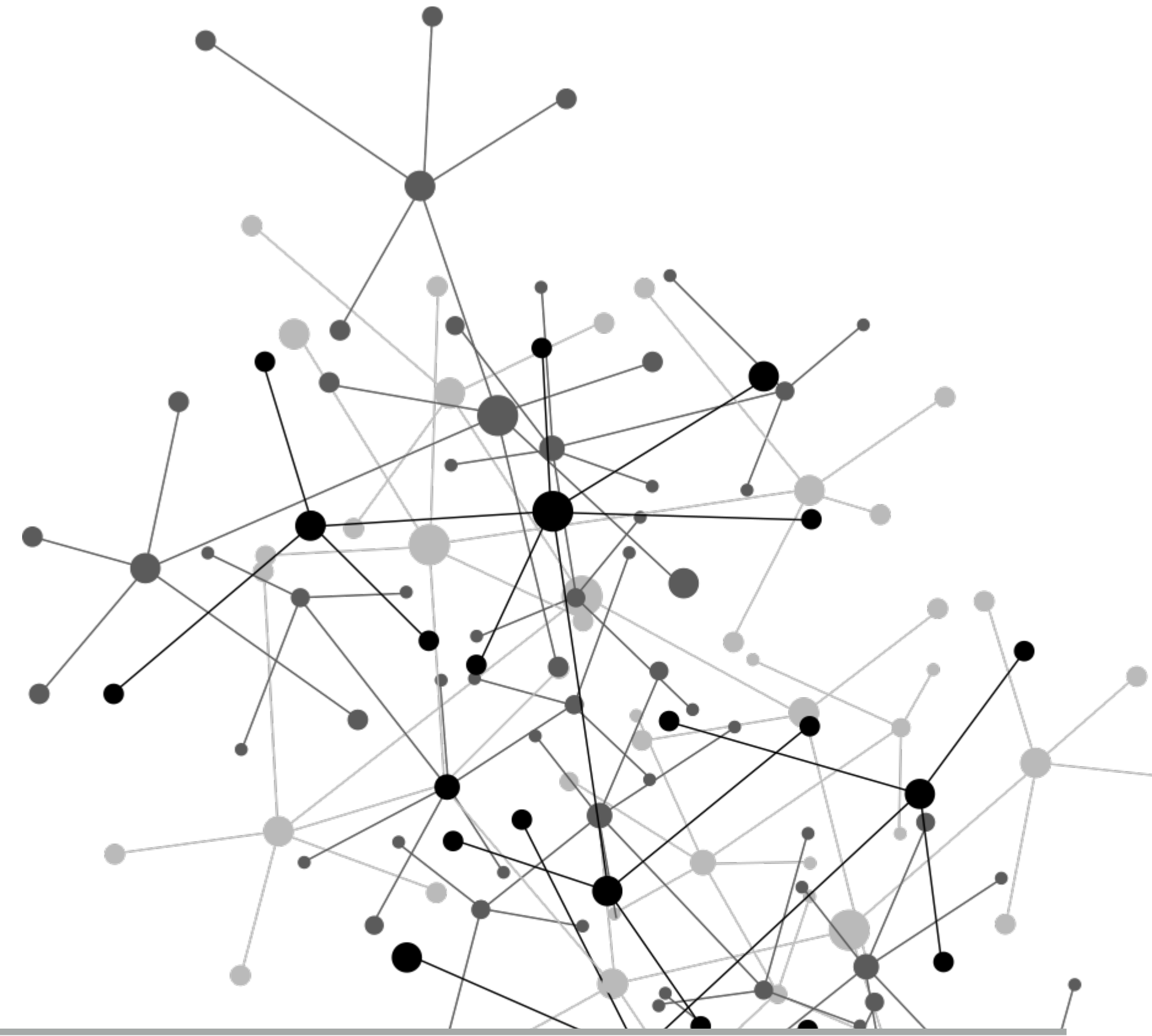


CS+X 2017

AARON STOCKDILL



PROBLEM SOLVING

$$\text{Red Flower} + \text{Red Flower} + \text{Red Flower} = 60$$

$$\text{Red Flower} + \text{Blue Flower} + \text{Blue Flower} = 30$$

$$\text{Blue Flower} - \text{Two Yellow Flowers} = 3$$

$$\text{Yellow Flower} + \text{Red Flower} \times \text{Blue Flower} = ?$$

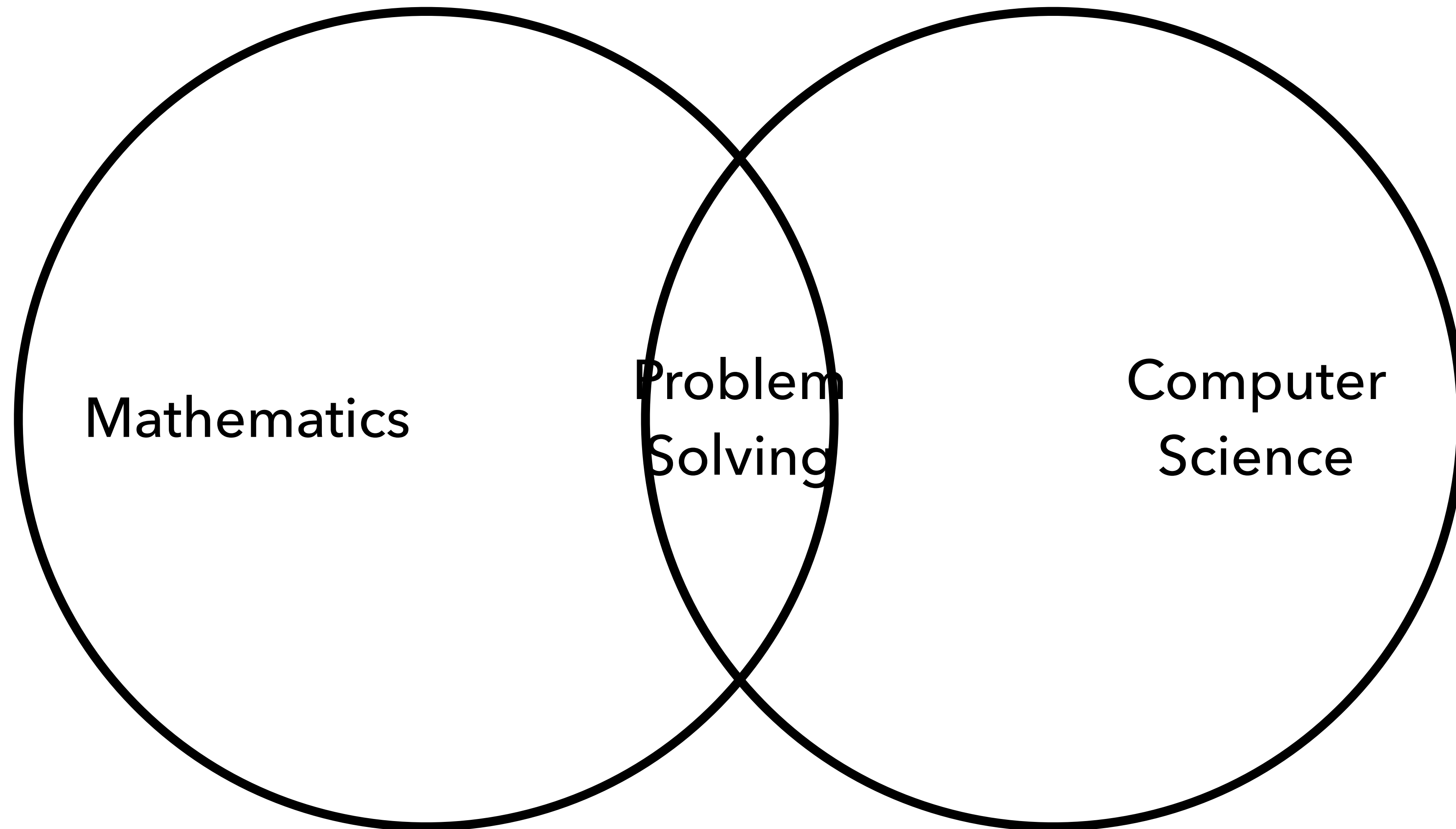
GEOLOGY

SCULPTURE

FINANCE

MATHEMATICS

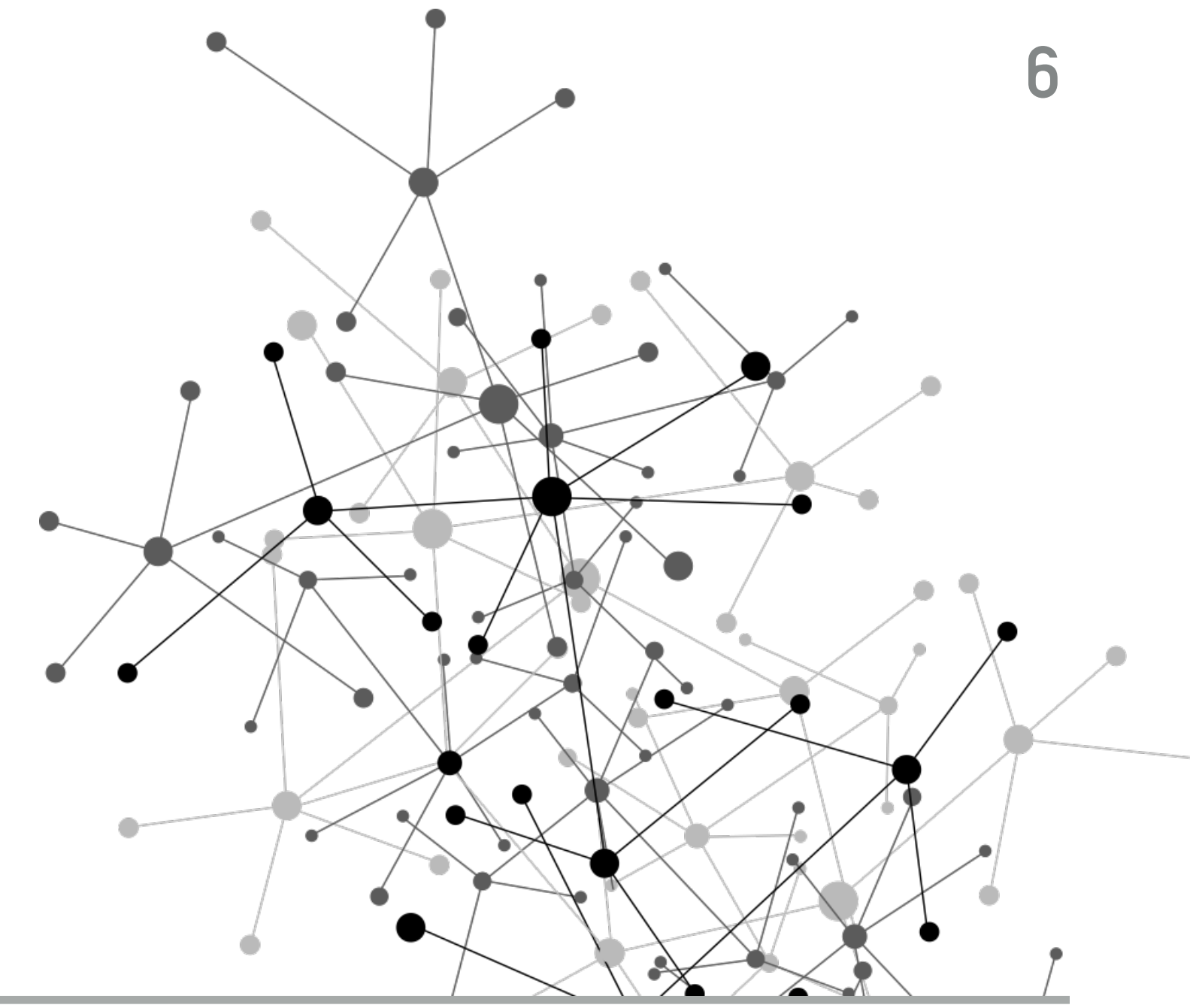
COMPUTER SCIENCE



What does it mean to solve a problem?

Exploring languages with compression

Problems we can't solve



**WHAT DOES IT MEAN TO
SOLVE A PROBLEM?**

WHAT IS COMPUTER SCIENCE?

Computer science is the study of the theory, experimentation, and engineering that form the basis for the design and use of computers.

From Wikipedia, the free encyclopedia

Computer science is as much about computers as astronomy is about telescopes.

Edsger Dijkstra, supposedly...

WHAT IS A COMPUTER?



CHURCH-TURING THESIS

“A problem can be solved by an algorithm iff
it can be solved by a **Turing Machine**”

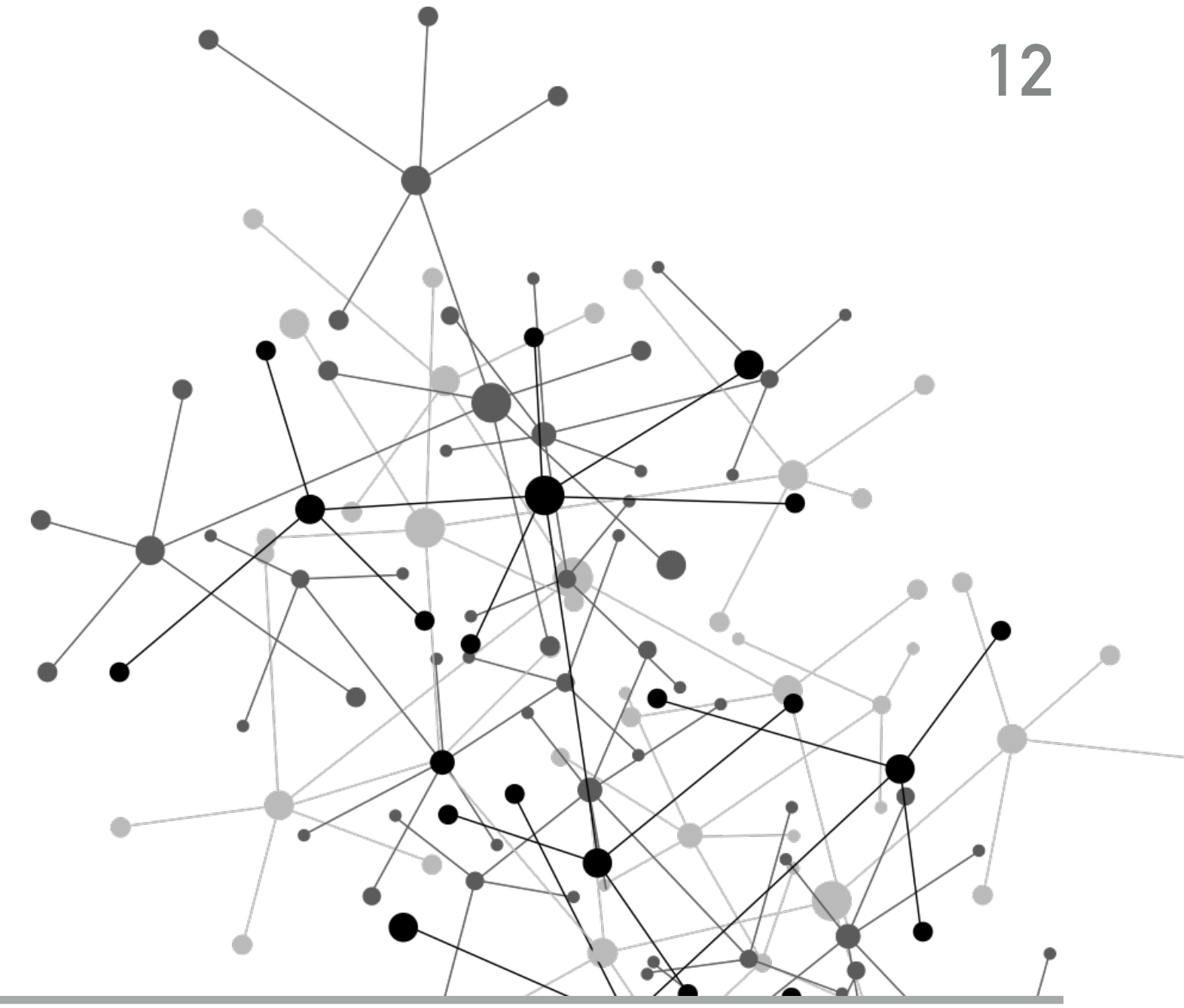
Lambda Calculus

Magic: The Gathering

Music notation

ALGORITHM \equiv FORMAL SEQUENCE OF STEPS

```
was_boring = False
while speaker.is_speaking():
    self.listen()
    if speaker.is_boring():
        self.boo()
        was_boring = True
if not was_boring:
    self.cheer()
```



EXPLORING LANGUAGES WITH COMPRESSION

LANGUAGES CAN BE SIMILAR

Portuguese

Olá, estou bem

Spanish

Hola, estoy bien

German

Hallo, mir geht es gut

WHAT DOES “SIMILAR” MEAN?

$$NCD_Z(x, y) = \frac{Z(xy) - \min\{Z(x), Z(y)\}}{\max\{Z(x), Z(y)\}}$$

“How similarly do two different things compress?”

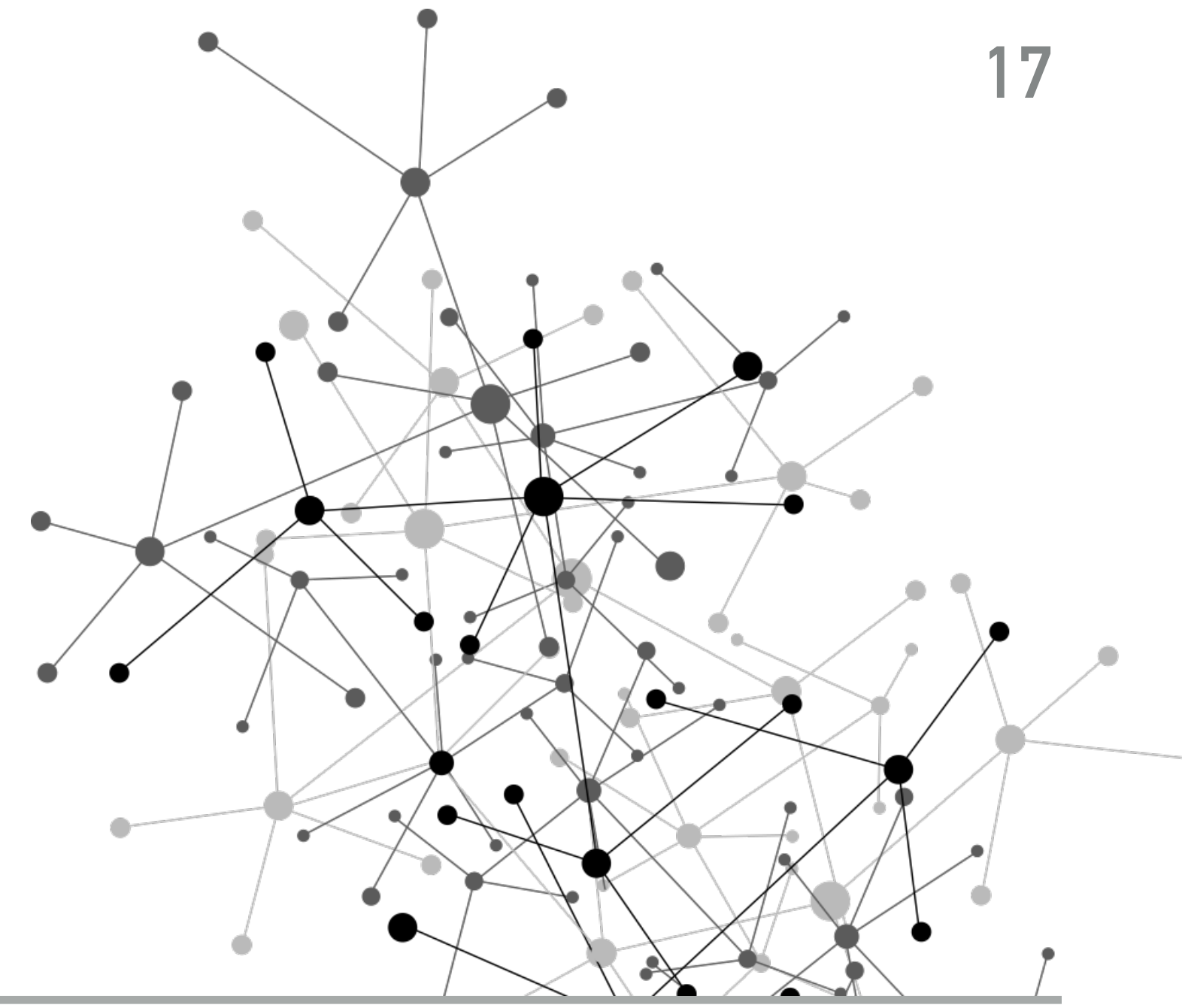
GENERAL CATEGORISATION ALGORITHM

Genomes / Phylogenetics

Plagiarism

Music Genres

Determining File Types

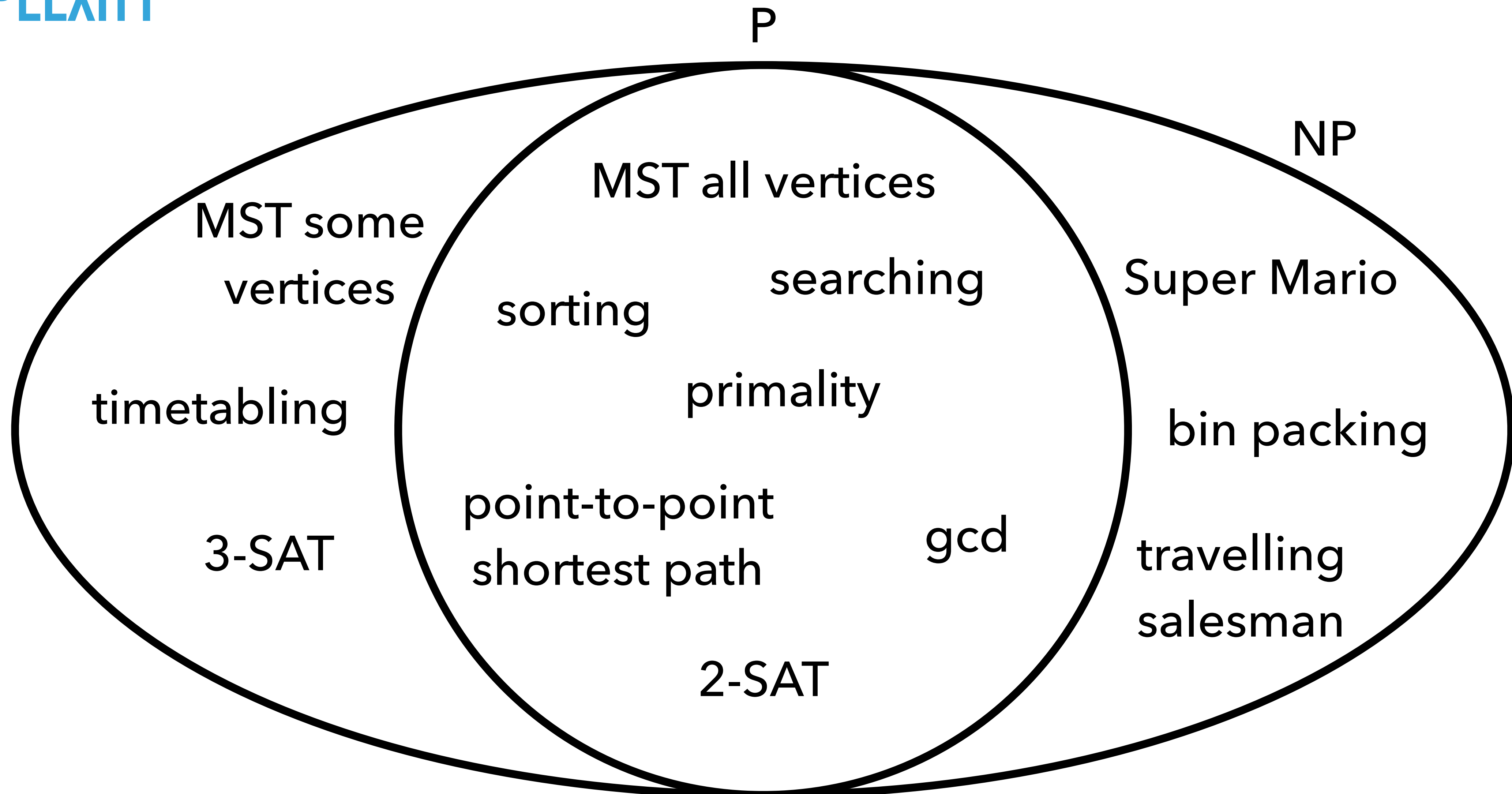


PROBLEMS WE CAN'T SOLVE

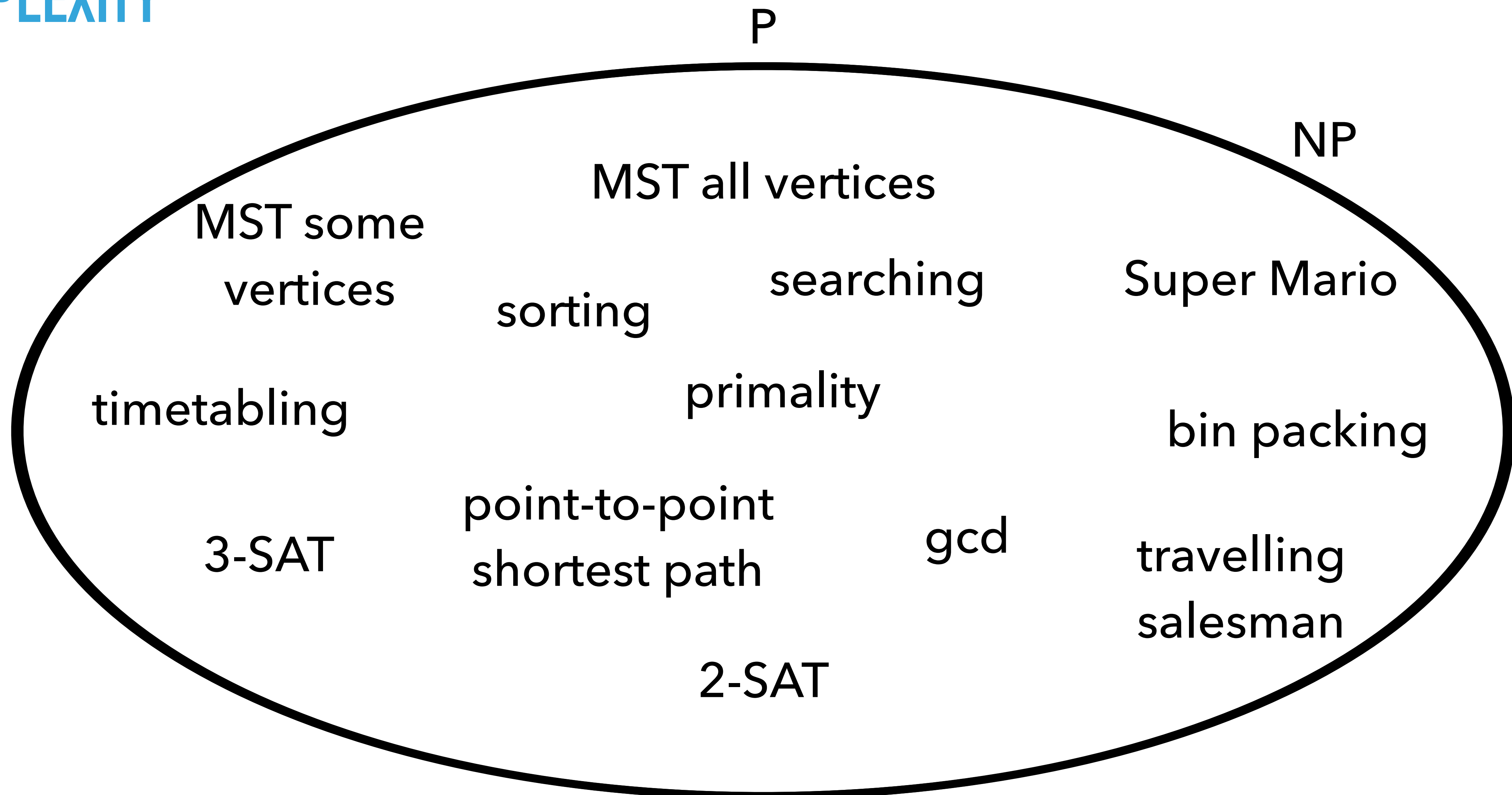
COMPLEXITY

P $\stackrel{?}{=}$ **NP**

COMPLEXITY



COMPLEXITY



UNCOMPUTABLE FUNCTIONS

The Halting Problem

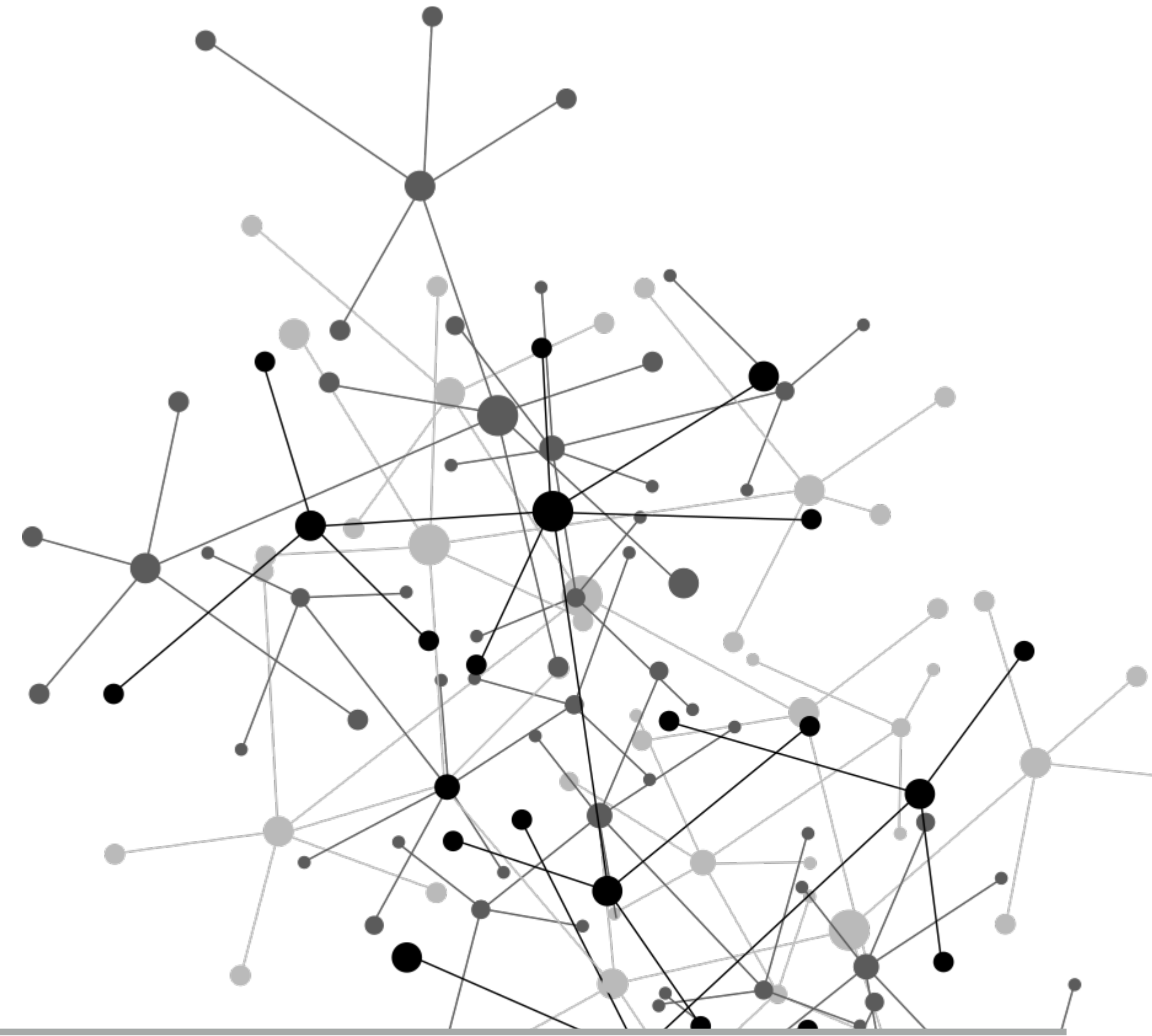
Kolmogorov Complexity

Busy Beaver

Chaitin's Constant

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