Theory of Efficient Algorithms

Prof. Dr. Peter Kling – Universität Hamburg

The Team

Research Group TEA

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Focus: Design & Analysis of Algorithms

- Distributed Systems
- Online Computation
- Resource Management

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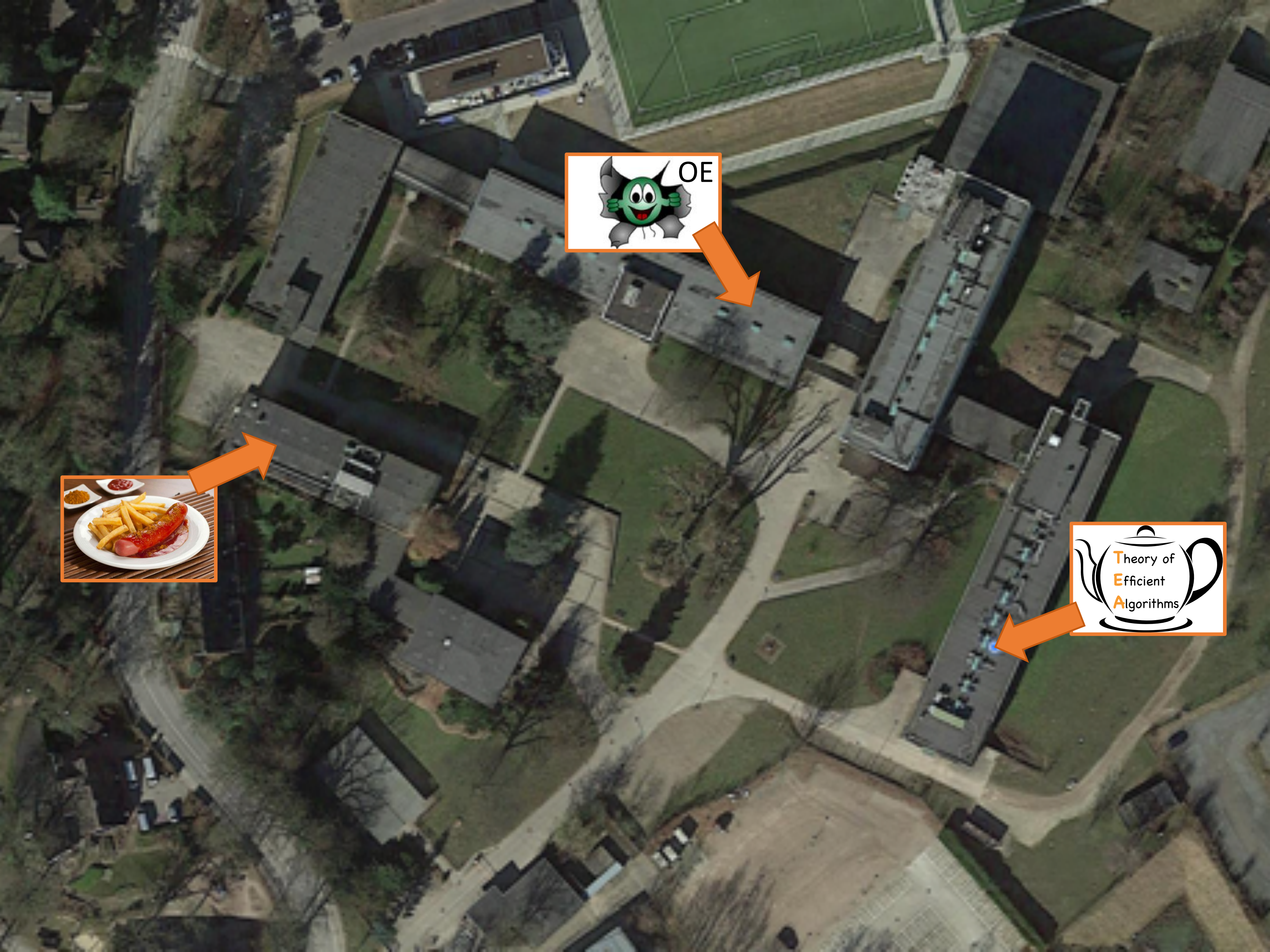
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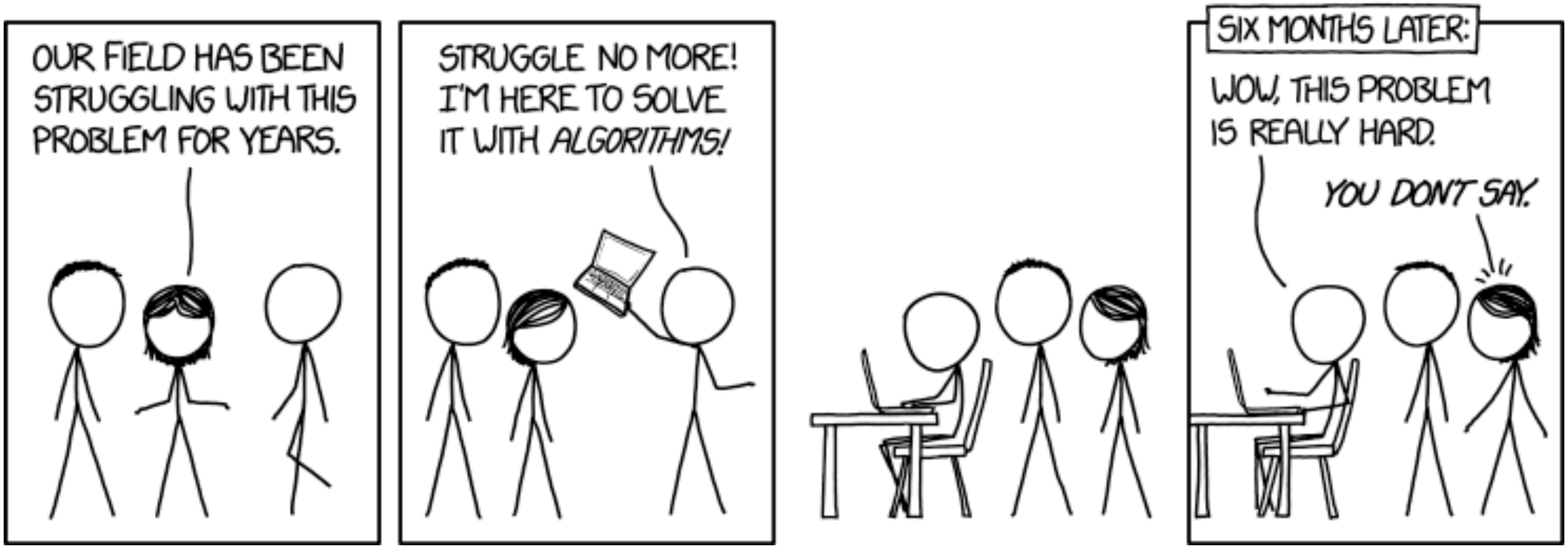


Why is the problem hard?

How hard is the problem?

What part of the problem is hard?

Can we solve it anyway?

Teaching

Teaching Overview

Winter Term

InfM-Kryp: Cryptography

Wahlpflichtbereich Theorie

Summer Term

InfM-MDAE: Methods of Algorithm Design

Wahlpflichtbereich Theorie

Always

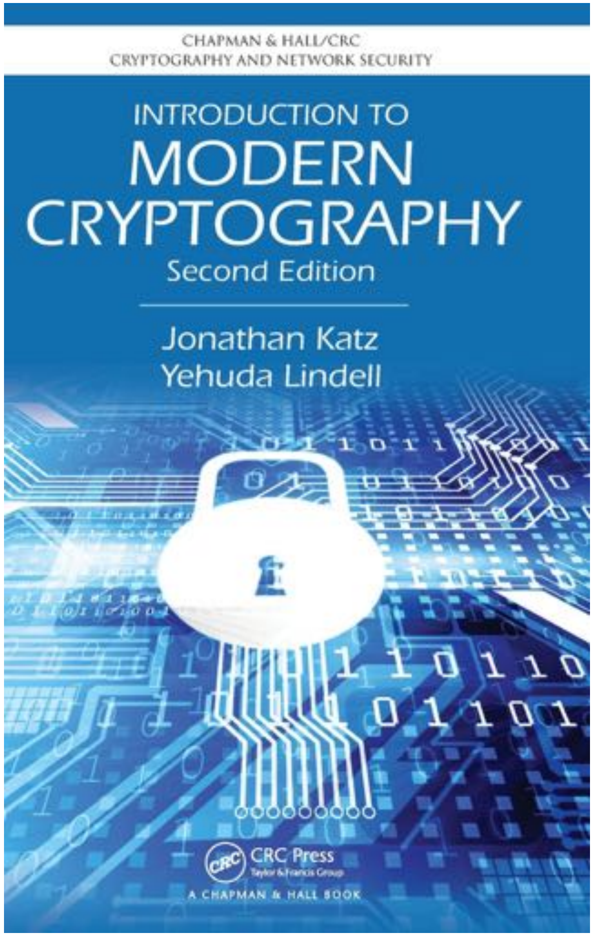
Master’s Thesis

talk to me

Cryptography

Module InfM-Kryp

- (Why) Is today's cryptography safe?
- **mathematical** foundations to understand cryptographic protocols
- How to quantify cryptographic security?



Lecture

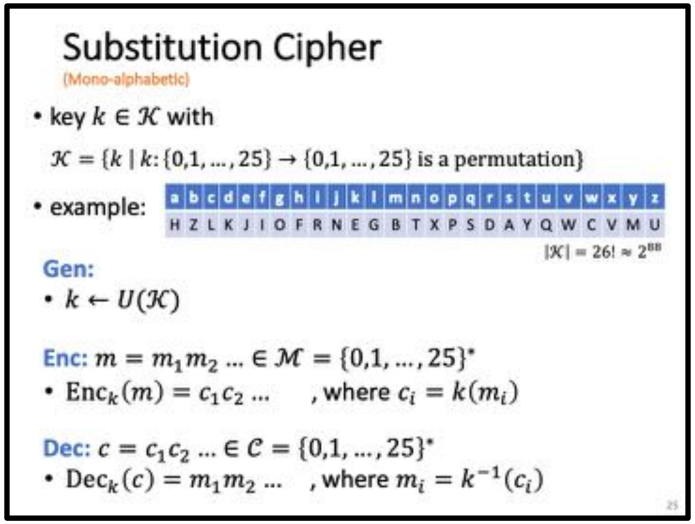
- definitions + theorems + proofs
- (black-/white-) board + slides
- integrated exercises

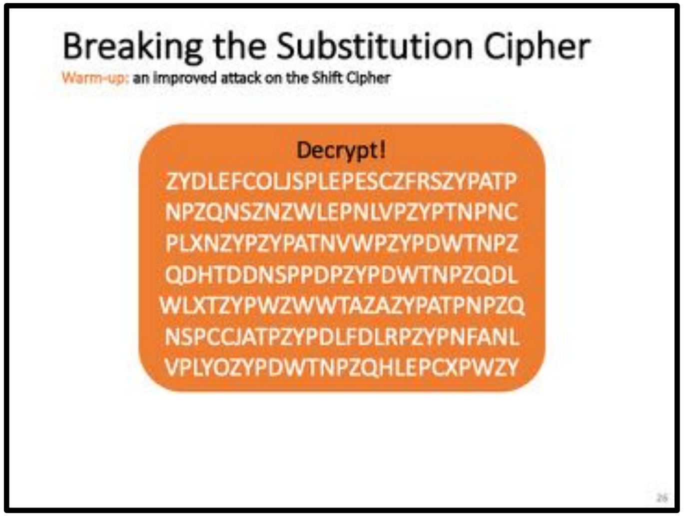
Seminar

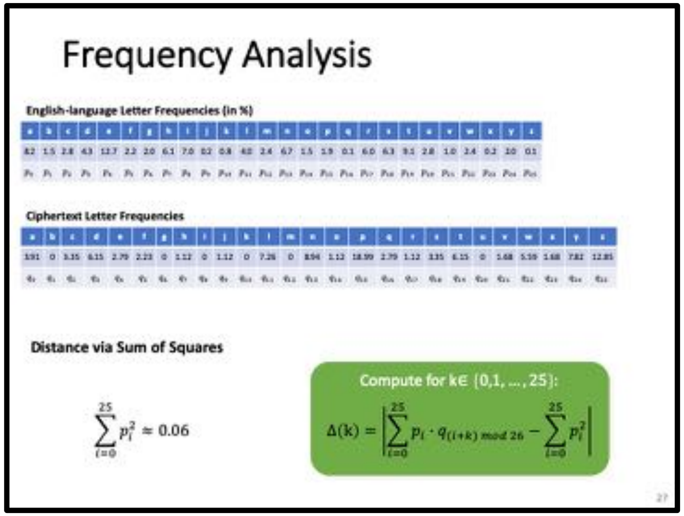
- block and/or running

Cryptography

Module InfM-Kryp

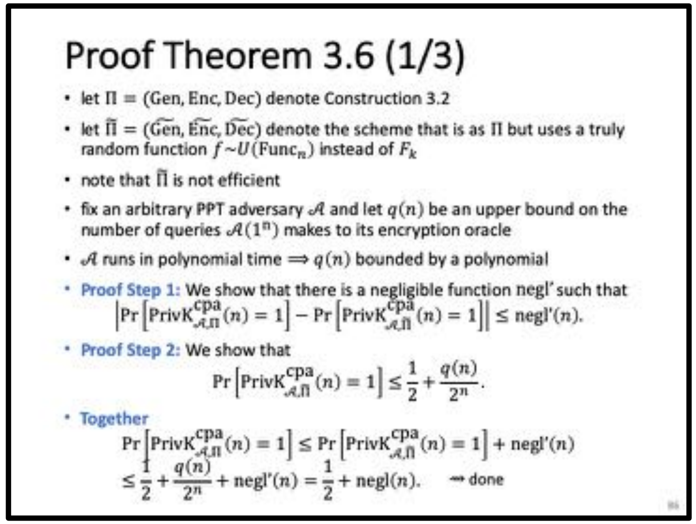


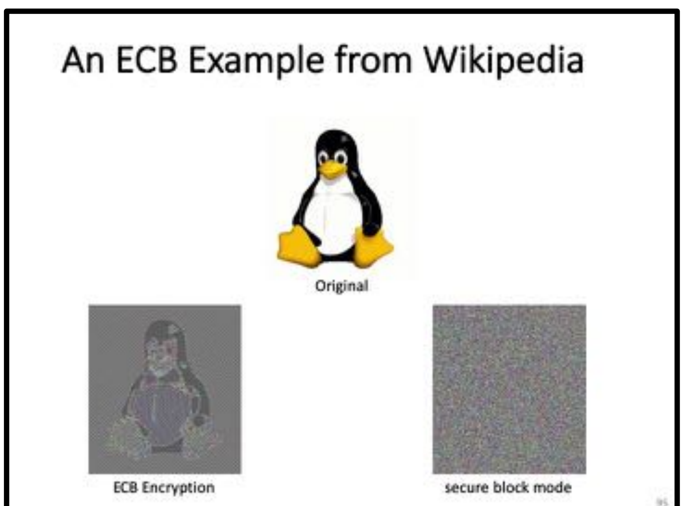


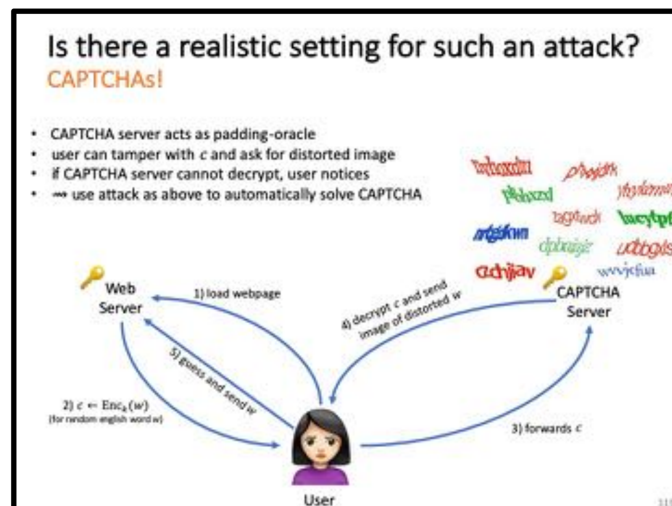


Cryptography

Module InfM-Kryp



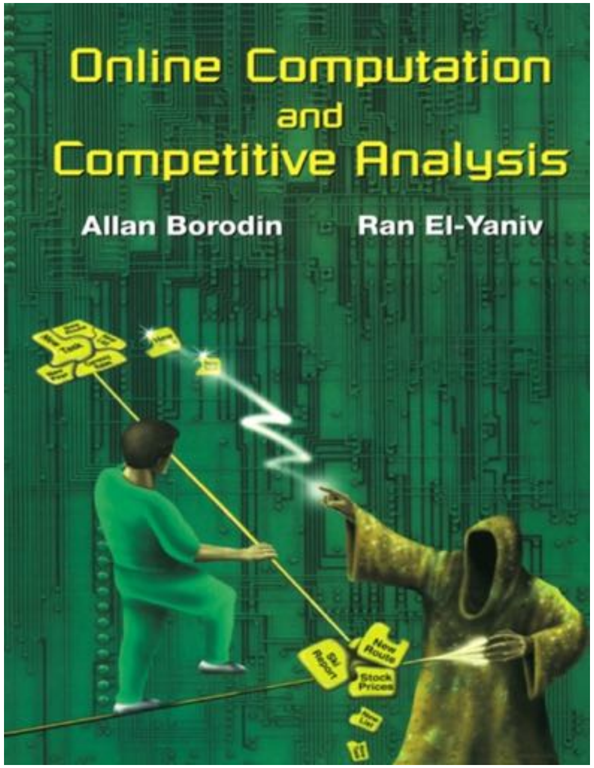




Methods of Algorithm Design

Module InfM-MDAE

- approximation & online algorithms
- quality guaranties under uncertainty
- how to design & analyze optimization algorithms



Lecture

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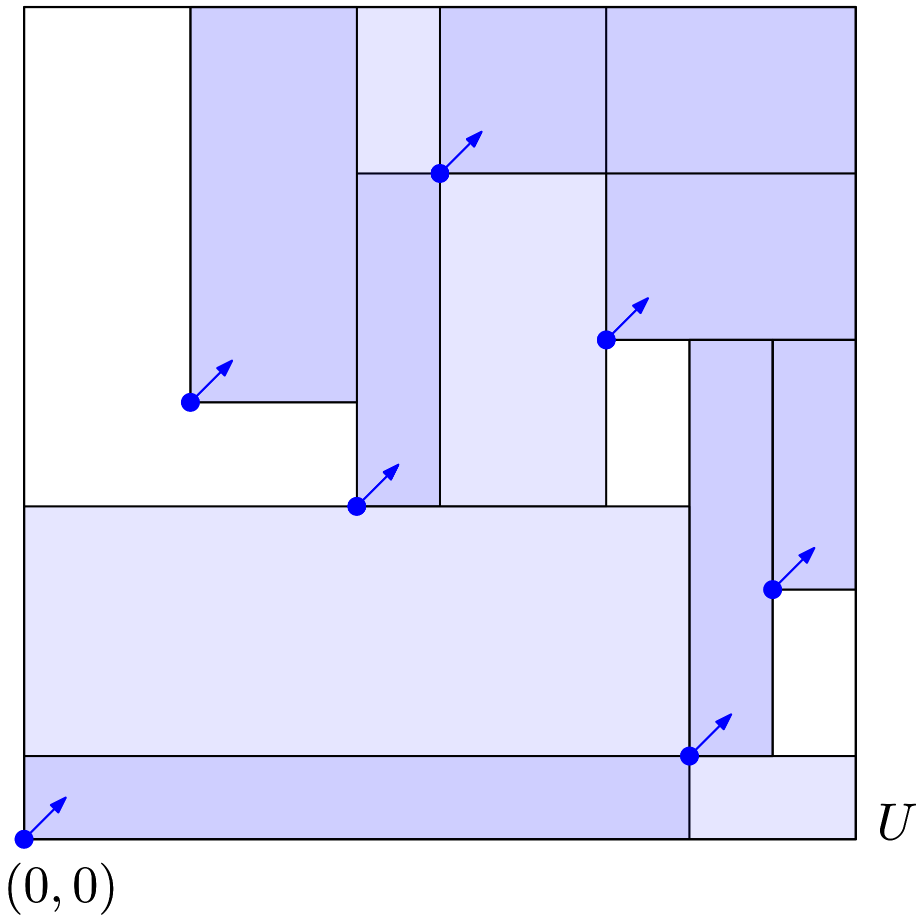
Research Examples

or: some Algorithmic Puzzles

Anchored Rectangle Packing

- n points in the unit square
- one of them at $(0,0)$



Objective

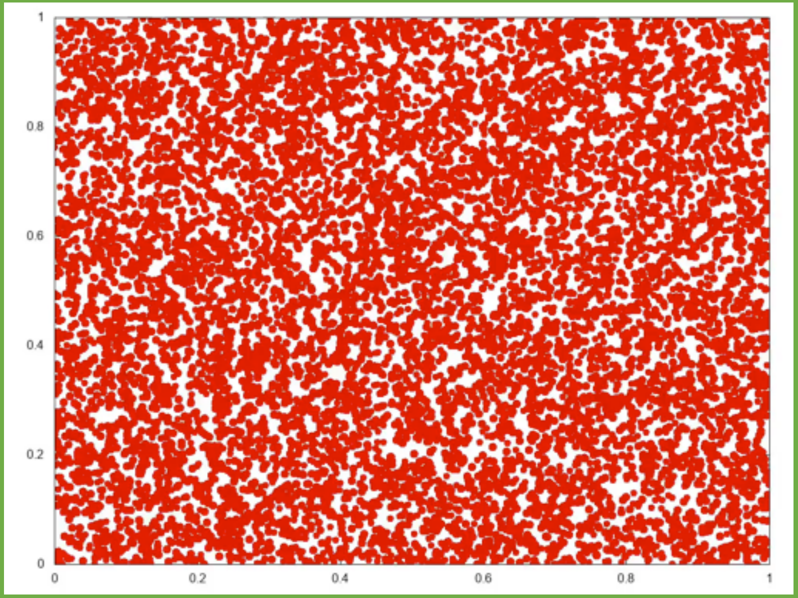
- for each point p, choose an axis-aligned rectangle with lower-left corner at p
- must be non-overlapping
- maximize covered area

Randomized Gathering

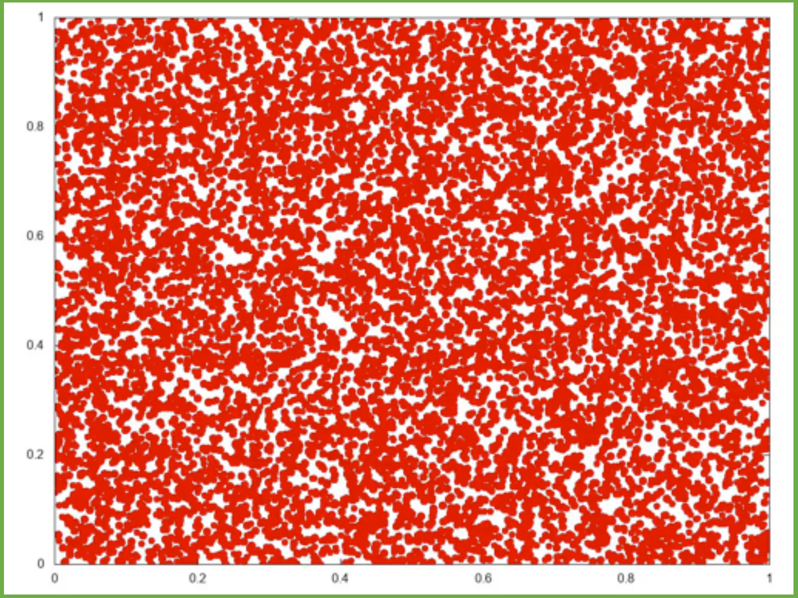
- n robots in the plane
- act in discrete rounds
- instantaneous movement
- not necessarily local

Objective:
Gather in one point

Strategy 1:
go to random robot

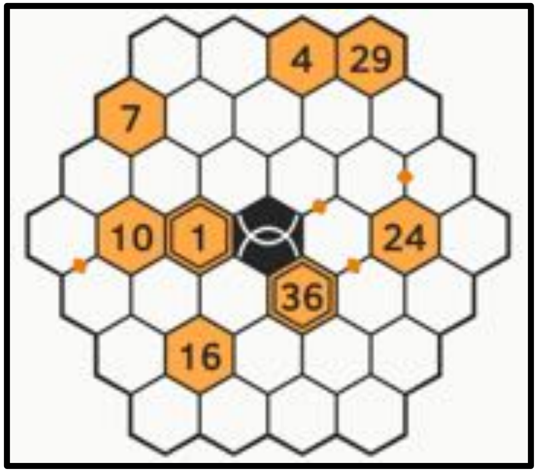


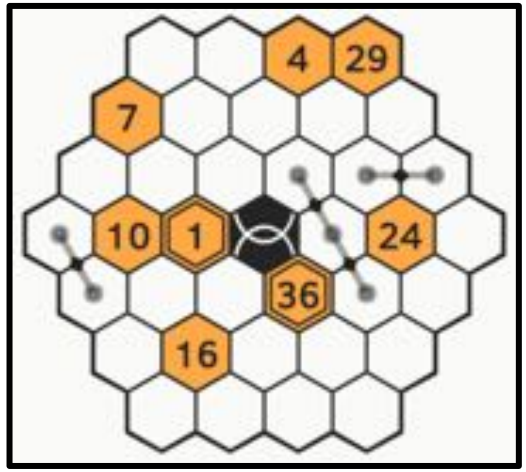
Strategy 2:
go to closest of two random robots

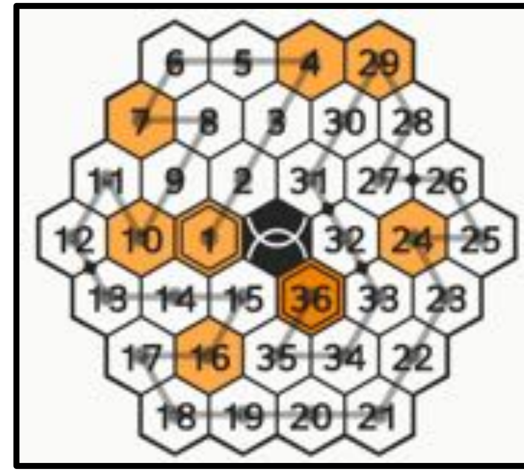


http://www.rikudo-puzzle.com

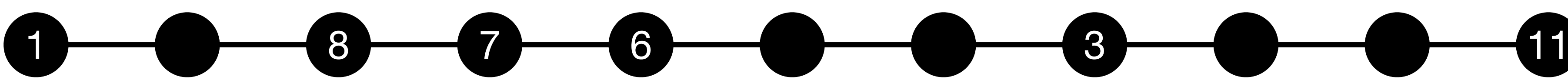
Rikudo







Let's try something simpler: Rikudo on the line (sort of)



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Questions

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slides available on TEA homepage (https://www.inf.uni-hamburg.de/en/inst/ab/tea/)