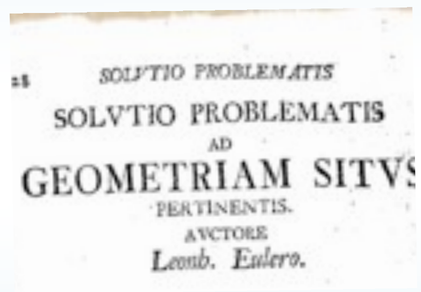
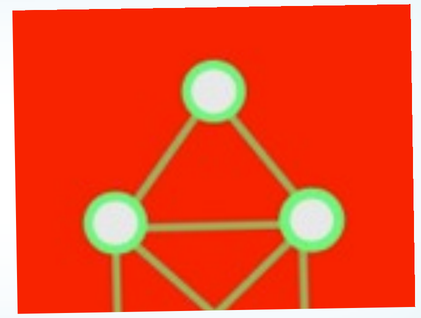

SOLVTIO PROBLEMATIS

SOLVTIO PROBLEMATIS
AD
GEOMETRIAM SITVS
PERTINENTIS.
AVCTORE
Leonh. Eulero.



Kapitel 2: Graphen

Algorithmen und Datenstrukturen
WS 2016/17

Prof. Dr. Sándor Fekete

Konzentration

2.1 Historie: Ein Mathematiker geht spazieren

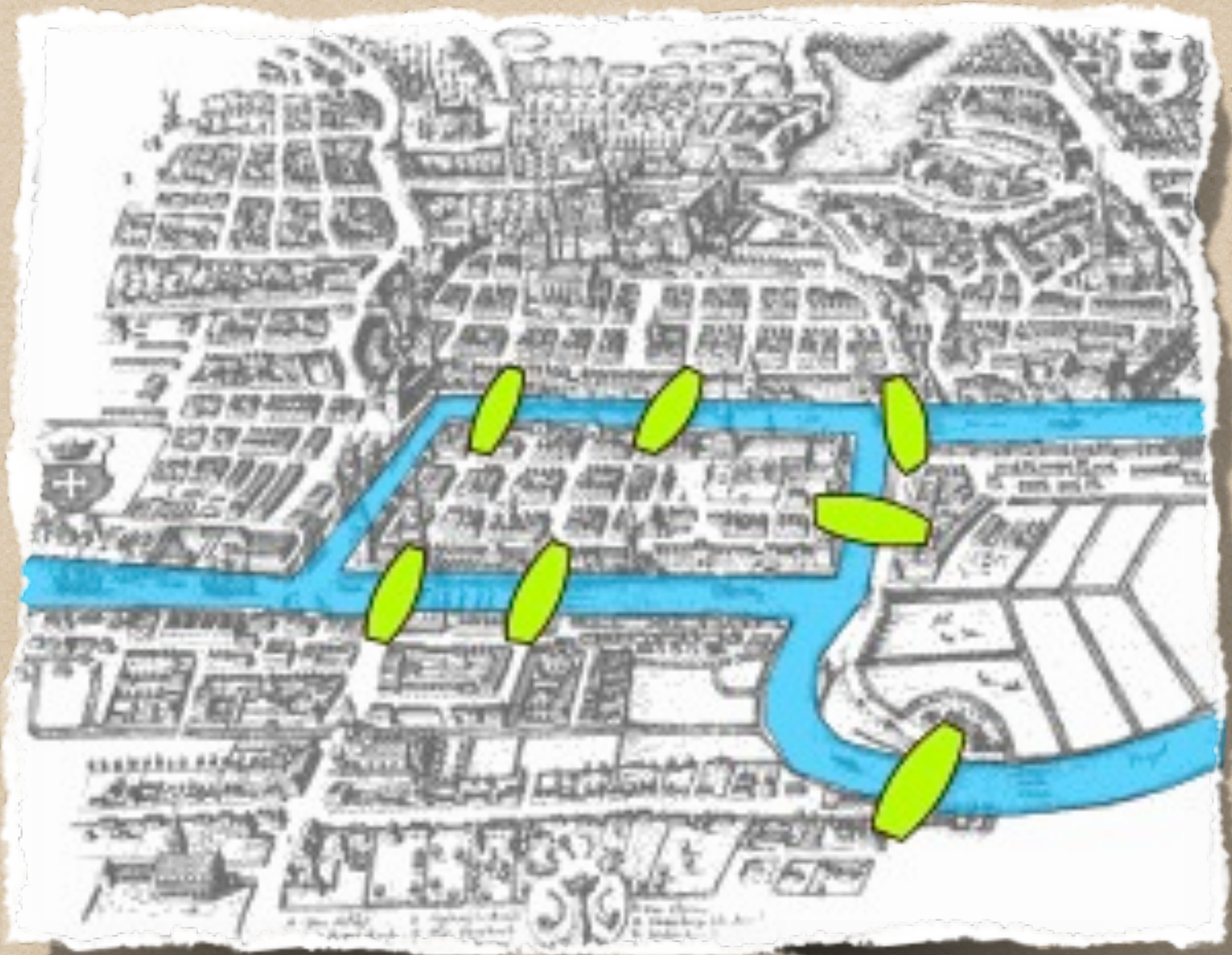
Carl Friedrich Gauß (1777-1855)

2.1 Historie: Ein Mathematiker geht spazieren

Leonhard Euler (1707-1783)

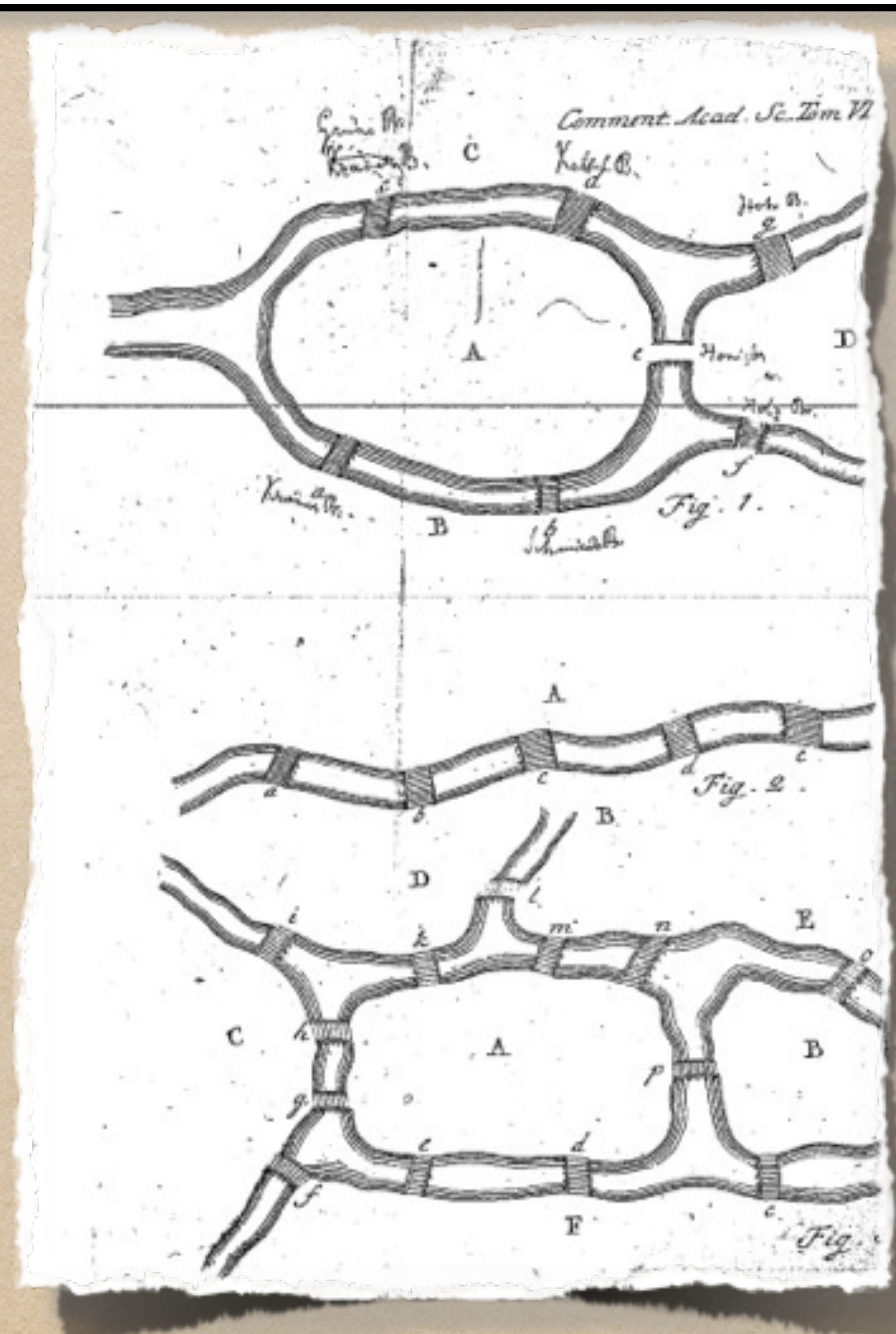
2.1 Historie: Ein Mathematiker geht spazieren

2.1 Historie: Ein Mathematiker geht spazieren



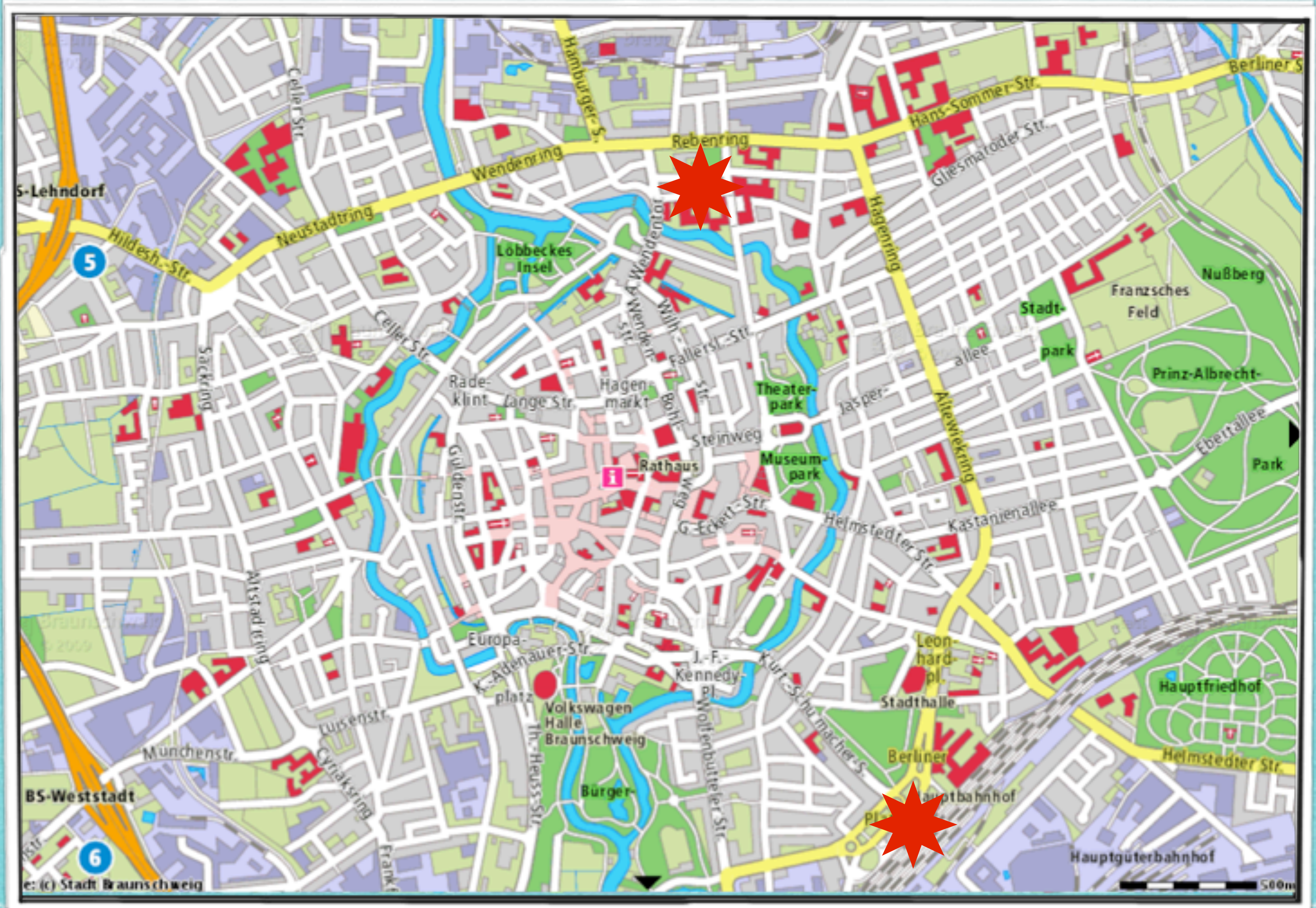
Königsberg und seine 7 Brücken

2.1 Historie: Ein Mathematiker geht spazieren



Wie kommt man zur TU?

Wie kommt man zur TU?



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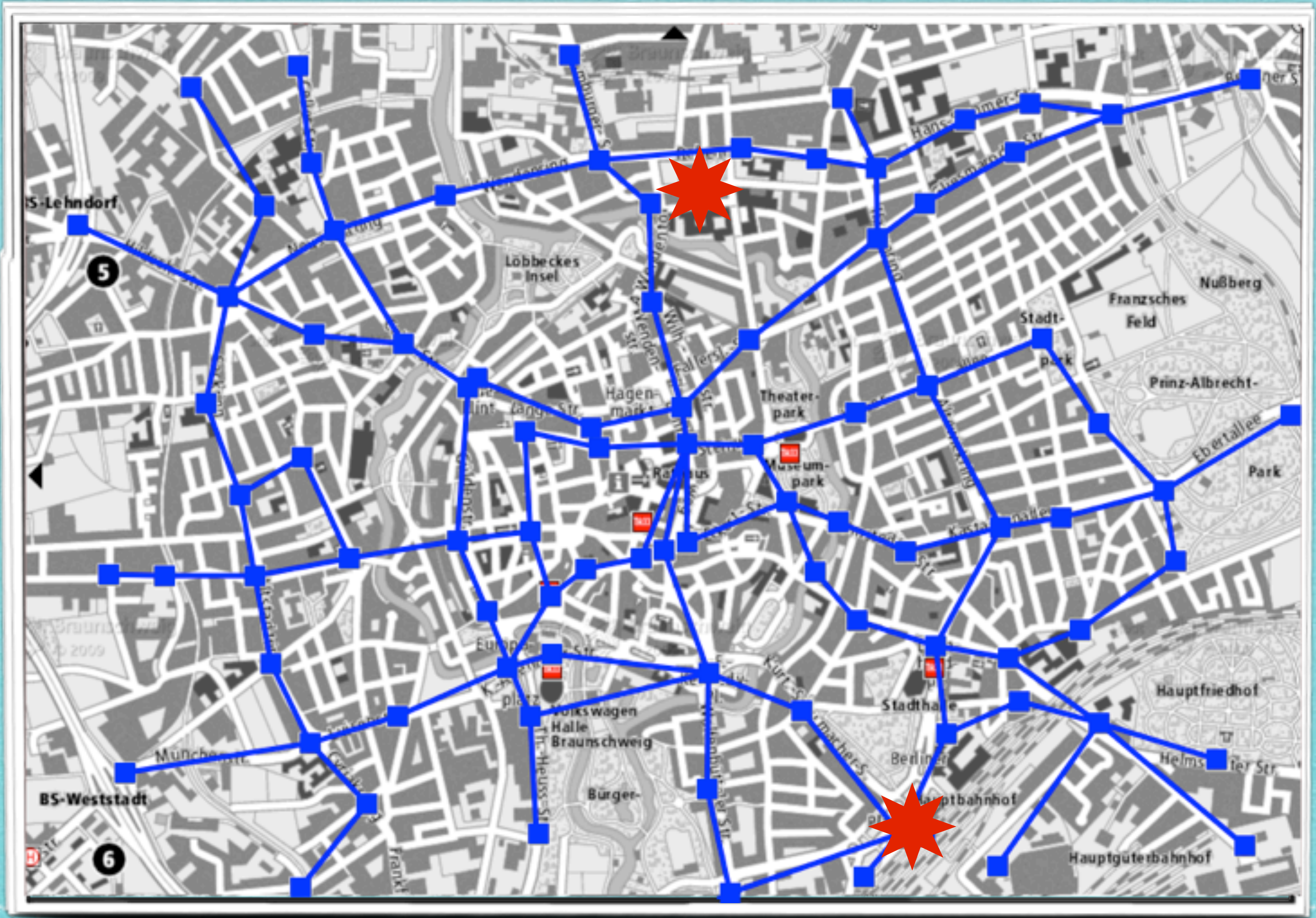
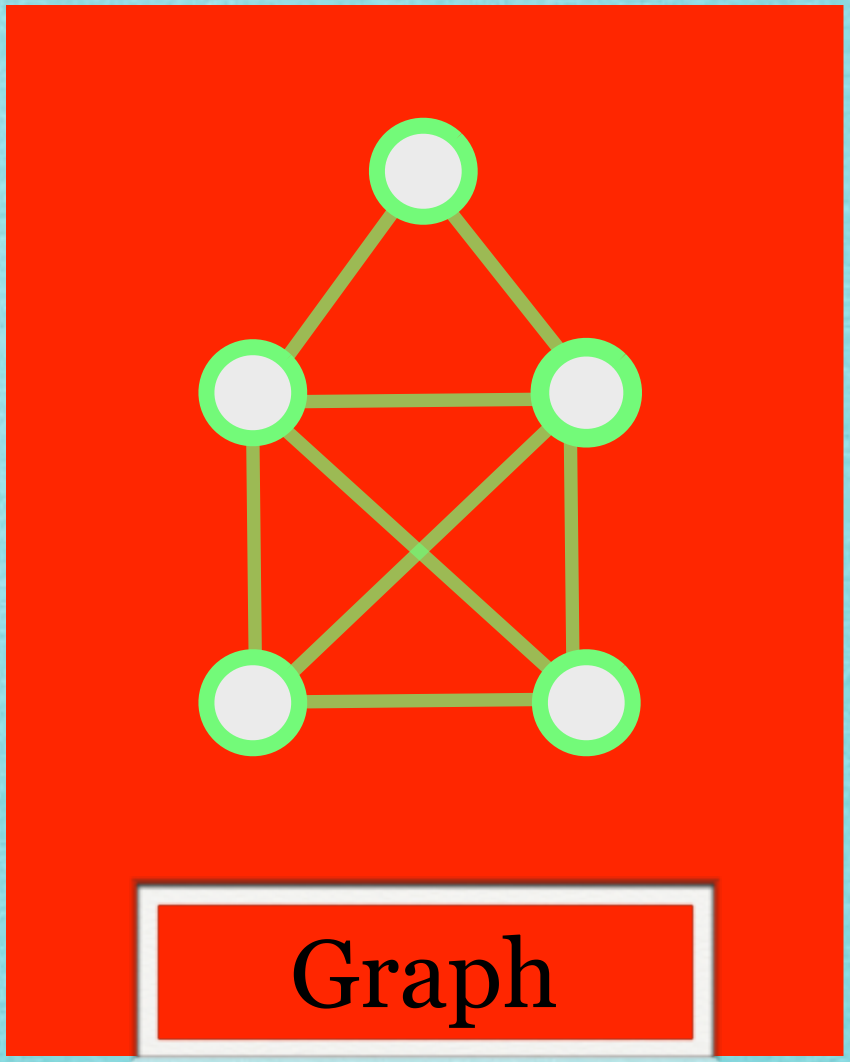


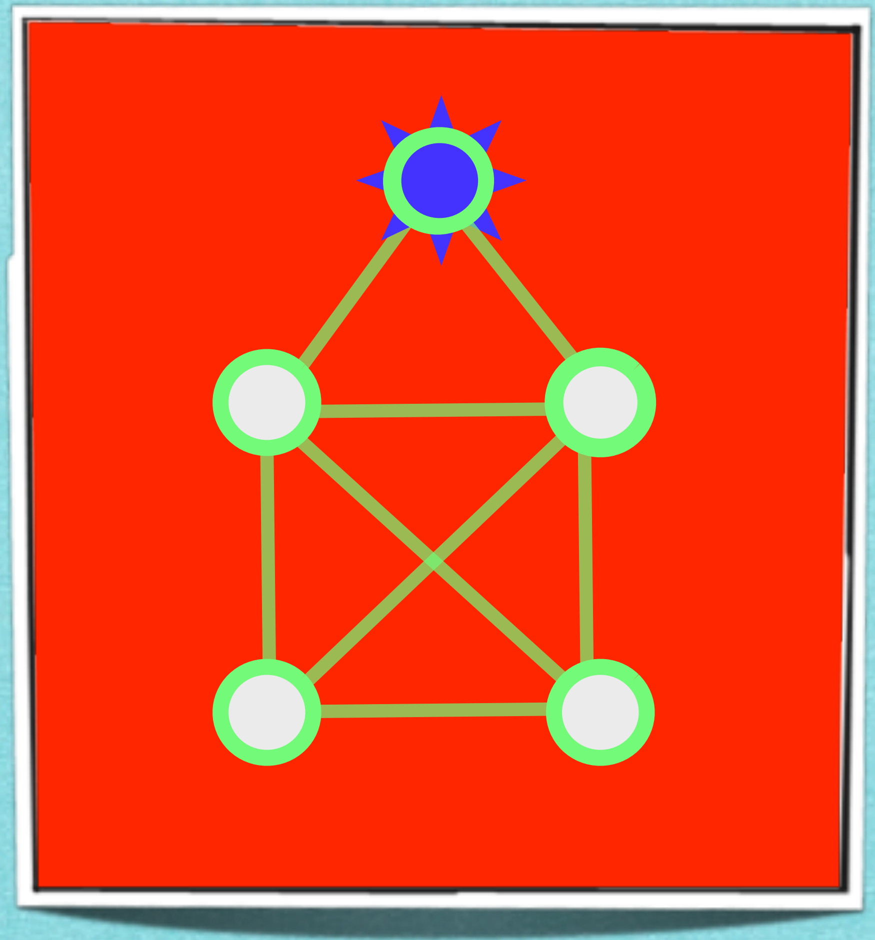
Gestatten, Graph!



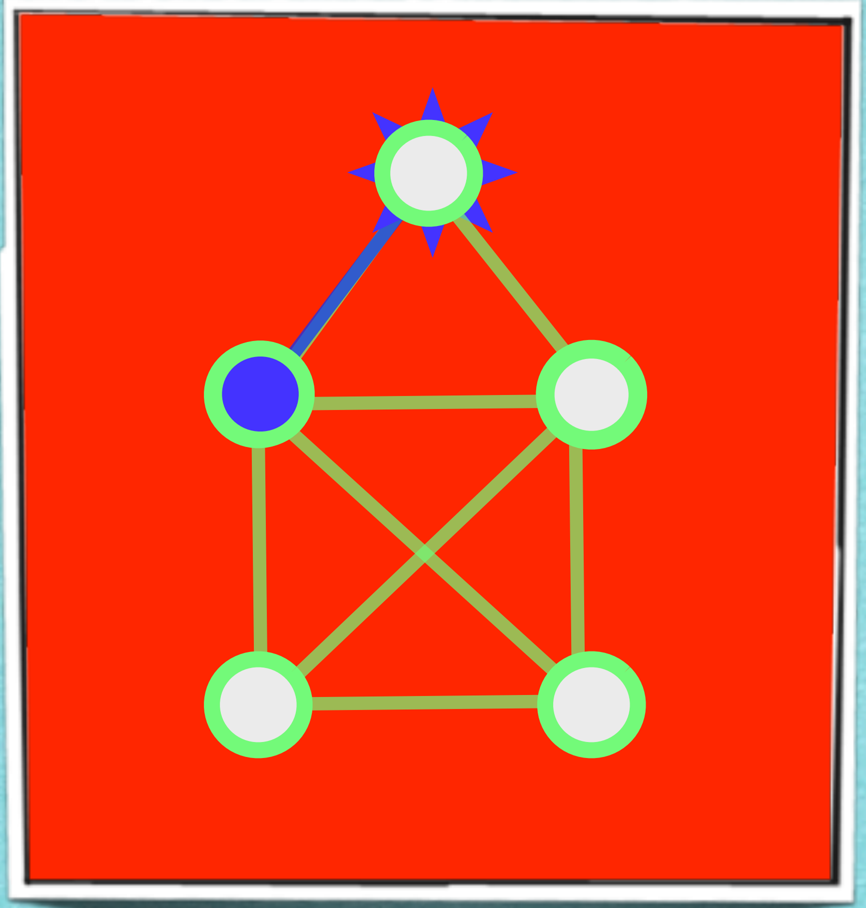
Graph: Ein Gebilde aus Knoten (Haltestellen) und Kanten (Verbindungen)

Das Haus des Nikolaus

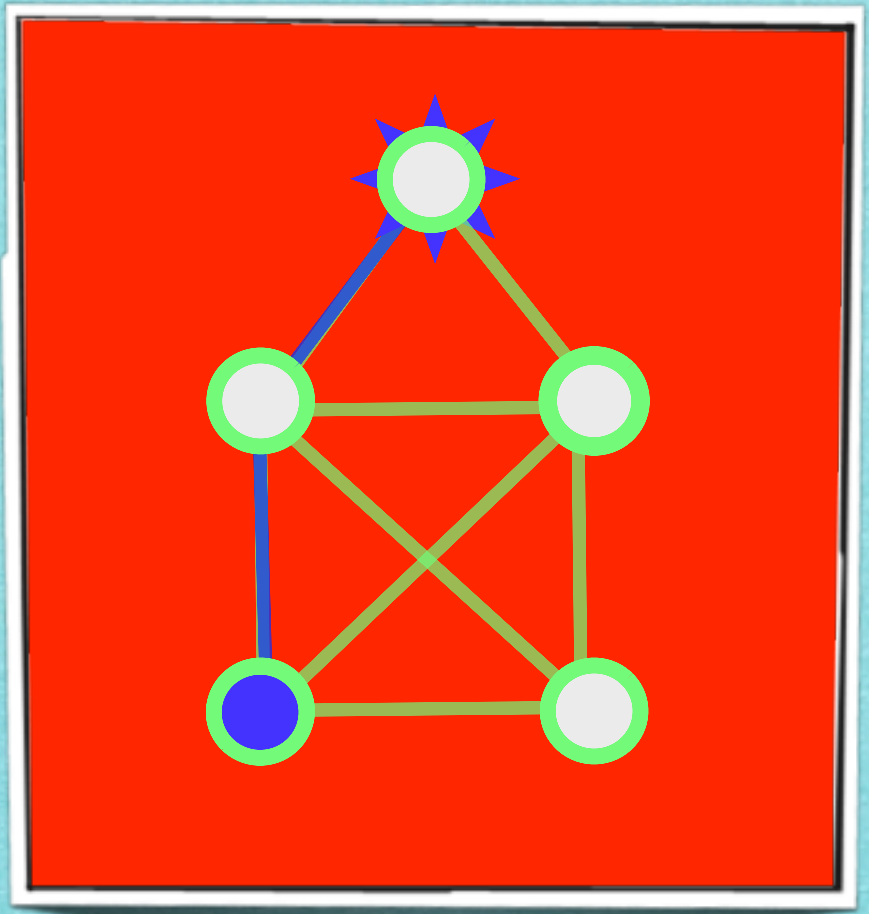
Das Haus des Nikolaus



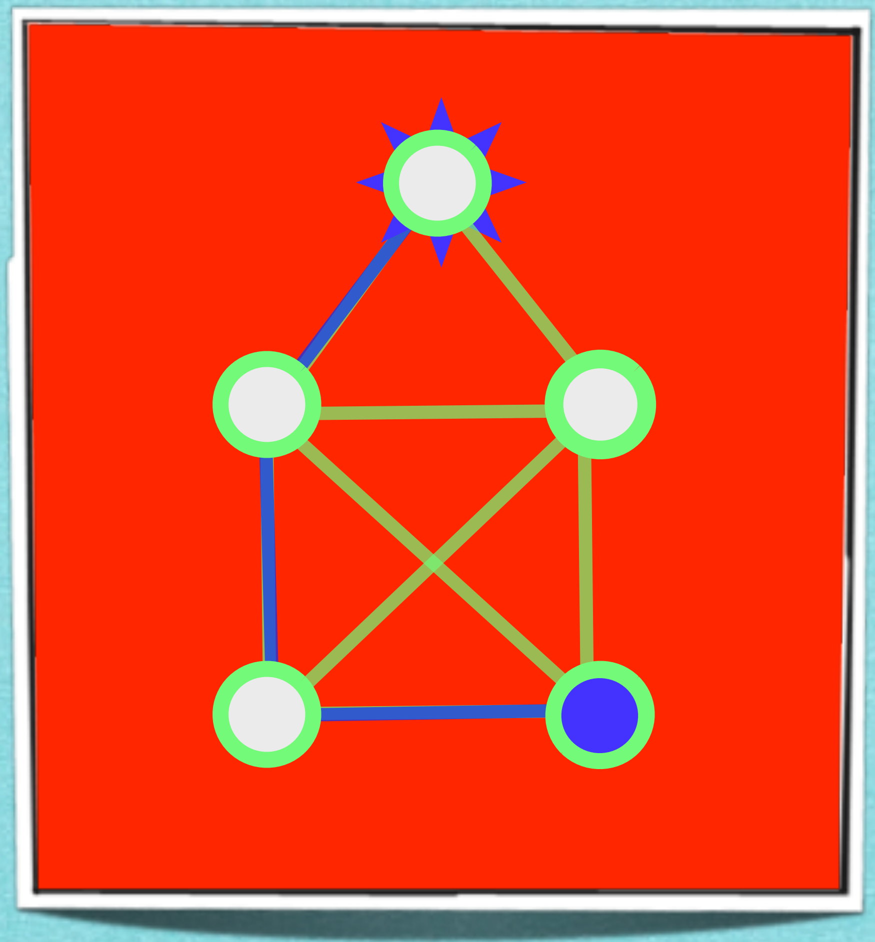
Das Haus des Nikolaus



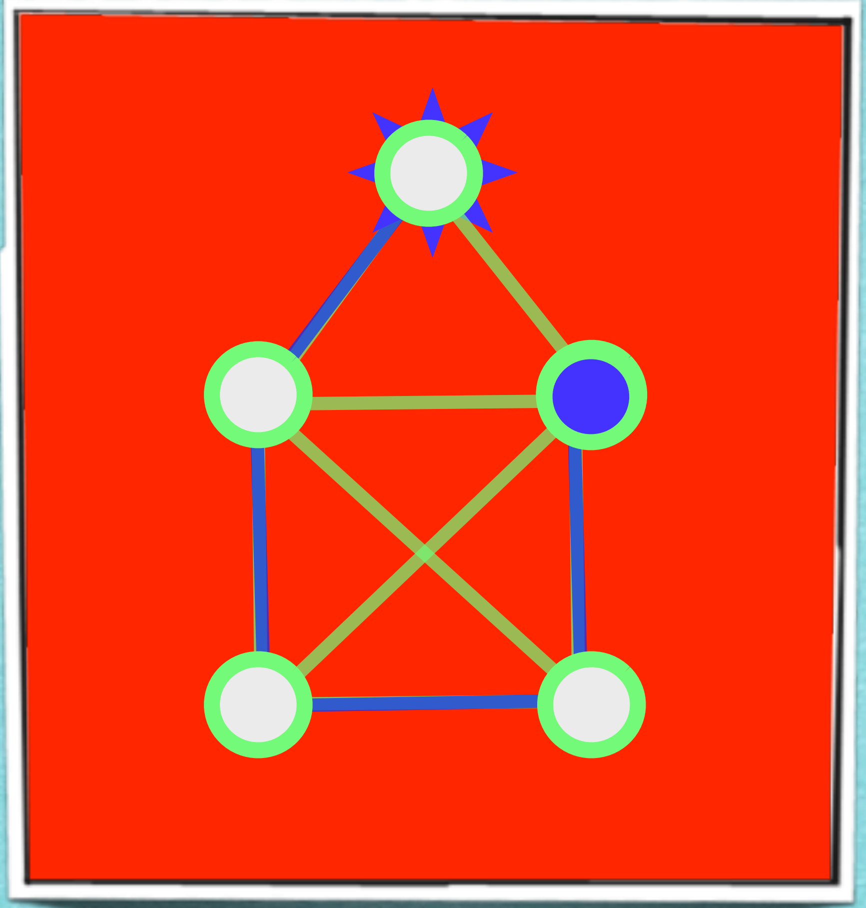
Das Haus des Nikolaus



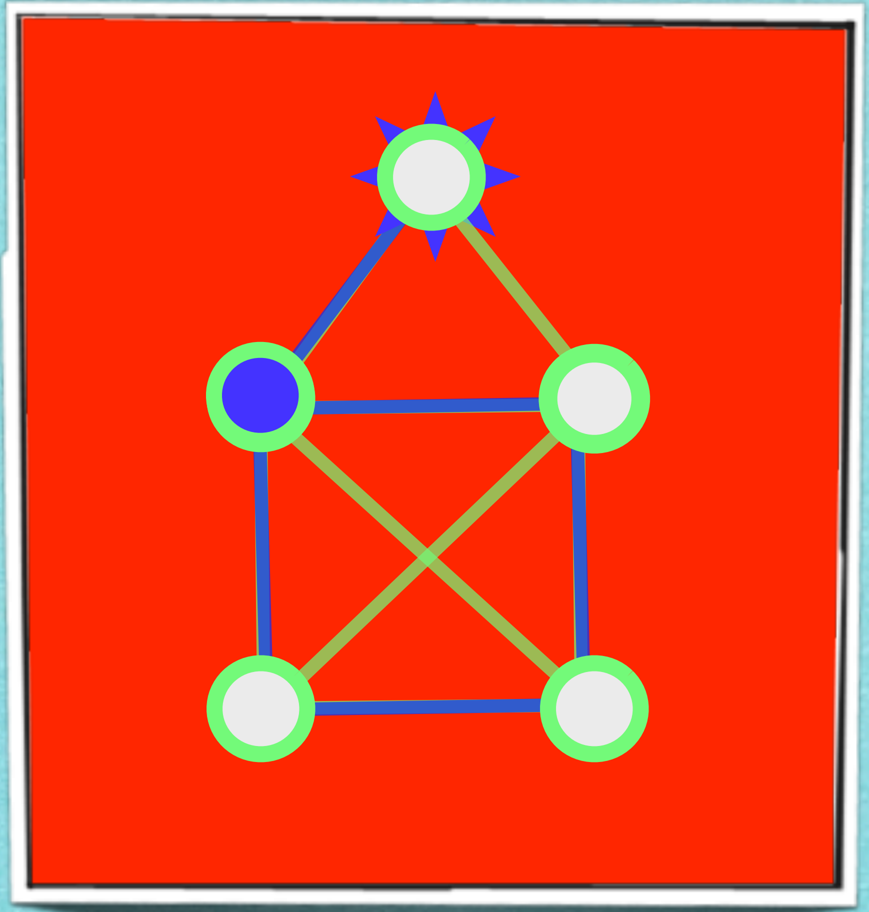
Das Haus des Nikolaus



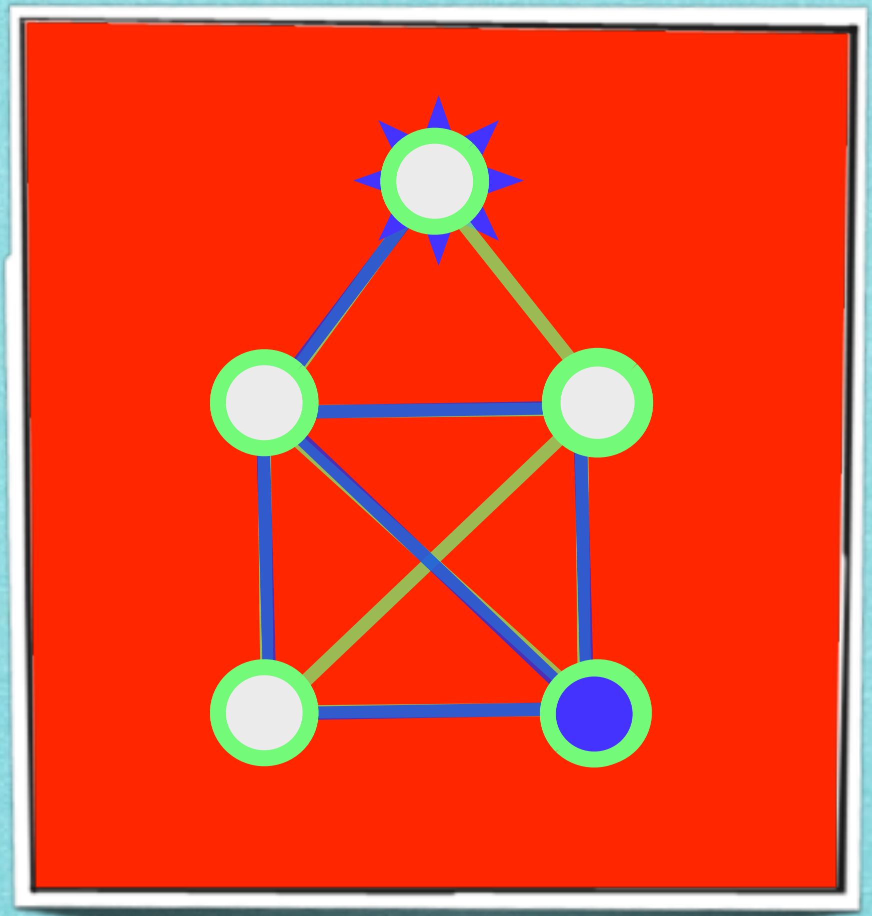
Das Haus des Nikolaus



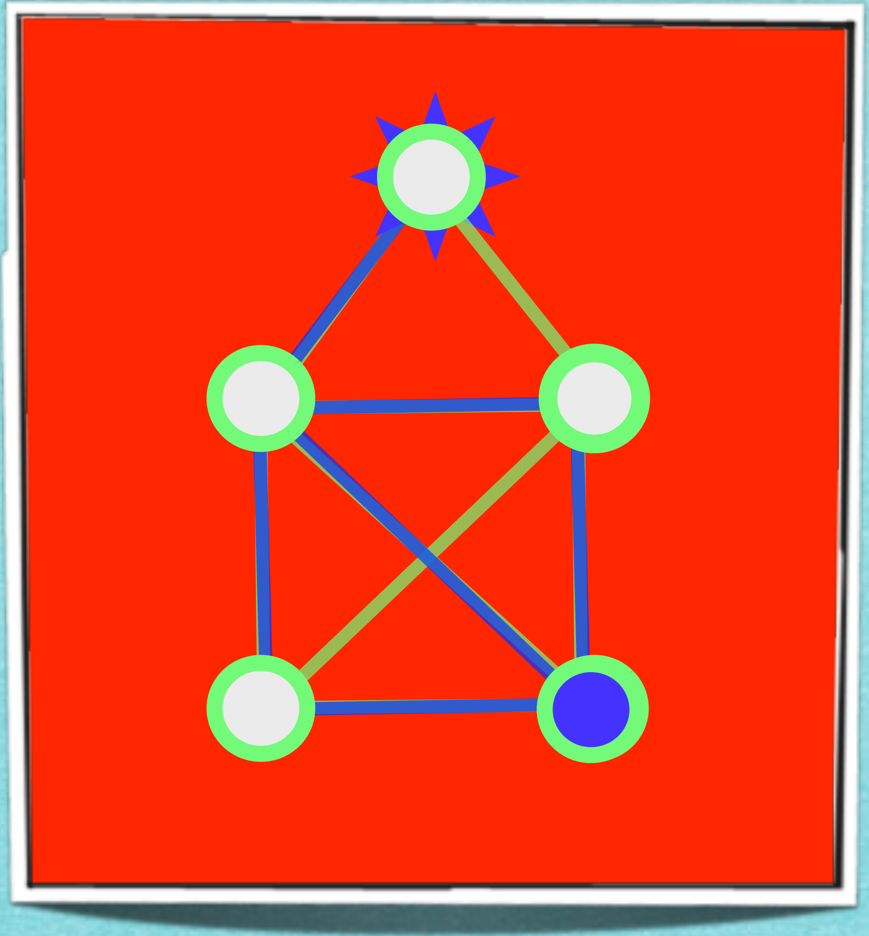
Das Haus des Nikolaus



Das Haus des Nikolaus

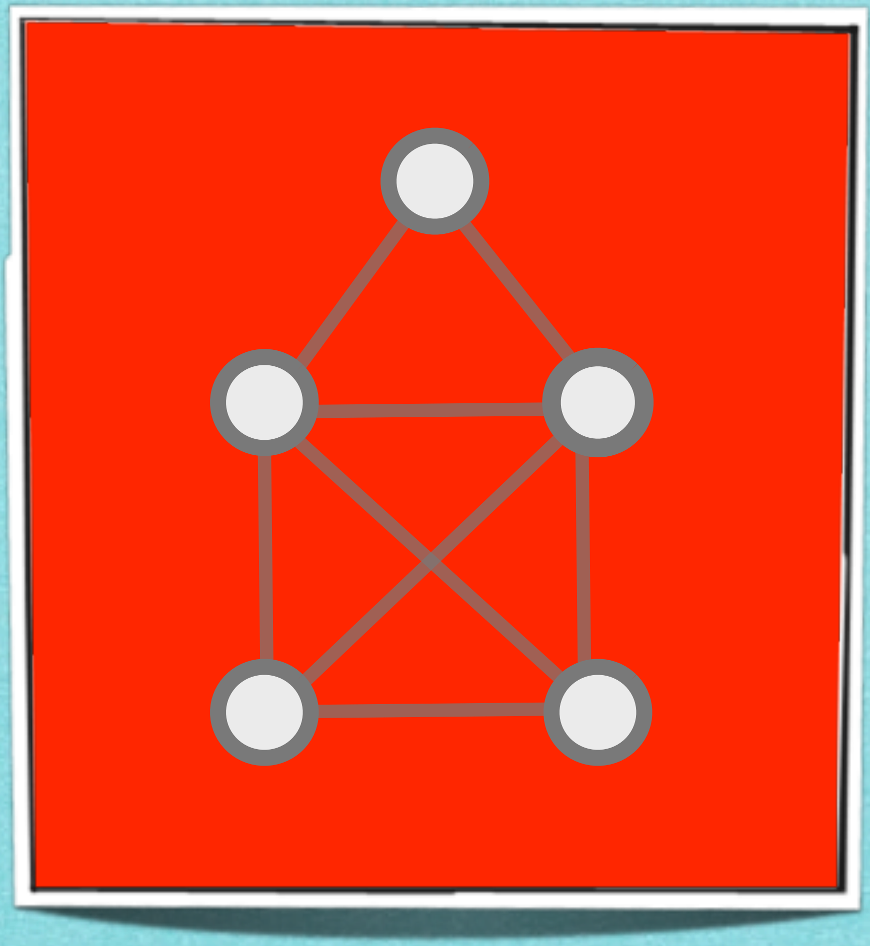


Das Haus des Nikolaus



Klappt so nicht...

Das Haus des Nikolaus



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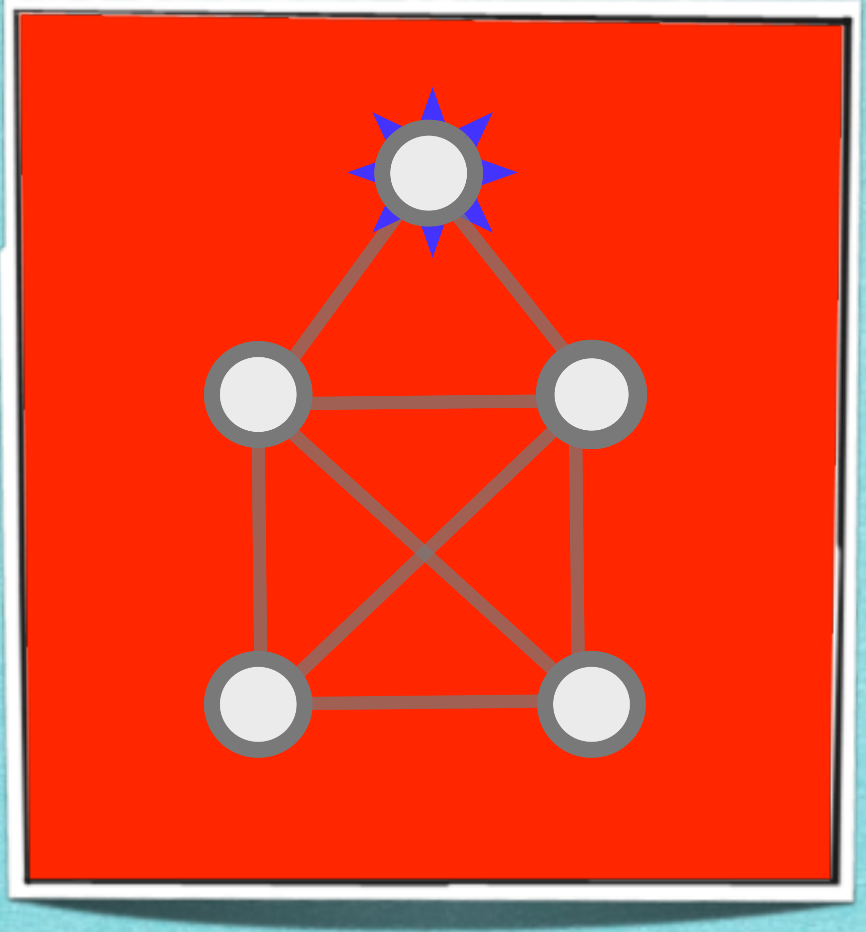
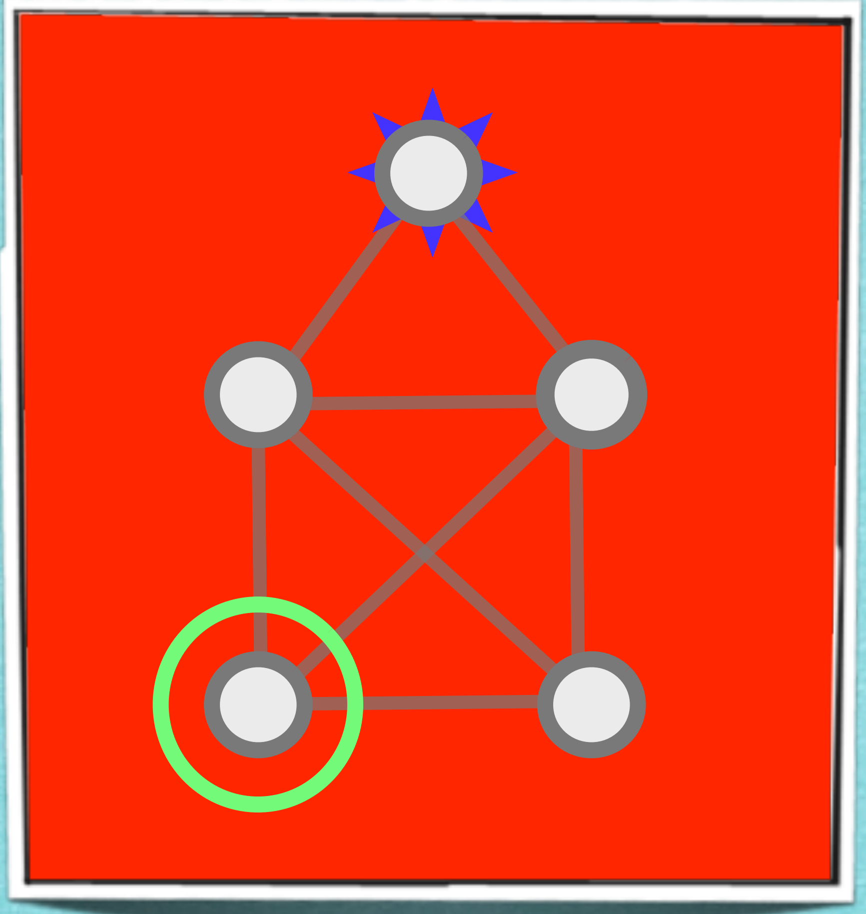
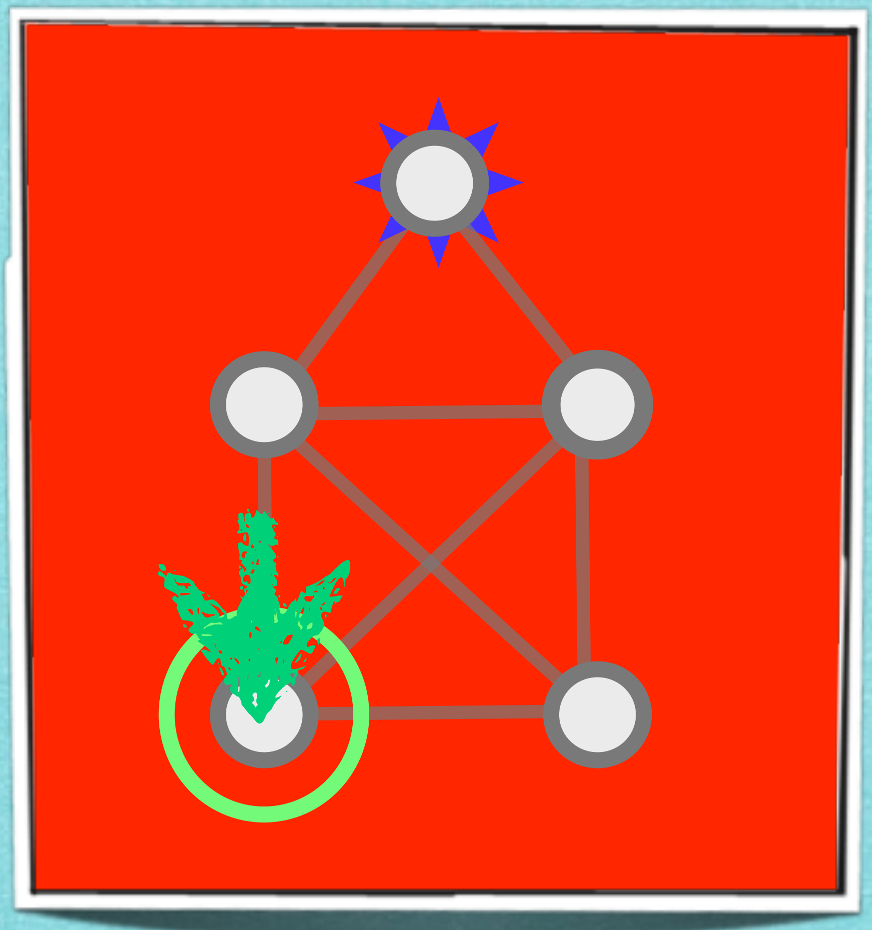


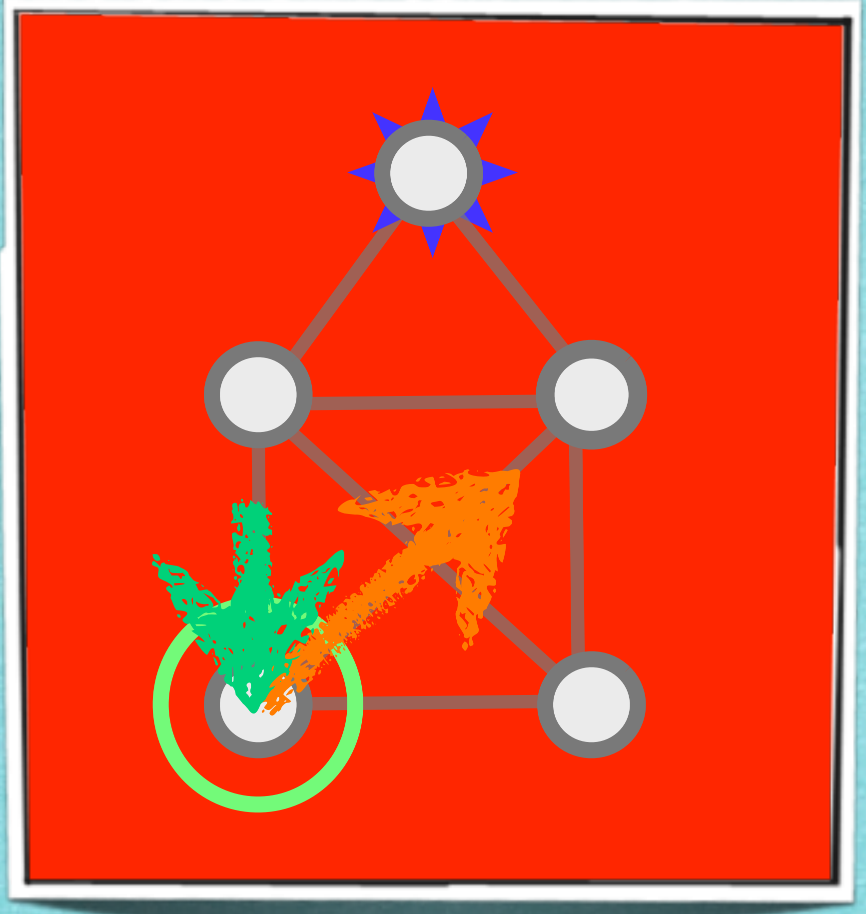
Das Haus des Nikolaus



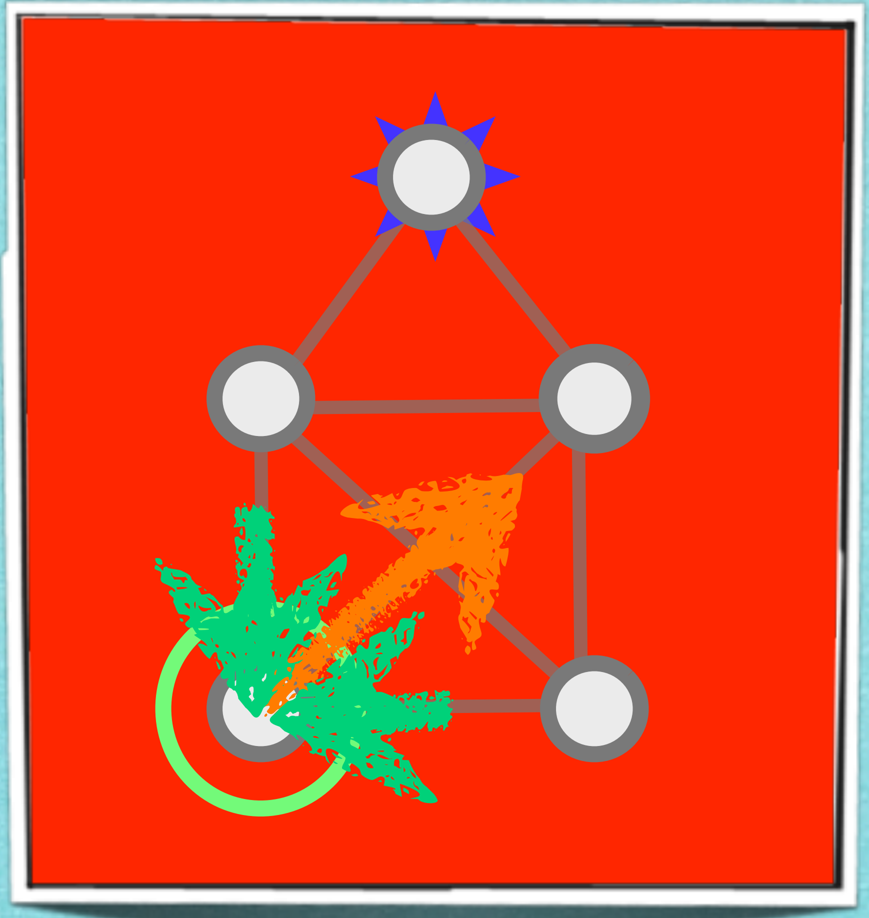
Das Haus des Nikolaus



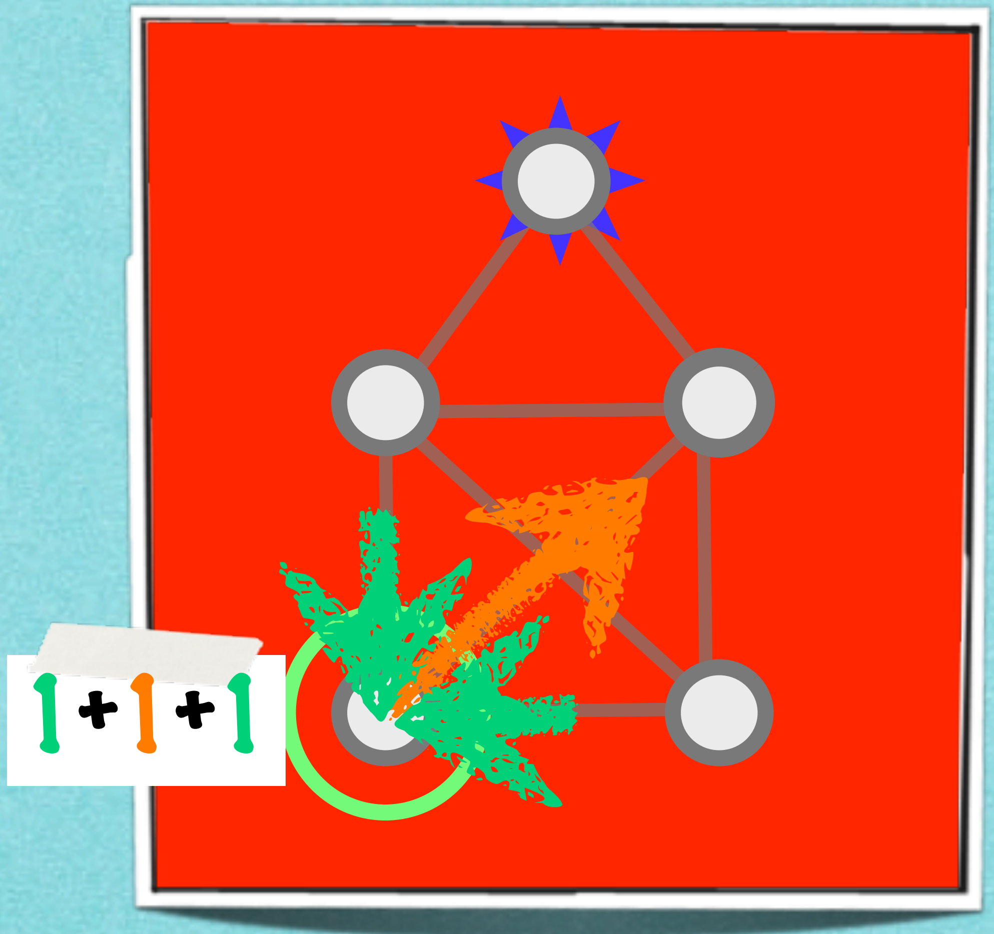
Das Haus des Nikolaus



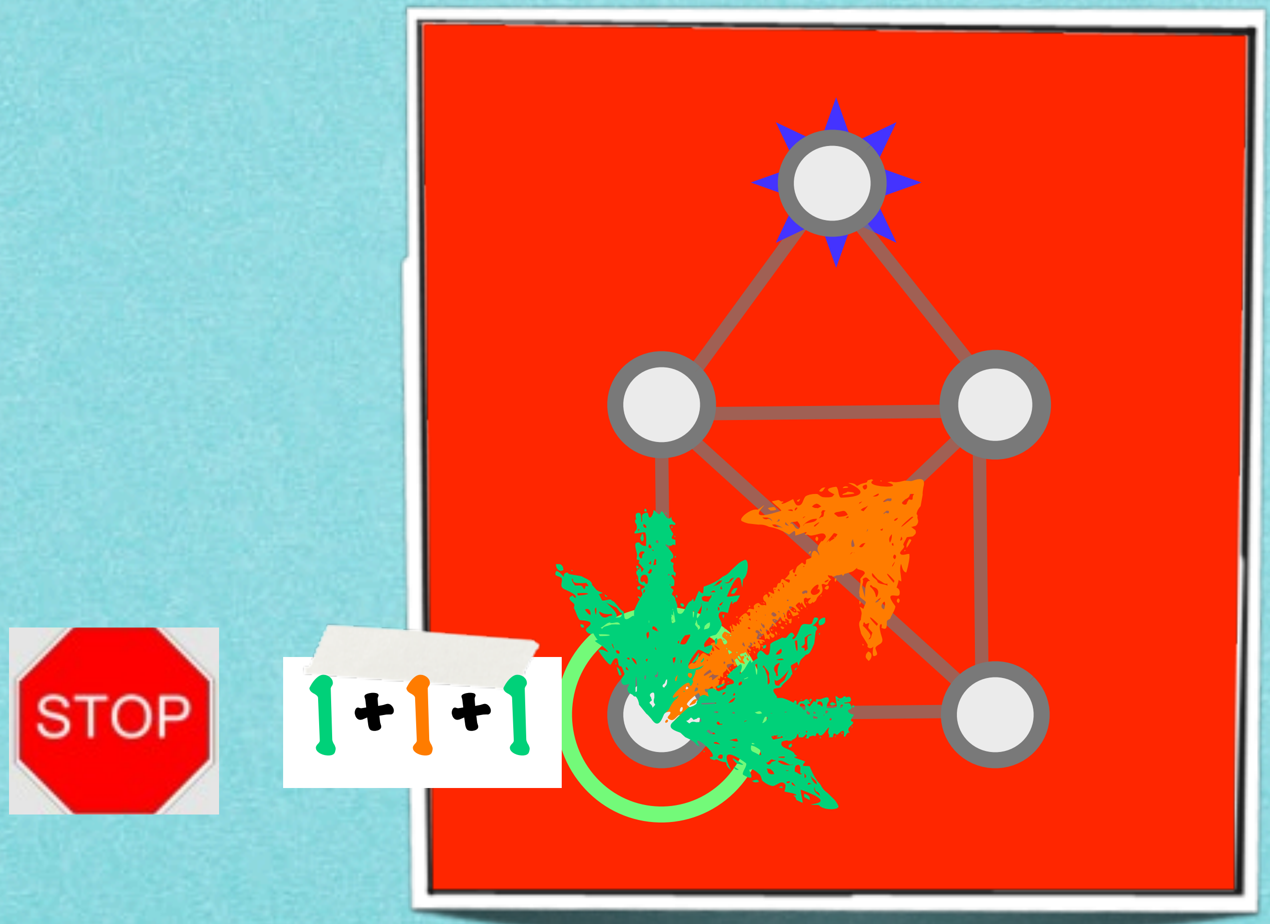
Das Haus des Nikolaus



Das Haus des Nikolaus



Das Haus des Nikolaus



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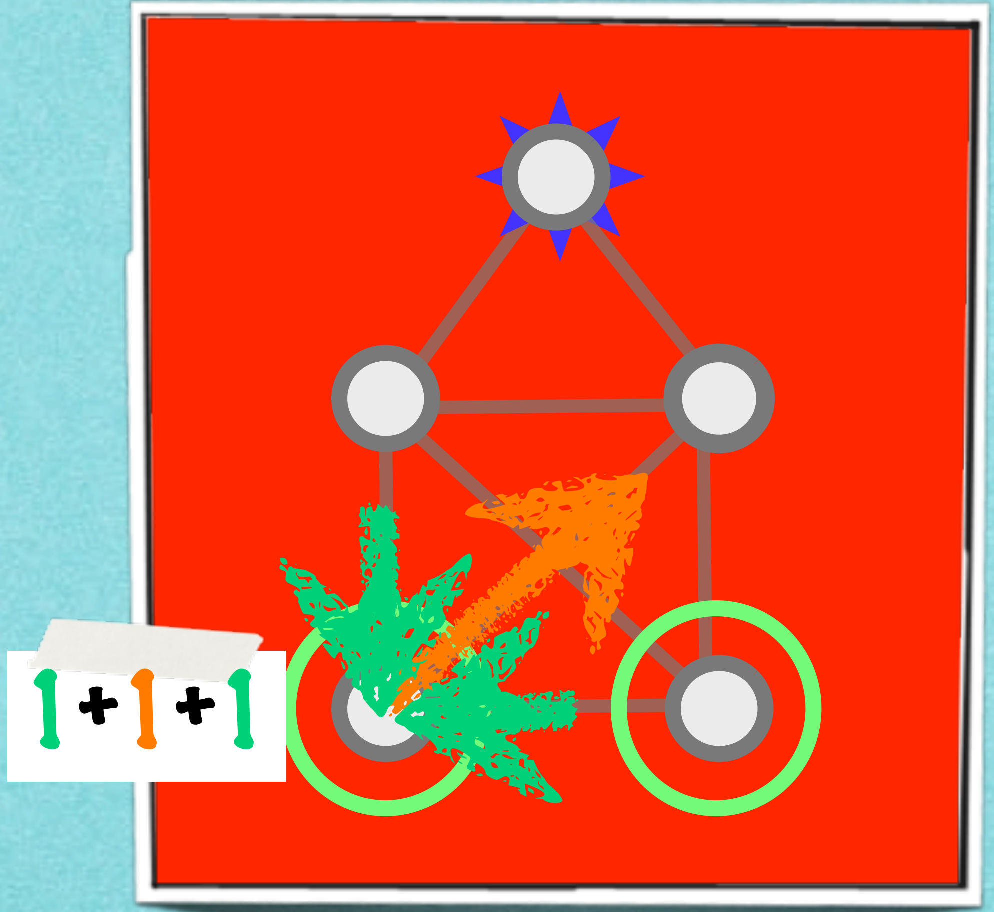
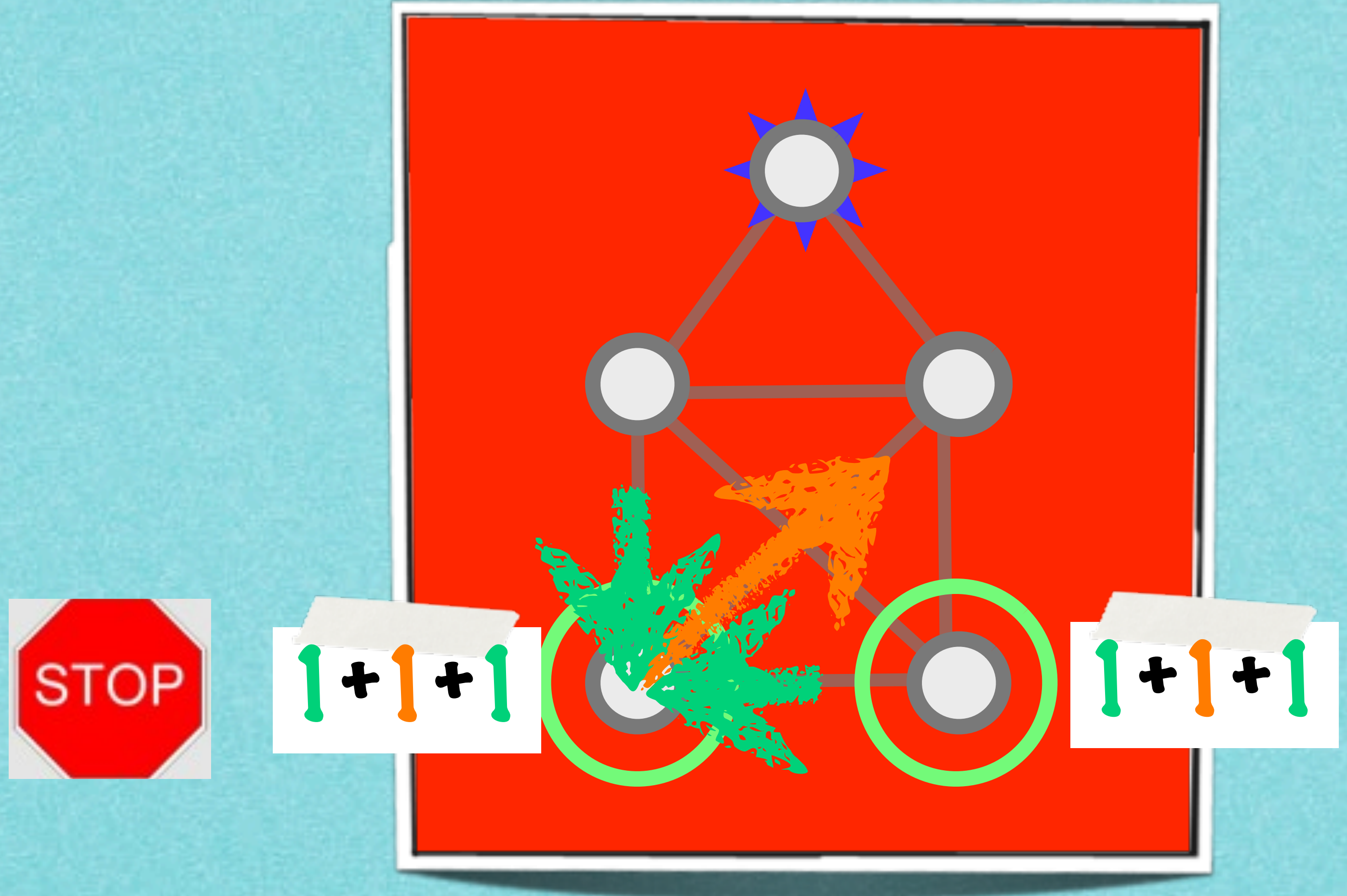


Das Haus des Nikolaus



Das Haus des Nikolaus

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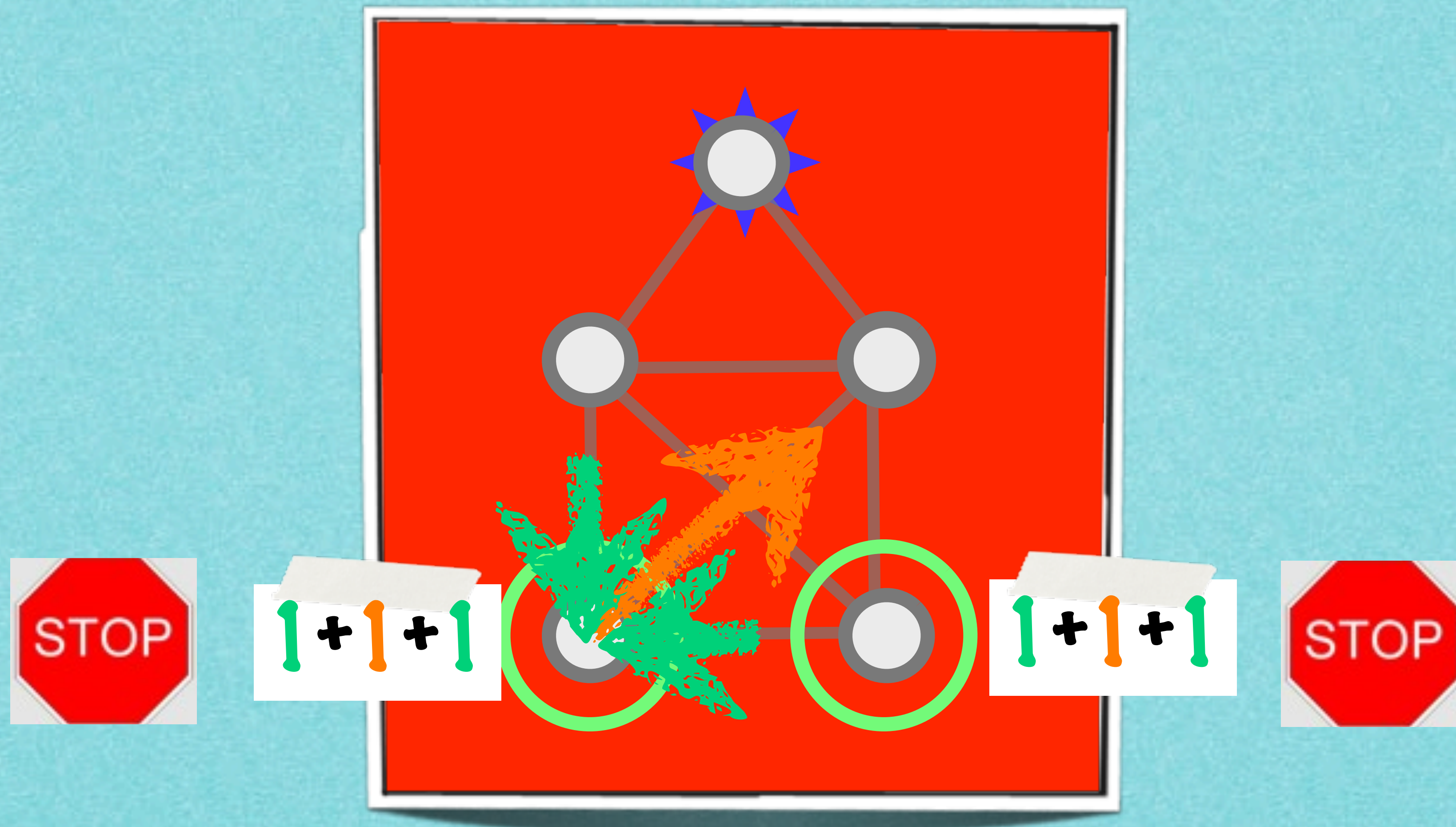
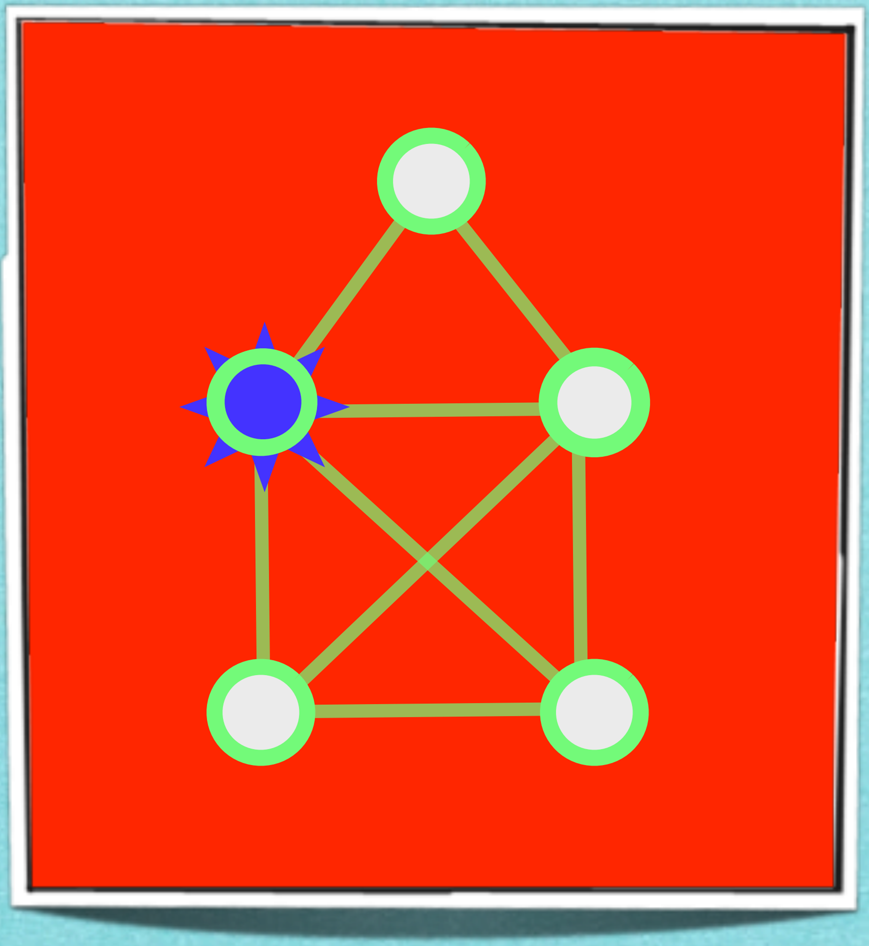
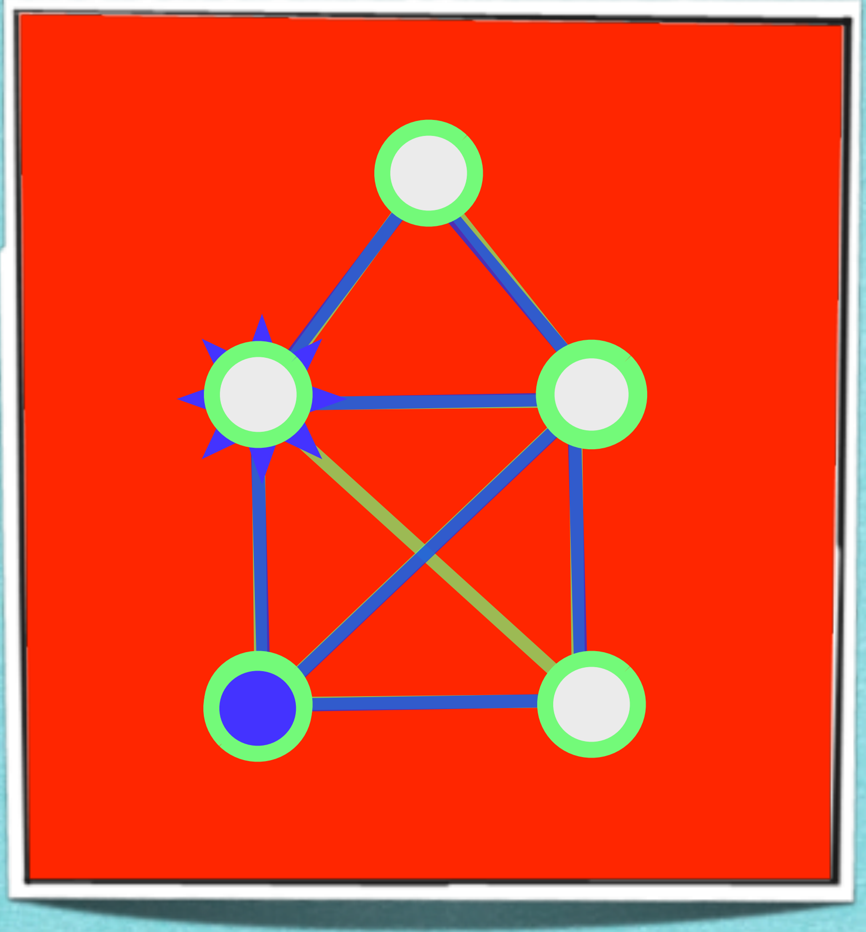


Hmmmm...

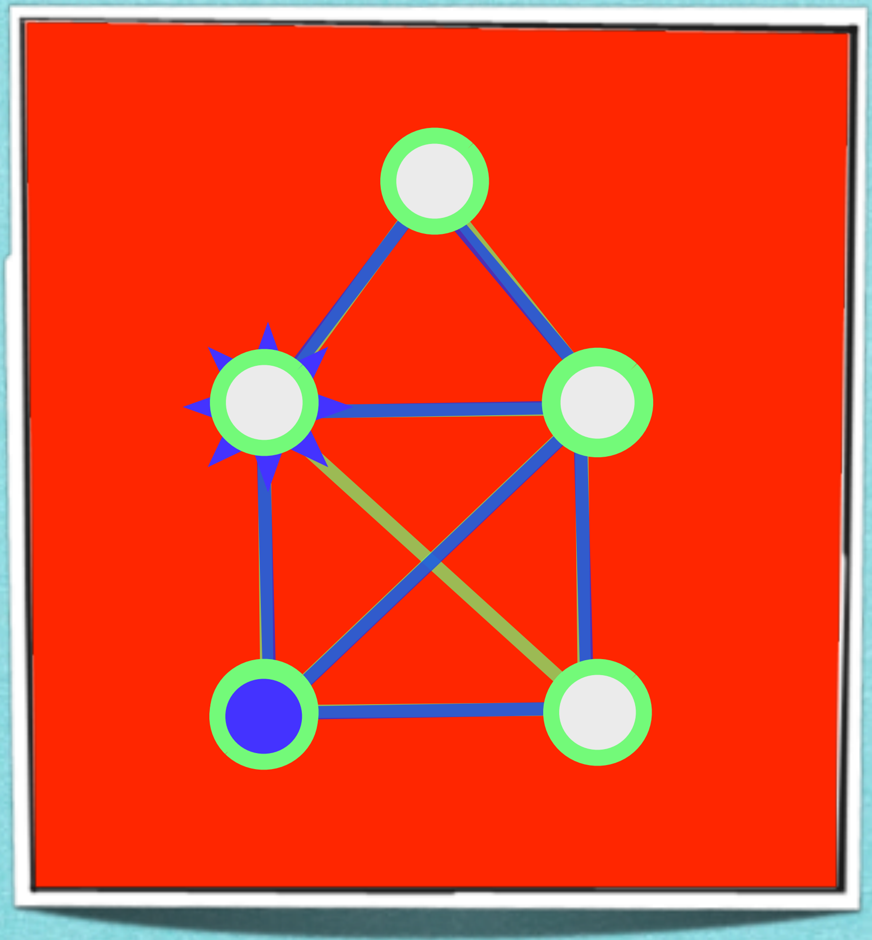
Das Haus des Nikolaus



Das Haus des Nikolaus

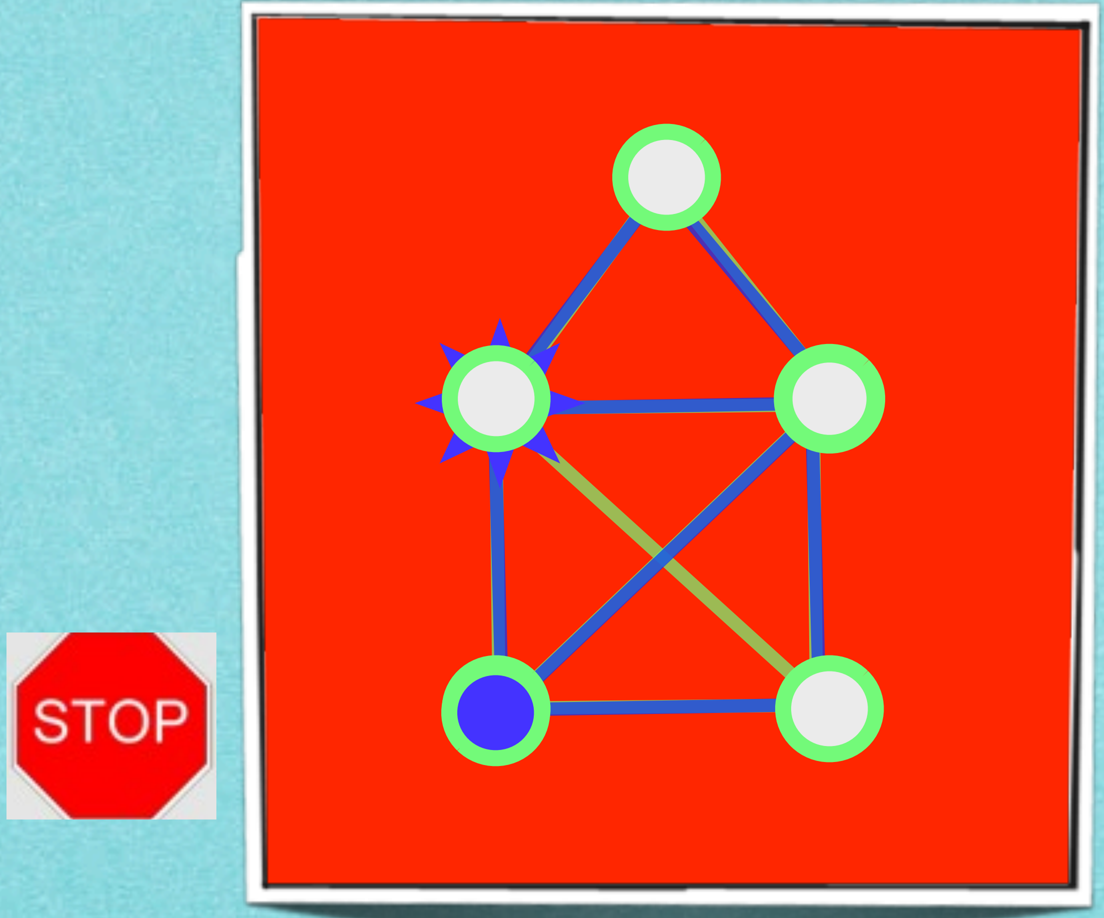


Das Haus des Nikolaus



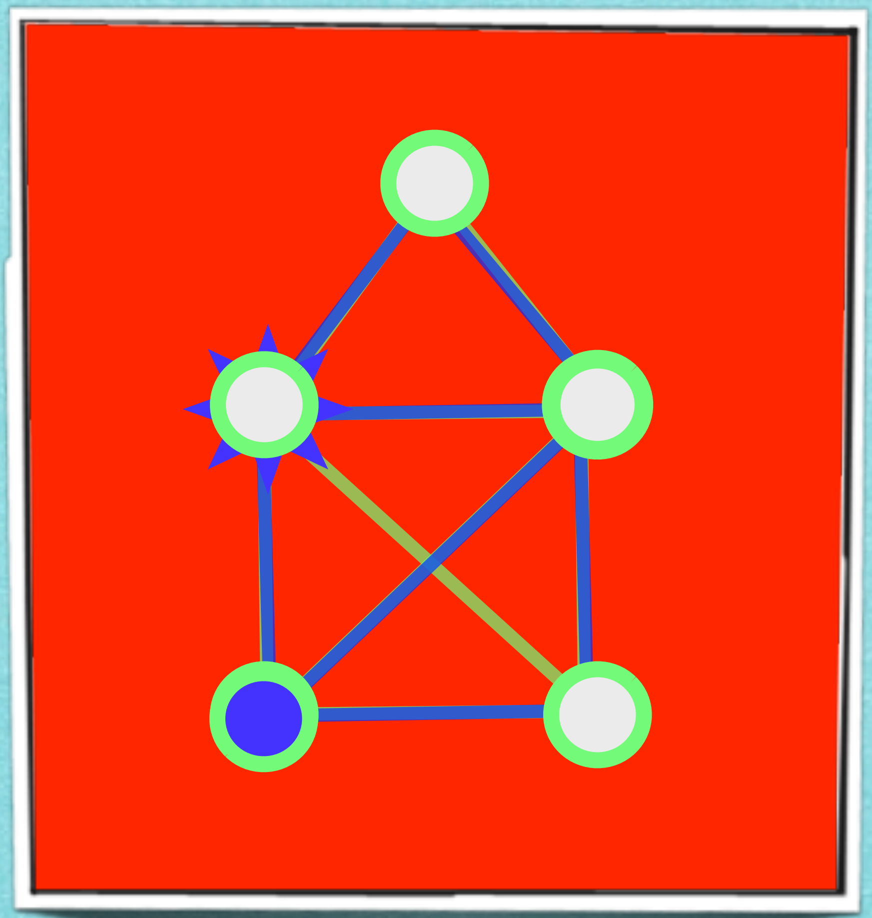
Ohhhhhhh...

Das Haus des Nikolaus



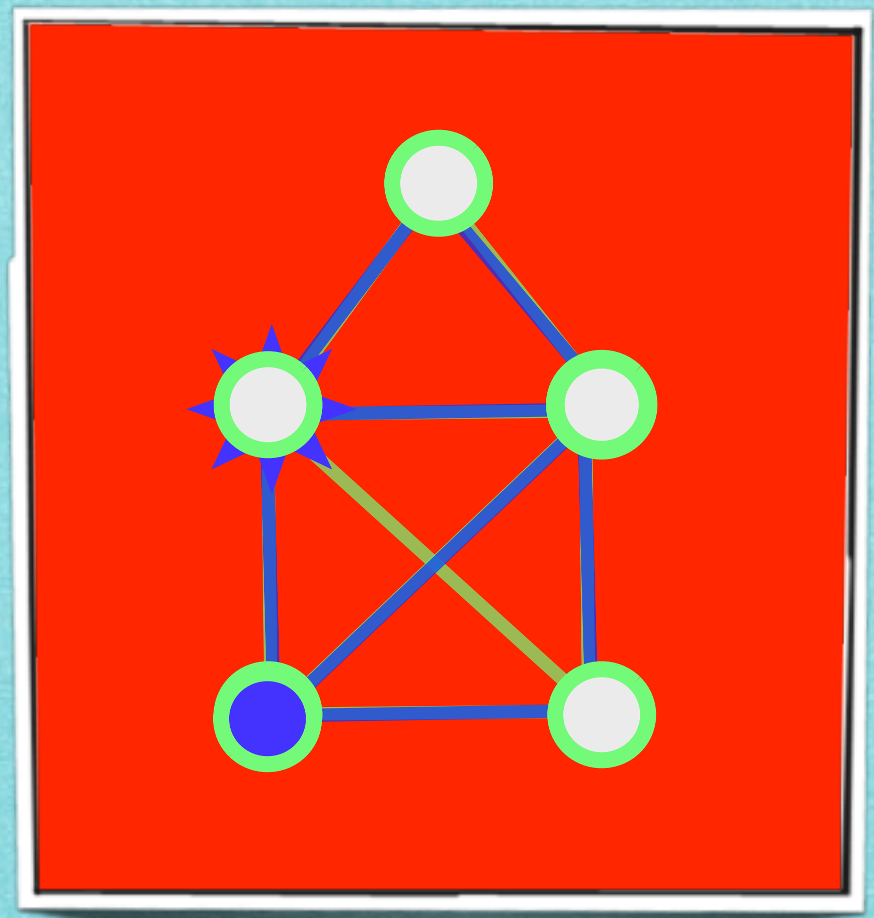
Ohhhhhhh...

Das Haus des Nikolaus

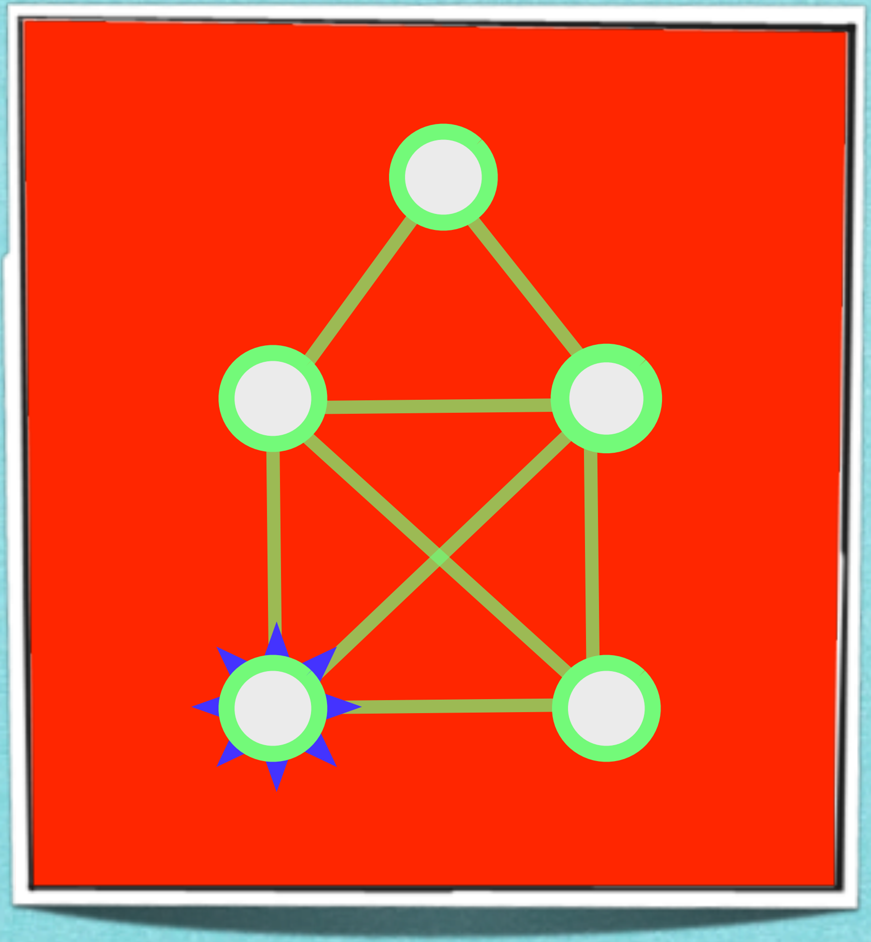


Ohhhhhhh...

Das Haus des Nikolaus



Das Haus des Nikolaus



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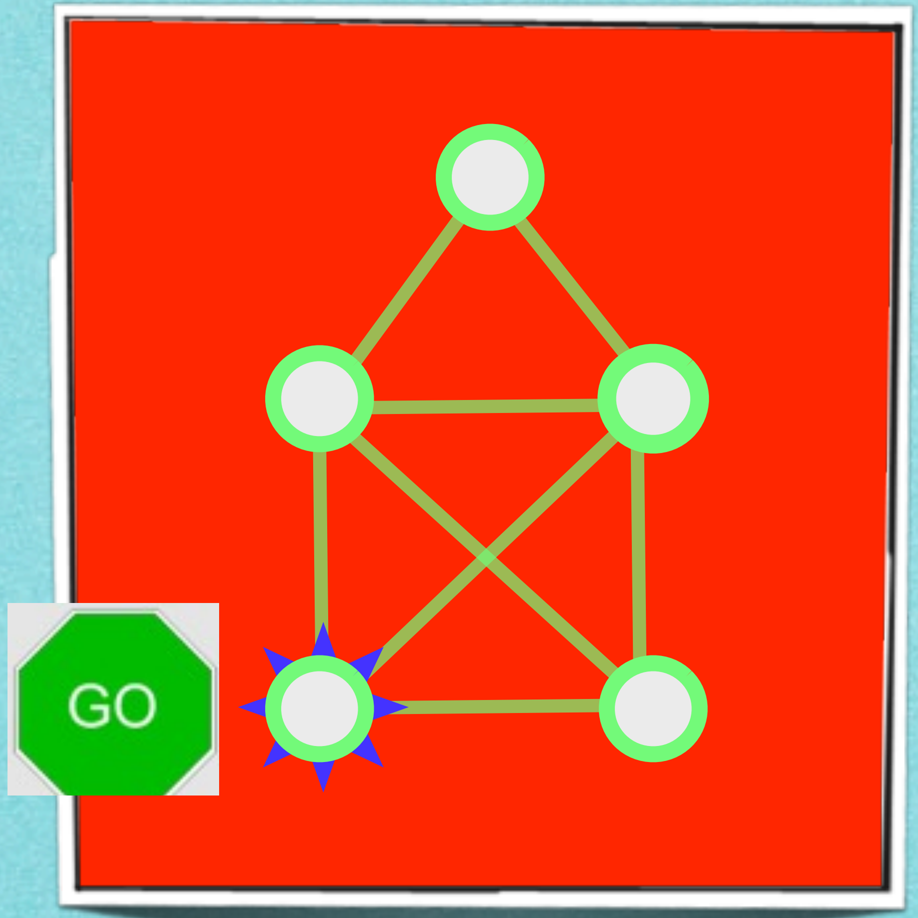
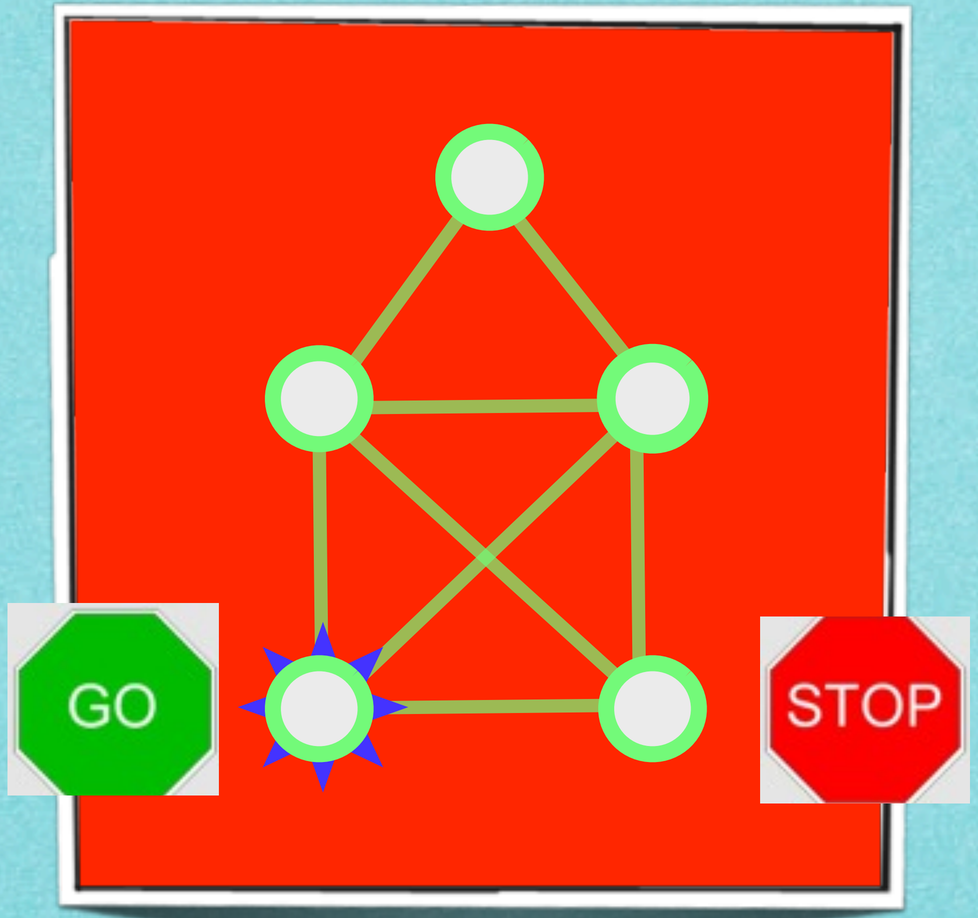
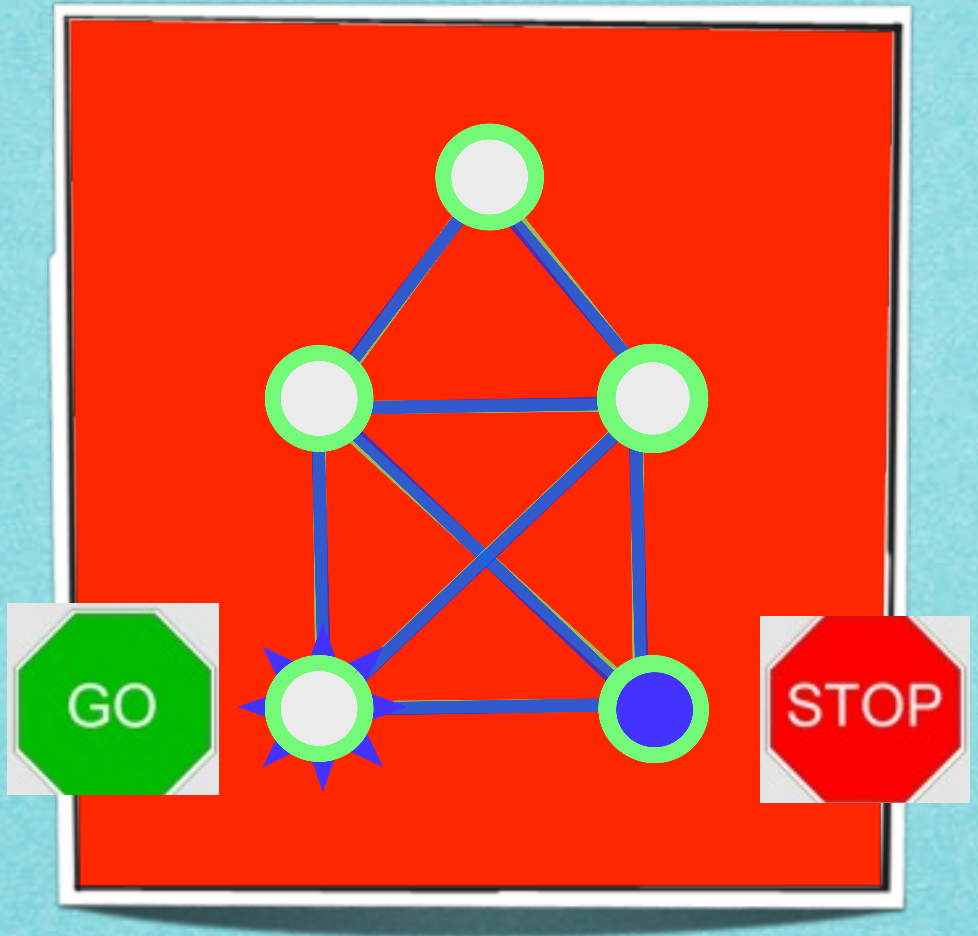


Das Haus des Nikolaus

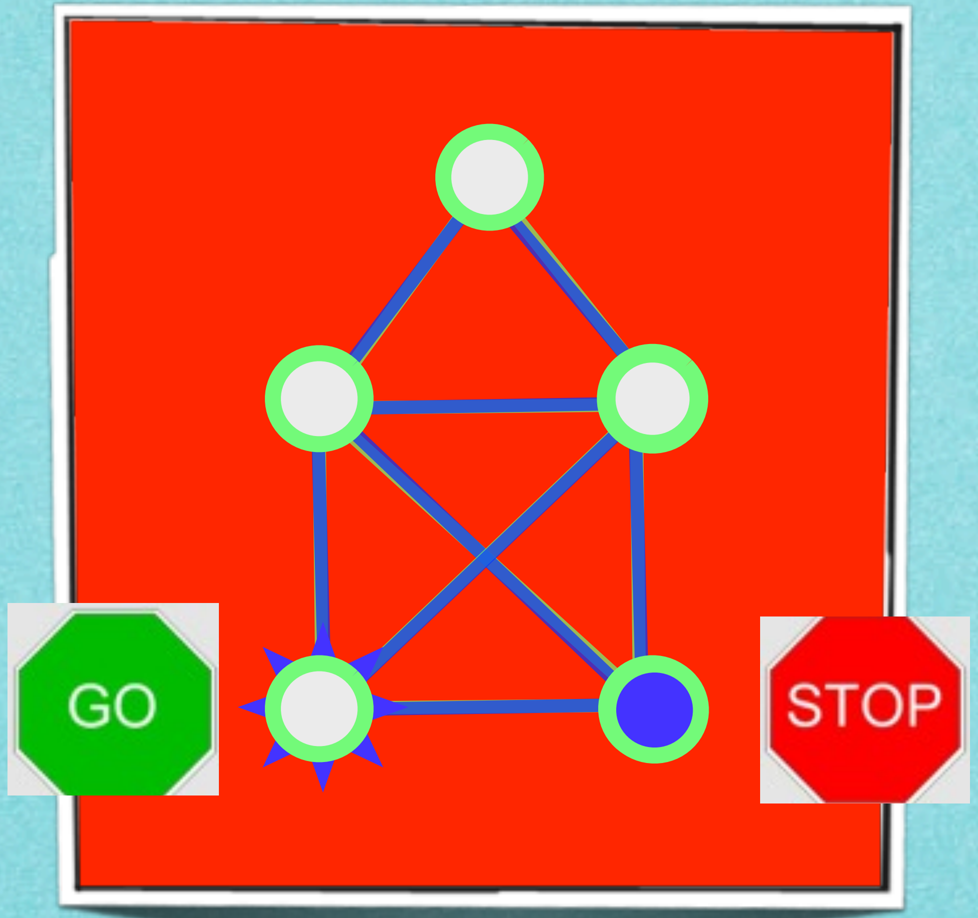


Das Haus des Nikolaus

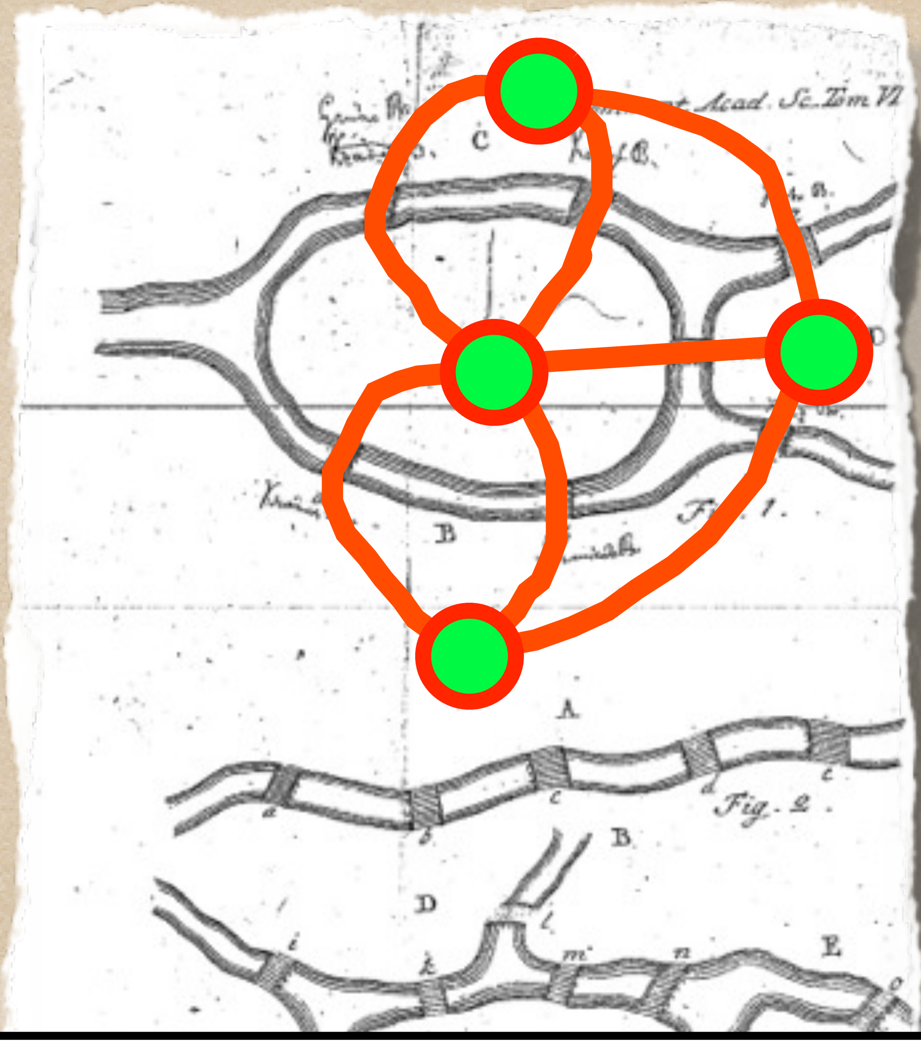


Ahhhhhhh!

Das Haus des Nikolaus



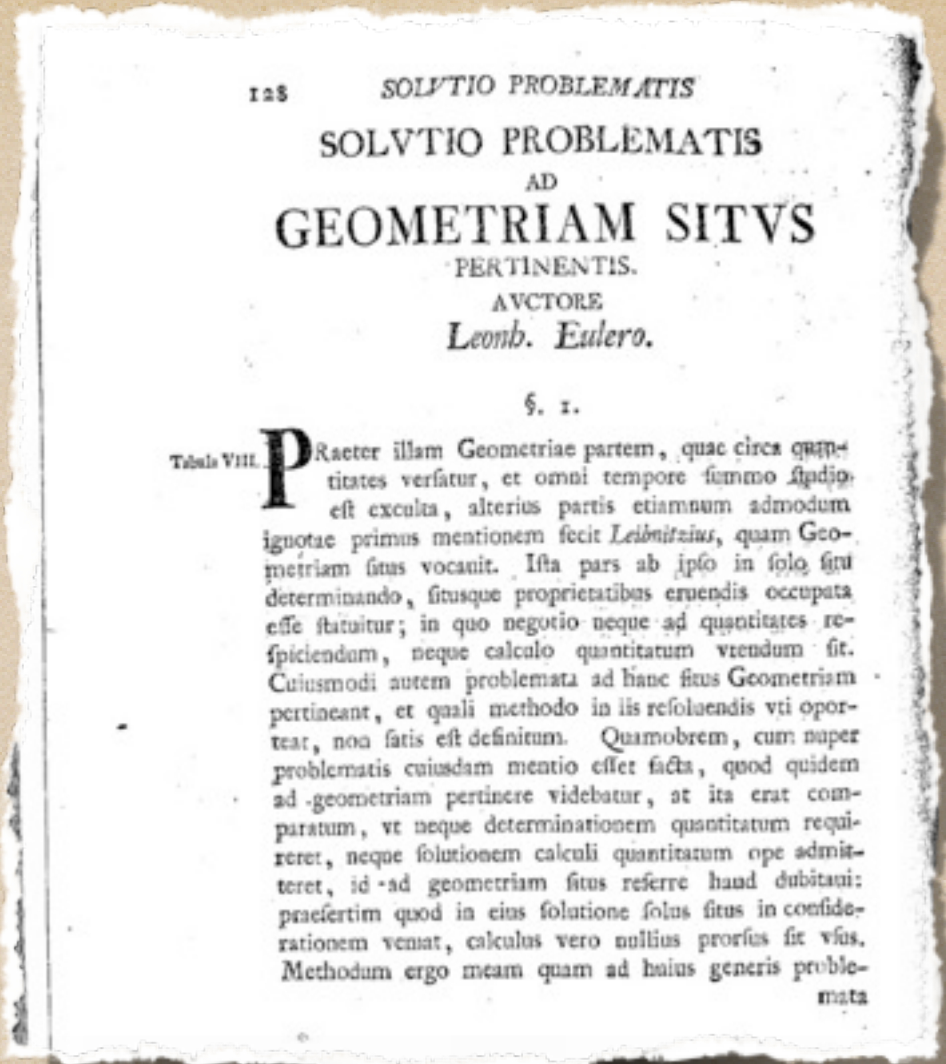
Wichtig: An einem der Knoten mit drei Kanten anfangen, weil man sonst irgendwann dort nicht mehr weg kommt!



- Alle Knoten sind ungerade?!
- Man müsste an allen anfangen oder aufhören!
- Das geht nicht an einem Stück!

Euler: (1) Das gilt für jede beliebige Instanz: Mit mehr als zwei ungeraden Knoten gibt es keinen solchen Weg.

(2) Man kann auch charakterisieren, unter welchen Bedingungen es einen Weg tatsächlich gibt.



128 *SOLVTIO PROBLEMATIS*

SOLVTIO PROBLEMATIS
AD
GEOMETRIAM SITVS
PERTINENTIS.
AVCTORE
Leonh. Eulero.

§. 1.

Tabula VIII. PRaeter illam Geometriae partem, quae circa quantitates versatur, et omni tempore summo studio est exculta, alterius partis etiamnum admodum ignotae primus mentionem fecit *Leibnitzius*, quam Geometriam situs vocauit. Ista pars ab ipso in solo situ determinando, situsque proprietatibus eruendis occupata esse statuitur; in quo negotio neque ad quantitates respiciendum, neque calculo quantitatum vtendum sit. Cuiusmodi autem problemata ad hanc situs Geometriam pertineant, et quali methodo in iis resoluendis vti oporteat, non satis est definitum. Quamobrem, cum nuper problematis cuiusdam mentio esset facta, quod quidem ad geometriam pertinere videbatur, at ita erat comparatum, vt neque determinationem quantitatum requireret, neque solutionem calculi quantitatum ope admitteret, id ad geometriam situs referre haud dubitaui: praesertim quod in eius solutione solus situs in considerationem veniat, calculus vero nullius prorsus sit vsus. Methodum ergo meam quam ad huius generis problemata

- Alle Knoten sind ungerade?!
- Man müsste an allen anfangen oder aufhören!
- Das geht nicht an einem Stück!

Euler: (1) Das gilt für jede beliebige Instanz: Mit mehr als zwei ungeraden Knoten gibt es keinen solchen Weg.

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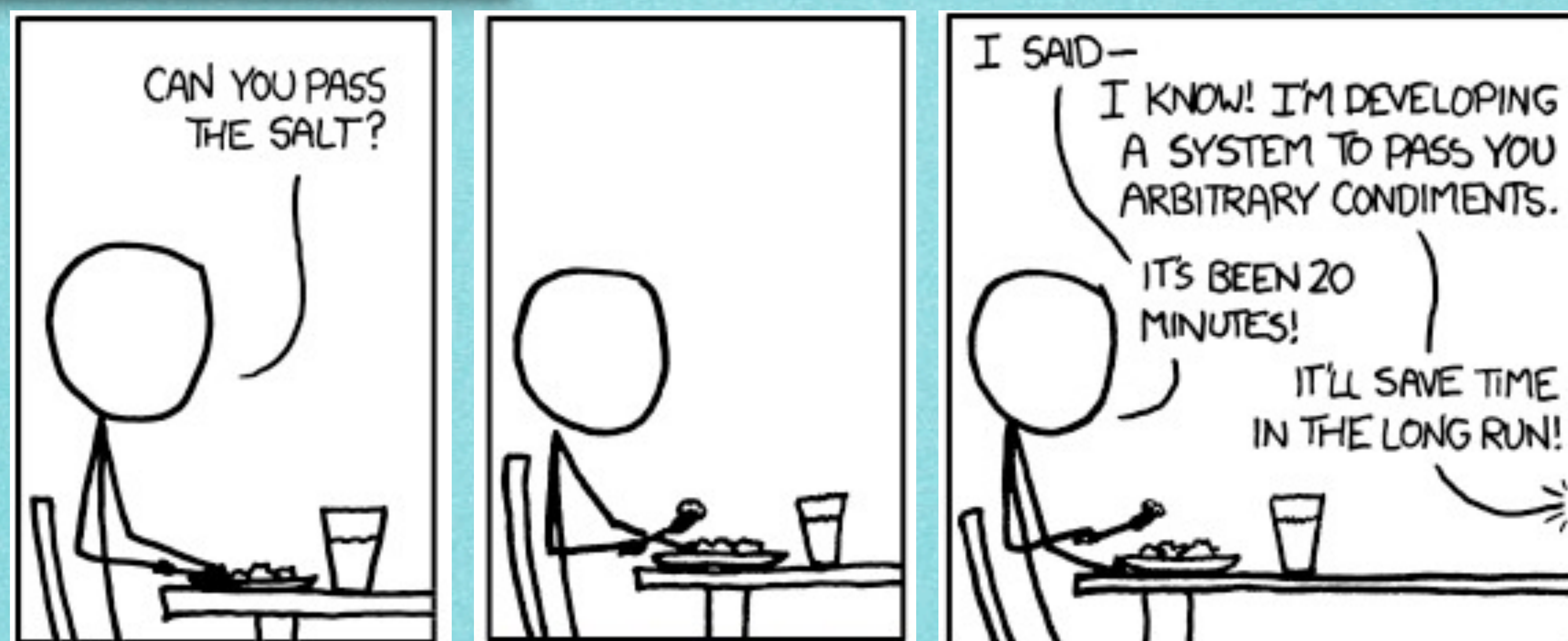
2.1 Historie



Euler hat:

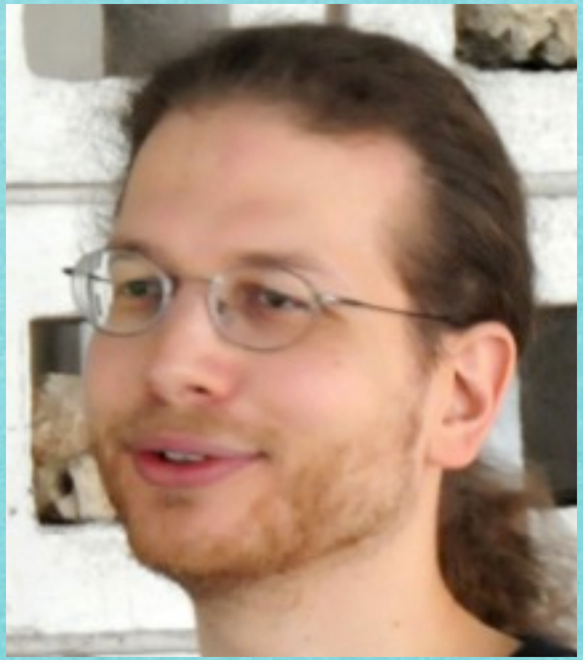
- eine Instanz betrachtet
- ein Problem gelöst
- ein Gebiet begründet

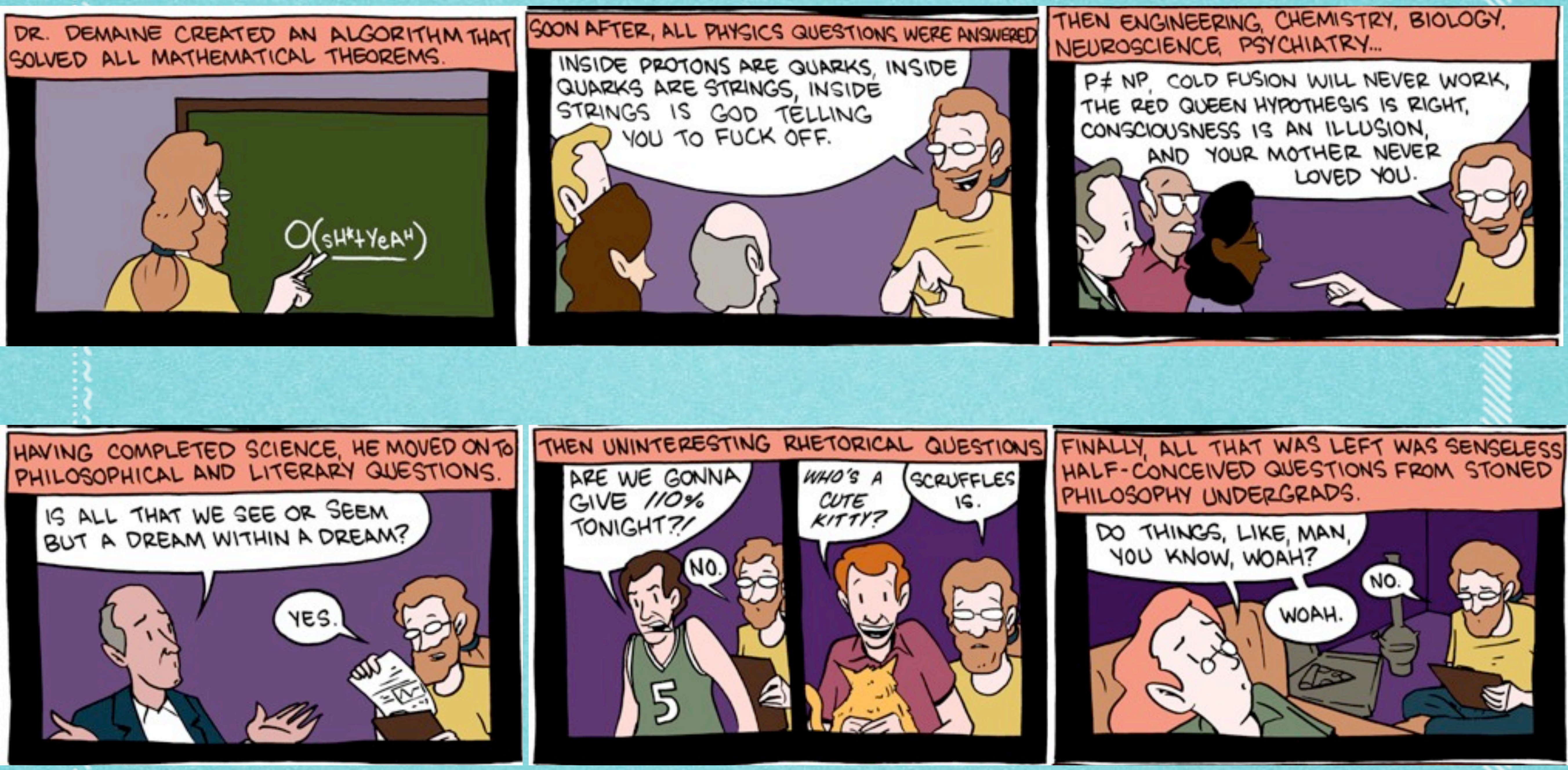
Leonhard Euler:

1707 Geboren in Basel
1720 Studienbeginn in Basel
1723 Magister
1727 Berufung an Petersburger Akademie
1731 Professur für Physik

Erik Demaine:

1981 Geboren in Halifax
1993 Studienbeginn in Halifax
1995 Bachelor
1996 Master
2001 Ph.D.
2001 Assistenzprofessor am MIT
2005 Full Professor am MIT




DR. DEMAINE CREATED AN ALGORITHM THAT SOLVED ALL MATHEMATICAL THEOREMS.
O(SH*T YEAH)
SOON AFTER, ALL PHYSICS QUESTIONS WERE ANSWERED.
INSIDE PROTONS ARE QUARKS, INSIDE QUARKS ARE STRINGS, INSIDE STRINGS IS GOD TELLING YOU TO FUCK OFF.
THEN ENGINEERING, CHEMISTRY, BIOLOGY, NEUROSCIENCE, PSYCHIATRY...
P≠NP, COLD FUSION WILL NEVER WORK, THE RED QUEEN HYPOTHESIS IS RIGHT, CONSCIOUSNESS IS AN ILLUSION, AND YOUR MOTHER NEVER LOVED YOU.
HAVING COMPLETED SCIENCE, HE MOVED ON TO PHILOSOPHICAL AND LITERARY QUESTIONS.
IS ALL THAT WE SEE OR SEEM BUT A DREAM WITHIN A DREAM?
YES.
THEN UNINTERESTING RHETORICAL QUESTIONS.
ARE WE GONNA GIVE 110% TONIGHT?!
NO.
WHO'S A CUTE KITTY?
SCRUFFLES IS.
5
FINALLY, ALL THAT WAS LEFT WAS SENSELESS HALF-CONCEIVED QUESTIONS FROM STONED PHILOSOPHY UNDERGRADS.
DO THINGS, LIKE, MAN, YOU KNOW, WOAH?
WOAH.
NO.

02.11.2016

Three Colors Suffice: Conflict-Free Coloring of Planar Graphs*

Zachary Abel[1], Victor Alvarez[2], Erik D. Demaine[3], Sándor P. Fekete[2], Aman Gour[4], Adam Hesterberg[1], Phillip Keldenich[2], and Christian Scheffer[2]

[1]Mathematics Department, MIT, Cambridge, Massachusetts, USA
[2]Algorithms Group, TU Braunschweig, Braunschweig, Germany
[3]Computer Science and Artificial Intelligence Laboratory, MIT, Massachusetts, USA
[4]Computer Science and Engineering, IIT Bombay, Mumbai, India

Abstract

A *conflict-free k-coloring* of a graph assigns one of k different colors to some of the vertices such that, for every vertex v, there is a color that is assigned to exactly one vertex among v and v's neighbors. Such colorings have applications in wireless networking, robotics, and geometry, and are well-studied in graph theory. Here we study the natural problem of the *conflict-free chromatic number* $\chi_{CF}(G)$ (the smallest k for which conflict-free k-colorings exist), with a focus on planar graphs.

For general graphs, we provide a sufficient condi-

1 Introduction.

Coloring the vertices of a graph is one of the fundamental problems in graph theory, both scientifically and historically. Proving that four colors always suffice to color a planar graph [5, 6, 25] was a tantalizing open problem for more than 100 years; the quest for solving this challenge contributed to the development of graph theory, but also to computers in theorem proving [29]. A generalization that is still unsolved is the *Hadwiger Conjecture* [18]: A graph is k-colorable if it has no K_{k+1} minor.

Jetzt wird's genauer!

s.fekete@tu-bs.de