

GRAPH DRAWING CONTEST

2018 report



CONTEST COMMITTEE

William Devanny
University of California, Irvine

Philipp Kindermann
University of Waterloo

Maarten Löffler
Utrecht University

Ignaz Rutter
University of Passau

GRAPH DRAWING CONTEST

historic perspective

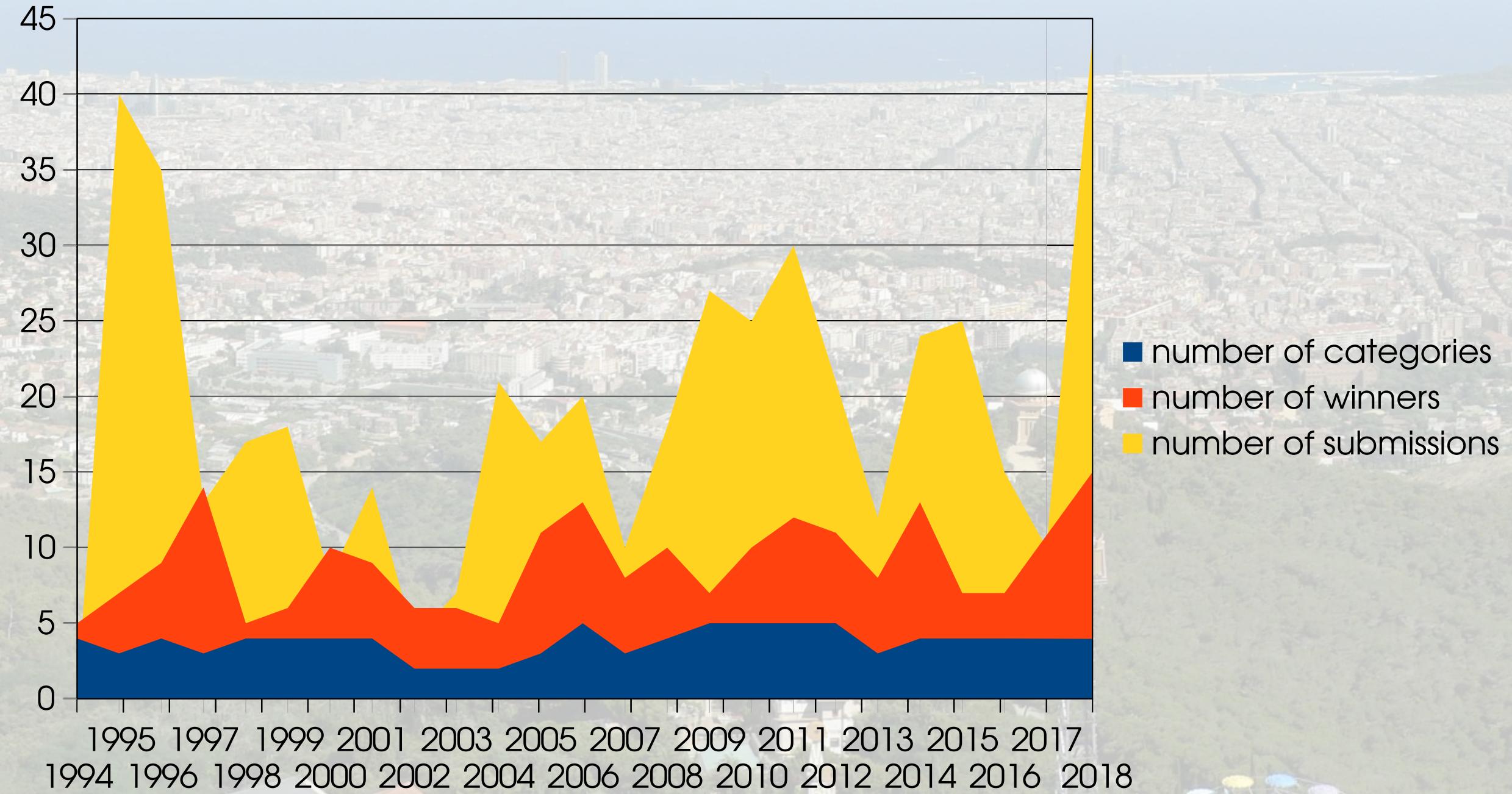
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GRAPH DRAWING CONTEST

historic perspective

gd
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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 Santamaría,
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 ?

2018 CONTEST *overview*

gd
g18



2018 CONTEST overview



CREATIVE TOPICS

Game of Thrones

Draw the graph of relations between characters in the series.

Math Genealogy

Draw the roots of the family tree of the mother of all sciences!

LIVE CHALLENGE

In one hour, draw a number of graphs as straight line embeddings in the plane, maximising the smallest crossing angle.

manual category

automatic category

2018 CONTEST overview



CREATIVE TOPICS

Game of Thrones

Draw the graph of relations between characters in the series.

23 submissions

Math Genealogy

Draw the roots of the family tree of the mother of all sciences!

8 submissions

LIVE CHALLENGE

In one hour, draw a number of graphs as straight line embeddings in the plane, maximising the smallest crossing angle.

manual category

9 submissions

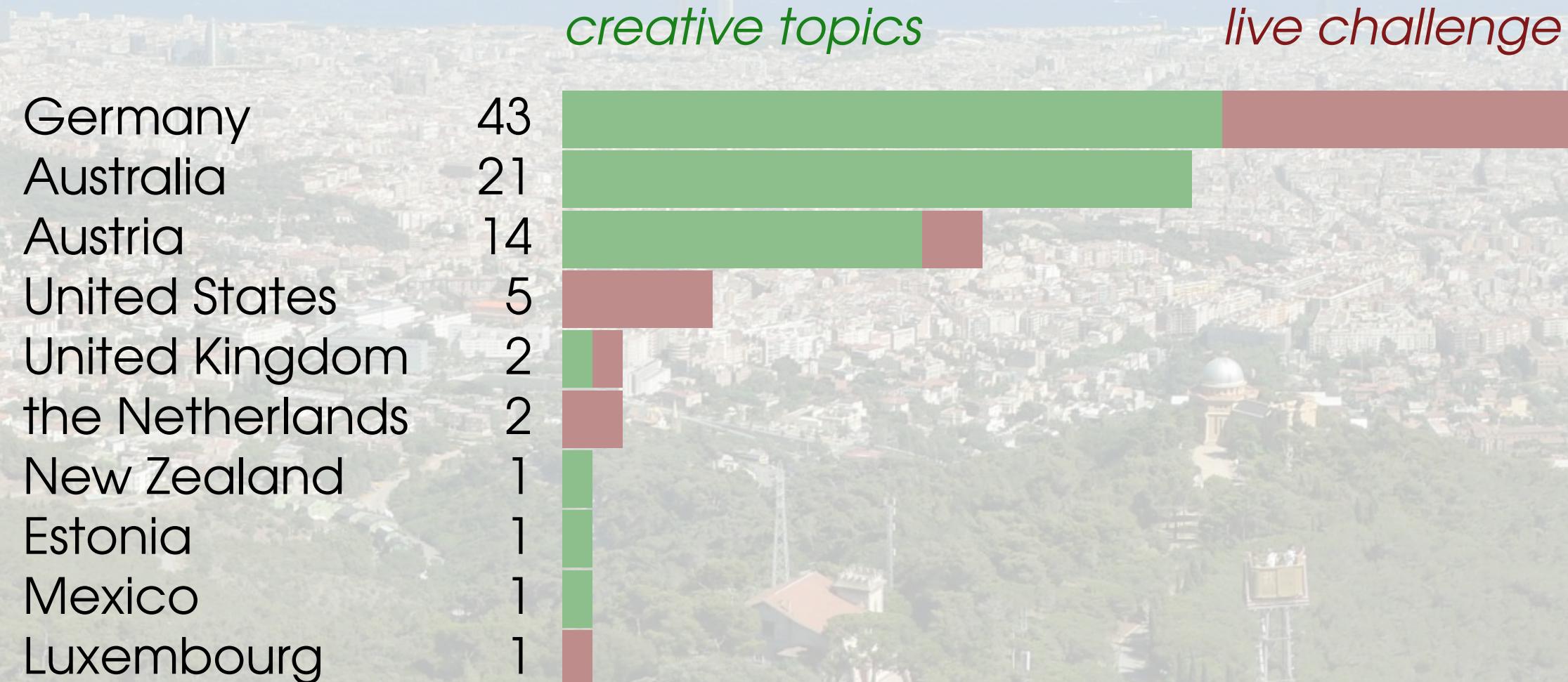
automatic category

4 submissions

2018 CONTEST overview



Participating individuals per country



CREATIVE TOPICS

Game of Thrones

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CREATIVE TOPICS

Game of Thrones



Game of Thrones Character Relation Graph

vertices are characters in the show
edges encode character relations

- family relations
- romantic relations
- allegiance
- death (who killed who)

84 vertices
216 edges

CREATIVE TOPICS

Game of Thrones

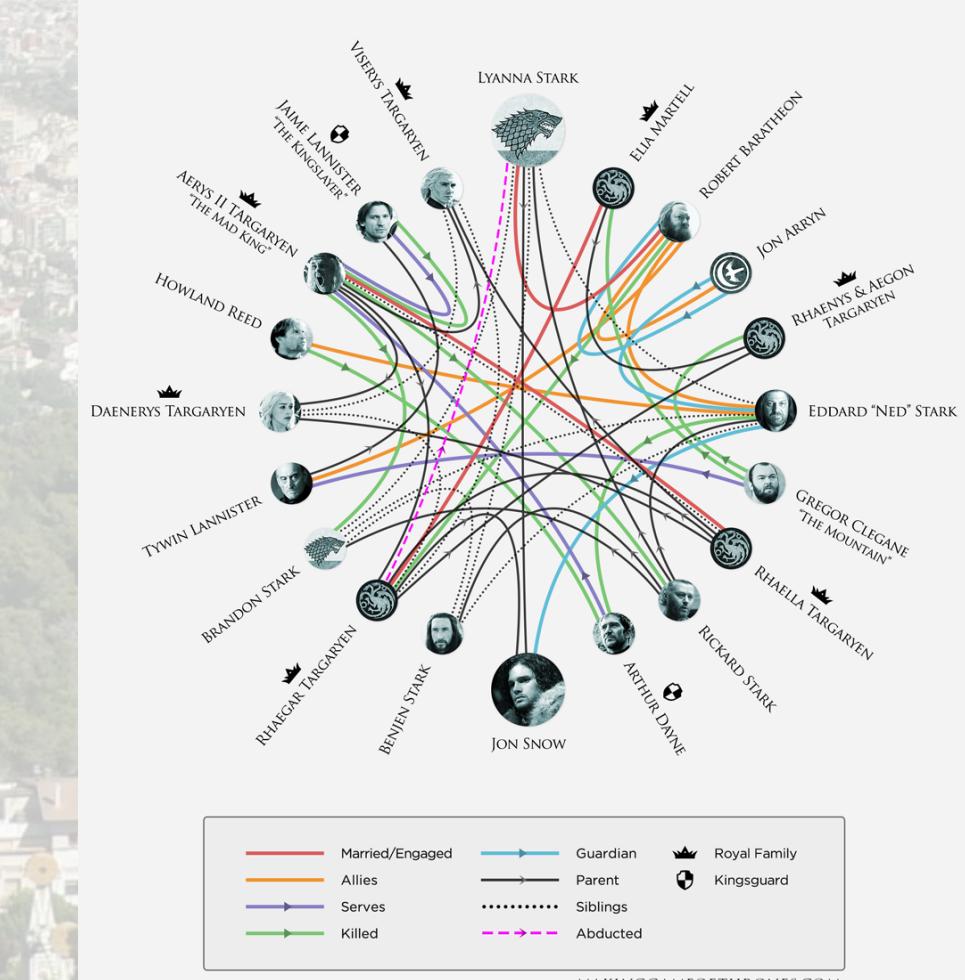
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Game of Thrones Character Relation Graph

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CREATIVE TOPICS

Game of Thrones

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18

Game of Thrones Character Relation Graph

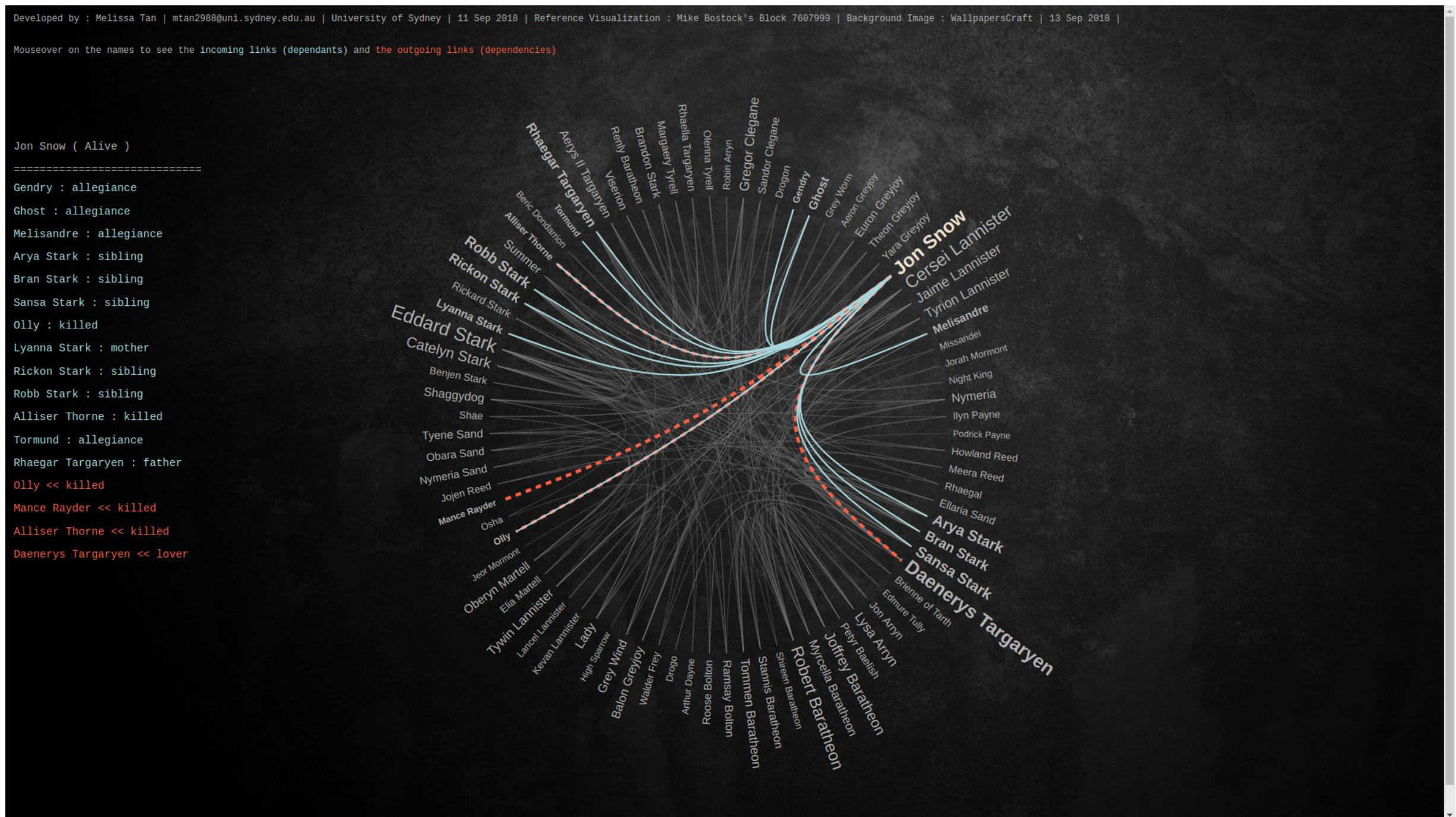
in the show



CREATIVE TOPICS

Game of Thrones

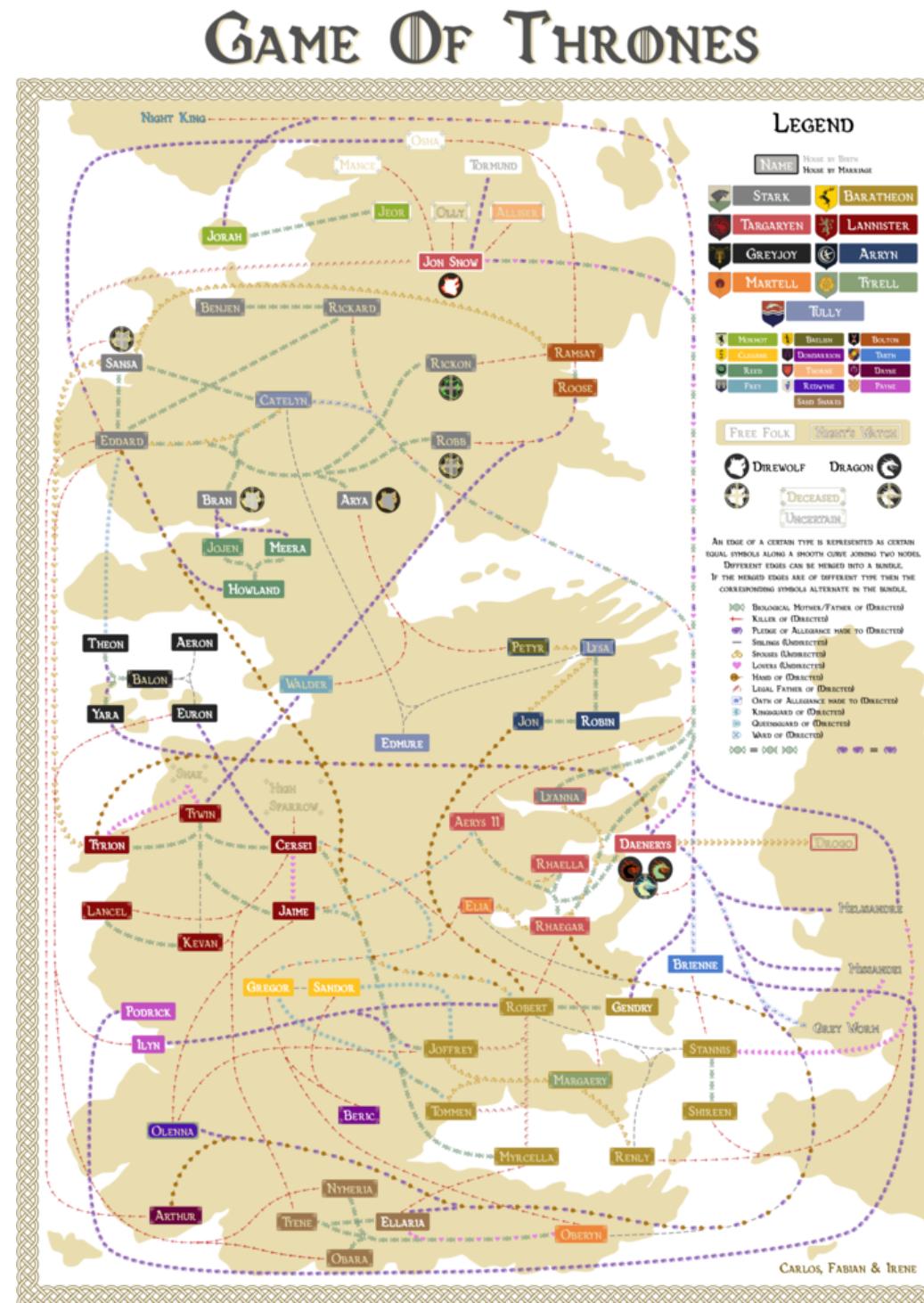
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g 18



CREATIVE TOPICS

Game of Thrones

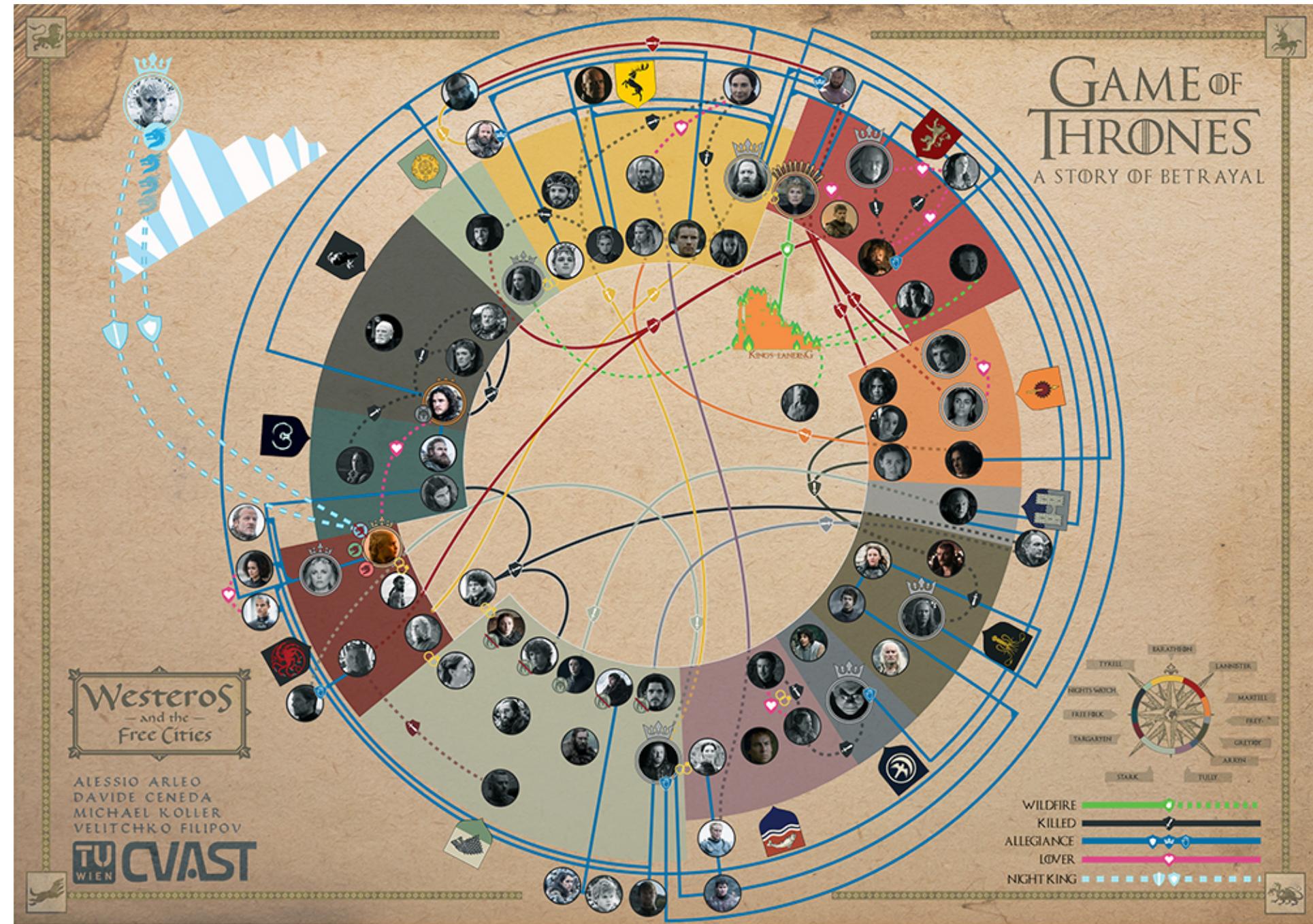
The logo consists of the lowercase letters 'gd' in a large, bold, black sans-serif font. To the right of a vertical white line, the number '18' is displayed in a large, bold, red sans-serif font.



CREATIVE TOPICS

Game of Thrones

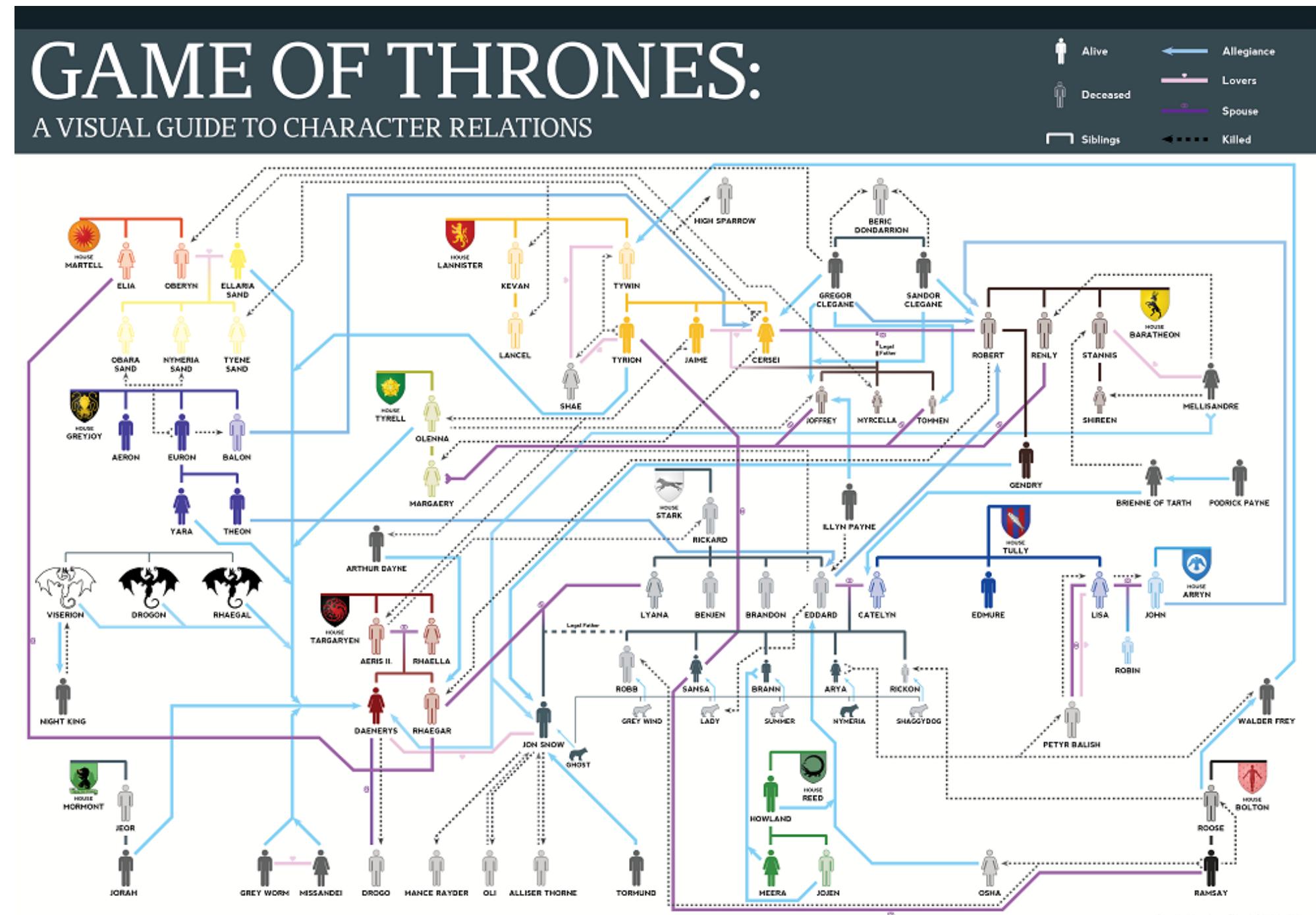
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CREATIVE TOPICS

Game of Thrones

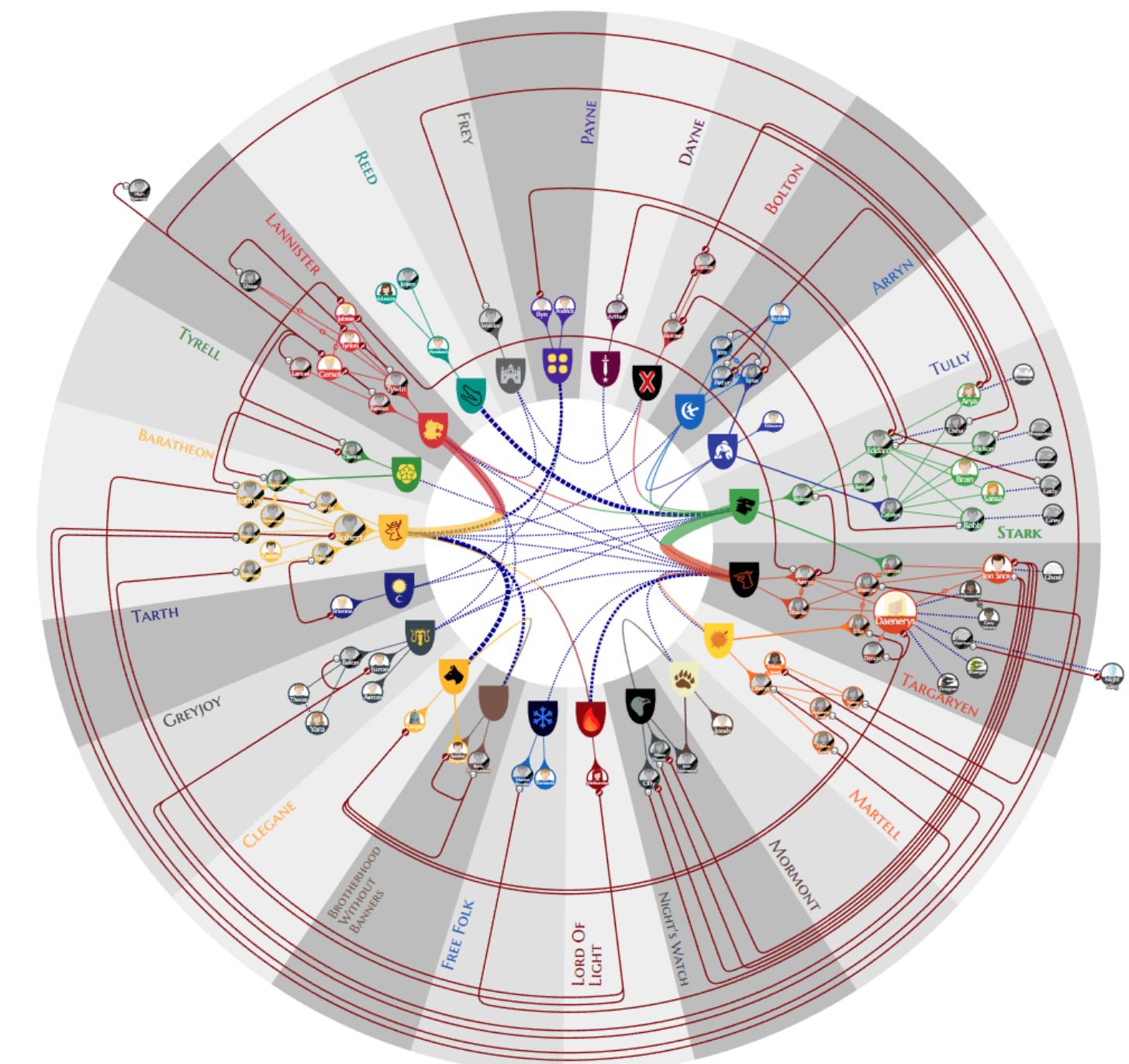
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CREATIVE TOPICS

Game of Thrones

gd
18



CREATIVE TOPICS

Mathematics Genealogy

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g18



CREATIVE TOPICS

Mathematics Genealogy



Math Genealogy Academic Family “Tree”

vertices are mathematicians

edges are adviser relations

2277 vertices

2554 edges

only mathematicians who graduated
before 1900, but number of descendants
is retained

CREATIVE TOPICS

Mathematics Genealogy



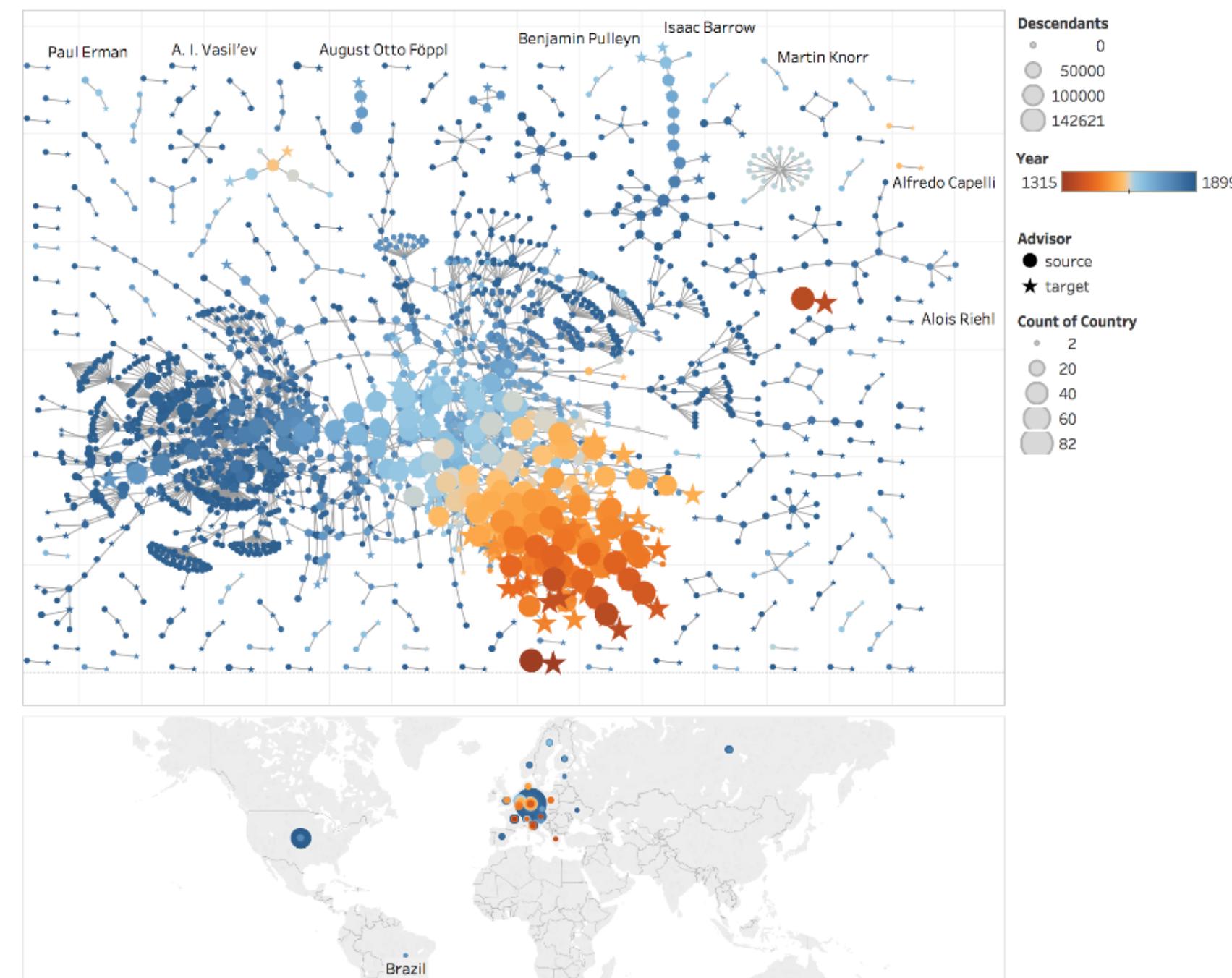
Math Genealogy Academic Family “Tree”



CREATIVE TOPICS

Mathematics Genealogy

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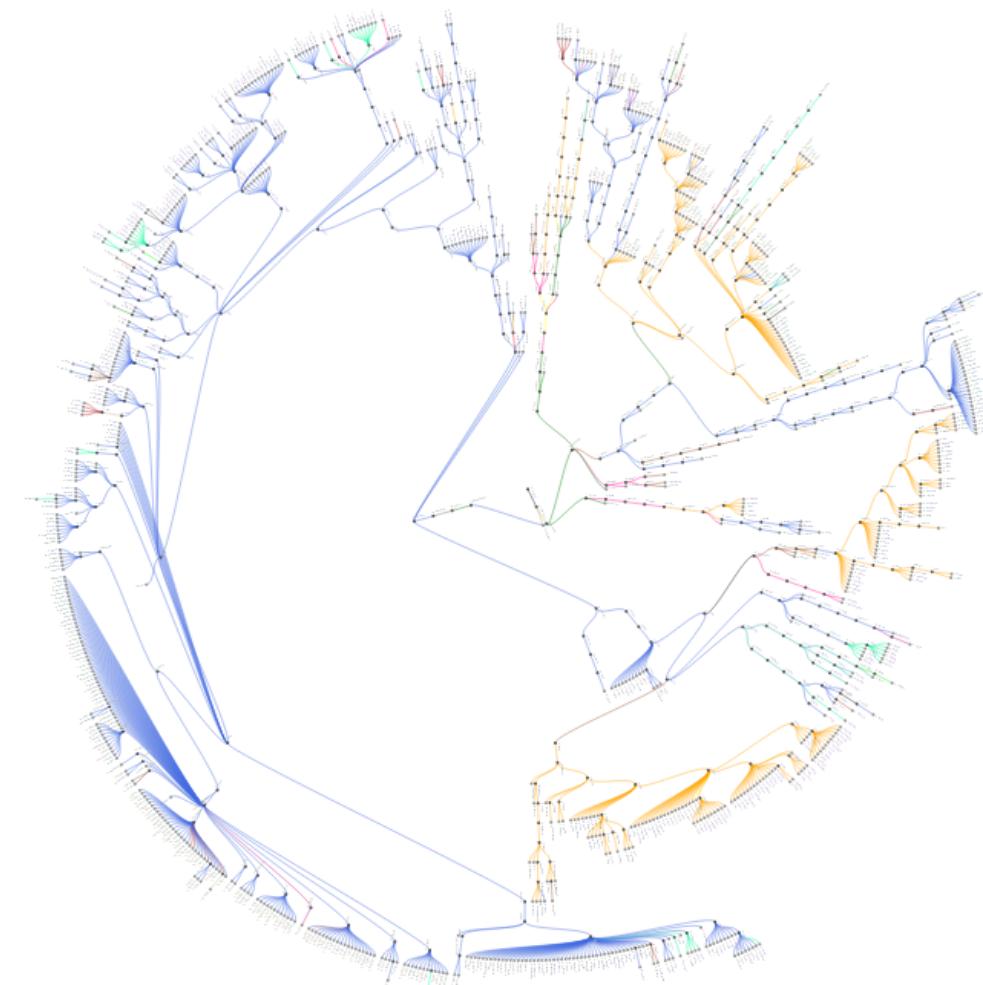
CREATIVE TOPICS

Mathematics Genealogy

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Mathematical Genealogy

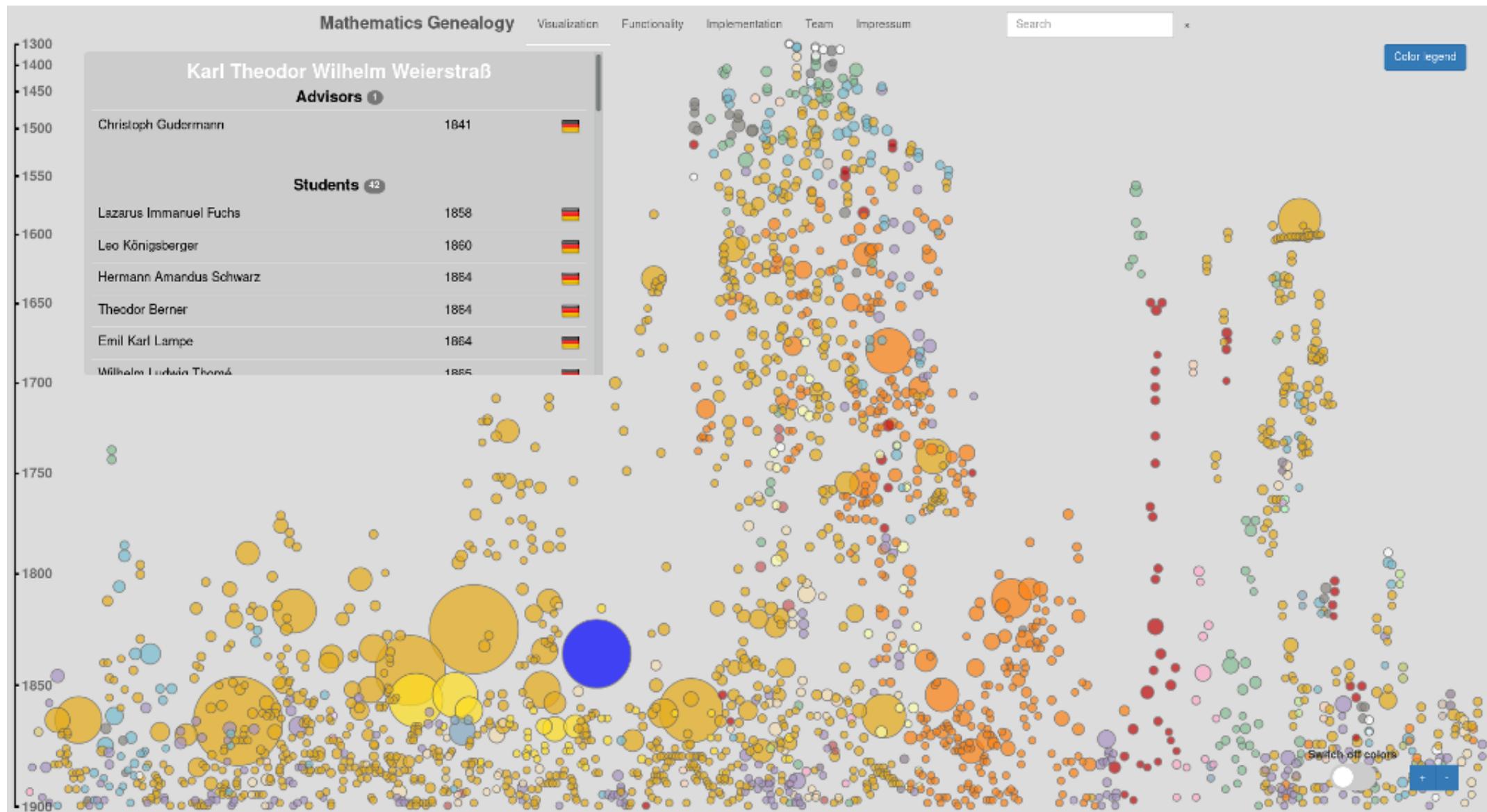
A visualisation of advisor-advisee relations in science preceding the year 1900



CREATIVE TOPICS

Mathematics Genealogy

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LIVE CHALLENGE

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LIVE CHALLENGE



Crossing Angle Maximization

input: arbitrary graph

output: straight-line embedding with
integer vertex coordinates

must be a proper
drawing

objective:
maximize the
smallest angle
between any
crossing edges

LIVE CHALLENGE

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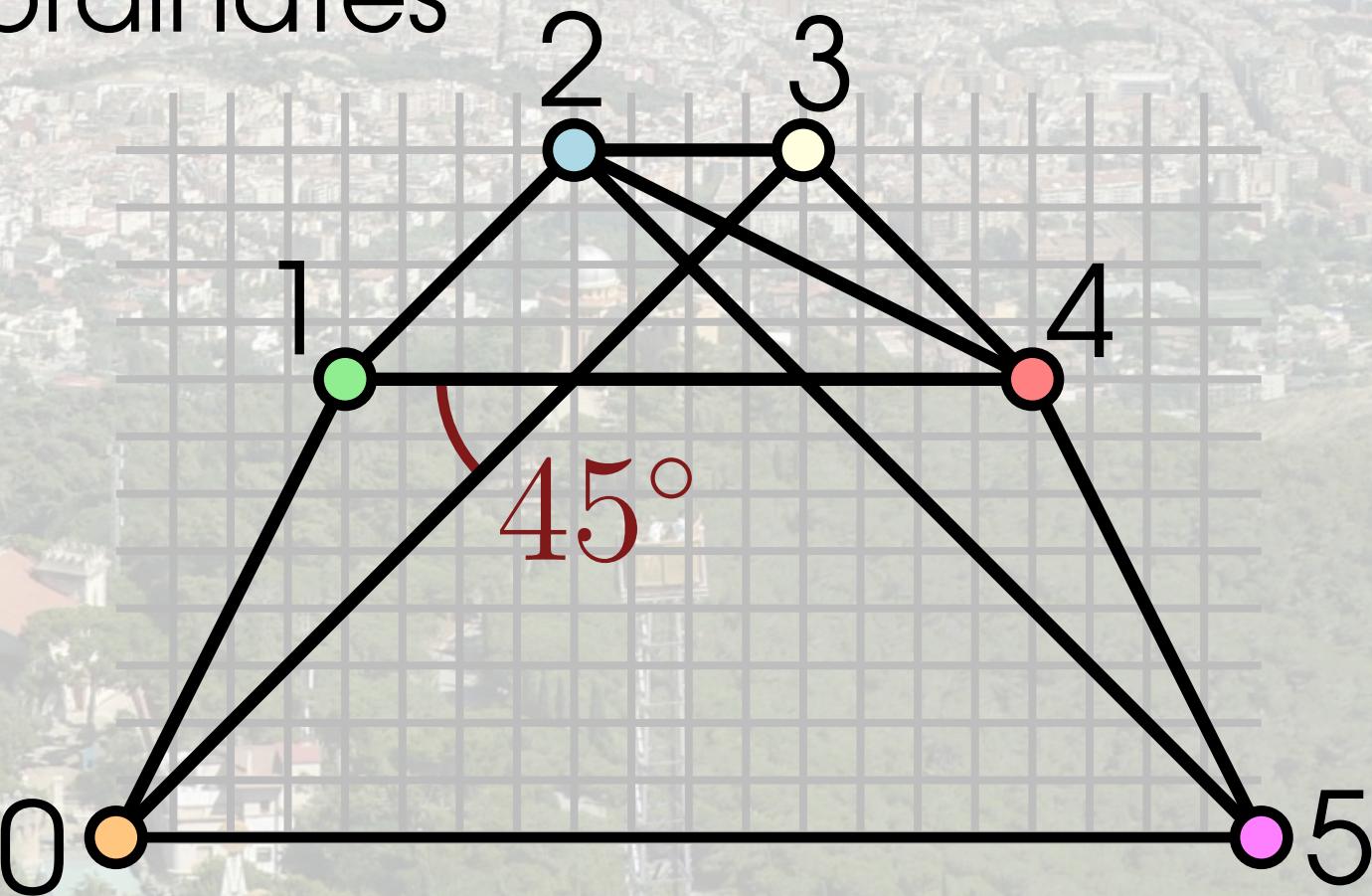
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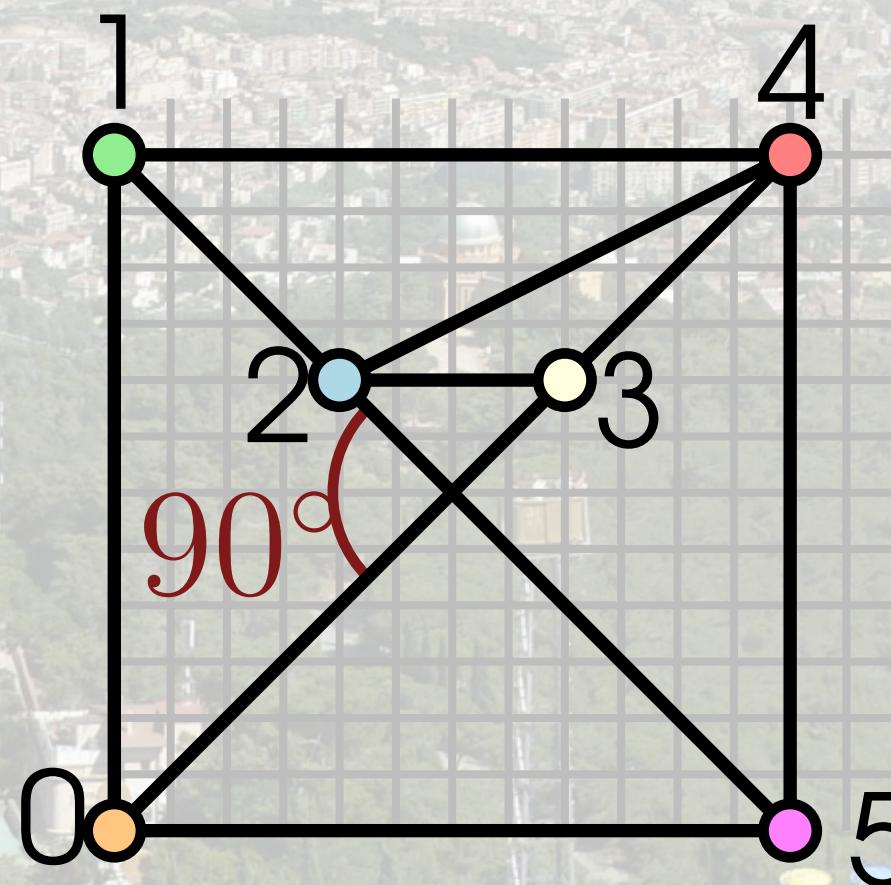
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LIVE CHALLENGE

the graphs

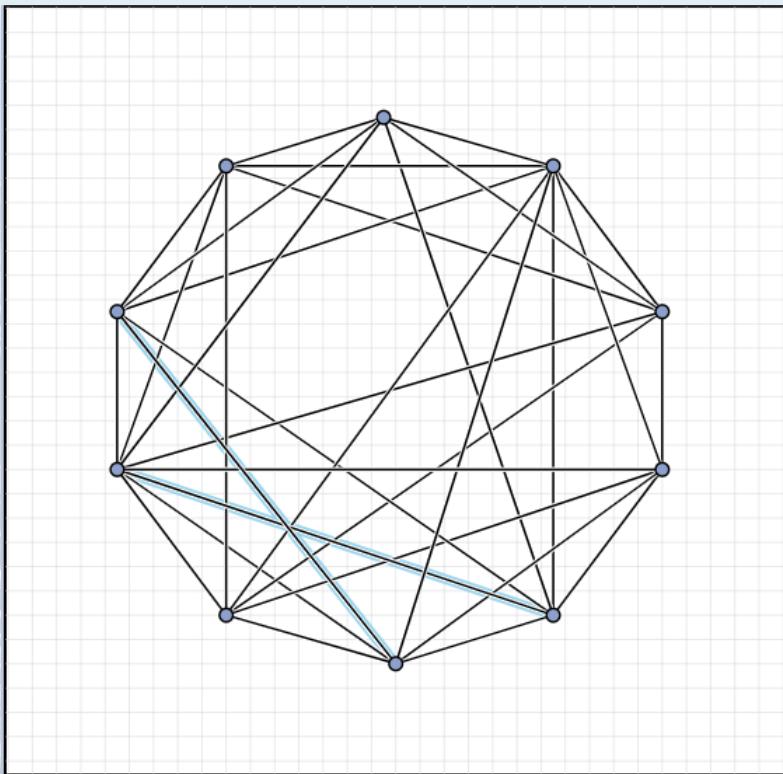
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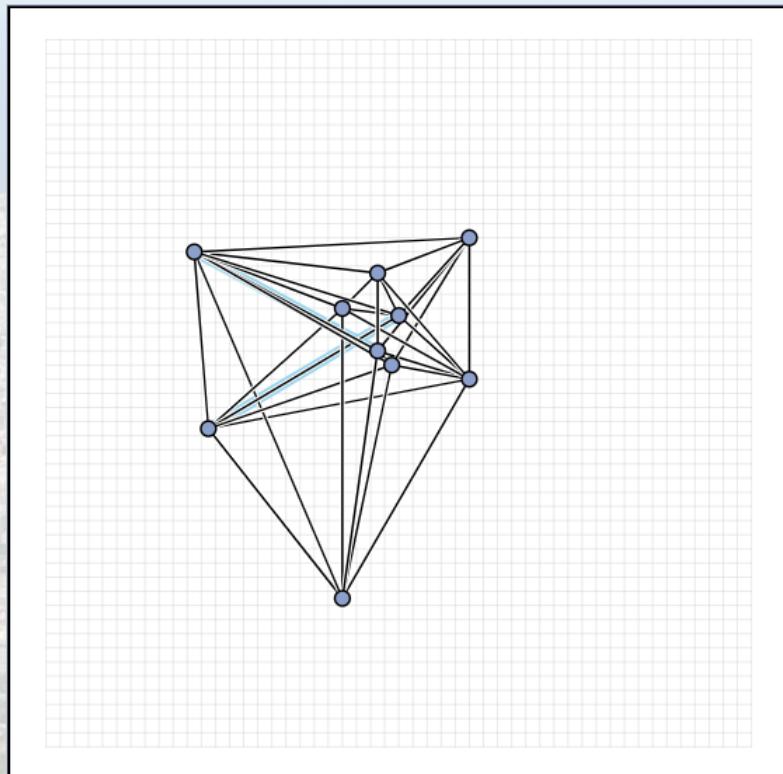
LIVE CHALLENGE

the graphs

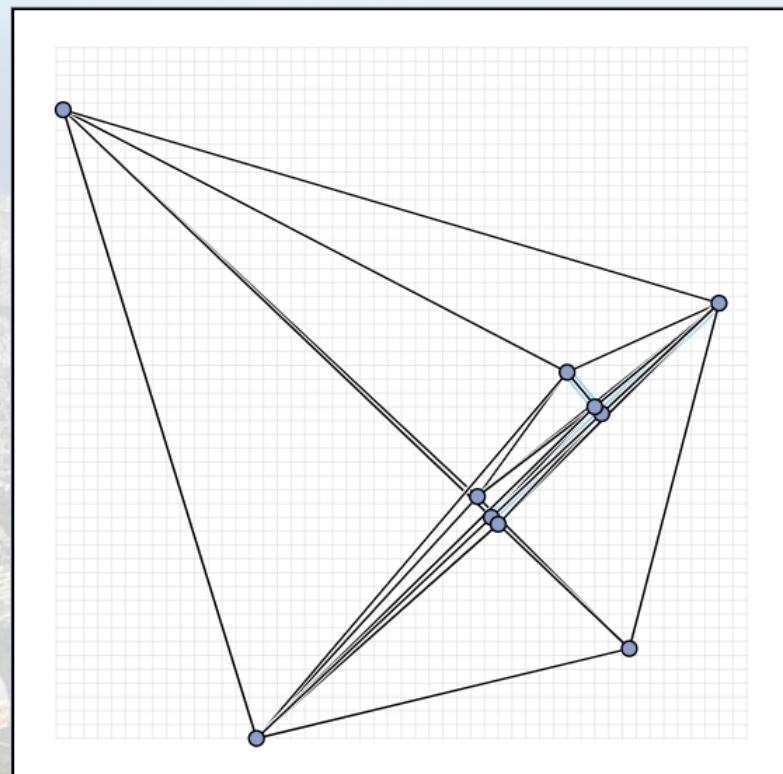
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input



best manual



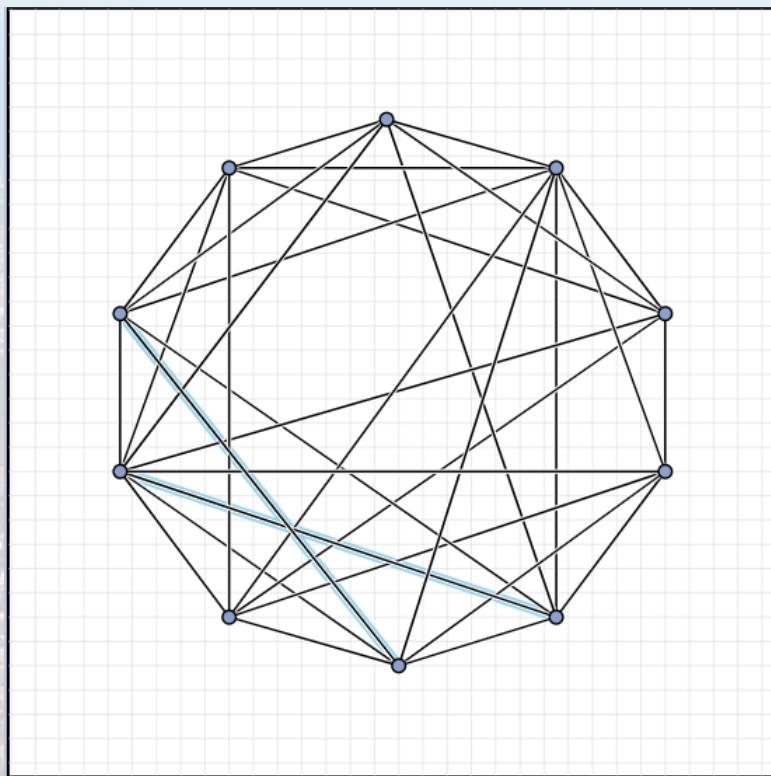
best automatic

graph 1

LIVE CHALLENGE

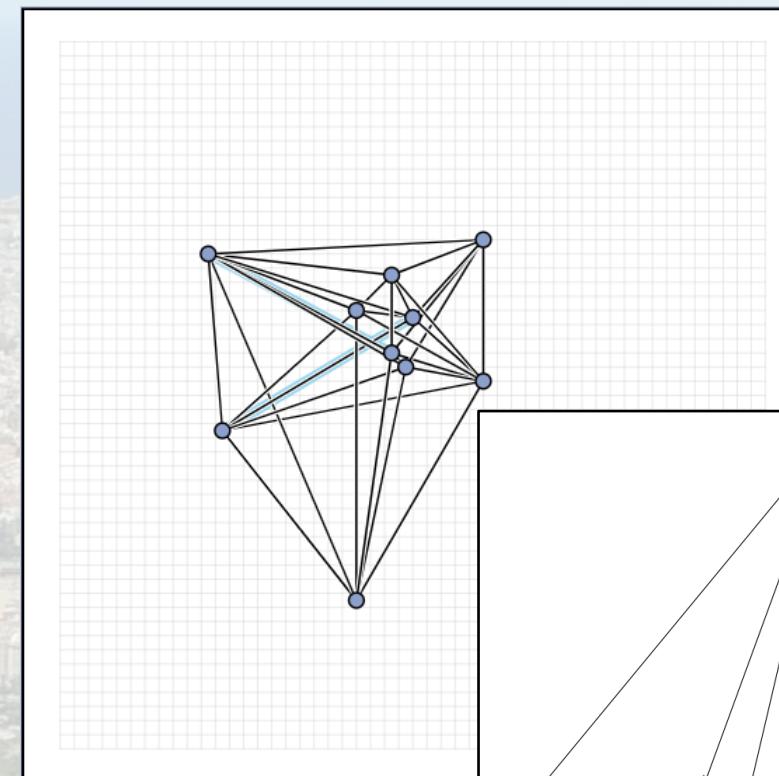
the graphs

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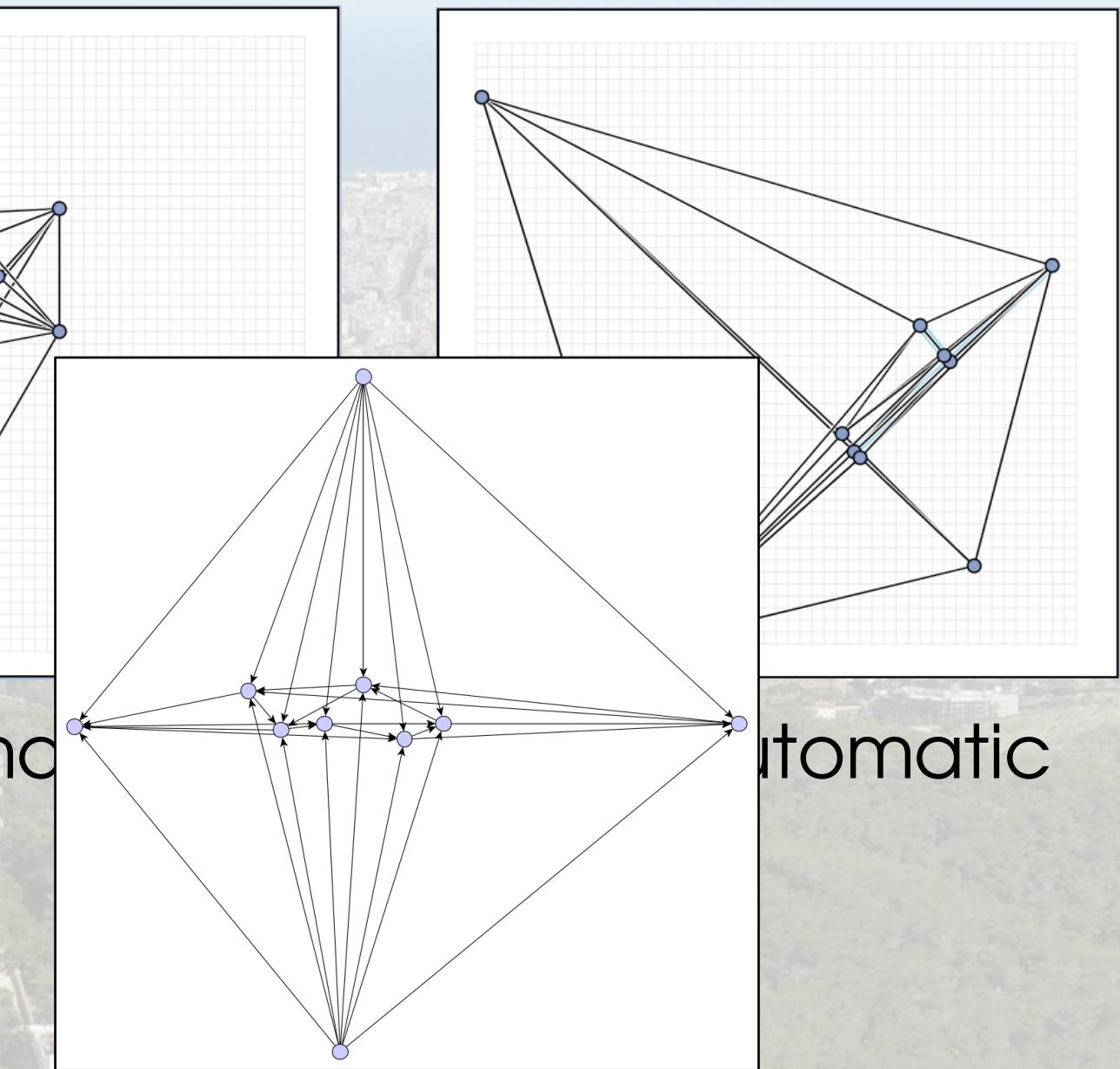


input

graph 1



best mo

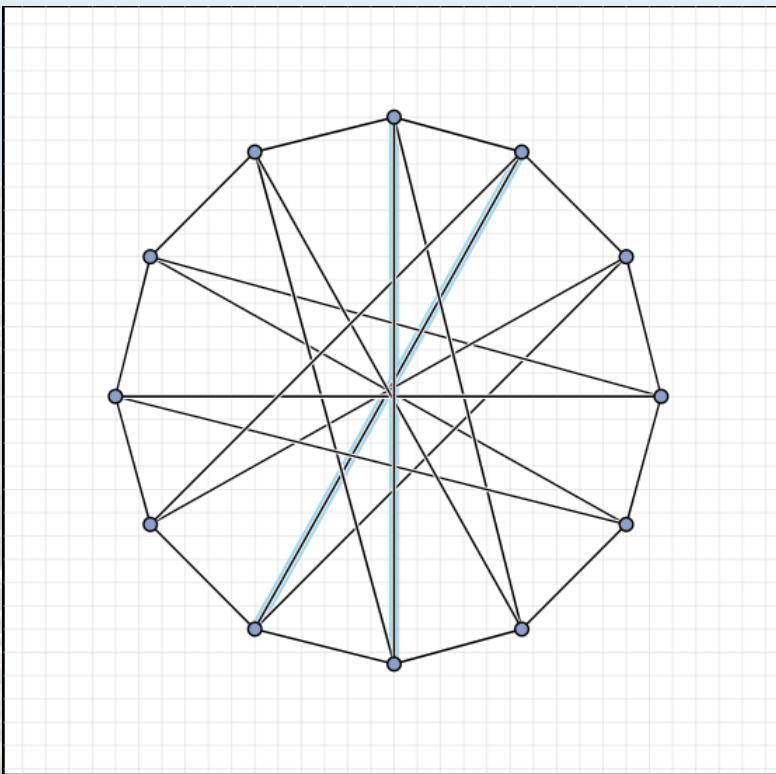


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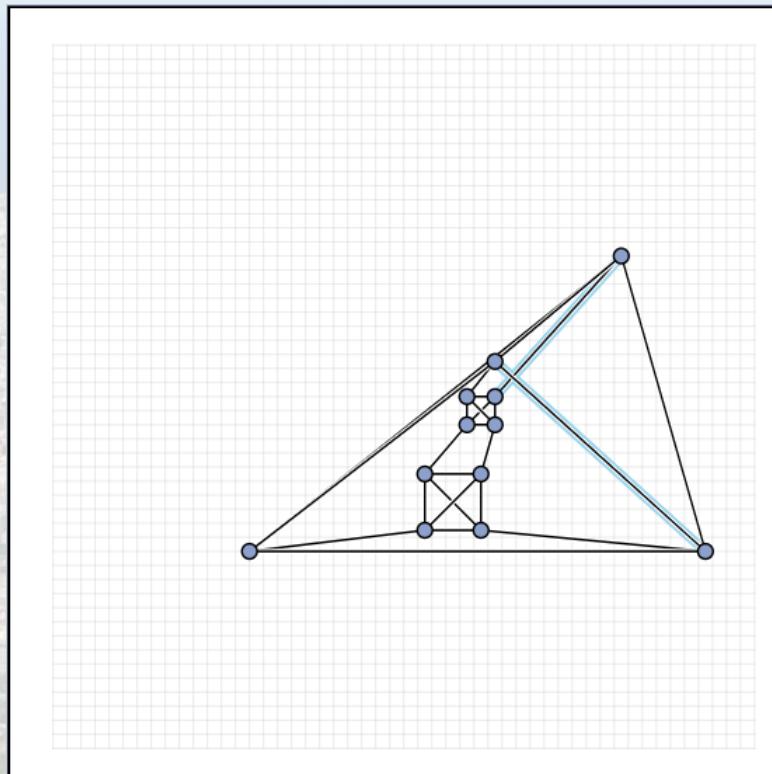
LIVE CHALLENGE

the graphs

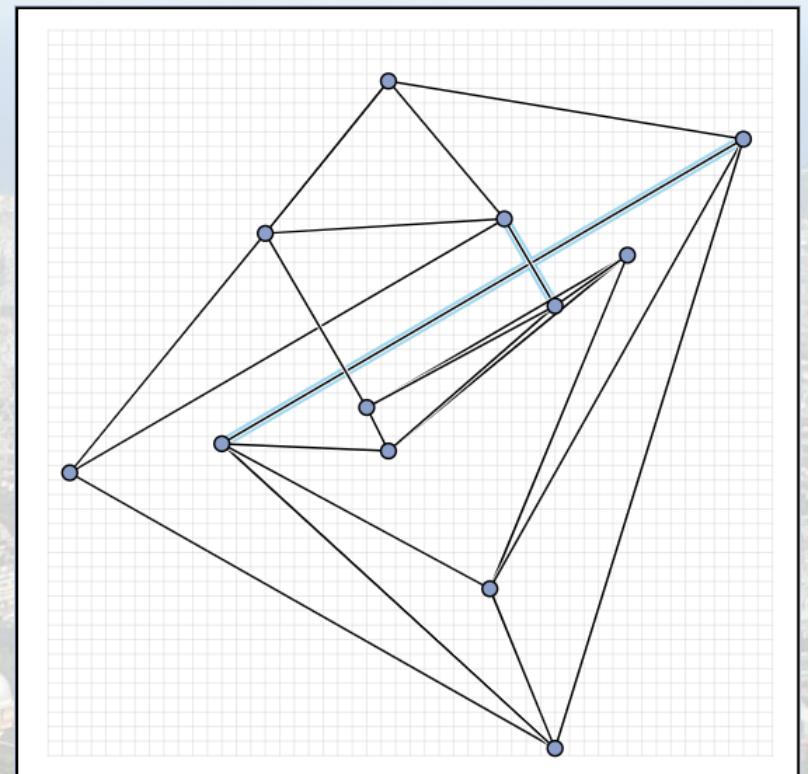
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input



best manual



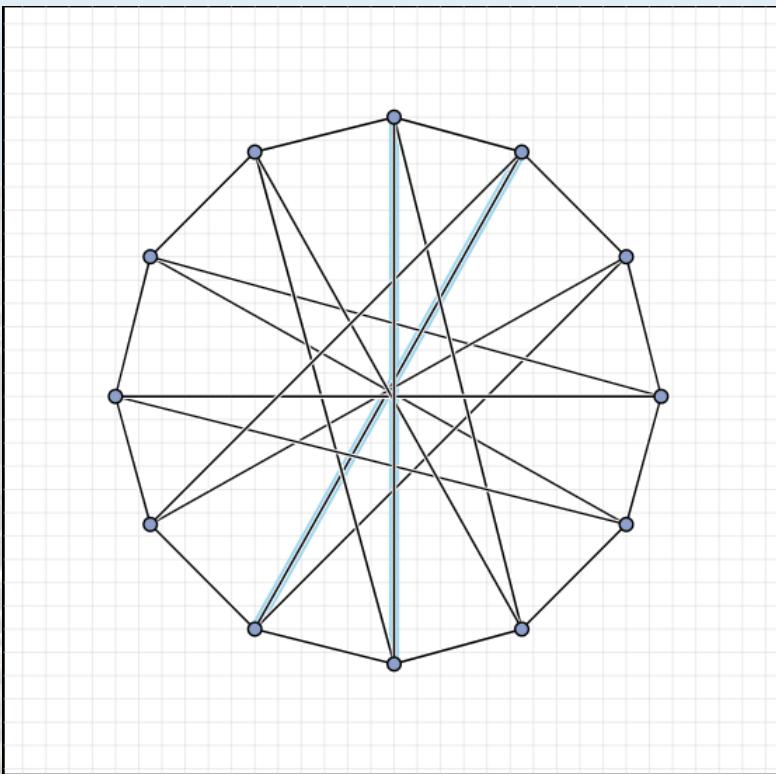
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graph 2

LIVE CHALLENGE

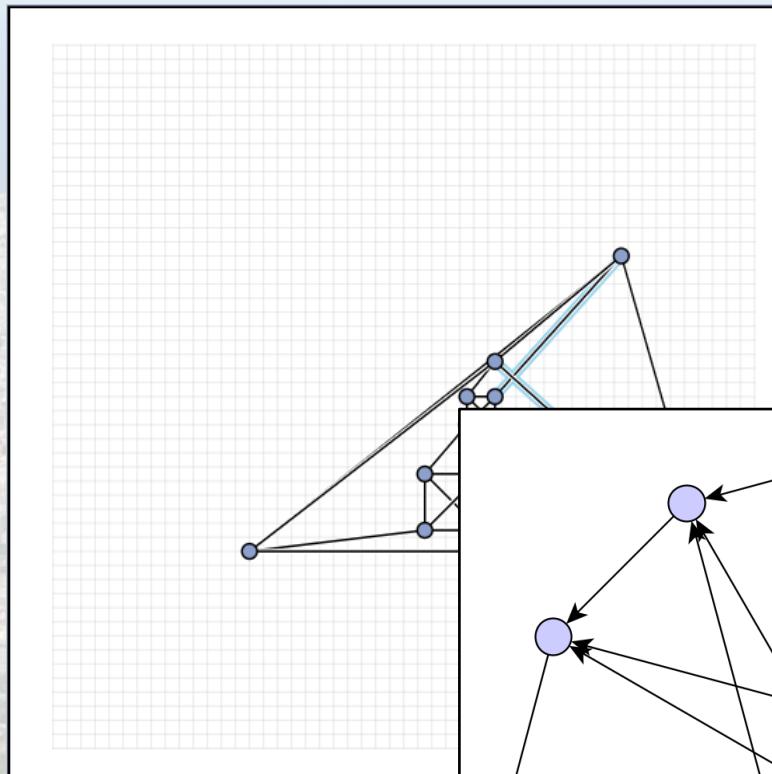
the graphs

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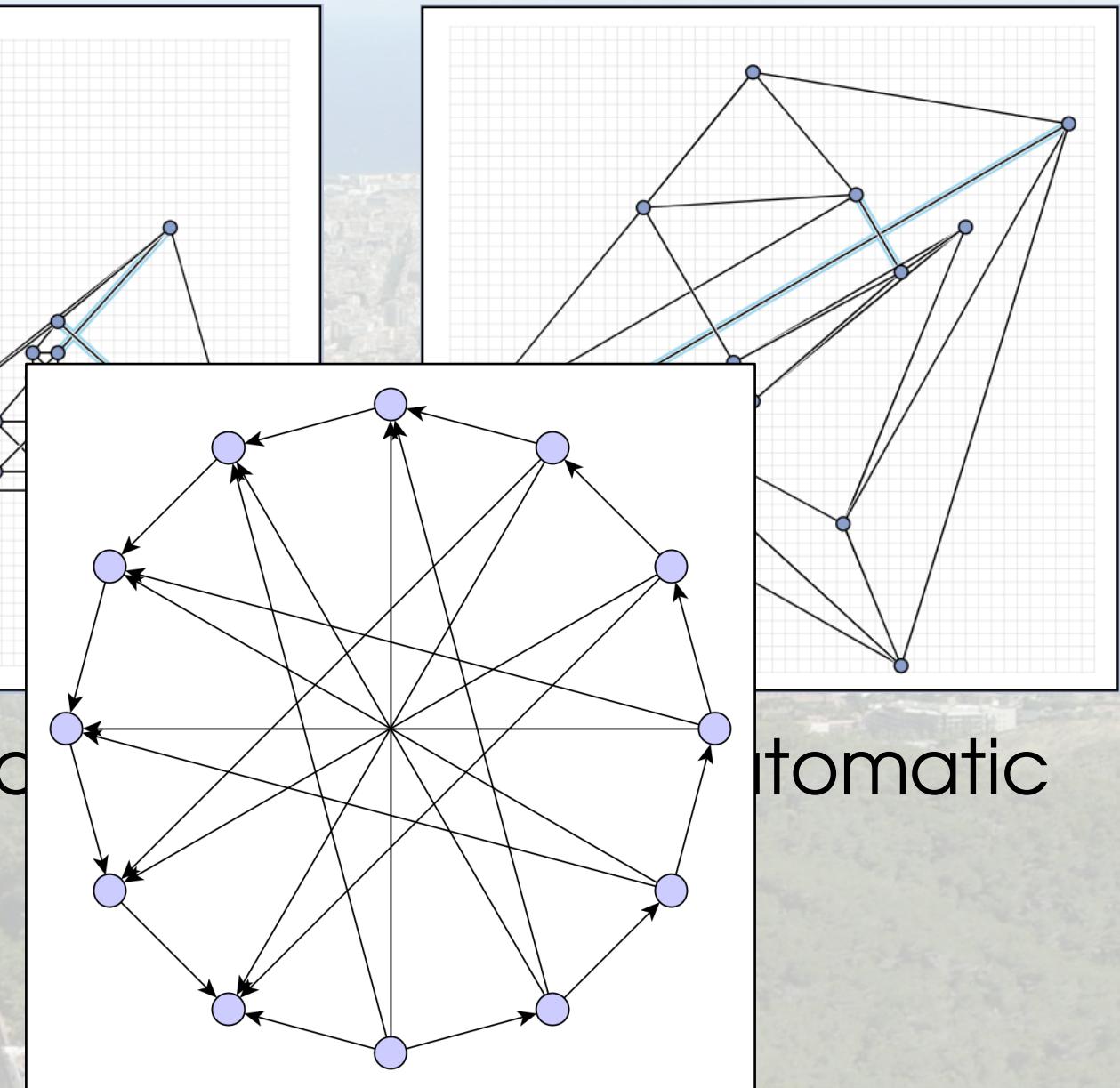


input

graph 2



best mo

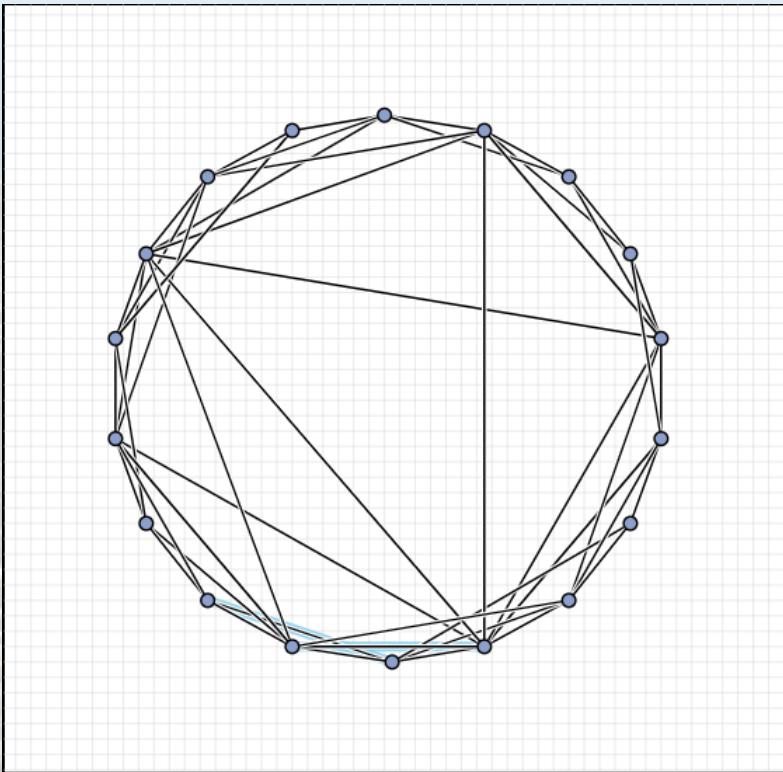


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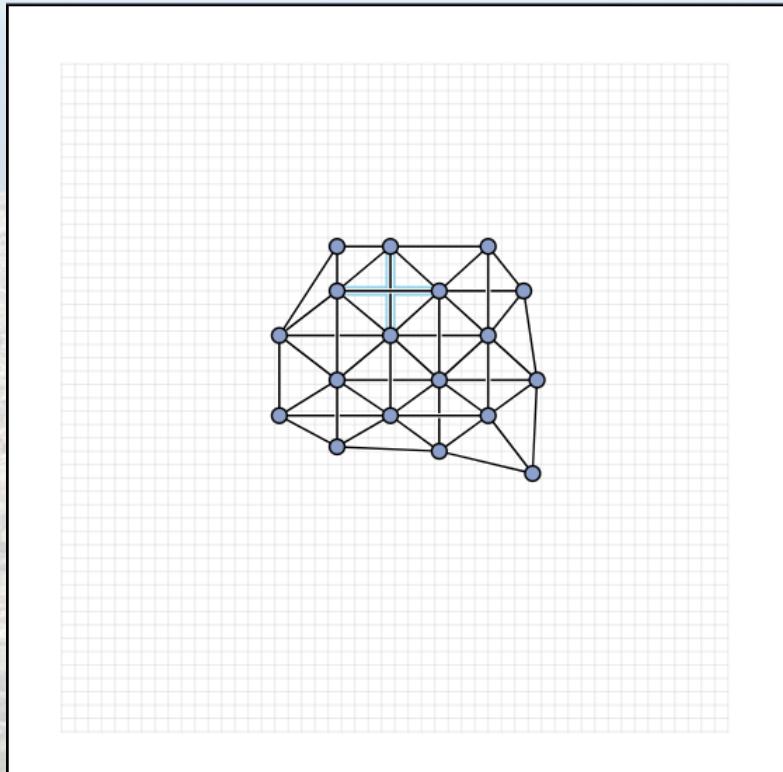
LIVE CHALLENGE

the graphs

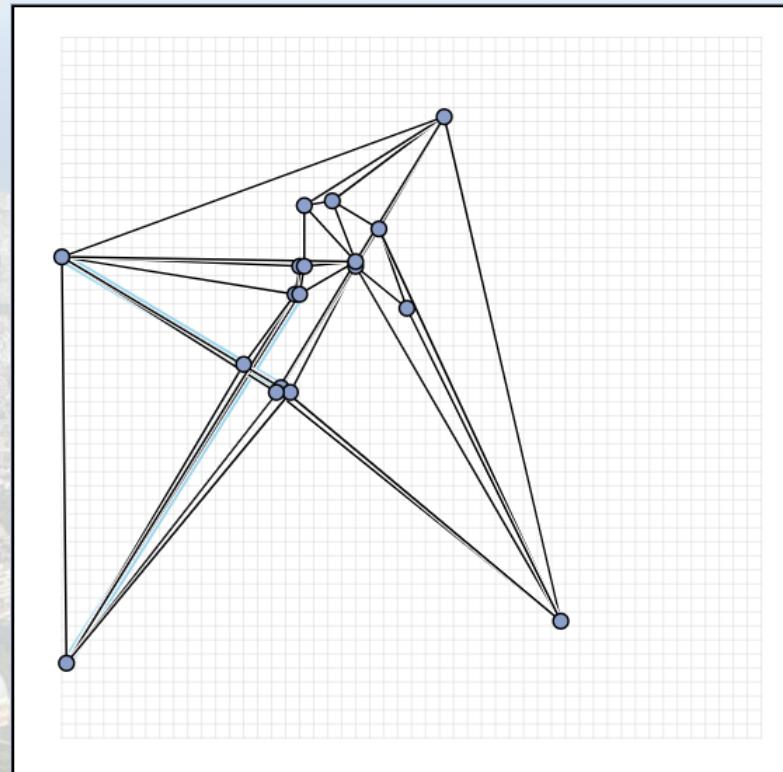
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input



best manual



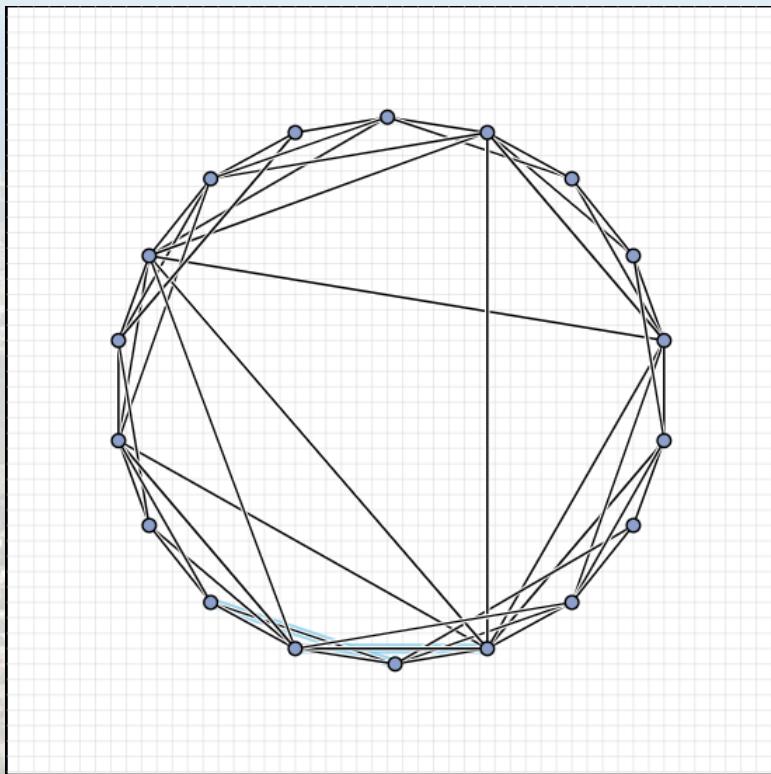
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graph 3

LIVE CHALLENGE

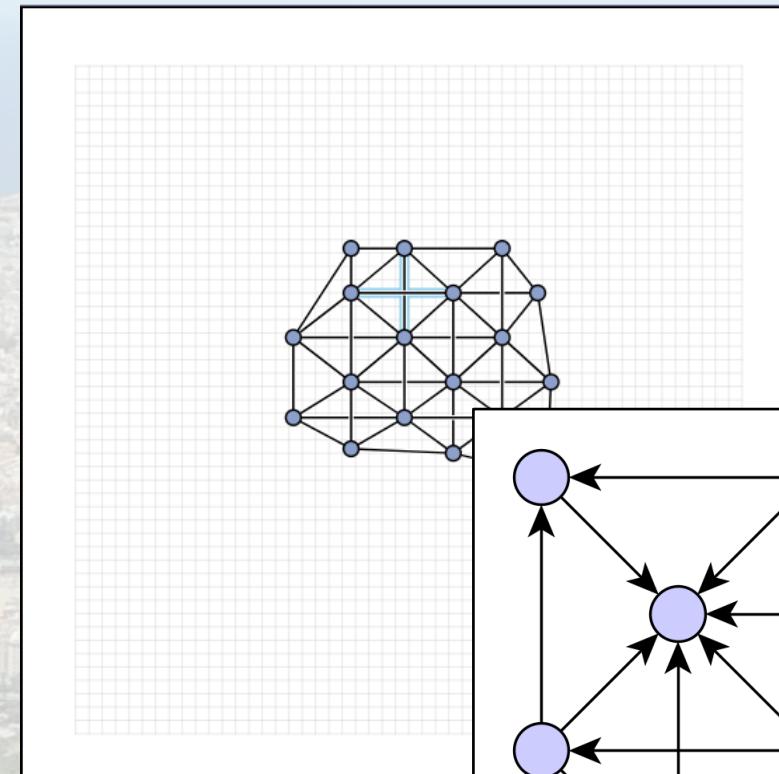
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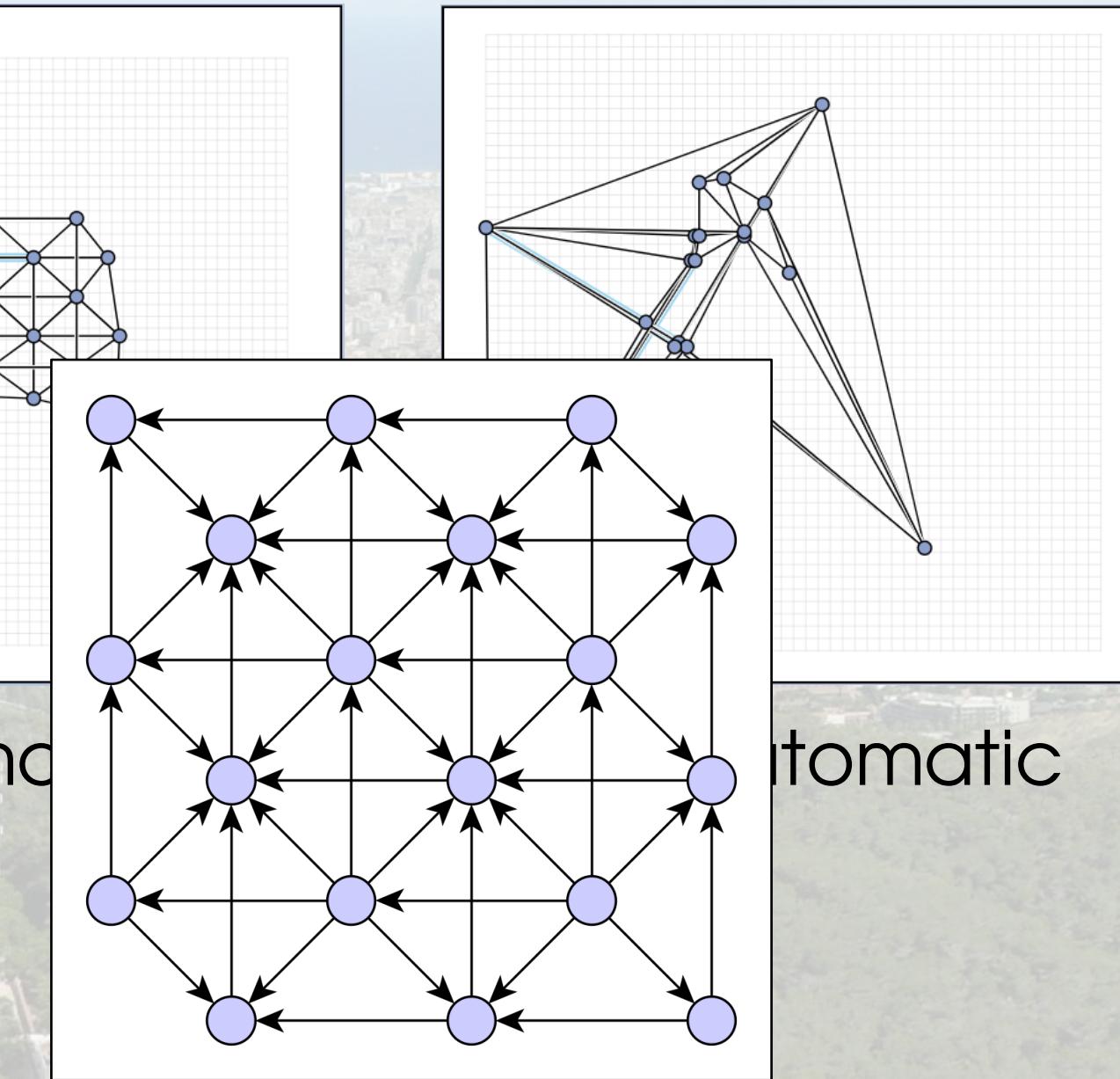


input

graph 3



best mo

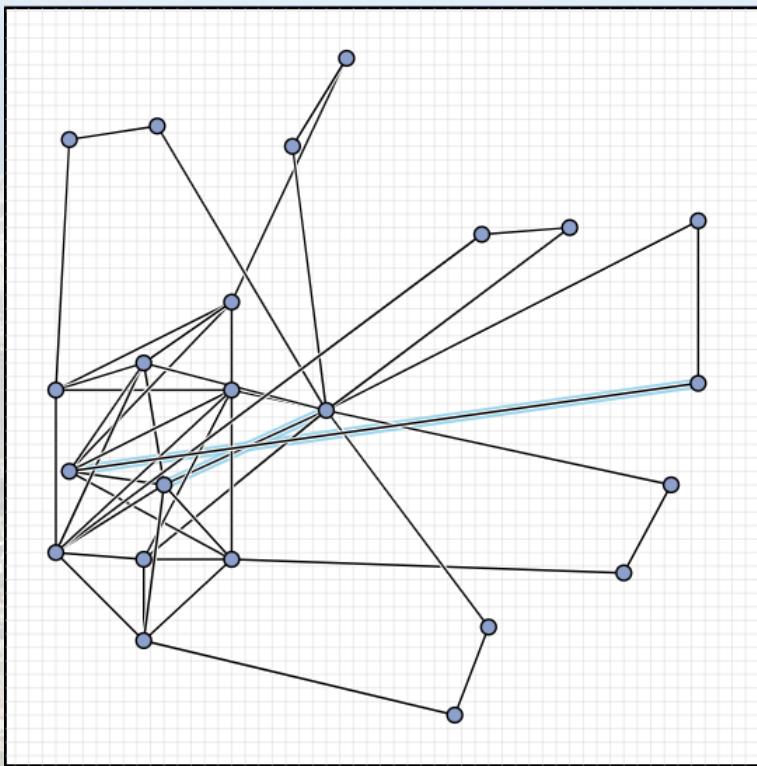


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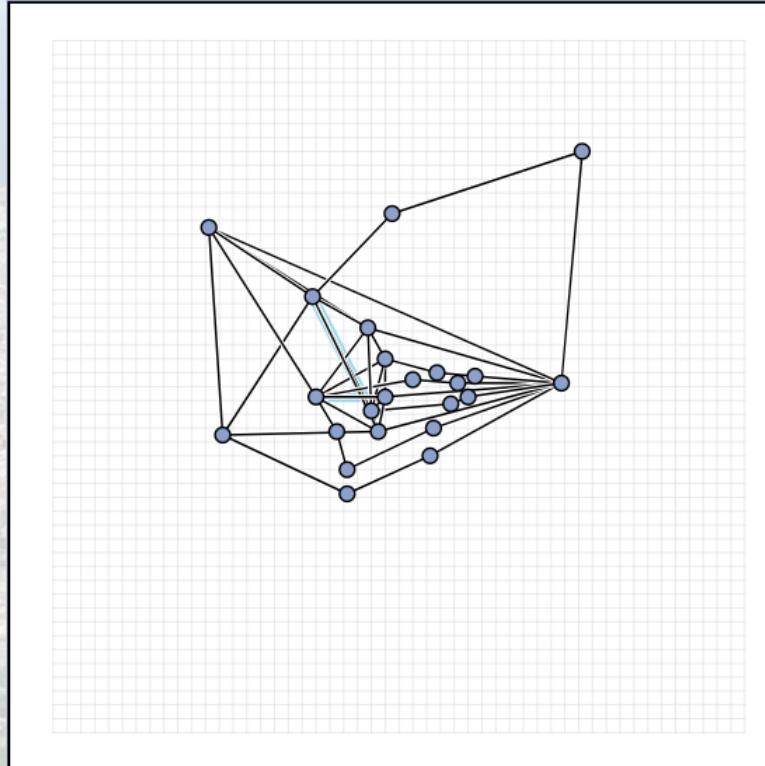
LIVE CHALLENGE

the graphs

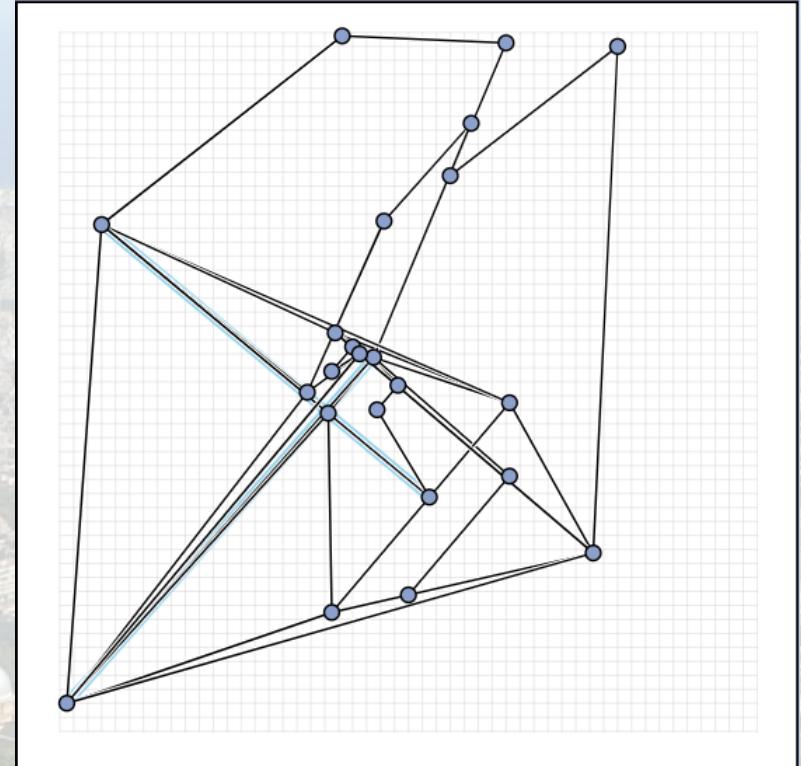
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input



best manual



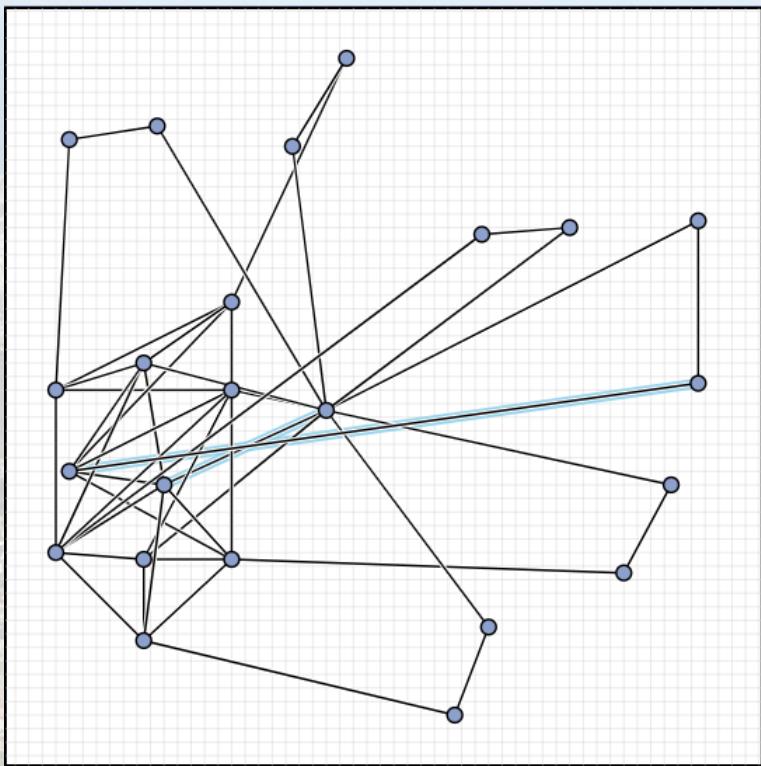
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graph 4

LIVE CHALLENGE

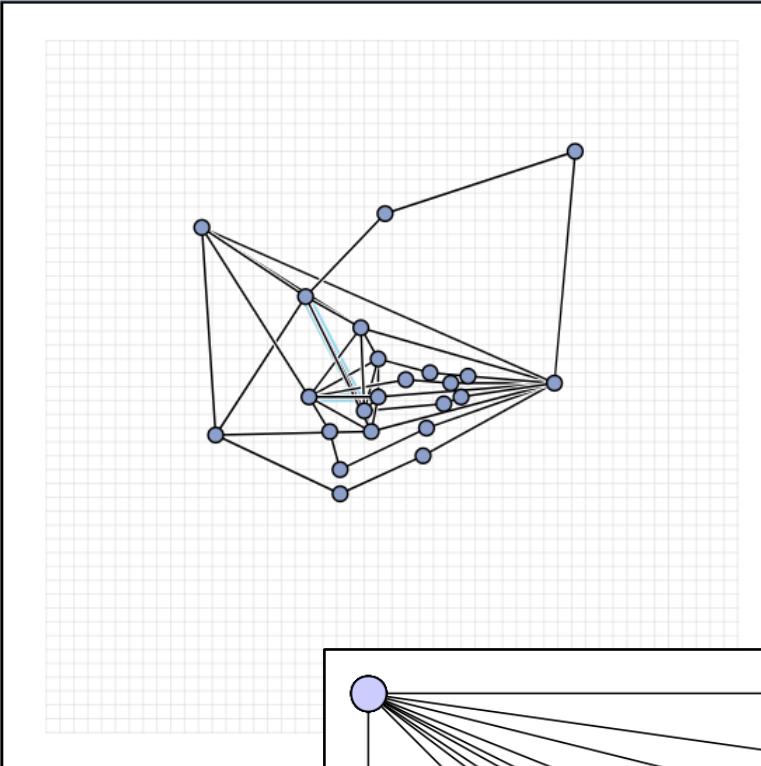
the graphs

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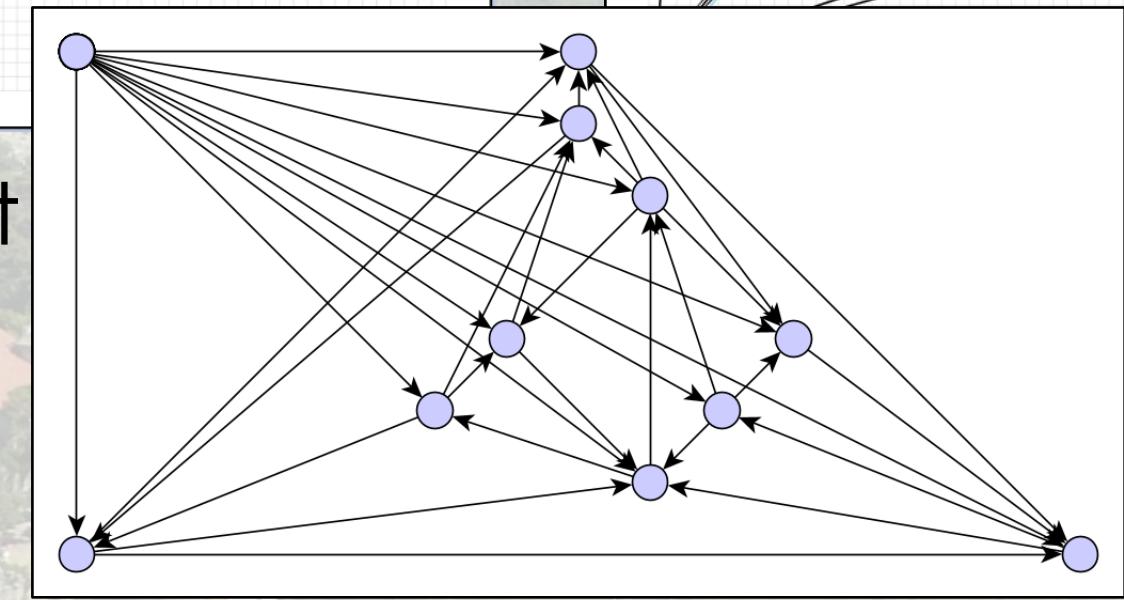


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graph 4



best

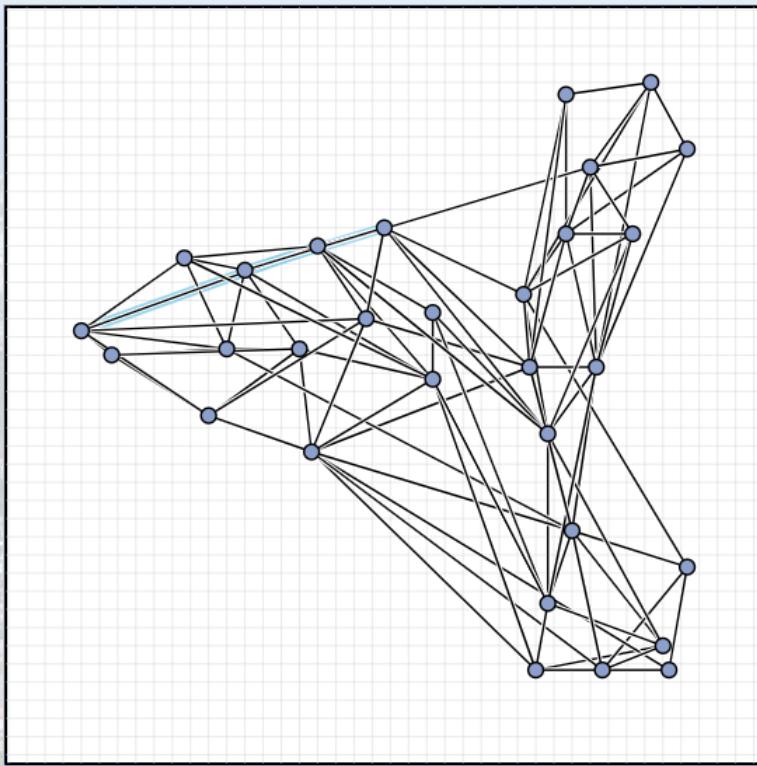


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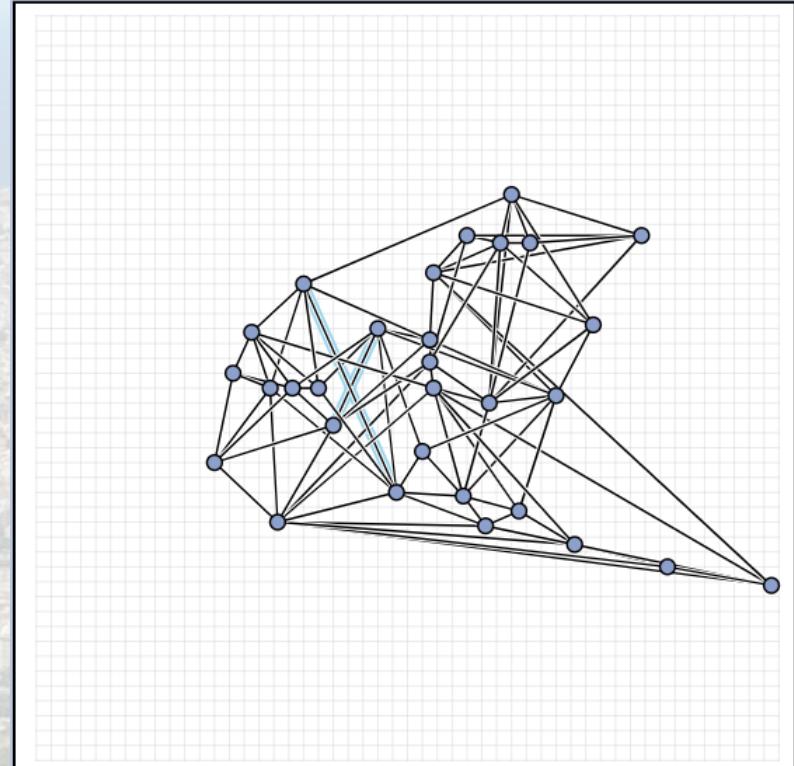
LIVE CHALLENGE

the graphs

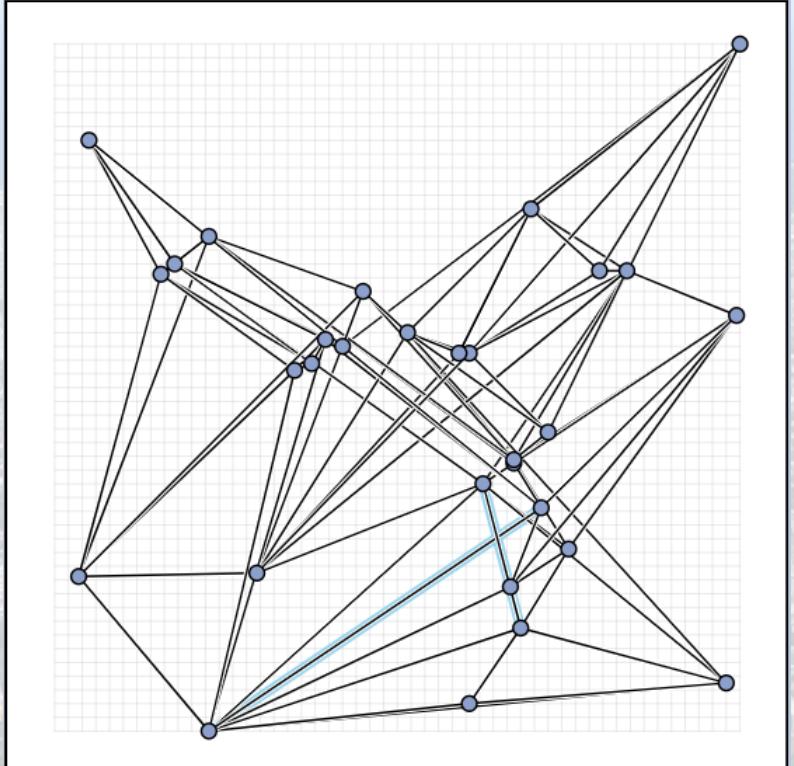
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input



best manual



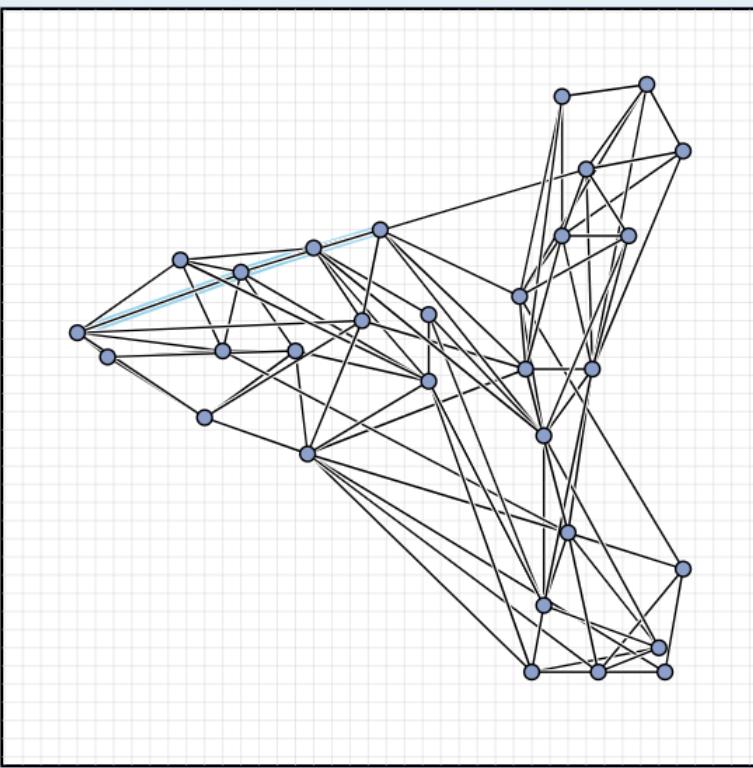
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graph 5

LIVE CHALLENGE

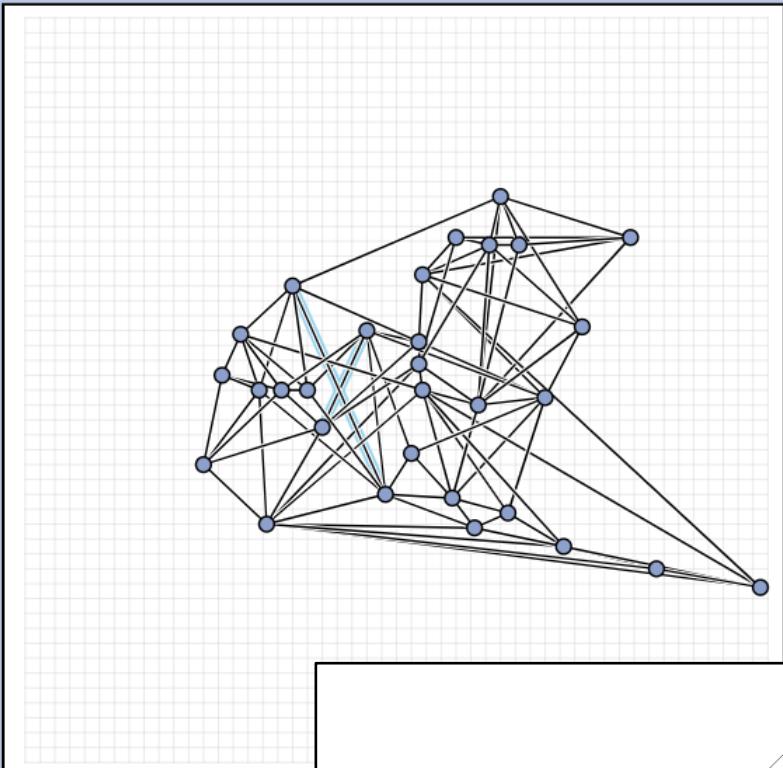
the graphs

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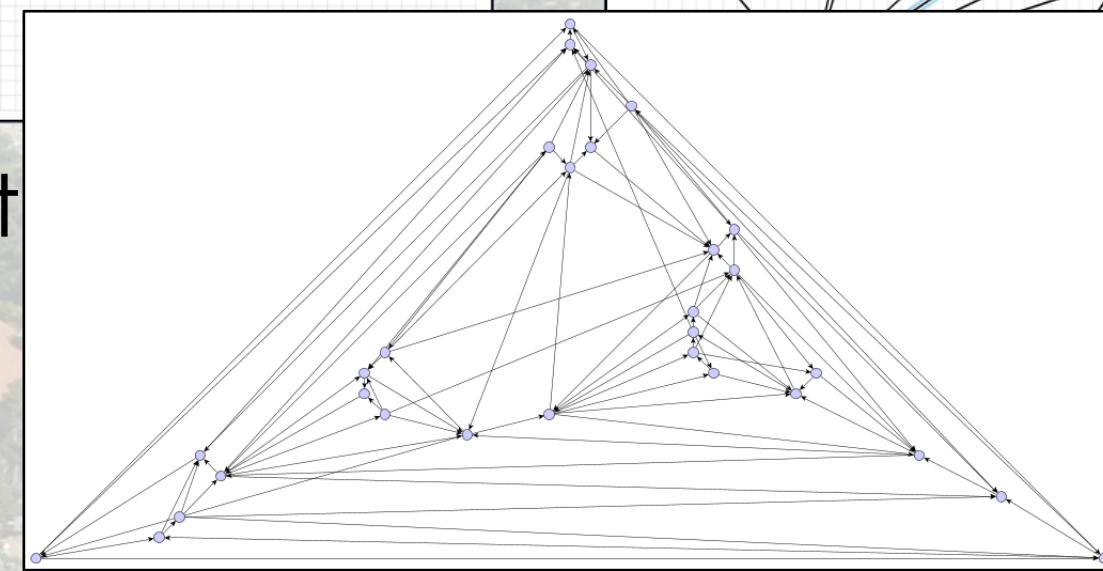


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graph 5



best

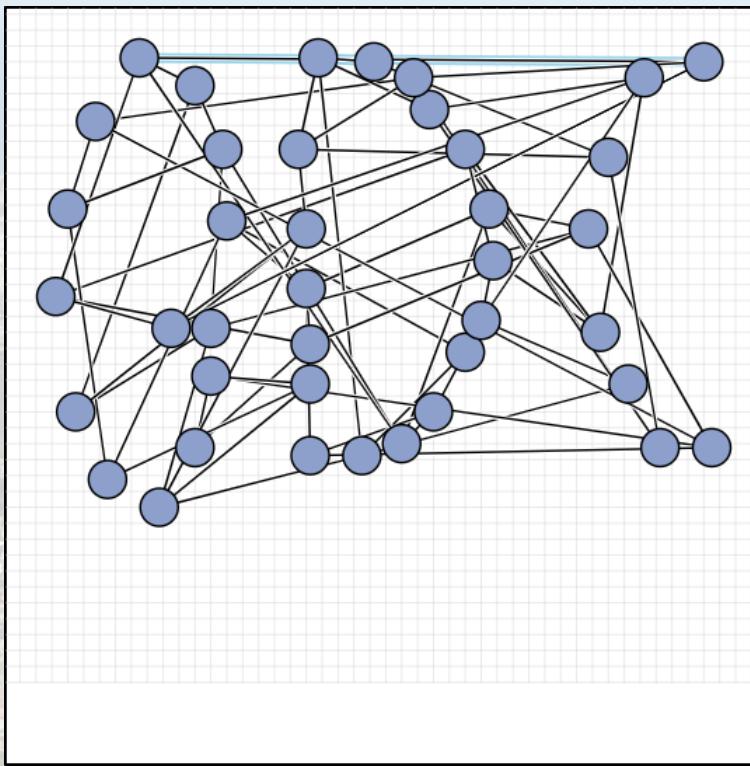


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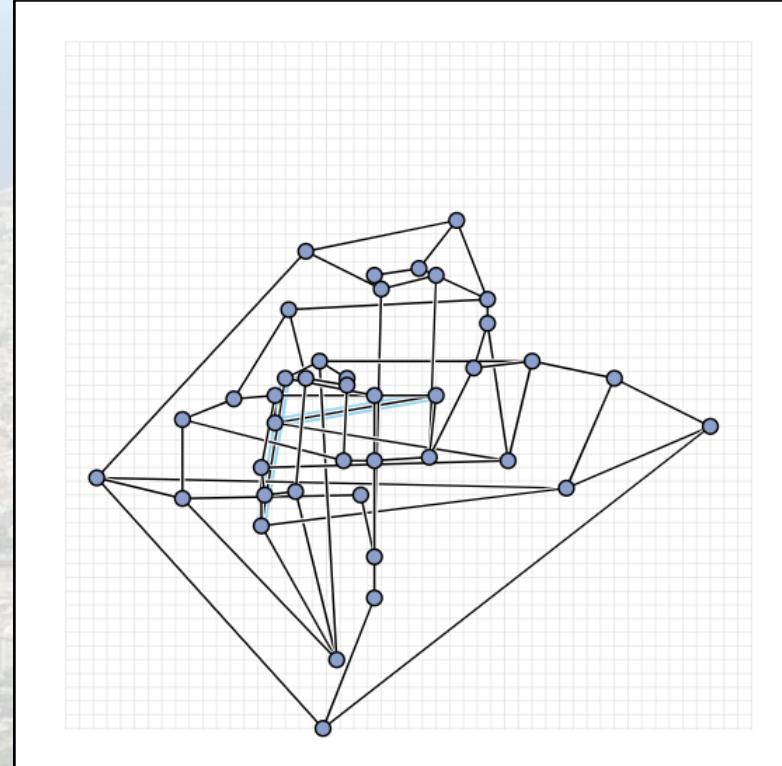
LIVE CHALLENGE

the graphs

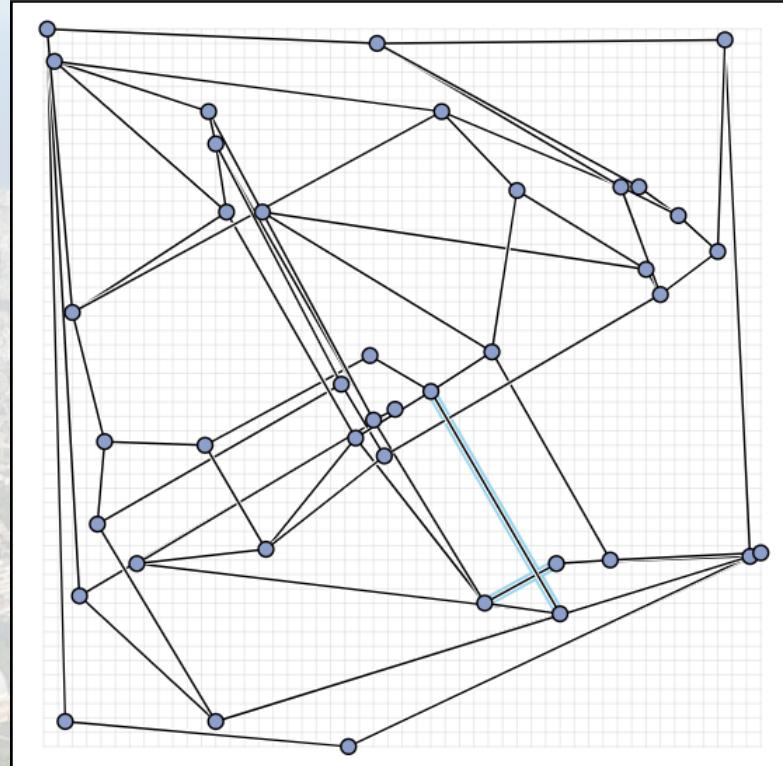
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best manual



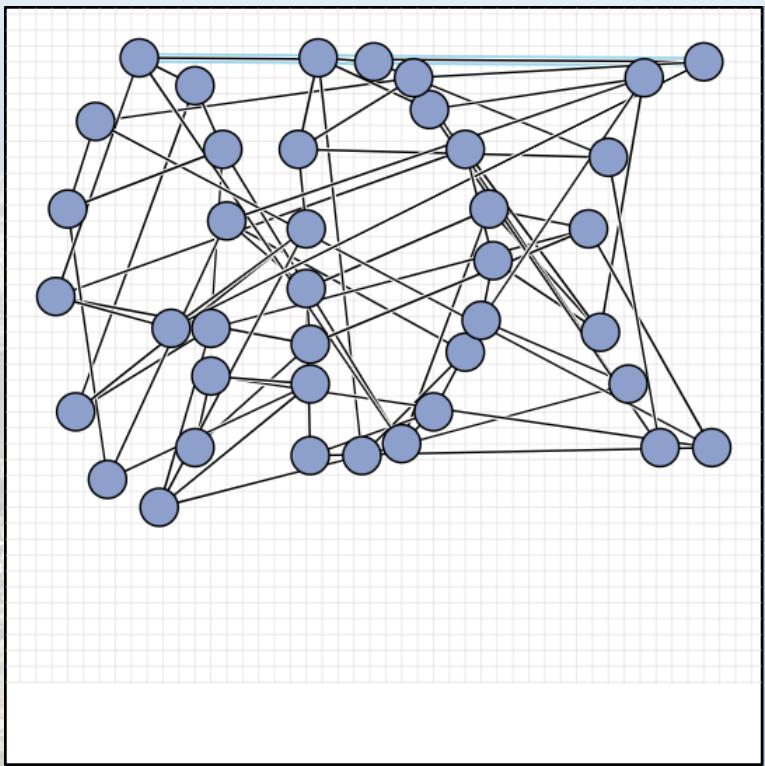
best automatic

graph 6

LIVE CHALLENGE

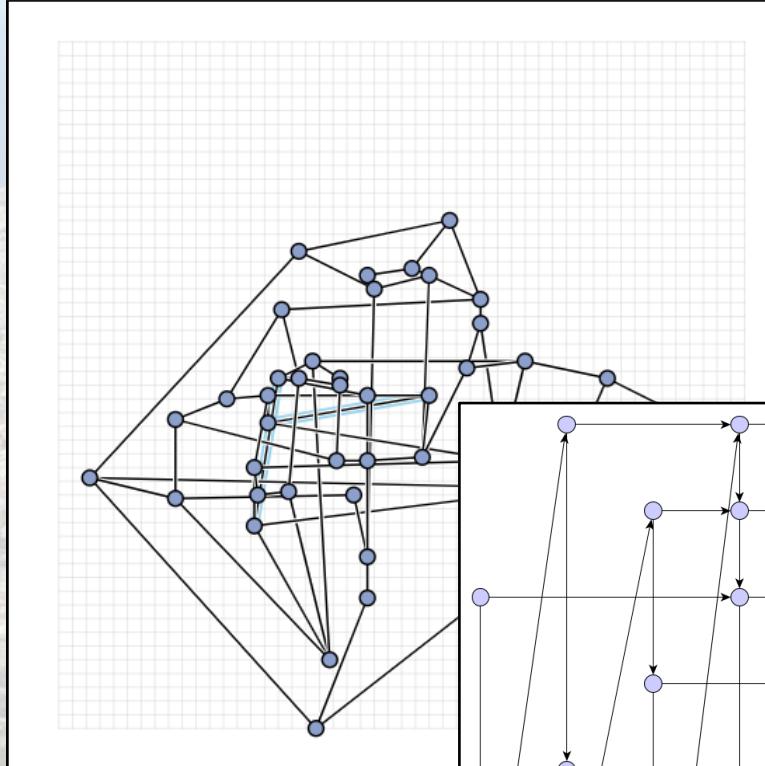
the graphs

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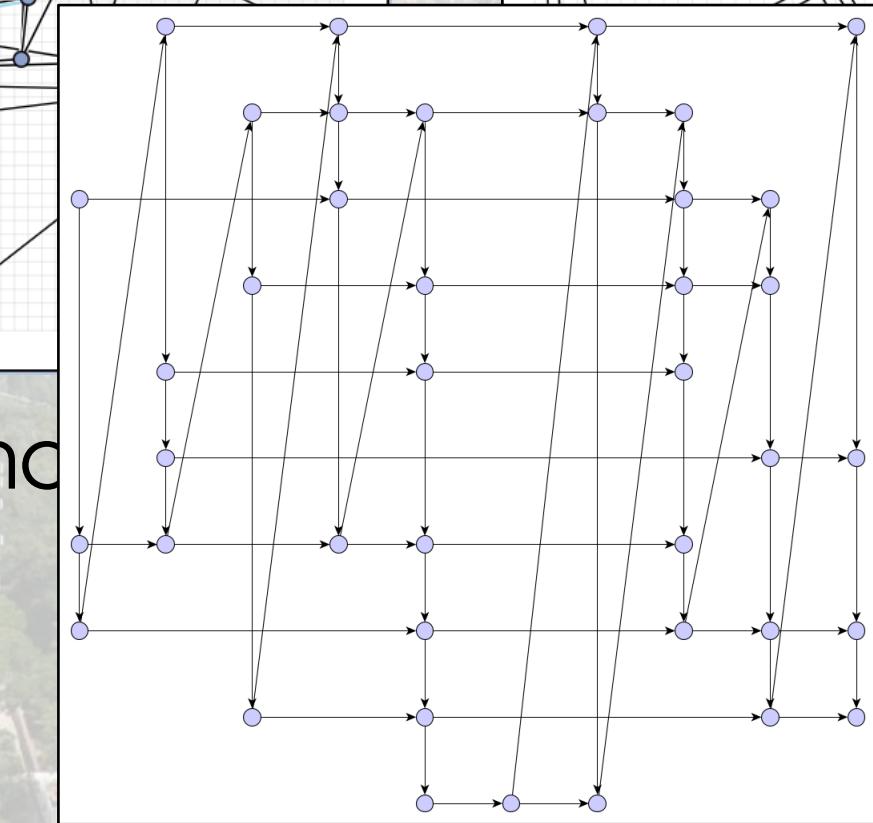


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graph 6



best mo

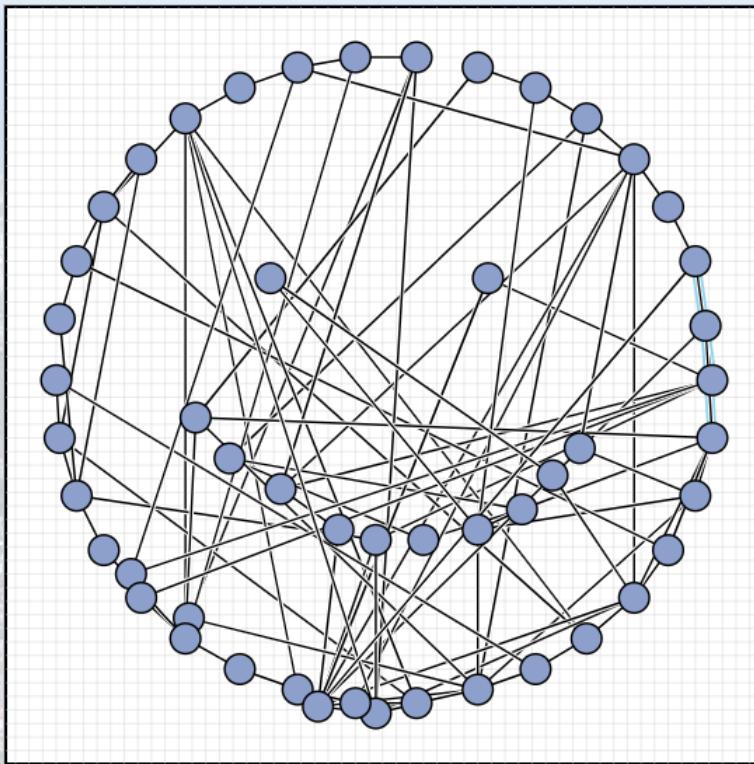


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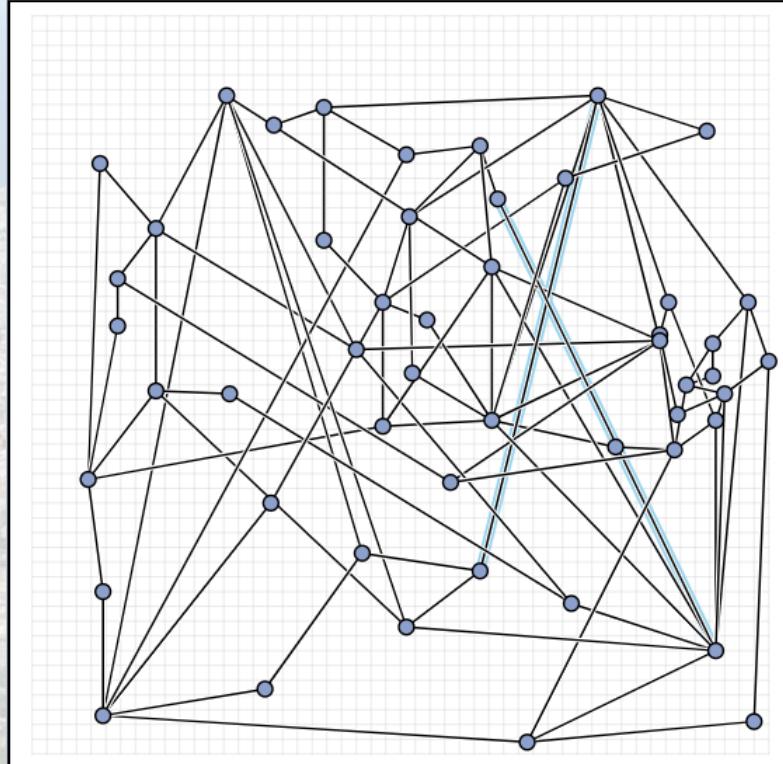
LIVE CHALLENGE

the graphs

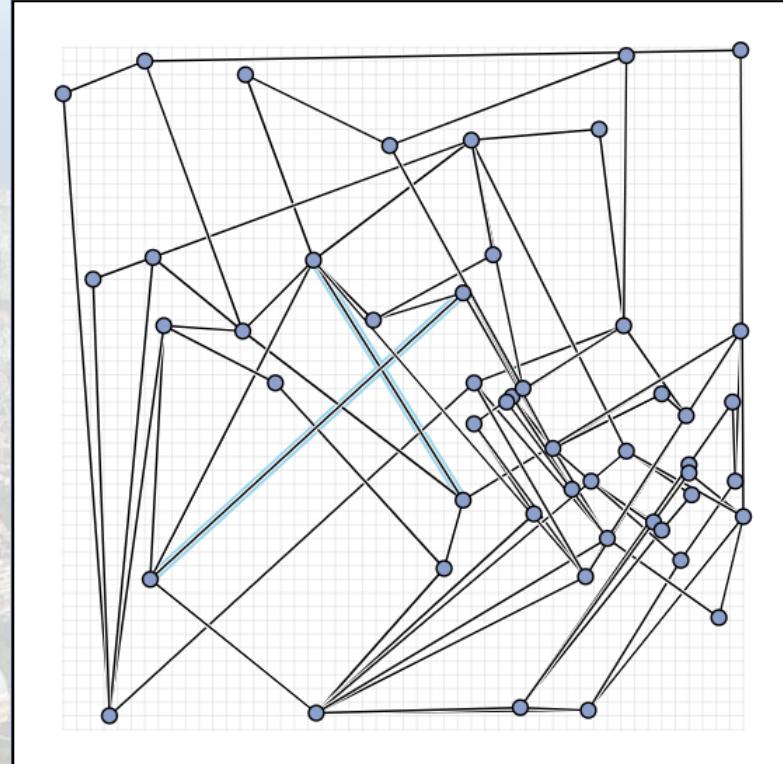
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input



best manual



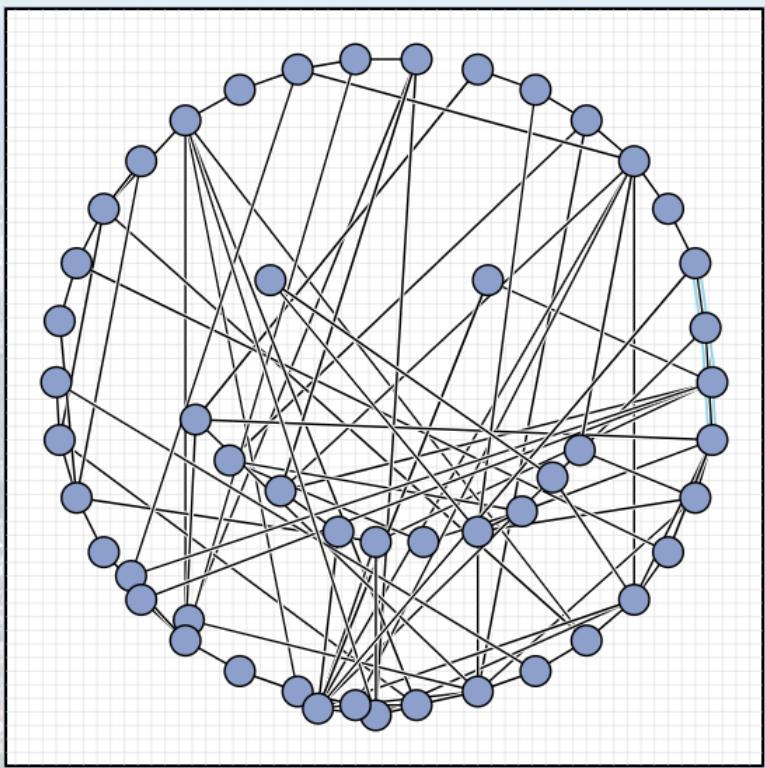
best automatic

graph 7

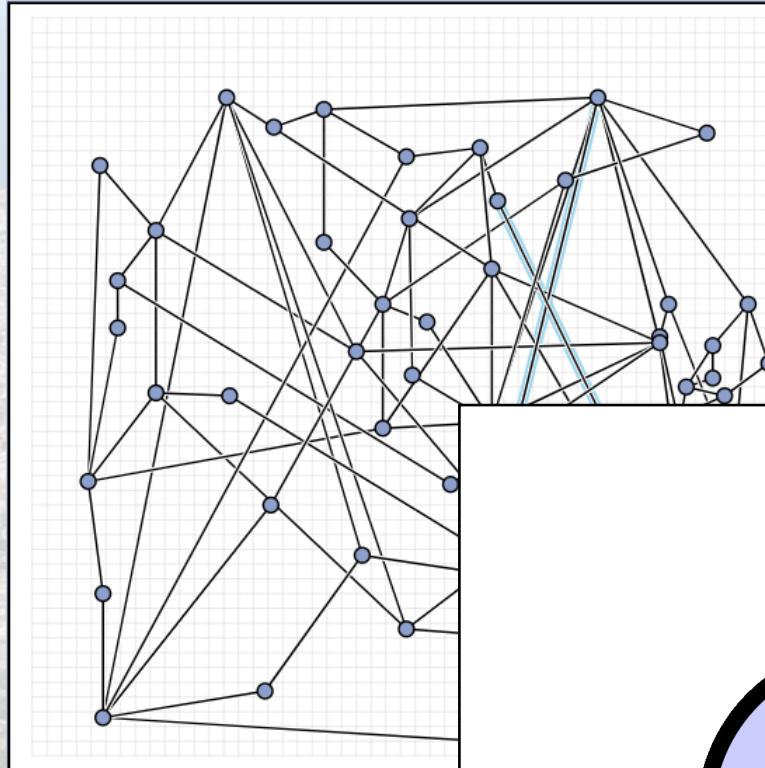
LIVE CHALLENGE

the graphs

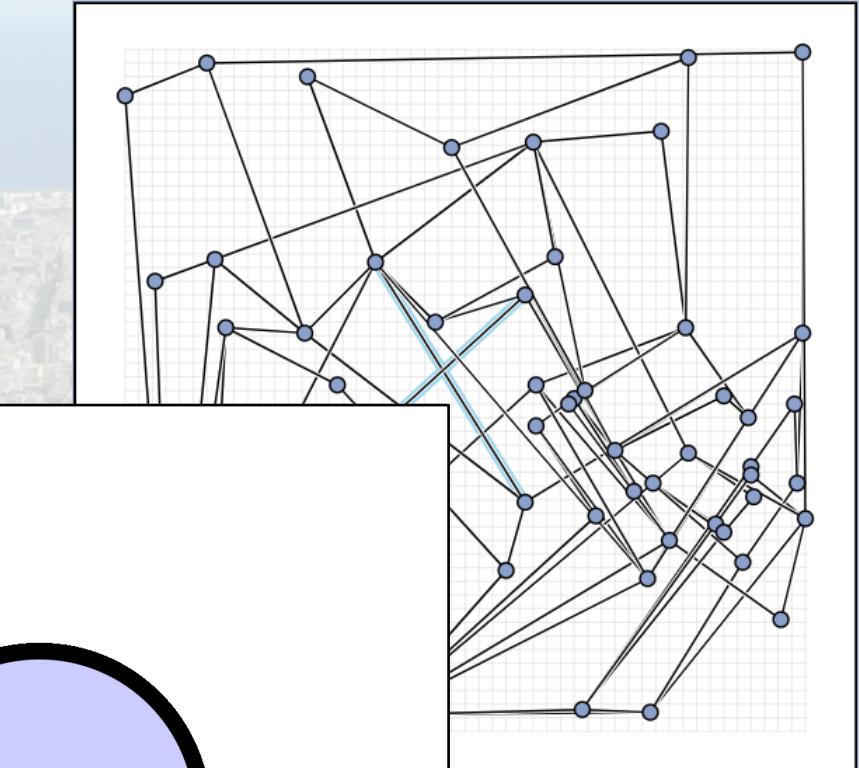
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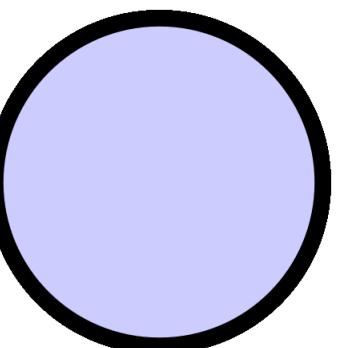
input



best model



automatic



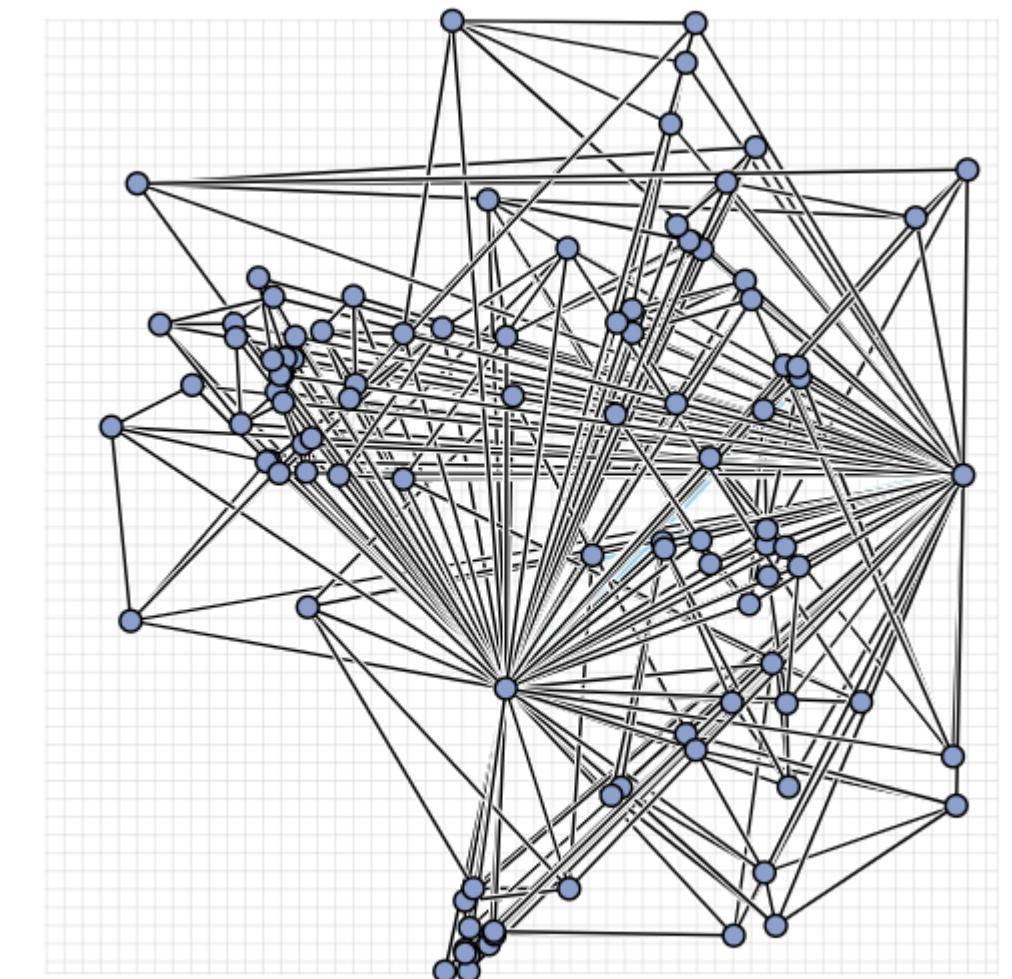
graph 7

LIVE CHALLENGE

the graphs

gd
18

graph 8

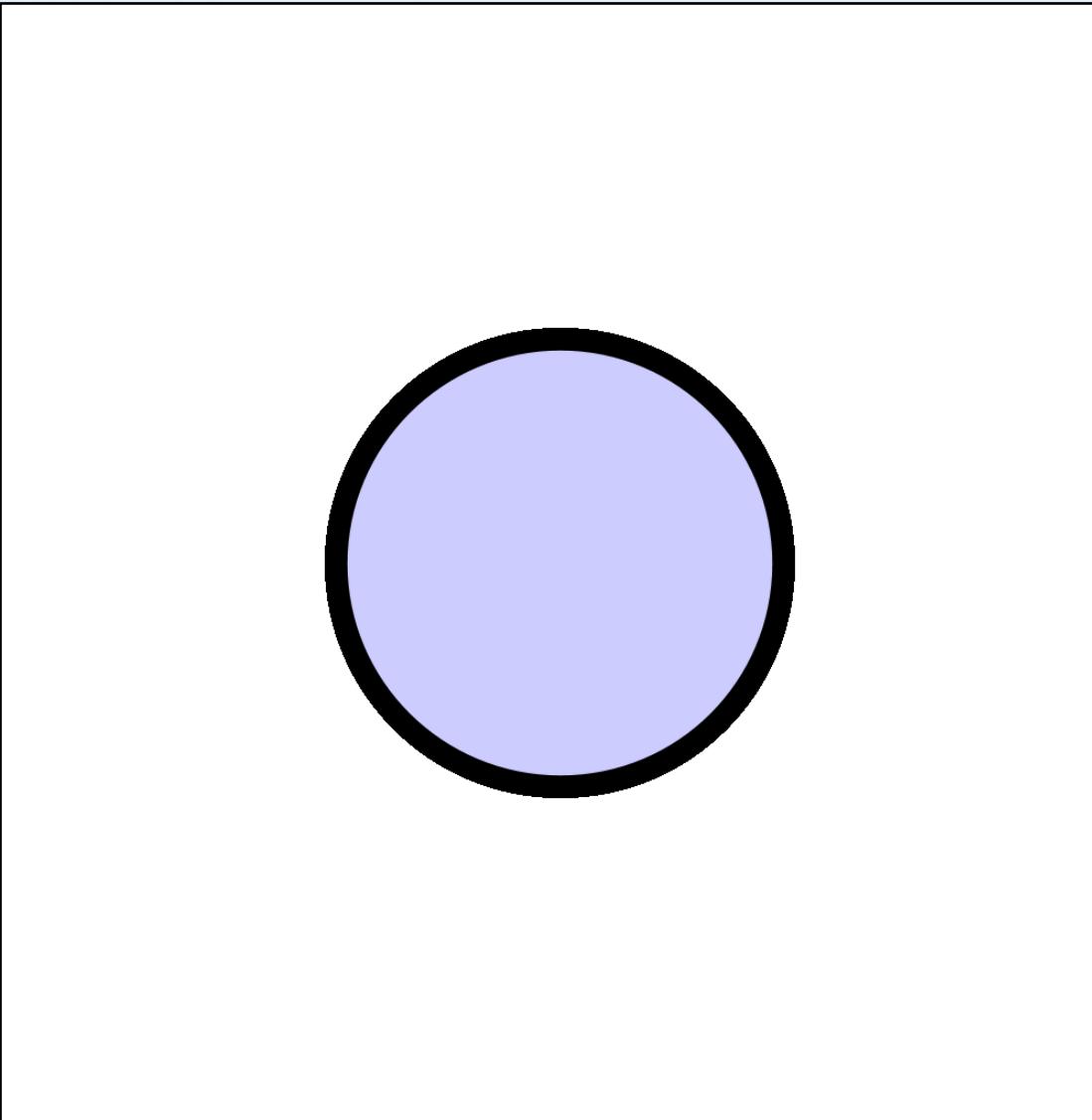


best automatic

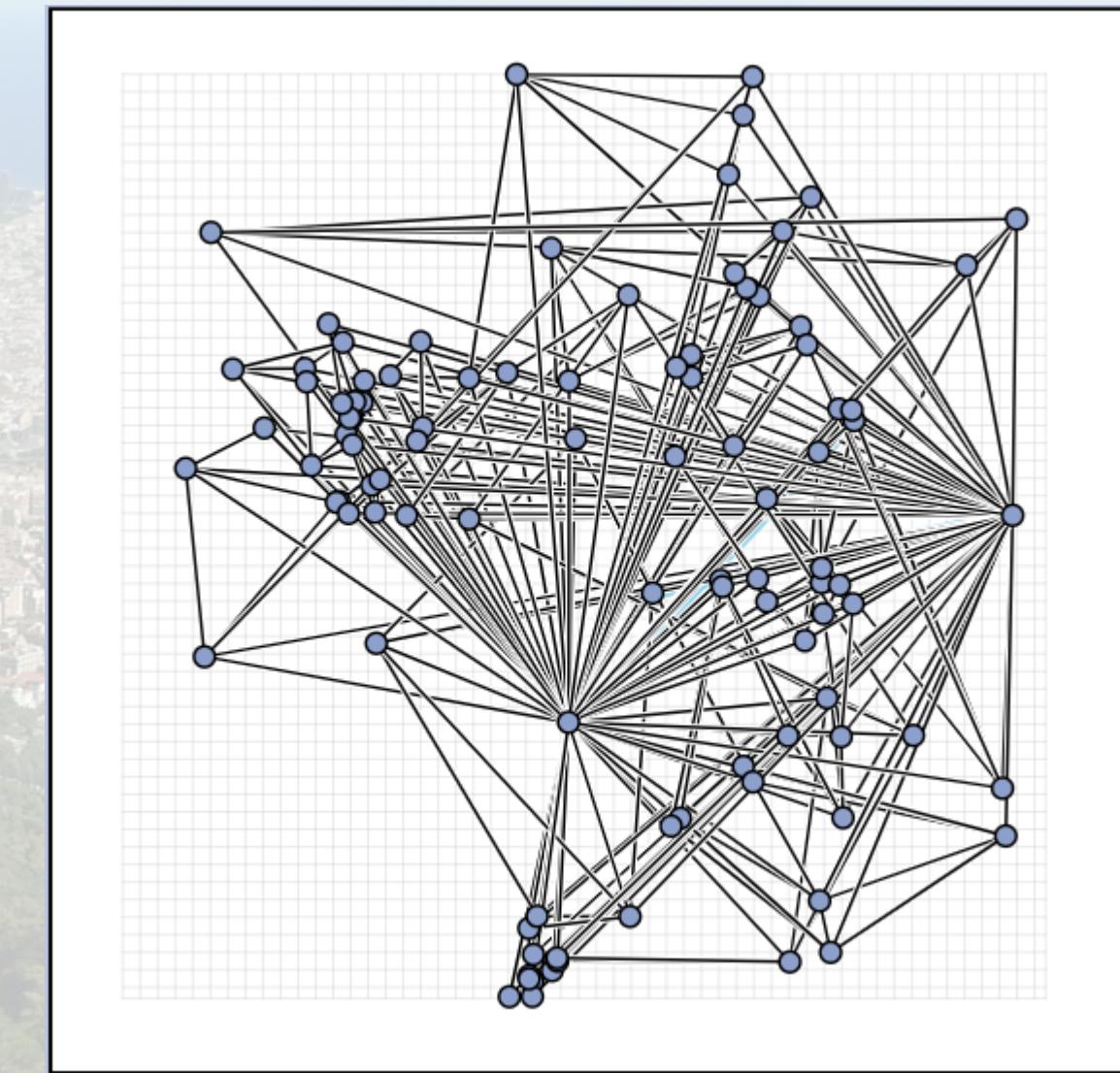
LIVE CHALLENGE

the graphs

gd
18



graph 8



best automatic

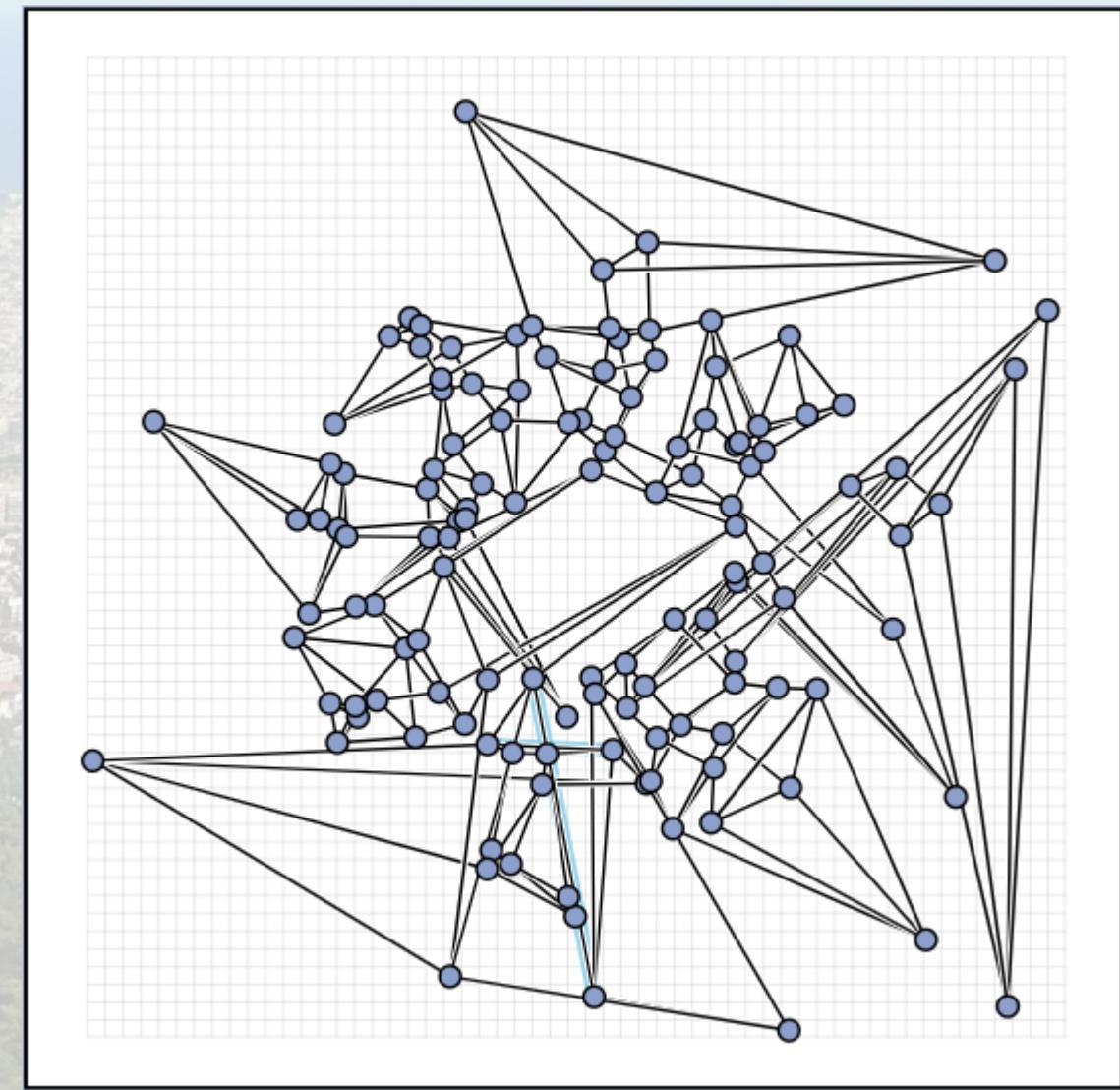
LIVE CHALLENGE

the graphs

gd
18



graph 9

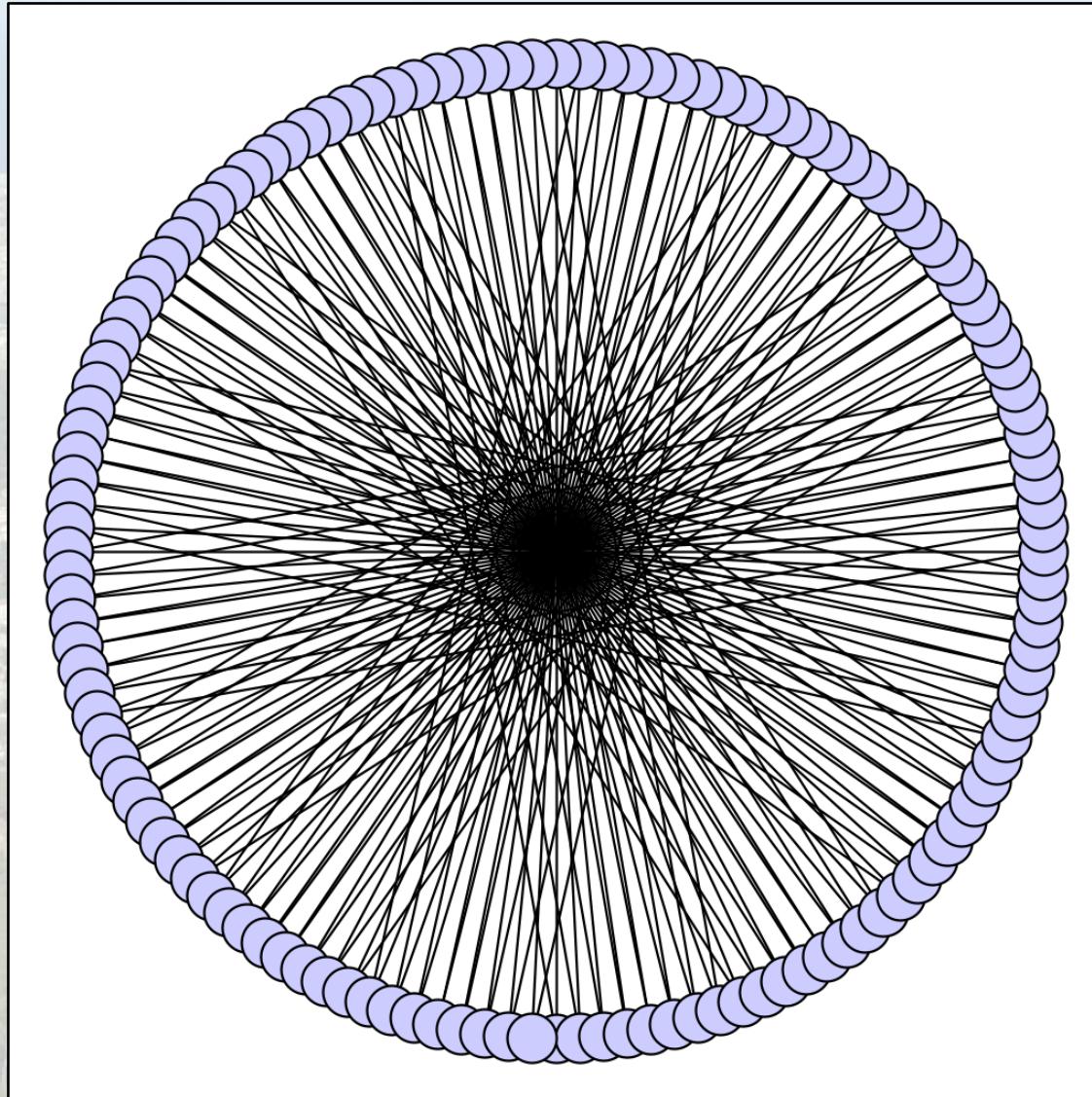


best automatic

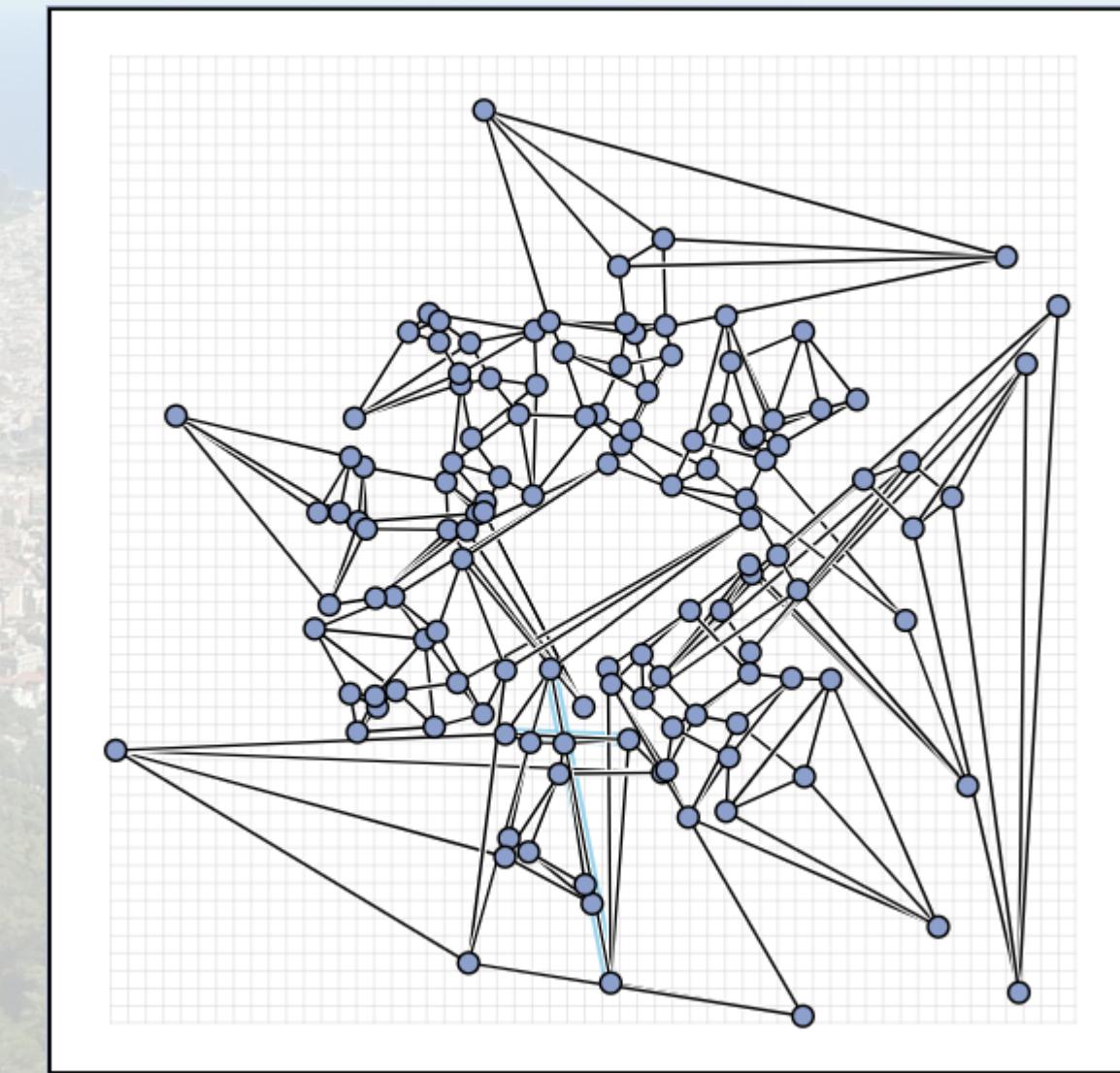
LIVE CHALLENGE

the graphs

gd
18



graph 9



best automatic

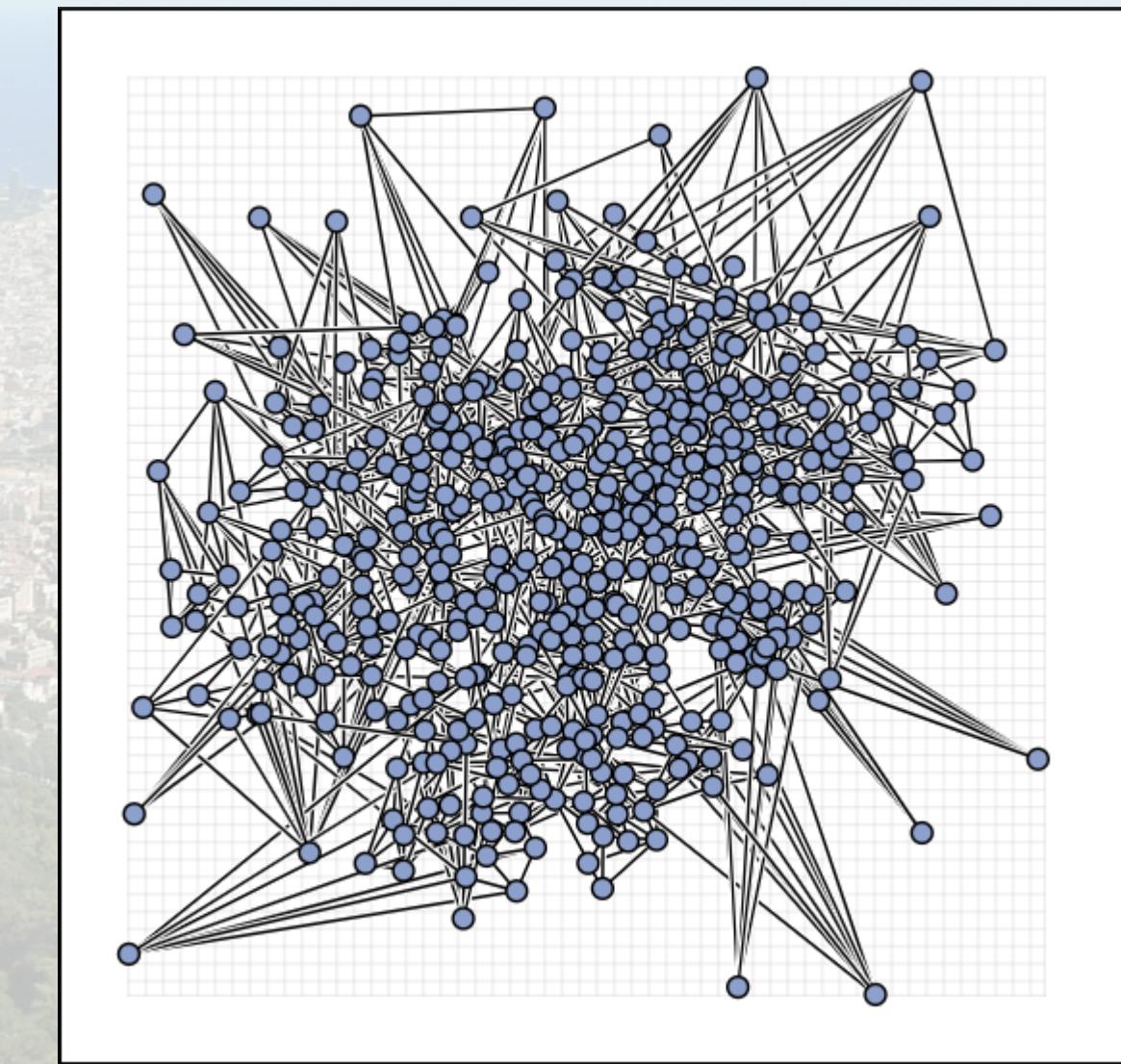
LIVE CHALLENGE

the graphs

gd
g18



graph 10

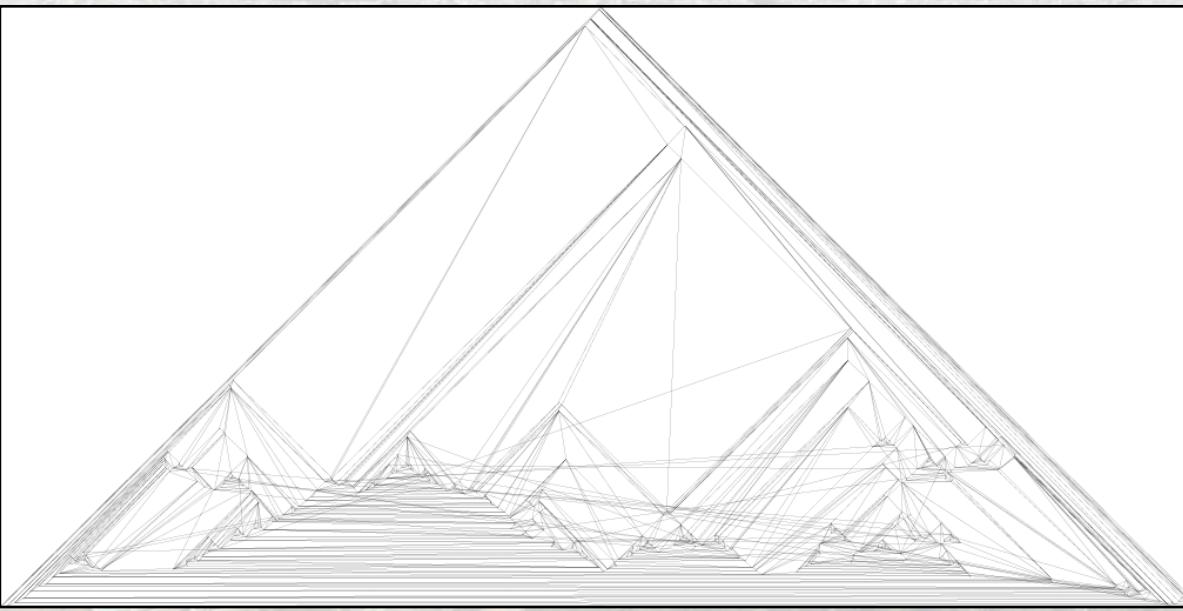


best automatic

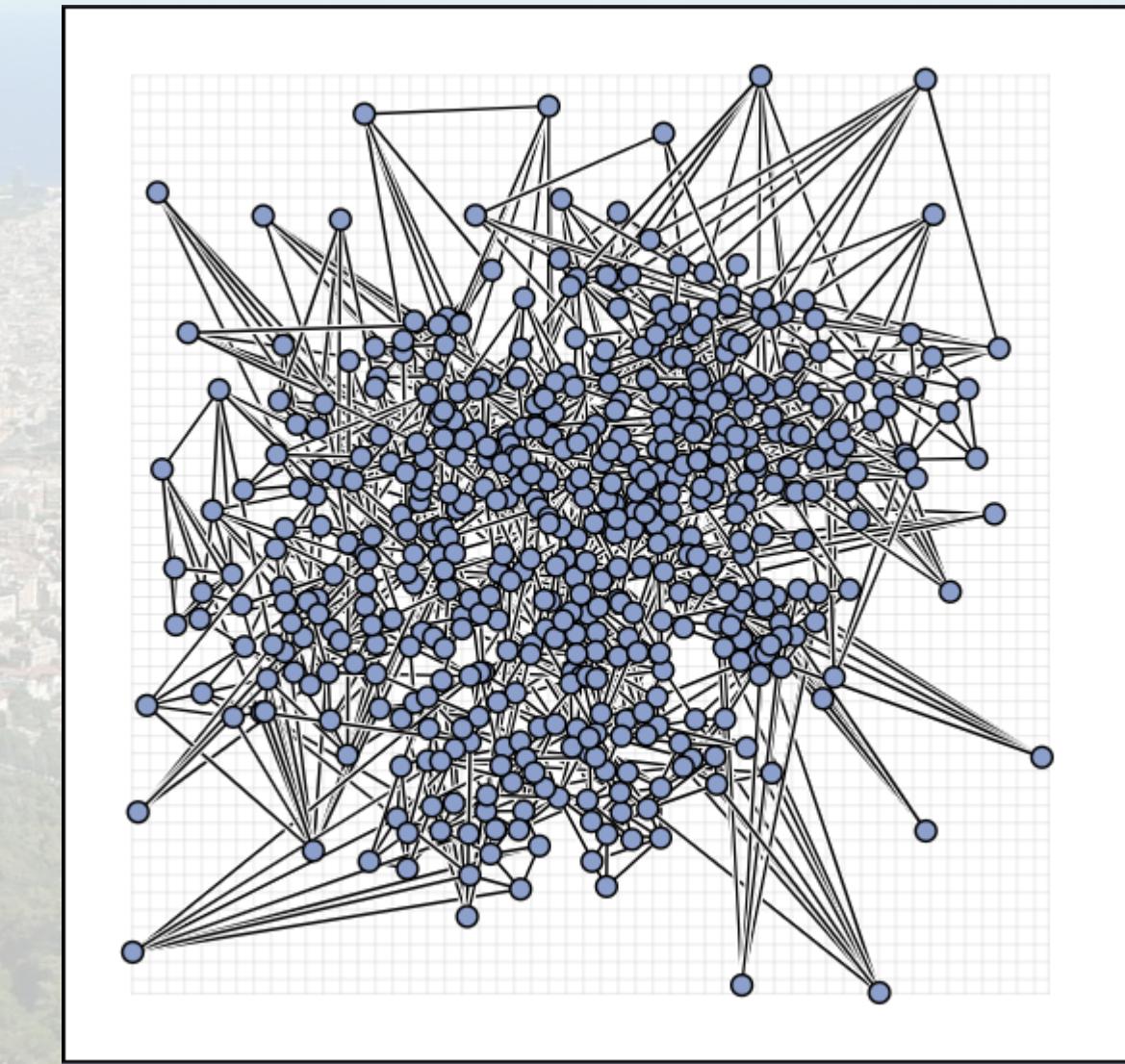
LIVE CHALLENGE

the graphs

gd
18



graph 10

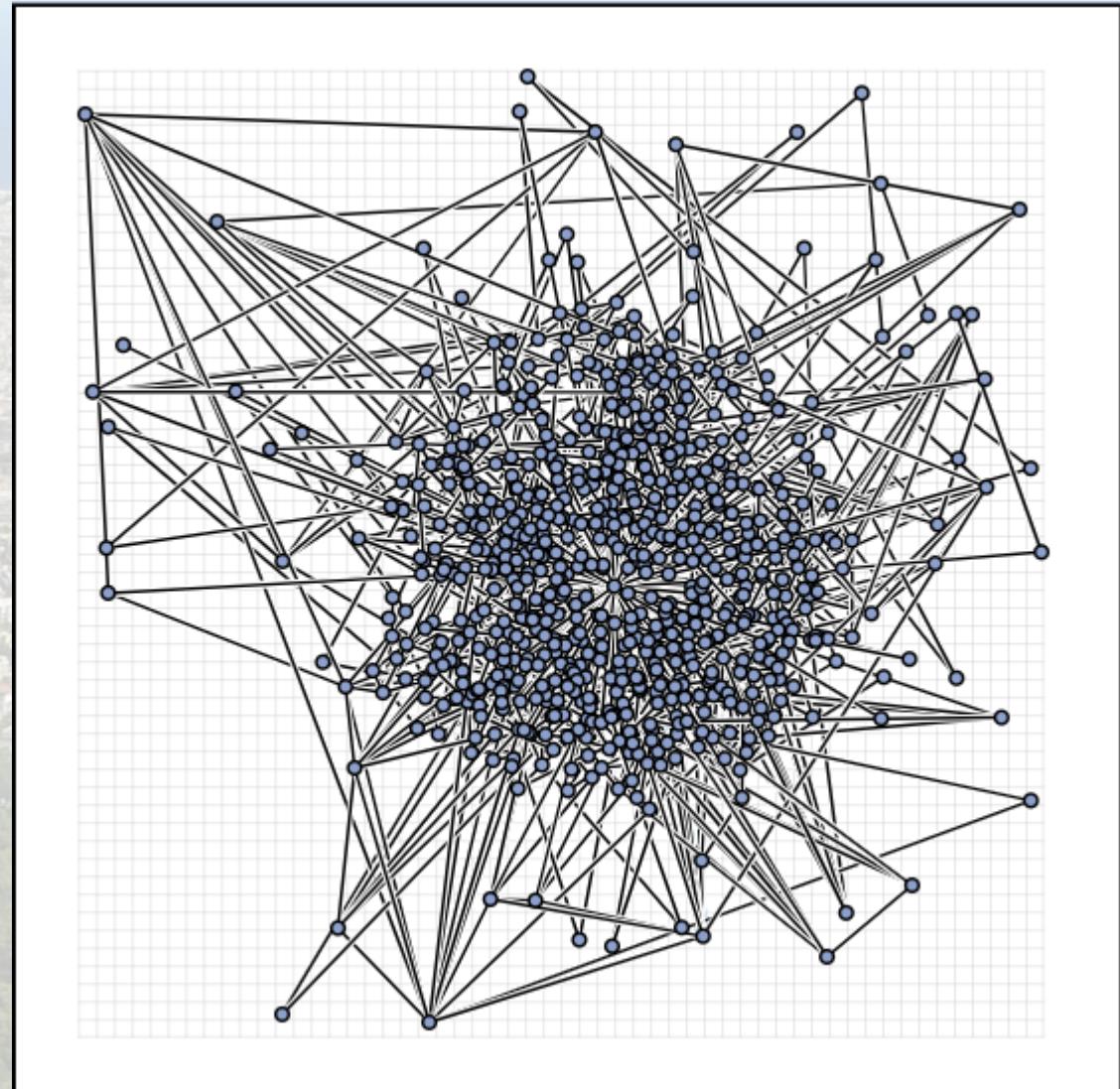


best automatic

LIVE CHALLENGE

the graphs

gd
18



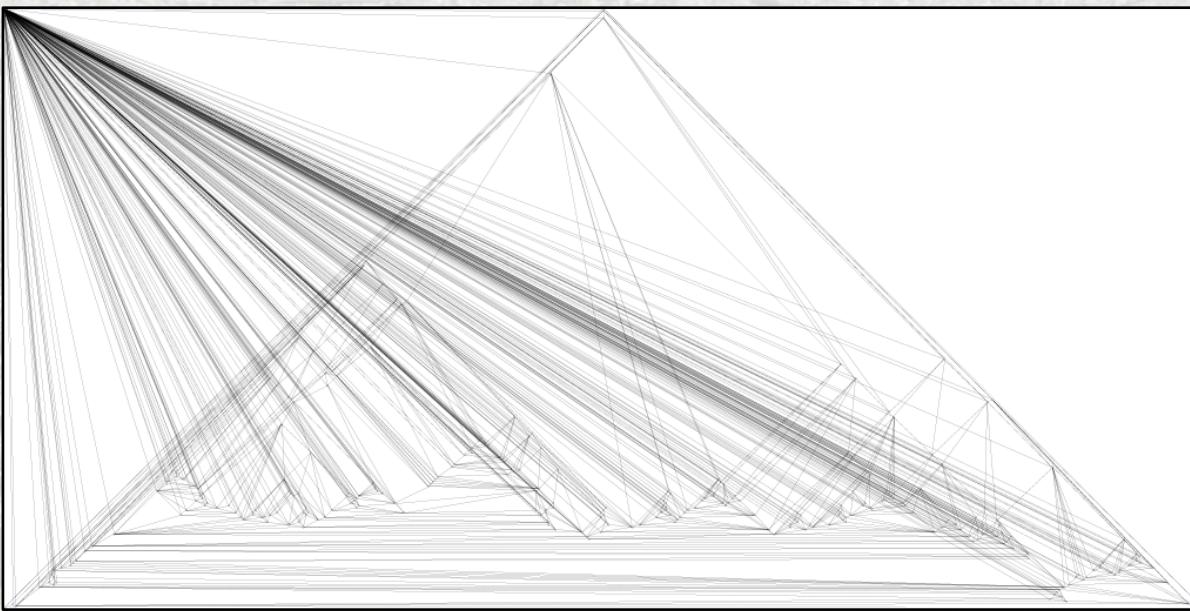
graph 11

best automatic

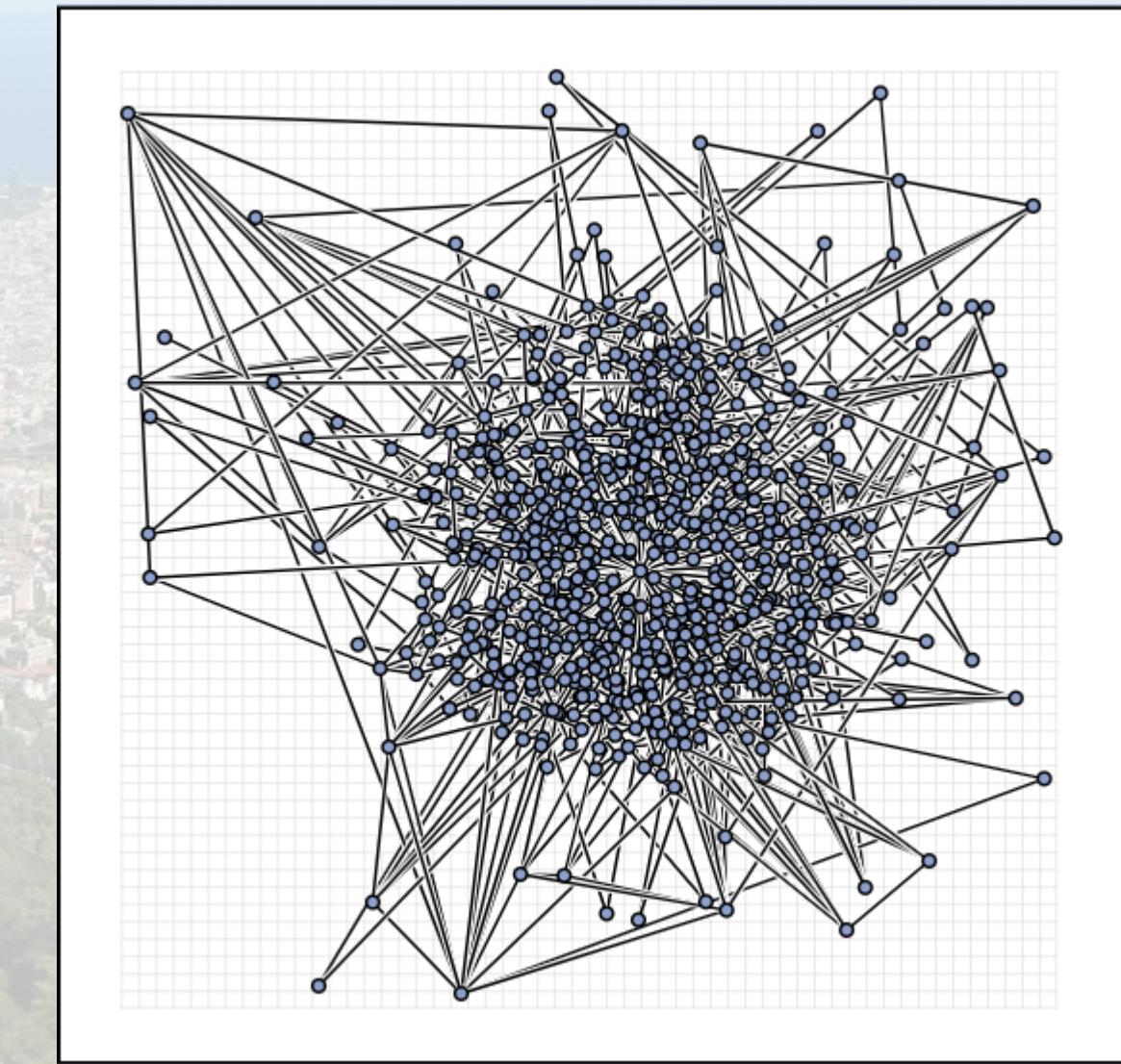
LIVE CHALLENGE

the graphs

gd
18



graph 11



best automatic

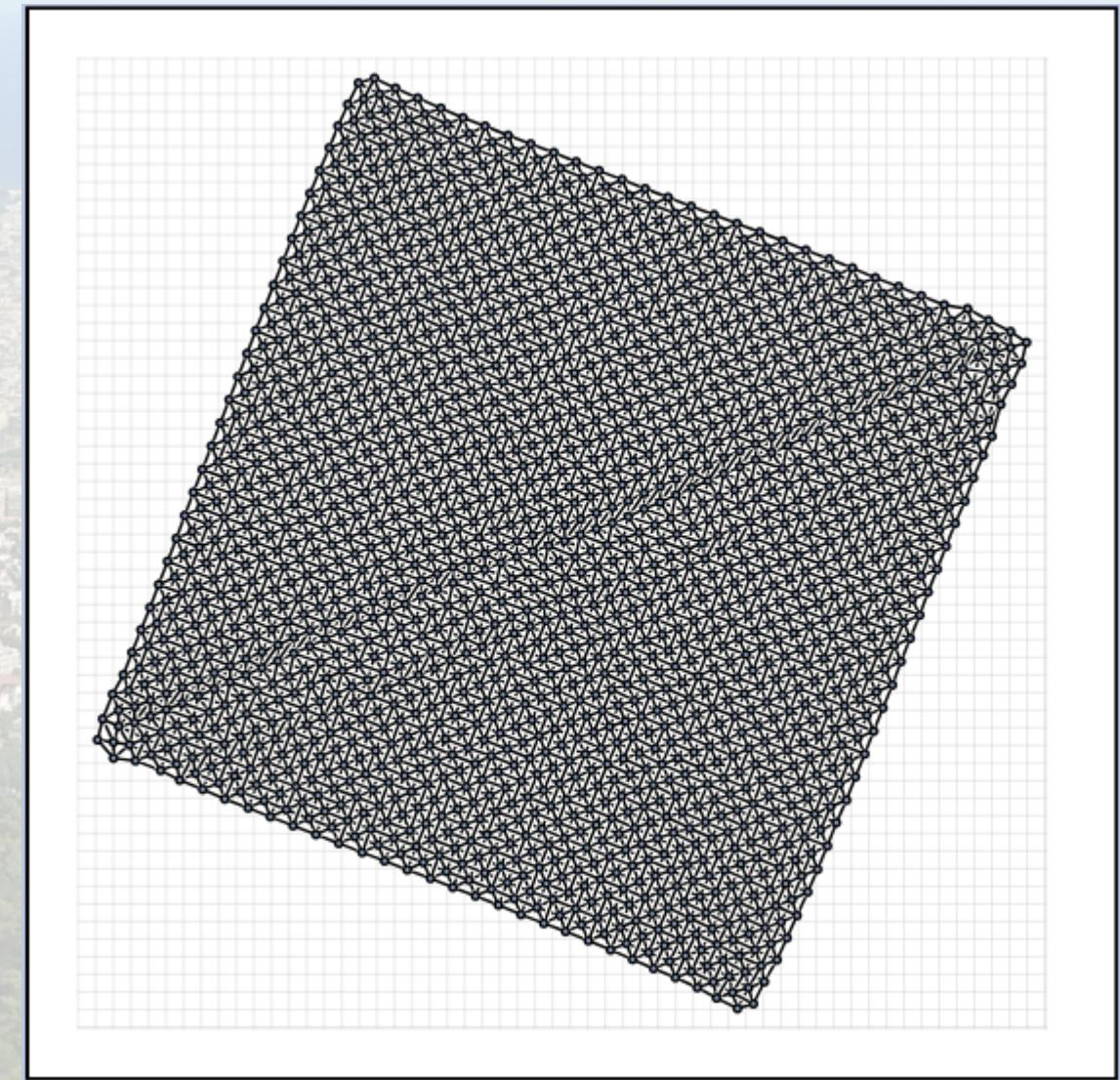
LIVE CHALLENGE

the graphs

gd
g18



graph 12

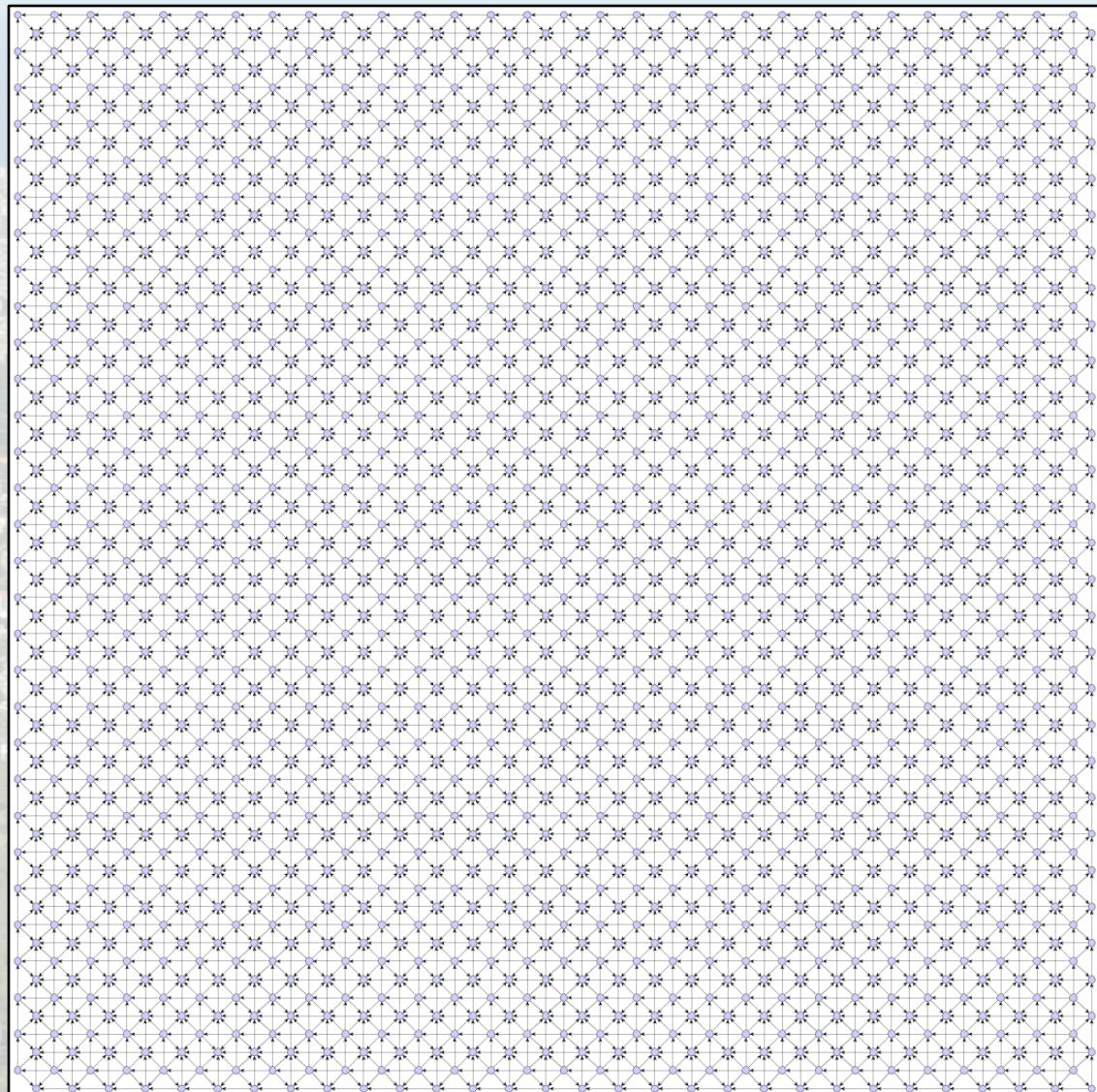


best automatic

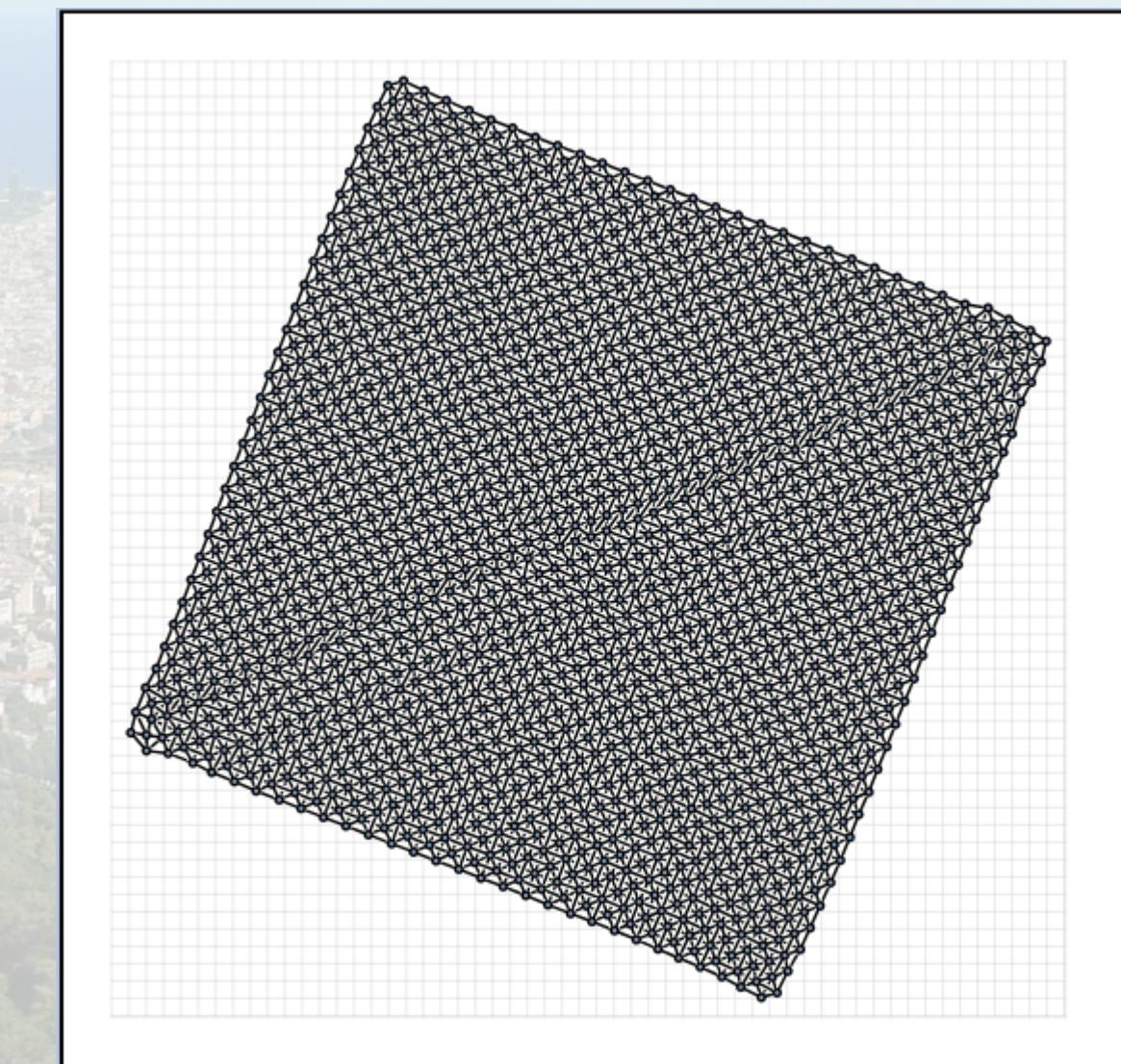
LIVE CHALLENGE

the graphs

gd
18



graph 12



best automatic

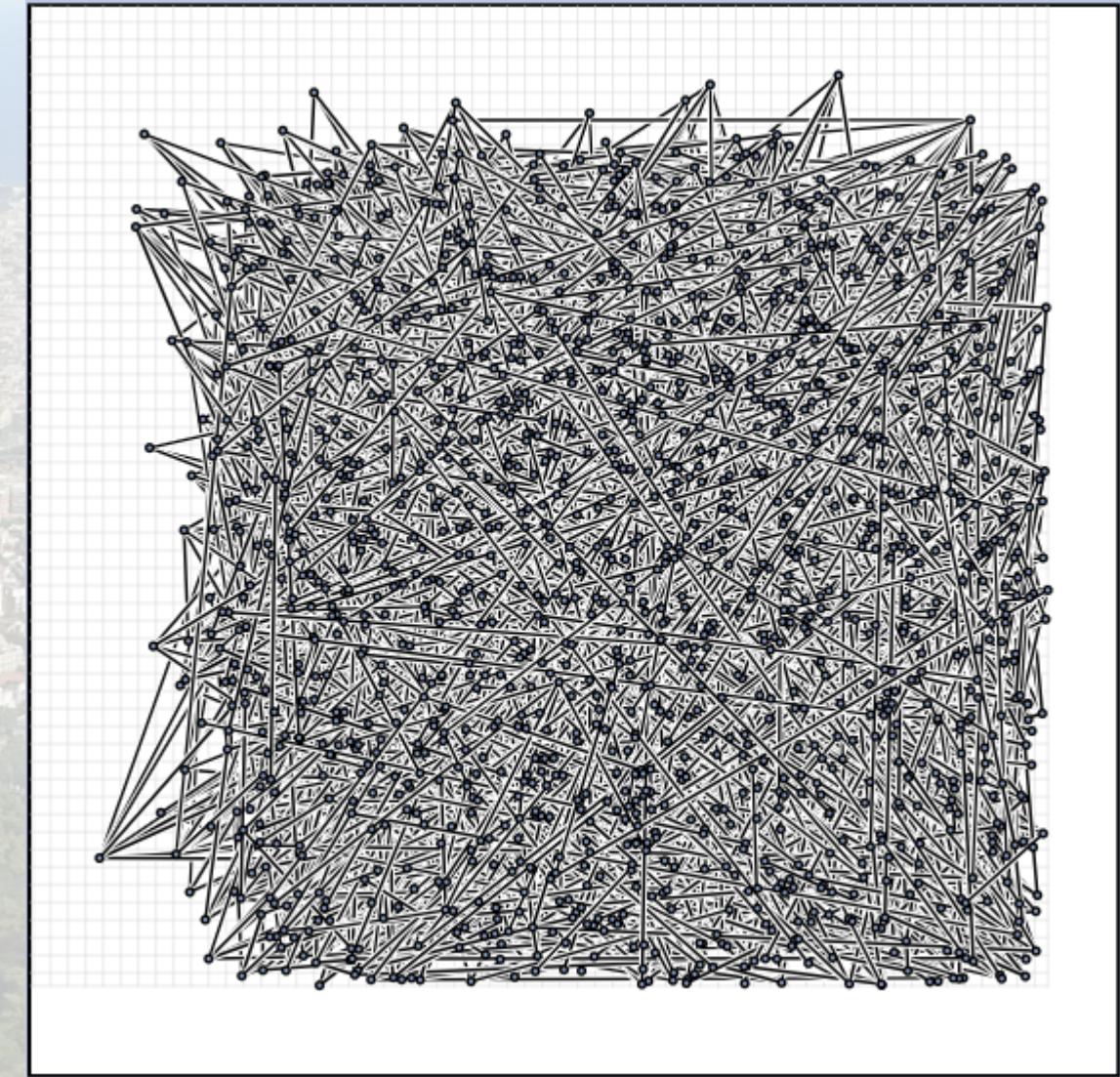
LIVE CHALLENGE

the graphs

gd
18

graph 13

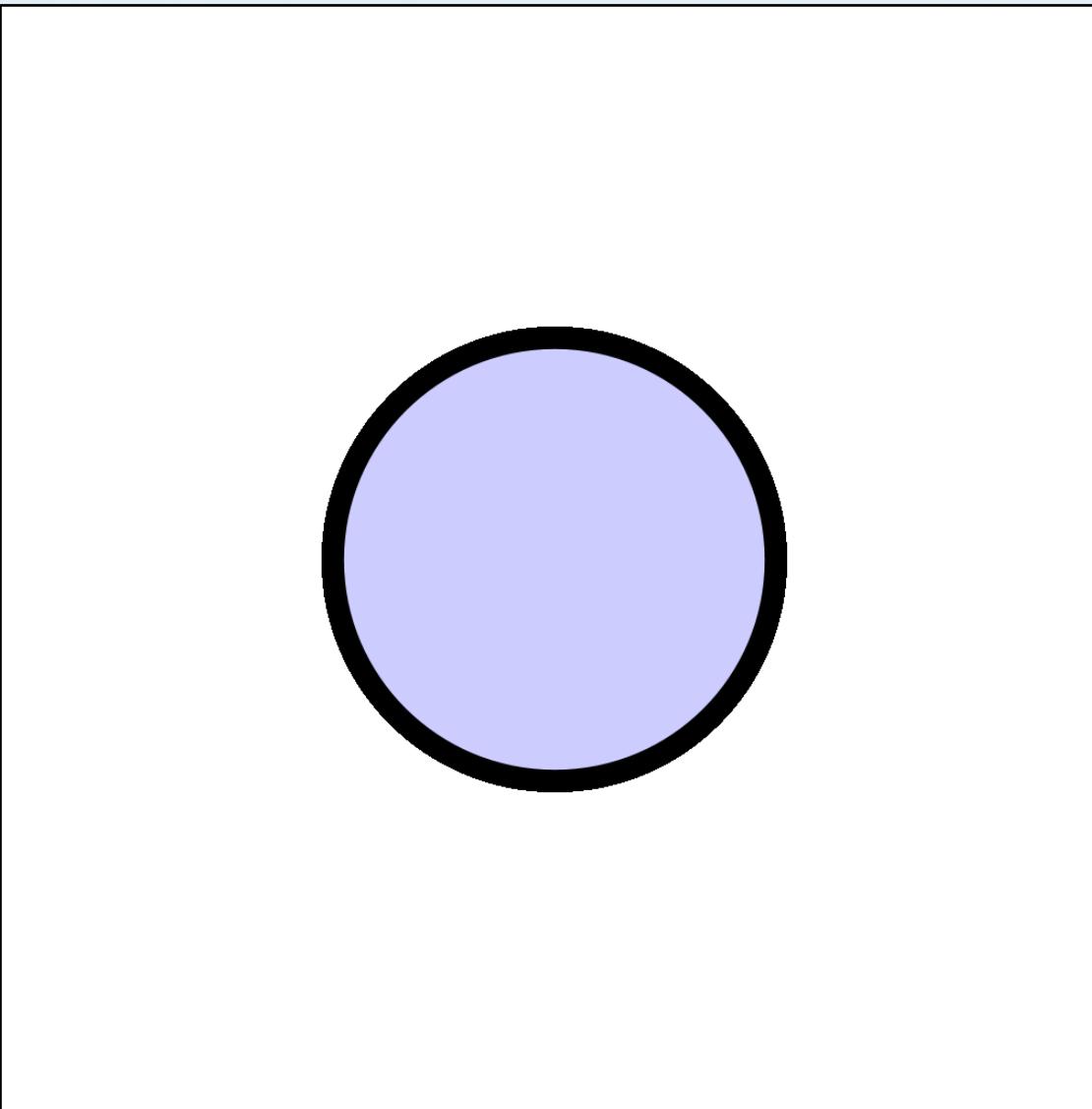
best automatic



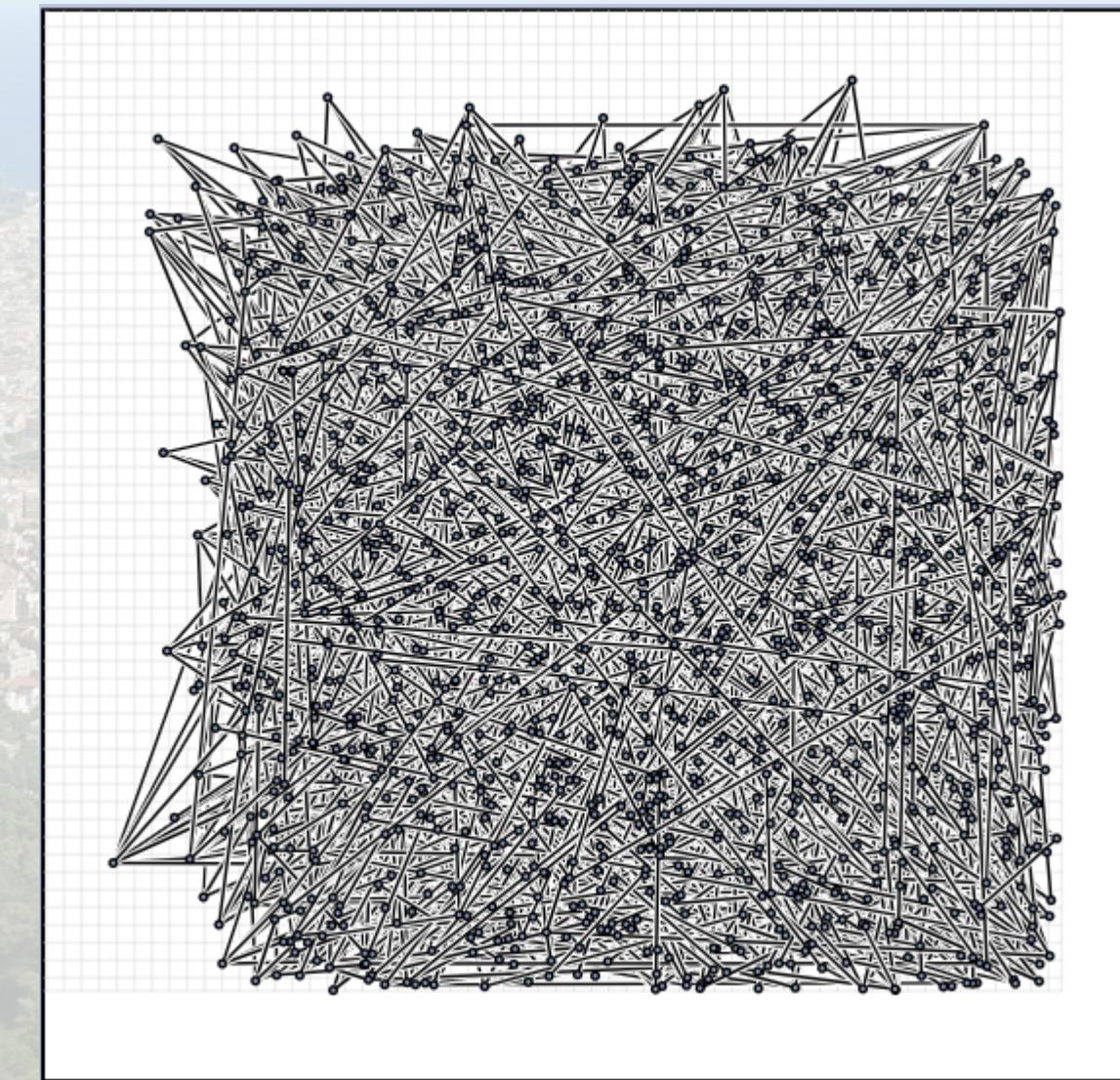
LIVE CHALLENGE

the graphs

gd
g18



graph 13



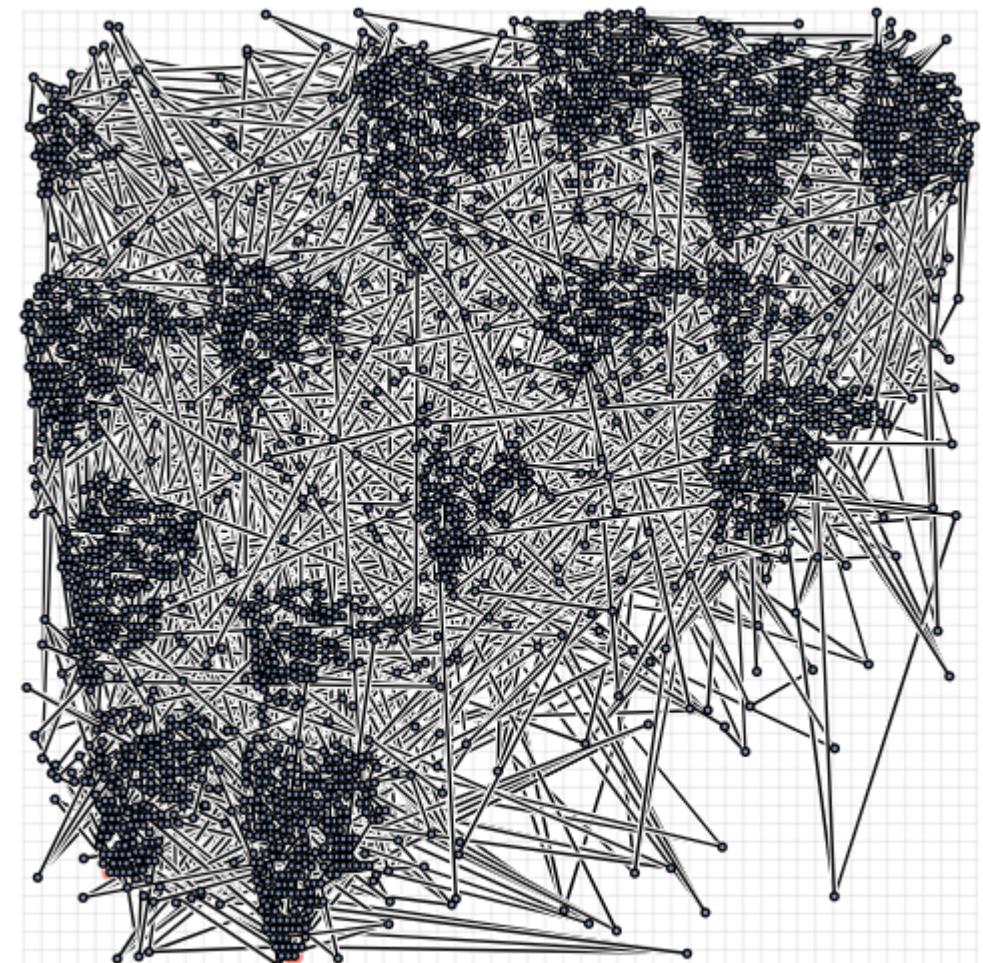
best automatic

LIVE CHALLENGE

the graphs

gd
18

graph 14

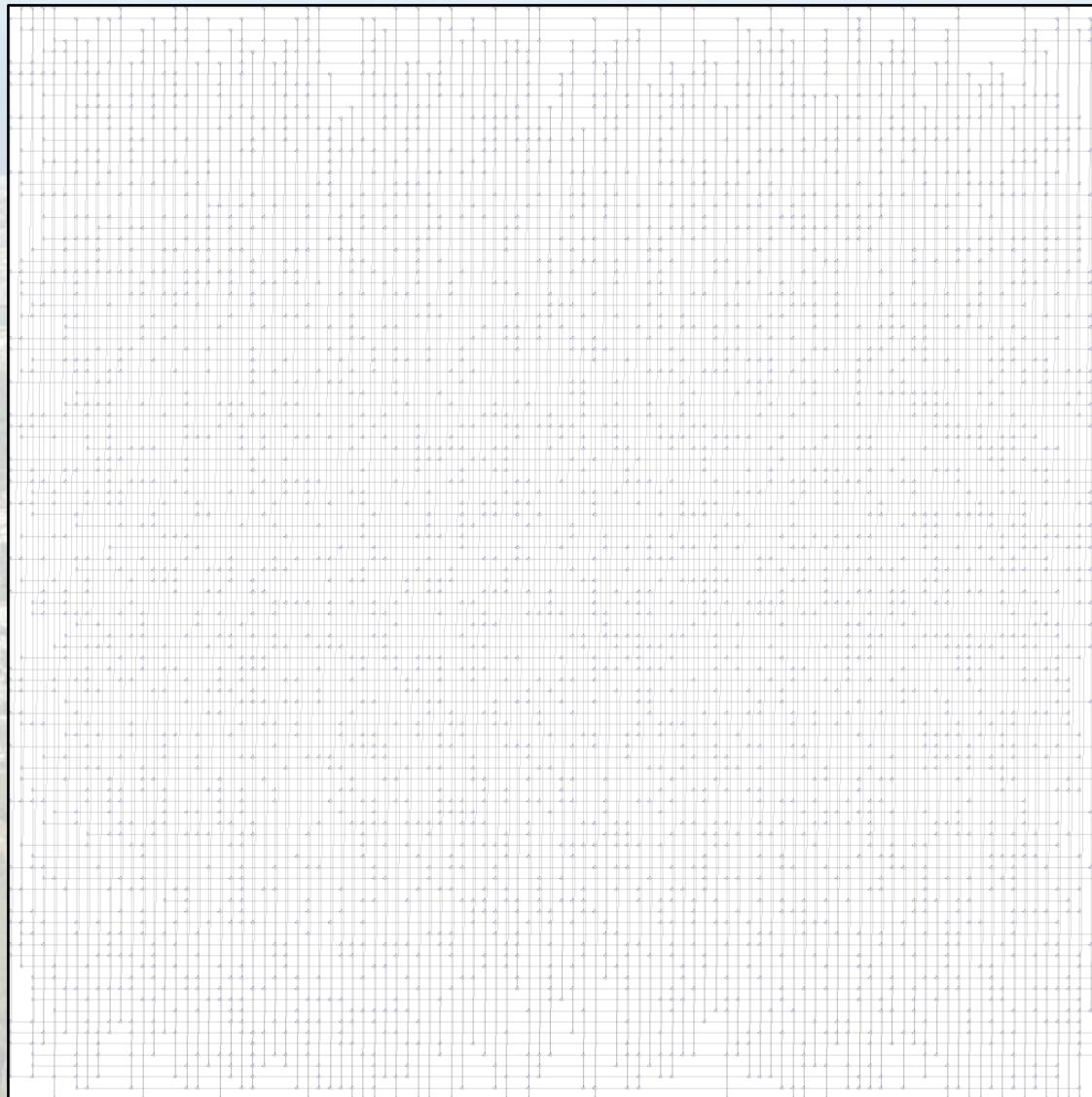


best automatic

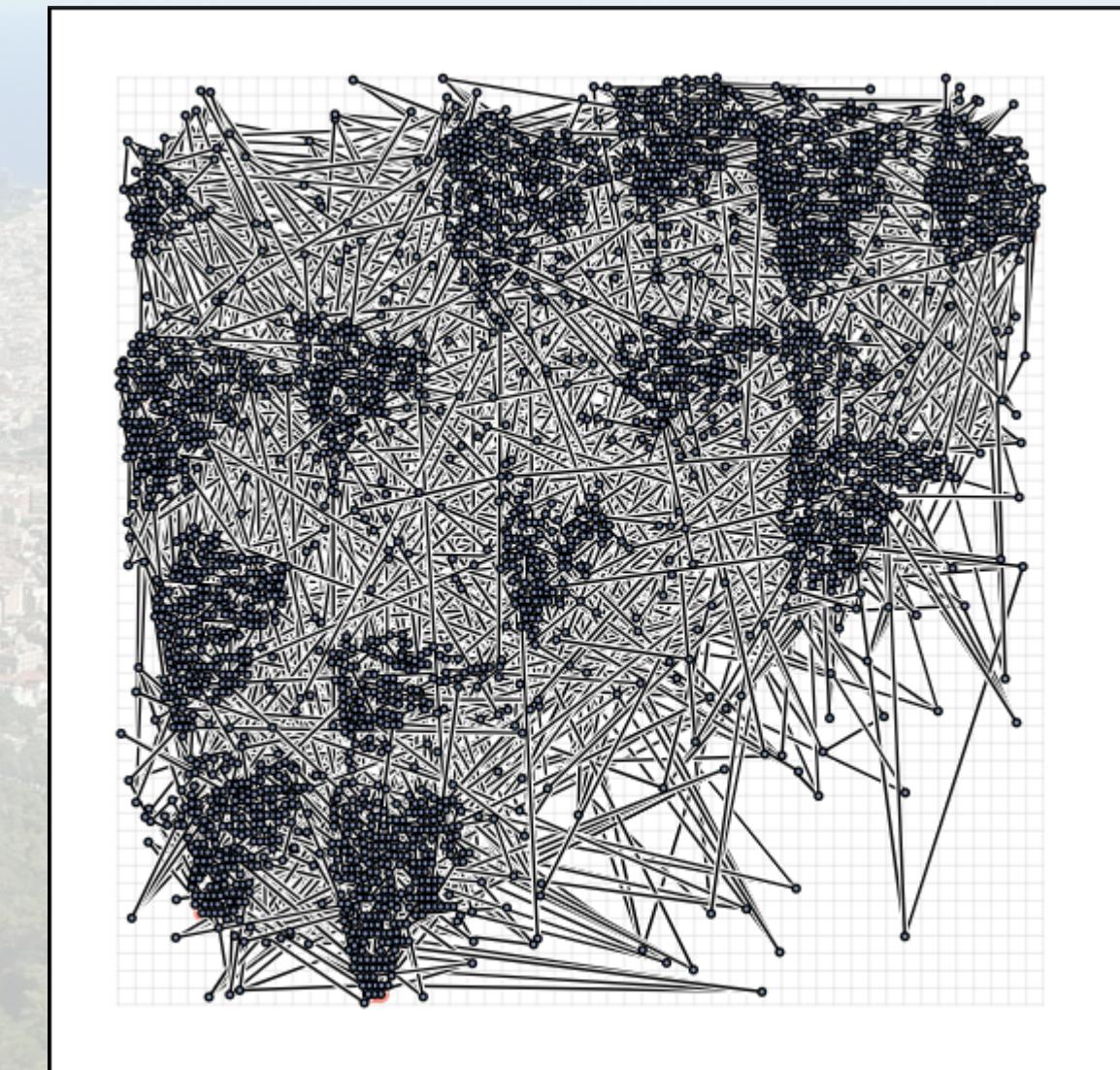
LIVE CHALLENGE

the graphs

gd
18



graph 14



best automatic



LIVE CHALLENGE
manual category

gd
g18

RESULTS



LIVE CHALLENGE
manual category

gd
g18

LIVE CHALLENGE

manual category

gd
g18

graph

OFMO
MaLaRa
PUK
To Be Decided
Over-Aged
NonAustrians
Scho
Rotes Minions
AFT

LIVE CHALLENGE

manual category

gd
g18

| graph | 1 |
|---------------|-----|
| OFMO | 47° |
| MaLaRa | 56° |
| PUK | 58° |
| To Be Decided | 33° |
| Over-Aged | 46° |
| NonAustrians | 43° |
| Scho | 59° |
| Rotes Minions | 42° |
| AFT | 45° |

LIVE CHALLENGE

manual category

gd
18

| graph | 1 | 2 |
|---------------|-----|-----|
| OFMO | 47° | 90° |
| MaLaRa | 56° | 89° |
| PUK | 58° | 90° |
| To Be Decided | 33° | 90° |
| Over-Aged | 46° | 90° |
| NonAustrians | 43° | 90° |
| Scho | 59° | 90° |
| Rotes Minions | 42° | 89° |
| AFT | 45° | 90° |

LIVE CHALLENGE

manual category

gd
18

| graph | 1 | 2 | 3 |
|---------------|-----|-----|-----|
| OFMO | 47° | 90° | 74° |
| MaLaRa | 56° | 89° | 71° |
| PUK | 58° | 90° | 90° |
| To Be Decided | 33° | 90° | 90° |
| Over-Aged | 46° | 90° | 78° |
| NonAustrians | 43° | 90° | 71° |
| Scho | 59° | 90° | 90° |
| Rotes Minions | 42° | 89° | 88° |
| AFT | 45° | 90° | 90° |

LIVE CHALLENGE

manual category

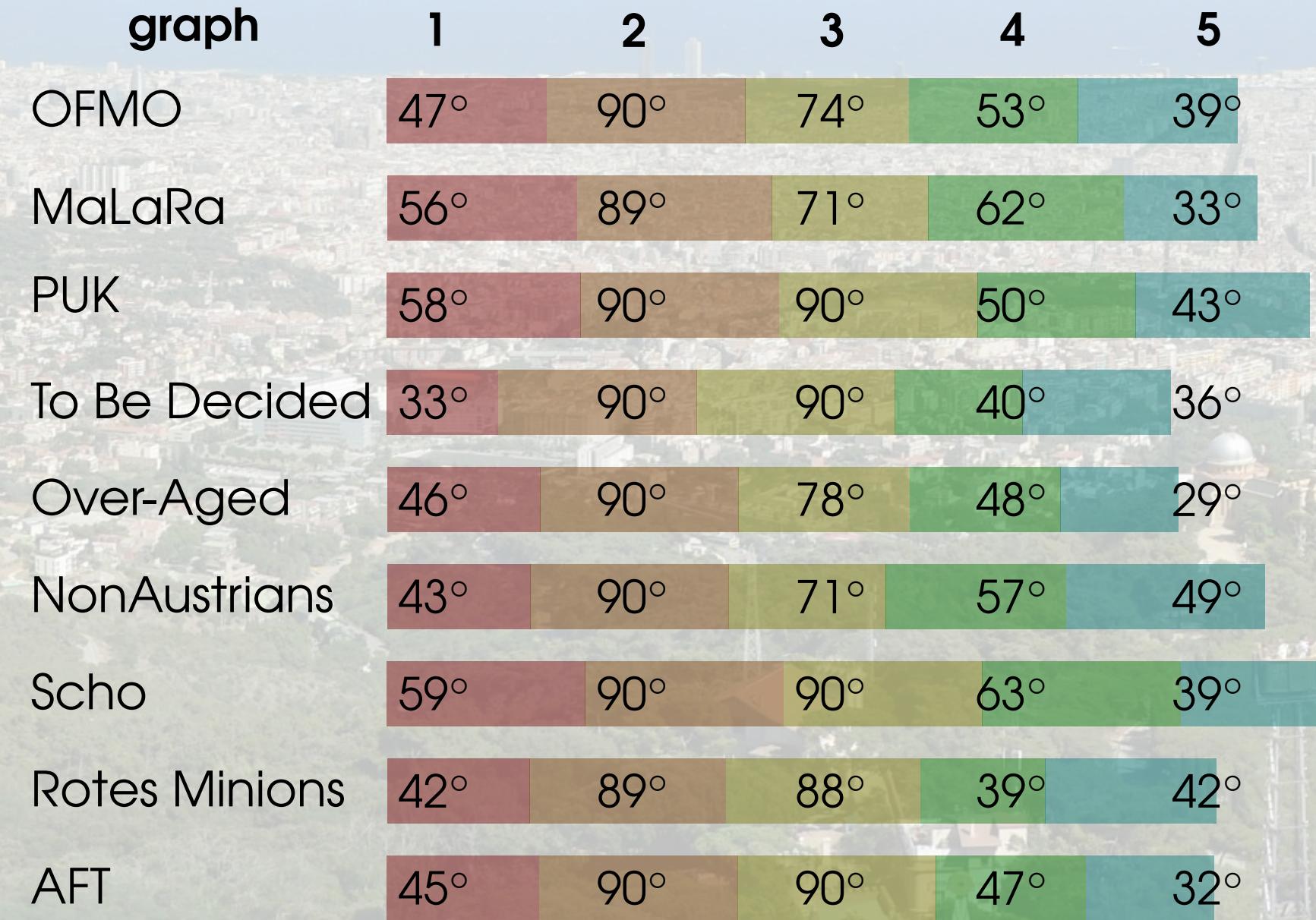
gd
18

| graph | 1 | 2 | 3 | 4 |
|---------------|-----|-----|-----|-----|
| OFMO | 47° | 90° | 74° | 53° |
| MaLaRa | 56° | 89° | 71° | 62° |
| PUK | 58° | 90° | 90° | 50° |
| To Be Decided | 33° | 90° | 90° | 40° |
| Over-Aged | 46° | 90° | 78° | 48° |
| NonAustrians | 43° | 90° | 71° | 57° |
| Scho | 59° | 90° | 90° | 63° |
| Rotes Minions | 42° | 89° | 88° | 39° |
| AFT | 45° | 90° | 90° | 47° |

LIVE CHALLENGE

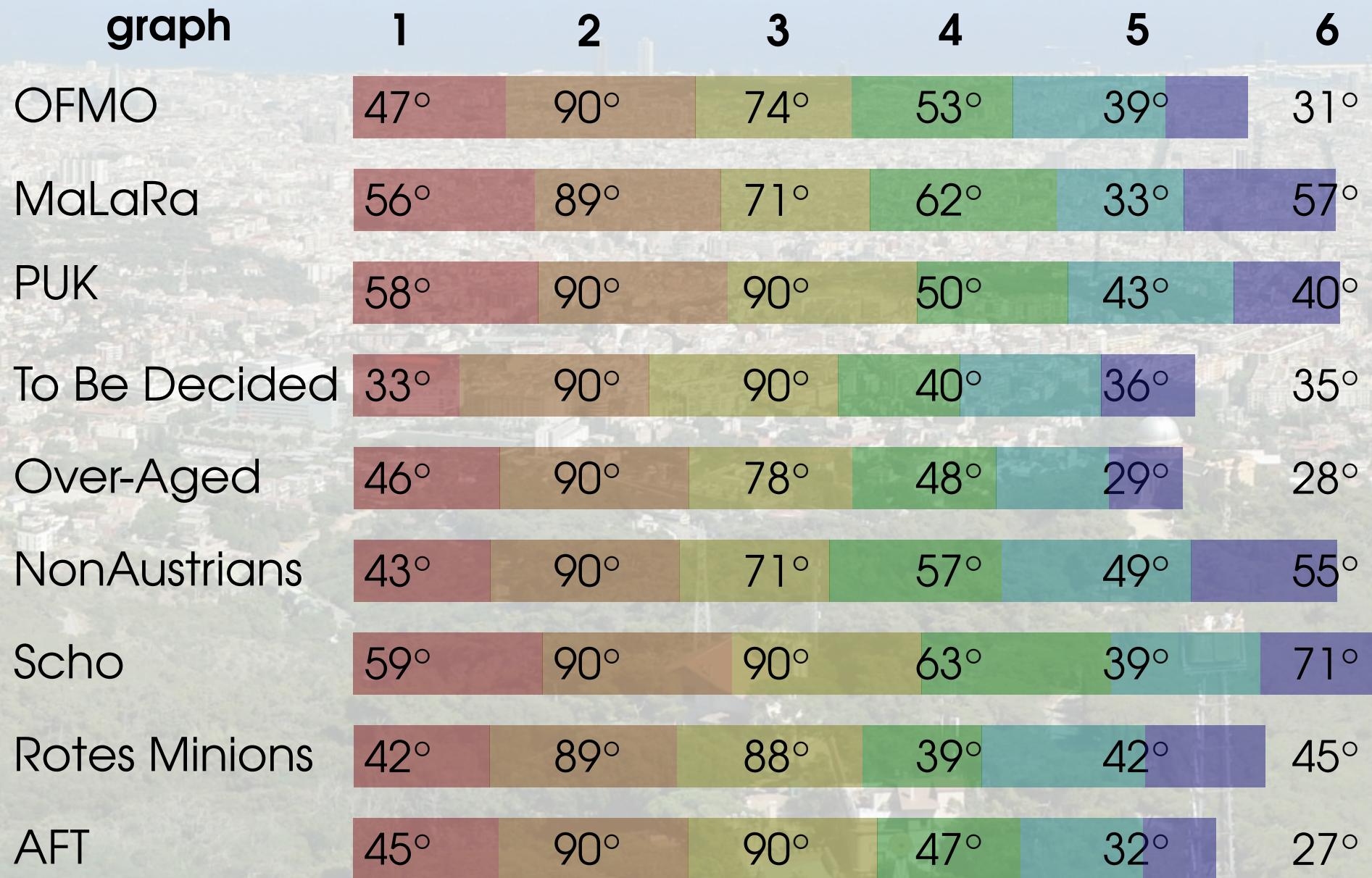
manual category

gd
18



LIVE CHALLENGE

manual category



LIVE CHALLENGE

manual category



| graph | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---------------|-----|-----|-----|-----|-----|-----|-----|
| OFMO | 47° | 90° | 74° | 53° | 39° | 31° | 23° |
| MaLaRa | 56° | 89° | 71° | 62° | 33° | 57° | 22° |
| PUK | 58° | 90° | 90° | 50° | 43° | 40° | 28° |
| To Be Decided | 33° | 90° | 90° | 40° | 36° | 35° | 21° |
| Over-Aged | 46° | 90° | 78° | 48° | 29° | 28° | 33° |
| NonAustrians | 43° | 90° | 71° | 57° | 49° | 55° | 37° |
| Scho | 59° | 90° | 90° | 63° | 39° | 71° | 21° |
| Rotes Minions | 42° | 89° | 88° | 39° | 42° | 45° | 40° |
| AFT | 45° | 90° | 90° | 47° | 32° | 27° | 23° |

LIVE CHALLENGE

automatic category

gd
g18



LIVE CHALLENGE

automatic category

gd
g18

graph

Arizona Anglers
TübingenColdShower
CoffeeVM+
TKMKN

LIVE CHALLENGE

automatic category

gd
g18

graph

1

| | |
|--------------------|-----|
| Arizona Anglers | 49° |
| TübingenColdShower | 87° |
| CoffeeVM+ | 58° |
| TKMKN | |

LIVE CHALLENGE

automatic category

gd
g18

graph

1 2

| | |
|--------------------|---------|
| Arizona Anglers | 49° 86° |
| TübingenColdShower | 87° 90° |
| CoffeeVM+ | 58° 90° |
| TKMKN | 15° |

LIVE CHALLENGE

automatic category

gd
g18

graph 1 2 3

Arizona Anglers 

TübingenColdShower 

CoffeeVM+ 

TKMKN 

LIVE CHALLENGE

automatic category

gd
g18

graph 1 2 3 4

Arizona Anglers 49° 86° 87° 37°

TübingenColdShower 87° 90° 88° 88°

CoffeeVM+ 58° 90° 85° 60°

TKMKN 15° 87°

LIVE CHALLENGE

automatic category

gd
18

graph 1 2 3 4 5

Arizona Anglers 

TübingenColdShower 

CoffeeVM+ 

TKMKN 

LIVE CHALLENGE

automatic category

gd
18

graph 1 2 3 4 5 6

Arizona Anglers 

TübingenColdShower 

CoffeeVM+ 

TKMKN 

LIVE CHALLENGE

automatic category

gd
18

graph 1 2 3 4 5 6 7

| | | | | | | | |
|--------------------|-----|-----|-----|-----|-----|-----|-----|
| Arizona Anglers | 49° | 86° | 87° | 37° | 30° | 41° | 25° |
| TübingenColdShower | 87° | 90° | 88° | 88° | 71° | 89° | 80° |
| CoffeeVM+ | 58° | 90° | 85° | 60° | 48° | 71° | 43° |
| TKMKN | 15° | 87° | | | | | |

LIVE CHALLENGE

automatic category

gd
g18

graph 1 2 3 4 5 6 7 8

| | | | | | | | | |
|--------------------|-----|-----|-----|-----|-----|-----|-----|-----|
| Arizona Anglers | 49° | 86° | 87° | 37° | 30° | 41° | 25° | 4° |
| TübingenColdShower | 87° | 90° | 88° | 88° | 71° | 89° | 80° | 34° |
| CoffeeVM+ | 58° | 90° | 85° | 60° | 48° | 71° | 43° | 27° |
| TKMKN | 15° | 87° | | | | | | |

LIVE CHALLENGE

automatic category

gd
g18

graph 1 2 3 4 5 6 7 8 9

Arizona Anglers 49° 86° 87° 37° 30° 41° 25° 4° 28°

TübingenColdShower 87° 90° 88° 88° 71° 89° 80° 34° 77°

CoffeeVM+ 58° 90° 85° 60° 48° 71° 43° 27° 60°

TKMKN 15° 87°

LIVE CHALLENGE

automatic category



LIVE CHALLENGE

automatic category



graph

1 2 3 4 5 6 7 8 9 10 11

Arizona Anglers



| Temperature Range | Number of Anglers |
|-------------------|-------------------|
| 49° | 100 |
| 86° | 100 |
| 87° | 100 |
| 37° | 100 |
| 30° | 100 |
| 41° | 100 |
| 25° | 100 |
| 4° | 100 |
| 28° | 100 |
| 3° | 100 |
| 1° | 100 |

Tübingen Cold Shower 87° 90° 88° 88° 71° 89° 80° 34° 77° 13° 11°

CoffeeVM+ 58° 90° 85° 60° 48° 71° 43° 27° 60° 19° 22°

TKMKN 15° 87°

LIVE CHALLENGE

automatic category



graph

1 2 3 4 5 6 7 8 9 10 11 12

Arizona Anglers

| Location | Latitude |
|----------|--------------|
| 49° | Red |
| 86° | Orange |
| 87° | Yellow |
| 37° | Green |
| 30° | Blue |
| 41° | Purple |
| 25° | Pink |
| 4° | Light Green |
| 28° | Yellow-Green |
| 3° | Light Blue |
| 1° | Cyan |

49° 86° 87° 37° 30° 41° 25° 4° 28° 3° 1°

Tübingen Cold Shower 87° 90° 88° 88° 71° 89° 80° 34° 77° 13° 11° 74°

87° 90° 88° 88° 71° 89° 80° 34° 77° 13° 11° 74°

CoffeeVM+ 58° 90° 85° 60° 48° 71° 43° 27° 60° 19° 22° 9°

58° 90° 85° 60° 48° 71° 43° 27° 60° 19° 22° 9°

TKMKN 15° 87° 72°

LIVE CHALLENGE

automatic category



graph

1 2 3 4 5 6 7 8 9 10 11 12 13

Arizona Anglers

49° 86° 87° 37° 30° 41° 25° 4° 28° 3° 1°

TübingenColdShower

87° 90° 88° 88° 71° 89° 80° 34° 77° 13° 11° 74° 2°

CoffeeVM+

58° 90° 85° 60° 48° 71° 43° 27° 60° 19° 22° 9° 2°

TKMKN

15° 87° 72°

LIVE CHALLENGE

automatic category



graph

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
|--|---|---|---|---|---|---|---|---|---|----|----|----|----|----|
|--|---|---|---|---|---|---|---|---|---|----|----|----|----|----|

| | | | | | | | | | | | | | | |
|--------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|----|-----|
| Arizona Anglers | 49° | 86° | 87° | 37° | 30° | 41° | 25° | 4° | 28° | 3° | 1° | | | |
| TübingenColdShower | 87° | 90° | 88° | 88° | 71° | 89° | 80° | 34° | 77° | 13° | 11° | 74° | 2° | 3° |
| CoffeeVM+ | 58° | 90° | 85° | 60° | 48° | 71° | 43° | 27° | 60° | 19° | 22° | 9° | 2° | 11° |
| TKMKN | | 15° | 87° | | | | | | | | | 72° | | |

GRAPH DRAWING CONTEST

2019 announcement



Announcement of Tasks

GRAPH DRAWING CONTEST

2019 creative topic #1



GRAPH DRAWING CONTEST

2019 creative topic #1



Marvel Cinematic Universe Graph

vertices are characters and movies
character-movie
edges indicate
appearance in a
movie
movie-movie
edges encode
successor
relations

GRAPH DRAWING CONTEST

2019 creative topic #1

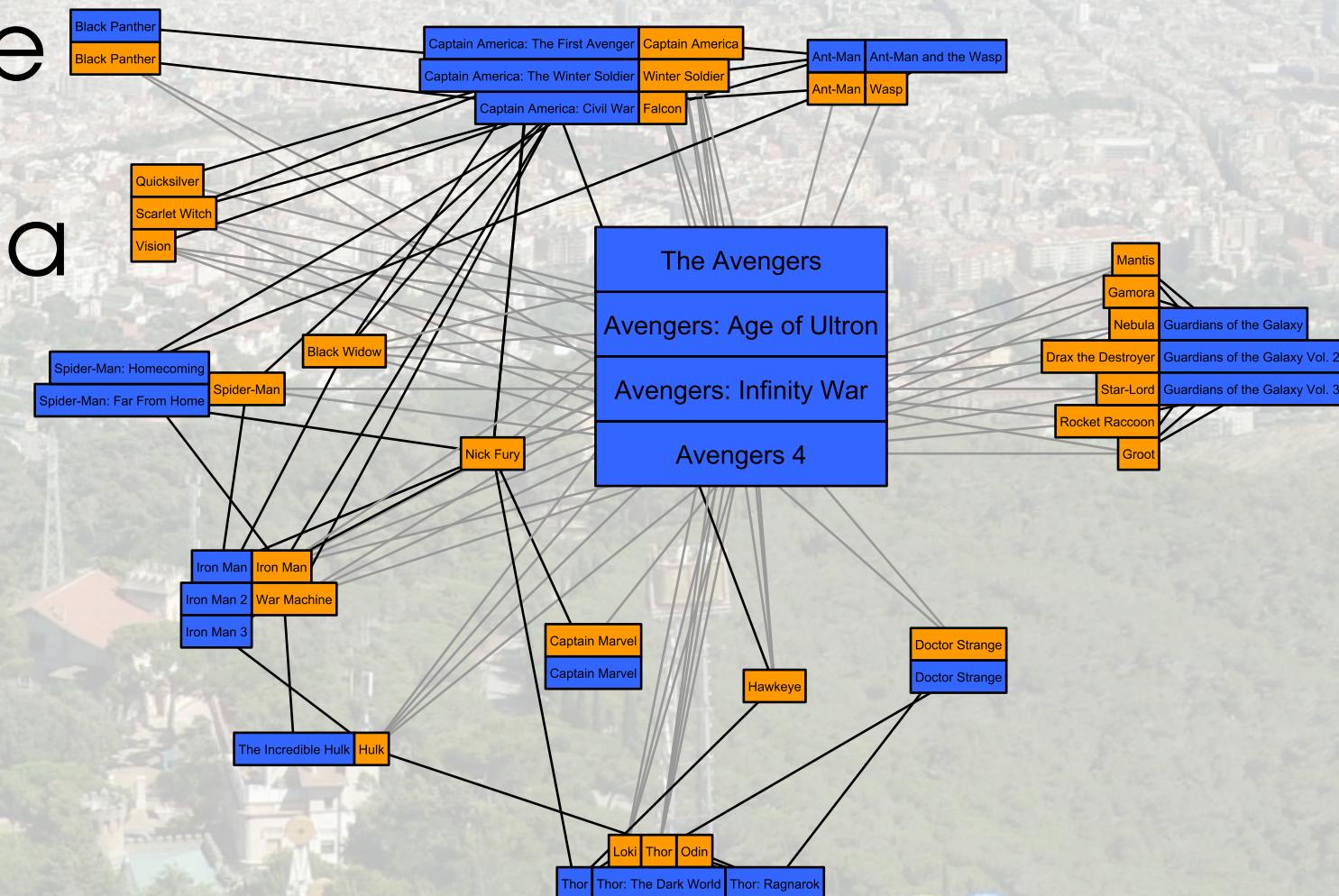
gd 518

Marvel Cinematic Universe Graph

vertices are characters and movies

character-movie
edges indicate
appearance in a
movie

movie-movie
edges encode
successor
relations



GRAPH DRAWING CONTEST

2019 creative topic #2

gd
18



GRAPH DRAWING CONTEST

2019 creative topic #2



The Meal Database Ingredient Graph

vertices are ingredients and dishes
edges are ingredient presence in dishes
dishes have additional *region* attribute

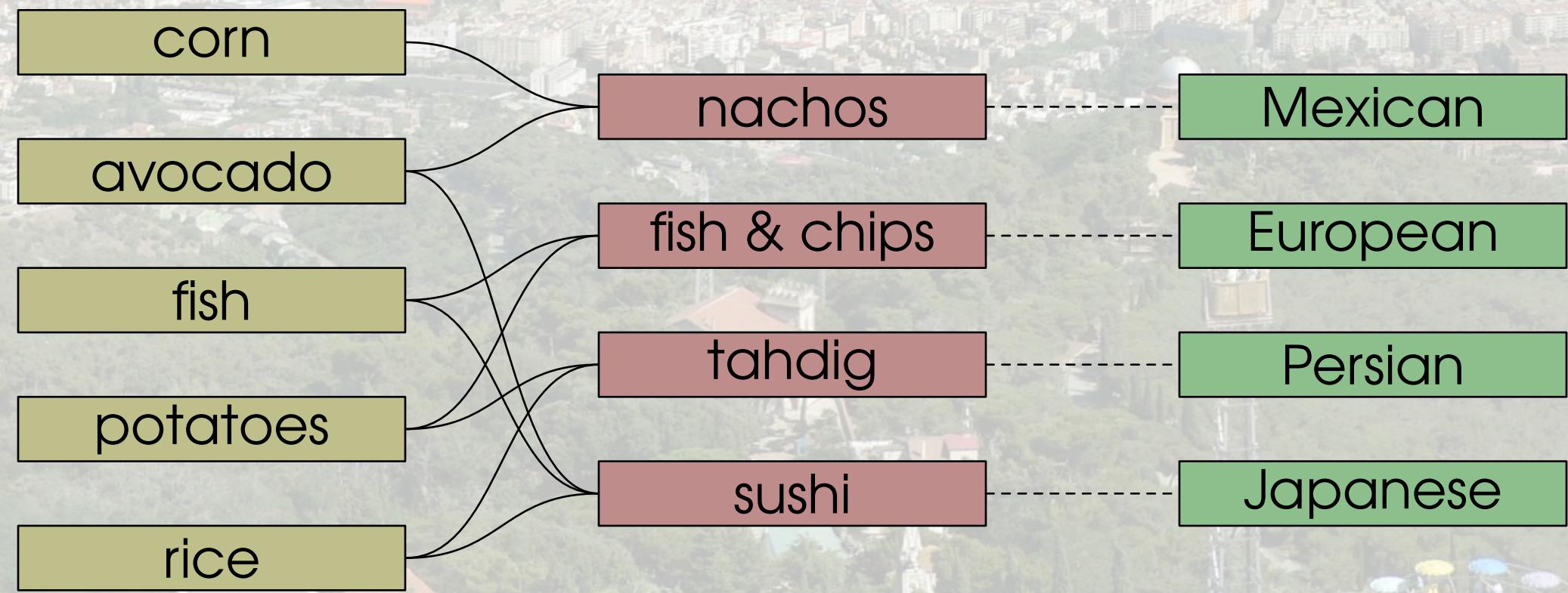
GRAPH DRAWING CONTEST

2019 creative topic #2



The Meal Database Ingredient Graph

vertices are ingredients and dishes
edges are ingredient presence in dishes
dishes have additional *region* attribute



GRAPH DRAWING CONTEST

2019 live challenge



GRAPH DRAWING CONTEST

2019 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

GRAPH DRAWING CONTEST

2019 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

