Graduate Seminar on Discrete Optimization

New Shortest Path Algorithms

How the Seminar runs

Each talk shall run as follows:

1. Part 1 (10–20 minutes)
   Introduce the topic.
   What will be the main results?
   Why are they important and interesting?
   Embed your topic into a broader context, e.g., by showing connections to other talks in this seminar or related results in the literature.

2. Questions to the audience
   Ask one or two (multiple-choice) questions to check whether the audience has understood the key concepts.
   This is also a good opportunity for the audience to ask questions.

How the Seminar runs

Each talk shall run as follows:

1. Part 1 (10–20 minutes)
2. Questions to the audience
3. Part 2 (55–65 minutes)
   Explain proofs, but focus on the main ideas rather than detailed calculations.
4. Discussion (15 minutes)
   Questions of the audience to the speaker. Everyone should participate in the discussion!

The two parts of the talk together must not exceed 75 minutes.
If you use definitions or proofs from previous talks, remind the audience by repeating relevant things briefly.

What we expect from you

- Understand every aspect of your topic

- Prepare your talk on the assigned topic carefully, including questions to the audience.

- Prepare a 1- or 2-page summary of your talk, with the most important definitions and results. Distribute hardcopies of this before your talk to the audience.

- Give a rehearsal talk about 2–3 weeks before your main talk.

- Participate actively in the discussions in the seminar.

Besides the text assigned to you, it is usually necessary and always helpful to study further sources.

Assignment of topics and registration

If you want to participate in this seminar, send an e-mail to Ulrich Brenner (`brenner@or.uni-bonn.de`) with your name and your favorite topics no later than

Monday, January 29, 10 am.

A few days later we will inform you by e-mail about the assignment of the topics.

After the assignment you have one week for the final registration. After that we may give your place to another student.

In addition, you have to register in BASIS in early April (before the seminar begins).

Each participant will be assigned an advisor (usually one of our PhD students) who can help with questions.

Main Sources

[BNW] Negative-weight single-source shortest paths in near-linear time (Bernstein, Nanongkai, Wulff-Nilsen): arXiv:2203.03456

[F] Single-source shortest paths with negative real weights in $\tilde{O}(mn^{8/9})$ time (Fineman): arXiv:2311.02520

[CW] Deterministic APSP, orthogonal vectors, and more: quickly derandomizing Razborov–Smolensky (Chan, Williams): ACM TALG 17 (2020), Article 2

[FS] Dijkstra's algorithm with predictions to solve the single-source many-targets shortest-path problem (Feijen, Schäfer): arXiv:2112.11927

Topics of the Talks

1. Shortest paths with some negative edges [BNW, Sections 2,3,A,B]
2. [BNW, Sections 6, D]
3. [BNW, Section 4]
4. [BNW, Sections 5, C]
5. [F, Sections 2, 3.1, 7]
6. [F, Sections 3.2, 4]
7. [F, Section 3.3, 6, 3.4]
8. [F, Section 5, 3.5]
9. [CW]
10. [FS]