Theory of
Efficient Algorithms

Prof. Dr. Peter Kling – Universität Hamburg

The Team

Research Group TEA

Christiane Frede

G-209

Christoph Damerius

G-208

Katrin Köster
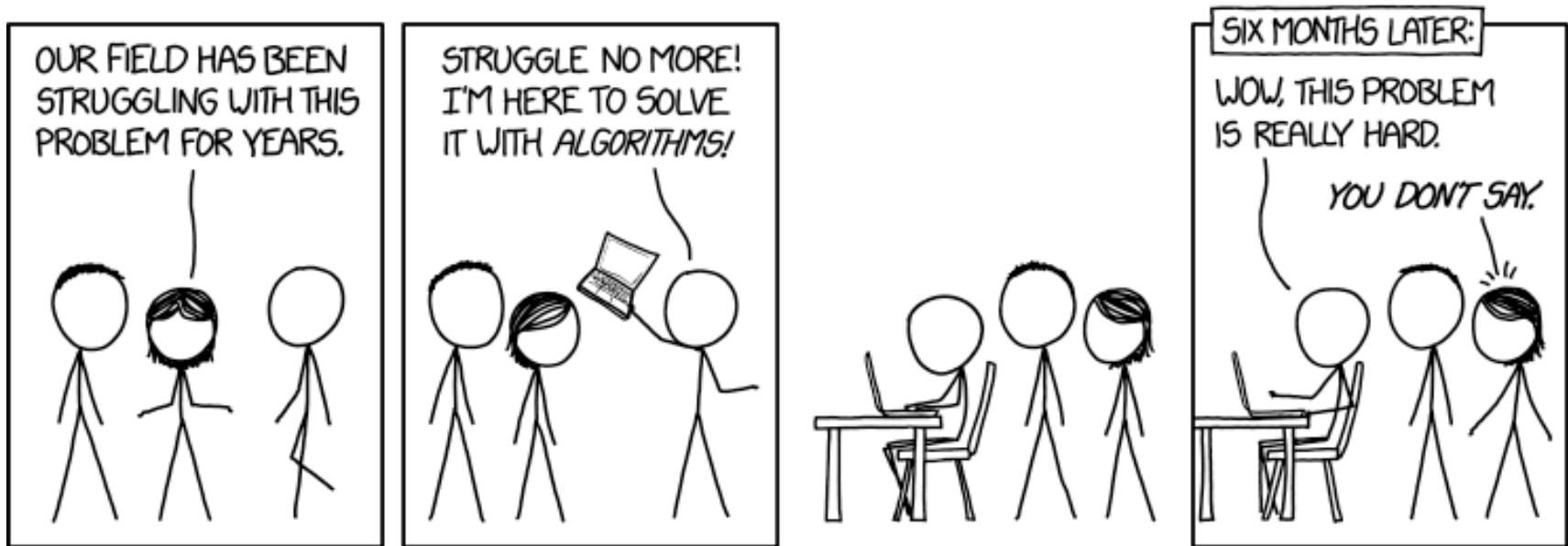

G-218

Peter Kling

G-229

Focus: Design & Analysis of Algorithms

- Distributed Systems
- Online Computation
- Resource Management
- Stochastic Processes
- Robot Coordination
- …

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Theory of Efficient Algorithms

Theory of Efficient Algorithms

- many problems are hard **Why?** **What part of the problem?** **How hard?**
- we need a systematic way to solve them **What means "solve"?** **How?**
- we need quality guarantees **Which?** **How strong?** **Possible?**

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
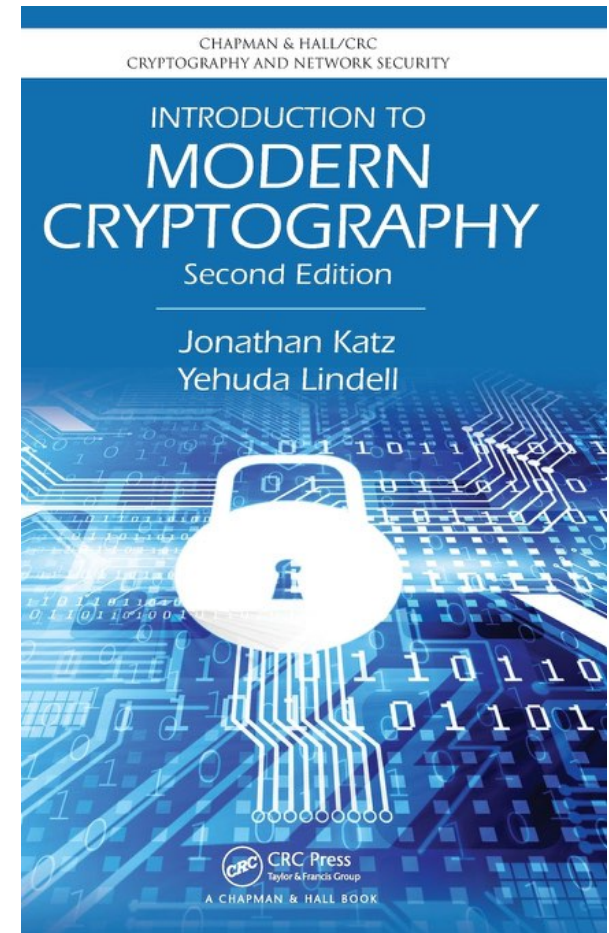
Cryptography
Module InfM-Kryp

- (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

CHAPMAN & HALL/CRC
CRYPTOGRAPHY AND NETWORK SECURITY

INTRODUCTION TO
MODERN
CRYPTOGRAPHY
Second Edition

Jonathan Katz
Yehuda Lindell

CRC Press
Taylor & Francis Group

A CHAPMAN & HALL BOOK

Methods of Algorithm Design

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

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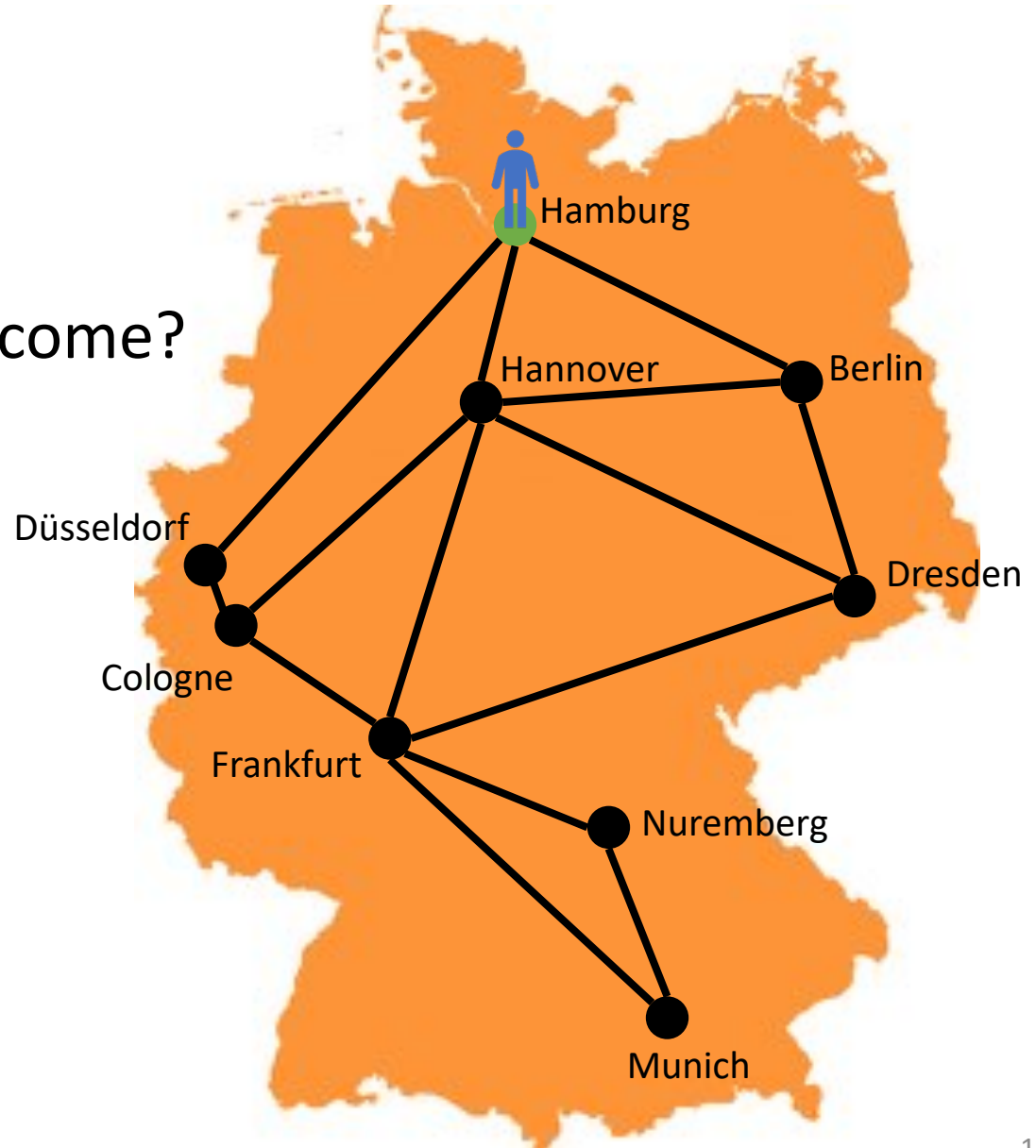- integrated exercises

Seminar
- block and/or running
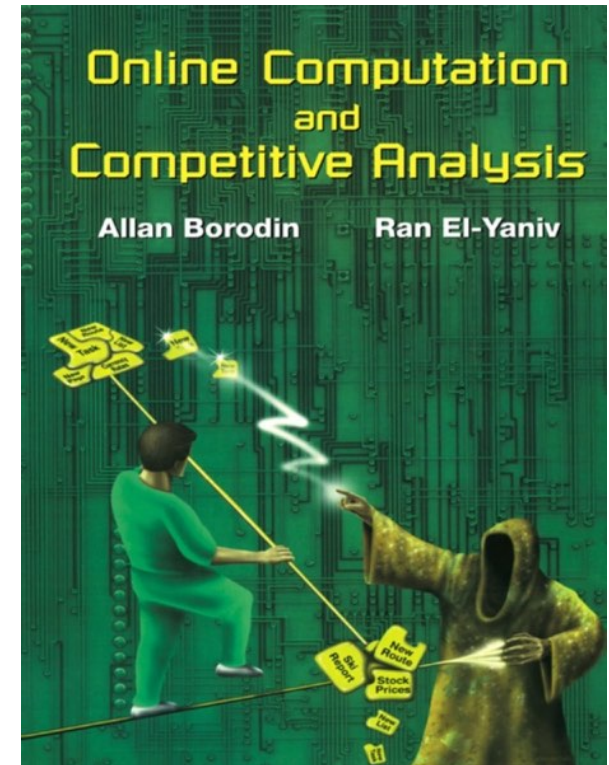
Research Examples

or: some Algorithmic Puzzles

Online Graph Exploration
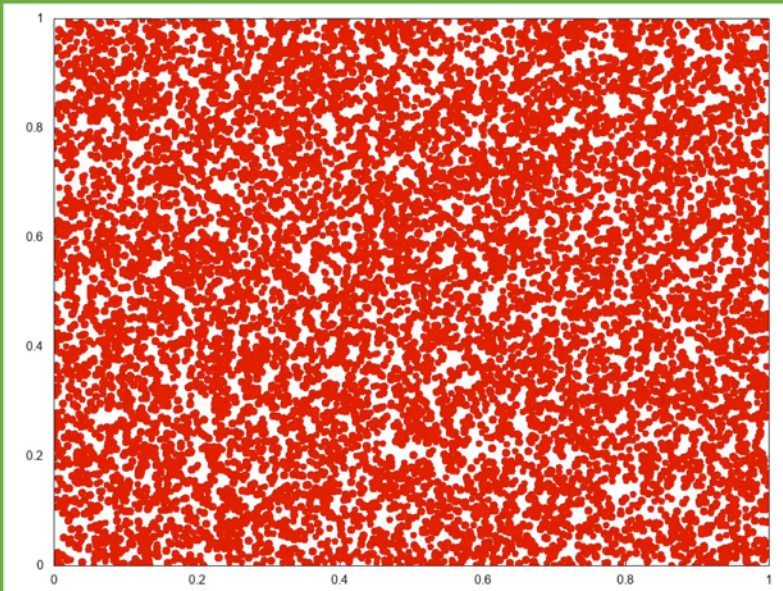
- cannot be optimal
- But how close can we come?

Randomized Gathering

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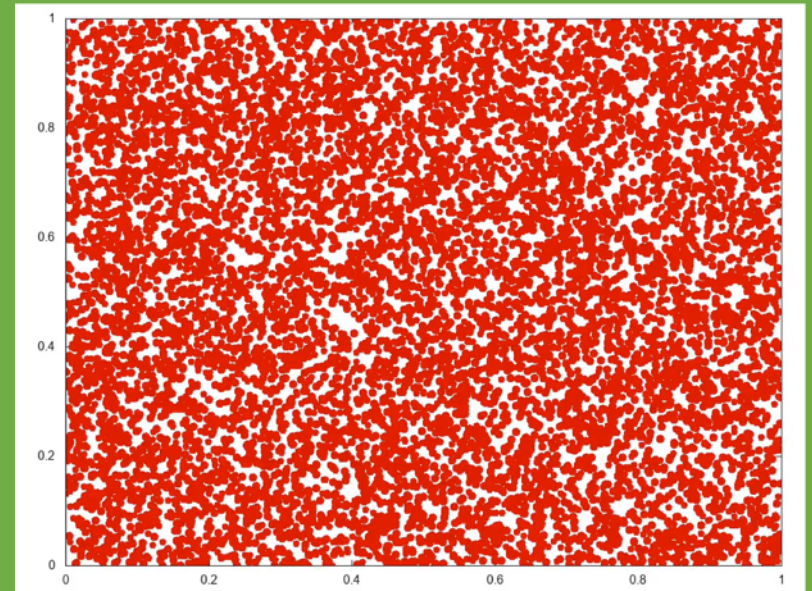- instantaneous movement
- not necessarily local

Objective:
Gather in one point

Strategy 1:
go to random robot
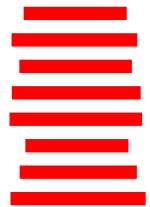

Strategy 2:
go to closest of two random robots

Online Matching on the Line

- n servers on the real line ●
- n requests on the real line ●
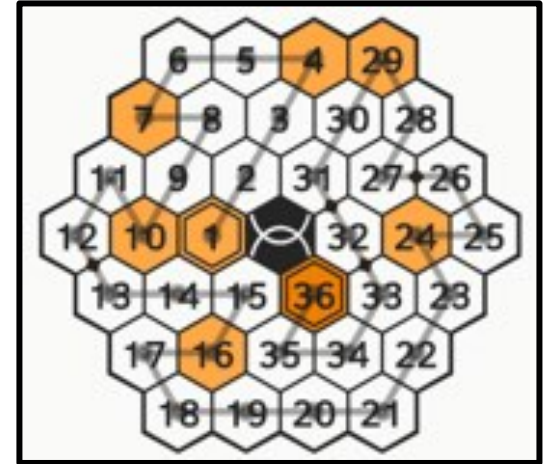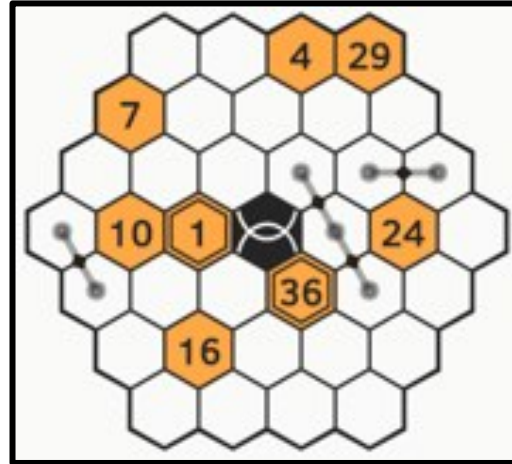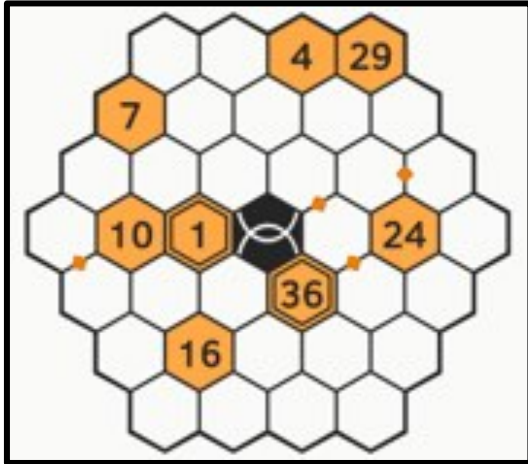 - pop up one after another
  - Not known in advance!

Objective:
- when a request pops up, match it to an unmatched server
- pay distance request ⟷ server

optimal solution

Rikudo

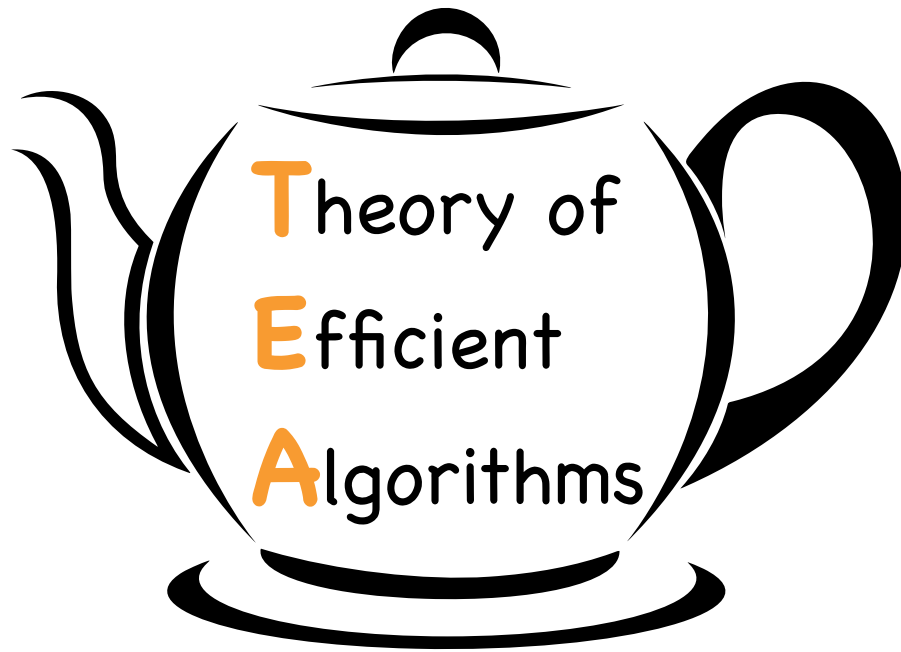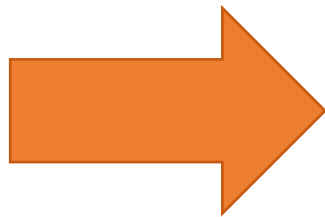**Let's try something simpler:** Rikudo on the line   (sort of)

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Algorithms

Questions ?

→ peter.kling@uni-hamburg.de

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