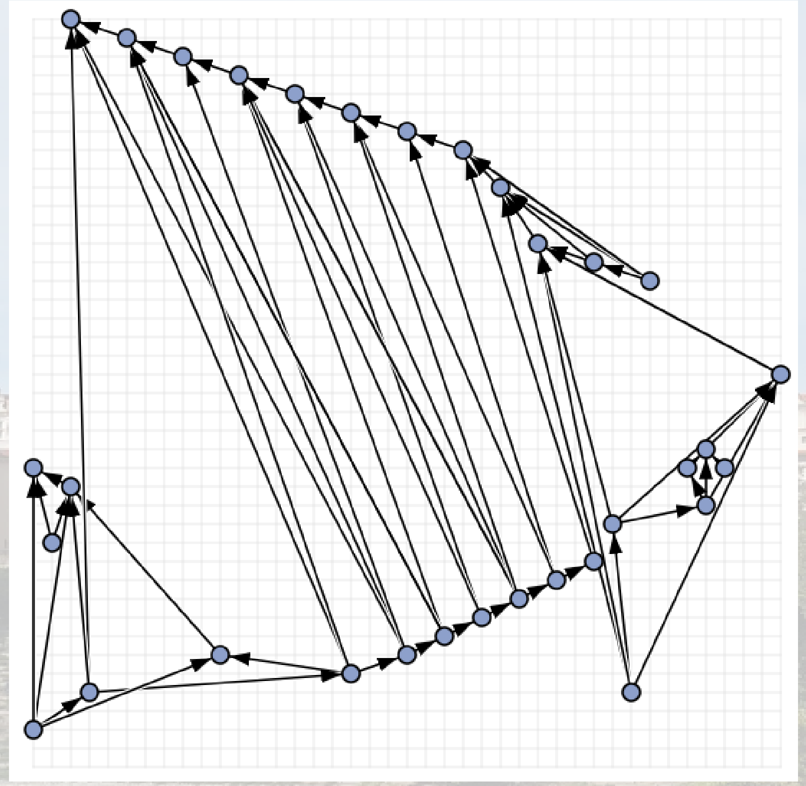
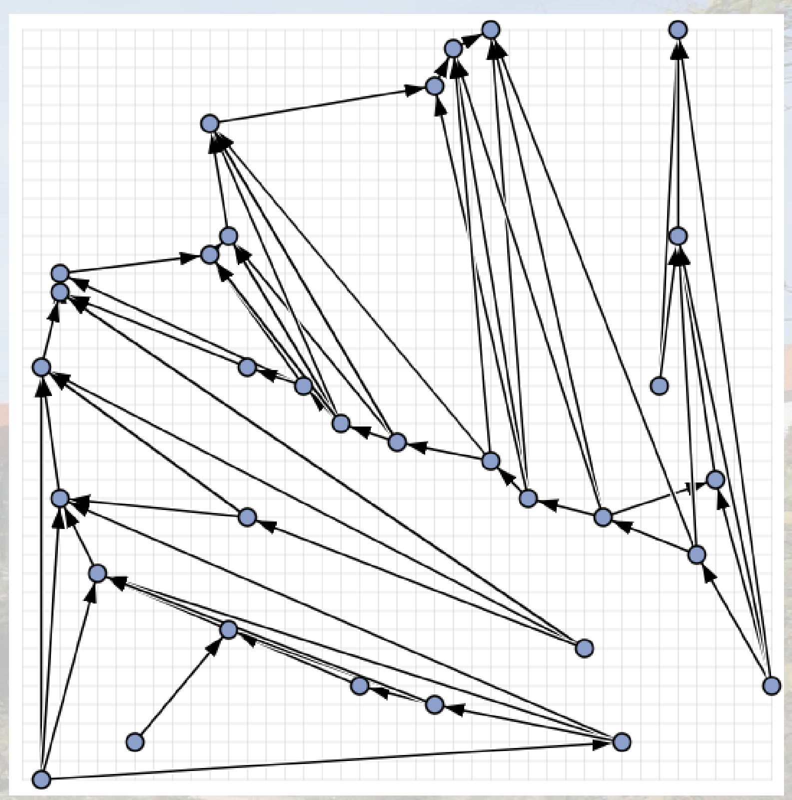


best manual

Vertigo

5 crossings



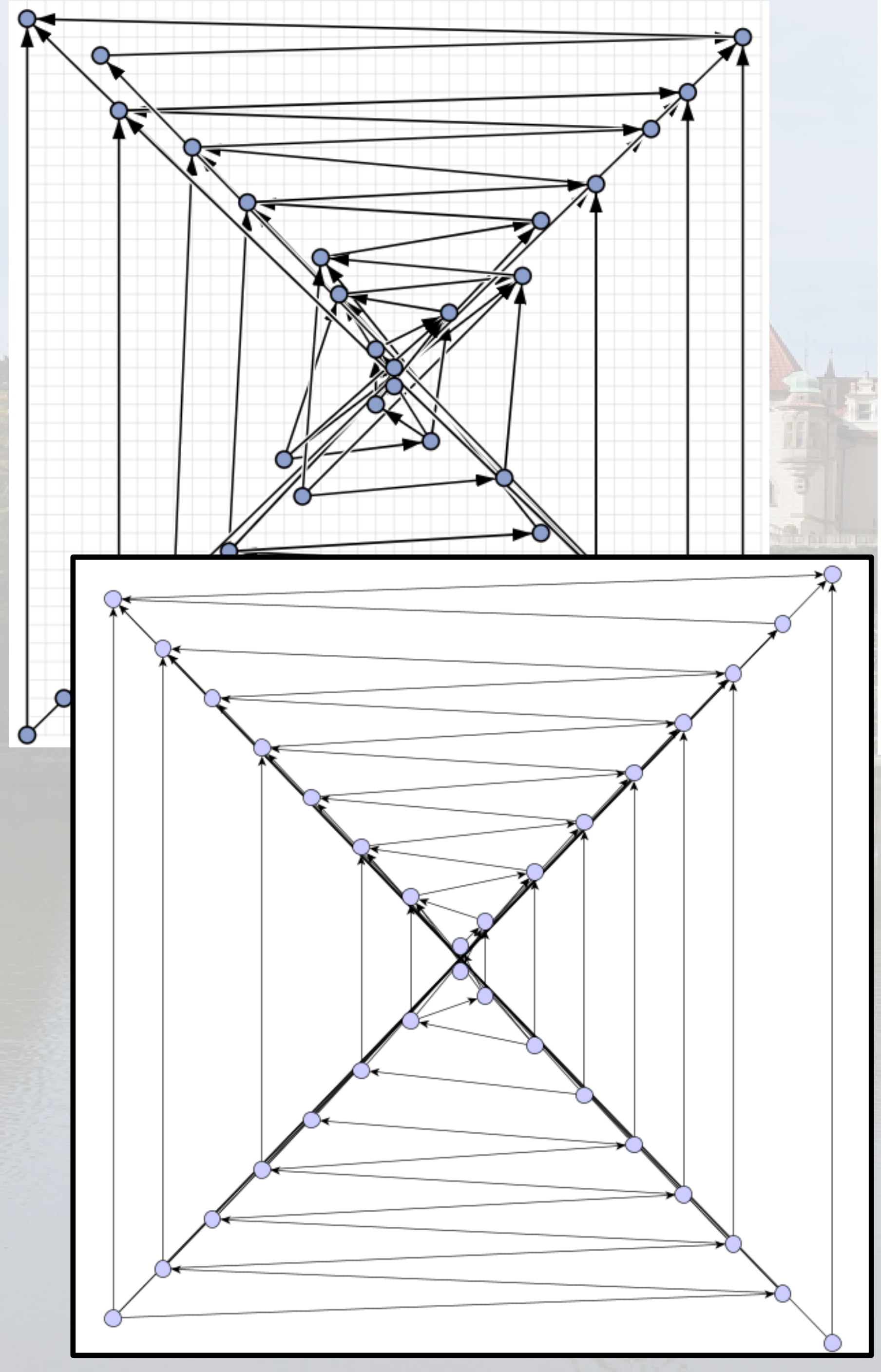
best automatic

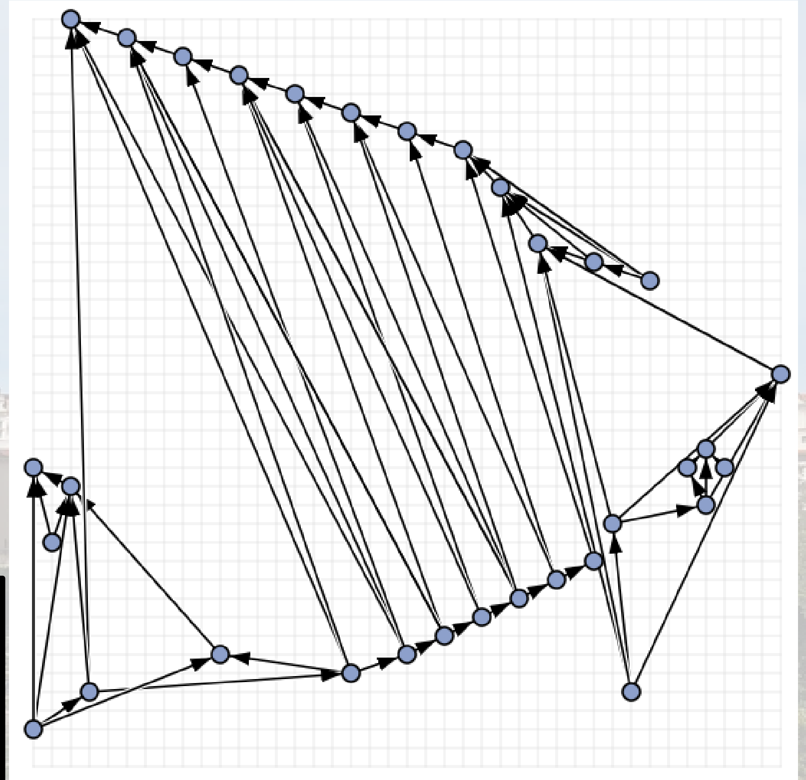
5 crossings

graph **3**

LIVE CHALLENGE

the graphs

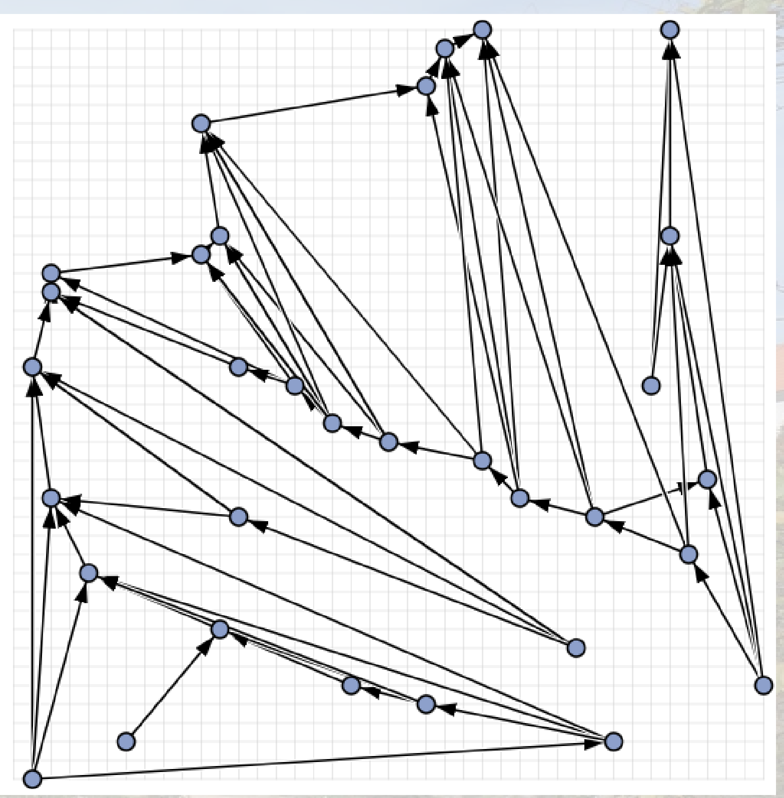




best manual

Vertigo

5 crossings

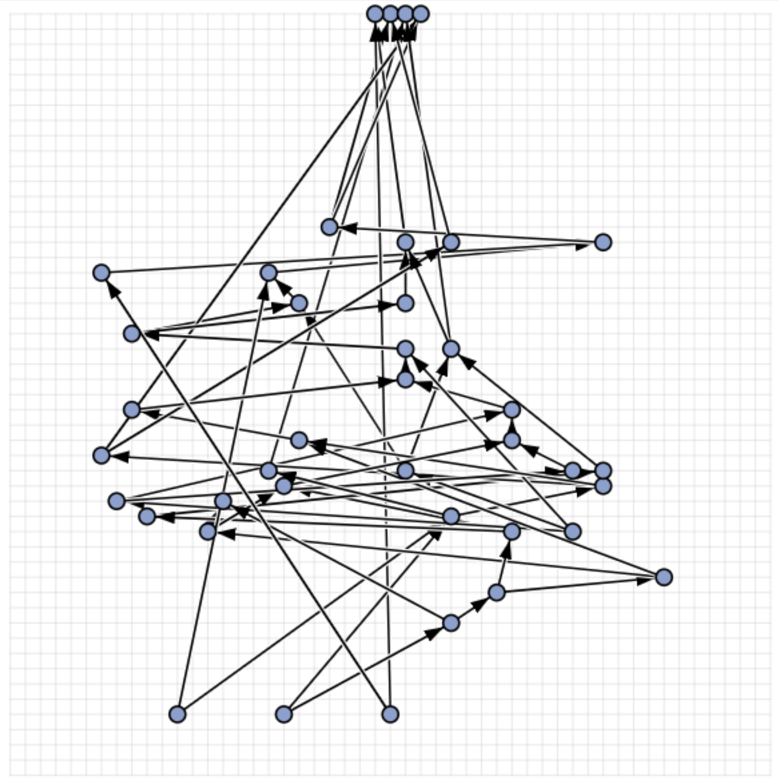


best automatic

5 crossings

LIVE CHALLENGE

the graphs



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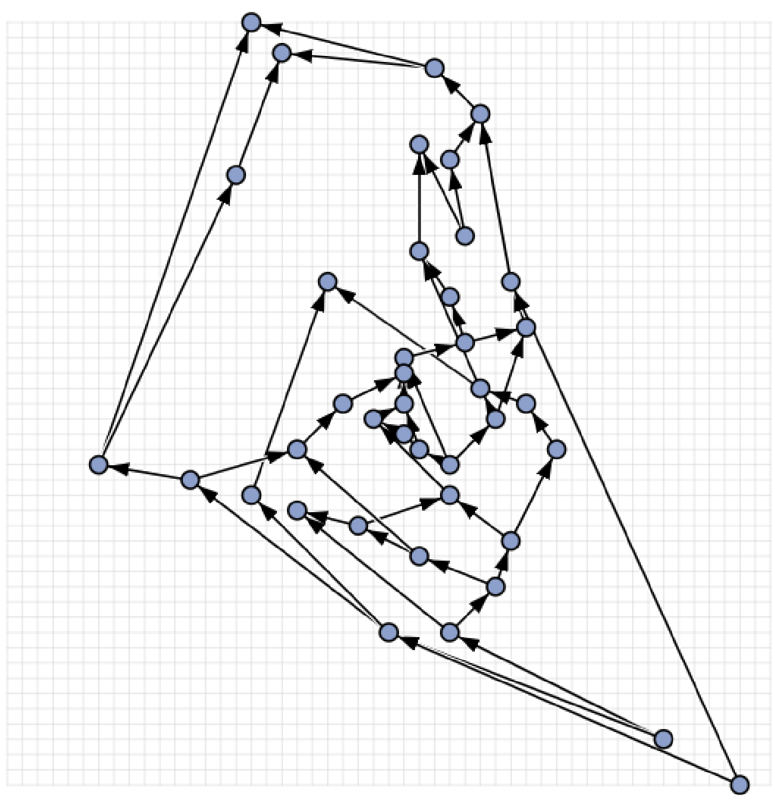
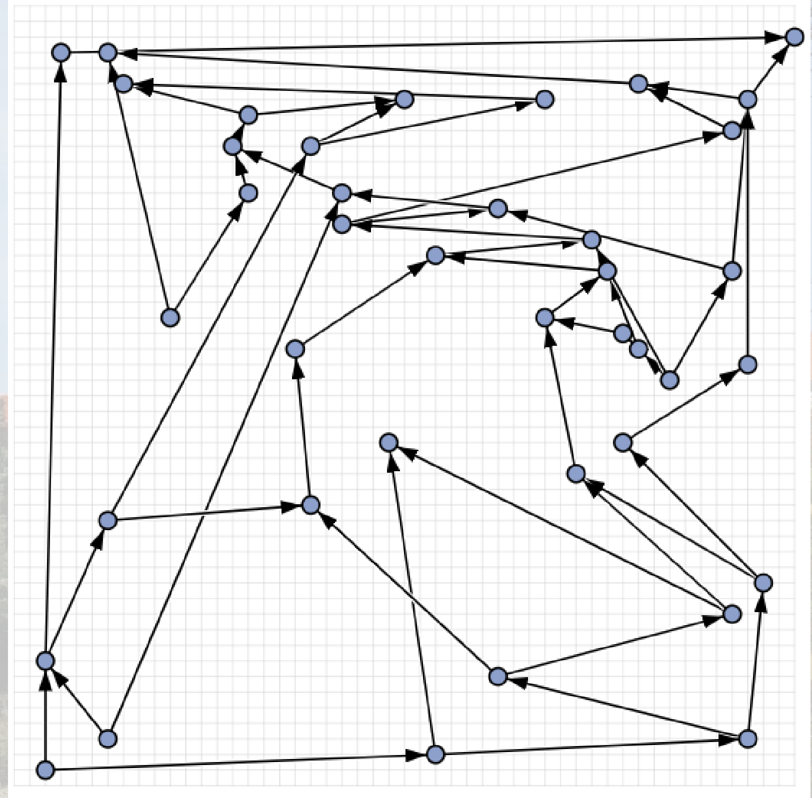


best manual

UpperCut

5 crossings



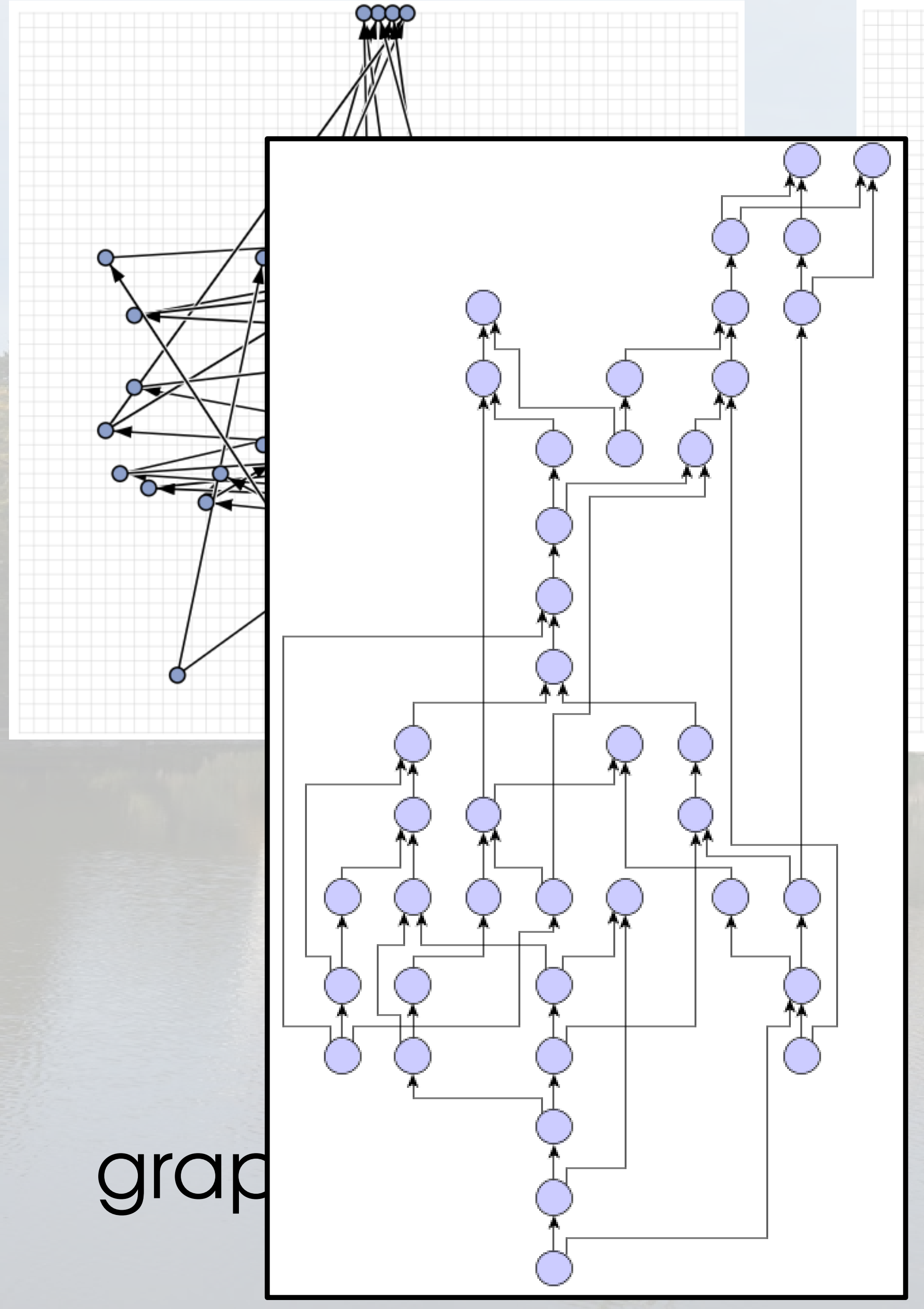
best automatic

4 crossings

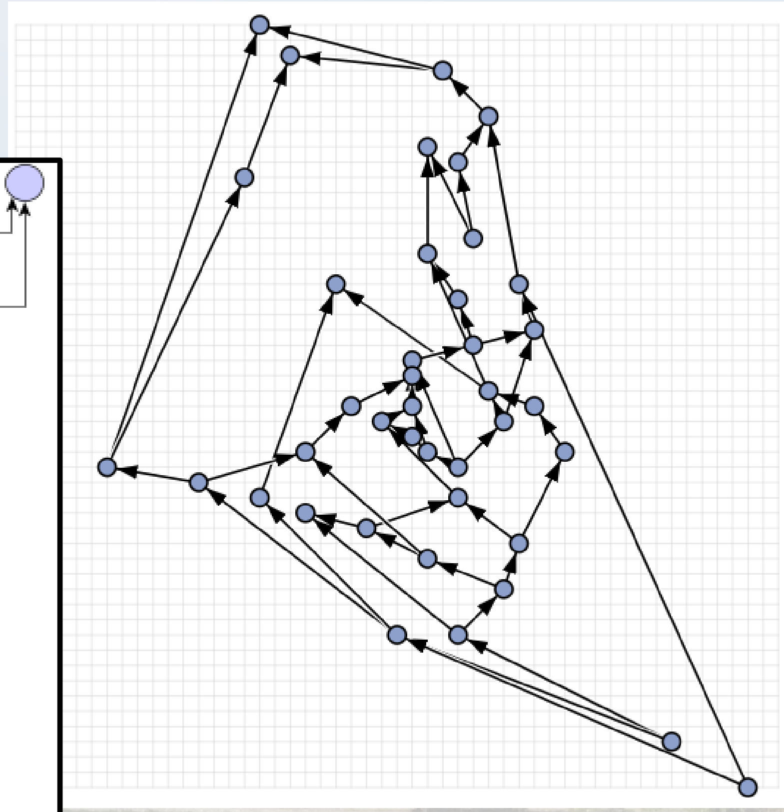
graph **4**

LIVE CHALLENGE

the graphs



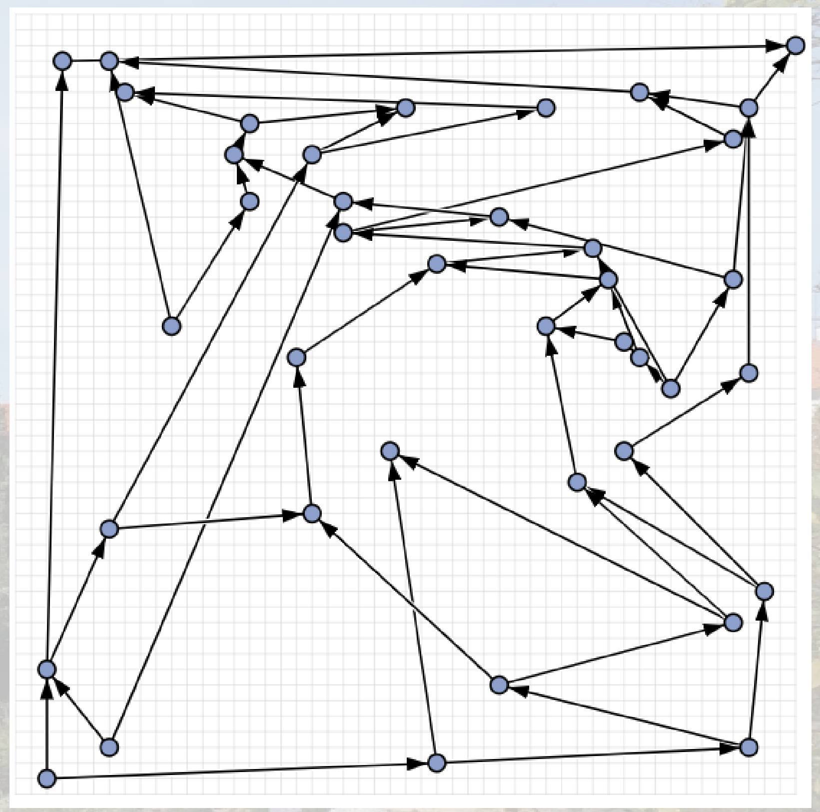
grap



best manual

UpperCut

5 crossings

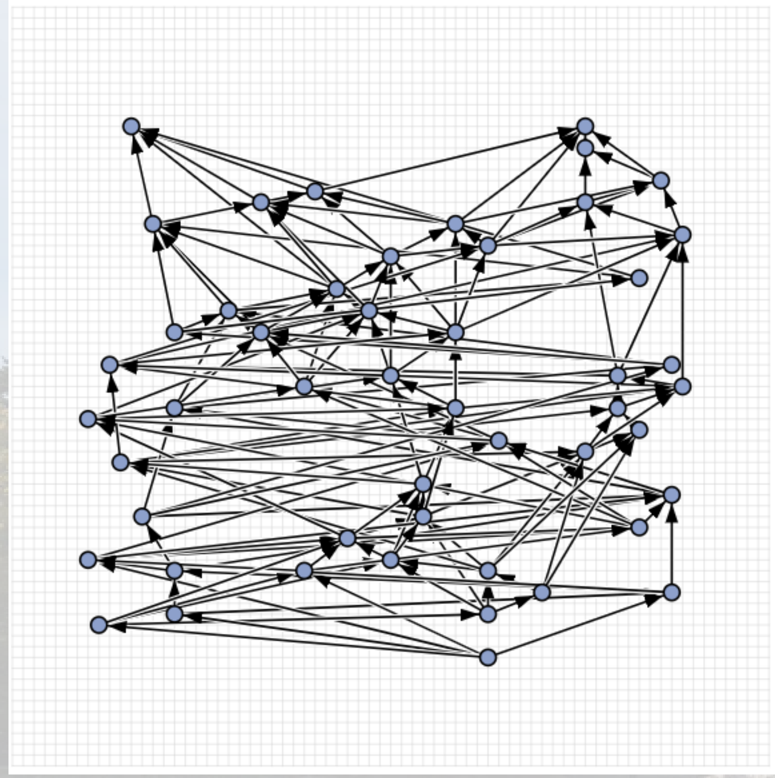


best automatic

4 crossings

LIVE CHALLENGE

the graphs



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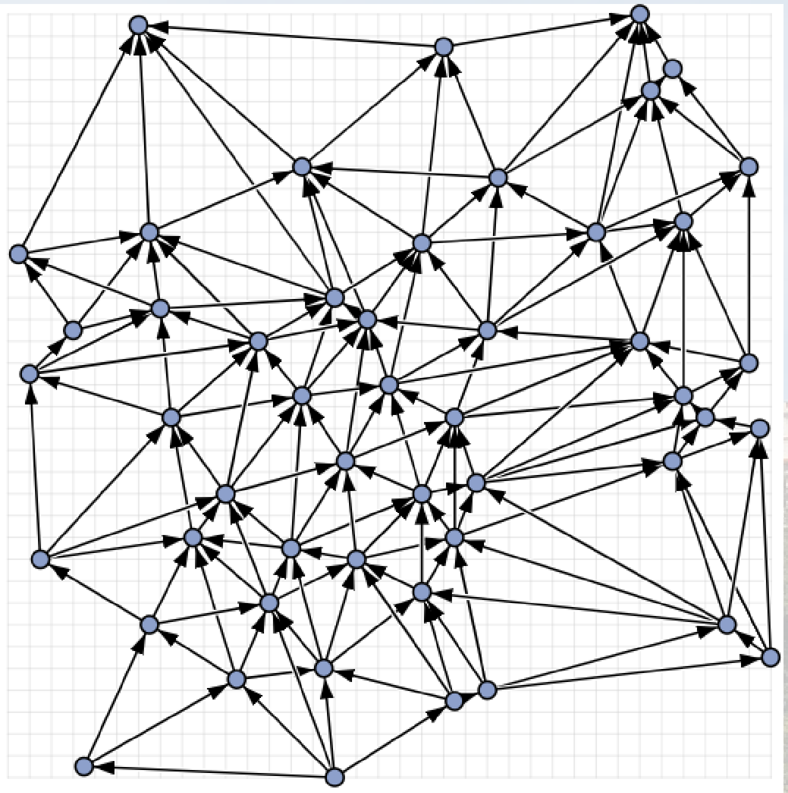
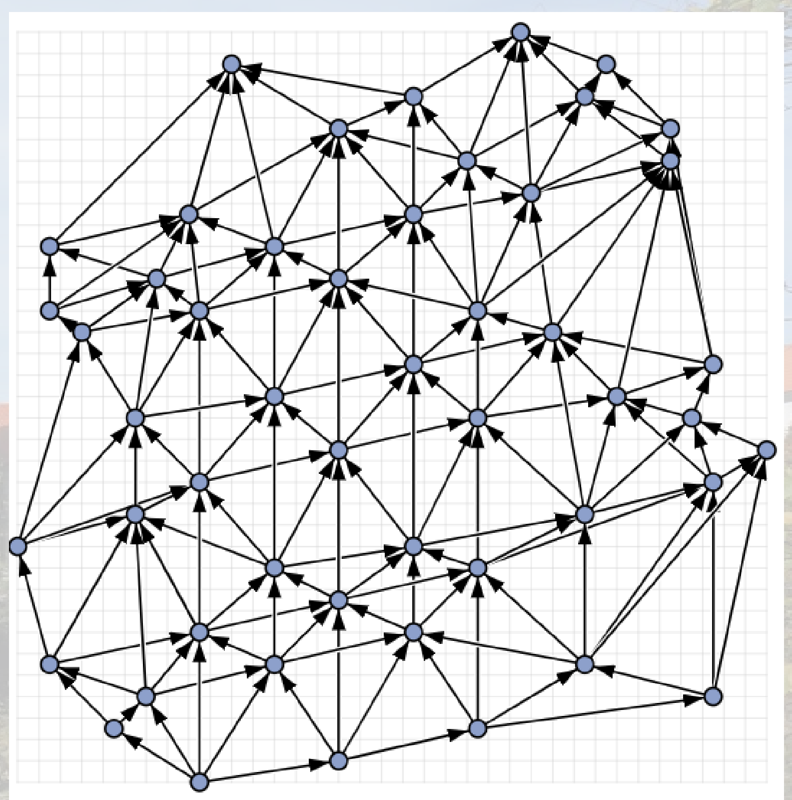


best manual

Dinosaurs

32 crossings

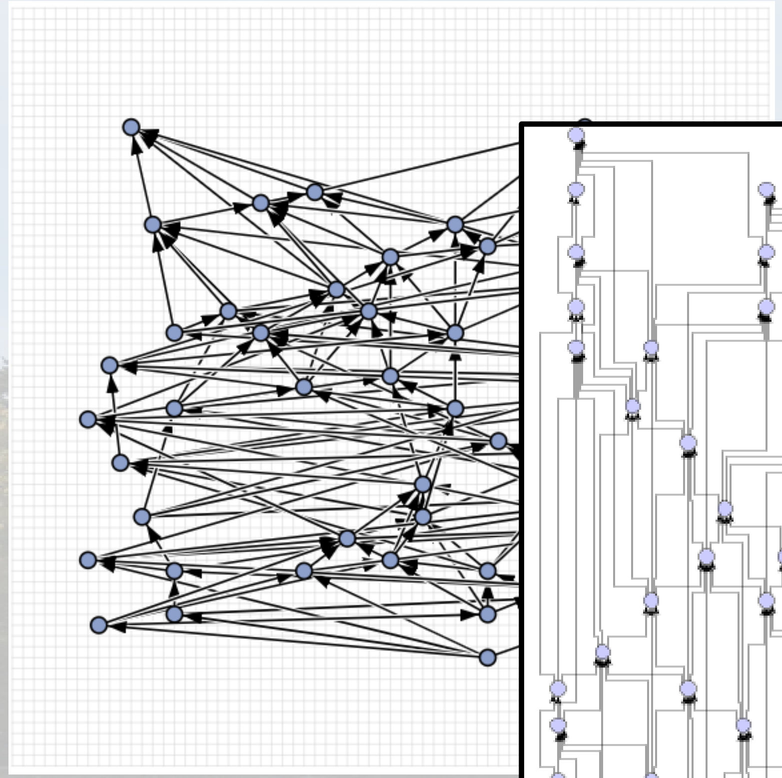


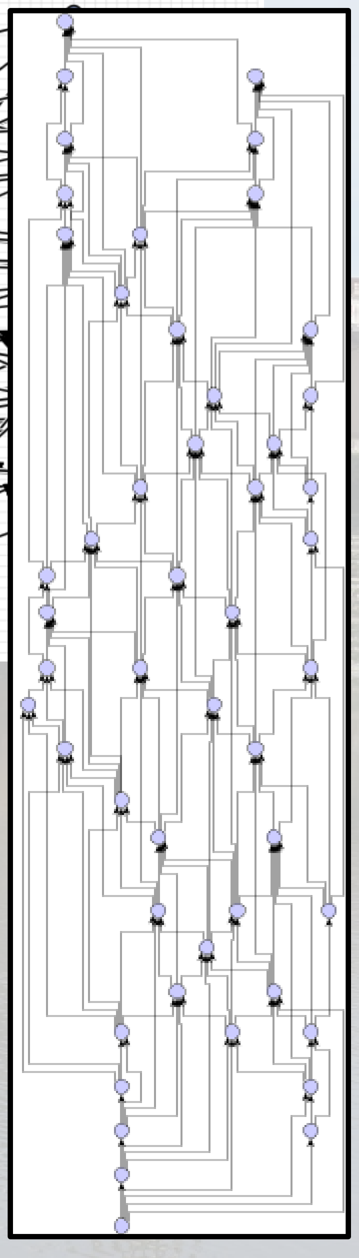
best automatic

32 crossings

graph **5**

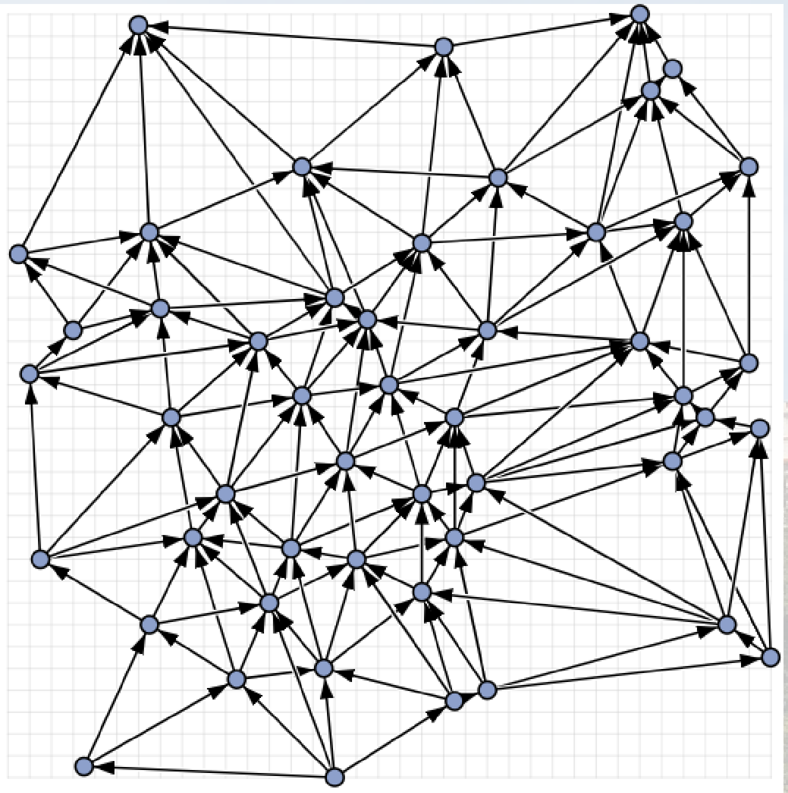
LIVE CHALLENGE
the graphs





input

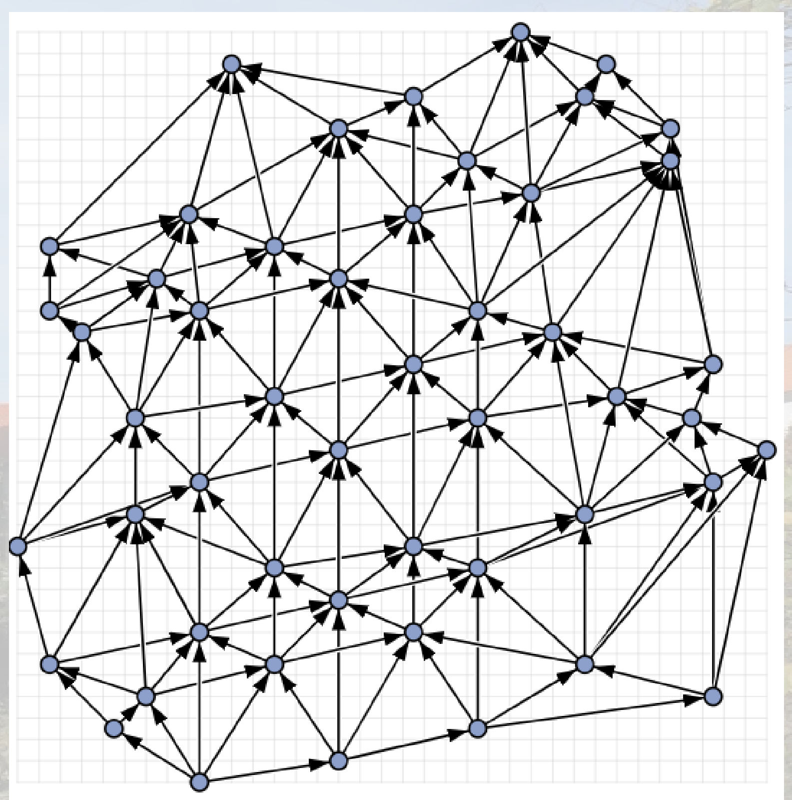
graph **5**



best manual

Dinosaurs

32 crossings

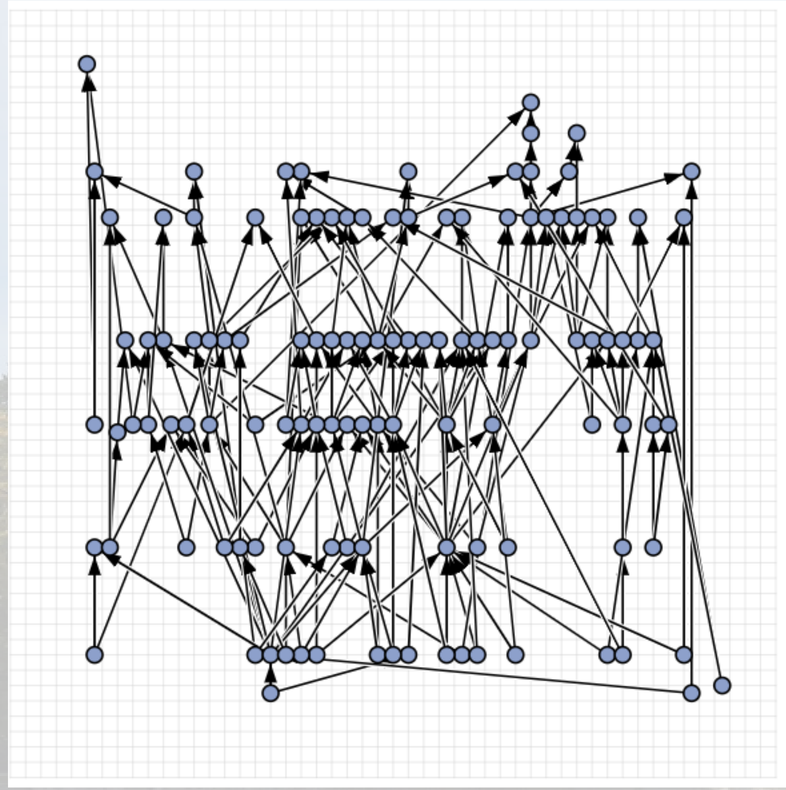


best automatic

32 crossings

LIVE CHALLENGE

the graphs



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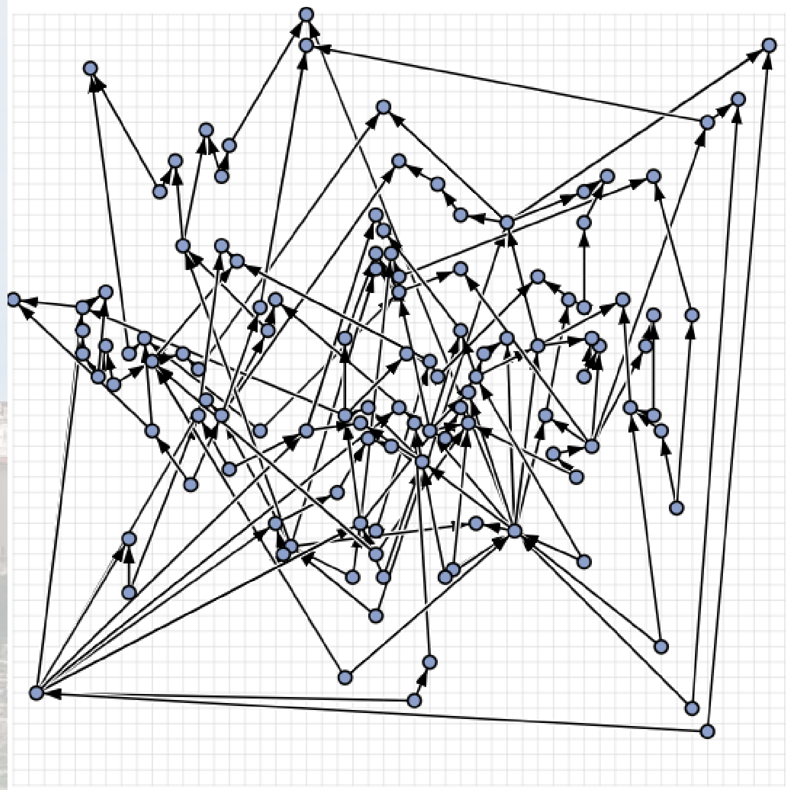
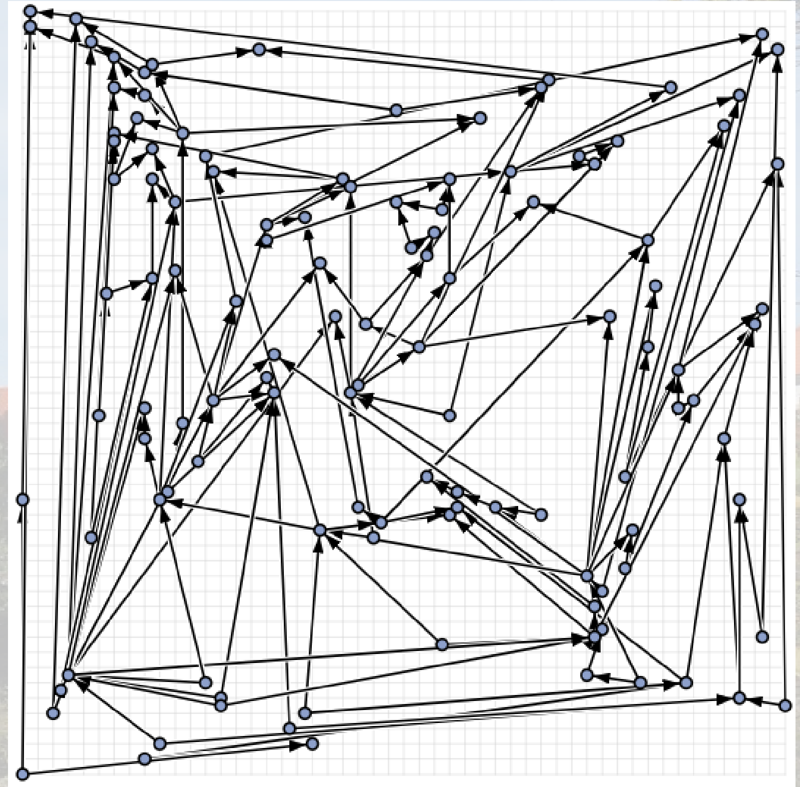


best manual

scho+

196 crossings



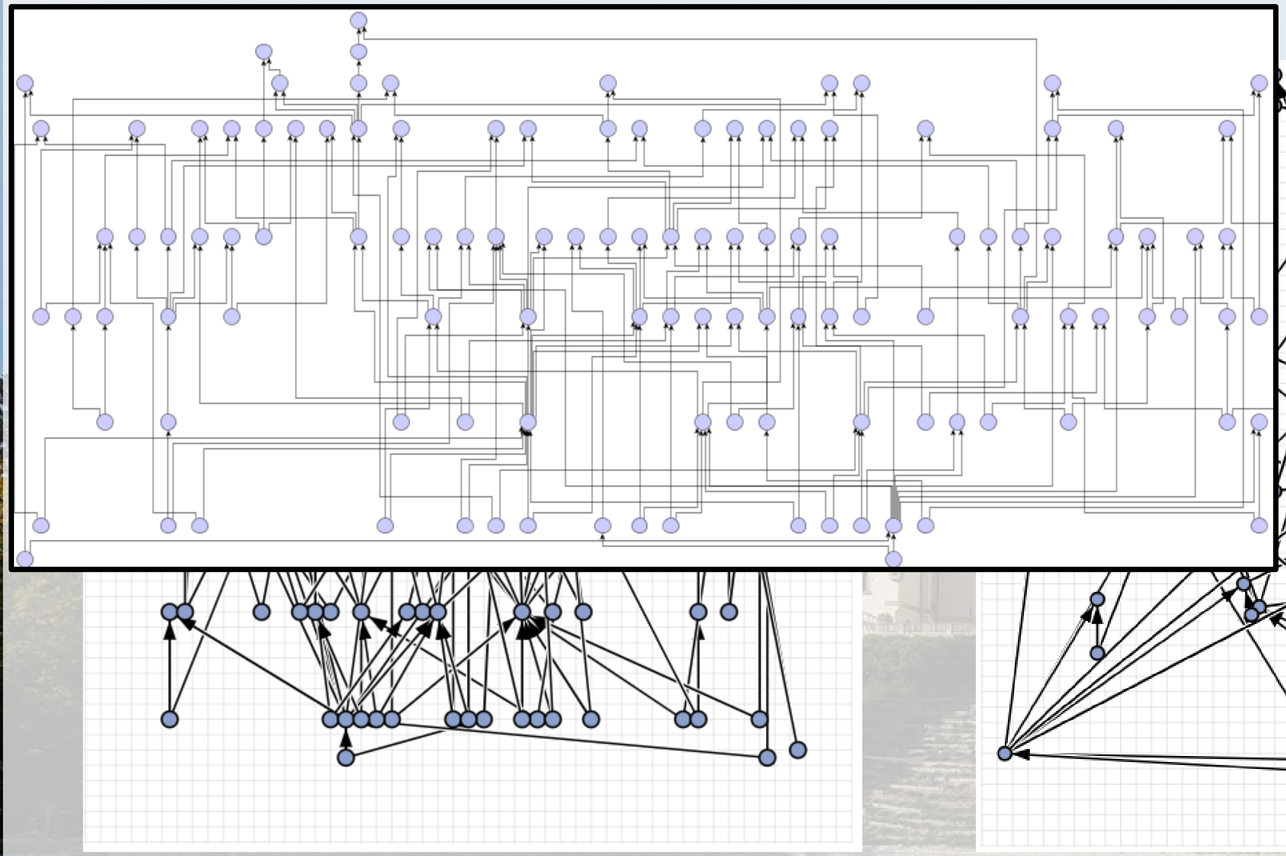
best automatic

81 crossings

graph **6**

LIVE CHALLENGE

the graphs



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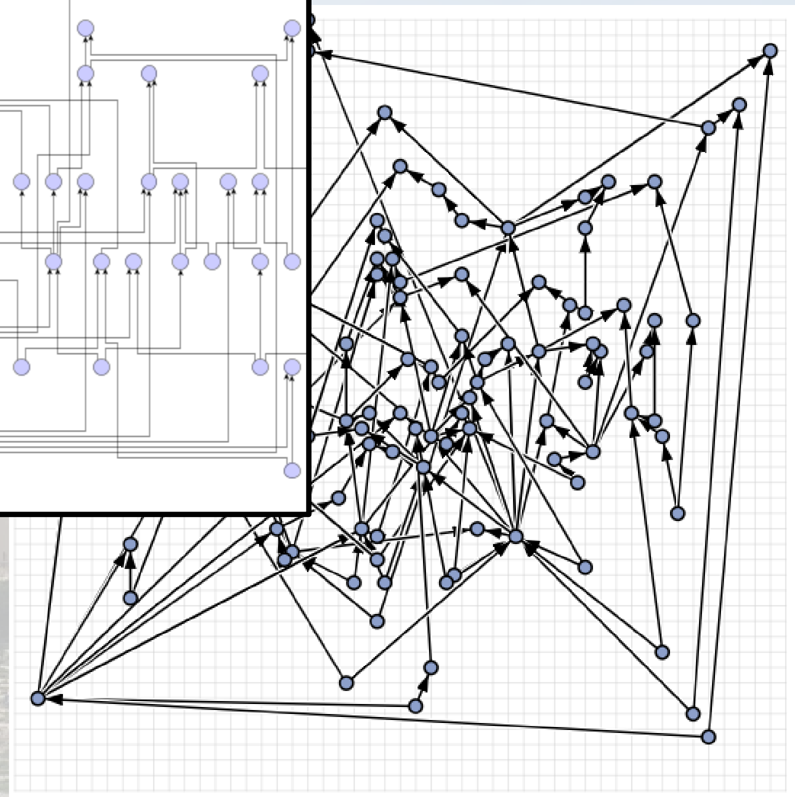
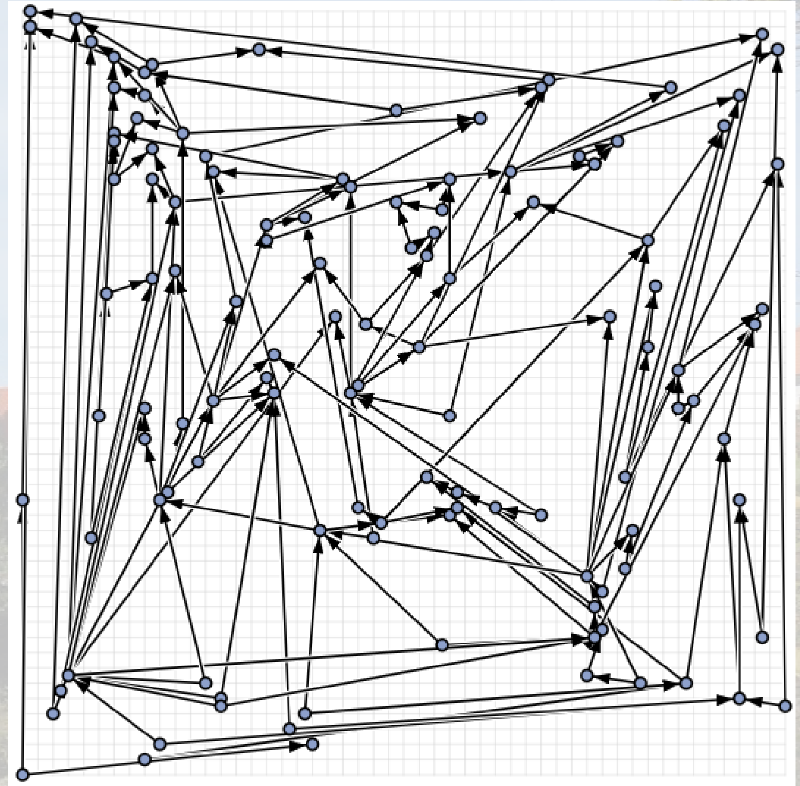


best manual

scho+

196 crossings



best automatic

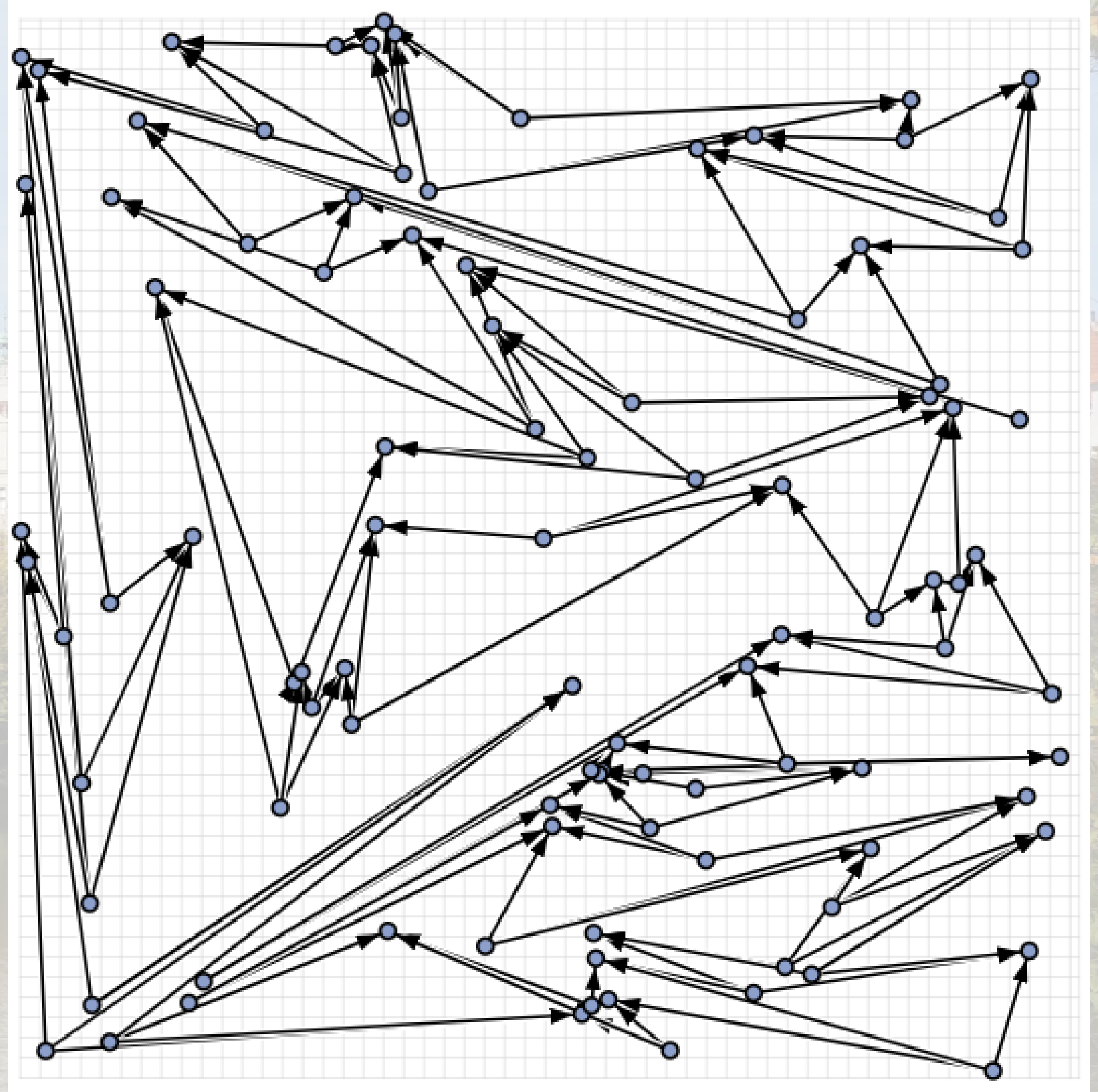
81 crossings

graph **6**

LIVE CHALLENGE

the graphs

gd 19

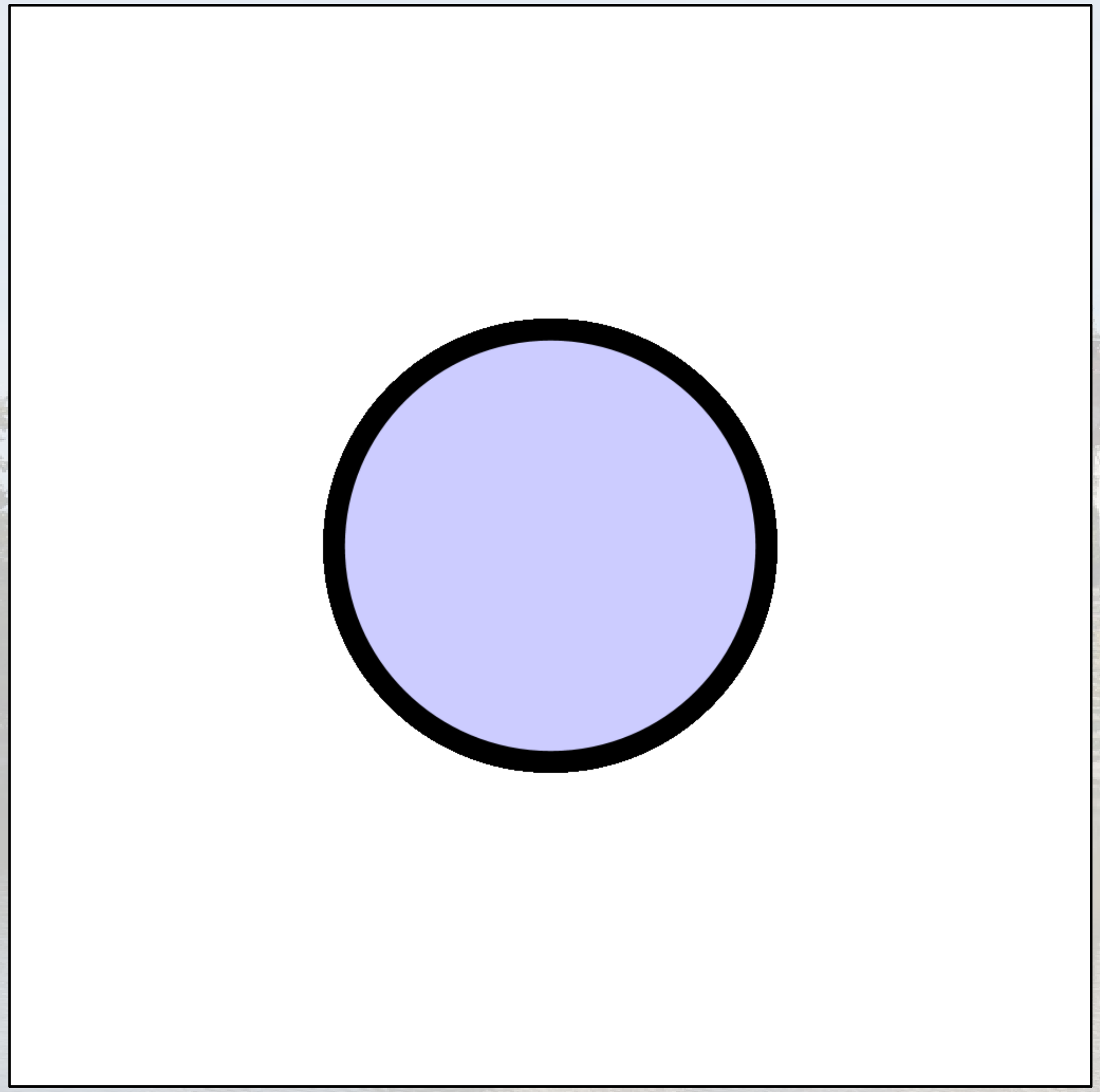


graph **7**

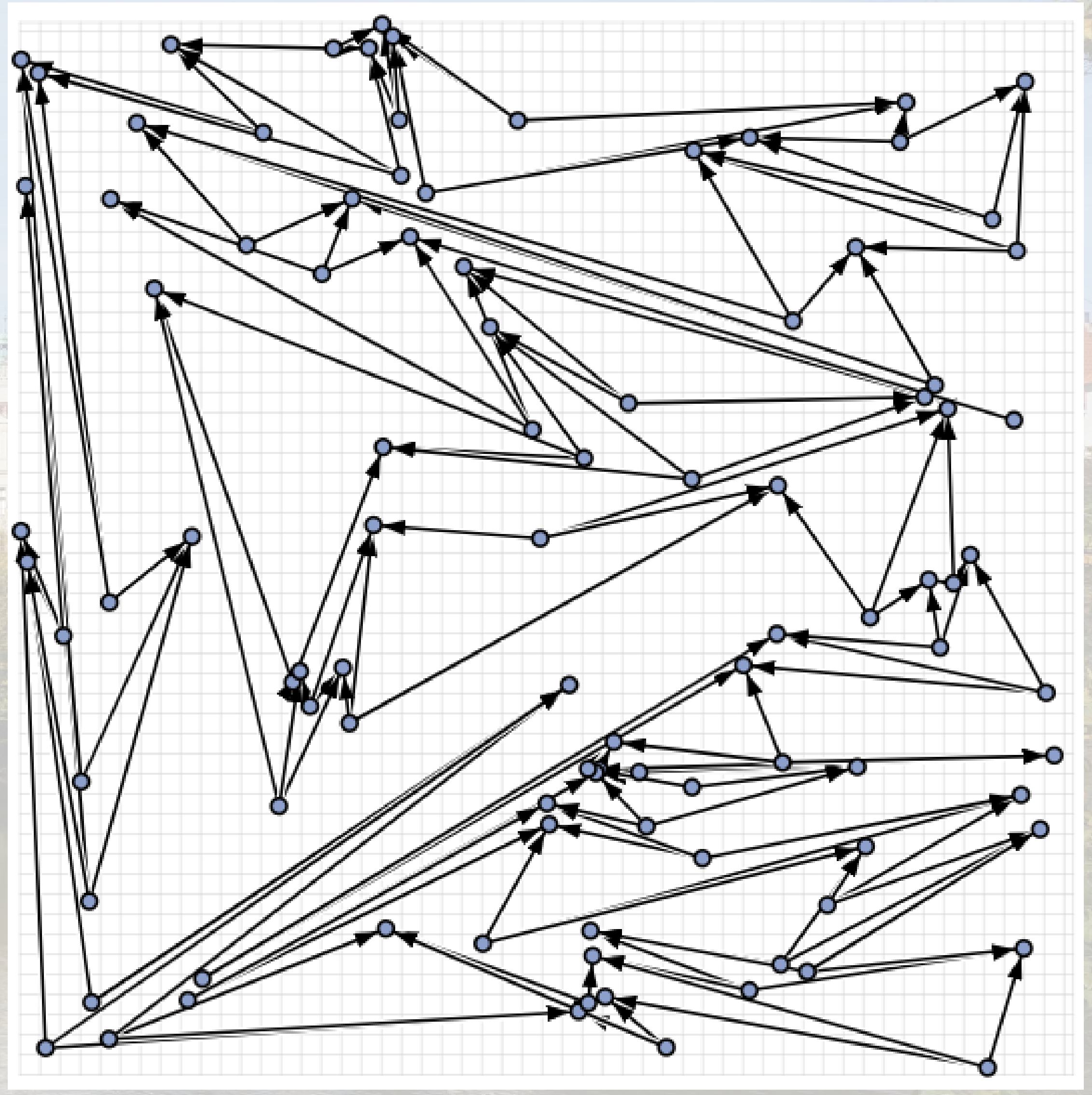
best automatic
7 crossings

LIVE CHALLENGE

the graphs



graph **7**

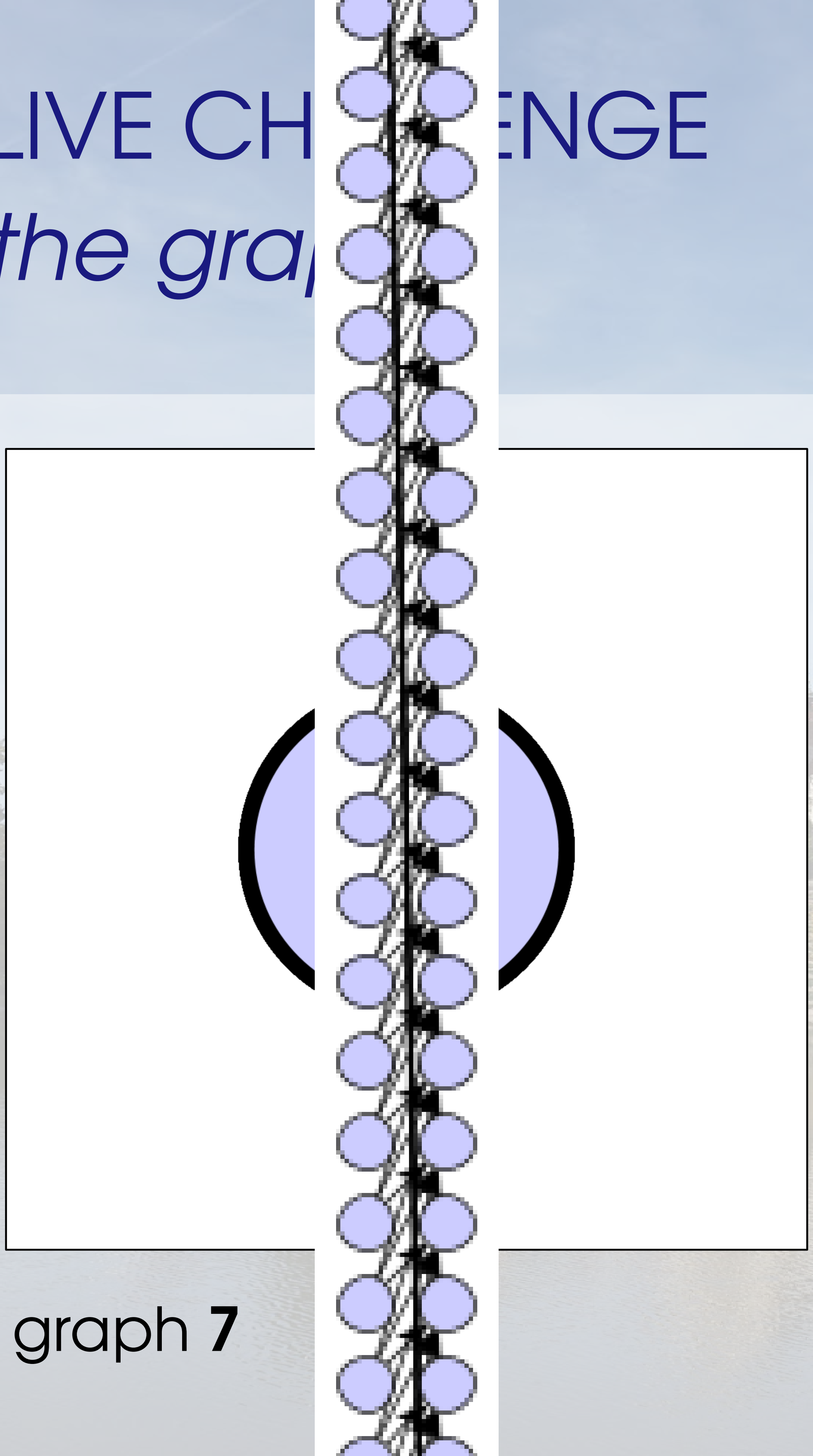


best automatic

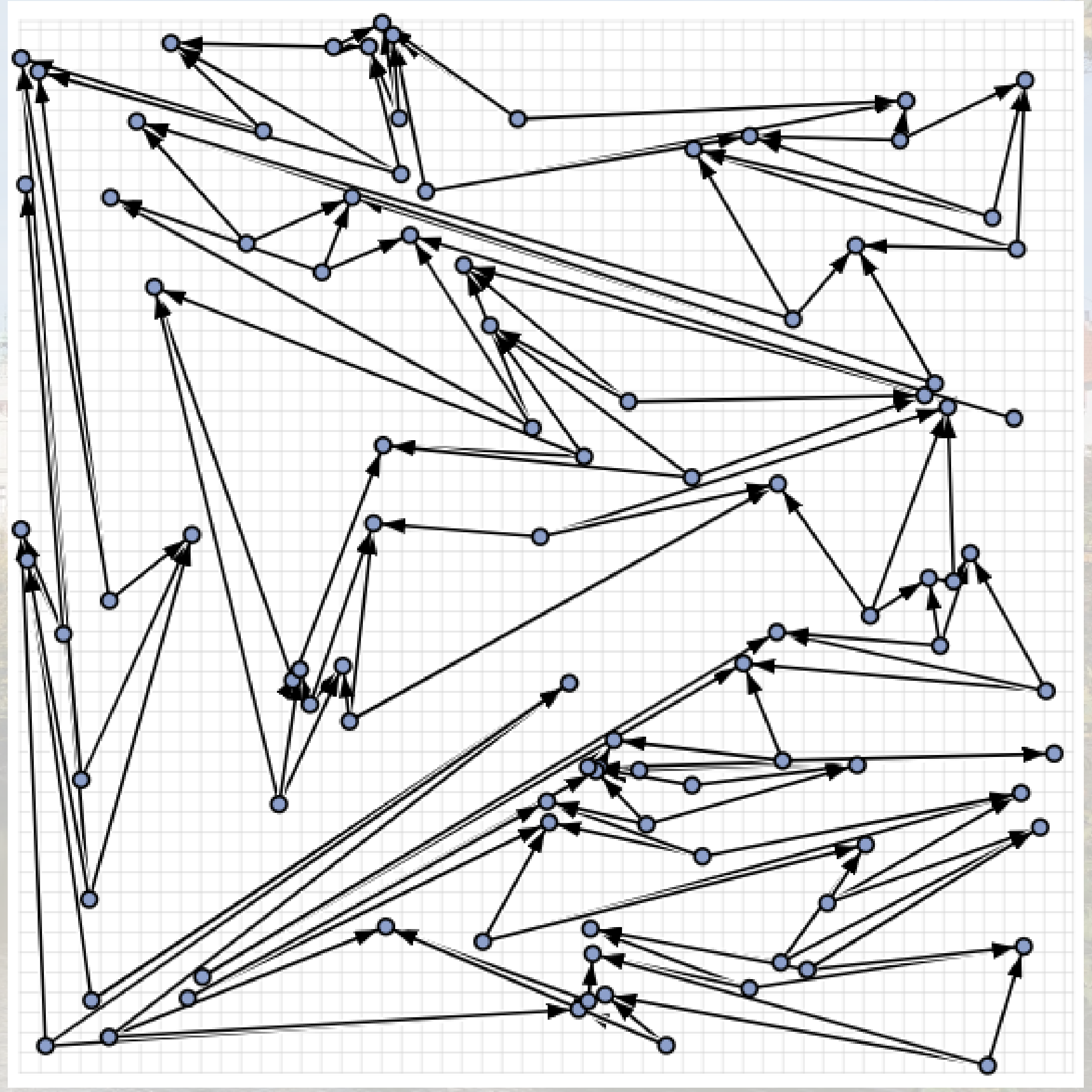
7 crossings

LIVE CH ENGE

the gra



graph **7**



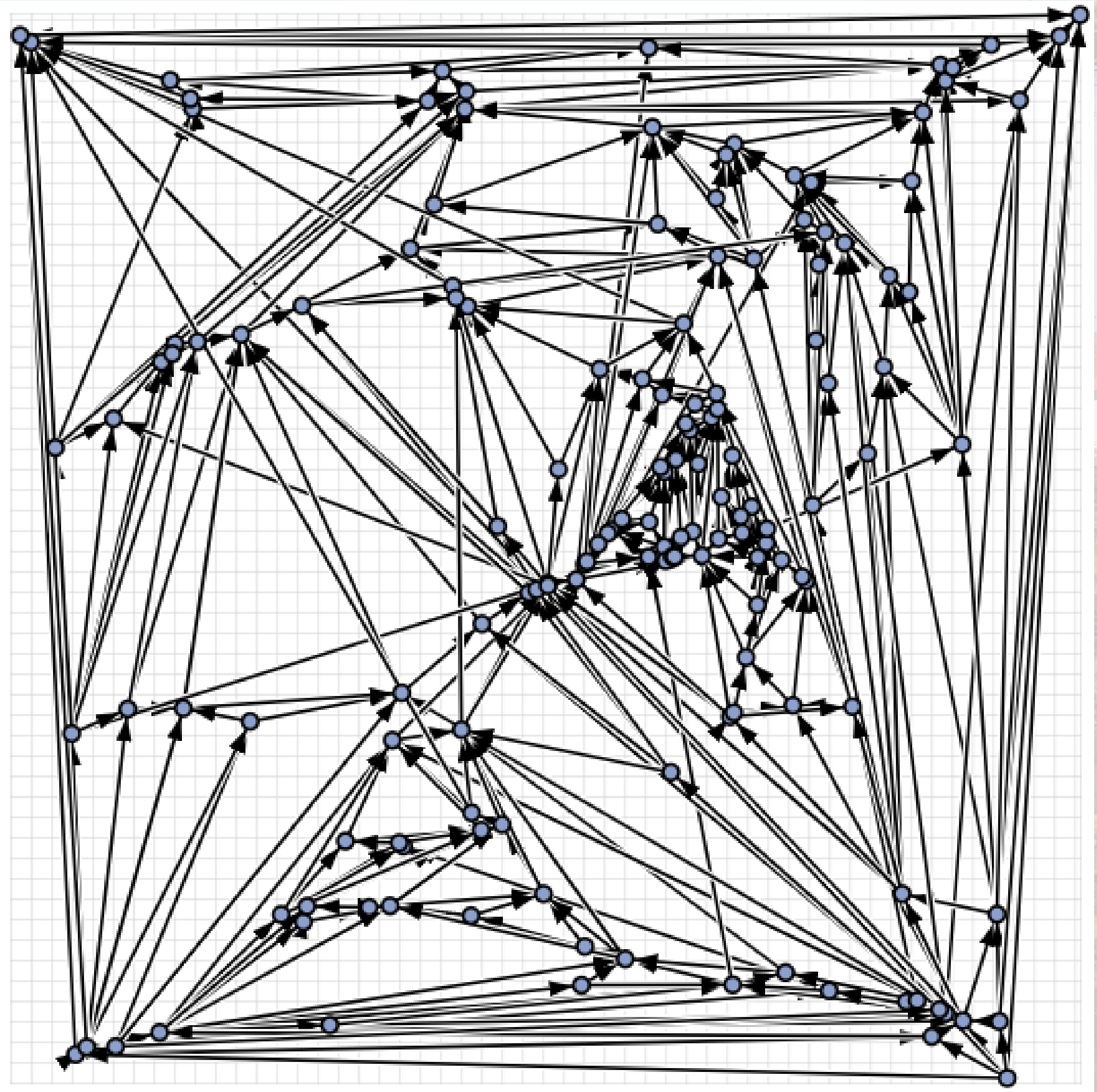
best automatic

7 crossings

LIVE CHALLENGE

the graphs

gd 19



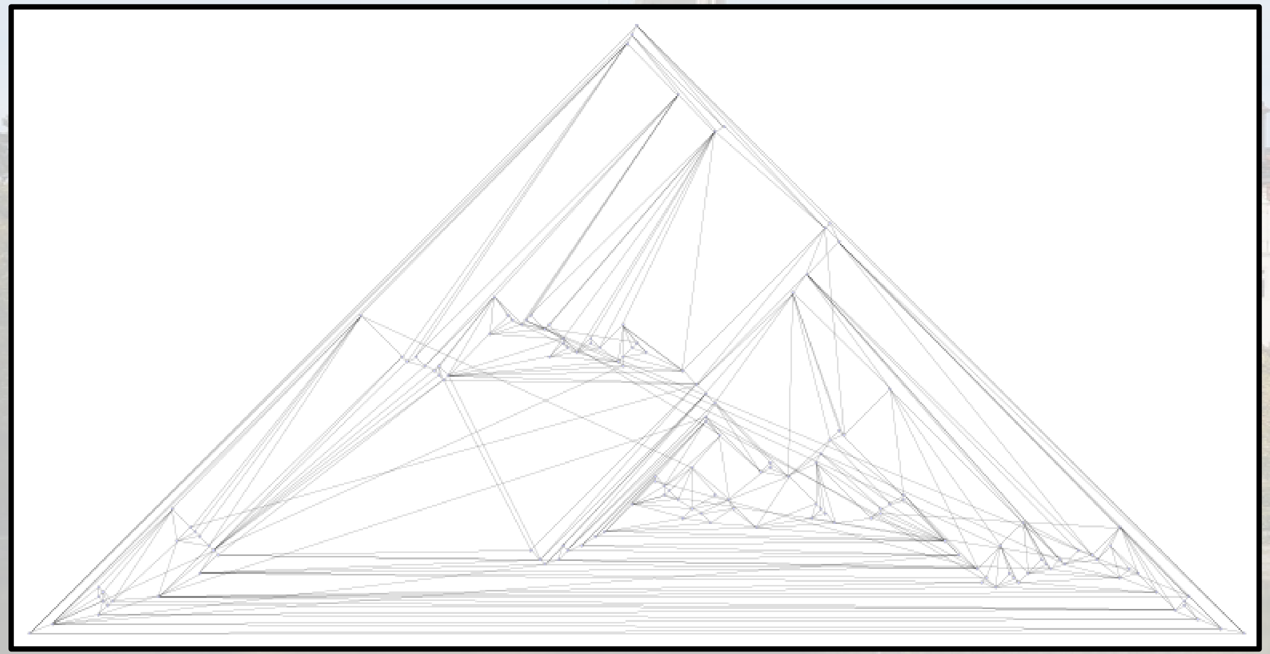
graph **8**

best automatic

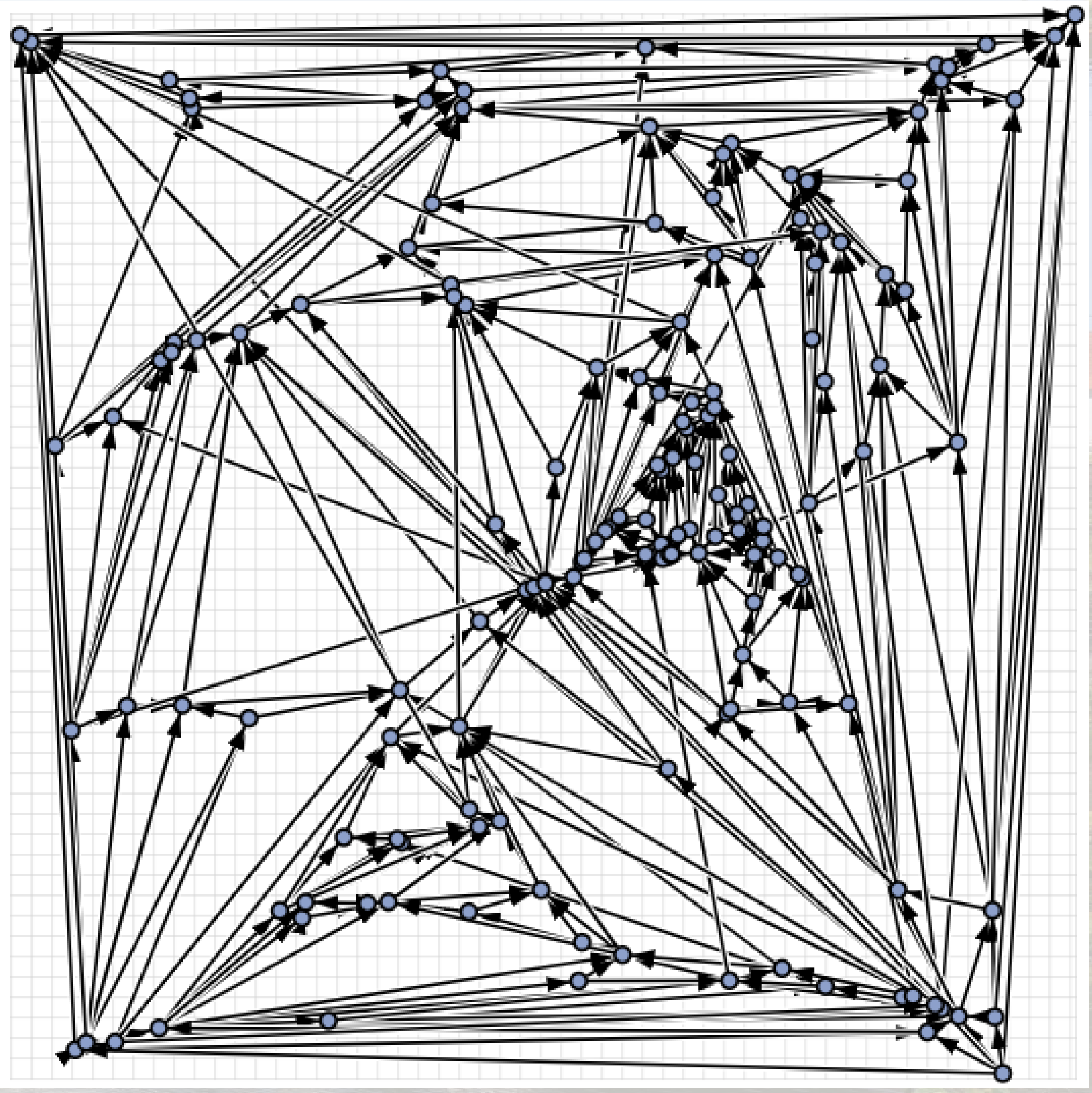
307 crossings

LIVE CHALLENGE

the graphs



graph **8**

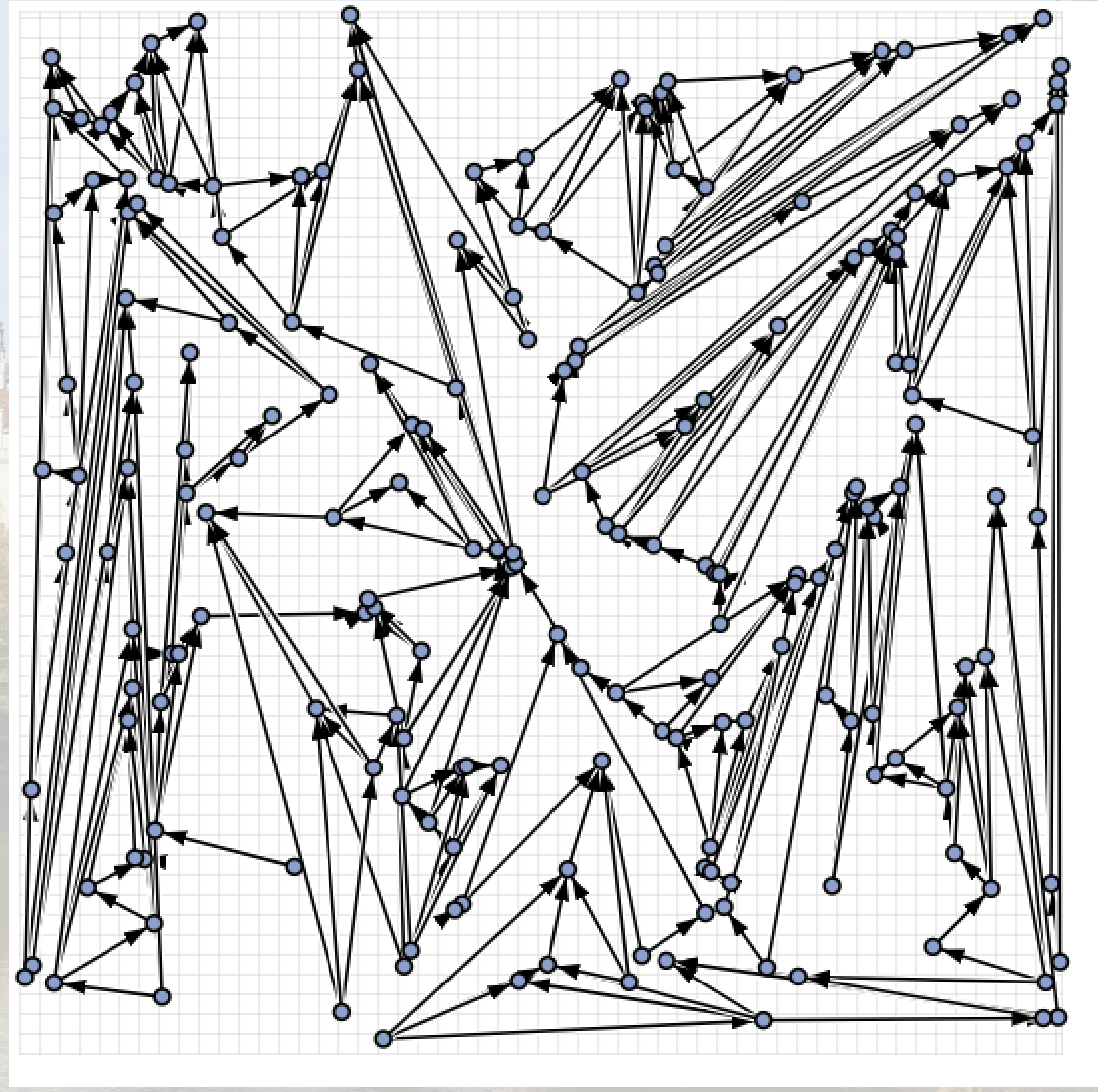


best automatic
307 crossings

LIVE CHALLENGE

the graphs

gd 19

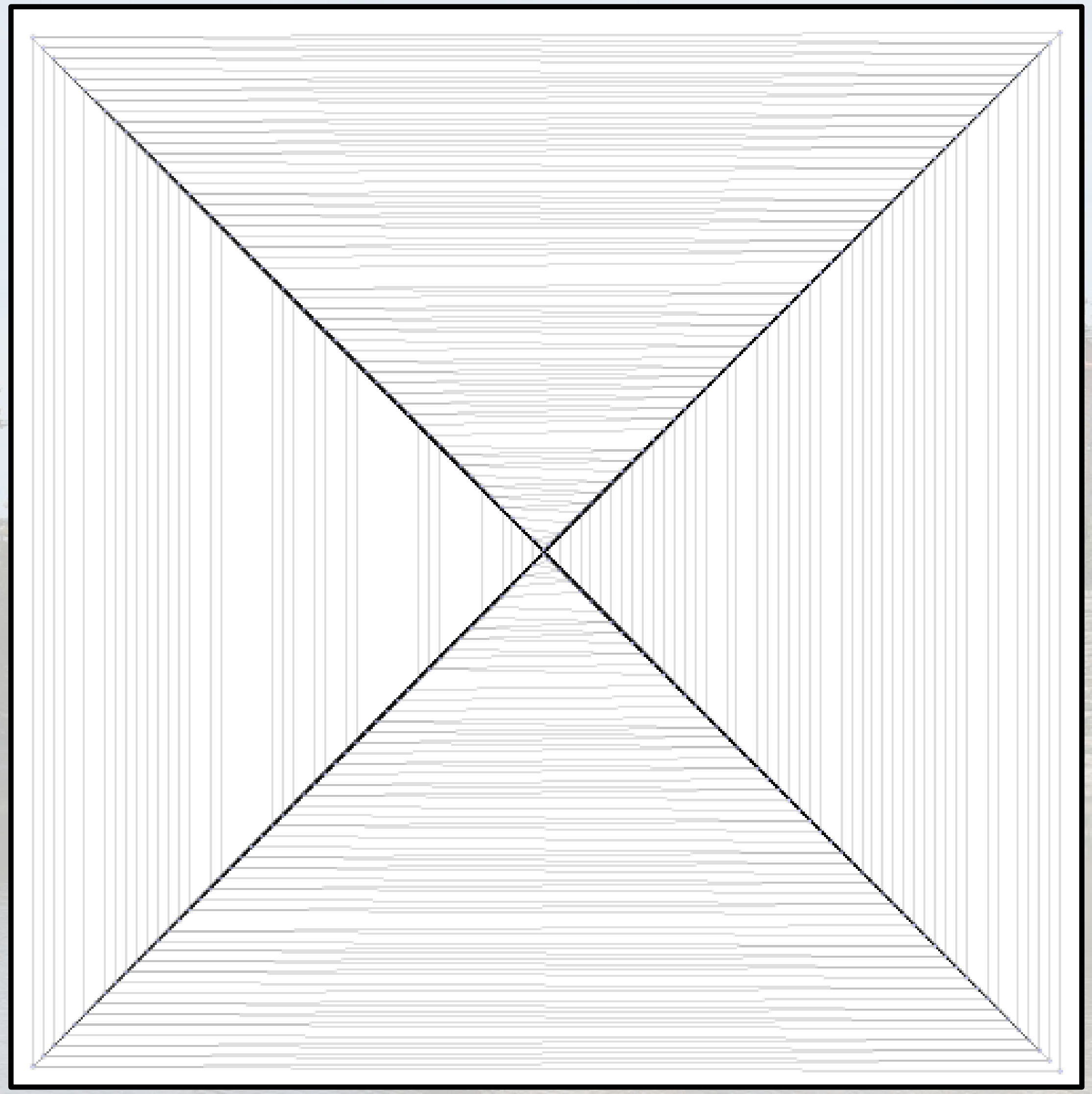


graph **9**

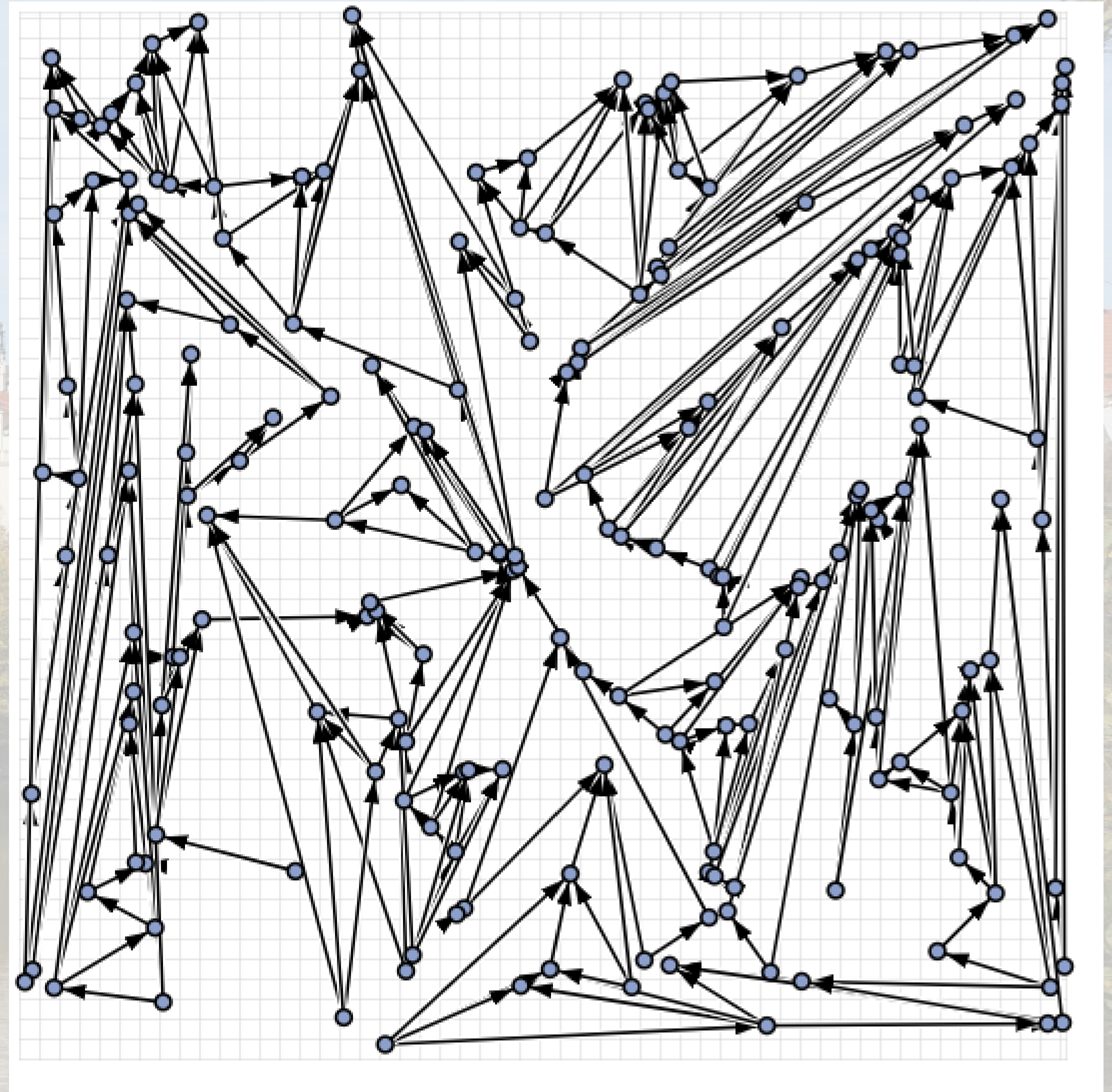
best automatic
38 crossings

LIVE CHALLENGE
the graphs

gd 19



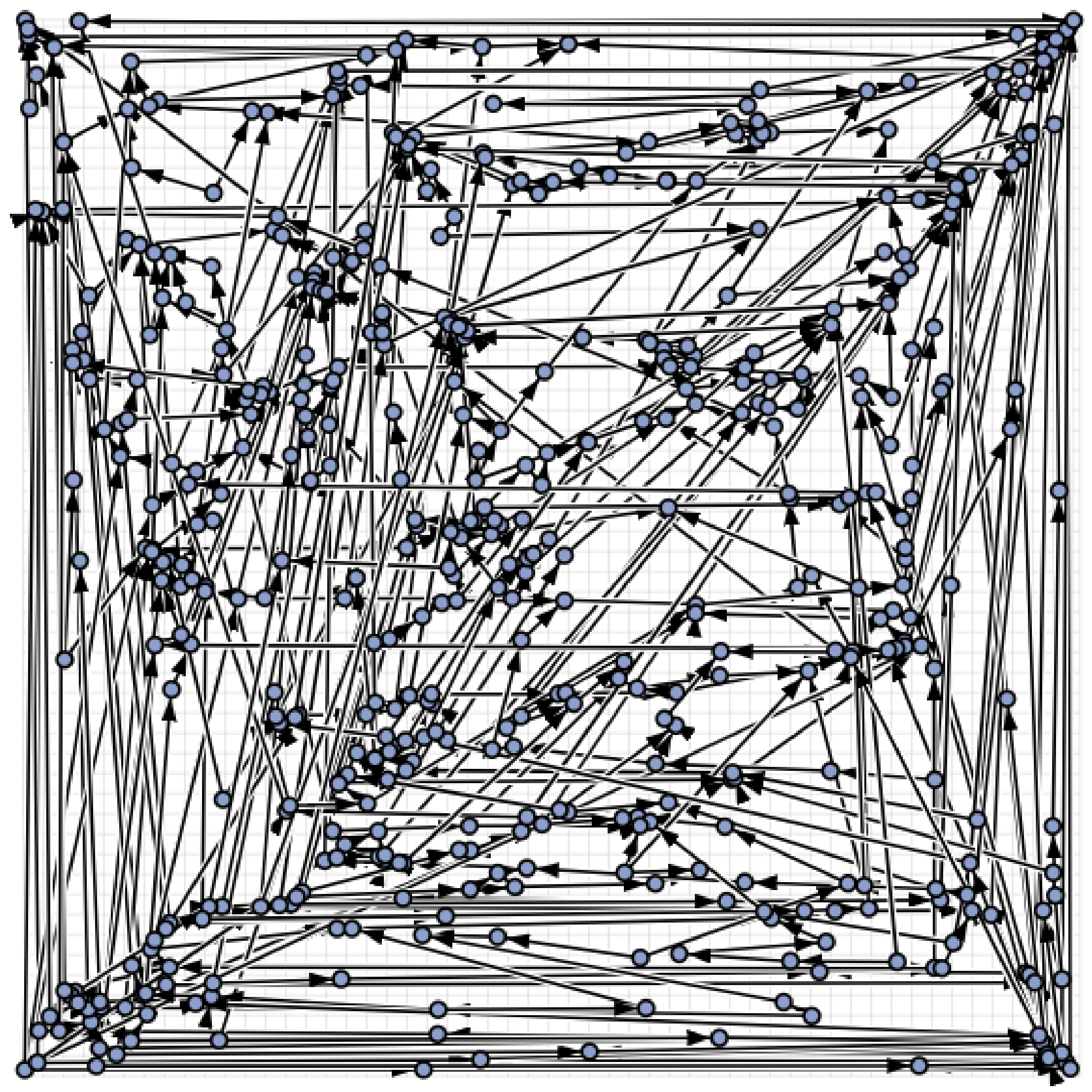
graph **9**



best automatic
38 crossings

LIVE CHALLENGE

the graphs



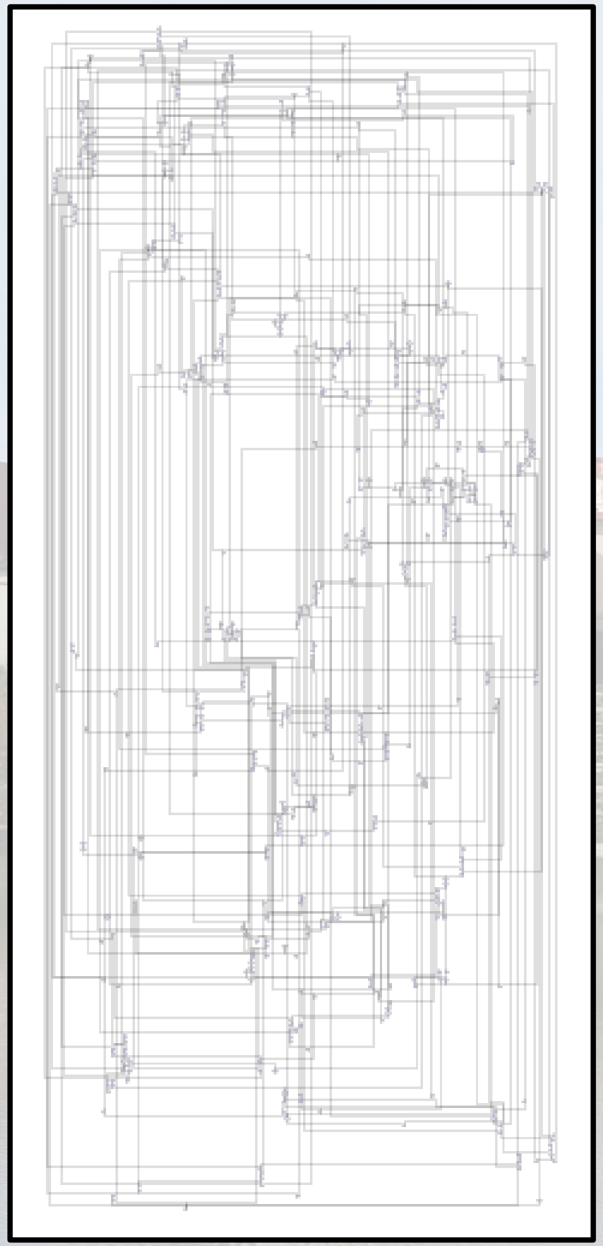
graph **10**

best automatic

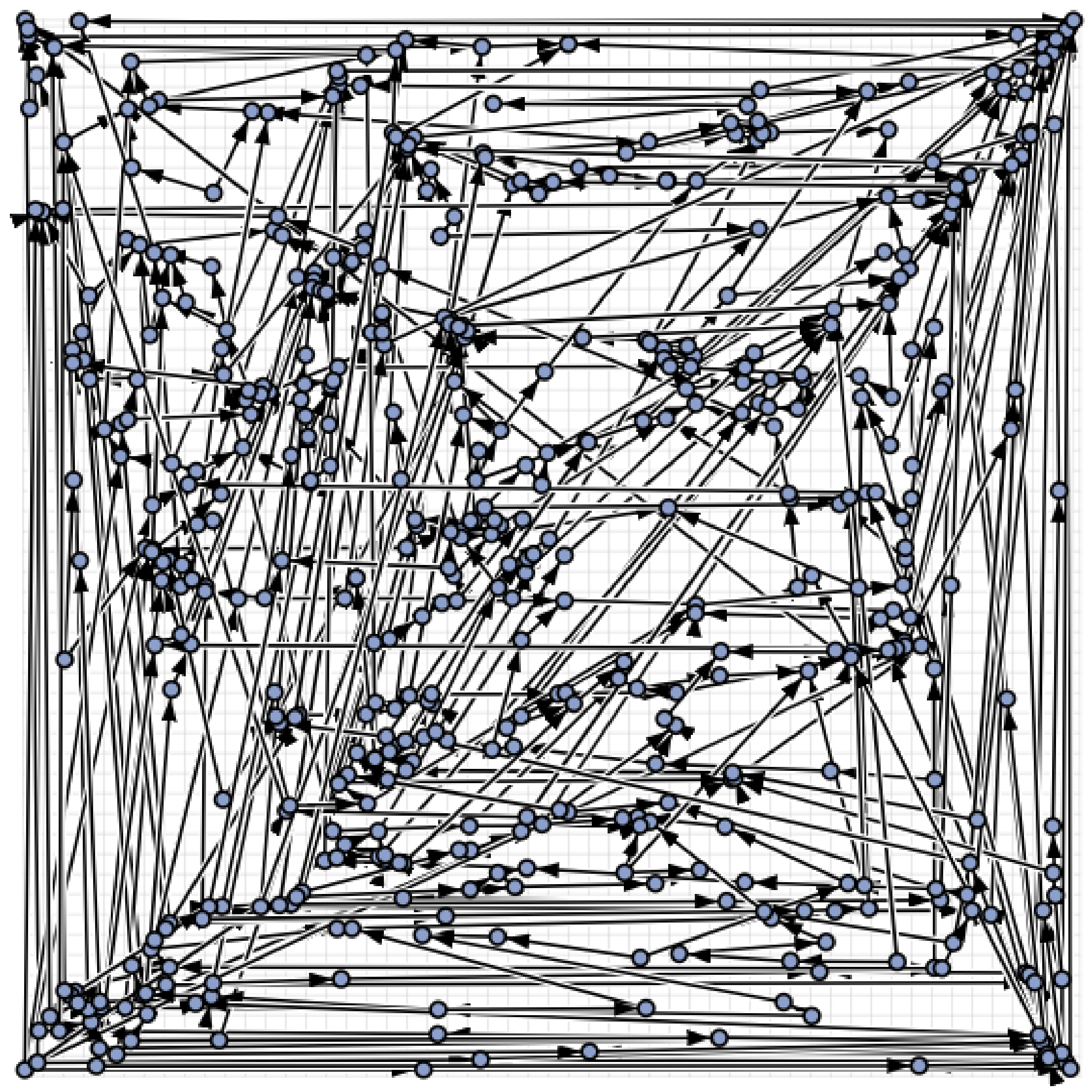
1568 crossings

LIVE CHALLENGE

the graphs



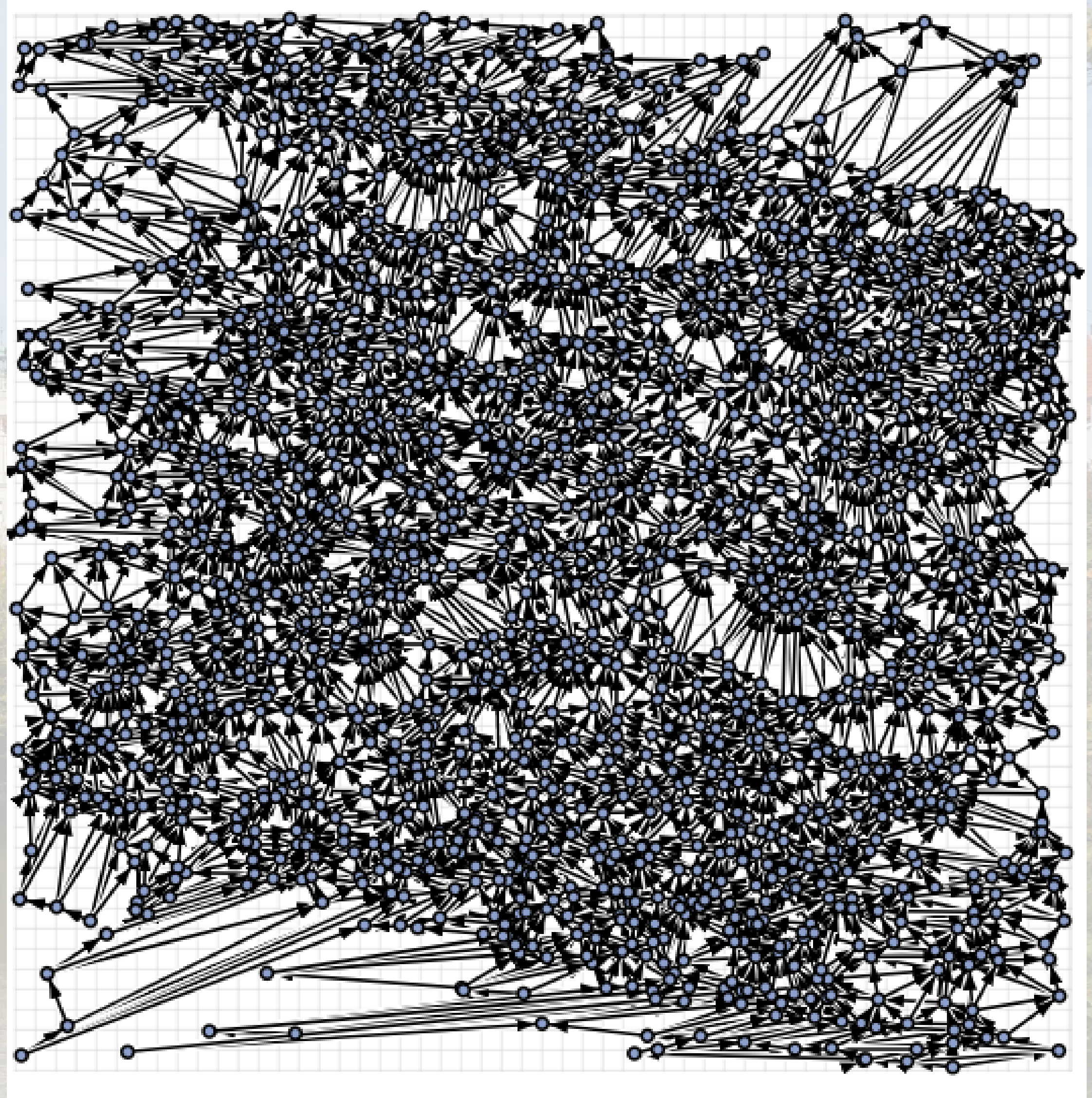
graph **10**



best automatic

1568 crossings

LIVE CHALLENGE
the graphs

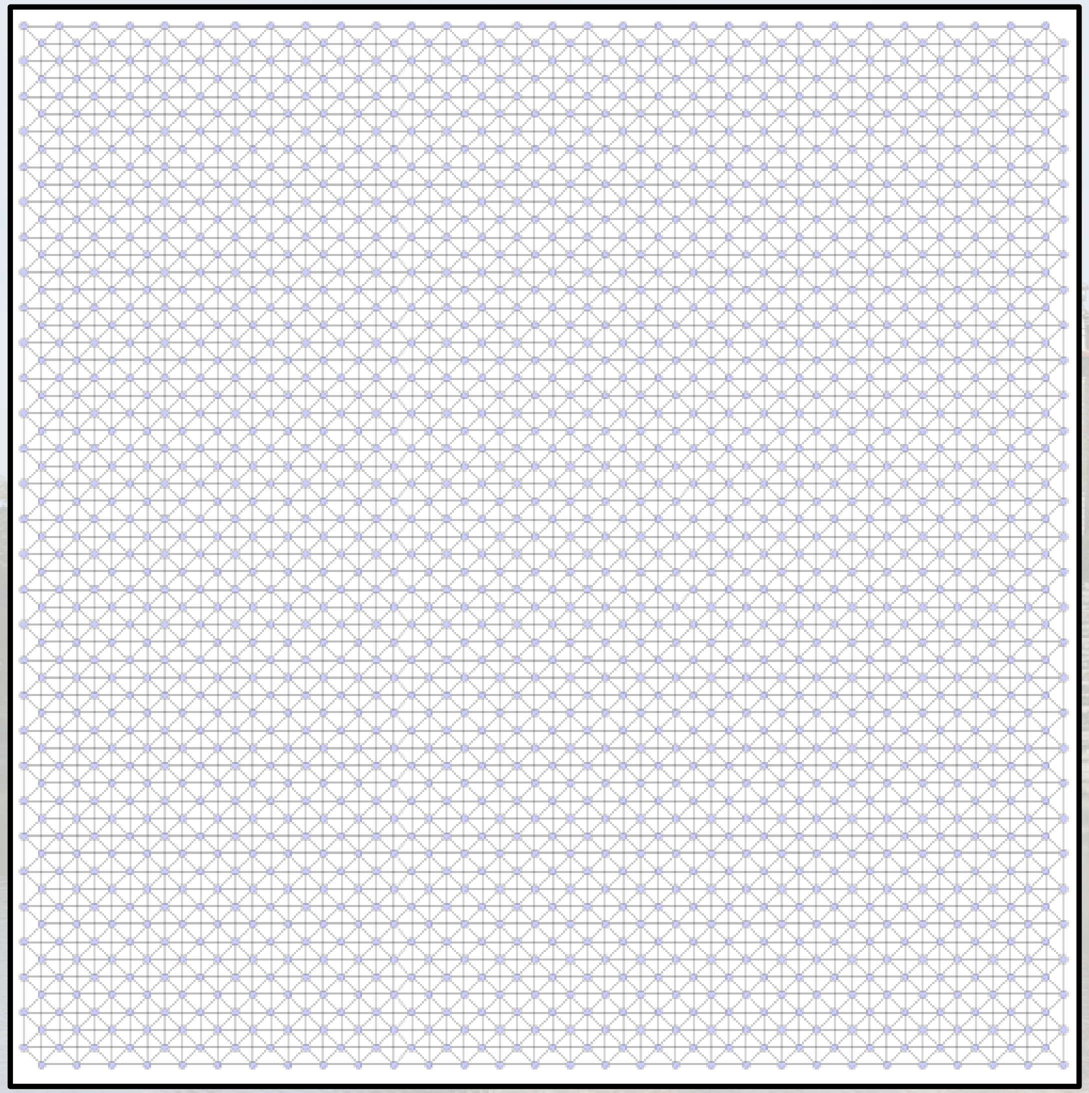


graph **11**

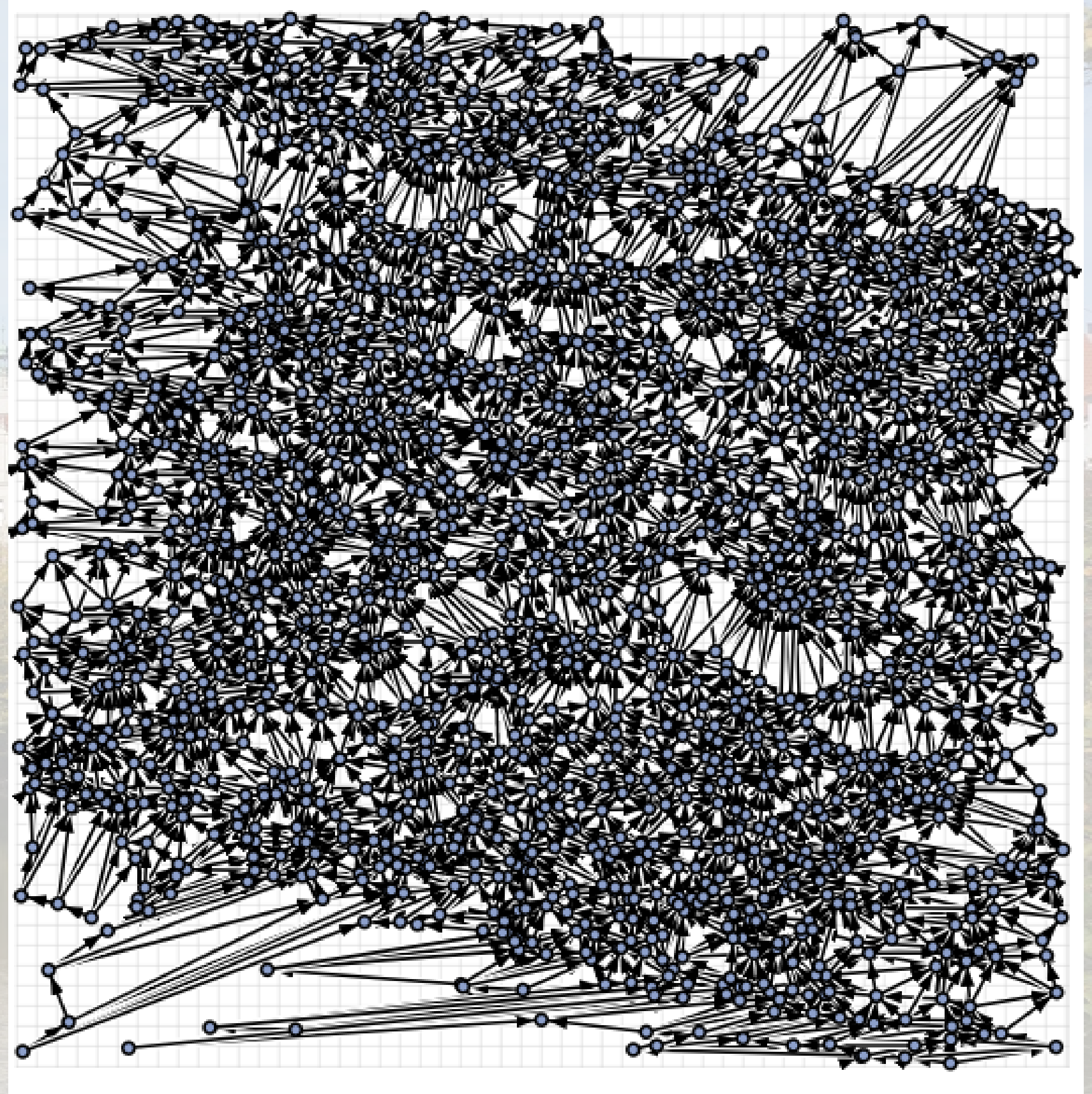
best automatic
1721 crossings

LIVE CHALLENGE

the graphs



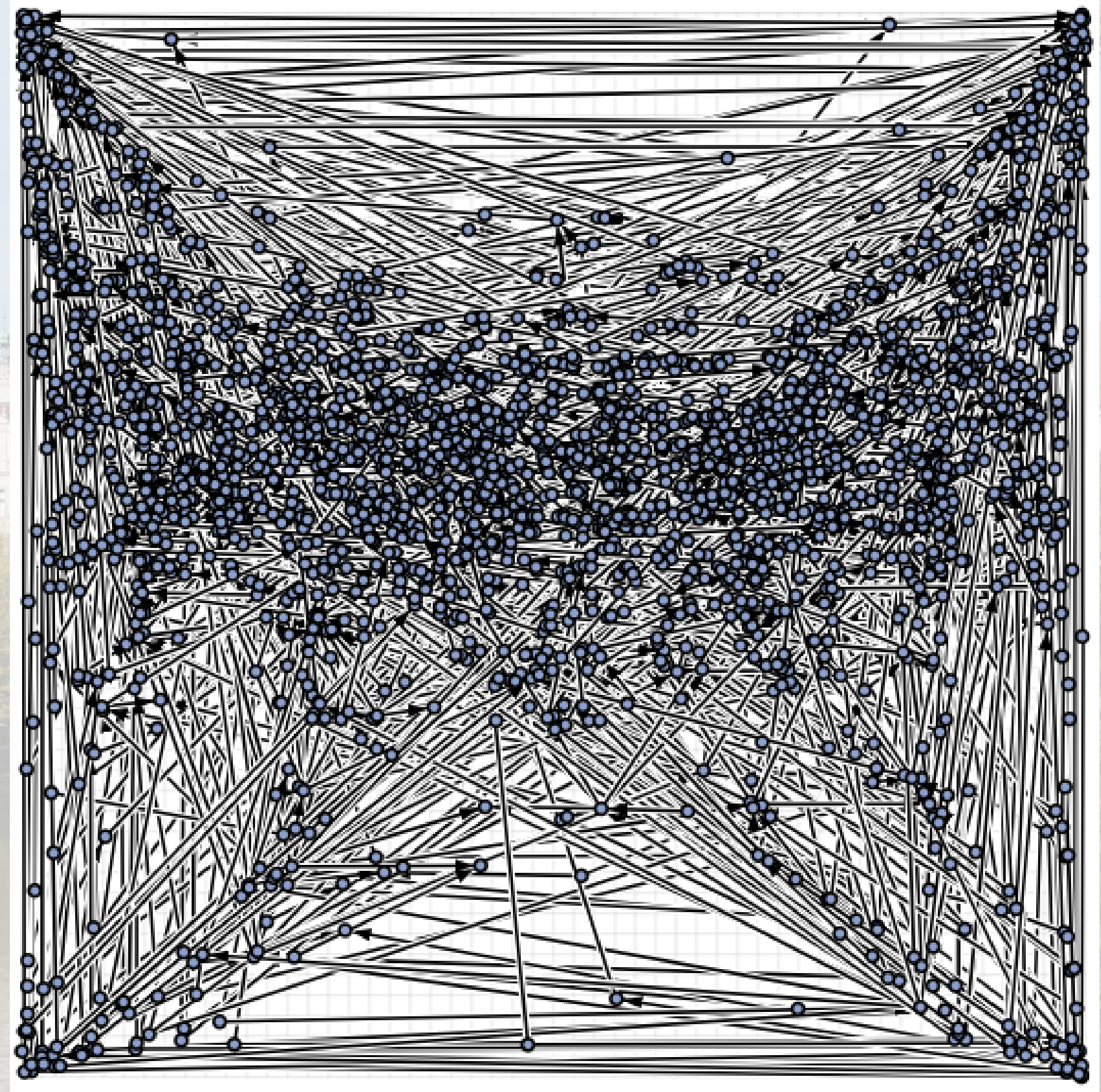
graph **11**



best automatic
1721 crossings

LIVE CHALLENGE

the graphs



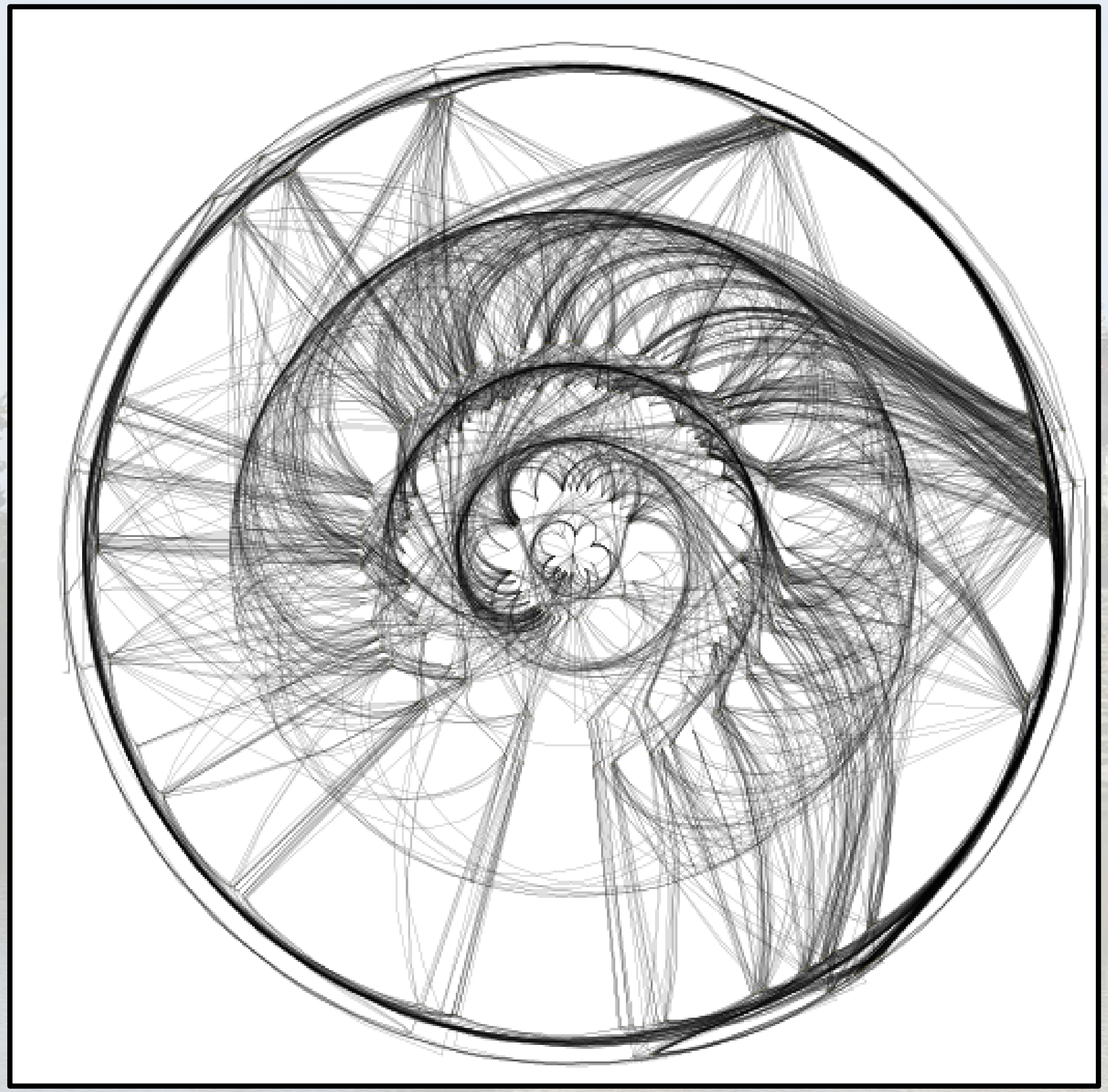
graph **12**

best automatic

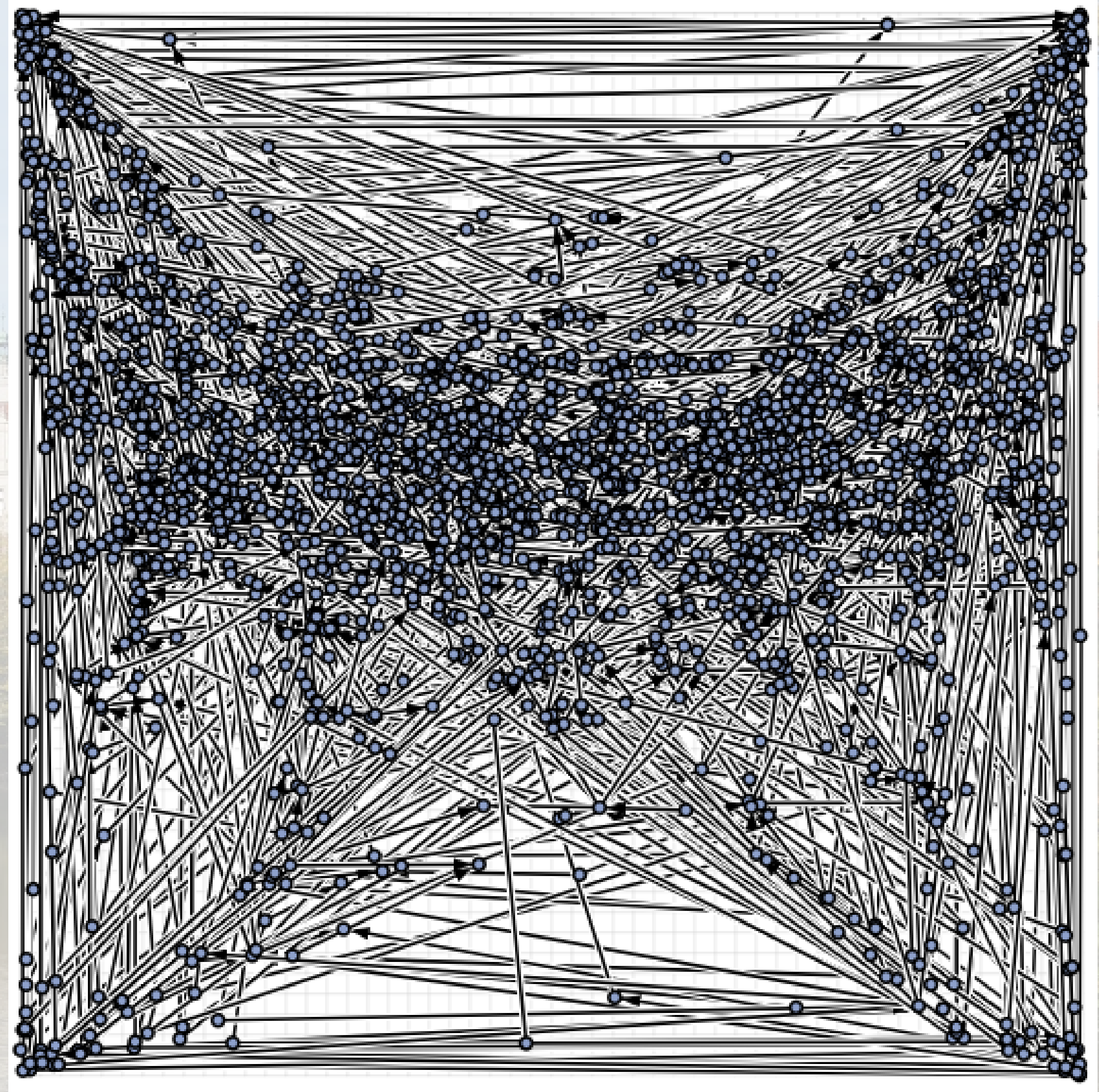
147628 crossings

LIVE CHALLENGE

the graphs



graph **12**



best automatic
147628 crossings

LIVE CHALLENGE

manual category

RESULTS

LIVE CHALLENGE

manual category

graph

balloon
UpperCut
UPGD19
1 device per team
Vertigo
Discrete geometers
36% Battery Remaining
PAF
scho+
Dinosaurs
#OnlyGoodDrawings
Complicated Graphs
IV
Now Austrians
Aaaaaah

LIVE CHALLENGE
manual category

graph	1
balloon	2
UpperCut	2
UPGD19	0
1 device per team	4
Vertigo	0
Discrete geometers	6
36% Battery Remaining	2
PAF	0
scho+	2
Dinosaurs	4
#OnlyGoodDrawings	2
Complicated Graphs	2
IV	0
Now Austrians	2
Aaaaaah	0

LIVE CHALLENGE
manual category

graph	1	2
balloon	2	14
UpperCut	2	21
UPGD19	0	13
1 device per team	4	47
Vertigo	0	20
Discrete geometers	6	18
36% Battery Remaining	2	4
PAF	0	9
scho+	2	17
Dinosaurs	4	16
#OnlyGoodDrawings	2	8
Complicated Graphs	2	24
IV	0	22
Now Austrians	2	14
Aaaaaah	0	8

LIVE CHALLENGE
manual category

graph	1	2	3
balloon	2	14	7
UpperCut	2	21	9
UPGD19	0	13	21
1 device per team	4	47	70
Vertigo	0	20	5
Discrete geometers	6	18	5
36% Battery Remaining	2	4	7
PAF	0	9	6
scho+	2	17	7
Dinosaurs	4	16	7
#OnlyGoodDrawings	2	8	8
Complicated Graphs	2	24	147
IV	0	22	49
Now Austrians	2	14	5
Aaaaaah	0	8	6

LIVE CHALLENGE
manual category

graph	1	2	3	4
balloon	2	14	7	27
UpperCut	2	21	9	5
UPGD19	0	13	21	8
1 device per team	4	47	70	25
Vertigo	0	20	5	9
Discrete geometers	6	18	5	5
36% Battery Remaining	2	4	7	7
PAF	0	9	6	10
scho+	2	17	7	12
Dinosaurs	4	16	7	12
#OnlyGoodDrawings	2	8	8	6
Complicated Graphs	2	24	147	26
IV	0	22	49	10
Now Austrians	2	14	5	8
Aaaaaah	0	8	6	6

LIVE CHALLENGE
manual category

graph	1	2	3	4	5
balloon	2	14	7	27	-
UpperCut	2	21	9	5	32
UPGD19	0	13	21	8	32
1 device per team	4	47	70	25	77
Vertigo	0	20	5	9	32
Discrete geometers	6	18	5	5	32
36% Battery Remaining	2	4	7	7	32
PAF	0	9	6	10	38
scho+	2	17	7	12	35
Dinosaurs	4	16	7	12	32
#OnlyGoodDrawings	2	8	8	6	32
Complicated Graphs	2	24	147	26	35
IV	0	22	49	10	34
Now Austrians	2	14	5	8	32
Aaaaaah	0	8	6	6	215

LIVE CHALLENGE
manual category

graph	1	2	3	4	5	6
balloon	2	14	7	27	-	424
UpperCut	2	21	9	5	32	323
UPGD19	0	13	21	8	32	242
1 device per team	4	47	70	25	77	380
Vertigo	0	20	5	9	32	394
Discrete geometers	6	18	5	5	32	251
36% Battery Remaining	2	4	7	7	32	278
PAF	0	9	6	10	38	396
scho+	2	17	7	12	35	196
Dinosaurs	4	16	7	12	32	270
#OnlyGoodDrawings	2	8	8	6	32	271
Complicated Graphs	2	24	147	26	35	371
IV	0	22	49	10	34	283
Now Austrians	2	14	5	8	32	308
Aaaaaah	0	8	6	6	215	267

LIVE CHALLENGE

automatic category

LIVE CHALLENGE
automatic category

graph

JáMa

InfitIntersect? Uni Kassel

UoA

Tübingen-Bus

LIVE CHALLENGE
automatic category

graph	1
JáMa	2
InfitIntersect? Uni Kassel	2
UoA	14
Tübingen-Bus	0

LIVE CHALLENGE
automatic category

graph	1	2
JáMa	2	19
InfitIntersect? Uni Kassel	2	17
UoA	14	108
Tübingen-Bus	0	4

LIVE CHALLENGE

automatic category

graph	1	2	3
JáMa	2	19	10
InfitIntersect? Uni Kassel	2	17	6
UoA	14	108	176
Tübingen-Bus	0	4	5

LIVE CHALLENGE
automatic category

graph	1	2	3	4
JáMa	2	19	10	13
InfitIntersect? Uni Kassel	2	17	6	7
UoA	14	108	176	39
Tübingen-Bus	0	4	5	4

LIVE CHALLENGE
automatic category

graph	1	2	3	4	5
JáMa	2	19	10	13	48
InfitIntersect? Uni Kassel	2	17	6	7	40
UoA	14	108	176	39	32
Tübingen-Bus	0	4	5	4	32

LIVE CHALLENGE
automatic category

graph	1	2	3	4	5	6
JáMa	2	19	10	13	48	297
InfitIntersect? Uni Kassel	2	17	6	7	40	354
UoA	14	108	176	39	32	437
Tübingen-Bus	0	4	5	4	32	81

LIVE CHALLENGE

automatic category

graph	1	2	3	4	5	6	7
JáMa	2	19	10	13	48	297	
InfitIntersect? Uni Kassel	2	17	6	7	40	354	267
UoA	14	108	176	39	32	437	
Tübingen-Bus	0	4	5	4	32	81	0

LIVE CHALLENGE
automatic category

graph	1	2	3	4	5	6	7	8
JáMa	2	19	10	13	48	297		
InfitIntersect? Uni Kassel	2	17	6	7	40	354	267	2730
UoA	14	108	176	39	32	437		
Tübingen-Bus	0	4	5	4	32	81	0	307

LIVE CHALLENGE

automatic category

graph	1	2	3	4	5	6	7	8	9
JáMa	2	19	10	13	48	297			
InfitIntersect? Uni Kassel	2	17	6	7	40	354	267	2730	495
UoA	14	108	176	39	32	437			
Tübingen-Bus	0	4	5	4	32	81	0	307	38

LIVE CHALLENGE
automatic category

graph	1	2	3	4	5	6	7	8	9	10
JáMa	2	19	10	13	48	297				
InfitIntersect? Uni Kassel	2	17	6	7	40	354	267	2730	495	6405
UoA	14	108	176	39	32	437				
Tübingen-Bus	0	4	5	4	32	81	0	307	38	1568

LIVE CHALLENGE
automatic category

graph	1	2	3	4	5	6	7	8	9	10	11
JáMa	2	19	10	13	48	297					
InfitIntersect? Uni Kassel	2	17	6	7	40	354	267	2730	495	6405	14697
UoA	14	108	176	39	32	437					
Tübingen-Bus	0	4	5	4	32	81	0	307	38	1568	1721

LIVE CHALLENGE
automatic category

graph	1	2	3	4	5	6	7	8	9	10	11	12
JáMa	2	19	10	13	48	297						
InfitIntersect? Uni Kassel	2	17	6	7	40	354	267	2730	495	6405	14697	706388
UoA	14	108	176	39	32	437						
Tübingen-Bus	0	4	5	4	32	81	0	307	38	1568	1721	147628

GRAPH DRAWING CONTEST

2019 announcement

Announcement of Tasks

GRAPH DRAWING CONTEST

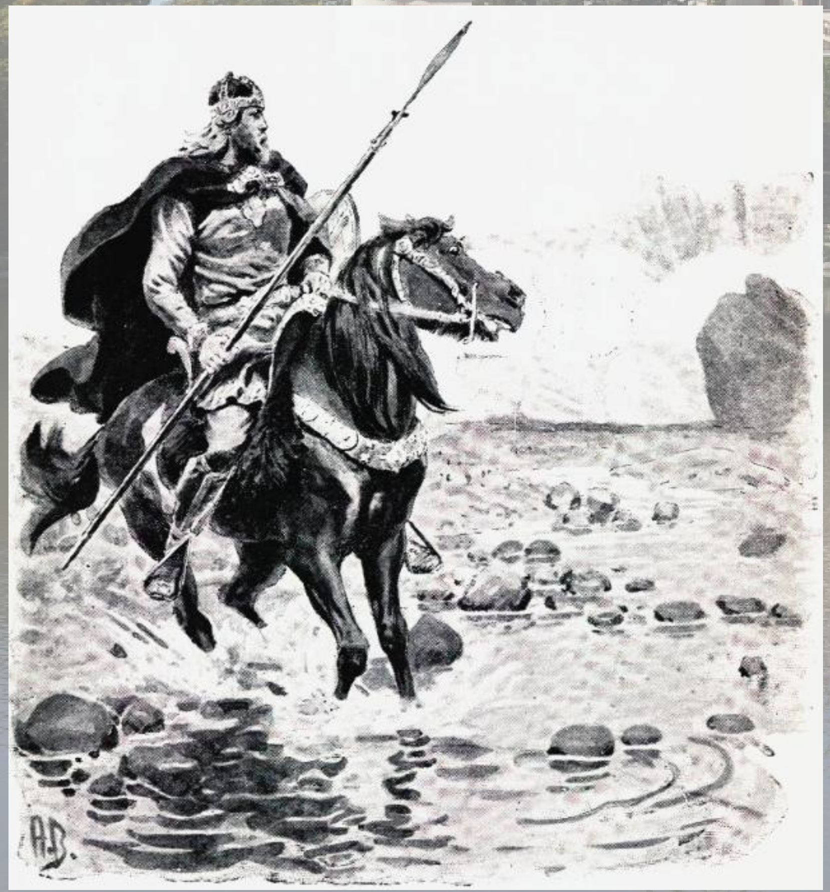
2020 creative topic #1

GRAPH DRAWING CONTEST

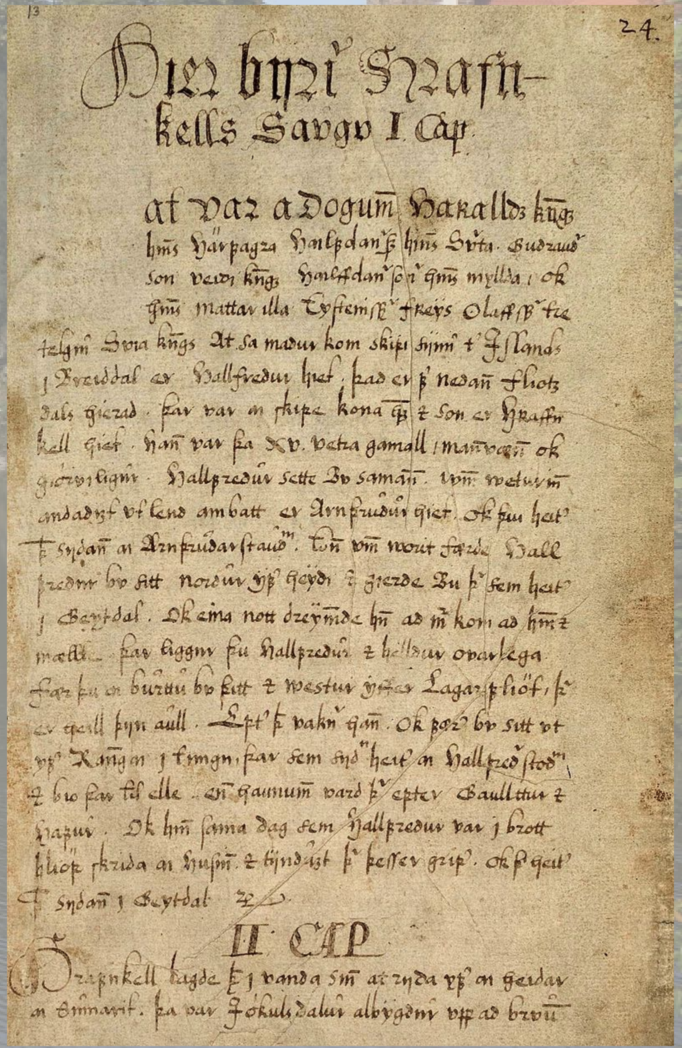
2020 creative topic #1

Icelandic Hrafnkels Saga Graph

The saga tells of struggles between chieftains and farmers in the east of Iceland in the 10th century.



The graph describes communications between people.



GRAPH DRAWING CONTEST

2020 creative topic #2

GRAPH DRAWING CONTEST

2020 creative topic #2

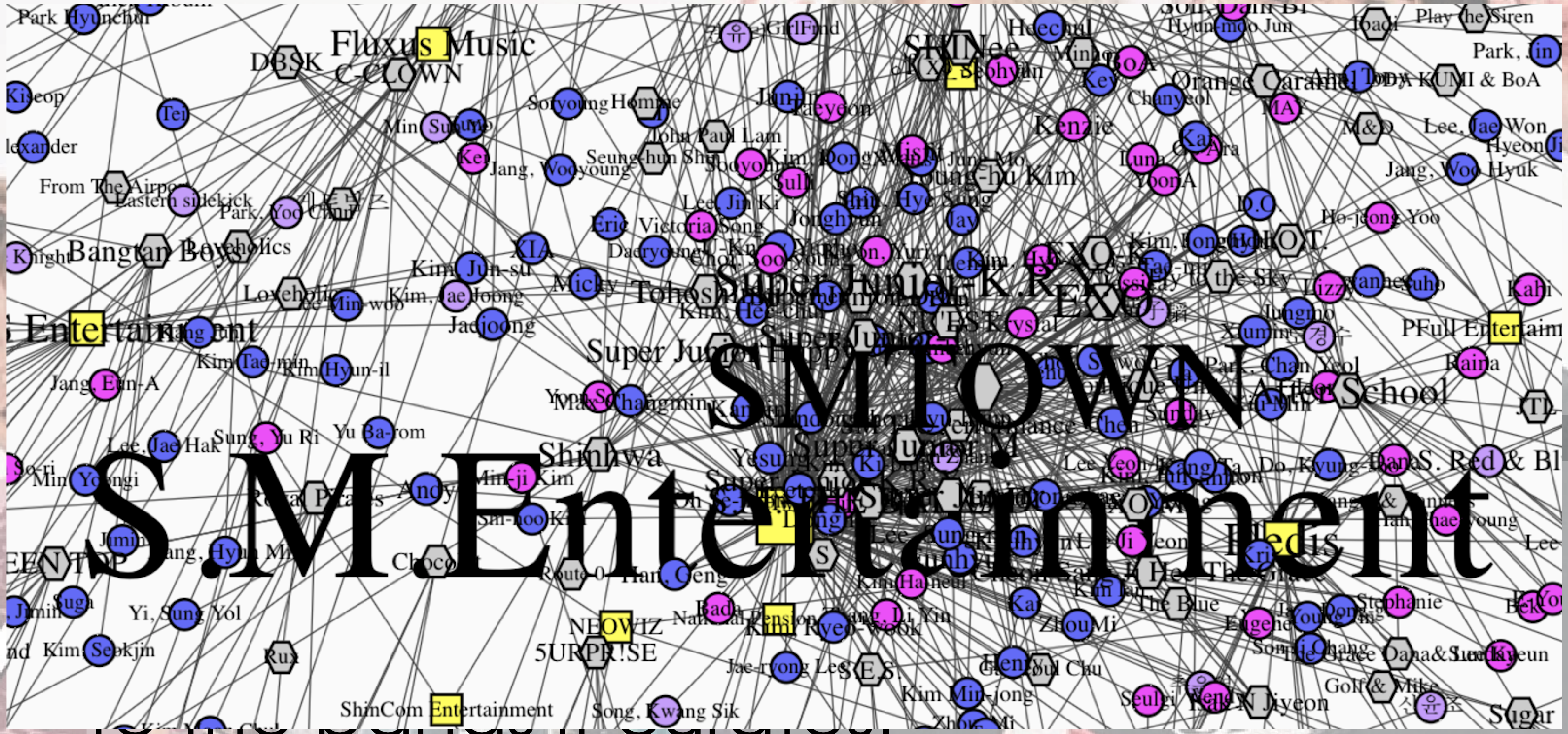
The K-Pop (Korean Popular Music) Graph

vertices are various actants - performers, bands, producers, promoters, production companies

edges express the relationships among actants; band is connected to performer that it contains; a producer is connected to the bands it curates.

GRAPH DRAWING CONTEST
2020 creative topic #2

The K-Pop (Korean Popular Music) Graph



GRAPH DRAWING CONTEST

2020 live challenge

GRAPH DRAWING CONTEST
2020 live challenge

Upward drawings on a fixed grid

input: arbitrary directed graph and numbers w and h

- output: straight-line upward embedding with integer vertex coordinates

must be a proper drawing

objective: minimize the number of crossings