

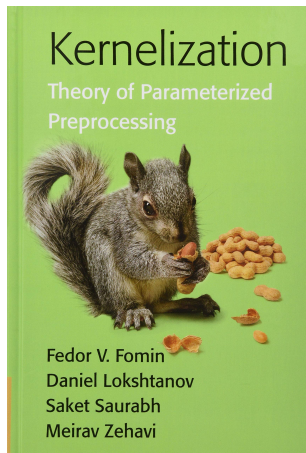
Kernelization Seminar

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Outline

- ▶ **Kickoff / Questions** (today)
- ▶ **Topic Assignment / Questions** (next week)
 - ▶ Everyone gets a topic to present (1-2 persons per topic)
- ▶ **Preparation** (at least one month)
- ▶ **Weekly Presentations** (starting week of 11. May)
 - ▶ Two talks per week
 - ▶ 35 minutes talk + 10 minutes discussion
- ▶ **Preparing Essay** (end of lectures)
 - ▶ Summarize the main ideas, at most 8 pages, \LaTeX
- ▶ **Essay Deadline** (17. August, 10:00)
 - ▶ Hand in via email

The Book



- ▶ May be found ~~in the CS library~~ online?
- ▶ Today: Questions on Chapter 1, 2

Meetings

Online meetings using Zoom.

Resigning

Two weeks after assigning the topics you can resign without any consequences. Just write us an email.

Possible Structure of a Presentation

- ▶ Briefly introduce the Topic.
- ▶ Why is it interesting? What are typical applications? What techniques are used?
- ▶ Give necessary background knowledge.
- ▶ Present the topic.

Advice:

- ▶ Go slowly. Do not expect everybody to understand everything immediately.
- ▶ Keep the slides clean. Usually one figure is better than a wall of text.

Essay

- ▶ Feel free to use the same structure as for the presentation
- ▶ L^AT_EX is mandatory (tutorial:
<https://www.latex-tutorial.com/tutorials/>)
- ▶ 8 pages
- ▶ template is available on our website

But:

- ▶ Do not simply retell the chapter!

Discussion Group?

Telegram, WhatsApp, ...

The Topics

Upper Bounds I

3: Inductive Priorities

- ▶ a systematic way to obtain reduction rules

4: Crown Decomposition

- ▶ design algorithms based on presence or absence of crown structure
- ▶ 3k kernel for vertex cover

5: Expansion Lemma (2 people)

- ▶ generalization of crown decomposition
- ▶ good kernel for feedback vertex set

6: Linear Programming (2 People)

- ▶ formulate problems as IP
- ▶ kernelize using LP relaxation

Upper Bounds II

8: Sunflower Lemma

- ▶ kernelization based on extremal combinatorics

9: Modules (1-2 People)

- ▶ decompose graphs into blocks with the same neighborhood

10: Matroids

- ▶ a basic combinatorial object that generalizes many notions from graph theory

12: Greedy Packing

- ▶ kernels for above guarantee parametrization

13: Euler's Formula

- ▶ kernelization on planar graphs

Lower Bounds

17: Framework (2 People)

- ▶ introduce concept to prove that certain problems most likely have no polynomial kernel
- ▶ also read Parameterized Algorithms from Cygan et al

18: Instance Selectors

- ▶ a method to derive OR-cross-decompositions

19: Polynomial Parameter Transformation

- ▶ reductions suitable for deriving kernelization lower bounds

20: Polynomial lower bounds

- ▶ provide lower bounds for problems with polynomial kernel

Beyond Kernelization

22: Turing Kernelization

- ▶ another notation of kernelization

23: Lossy Kernelization (2 People)

- ▶ these kernels do not need to be exact and may therefore be smaller